

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
(Autonomous)

Ravindra College of Engineering for Women : Kurnool
(Autonomous)

**(Approved by AICTE | NAAC Accreditation with 'A+' Grade | Accredited by NBA (CSE, ECE) |
Affiliated to JNTUA)**

Nandikotkur Road, Venkayapalli (V), Kurnool - 518452, Andhra Pradesh

BACHELOR OF TECHNOLOGY



ACADEMIC REGULATIONS
RCEW – R23

B.Tech Regular Four Year Degree Programme
(for the batches admitted from the academic year 2023- 2024)
&
B.Tech (Lateral Entry Scheme)
(for the batches admitted from the academic year 2024 - 2025)

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
(Autonomous)

PROGRAM CURRICULUM STRUCTURE UNDER R23 REGULATION

B. Tech – I Year I Semester

		I SEMESTER (I YEAR)								
S.NO	Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal	External	Total
1	A10001	Communicative English	BS&H	2	0	0	2	30	70	100
2	A10004	Chemistry	BS&H	3	0	0	3	30	70	100
3	A10002	Linear Algebra & Calculus	BS&H	3	0	0	3	30	70	100
4	A10101	Basic Civil & Mechanical Engineering	ES	3	0	0	3	30	70	100
5	A10501	Introduction to Programming	ES	3	0	0	3	30	70	100
6	A10005	Communicative English Lab	BS&H	0	0	2	1	30	70	100
7	A10007	Chemistry Lab	BS&H	0	0	2	1	30	70	100
8	A10302	Engineering Workshop	ES	0	0	3	1.5	30	70	100
9	A10502	Computer Programming Lab	ES	0	0	3	1.5	30	70	100
10	A10012	Health and wellness, Yoga and Sports	BS&H	.	.	1	0.5	---	---	---
TOTAL				14	00	11	19.5	270	630	900

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
(AUTONOMOUS)

B. Tech – I Year II Semester

		II SEMESTER (I YEAR)								
S.NO	Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal	External	Total
1	A10003	Engineering Physics	BS&H	3	0	0	3	30	70	100
2	A10009	Differential Equations & Vector Calculus	BS&H	3	0	0	3	30	70	100
3	A10201	Basic Electrical & Electronics Engineering	ES	3	0	0	3	30	70	100
4	A10301	Engineering Graphics	ES	1	0	4	3	30	70	100
5	A10505	Data Structures	PC	3	0	0	3	30	70	100
6	A10503	IT Workshop	ES	0	0	2	1	30	70	100
7	A10006	Engineering Physics Lab	BS&H	0	0	2	1	30	70	100
8	A10202	Electrical & Electronics Engineering Workshop	ES	0	0	3	1.5	30	70	100
9	A10505	Data Structures Lab	PC	0	0	3	1.5	30	70	100
10	A1011	NSS/NCC/Scouts & Guides/Community Service	BS&H	.	.	1	0.5	---	---	---
		TOTAL		13	00	15	20.5	270	630	900

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
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B. Tech – II Year I Semester

III SEMESTER (II YEAR)										
S.NO	Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal	External	Total
1	A14301	Discrete Mathematics & Graph Theory	BS&H	3	0	0	3	30	70	100
2	A12301	Universal Human Values- Understanding Harmony	BS&H	2	1	0	3	30	70	100
3	A10402	Digital Logic and Computer Organization	ES	3	0	0	3	30	70	100
4	A15302T	Advanced Data Structures & Algorithms Analysis	PC	3	0	0	3	30	70	100
5	A15303T	Database Management Systems	PC	3	0	0	3	30	70	100
6	A15302P	Advanced Data Structures and Algorithms Analysis Lab	PC	0	0	3	1.5	30	70	100
7	A15303P	Database Management Systems Lab	PC	0	0	3	1.5	30	70	100
8	A15304	Python programming	SEC	0	1	2	2	30	70	100
9	A19301	Environmental Science	MC	2	0	0	-	100*	.	100*
TOTAL				15	02	08	20	240	560	900

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
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B.TECH. -COMPUTERT SCIENCE &ENGINEERING
III YEAR COURSE STRUCTURE & SYLLABI

B. Tech – III Year I Semester

V SEMESTER (III YEAR)										
S.NO	Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal	External	Total
1	A1CS501T	Introduction to Artificial Intelligence	PC	3	0	0	3	30	70	100
2	A1CS502T	Computer Networks	PC	3	0	0	3	30	70	100
3	A1CS503	Automata Theory and Compiler Design	PC	3	0	0	3	30	70	100
4	A1CS505h	Introduction to Quantum Technology & Applications	PC	3	0	0	3	30	70	100
5	A1CS504a A1CS504b A1EC50T A1CS504c A1CS505d	Professional Elective-I 1. Software Testing Methodologies 2. Soft Computing 3. Microprocessors & Microcontrollers 4. Data Warehousing & Data Mining 5. Privacy and Security in Online social media	PE	3	0	0	3	30	70	100
6		Open Elective-I	OE	3	0	0	3	30	70	100
7	A1CS501P	Introduction to Artificial Intelligence Lab	PC	0	0	3	1.5	30	70	100
8	A1CS502P	Computer Networks Lab	PC	0	0	3	1.5	30	70	100
9	A1CS506	Skill Enhancement course Full Stack Development – II	SEC	0	1	2	2	30	70	100
10	A1ES507	Tinkering Lab	ES	0	0	2	1	30	70	100
11	A1CSP	Evaluation of Community Service Internship	CSP	-	-	-	2		.	100*
TOTAL				15	01	10	26	240	560	900

* The marks for Mandatory Courses are not considered for calculating SGPA

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL (AUTONOMOUS)

Open Elective – I

S.No.	Course Code	Course Name	Offered by the Dept.
1	A1EC505a	Electronic Circuits	ECE
2	A1HS505c	Mathematics for Machine Learning and AI	Mathematics
3	A1HS505d	Materials Characterization Techniques	Physics
4	A1HS505e	Chemistry of Energy Systems	Chemistry
5	A1HS505f	English for Competitive Examinations	Humanities
6	A1HS505g	Entrepreneurship and New Venture Creation	

NPTEL

Professional Elective-I

S.No	Course Code	Course Name	Link
1	A1CS504as	Software Testing	https://onlinecourses.nptel.ac.in/noc25_cs113/preview
2	A1CS504bs	Privacy and Security in Online social media	https://onlinecourses.nptel.ac.in/noc25_cs116/preview

Open Elective – I

S.No	Course Code	Course Name	Link
1	A1HS505fs	English Language for Competitive Exams	https://onlinecourses.nptel.ac.in/noc25_hs137/preview
2	A1HS505gs	Entrepreneurship	https://onlinecourses.nptel.ac.in/noc25_mg81/preview
3	A1ME505ks	Sustainable Energy Technologies	https://onlinecourses.nptel.ac.in/noc25_me178/preview
4	A1HS505cs	Mathematics for Machine Learning	https://onlinecourses.nptel.ac.in/noc25_ma61/preview

Note:

1. A student is permitted to register for Honours or a Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to their Minor from V Semester onwards.
2. A student shall not be permitted to take courses as Open Electives/Minor/Honours with content substantially equivalent to the courses pursued in the student's primary major.
3. A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline.

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
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LIST OF MINORS OFFERED TO COMPUTER SCIENCE & ENGINEERING

BUILDING PLANNING & CONSTRUCTION TECHNOLOGY

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A01M01	Construction Materials	3	-	0	3
2	23A01M02	Construction Methods	3	-	0	3
3	23A01M03	Building Planning And Drawing	3	-	0	3
4	23A01M04	Surveying	3	-	0	3
5	23A01M05	Concrete Technology	3	-	0	3
6	23A01M06	Concrete Technology Lab	0	0	3	1.5
7	23A01M07	Surveying Lab	0	0	3	1.5

ENERGY SYSTEMS

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A02M01	Energy Audit and Management	3	-	0	3
2	23A02M02	Energy Management in Building	3	-	0	3
3	23A02M03	Energy Storage Technologies	3	-	0	3
4	23A02M04	Energy Scenario and Energy Policy	3	-	0	3
5	23A02M05	Waste Energy Management	3	-	0	3
6	23A02M06	Project in Energy Systems	-	-	6	3

MICRO GRID TECHNOLOGY

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A02M07	Futuristic Power Systems	3	0	0	3
2	23A02M08	Power Electronic Converters for Energy Sources	3	0	0	3
3	23A02M09	Microgrid Power and Control Architecture	3	0	0	3
4	23A02M10	Microgrid System Design	3	0	0	3
5	23A02M11	Analysis of Smart Grid Systems	3	0	0	3
6	23A02M12	Project in Micro Grid Technology	0	0	6	3

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3D PRINTING

S. No.	Course Code	Title	L	T	P	Credits
1	23A03M01	Material Science & Engineering	3	0	0	3
2	23A03M02	Additive Manufacturing	3	0	0	3
3	23A03M03	Material Characterization Techniques	3	0	0	3
4	23A03M04	3D Printing Materials and Applications	3	0	0	3
5	23A03602T	CAD/CAM	3	0	0	3
6	23A03M05	Computer Aided Machine Drawing	0	0	3	1.5
7	23A03607	3D Printing Lab	0	0	3	1.5
Total			15	0	6	18

INDUSTRIAL ENGINEERING

S. No.	Course Code	Title	L	T	P	Credits
1	23A03M06	Production Planning & Control	3	0	0	3
2	23A03M07	Marketing Management	3	0	0	3
3	23A03M08	Supply Chain Management	3	0	0	3
4	23A03M09	Strategic Management for Competitive Advantage	3	0	0	3
5	23A03M10	Six Sigma & Lean Manufacturing	3	0	0	3
6	23A03M11	Applied Project Work	0	0	6	3
Total			15	0	6	18

EMBEDDED SYSTEMS AND IOT

S.No.	Course Code	Title	L	T	P	Credits
1	23A04M01	Embedded Systems Technology	3	0	0	3
2	23A04M02	Real Time Embedded systems design and Analysis	3	0	0	3
3	23A04M03	Principles of IoT	3	0	0	3
4	23A04703b	Wireless Sensor Networks	3	0	0	3
5	23A04M04	Industrial Internet of things	3	0	0	3
6	23A04M05	Principles of IoT Lab	0	0	3	1.5
7	23A04M06	Industrial Internet of things Lab	0	0	3	1.5
Total			15	0	06	18

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
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ELECTRONIC SYSTEMS

S. No.	Course Code	Title	L	T	P	Credits
1	23A04505	Electronic Circuits	3	0	0	3
2	23A04506	Digital Electronics	3	0	0	3
3	23A04M07	Principles of Communication Engineering	3	0	0	3
4	23A04M08	Electronic Instrumentation	3	0	0	3
5	23A04503T	Microprocessors and Microcontrollers	3	0	0	3
6	23A04M09	Electronic Circuits and Digital Electronics Lab	0	0	3	1.5
7	23A04503P	Microprocessors and Microcontrollers Lab	0	0	3	1.5
Total			15	0	06	18

COMPUTER SCIENCE AND ENGINEERING

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A05M01	Data Structures And Algorithms	3	-	0	3
2	23A32502	Software Engineering	3	-	0	3
3	23A05M02	Computer Organization	3	-	0	3
4	23A05M03	Web Technologies	3	-	0	3
5	23A37401T	Computer Networks	3	-	0	3
6	23A05M04	Data Structures and Algorithms Lab	0	0	3	1.5
7	23A05M05	Web Technologies Lab	0	0	3	1.5

CYBER SECURITY

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A38502	Introduction to Cyber Security	3	-	0	3
2	23A37601T	Cyber Crimes & Digital Forensics	3	-	0	3
3	23A05601T	Cryptography & Network Security (Pre-requisite: Computer Networks)	3	-	0	3
4	23A35703a	Cyber Laws and Security Policies	3	-	0	3
5	23A05701b	Blockchain Technology	3	-	0	3
6	23A37502P	Cyber Security Lab	0	0	3	1.5
7	23A05601P	Cryptography & Network Security Lab	0	0	3	1.5

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INTERNET OF THINGS

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A35M01	Introduction to IoT	3	-	0	3
2	23A37503	Wireless Sensor Networks for CS	3	-	0	3
3	23A35H01	Communication Protocols for IoT	3	-	0	3
4	23A35H04	Industrial IoT	3	-	0	3
5	23A37501T	Cloud Computing	3	-	0	3
6	23A32503P	IoT Lab	0	0	3	1.5
7	23A37501P	Cloud Computing Lab	0	0	3	1.5

DATA SCIENCE

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A32M01	Introduction to Data Science	3	-	0	3
2	23A32M02	Statistical Learning for Data Science	3	-	0	3
3	23A32M03	Data Engineering	3	-	0	3
4	23A32M04	Machine learning fundamentals	3	-	0	3
5	23A32M05	Data Science applications	3	-	0	3
6	23A32M06	Data Science Practice Lab (R/Python)	0	0	3	1.5
7	23A32M07	Statistical Learning & ML Lab	0	0	3	1.5

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A33M01	Introduction to Artificial Intelligence	3	-	0	3
2	23A33M02	Machine Learning Fundamentals	3	-	0	3
3	23A33M03	Deep Learning & Neural Networks	3	-	0	3
4	23A31501	Natural Language Processing	3	-	0	3
5	23A30604a	Computer Vision	3	-	0	3
6	23A33M04	AI & ML Lab	0	0	3	1.5
7	23A33M05	NLP & Computer Vision Lab	0	0	3	1.5

DATA ANALYTICS

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A32M06	Introduction to Data Analytics	3	-	0	3
2	23A32M03	Data Engineering	3	-	0	3
3	23A30603b	Predictive Analytics	3	-	0	3
4	23A32M07	Big Data Analytics (Hadoop, Spark)	3	-	0	3
5	23A32M08	Data Analytics with Power BI/Tableau/Matplotlib	3	-	0	3
6	23A32M09	Data Analytics Tools Lab	0	0	3	1.5
7	23A32M10	Big Data & NoSQL Lab	0	0	3	1.5

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DATA SCIENCE AND ANALYTICS

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A32M01	Introduction to Data Science	3	-	0	3
2	23A32M02	Statistical Learning for Data Science	3	-	0	3
3	23A32M11	Data Visualization & Exploratory Data Analysis	3	-	0	3
4	23A30601	Big Data Analytics	3	-	0	3
5	23A32602	Recommender Systems	3	-	0	3
6	23A32M12	Data Visualization & EDA Lab	0	0	3	1.5
7	23A32M13	Recommender System Lab	0	0	3	1.5

PROGRAMMING & COMPUTATIONAL INTELLIGENCE

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A30M01	Python for AI & Data Science	3	-	0	3
2	23A30M02	Data Structures & Algorithms for AI	3	-	0	3
3	23A30603a	Reinforcement Learning	3	-	0	3
4	23A30M03	Quantum Computing for AI	3	-	0	3
5	23A30M04	Edge AI & IoT	3	-	0	3
6	23A30M05	Python & DS Lab	0	0	3	1.5
7	23A30M06	RL & Quantum AI Lab	0	0	3	1.5

AI APPLICATIONS & EMERGING TECHNOLOGIES

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A30M07	AI in Finance & Business Analytics	3	-	0	3
2	23A30M08	Ethical AI & Responsible AI	3	-	0	3
3	23A31701	Generative AI & Prompt Engineering	3	-	0	3
4	23A31702b	AI in Cybersecurity	3	-	0	3
5	23A31703c	HealthCare AI	3	-	0	3
6	23A30M09	Generative AI Lab	0	0	3	1.5
7	23A44503	AI Applications Lab	0	0	3	1.5

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QUANTUM COMPUTING

S.No.	Course Title	Contact Hours per week			Credits
		L	T	P	
1	Introduction to Quantum Computing	3	-	0	3
2	Mathematical Foundations for Quantum Computing	3	-	0	3
3	Quantum Algorithms	3	-	0	3
4	Quantum Information and Communication	3	-	0	3
5	Quantum Machine Learning (QML)	3	-	0	3
6	Quantum Algorithms Lab	0	0	3	1.5
7	Quantum Programming and Simulation Lab	0	0	3	1.5

QUANTUM TECHNOLOGIES

S.No.	Course Title	Contact Hours per week			Credits
		L	T	P	
1	Foundations of Quantum Technologies	3	-	0	3
2	Solid State Physics for Quantum Technologies	3	-	0	3
3	Quantum Optics Prerequisites for Quantum Technologies	3	-	0	3
4	Introduction to Quantum Communication	3	-	0	3
5	Introduction to Quantum Sensing	3	-	0	3
6	Quantum Communication and Sensing Lab	0	0	3	1.5
7	Quantum Devices and Materials Lab	0	0	3	1.5

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
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B.Tech– III Year II Semester

VI SEMESTER (III YEAR)										
S.NO	Course Code	Title of the Course	Category	Periods per Week			Credit s	Scheme of Examination Maximum Marks		
				L	T	P		C	Internal	External
1	A1CS601T	Introduction to Machine Learning	PC	3	0	0	3	30	70	100
2	A1CS602	Cloud Computing	PC	3	0	0	3	30	70	100
3	A1CS603T	Cryptography & Network Security	PC	3	0	0	3	30	70	100
4	A1CS604a A1CS604b A1CS604c A1CS604d	Professional Elective-II 1. Object Oriented Analysis and Design 2. Cyber Security 3. DevOps 4. Embedded Systems Design	PE	3	0	0	3	30	70	100
5	A1CS605a A1CS605b A1CS605c A1CS605d	Professional Elective-III 1. Software Project Management 2. Mobile Adhoc Networks 3. Natural Language Processing 4. Distributed Operating System	PE	3	0	0	3	30	70	100
6		Open Elective – II	OE	3	0	0	3	30	70	100
7	A1CS601P	Introduction to Machine Learning Lab	PC	0	0	3	1.5	30	70	100
8	A1CS603P	Cryptography & Network Security Lab	PC	0	0	3	1.5	30	70	100
9	A12403	Skill Enhancement course Soft skills	SEC	0	1	2	2	30	70	100
10	A1ES608	Audit Course Technical Paper Writing & IPR	ES	2	0	0	-			
		TOTAL		20	1	08	23	240	560	900
Mandatory Industry Internship of 08 weeks duration during summer vacation										

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
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Open Elective – II

S.No.	Course Code	Course Name	Offered by the Dept.
1	A1EC606a	Digital Electronics	ECE
2	A1HS606a	Optimization Techniques	Mathematics
3	A1CS606b	Mathematical Foundation of Quantum Technologies	Computer
4	A1HS606c	Physics Of Electronic Materials and Devices	Physics
5	A1HS606d	Chemistry Of Polymers and Applications	Chemistry
6	A1CS606e	Academic Writing and Public Speaking	Humanities

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
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IV B.Tech I Semester (CSE)

VII SEMESTER (IV YEAR)										
S.NO	Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal	External	Total
1	A1CS701	Deep Learning	PC	3	0	0	3	30	70	100
2	A1HS702a A1HS702b A1HS702c	Management Course- II 1. Management Science 2. Business Ethics and Corporate Governance 3. E-Business	PC	3	0	0	2	30	70	100
3	A1CS703a A1CS703b A1CS703c A1CS703d	Professional Elective-IV 1. Internet of Things 2. Software Architecture & Design Patterns 3. Blockchain Technology 4. Augmented Reality & Virtual Reality	PC	3	0	0	3	30	70	100
4	A1CS704a A1CS704b A1CS704c A1CS704d	Professional Elective-V 1. Agile methodologies 2. Metaverse 3. Computer Vision 4. Cyber Physical Systems	PE	3	0	0	3	30	70	100
5		Open Elective-III	OE	3	0	0	3	30	70	100
6		Open Elective-IV	OE	3	0	0	3			
7	A1CS707	Skill Enhancement Course Prompt Engineering	SEC	0	1	2	2	30	70	100
8	A1AC708	Audit Course Gender Sensitization	AC	2	0	0	-	30	70	100
9	A1II	Evaluation of Industry Internship		-	-	-	2	30	70	100
TOTAL				18	02	02	21	240	560	900

12 week MOOC Swayam/NPTEL course recommended by the BoS

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
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Open Elective – III

S.No	Course Code	Course Name	Offered by the Dept.
1	A1EC503T	Microprocessors and Microcontrollers	ECE
2	A1HS705a	Wavelet transforms and its Applications	Mathematics
3	A1HS705b	Smart Materials And Devices	Physics
4	A1HS705c	Green Chemistry and Catalysis For Sustainable Environment	Chemistry
5	A1HS705d	Employability Skills	Humanities
6	A1CS705e	Introduction to Quantum Mechanics	Computer Science

Open Elective – IV

S.No	Course Code	Course Name	Offered by the Dept.
1	A1EC706a	Transducers and Sensors	ECE
2	A1HS706b	Financial Mathematics	Mathematics
3	A1HS706c	Sensors And Actuators For Engineering Applications	Physics
4	A1HS706d	Chemistry Of Nanomaterials and Applications	Chemistry
5	A1HS706e	Literary Vibes	Humanities
6	A1CS706f	Quantum Computing	Computer Science

IV B.Tech II Semester (CSE)

VIII SEMESTER (IV YEAR)							
S.No.	Course code	Title	Category	L	T	P	Credits
1	A1CS801	Internship		-	-	24	4
	A1CS802	Project					8
Total							12

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PROGRAM CURRICULUM STRUCTURE UNDER R23 REGULATION

B. Tech – I Year I Semester

		I SEMESTER (I YEAR)								
S.NO	Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P	C	Internal	External	Total
1	A10001	Communicative English	BS&H	2	0	0	2	30	70	100
2	A10004	Chemistry	BS&H	3	0	0	3	30	70	100
3	A10002	Linear Algebra & Calculus	BS&H	3	0	0	3	30	70	100
4	A10101	Basic Civil & Mechanical Engineering	ES	3	0	0	3	30	70	100
5	A10501	Introduction to Programming	ES	3	0	0	3	30	70	100
6	A10005	Communicative English Lab	BS&H	0	0	2	1	30	70	100
7	A10007	Chemistry Lab	BS&H	0	0	2	1	30	70	100
8	A10302	Engineering Workshop	ES	0	0	3	1.5	30	70	100
9	A10502	Computer Programming Lab	ES	0	0	3	1.5	30	70	100
10	A10012	Health and wellness, Yoga and Sports	BS&H	.	.	1	0.5	---	---	---
		TOTAL		14	00	11	19.5	270	630	900

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
(AUTONOMOUS)

COMMUNICATIVE ENGLISH

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	32	0	0	2	30	70	100

Course Objective

:

The main objective of introducing this course, *Communicative English*, is to facilitate effective listening, Reading, Speaking and Writing skills among the students. It enhances the same in their comprehending abilities, oral presentations, reporting useful information and providing knowledge of grammatical structures and vocabulary. This course helps the students to make them effective in speaking and writingskills and to make them industry ready.

Course Pre/co requisites:

The course has no specific pre/co-requisites

Course Outcomes (COs)

After the completion of the course, the student will be able to:

CO1	Remember the concepts which the student has learnt previously and identifying their connection.
CO2	Understand the structure of the sentence.
CO3	Apply Grammatically correct structures in oral and written communication.
CO4	Analyze complex technical ideas with precision to interpret facts in a given text.
CO5	Write summaries and essays based on global comprehension of the texts.
CO6	Write Officials letters,Resume and Emails.

UNIT I

Lesson: HUMAN VALUES: Gift of Magi (Short Story)

Listening: Identifying the topic, the context and specific pieces of information by listening to people talk about their past.

Speaking: Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. Introducing self, talking about oneself, exchanging personal information, remembering childhood and asking about someone's childhood

Reading: Skimming to get the main idea of a text; scanning to look for specific pieces of information.

Writing: Mechanics of Writing-Capitalization, Spellings, Punctuation-Parts of Sentences.

Grammar: Parts of Speech, Basic Sentence Structures-forming questions

Vocabulary: Synonyms, Antonyms, Affixes (Prefixes/Suffixes), Root words.

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UNIT II

Lesson: NATURE: The Brook by Alfred Tennyson (Poem)

Listening: Answering a series of questions about main ideas and supporting ideas after listening to a description of a transportation system.

Speaking: Discussion in pairs/small groups on specific topics followed by short structure talks-talking about transportation and transportation problems, evaluating city services, asking for and giving information.

Reading: Identifying sequence of ideas; recognizing verbal techniques that help to link the ideas in a paragraph together.

Writing: Structure of a paragraph - Paragraph writing (specific topics)

Grammar: Cohesive devices - linkers, use of articles and zero article;

prepositions. **Vocabulary:** Homonyms, Homophones, Homographs.

UNIT III

Lesson: BIOGRAPHY: Elon Musk

Listening: Listening for global comprehension and summarizing (Listening to people talk about capsule hotels.)

Speaking: Discussing specific topics in pairs or small groups and reporting what is discussed. Describing positive and negative features; making comparisons; talking about lifestyle changes.

Reading: Reading a text in detail by making basic inferences -recognizing and interpreting specific context clues; strategies to use text clues for comprehension.

Writing: Summarizing, Note-making, paraphrasing

Grammar: Verbs - tenses; subject-verb agreement; Compound words, Collocations

Vocabulary: Compound words, Collocations

UNIT IV

Lesson: INSPIRATION: The Toys of Peace by Saki

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video.

Speaking: Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. Talking about food, expressing likes and dislikes; describing a favorite snack; giving step-by-step instructions.

Reading: Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data.

Writing: Letter Writing: Official Letters, Resumes

Grammar: Reporting verbs, Direct & Indirect speech, Active & Passive Voice

Vocabulary: Words often confused, Jargons

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UNIT V

Lesson: MOTIVATION: The Power of Intrapersonal Communication (An Essay)

Listening: Identifying key terms, understanding concepts and answering a series of relevant questions that test comprehension. (Listening to travel advice.)

Speaking: Formal oral presentations on topics from academic contexts. Describing vacation plans; giving travel advice; planning a vacation

Reading: Reading comprehension.

Writing: Writing structured essays on specific topics.

Grammar: Editing short texts –identifying and correcting common errors in grammar and usage (articles, prepositions, tenses, subject verb agreement)

Vocabulary: Technical Jargons

Textbooks:

1. Pathfinder: Communicative English for Undergraduate Students, 1st Edition, Orient Black Swan, 2023(Units 1,2 & 3)
2. Empowering with Language by Cengage Publications, 2023 (Units 4 & 5)
3. Interchange fifth edition by Cambridge University Press, 2021

Reference Books:

1. Dubey, Sham Ji & Co. English for Engineers, Vikas Publishers, 2020
2. Bailey, Stephen. Academic writing: A Handbook for International Students. Routledge, 2014.
3. Murphy, Raymond. English Grammar in Use, Fourth Edition, Cambridge University Press, 2019.
4. Lewis, Norman. Word Power Made Easy- The Complete Handbook for Building a Superior Vocabulary. Anchor, 2014.

Web Resources:

GRAMMAR:

www.bbc.co.uk/learningenglish

<https://dictionary.cambridge.org/grammar/british-english>

[sh-grammar/ www.eslpod.com/index.html](http://www.eslpod.com/index.html)

<https://www.learngrammar.net/>

<https://english4today.com/english-grammar-online-with-quizzes/>

<https://www.talkenglish.com/grammar/grammar.aspx>

VOCABULARY

<https://www.youtube.com/c/DailyVideoVocabulary/videos>

https://www.youtube.com/channel/UC4cmBAit8i_NJZE8qK8sfpA

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL

(AUTONOMOUS) COMMUNICATIVE ENGLISH LAB

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	32	1	30	70	100

Course

Description

Course

Overview

The main objective of introducing this course, Communicative English Laboratory, is to expose the students to a variety of self-instructional, learner friendly modes of language learning. The students will get trained in basic communication skills and also make them ready to face job interviews

Course Pre/co-requisites

Bridge Course

Course Outcomes (COs)

After completion of the course, the learner will be able to:

CO1	Understand the different aspects of the English language proficiency with emphasis on LSRW skills.
CO2	Apply communication skills through various language learning activities.
CO3	Analyze the english speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.
CO4	Evaluate and exhibit professionalism in participating in debates and group discussion s.
CO5	Create effective Course Objectives.
CO6	Apply interview skills in participating.

List of Topics:

1. Vowels & Consonants
2. Neutralization/Accent Rules
3. Communication Skills & JAM
4. Role Play or Conversational Practice
5. E-mail Writing
6. Resume Writing, Cover letter, SOP
7. Group Discussions-methods & practice
8. Debates - Methods & Practice
9. PPT Presentations/ Poster Presentation
10. Interviews Skills

Suggested Software:

- Walden Infotech
- Young India Films

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Reference Books:

1. Raman Meenakshi, Sangeeta-Sharma. *Technical Communication*. Oxford Press.2018.
2. Taylor Grant: *English Conversation Practice*, Tata McGraw-Hill Education India, 2016
3. Hewing's, Martin. *Cambridge Academic English (B2)*. CUP, 2012.
4. J. Sethi & P.V. Dhamija. *A Course in Phonetics and Spoken English*, (2nd Ed), Kindle, 2013

Web Resources:

Spoken English:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. <https://www.britishcouncil.in/english/online>
5. <http://www.letstalkpodcast.com/>
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. <https://www.youtube.com/c/ArnelsEverydayEnglish/featured>
8. <https://www.youtube.com/c/engvidAdam/featured>
9. <https://www.youtube.com/c/EnglishClass101/featured>
10. <https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists>
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw

Voice & Accent:

1. <https://www.youtube.com/user/letstalkaccent/videos>
2. <https://www.youtube.com/c/EngLanguageClub/featured>
3. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
4. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
(AUTONOMOUS)
Linear Algebra and Calculus

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	48	0	0	3	30	70	100

Course Description

Course Overview

Engineering mathematics is a branch of applied mathematics concerning mathematical methods and techniques that are typically used in engineering and industry. Along with fields like engineering physics and engineering geology, both of which may belong in the wider category engineering science, engineering mathematics is an interdisciplinary subject motivated by engineers' needs both for practical, theoretical and other considerations outside their specialization, and to deal with constraints to be effective in their work

. Course Pre/co-requisites

Bridge Course

1. Course Outcomes (COs)

After completion of the course, the learner will be able to:

CO1	Develop and use of matrix algebra techniques that are needed by engineers for practical applications.
CO2	Utilize mean value theorems to real life problems.
CO3	Familiarize with functions of several variables which is useful in optimization.
CO4	Learn important tools of calculus in higher dimensions.
CO5	Familiarize with double and triple integrals of functions of several variables in two dimensions using Cartesian and polar coordinates and in three dimensions using cylindrical and spherical coordinates.
CO6	Develop and use of multiple integrals

Course Syllabus

UNIT-I

Matrices

Rank of a matrix by echelon form, normal form .Cuchy-Binet Formula (without proof).Inverse of Non- singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations by Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods.

UNIT II

Eigenvalues, Eigenvectors and Orthogonal Transformation

Eigenvalues, Eigenvectors and their properties, Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation.

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UNIT III

Calculus

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainder (without proof), problems and applications on the above theorems.

UNIT IV

Partial differentiation and Applications (Multi variable calculus)

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Directional derivative, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, maxima and minima of functions of two variables, method of Lagrange multipliers

UNIT V

Multiple Integrals (Multi variable Calculus)

Double integrals, triple integrals, change of order of integration, change of variables to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

Books and Materials

Text Book(s):

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Book(s):

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, Micheal Greenberg, , Pearson publishers, 9th edition
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications, 2014, Third Edition (Reprint 2021)

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(AUTONOMOUS)
CHEMISTRY

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	48	0	0	3	30	70	100

Course Overview

To familiarize engineering chemistry and its applications

To train the students on the principles and applications of electrochemistry

and polymers To introduce instrumental methods, molecular machines and switches.

Course Pre/co-requisites

Bridge Course

1. Course Outcomes (COs)

After completion of the course, the learner will be able to:

CO1	Compare the materials of construction for battery and electrochemical sensors.
CO2	Explain the preparation, properties, and applications of thermoplastics & thermosetting & elastomers conducting polymers.
CO3	Explain the principles of spectrometry, slc in separation of solid and liquid mixtures.
CO4	Apply the principle of Band diagrams in the application of conductors and semiconductors
CO5	Summarize the concepts of Instrumental methods.
CO6	Compare the materials of construction Polymer Chemistry

UNIT I **Structure and Bonding Models:**

Fundamentals of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2 , particle in one dimensional box, molecular orbital theory – bonding in homo- and heteronuclear diatomic molecules – energy level diagrams of O₂ and CO, etc. π -molecular orbitals of butadiene and benzene, calculation of bond order.

UNIT II **Modern Engineering materials**

Semiconductors – Introduction, basic concept, application Super Conductors- Introduction basic concept, applications.

Supercapacitors: Introduction, Basic Concept-Classification – Applications.

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Nano materials: Introduction, classification, properties and applications of Fullerenes, carbon nano tubes and Graphines nanoparticles.

UNIT III Electrochemistry and Applications

Electrochemical cell, Nernst equation, cell potential calculations and numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).

Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples. Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries-working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell– working of the cells. Polymer Electrolyte Membrane Fuel cells (PEMFC).

UNIT IV Polymer Chemistry

Introduction to polymers, functionality of monomers, chain growth and step growth polymerization, coordination polymerization, with specific examples and mechanisms of polymer formation.

Plastics –Thermo and Thermosetting plastics, Preparation, properties and applications of – PVC, Teflon, Bakelite, Nylon-6,6, carbon fibres.

Elastomers–Buna-S, Buna-N–preparation, properties and applications.

Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications. Bio- Degradable polymers - Poly Glycolic Acid (PGA), Polyl Lactic Acid (PLA).

UNIT V Instrumental Methods and Applications

Electromagnetic spectrum. Absorption of radiation: Beer-Lambert's law. UV-Visible Spectroscopy, electronic transition, Instrumentation, IR spectroscopies, fundamental modes and selection rules, Instrumentation. Chromatography-Basic Principle, Classification-HPLC:

Principle, Instrumentation and Applications.

Textbooks:

Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.

Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e, Oxford University Press, 2010.

Reference Books:

Skoog and West, Principles of Instrumental Analysis, 6/e, Thomson, 2007.

J.D. Lee, Concise Inorganic Chemistry, 5th Edition, Wiley

Publications, Feb.2008 Textbook of Polymer Science, Fred W.

Billmayer Jr, 3rd Edition

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CHEMISTRY LAB

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	32	1	30	70	100

1. Course Description

Course Overview

Verify the fundamental concepts with experiments

Course Pre/co-requisites

Bridge Course

Course Outcomes (COs)

After completion of the course, the learner will be able to:

CO1	Determine the cell constant and conductance of solutions.
CO2	Prepare advanced polymer Bakelite materials
CO3	Measure the strength of an acid present in secondary batteries.
CO4	Analyze the IR spectra of some organic compounds.
CO5	Calculate strength of acid in Pb-Acid battery.
CO6	Calculate wavelength, nanomaterial

List of Experiments:

1. Measurement of 10Dq by spectrophotometric method
2. Conductometric titration of strong acid vs. strong base
3. Conductometric titration of weak acid vs. strong base
4. Determination of cell constant and conductance of solutions
5. Potentiometry - determination of redox potentials and emfs
6. Determination of Strength of an acid in Pb-Acid battery
7. Preparation of a Bakelite
8. Verify Lambert-Beer's law
9. Wavelength measurement of sample through UV-Visible Spectroscopy

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10. Identification of simple organic compounds by IR
11. Preparation of nanomaterials by precipitation method
12. Estimation of Ferrous Iron by Dichrometry

Reference:

"Vogel's Quantitative Chemical Analysis 6th Edition 6th Edition" Pearson Publications by J. Mendham, R.C.Denney, J.D.Barnes and B. Sivasankar

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
(AUTONOMOUS)
INTRODUCTION TO PROGRAMMING

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	48	0	0	3	30	70	100

1. Course Objectives:

- To introduce students to the fundamentals of computer programming.
- To provide hands-on experience with coding and debugging.
- To foster logical thinking and problem-solving skills using programming.
- To familiarize students with programming concepts such as data types, control structures, functions, and arrays.
- To encourage collaborative learning and teamwork in coding projects

2. Course Outcomes:

A student after completion of the course will be able to

CO1	Understand basics of computers, the concept of algorithm and algorithmic thinking
CO2	Analyse a problem and develop an algorithm to solve it.
CO3	Implement various algorithms using the C programming language
CO4	Understand more advanced features of C language.
CO5	Develop problem-solving skills and the ability to debug and optimize the code.
CO6	Develop problem solving on pointers

3. Course Syllabus

UNIT I Introduction to Programming and Problem Solving

History of Computers, Basic organization of a computer: ALU, input-output units, memory, program counter, Introduction to Programming Languages, Basics of a Computer Program- Algorithms, flowcharts (Using Dia Tool), pseudo code. Introduction to Compilation and Execution, Primitive Data Types, Variables, and Constants, Basic Input and Output, Operations, Type Conversion, and Casting.

Problem solving techniques: Algorithmic approach, characteristics of algorithm, Problem solving strategies: Top-down approach, Bottom-up approach, Time and space complexities of algorithms.

UNIT II Control Structures

Simple sequential programs Conditional Statements (if, if-else, switch), Loops (for, while, do-while) Break and Continue.

UNIT III Arrays and Strings

Arrays indexing, memory model, programs with array of integers, two dimensional arrays, Introduction to Strings.

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UNIT IV Pointers & User Defined Data types

Pointers, dereferencing and address operators, pointer and address arithmetic, array manipulation using pointers, User-defined data types-Structures and Unions.

UNIT V Functions & File Handling

Introduction to Functions, Function Declaration and Definition, Function call Return Types and Arguments, modifying parameters inside functions using pointers, arrays as parameters. Scope and Lifetime of Variables, Basics of File Handling

Note: The syllabus is designed with C Language as the fundamental language of implementation.

Textbooks:

1. "The C Programming Language", Brian W. Kernighan and Dennis M. Ritchie, Prentice-Hall, 1988
2. Schaum's Outline of Programming with C, Byron S Gottfried, McGraw-Hill Education, 1996

Reference Books:

1. Computing fundamentals and C Programming, Balagurusamy, E., McGraw-Hill Education, 2008.
2. Programming in C, Rema Thiraja, Oxford, 2016, 2nd edition
3. C Programming, A Problem Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE, 3rd edition

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(AUTONOMOUS)
COMPUTER PROGRAMMING LAB

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	48	0	0	3	30	70	100

1. Course Objectives:

The course aims to give students hands – on experience and train them on the concepts of the C- programming language.

2. Course Outcomes:

CO1	Read, understand, and trace the execution of programs written in C language.
CO2	Select the right control structure for solving the problem
CO3	Develop C programs which utilize memory efficiently using programming constructs like pointers.
CO4	Develop, Debug and Execute programs in c
CO5	To demonstrate the applications of arrays, functions, basic concepts of pointers in C.
CO6	To demonstrate the recursive functions

Course Syllabus

UNIT I

WEEK1

Objective: Getting familiar with the programming environment on the computer and writing the first program.

Suggested Experiments/Activities:

Tutorial 1: Problem-solving using Computers.

Lab1: Familiarization with programming environment

- Basic Linux environment and its editors like Vi, Vim & Emacs etc.
- Exposure to Turbo C, gcc
- Writing simple programs using printf(), scanf()

WEEK 2

Objective: Getting familiar with how to formally describe a solution to a problem in a series of finite steps both using textual notation and graphic notation.

Suggested Experiments /Activities:

Tutorial 2: Problem-solving using Algorithms and Flow charts.

Lab 1: Converting algorithms/flow charts into C Source code.

Developing the algorithms/flowcharts for the following sample programs

- Sum and average of 3 numbers
- Conversion of Fahrenheit to Celsius and vice versa

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- iii) Simple interest calculation

WEEK 3

Objective: Learn how to define variables with the desired data-type, initialize them with appropriate values and how arithmetic operators can be used with variables and constants.

Suggested Experiments/Activities:

Tutorial 3: Variable types and type conversions:

Lab 3: Simple computational problems using arithmetic expressions.

- i) Finding the square root of a given number
- ii) Finding compound interest
- iii) Area of a triangle using heron's formulae
- iv) Distance travelled by an object

UNIT II WEEK 4

Objective: Explore the full scope of expressions, type-compatibility of variables & constants and operators used in the expression and how operator precedence works.

Suggested Experiments/Activities:

Tutorial 4: Operators and the precedence and as associativity:

Lab 4: Simple computational problems using the operator's precedence and associativity

- i) Evaluate the following expressions.
 - a. $A+B*C+(D*E) + F*G$
 - b. $A/B*C-B+A*D/3$
 - c. $A+++B---A$
 - d. $J=(i++) + (++i)$
- ii) Find the maximum of three numbers using conditional operator
- iii) Take marks of 5 subjects in integers, and find the total, average in float

WEEK 5

Objective: Explore the full scope of different variants of "if construct" namely if-else, null- else, if-else if*-else, switch and nested-if including in what scenario each one of them can be used and how to use them. Explore all relational and logical operators while writing conditionals for "if construct".

Suggested Experiments/Activities:

Tutorial 5: Branching and logical expressions:

Lab 5: Problems involving if-then-else structures.

- i) Write a C program to find the max and min of four numbers using if-else.
- ii) Write a C program to generate electricity bill.
- iii) Find the roots of the quadratic equation.
- iv) Write a C program to simulate a calculator using switch case.
- v) Write a C program to find the given year is a leap year or not.

WEEK 6

Objective: Explore the full scope of iterative constructs namely while loop, do-while loop and

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(AUTONOMOUS)

for loop in addition to structured jump constructs like break and continue including when each of these statements is more appropriate to use.

Suggested Experiments/Activities:

Tutorial 6: Loops, while and for loops

Lab 6: Iterative problems e.g., the sum of series

- i) Find the factorial of given number using any loop.
- ii) Find the given number is a prime or not.
- iii) Compute sine and cos series
- iv) Checking a number palindrome
- v) Construct a pyramid of numbers.

UNIT III

WEEK 7:

Objective: Explore the full scope of Arrays construct namely defining and initializing 1-D and 2-D and more generically n-D arrays and referencing individual array elements from the defined array. Using integer 1-D arrays, explore search solution linear search.

Suggested Experiments/Activities:

Tutorial 7: 1 D Arrays: searching.

Lab 7: 1D Array manipulation, linear search

- i) Find the min and max of a 1-D integer array.
- ii) Perform linear search on 1D array.
- iii) The reverse of a 1D integer array
- iv) Find 2's complement of the given binary number.
- v) Eliminate duplicate elements in an array.

WEEK 8:

Objective: Explore the difference between other arrays and character arrays that can be used as Strings by using null character and get comfortable with string by doing experiments that will reverse a string and concatenate two strings. Explore sorting solution bubble sort using integer arrays.

Suggested Experiments/Activities:

Tutorial 8: 2 D arrays, sorting and Strings.

Lab 8: Matrix problems, String operations, Bubble sort

- i) Addition of two matrices
- ii) Multiplication two matrices
- iii) Sort array elements using bubble sort
- iv) Concatenate two strings without built-in functions
- v) Reverse a string using built-in and without built-in string functions

UNIT IV

WEEK 9:

Objective: Explore pointers to manage a dynamic array of integers, including memory allocation & value initialization, resizing changing and reordering the contents of an array and memory de-allocation using malloc (), calloc (), realloc () and free () functions. Gain

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experience processing command-line arguments received by C

Suggested Experiments/Activities:

Tutorial 9: Pointers, structures and dynamic memory allocation

Lab 9: Pointers and structures, memory dereference.

- i) Write a C program to find the sum of a 1D array using malloc()
- ii) Write a C program to find the total, average of n students using structures
- iii) Enter n students data using calloc() and display failed students list
- iv) Read student name and marks from the command line and display the student details along with the total.
- v) Write a C program to implement realloc()

WEEK 10:

Objective: Experiment with C Structures, Unions, bit fields and self-referential structures (Singly linked lists) and nested structures

Suggested Experiments/Activities:

Tutorial 10: Bitfields, Self-Referential Structures, Linked lists

Lab10 : Bitfields, linked lists

Read and print a date using dd/mm/yyyy format using bit-fields and differentiate the same without using bit- fields

- i) Create and display a singly linked list using self-referential structure.
- ii) Demonstrate the differences between structures and unions using a C program.
- iii) Write a C program to shift/rotate using bitfields.
- iv) Write a C program to copy one structure variable to another structure of the same type.

UNIT V

WEEK11:

Objective: Explore the Functions, sub-routines, scope and extent of variables, doing some experiments by parameter passing using call by value. Basic methods of numerical integration

Suggested Experiments/Activities:

Tutorial 11: Functions, call by value, scope and extent,

Lab 11: Simple functions using call by value, solving differential equations using Euler's theorem.

- i) Write a C function to calculate NCR value.
- ii) Write a C function to find the length of a string.
- iii) Write a C function to transpose of a matrix.
- iv) Write a C function to demonstrate numerical integration of differential equations using Euler's method

WEEK 12:

Objective: Explore how recursive solutions can be programmed by writing recursive functions that can be invoked from the main by programming at-least five distinct problems that have naturally recursive solutions.

Suggested Experiments/Activities:

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Tutorial 12: Recursion, the structure of recursive calls

Lab 12: Recursive functions

- i) Write a recursive function to generate Fibonacci series.
- ii) Write a recursive function to find the lcm of two numbers.
- iii) Write a recursive function to find the factorial of a number.
- iv) Write a C Program to implement Ackermann function using recursion.
- v) Write a recursive function to find the sum of series.

WEEK 13:

Objective: Explore the basic difference between normal and pointer variables, Arithmetic operations using pointers and passing variables to functions using pointers

Suggested Experiments/Activities:

Tutorial 13: Call by reference, dangling pointers

Lab 13: Simple functions using Call by reference, Dangling pointers.

- i) Write a C program to swap two numbers using call by reference.
- ii) Demonstrate Dangling pointer problem using a C program.
- iii) Write a C program to copy one string into another using pointer.
- iv) Write a C program to find no of lowercase, uppercase, digits and other characters using pointers.

WEEK 14:

Objective: To understand data files and file handling with various file I/O functions. Explore the differences between text and binary files.

Suggested Experiments/Activities:

Tutorial 14: File handling

Lab 14: File operations

- i) Write a C program to write and read text into a file.
- ii) Write a C program to write and read text into a binary file using fread() and fwrite()
- iii) Copy the contents of one file to another file.
- iv) Write a C program to merge two files into the third file using command line arguments.
- v) Find no. of lines, words and characters in a file
- vi) Write a C program to print last n characters of a given file.

Textbooks:

1. Ajay Mittal, Programming in C: A practical approach, Pearson.
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw Hill

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice-Hall of India
2. C Programming, A Problem-Solving Approach, Forouzan, Gilberg, Prasad, CENGAGE

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(AUTONOMOUS)

ENGINEERING WORKSHOP

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	0	0	48	1.5	30	70	100

1. Course Description:

This course introduces students to the basic concepts related to Engineering workshop and also imparts the knowledge about usage of the tools. This course familiarizes students with woodworking, welding, sheet metal operations, fitting and electrical house wiring skills. This knowledge enables the students to fabricate, manufacture or work with materials.

Course Pre/co-requisites:

This course has no Pre/co-requisites

2. Course Outcomes: (COs)

After completion of the course, the learner will be able to:

CO1	Identify workshop tools and their operational capabilities
CO2	Practice on manufacturing of components using workshop trades including fitting, carpentry, foundry and welding.
CO3	Apply fitting operations in various applications.
CO4	Apply basic electrical engineering knowledge for House Wiring Practice
CO5	Apply Welding shop operations in various applications.
CO6	Apply plumbing operations in various applications.

3. Course Syllabus:

- Demonstration:** Safety practices and precautions to be observed in workshop.
- Wood Working:** Familiarity with different types of woods and tools used in wood working and make following joints. a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint
- Sheet Metal Working:** Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets. a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing
- Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises. a) V-fit b) Dovetail fit c) Semi-circular fit d) Bicycle tire puncture and change of two-wheeler tyre

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5. **Electrical Wiring:** Familiarity with different types of basic electrical circuits and make the following connections. a) Parallel and series b) Two-way switch c) Godown lighting d) Tube light e) Three phase motor f) Soldering of wires

6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.

7. **Welding Shop:** Demonstration and practice on Arc Welding and Gas welding. Preparation of Lap joint and Butt joint.

8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

4. *Laboratory Equipment/Software/Tools Required:*

1. Fitting bench wise
2. Hack saw frame
3. Carpentry benchwise
4. Jack plane
5. Snip tool
6. Nose player
7. Cope & Drag
8. Sprue
9. Welding machine
10. House wiring set up
11. Plumbing Setup

5. *Books and Materials*

Text Book(s) :

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published, 2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Book(s) :

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL

(AUTONOMOUS)

PART A: BASIC CIVIL ENGINEERING

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	48	0	0	3	30	70	100

1. Course Description

Course Overview

- Get familiarized with the scope and importance of Civil Engineering sub-divisions. □Introduce the preliminary concepts of surveying.
- Acquire preliminary knowledge on Transportation and its importance in nation's economy.
- Get familiarized with the importance of quality, conveyance and storage of water.
- Introduction to basic civil engineering materials and construction techniques.

Course Pre/co-requisites

Bridge Course

2. Course Outcomes (COs)

After completion of the course, the learner will be able to:

CO1	Understand various sub-divisions of Civil Engineering and to appreciate their role in ensuring better society.
CO2	Know the concepts of surveying and to understand the measurement of distances, angles and levels through surveying
CO3	Realize the importance of Transportation in nation's economy and the engineering measures related to Transportation.
CO4	Understand the importance of Water Storage and Conveyance Structures so that the social responsibilities of water conservation will be appreciated.
CO5	Understand the basic characteristics of Civil Engineering Materials and attain knowledge on prefabricated technology.

UNIT I

Basics of Civil Engineering: Role of Civil Engineers in Society- Various Disciplines of Civil Engineering- Structural Engineering- Geo-technical Engineering- Transportation Engineering - Hydraulics and Water Resources Engineering - Environmental Engineering-Scope of each discipline - Building Construction and Planning- Construction Materials-Cement - Aggregate - Bricks- Cement concrete- Steel. Introduction to Prefabricated construction Techniques.

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UNIT II

Surveying: Objectives of Surveying- Horizontal Measurements- Angular Measurements- Introduction to Bearings Levelling instruments used for levelling -Simple problems on levelling and bearings-Contour mapping.

UNIT III

Transportation Engineering Importance of Transportation in Nation's economic development- Types of Highway Pavements- Flexible Pavements and Rigid Pavements - Simple Differences. Basics of Harbour, Tunnel, Airport, and Railway Engineering.

Water Resources and Environmental Engineering: Introduction, Sources of water- Quality of water- Specifications- Introduction to Hydrology–Rainwater Harvesting-Water Storage and Conveyance Structures (Simple introduction to Dams and Reservoirs).

Textbooks:

1. Basic Civil Engineering, M.S.Palanisamy, , Tata Mcgraw Hill publications (India) Pvt. Ltd. Fourth Edition.
2. Introduction to Civil Engineering, S.S. Bhavikatti, New Age International Publishers. 2022. First Edition.
3. Basic Civil Engineering, Satheesh Gopi, Pearson Publications, 2009, First Edition.

Reference Books:

1. Surveying, Vol- I and Vol-II, S.K. Duggal, Tata McGraw Hill Publishers 2019. Fifth Edition.
2. Hydrology and Water Resources Engineering, Santosh Kumar Garg, Khanna Publishers, Delhi. 2016
3. Irrigation Engineering and Hydraulic Structures - Santosh Kumar Garg, Khanna Publishers, Delhi 2023. 38th Edition.
4. Highway Engineering, S.K.Khanna, C.E.G. Justo and Veeraraghavan, Nemchand and Brothers Publications 2019. 10th Edition.
5. Indian Standard DRINKING WATER — SPECIFICATION IS 10500-2012.

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(AUTONOMOUS)

PART B: BASIC MECHANICAL ENGINEERING

Course Description

Course Overview

The students after completing the course are expected to

- Get familiarized with the scope and importance of Mechanical Engineering in different sectors and industries.
- Explain different engineering materials and different manufacturing processes.
- Provide an overview of different thermal and mechanical transmission systems and introduce basics of robotics and its applications.

2. Course Outcomes (COs)

After completion of the course, the learner will be able to:

CO1	Understand the different manufacturing processes.
CO2	Explain the basics of thermal engineering and its applications.
CO3	Describe the working of different mechanical power transmission systems and power plants.
CO4	Describe the basics of robotics and its applications.
CO5	Describe the working principles of casting
CO6	Explain the process of Thermal steel

UNIT I

Introduction to Mechanical Engineering: Role of Mechanical Engineering in Industries and Society- Technologies in different sectors such as Energy, Manufacturing, Automotive, Aerospace, and Marine sectors.

Engineering Materials - Metals-Ferrous and Non-ferrous, Ceramics, Composites, Smart materials.

UNIT II

Manufacturing Processes: Principles of Casting, Forming, joining processes, Machining, Introduction to CNC machines, 3D printing, and Smart manufacturing.

Thermal Engineering – working principle of Boilers, Otto cycle, Diesel cycle, Refrigeration and air- conditioning cycles, IC engines, 2-Stroke and 4-Stroke engines, SI/CI Engines, Components of Electric and Hybrid Vehicles.

UNIT III

Power plants – working principle of Steam, Diesel, Hydro, Nuclear power plants.

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Mechanical Power Transmission - Belt Drives, Chain, Rope drives, Gear Drives and their applications.

Introduction to Robotics - Joints & links, configurations, and applications of robotics.

(Note: The subject covers only the basic principles of Civil and Mechanical Engineering systems.
The evaluation shall be intended to test only the fundamentals of the subject)

Textbooks:

1. Internal Combustion Engines by V.Ganesan, By Tata McGraw Hill publications (India) Pvt. Ltd.
2. A Tear book of Theory of Machines by S.S. Rattan, Tata McGraw Hill Publications, (India) Pvt. Ltd.
3. An introduction to Mechanical Engg by Jonathan Wicker and Kemper Lewis, Cengage learning India Pvt. Ltd.

Reference Books:

1. Appuu Kuttan KK, Robotics, I.K. International Publishing House Pvt. Ltd. Volume-I
2. 3D printing & Additive Manufacturing Technology- L. Jyothish Kumar, Pulak M Pandey, Springer publications
3. Thermal Engineering by Mahesh M Rathore Tata McGraw Hill publications (India) Pvt. Ltd.
4. G. Shanmugam and M.S.Palanisamy, Basic Civil and the Mechanical Engineering, Tata McGraw Hill publications (India) Pvt. Ltd.

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL

(AUTONOMOUS)

HEALTH AND WELLNESS, YOGA AND SPORTS

(Common to All Branches of Engineering)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	1	0	0	16	0.5	-	-	100

Course Description

Course Overview

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

Course Pre/co-requisites

Bridge Course

Course Outcomes (COs)

Course Outcomes: After completion of the course the student will be able to

CO1	Understand the importance of yoga and sports for Physical fitness and sound health.
CO2	Demonstrate an understanding of health-related fitness components
CO3	Compare and contrast various activities that help enhance their health.
CO4	Assess current personal fitness levels.
CO5	Develop Positive Personality.

Course Syllabus:

UNIT I

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity

Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index (BMI) of all age groups.

Activities:

- Organizing health awareness programmes in community
- Preparation of health profile
- Preparation of chart for balance diet for all age groups

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UNIT II

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT III

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

- i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc. Practicing general and specific warm up, aerobics.
- ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping and running.

Reference Books:

- 1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning, 2022
- 2. T.K.V.Desikachar. The Heart of Yoga: Developing a Personal Practice
- 3. Archie J.Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
- 4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
- 5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014

General Guidelines:

- 1. Institutes must assign slots in the Timetable for the activities of Health/Sports/Yoga.
- 2. Institutes must provide field/facility and offer the minimum of five choices of as many as Games/Sports.
- 3. Institutes are required to provide sports instructor / yoga teacher to mentor the students.

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B. Tech – I Year II Semester

		II SEMESTER (I YEAR)								
S.NO	Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal	External	Total
1	A10003	Engineering Physics	BS&H	3	0	0	3	30	70	100
2	A10009	Differential Equations & Vector Calculus	BS&H	3	0	0	3	30	70	100
3	A10201	Basic Electrical & Electronics Engineering	ES	3	0	0	3	30	70	100
4	A10301	Engineering Graphics	ES	1	0	4	3	30	70	100
5	A10505	Data Structures	PC	3	0	0	3	30	70	100
6	A10503	IT Workshop	ES	0	0	2	1	30	70	100
7	A10006	Engineering Physics Lab	BS&H	0	0	2	1	30	70	100
8	A10202	Electrical & Electronics Engineering Workshop	ES	0	0	3	1.5	30	70	100
9	A10505	Data Structures Lab	PC	0	0	3	1.5	30	70	100
10	A1011	NSS/NCC/Scouts & Guides/Community Service	BS&H	.	.	1	0.5	---	---	---
		TOTAL		13	00	15	20.5	270	630	900

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
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ENGINEERING PHYSICS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	48	0	0	3	30	70	100

Course Description

Course Overview

The laws of physics play a key role in the development of science, engineering and technology. Sound knowledge of physical principles is of paramount importance in understanding new discoveries, recent trends and latest developments in the field of engineering. To keep in pace with the recent scientific advancements in the areas of emerging technologies, the syllabi of Engineering physics has been thoroughly revised keeping in view of the basic needs of all engineering branches by including the topics like physical optics, properties of dielectric and magnetic materials, determination of crystal structures, fundamentals of Quantum Mechanics semiconductors and superconductors are introduced.

Course Pre/co-requisites

Bridge Course

Course Outcomes (COs)

After completion of the course, the learner will be able to:

CO1	Interpret the properties of light waves and its interaction of energy with the matter
CO2	Apply the concepts of crystallography for the determination of crystal structures
CO3	Identify the suitable dielectric and magnetic material for the Engineering
CO4	Apply the fundamentals of Quantum Mechanics to one dimensional motion of particles
CO5	Determine the type of semiconductor
CO6	Interpret the difference normal conductor and Super conductor

Course Syllabus

UNIT-I

Wave Optics

Interference: Introduction - Principle of superposition –Interference of light - Interference in thin films (Reflection Geometry) & applications - Colours in thin films- Newton's Rings, Determination of wavelength and refractive index.

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Diffraction: Introduction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction due to single slit, double slit & N-slits (Qualitative) – Diffraction Grating - Dispersive power and resolving power of Grating (Qualitative).

Polarization: Introduction -Types of polarization -Polarization by reflection, refraction and Double refraction - Nicol's Prism -Half wave and Quarter wave plates.

UNIT II

Crystallography and X-ray diffraction

Crystallography: Space lattice, Basis, Unit Cell and lattice parameters – Bravais Lattices – crystal systems (3D) – coordination number - packing fraction of SC, BCC & FCC – Miller indices – separation between successive (hkl) planes.

X-ray diffraction: Bragg's law - X-ray Diffractometer – crystal structure determination by Laue's and powder methods

UNIT III

Dielectric and Magnetic Materials

8 hrs

Dielectric Materials: Introduction - Dielectric polarization - Dielectric polarizability, Susceptibility, Dielectric constant and Displacement Vector – Relation between the electric vectors - Types of polarizations- Electronic (Quantitative), Ionic (Quantitative) and Orientation polarizations (Qualitative)

- Lorentz internal field - Clausius- Mossotti equation – complex dielectric constant – Frequency dependence of polarization – dielectric loss

Magnetic Materials: Introduction - Magnetic dipole moment - Magnetization-Magnetic susceptibility and permeability – Atomic origin of magnetism - Classification of magnetic materials: Dia, para, Ferro, anti-ferro & Ferri magnetic materials - Domain concept for Ferromagnetism & Domain walls (Qualitative) - Hysteresis - soft and hard magnetic materials.

UNIT IV

Quantum Mechanics and Free Electron Theory

8 hrs

Quantum Mechanics: Dual nature of matter – Heisenberg's Uncertainty Principle – Significance and properties of wave function – Schrodinger's time independent and dependent wave equations– Particle in a one-dimensional infinite potential well.

Free Electron Theory: Classical free electron theory (Qualitative with discussion of merits and demerits) – Quantum free electron theory – electrical conductivity based on quantum free electron theory - Fermi-Dirac distribution - Density of states - Fermi energy

UNIT V

Semiconductors

6 hrs

Semiconductors: Formation of energy bands – classification of crystalline solids – Intrinsic semiconductors: Density of charge carriers – Electrical conductivity – Fermi level – Extrinsic semiconductors: density of charge carriers – dependence of Fermi energy on carrier concentration and temperature - Drift and diffusion currents – Einstein's equation – Hall effect and its applications.

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Books and Materials

Text Book(s):

- 1.P.K.Palaniswamy, “Engineering Physics” ScitechPublications,2011.
- 2.B.K.Pandey and S.Chaturvedi, “Engineering Physics”,Cengage Learning, 2012.
- 3.K.Thyagarajan, “Applied Physics”, Mc Graw Hill Education(India) Private Limited,2020.

Reference Book(s):

1. ShatendraSharma,Jyotsna Sharma, “Engineering Physics” Pearson Education,2018.
2. M.N. Avadhanulu, P.G.Kshirsagar& TVS Arun Murthy “A Text book of Engineering Physics”- S.Chand Publications,11th Edition 2019.

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
(AUTONOMOUS)

ENGINEERING PHYSICS LABORATORY

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	32	1	30	70	100

Course Description

Course Overview

This course imparts practical and conceptual knowledge of Physics applicable to the domain of civil and mechanical engineering. The laboratory work of the course is aimed to ensure that the student comprehends the concepts of Physics through demonstrable and executable experiments. This course will enable the student to determine the thickness of paper, radius of curvature of plano-convex lens, wavelength of different colors of white light, dispersive power of grating, self -Inductance of the coil, numerical aperture and acceptance angle of an optical fiber, resistivity and energy gap of a semiconductor, study of magnetic field along the axis of a current carrying coil, diffraction of light through single slit and measurement of resistance by varying temperature.

Course Pre/co-requisites:

Engineering Physics

2. Course Outcomes (COs)

After completion of the course, the learner will be able to:

CO1	Operate optical instruments like Travelling microscope and spectrometer
CO2	Understand the concepts of interference by finding thickness of paper, radius of curvature of Newton's rings
CO3	Interpret the concept of diffraction by the determination of wavelength of different colors of white light and dispersive power of grating
CO4	Plot the intensity of the magnetic field of circular coil carrying current with varying distance and B-H curve
CO5	Evaluate the acceptance angle of an optical fiber and numerical aperture
CO6	Determine the resistivity of the given semiconductor using four probe method, the band gap of a semiconductor

Course Syllabus

(Any 12 of the following)

1. Determine the thickness of the paper using wedge shape method
2. Determination of the radius of curvature of the lens by Newton's ring method
3. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.

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4. Diffraction due to single slit
5. Determination of Dispersive power of a diffraction grating by using spectrometer.
6. Magnetic field along the axis of a circular coil carrying current
7. Study the variation of B versus H by magnetizing the magnetic material (B-H curve)
8. Determination of energy gap of a semiconductor using p-n junction diode.
9. Determination of temperature coefficients of a thermistor.
10. LASER: Determination of wavelength of laser source by using diffraction grating
11. LASER: Determination of Particle size (hair) by using laser source
12. Determination of rigidity modulus of the material of the given wire using Torsional pendulum.
13. Sonometer: Verification of laws of stretched string.
14. Determination of Frequency of electrically maintained tuning fork by Melde's experiment.
15. Determination of Numerical Aperture and Acceptance angle of an optical fiber.

3. Laboratory Equipment/Software/Tools Required

1. Spectrometer
2. Travelling Microscope
3. Stewart-Gee's Apparatus
4. Single slit
5. Melde's Apparatus
6. B-H Curve
7. Torsional pendulum
8. Sonometer
9. Energy gap kit
10. Thermistor

Books and Materials

Text Book(s):

S.Balasubramanian, M.N.Srinivasan "A Text book of Practical Physics"- S. Chand Publishers, 2017

Reference Book(s)

<https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=802&cnt=1>.

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(AUTONOMOUS)

ENGINEERING GRAPHICS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
1	0	4	16	0	64	3	30	70	100

Course Description:

This course teaches the practices for accuracy and clarity in presenting the technical information in the form of drawings and the utility of drafting & modelling packages in orthographic and isometric drawings. It enables the student to understand and develop engineering imagination essential for successful design and familiarize how industry communicates technical information.

Course Pre/co-requisites:

This course has no Pre/co-requisites

Course Outcomes: (COs)

After completion of the course, the learner will be able to:

CO1	Understand the principles of engineering drawing, including engineering curves, scales, orthographic and isometric projections.
CO2	Draw and interpret orthographic projections of points, lines, planes and solids in front, top and side views.
CO3	Understand and draw projection of solids in various positions in first quadrant. CO4: Explain principles behind development of surfaces.
CO4	Explain principles behind development of surfaces.
CO5	Prepare isometric and perspective sections of simple solids.
CO6	Explain 2D & 3D printings

Course Syllabus:

UNIT -I :

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions and Constructing regular polygons by general methods. Curves: construction of ellipse, parabola and hyperbola by general, Cycloids, Involute, Normal and tangent to Curves. Scales: Plain scales, diagonal scales and vernier scales

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UNIT II:

Orthographic Projections: Reference plane, importance of reference lines or Plane, Projections of a point situated in any one of the four quadrants.

Projections of Straight Lines: Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of Straight Line Inclined to both the reference planes.

Projections of Planes: regular planes Perpendicular to both reference planes, parallel to one reference plane and inclined to the other reference plane; plane inclined to both the reference planes.

UNIT III:

Projections of Solids: Types of solids: Polyhedra and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to another plane.

UNIT IV:

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

UNIT V:

Conversion of Views: Conversion of isometric views to orthographic views; Conversion of orthographic views to isometric views.

Computer graphics: Creating 2D&3D drawings of objects including PCB and Transformations using Auto CAD (Not for end examination).

Books and Materials Text Book(s) :

1. N. D. Bhatt, Engineering Drawing, Charotar Publishing House, 2016.

Reference Book(s):

1. Engineering Drawing, K.L. Narayana and P. Kanniah, Tata McGraw Hill, 2013.
2. Engineering Drawing, M.B.Shah and B.C. Rana, Pearson Education Inc, 2009.
3. Engineering Drawing with an Introduction to AutoCAD, Dhananjay Jolhe, Tata McGraw Hill, 2017.

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL

(AUTONOMOUS)

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

(Common to All branches of Engineering)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

Course Description

Course Overview

This is the fundamental course for engineering students. This course is intended to enhance the technical skills in understanding of the operation and design of basic components like resistor, inductor and capacitor voltage and current sources and finally a complex DC circuits. It is also important to learn about basic principles of operations DC and AC electrical machines with their applications. It is also important to learn about basic principles of Energy Resources and their operations, tariff calculations and equipment safety measures.

Course Pre/co requisites.

1. Basic Mathematics
2. Fundamentals of Physics

PART A: BASIC ELECTRICAL ENGINEERING

2.Course Outcomes (COs)

After completion of the course, the student will be able to:

CO1	Remember the fundamental laws, operating principles of motors, generators, MC and MI instruments.
CO2	Understand the problem-solving concepts associated to AC and DC circuits, construction and operation of AC and DC machines, measuring instruments
CO3	Understand the different power generation mechanisms, Electricity billing concept and important safety measures related to electrical operations.
CO4	Apply mathematical tools and fundamental concepts to derive various equations related to machines, circuits and measuring instruments; electricity bill calculations and layout representation of electrical power systems..
CO5	Analyse different electrical circuits, performance of machines and measuring instruments.
CO6	Evaluate different circuit configurations, Machine performance and Power systems operation

Course Syllabus

UNIT I DC & AC Circuits

DC Circuits: Electrical circuit elements (R, L and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Super Position theorem, Simple numerical problems.

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AC Circuits: A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems)

UNIT II Machines and Measuring Instruments

Machines: Construction, principle and operation of (i) DC Motor, (ii) DC Generator, (iii) Single Phase Transformer, (iv) Three Phase Induction Motor and (v) Alternator, Applications of electrical machines.

Measuring Instruments: Construction and working principle of Permanent Magnet Moving Coil (PMMC), Moving Iron (MI) Instruments and Wheat Stone bridge.

UNIT III Energy Resources, Electricity Bill & Safety Measures

Energy Resources: Conventional and non-conventional energy resources; Layout and operation of various Power Generation systems: Hydel, Nuclear, Solar & Wind power generation.

Electricity bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of “unit” used for consumption of electrical energy, two-part electricity tariff, calculation of electricity bill for domestic consumers.

Equipment Safety Measures: Working principle of Fuse and Miniature circuit breaker (MCB), merits and demerits. Personal safety measures: Electric Shock, Earthing and its types, Safety Precautions to avoid shock.

3. Books and Materials

Text Book(s)

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition

Reference Book(s)

1. Basic Electrical Engineering, D. P. Kothari and I. J. Nagrath, Mc Graw Hill, 2019, Fourth Edition
2. Principles of Power Systems, V.K. Mehtha, S.Chand Technical Publishers, 2020
3. Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford University Press, 2017
4. Basic Electrical and ElectSonics Engineering, S. K. Bhattacharya, Person Publications, 2018, Second Edition.

Web Resources:

1. <https://nptel.ac.in/courses/108105053>
2. <https://nptel.ac.in/courses/108108076>

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PART B: BASIC ELECTRONICS ENGINEERING

Course Description

Course Overview

This course covers fundamental topics that are common to a wide variety of electronic engineering devices and systems. The topics include an introduction to semiconductor devices and their applications. The course creates the background in the physics of the compound semiconductor-based electronic devices and also prepares students to learn about oscillators, op-amps and digital electronics.

Course Pre/co requisites.

1. Basic Mathematics
2. Fundamentals of Physics

2 Course Outcomes (COs)

After completion of the course, the student will be able to:

CO1	Apply the concept of science and mathematics to understand the working of diodes, transistors, and their applications.
CO2	Explain the characteristics of diodes and transistors.
CO3	Familiarize with the number systems, codes, Boolean algebra and logic gates.
CO4	Understand the working mechanism of different combinational, sequential circuits and their role in the digital systems.

Course Syllabus

UNIT I SEMICONDUCTOR DEVICES

Introduction - Evolution of electronics – Vacuum tubes to nano electronics - Characteristics of PN Junction Diode — Zener Effect — Zener Diode and its Characteristics. Bipolar Junction Transistor — CB, CE, CC Configurations and Characteristics — Elementary Treatment of Small Signal CE Amplifier.

UNIT II BASIC ELECTRONIC CIRCUITS AND INSTRUMENTATION

Rectifiers and power supplies: Block diagram description of a dc power supply, working of a full wave bridge rectifier, capacitor filter (no analysis), working of simple zener voltage regulator. Amplifiers: Block diagram of Public Address system, Circuit diagram and working of common emitter (RC coupled) amplifier with its frequency response. Electronic Instrumentation: Block diagram of an electronic instrumentation system.

UNIT III DIGITAL ELECTRONICS

Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Excess-3 code, Gray code, Hamming code. Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR. Simple

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combinational circuits–Half and Full Adder, Introduction to sequential circuits, Flip flops, Registers and counters (Elementary Treatment only)

Books and Materials Textbooks:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009

Reference Books:

1. R. S. Sedha, A Textbook of Electronic Devices and Circuits, S. Chand & Co, 2010.
2. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002.
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

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ELECTRICAL & ELECTRONICS ENGINEERING WORKSHOP

(Common to All branches of Engineering)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	1.5	30	70	100

Course Description

Course Overview

This course is designed to provide students with fundamental concepts of Electrical Circuits and Electrical Machines for lab experience. Verification of Thevenin's, Super Position theorems and open and short circuit parameters and determination of efficiency of DC & AC Machines.

This course is designed to provide students with fundamental concepts of Electronic Devices for lab experience. Analysis of V-I characteristics of diodes, BJT and FET. Study of operation of rectifiers with & without filters.

Course Pre/co requisites.

Basic Mathematics

Fundamentals of Physics

PART A: BASIC ELECTRICAL ENGINEERING

Course Outcomes (COs)

After completion of the course, the student will be able to:

CO1	Understand the Electrical circuit design concept; measurement of resistance, power, power factor; concept of wiring and operation of Electrical Machines and Transformer.
CO2	Apply the theoretical concepts and operating principles to derive mathematical models for circuits, Electrical machines and measuring instruments; calculations for the measurement of resistance, power and power factor.
CO3	Apply the theoretical concepts to obtain calculations for the measurement of resistance, power and power factor.
CO4	Analyse various characteristics of electrical circuits, electrical machines and measuring instruments.
CO5	Design suitable circuits and methodologies for the measurement of various electrical parameters; Household and commercial wiring.

Activities:

1. Familiarization of commonly used Electrical & Electronic Workshop Tools: Bread board, Solder, cables, relays, switches, connectors, fuses, Cutter, plier, screwdriver set, wire stripper, flux, knife/blade, soldering iron, de-soldering pump etc.
- Provide some exercises so that hardware tools and instruments are learned to be used by the students.

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2. Familiarization of Measuring Instruments like Voltmeters, Ammeters, multimeter, LCR-Q meter, Power Supplies, CRO, DSO, Function Generator, Frequency counter.
 - Provide some exercises so that measuring instruments are learned to be used by the students.
3. Components:
 - Familiarization/Identification of components (Resistors, Capacitors, Inductors, Diodes, transistors, IC's etc.) – Functionality, type, size, colour coding package, symbol, cost etc.Testing of components like Resistor, Capacitor, Diode, Transistor, ICs etc. - Compare values of components like resistors, inductors, capacitors etc with the measured values by using instruments

PART A: ELECTRICAL ENGINEERING LAB

List of experiments:

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Measurement of Resistance using Wheat stone bridge
4. Magnetization Characteristics of DC shunt Generator
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Measurement of Earth Resistance using Megger
7. Calculation of Electrical Energy for Domestic Premises

Reference Books:

1. Basic Electrical Engineering, D. C. Kulshreshtha, Tata McGraw Hill, 2019, First Edition
 2. Power System Engineering, P.V. Gupta, M.L. Soni, U.S. Bhatnagar and A. Chakrabarti, Dhanpat Rai & Co, 2013
 3. Fundamentals of Electrical Engineering, Rajendra Prasad, PHI publishers, 2014, Third Edition
- Edition Note: Minimum Six Experiments to be performed.

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PART B: ELECTRONICS ENGINEERING LAB

List of Experiments:

1. Plot V-I characteristics of PN Junction diode A) Forward bias B) Reverse bias.
2. Plot V – I characteristics of Zener Diode and its application as voltage Regulator.
3. Implementation of half wave and full wave rectifiers
4. Plot Input & Output characteristics of BJT in CE and CB configurations
5. Frequency response of CE amplifier.
6. Simulation of RC coupled amplifier with the design supplied
7. Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs.
8. Verification of Truth Tables of S-R, J-K& D flip flops using respective ICs.

Tools / Equipment Required: DC Power supplies, Multi meters, DC Ammeters, DC Voltmeters, AC Voltmeters, CROs, all the required active devices.

References:

1. R. L. Boylestad & Louis Nashlesky, Electronic Devices & Circuit Theory, Pearson Education, 2021.
2. R. P. Jain, Modern Digital Electronics, 4th Edition, Tata Mc Graw Hill, 2009
3. R. T. Paynter, Introductory Electronic Devices & Circuits – Conventional Flow Version, Pearson Education, 2009.

Note: Minimum Six Experiments to be performed. All the experiments shall be implemented using both Hardware and Software

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(AUTONOMOUS)

DATA STRUCTURES
(COMMON TO CSE & CAI)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	48	0	0	3	30	70	100

1. Course Objectives:

- To provide the knowledge of basic data structures and their implementations.
- To understand importance of data structures in context of writing efficient programs.
- To develop skills to apply appropriate data structures in problem solving.

2. Course Outcomes:

At the end of the course, Student will be able to

CO1	Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
CO2	Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
CO3	Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
CO4	Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs and distinguish between deques and priority queues, and apply them appropriately to solve data management challenges.
CO5	Devise novel solutions to small scale programming challenges involving data structures such as stacks, queues, Trees.
CO6	Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

Course Syllabus

UNIT I

Introduction to Linear Data Structures: Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Overview of time and space complexity analysis for linear data structures. Searching Techniques: Linear & Binary Search, Sorting Techniques: Bubble sort, Selection sort, Insertion Sort

UNIT II

Linked Lists: Singly linked lists: representation and operations, doubly linked lists and circular linked lists, Comparing arrays and linked lists, Applications of linked lists.

UNIT III

Stacks: Introduction to stacks: properties and operations, implementing stacks using arrays and linked lists, Applications of stacks in expression evaluation, backtracking, reversing list etc.

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UNIT IV

Queues: Introduction to queues: properties and operations, implementing queues using arrays and linked lists, Applications of queues in breadth-first search, scheduling, etc.

Deque: Introduction to deque (double-ended queues), Operations on deque and their applications.

UNIT V

Trees: Introduction to Trees, Binary Search Tree – Insertion, Deletion & Traversal

Hashing: Brief introduction to hashing and hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations, Applications of hashing in unique identifier generation, caching, etc.

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms" by Robert Sedgewick

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DATA STRUCTURES LAB

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	48	0	0	3	30	70	100

Course Objectives:

The course aims to strengthen the ability of the students to identify and apply the suitable datastructure for the given real-world problem. It enables them to gain knowledge in practical applications of data structures.

Course Outcomes:

At the end of the course, Student will be able to

CO1	Explain the role of linear data structures in organizing and accessing data efficiently in algorithms.
CO2	Design, implement, and apply linked lists for dynamic data storage, demonstrating understanding of memory allocation.
CO3	Develop programs using stacks to handle recursive algorithms, manage program states, and solve related problems.
CO4	Apply queue-based algorithms for efficient task scheduling and breadth-first traversal in graphs.
CO5	Distinguish between deques and priority queues and apply them appropriately to solve data management challenges.
CO6	Recognize scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

1. Course Syllabus

List of Experiments:

Exercise 1: Array Manipulation

- i) Write a program to reverse an array.
- ii) C Programs to implement the Searching Techniques – Linear & Binary Search
- iii) C Programs to implement Sorting Techniques – Bubble, Selection and Insertion Sort

Exercise 2: Linked List Implementation

- i) Implement a singly linked list and perform insertion and deletion operations.
- ii) Develop a program to reverse a linked list iteratively and recursively.
- iii) Solve problems involving linked list traversal and manipulation.

Exercise 3: Linked List Applications

- i) Create a program to detect and remove duplicates from a linked list.
 - ii) Implement a linked list to represent polynomials and perform addition.
- Implement a double-ended queue (deque) with essential operations.

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Exercise 4: Double Linked List Implementation

- i) Implement a doubly linked list and perform various operations to understand its properties and applications.
- ii) Implement a circular linked list and perform insertion, deletion, and traversal.

Exercise 5: Stack Operations

- i) Implement a stack using arrays and linked lists.
- ii) Write a program to evaluate a postfix expression using a stack.
- iii) Implement a program to check for balanced parentheses using a stack.

Exercise 6: Queue Operations

- i) Implement a queue using arrays and linked lists.
- ii) Develop a program to simulate a simple printer queue system.
- iii) Solve problems involving circular queues.

Exercise 7: Stack and Queue Applications

- i) Use a stack to evaluate an infix expression and convert it to postfix.
- ii) Create a program to determine whether a given string is a palindrome or not.
- iii) Implement a stack or queue to perform comparison and check for symmetry.

Exercise 8: Binary Search Tree

- i) Implementing a BST using Linked List.
- ii) Traversing of BST.

Exercise 9: Hashing

- i) Implement a hash table with collision resolution techniques.
- ii) Write a program to implement a simple cache using hashing.

Textbooks:

1. Data Structures and algorithm analysis in C, Mark Allen Weiss, Pearson, 2nd Edition.
2. Fundamentals of data structures in C, Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, Silicon Press, 2008

Reference Books:

1. Algorithms and Data Structures: The Basic Toolbox by Kurt Mehlhorn and Peter Sanders
2. C Data Structures and Algorithms by Alfred V. Aho, Jeffrey D. Ullman, and John E. Hopcroft
3. Problem Solving with Algorithms and Data Structures" by Brad Miller and David Ranum
4. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein
5. Algorithms in C, Parts 1-5 (Bundle): Fundamentals, Data Structures, Sorting, Searching, and Graph Algorithms by Robert Sedgewick.

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(AUTONOMOUS)

DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	48	0	0	3	30	70	100

Course Description

Course Overview

Engineering mathematics is a branch of applied mathematics concerning mathematical methods and techniques that are typically used in engineering and industry. Along with fields like engineering physics and engineering geology, both of which may belong in the wider category engineering science, engineering mathematics is an interdisciplinary subject motivated by engineers' needs both for practical, theoretical and other considerations outside their specialization, and to deal with constraints to be effective in their work

Course Pre/co-requisites

Bridge Course

Course Outcomes (COs)

After completion of the course, the learner will be able to:

CO1	Solve the differential equations related to various engineering fields
CO2	Identify solution methods for partial differential equations that model physical processes.
CO3	Interpret the physical meaning of different operators such as gradient, curl and divergence.
CO4	Estimate the work done against a field, circulation and flux using vector calculus.
CO5	Estimate the work done against a field, circulation and flux using vector integration.
CO6	Identify solution methods for scalar and vector function

3. Course Syllabus

UNIT I

Differential equations of first order and first degree

Linear differential equations – Bernoulli's equations- Exact equations and equations reducible to exact form. Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits.

UNIT II

Linear differential equations of higher order (Constant Coefficients)

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, Method of variation of parameters. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT III Partial Differential Equations

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method. Homogeneous Linear Partial differential equations with constant coefficients.

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UNIT IV Vector differentiation

Scalar and vector point functions, vector operator Del, Del applies to scalar point functions- Gradient, Directional derivative, del applied to vector point functions- Divergence and Curl, vector identities.

UNIT V Vector integration

Without integral-circulation-work done, surface integral-flux, Green's theorem in the plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (without proof) and related problems.

Textbooks:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books:

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, Dennis G. Zill and Warren S. Wright, Jones and Bartlett, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Alpha Science International Ltd., 2021 5th Edition (9th reprint).
5. Higher Engineering Mathematics, B. V. Ramana, , McGraw Hill Education, 2017

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NSS/NCC/SCOUTS & GUIDES/COMMUNITY SERVICE

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	1	0	0	16	0.5	-	-	100

Course Description

Course Overview

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

Course Pre/co-requisites

Bridge Course

2. Course Outcomes (COs)

After completion of the course, the learner will be able to:

CO1	Understand the importance of discipline, character and service motto.
CO2	Solve some societal issues by applying acquired knowledge, facts, and techniques.
CO3	Explore human relationships by analyzing social problems.
CO4	Determine to extend their help for the fellow beings and downtrodden people.
CO5	Develop leadership skills and civic responsibilities..

Course Syllabus

UNIT I Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

- Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
- Conducting orientations programs for the students –future plans-activities-releasing road map etc.
- Displaying success stories-motivational biopics- award winning movies on societal issues etc.
- Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II

Nature & Care

Activities:

- Best out of waste competition.
- Poster and signs making competition to spread environmental awareness.
- Recycling and environmental pollution article writing competition.
- Organising Zero-waste day.

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- v) Digital Environmental awareness activity via various social media platforms.
- vi) Virtual demonstration of different eco-friendly approaches for sustainable living.
- vii) Write a summary on any book related to environmental issues.

UNIT III Community

Service Activities:

- i) Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities-experts-etc.
- ii) Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
- iii) Conducting consumer Awareness. Explaining various legal provisions etc.
- iv) Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
- v) Any other programmes in collaboration with local charities, NGOs etc.

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol;I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., “Introduction to Environmental Engineering”, McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. “Introduction to Environmental Engineering and Science”, Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

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(AUTONOMOUS)
IT WORKSHOP

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	32	1	40	60	100

Course Objectives:

- To introduce the internal parts of a computer, peripherals, I/O ports, connecting cables
- To teach basic command line interface commands on Linux
- To teach the usage of Internet for productivity and self-paced life-long learning
- To introduce Compression, Multimedia and Antivirus tools and Office Tools such as
- Word processors, Spread sheets and Presentation tools.

Course Outcomes:

CO1	Perform Hardware troubleshooting.
CO2	Understand Hardware components and inter dependencies.
CO3	Safeguard computer systems from viruses/worms.
CO4	Document/ Presentation preparation
CO5	Perform calculations using spreadsheets

PC Hardware

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.

Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also, students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.

Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.

Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally, students should demonstrate, to the instructor, how to access the websites and email. If there

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is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.

Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.

Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

Task 1 – Word Orientation: The mentor needs to give an overview of La TeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of La TeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using La TeXand word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.

Task 2: Using La TeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both La TeX and Word.

Task 3: Creating project abstract Features to be covered: -Formatting Styles, inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.

Task 4: Creating a Newsletter: Features to be covered: - Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

Excel

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources

Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text

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Task 2 : Calculating GPA - .Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function,

LOOKUP/VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

Power point

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI Tools – ChatGPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Code Generation: Test the model's ability to generate code by giving it partial code snippets and asking it to complete them. You can also ask the model to explain programming concepts or help you debug code.

Ex: Prompt: "Complete the following Python code to swap the values of two variables:
\npython\nna = 5\nnb = 10\ntemp = a\nna = b\nnb = temp\n"

Task 4: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

Ex: Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

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Task 5: Summarization: Provide a long piece of text, such as an article or a blog post, and ask the model to summarize it. Compare the model's summary with the original text to assess its ability to condense information effectively.

Ex: Prompt: "Summarize the article titled 'Ramayanam' in 3-4 sentences."

Task 6: Futuristic Predictions: Have fun by asking the model to predict future technological advancements, societal changes, or even hypothetical scenarios. Compare its responses with your own ideas.

Ex: Prompt: "Predict how artificial intelligence will transform everyday life in the next 20 years."

Task 7: Technical Explanations: Challenge the model with technical questions from different domains. Ask it to explain scientific concepts, mathematical theorems, or complex algorithms in simple terms. Ex: Prompt: "Explain the concept of neural networks in machine learning, including their layers and the process of backpropagation."

Reference Books:

1. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dream tech
2. The Complete Computer upgrade and repair book, 3rd edition Cheryl A Schmidt, WILEY Dream tech
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. PC Hardware - A Handbook – Kate J. Chase PHI (Microsoft)
5. LaTeX Companion – Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.
7. IT Essentials PC Hardware and Software Labs and Study Guide Third Edition by Patrick Regan – CISCO Press, Pearson Education.

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B. Tech – II Year I Semester

III SEMESTER (II YEAR)										
S.NO	Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal	External	Total
1	A14301	Discrete Mathematics & Graph Theory	BS&H	3	0	0	3	30	70	100
2	A12301	Universal Human Values- Understanding Harmony	BS&H	2	1	0	3	30	70	100
3	A10402	Digital Logic and Computer Organization	ES	3	0	0	3	30	70	100
4	A15302T	Advanced Data Structures & Algorithms Analysis	PC	3	0	0	3	30	70	100
5	A15303T	Database Management Systems	PC	3	0	0	3	30	70	100
6	A15302P	Advanced Data Structures and Algorithms Analysis Lab	PC	0	0	3	1.5	30	70	100
7	A15303P	Database Management Systems Lab	PC	0	0	3	1.5	30	70	100
8	A15304	Python programming	SEC	0	1	2	2	30	70	100
9	A19301	Environmental Science	MC	2	0	0	-	100*	.	100*
TOTAL				15	02	08	20	240	560	900

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(A14301) DISCRETE MATHEMATICS & GRAPH THEORY

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

Course Outcomes:

After successful completion of this course, the students should be able to

COs	Statements	Blooms level
CO1	Apply mathematical logic to solve problems.	L2, L3
CO2	Understand the concepts and perform the operations related to sets, relations and functions	L3, L5
CO3	Gain the conceptual background needed and identify structures of algebraic nature	L3
CO4	Apply basic counting techniques to solve combinatorial problems.	L3
CO5	Formulate problems and solve recurrence relations.	L2, L3
CO6	Apply Graph Theory in solving computer science problems	L3, L5

UNIT I Mathematical Logic

Introduction, Statements and Notation, Connectives, Well-formed formulas, Tautology, Duality law, Equivalence, Implication, Normal Forms, functionally complete set of connectives, Inference Theory of Statement Calculus, Predicate Calculus, Inference theory of Predicate Calculus.

UNIT II Set theory

The Principle of Inclusion- Exclusion, Pigeon hole principle and its application, Functions composition of functions, Inverse Functions, Recursive Functions, Lattices and its properties. Algebraic structures: Algebraic Systems-Examples and General Properties, Semi groups and Monoids, groups, sub groups, homomorphism, Isomorphism.

UNIT III Elementary Combinatorics

Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutations with Constrained Repetitions, Binomial Coefficients, The Binomial and Multinomial Theorems.

UNITIV:Recurrence Relations

Generating Functions of Sequences, Calculating Coefficients of Generating Functions, Recurrence relations, Solving Recurrence Relations by Substitution and Generating functions, The Method of Characteristic roots, Solutions of Inhomogeneous, Recurrence Relations.

UNIT V Graphs

Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multigraphs and Euler Circuits, Hamiltonian Graphs.

Regulations **Textbooks:**

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw Hill, 2002.
2. Kenneth H. Rosen, Discrete Mathematics and its Applications with Combinatorics and Graph Theory, 7th Edition, McGraw Hill Education (India) Private Limited.

Reference Books:

1. Joe L. Mott, Abraham Kandel and Theodore P. Baker, Discrete Mathematics for Computer Scientists & Mathematicians, 2nd Edition, Pearson Education.
2. Narsingh Deo, Graph Theory with Applications to Engineering and Computer Science.

Online Learning Resources:

1. <http://www.cs.yale.edu/homes/aspnes/classes/202/notes.pdf>

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN

B.Tech. – Computer Science and Engineering
II Year B.Tech. CSE –I Semester

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UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT(A12301)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcome:

At the end of the course, students will be able to

COs	Statement	Blooms Level
CO1	Define the terms like Natural Acceptance, Happiness and Prosperity	L1, L2
CO2	Identify one's self, and one's surroundings (family, society nature)	L1, L2
CO3	Apply what they have learnt to their own self in different day-to-day settings in real life	L3
CO4	Relate human values with human relationship and human society.	L4
CO5	Justify the need for universal human values and harmonious existence	L5
CO6	Develop as socially and ecologically responsible engineers	L3, L6

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1- hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions. The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself Lecture 3: self-exploration as the Process for Value Education

Lecture 4: Continuous Happiness and Prosperity – the Basic Human Aspirations

Tutorial 2: Practice Session PS2 Exploring Human Consciousness Lecture 5: Happiness and Prosperity – Current Scenario

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Lecture 6: Method to Fulfill the Basic Human Aspirations Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT II Harmony in the Human Being (6 lectures and 3 tutorials for practice session)

Lecture 7: Understanding Human being as the Co-existence of the self and the body. Lecture

8: Distinguishing between the Needs of the self and the body

Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.

Lecture 9: The body as an Instrument of the self Lecture 10: Understanding Harmony in the self

Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self Lecture 11: Harmony of the self with the body

Lecture 12: Programme to ensure self-regulation and Health

Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III : Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction Lecture 14: 'Trust' – the Foundational Value in Relationship

Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust Lecture 15: 'Respect' – as the Right Evaluation Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect Lecture 16: Other Feelings, Justice in Human-to-Human Relationship Lecture 17: Understanding Harmony in the Society

Lecture 18: Vision for the Universal Human Order

Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)

Lecture 19: Understanding Harmony in the Nature

Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature Lecture 21:

Realizing Existence as Co-existence at All Levels

Lecture 22: The Holistic Perception of Harmony in Existence

Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence

UNIT V Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)

Lecture 23: Natural Acceptance of Human Values Lecture 24: Definitiveness of (Ethical) Human Conduct Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct

Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order Lecture 26: Competence in Professional Ethics

Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies

Lecture 28: Strategies for Transition towards Value-based Life and Profession

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Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value

Education PS1 Sharing about Oneself

PS2 Exploring Human Consciousness PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being

PS4 Exploring the difference of Needs of self and body

PS5 Exploring Sources of Imagination in the self PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and

Society PS7 Exploring the Feeling of Trust

PS8 Exploring the Feeling of Respect

PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)

PS10 Exploring the Four Orders of Nature

PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional

Ethics PS12 Exploring Ethical Human Conduct

PS13 Exploring Humanistic Models in Education

PS14 Exploring Steps of Transition towards Universal Human Order

READINGS: Textbook and Teachers Manual

1. The Textbook

R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

2. The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria, Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them. Tutorial hours are to be used for practice sessions. While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements. In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self- exploration.

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Regulations Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than "extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values. It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department. Teacher preparation with a minimum exposure to at least one 8- day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources

1. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf>
2. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf>
3. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf>
4. <https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf>
5. <https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf>
6. <https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf>
7. <https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf>
8. <https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385>
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

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B.Tech. – Computer Science and Engineering

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DIGITAL LOGIC & COMPUTER ORGANIZATION (A10402)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

Course Objectives: The main objective of the course is to

- Provide students with a comprehensive understanding of digital logic design principles and computer organization fundamentals
- Describe memory hierarchy concepts
- Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices

Course Outcomes: After completion of the course, students will be able to

CO1	Differentiate between combinational and sequential circuits based on their characteristics and functionalities
CO2	Demonstrate an understanding of computer functional units.
CO3	Analyze the design and operation of processors, including instruction execution, pipelining, and control unit mechanisms, to comprehend their role in computer systems
CO4	Describe memory hierarchy concepts, including cache memory, virtual memory, and secondary storage, and evaluate their impact on system performance and scalability.
CO5	Explain input/output (I/O) systems and their interaction with the CPU, memory, and peripheral devices, including interrupts, DMA, and I/O mapping techniques.
CO6	Design Sequential and Combinational Circuits

UNIT – I:

Data Representation: Binary Numbers, Fixed Point Representation. Floating Point Representation. Number base conversions, Octal and Hexadecimal Numbers, components, Signed binary numbers, Binary codes Digital Logic Circuits-I: Basic Logic Functions, Logic gates, universal logic gates, Minimization of Logic expressions. K-Map Simplification, Combinational Circuits, Decoders, Multiplexers

UNIT – II:

Digital Logic Circuits-II: Sequential Circuits, Flip-Flops, Binary counters, Registers, Shift Registers, Ripple counters

Basic Structure of Computers: Computer Types, Functional units, Basic operational concepts, Bus structures, Software, Performance, multiprocessors and multi computers, Computer Generations, Von- Neumann Architecture

UNIT – III:

Computer Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations

Processor Organization: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control and Multi programmed Control

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UNIT – IV

The Memory Organization: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage

UNIT – V

Input /Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces

Textbooks:

1. Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 6th edition, McGraw Hill, 2023.
2. Digital Design, 6th Edition, M. Morris Mano, Pearson Education, 2018.
3. Computer Organization and Architecture, William Stallings, 11th Edition, Pearson, 2022.

Reference Books:

1. Computer Systems Architecture, M. Morris Mano, 3rd Edition, Pearson, 2017.
2. Computer Organization and Design, David A. Paterson, John L. Hennessy, Elsevier, 2004.
3. Fundamentals of Logic Design, Roth, 5th Edition, Thomson, 2003.

Online Learning Resources:

1. <https://nptel.ac.in/courses/106/103/106103068/>

ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS (A15302T)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

Course Objectives: The main objective of the course is to

- Provide knowledge on advance data structures frequently used in Computer Science domain
- Develop skills in algorithm design techniques popularly used
- Understand the use of various data structures in the algorithm design

Course Outcomes: After completion of the course, students will be able to

CO1	Illustrate the working of the advanced tree data structures and their applications
CO2	Understand the Graph data structure, traversals and apply them in various contexts
CO3	Use various data structures in the design of algorithms
CO4	Recommend appropriate data structures based on the problem being solved
CO5	Analyze algorithms with respect to space and time complexities
CO6	Design new algorithms

UNIT – I:

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations. AVL Trees – Creation, Insertion, Deletion operations and Applications B-Trees – Creation, Insertion, Deletion operations and Applications

UNIT – II:

Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication, Convex Hull

UNIT – III:

Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths Dynamic Programming: General Method, All pairs shortest paths, Single Source Shortest Paths – General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, String Editing, Travelling Salesperson problem.

UNIT – IV:

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem

UNIT – V:

NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP) NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling

Textbooks:

1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh
2nd Edition Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran 2nd
Edition University Press

Reference Books:

1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
2. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth,
Addison- Wesley, 1997.
4. Data Structures using C & C++: Langsam, Augenstein & Tanenbaum, Pearson, 1995
5. Algorithms + Data Structures & Programs: N. Wirth, PHI
6. Fundamentals of Data Structures in C++: Horowitz Sahni & Mehta, Galgotia Pub.
7. Data structures in Java:, Thomas Standish, Pearson Education Asia

Online Learning Resources:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. <http://peterindia.net/Algorithms.html>
3. Abdul Bari, 1. Introduction to Algorithms (youtube.com)

DATABASE MANAGEMENT SYSTEMS (A15303T)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

Course Objectives: The main objective of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

Course Outcomes: After completion of the course, students will be able to

CO1	Understand the basic concepts of database management systems
CO2	Analyze a given database application scenario to use ER model for conceptual design of the database
CO3	Utilize SQL proficiently to address diverse query challenges
CO4	Employ normalization methods to enhance database structure
CO5	Assess and implement transaction processing, concurrency control and database recovery protocols in databases.
CO6	Implement and database recovery protocols in databases.

UNIT I: Introduction

Database system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

Unit II: Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL: Simple Database schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT III: SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions (Date and Time, Numeric, String conversion). Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view (updatable and non-updatable), relational set operations.

UNIT IV: Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce-Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT V: Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm. Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing:

Textbooks:

1. Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2. Database System Concepts, 5th edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

Reference Books:

1. Introduction to Database Systems, 8th edition, C J Date, Pearson.
2. Database Management System, 6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Web-Resources:

1. <https://nptel.ac.in/courses/106/105/106105175/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview

ADVANCED DATA STRUCTURES & ALGORITHM ANALYSIS LAB (A15302P)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
0	0	3	0	0	42	1.5	30	70	100

Course Objectives: The objective of the course is to acquire practical skills in constructing and managing Data structures apply the popular algorithm design methods in problem-solving scenarios

Course Outcomes: After completion of the course, students will be able to

CO1	Design and develop programs to solve real world problems with the popular algorithm design methods.
CO2	Demonstrate an understanding of Non-Linear data structures by developing implementing the operations on AVL Trees, B-Trees, Heaps and Graphs.
CO3	Critically assess the design choices and implementation strategies of algorithms and data structures in complex applications.
CO4	Utilize appropriate data structures and algorithms to optimize solutions for specific computational problems.
CO5	Compare the performance of different of algorithm design strategies
CO6	Design algorithms to new real world problems

Experiments covering the Topics:

- Operations on AVL trees, B-Trees, Heap Trees
- Graph Traversals
- Sorting techniques
- Minimum cost spanning trees
- Shortest path algorithms
- 0/1 Knapsack Problem
- Travelling Salesperson problem
- Optimal Binary Search Trees
- N-Queens Problem
- Job Sequencing

Sample Programs:

1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.
2. Construct B-Tree an order of 5 with a set of 100 random elements stored in array. Implement searching, insertion and deletion operations.
3. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.
4. Implement BFT and DFT for given graph, when graph is represented by
a) Adjacency Matrix b) Adjacency Lists
5. Write a program for finding the bi-connected components in a given graph.
6. Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).
7. Compare the performance of Single Source Shortest Paths using Greedy method when the

graph is represented by adjacency matrix and adjacency lists.

8. Implement Job sequencing with deadlines using Greedy strategy.
9. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.
10. Implement N-Queens Problem Using Backtracking.
11. Use Backtracking strategy to solve 0/1 Knapsack problem.
12. Implement Travelling Sales Person problem using Branch and Bound approach.

Reference Books:

1. Fundamentals of Data Structures in C++, Horowitz Ellis, SahniSartaj, Mehta, Dinesh, 2ndEdition, Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2ndEdition, University Press
3. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
4. An introduction to Data Structures with applications, Trembley& Sorenson, McGraw Hill

Online Learning Resources:

1. <http://cse01-iiith.vlabs.ac.in/>
2. <http://peterindia.net/Algorithms.html>

DATABASE MANAGEMENT SYSTEMS LAB (A15303P)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
0	0	3	0	0	42	1.5	30	70	100

Course Objectives: This Course will enable students to

- Populate and query a database using SQL DDL/DML Commands
- Declare and enforce integrity constraints on a database
- Writing Queries using advanced concepts of SQL
- Programming PL/SQL including procedures, functions, cursors and triggers.

Course Outcomes: After completion of the course, students will be able to

CO1	Utilizing Data Definition Language (DDL), Data Manipulation Language (DML), and Data Control Language (DCL) commands effectively within a database environment
CO2	Constructing and execute queries to manipulate and retrieve data from databases.
CO3	Develop application programs using PL/SQL.
CO4	Analyze requirements and design custom Procedures, Functions, Cursors, and Triggers, leveraging their capabilities to automate tasks and optimize database functionality
CO5	Establish database connectivity through JDBC (Java Database Connectivity)

Experiments covering the topics:

- DDL, DML, DCL commands
- Queries, nested queries, built-in functions,
- PL/SQL programming- control structures
- Procedures, Functions, Cursors, Triggers,
- Database connectivity- ODBC/JDBC

Sample Experiments:

1. Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command.
2. Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, Constraints. Example:- Select the roll number and name of the student who secured fourth rank in the class.
3. Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.
4. Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date)
5.
 - i. Create a simple PL/SQL program which includes declaration section, executable section and exception –Handling section (Ex. Student marks can be selected from the table and printed for those who secured first class and an exception can be raised if no records were found)
 - ii. Insert data into student table and use COMMIT, ROLLBACK and SAVEPOINT in PL/SQL block.

6. Develop a program that includes the features NESTED IF, CASE and CASE expression. The program can be extended using the NULLIF and COALESCE functions.
7. Program development using WHILE LOOPS, numeric FOR LOOPS, nested loops using ERROR Handling, BUILT –IN Exceptions, USE defined Exceptions, RAISE-APPLICATION ERROR.
8. Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.
9. Program development using creation of stored functions, invoke functions in SQL Statements and write complex functions.
10. Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.
11. Develop Programs using BEFORE and AFTER Triggers, Row and Statement Triggers and INSTEAD OF Triggers
12. Create a table and perform the search operation on table using indexing and nonindexing techniques.
13. Write a Java program that connects to a database using JDBC
14. Write a Java program to connect to a database using JDBC and insert values into it
15. Write a Java program to connect to a database using JDBC and delete values from it

Text Books/Suggested Reading:

1. Oracle: The Complete Reference by Oracle Press
2. Nilesh Shah, "Database Systems Using Oracle", PHI, 2007
3. Rick F Vander Lans, "Introduction to SQL", Fourth Edition, Pearson Education, 2007

PYTHON PROGRAMMING (A15304)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
0	1	2	0	14	28	2	30	70	100

Course Objectives: The main objectives of the course are to

- Introduce core programming concepts of Python programming language.
- Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
- Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

Course Outcomes: After completion of the course, students will be able to

- Classify data structures of Python (L4)
- Apply Python programming concepts to solve a variety of computational problems (L3)
- Understand the principles of object-oriented programming (OOP) in Python, including classes, objects, inheritance, polymorphism, and encapsulation, and apply them to design and implement Python programs (L3)
- Become proficient in using commonly used Python libraries and frameworks such as JSON, XML, NumPy, pandas (L2)
- Exhibit competence in implementing and manipulating fundamental data structures such as lists, tuples, sets, dictionaries (L3)
- Propose new solutions to computational problems (L6)

UNIT-I: History of Python Programming Language, Thrust Areas of Python, Installing Anaconda Python Distribution, Installing and Using Jupyter Notebook.

Parts of Python Programming Language: Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, the type () Function and Is Operator, Dynamic and Strongly Typed Language.

Control Flow Statements: if statement, if-else statement, if...elif...else, Nested if statement, while Loop, for Loop, continue and break Statements, Catching Exceptions Using try and except Statement.

Sample Experiments:

1. Write a program to find the largest element among three Numbers.
2. Write a Program to display all prime numbers within an interval
3. Write a program to swap two numbers without using a temporary variable.
4. Demonstrate the following Operators in Python with suitable examples.
 - i) Arithmetic Operators
 - ii) Relational Operators
 - iii) Assignment Operators
 - iv) Logical Operators
 - v) Bit wise Operators
 - vi) Ternary Operator
 - vii) Membership Operators
 - viii) Identity Operators
5. Write a program to add and multiply complex numbers
6. Write a program to print multiplication table of a given number.

UNIT-II: Functions: Built-In Functions, Commonly Used Modules, Function Definition and Calling the function, return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments.

Strings: Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and

Joining, String Methods, Formatting Strings. **Lists:** Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, del Statement.

Sample Experiments:

1. Write a program to define a function with multiple return values.
2. Write a program to define a function using default arguments.
3. Write a program to find the length of the string without using any library functions.
4. Write a program to check if the substring is present in a given string or not.
5. Write a program to perform the given operations on a list:
 - i. Addition
 - ii. Insertion
 - iii. slicing
6. Write a program to perform any 5 built-in functions by taking any list.

UNIT-III: Dictionaries: Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement.

Tuples and Sets: Creating Tuples, Basic Tuple Operations, tuple() Function, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function, Sets, Set Methods, Frozenset.

Sample Experiments:

1. Write a program to create tuples (name, age, address, college) for at least two members and concatenate the tuples and print the concatenated tuples.
2. Write a program to count the number of vowels in a string (No control flow allowed).
3. Write a program to check if a given key exists in a dictionary or not.
4. Write a program to add a new key-value pair to an existing dictionary.
5. Write a program to sum all the items in a given dictionary.

UNIT-IV:Files: Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, Pickle Module, Reading and Writing CSV Files, Python os and os.path Modules.

Object-Oriented Programming: Classes and Objects, Creating Classes in Python, Creating Objects in Python, Constructor Method, Classes with Multiple Objects, Class Attributes Vs Data Attributes, Encapsulation, Inheritance, Polymorphism.

Sample Experiments:

1. Write a program to sort words in a file and put them in another file. The output file should have only lower-case words, so any upper-case words from source must be lowered.
2. Python program to print each line of a file in reverse order.
3. Python program to compute the number of characters, words and lines in a file.
4. Write a program to create, display, append, insert and reverse the order of the items in the array.
5. Write a program to add, transpose and multiply two matrices.
6. Write a Python program to create a class that represents a shape. Include methods to calculate its area and perimeter. Implement subclasses for different shapes like circle, triangle, and square.

UNIT-V: Introduction to Data Science: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.

Sample Experiments:

1. Python program to check whether a JSON string contains complex object or not.
2. Python Program to demonstrate NumPy arrays creation using array () function.
3. Python program to demonstrate use of ndim, shape, size, dtype.
4. Python program to demonstrate basic slicing, integer and Boolean indexing.
5. Python program to find min, max, sum, cumulative sum of array
6. Create a dictionary with at least five keys and each key represent value as a list where this list contains at least ten values and convert this dictionary as a pandas data frame and explore the data through the data frame as follows:
 - a. Apply head () function to the pandas data frame
 - b. Perform various data selection operations on Data Frame
7. Select any two columns from the above data frame, and observe the change in one attribute with respect to other attribute with scatter and plot operations in matplotlib

Reference Books:

1. Gowrishankar S, Veena A., Introduction to Python Programming, CRC Press.
2. Python Programming, S Sridhar, J Indumathi, V M Hariharan, 2nd Edition, Pearson, 2024
3. Introduction to Programming Using Python, Y. Daniel Liang, Pearson.

Online Learning Resources/Virtual Labs:

1. <https://www.coursera.org/learn/python-for-applied-data-science-ai>
2. <https://www.coursera.org/learn/python?specialization=python#syllabus>

ENVIRONMENTAL SCIENCE (A19301)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
2	0	0	28	0	0	2	100	0	100

Course Objectives:

CO1	To make the students to get awareness on environment.
CO2	To understand the importance of protecting natural resources, ecosystems for future generations
CO3	To save earth from the inventions by the engineers.
CO4	To understand the importance of biodiversity
CO5	To save pollution causes due to the day-to-day activities of human life

UNIT I

Multidisciplinary Nature of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

1. Forest ecosystem.
2. Grassland ecosystem
3. Desert ecosystem.
4. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega- diversity nation – Hot-spots of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man- wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex- situ conservation of biodiversity.

UNIT III

Environmental Pollution: Definition, Cause, effects and control measures of :

1. Air Pollution.
2. Water pollution
3. Soil pollution
4. Marine pollution
5. Noise pollution

6. Thermal pollution
7. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT V

Human Population and the Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Textbooks:

1. Textbook of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
2. Palaniswamy, “Environmental Studies”, Pearson education
3. S.Azeem Unnisa, “Environmental Studies” Academic Publishing Company
4. K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

References:

1. Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
2. M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
5. G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.

Course Structure
II Semester

B.Tech– II Year II Semester

IV SEMESTER (II YEAR)										
S.NO	Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal	External	Total
1	A12402a	Managerial Economics and Financial Analysis	BS&H	2	0	0	2	30	70	100
2	A14401	Probability & Statistics	ES	3	0	0	3	30	70	100
3	A15401T	Operating Systems	PC	3	0	0	3	30	70	100
4	A15402T	Object-Oriented Programming Through JAVA	PC	3	0	0	3	30	70	100
5	A15403	Software Engineering	PC	3	0	0	3	30	70	100
6	A15401P	Operating Systems Lab	PC	0	0	3	1.5	30	70	100
7	A15402P	Object-Oriented Programming Through JAVA Lab	PC	0	0	3	1.5	30	70	100
8	A15403	Full Stack Development-1	SEC	0	1	2	2	30	70	100
9	A19401	Design Thinking & Innovation	BS&H	1	0	2	2	30	70	100
TOTAL				15	01	10	21	270	630	900

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (A12402a)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
2	0	0	28	0	0	2	100	0	100

Course Objectives:

- To inculcate the basic knowledge of microeconomics and financial accounting
- To make the students learn how demand is estimated for different products, input- output relationship for optimizing production and cost
- To Know the Various types of market structure and pricing methods and strategy
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statement

Course Outcomes:

CO1	Define the concepts related to Managerial Economics, financial accounting and management
CO2	Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets
CO3	Apply the Concept of Production cost and revenues for effective Business decision
CO4	Analyze how to invest their capital and maximize returns
CO5	Evaluate the capital budgeting techniques.
CO6	Develop the accounting statements and evaluate the financial performance of business entity

UNIT - I Managerial Economics

Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting-Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

UNIT - II Production and Cost Analysis

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least- cost combination– Short run and long run Production Function- Isoquants and Is costs, Cost & Break-Even Analysis - Cost concepts and Cost behaviour- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems).

UNIT - III Business Organizations and Markets

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition– Oligopoly-Price-Output Determination - Pricing Methods and Strategies

UNIT - IV Capital Budgeting

Introduction – Nature, meaning, significance. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back

Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR)
Method (sample problems)

UNIT - V Financial Accounting and Analysis

Introduction – Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH.

Reference Books:

1. Ahuja Hl Managerial economics Schand.
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage.

Online Learning Resources:

<https://www.slideshare.net/123ps/managerial-economics-ppt>
<https://www.slideshare.net/rossanz/production-and-cost-45827016>
<https://www.slideshare.net/darkyla/business-organizations-19917607>
<https://www.slideshare.net/balarajbl/market-and-classification-of-market>
<https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396>
<https://www.slideshare.net/ashu1983/financial-accounting>

PROBABILITY & STATISTICS (A14401)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
3	0	0	42	0	0	2	30	70	100

Course Outcomes: After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Acquire knowledge in finding the analysis of categorically and various statistical elementary tools.	L2, L3
CO2	Develop skills in designing mathematical models involving probability, random variables and the critical thinking in the theory of probability and its applications in real life problems.	L3, L5
CO3	Apply the theoretical probability distributions like binomial, Poisson, and Normal in the relevant application areas.	L3
CO4	Analyze to test various hypotheses included in theory and types of errors for large samples.	L2, L3
CO5	Apply the different testing tools like t-test, F-test, chi-square test to analyze the relevant real-life problems.	L3,L5

UNIT I: Descriptive statistics

Statistics Introduction, Population vs Sample, Collection of data, primary and secondary data, Measures of Central tendency, Measures of Variability (spread or variance) Skewness, Kurtosis, correlation, correlation coefficient, rank correlation, regression coefficients, method of least squares, regression lines.

UNIT II: Probability

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

UNIT III: Probability distributions

Probability distributions: Binomial, Poisson and Normal-their properties (Chebyshevs inequality). Approximation of the binomial distribution to normal distribution.

UNIT IV: Estimation and Testing of hypothesis, large sample tests

Estimation-parameters, statistics, sampling distribution, point estimation, Formulation of null hypothesis, alternative hypothesis, the critical and acceptance regions, level of significance, two types of errors and power of the test. Large Sample Tests: Test for single proportion, difference of proportions, test for single mean and difference of means. Confidence interval for parameters in one sample and two sample problems

UNIT V: Small sample tests

Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test), χ^2 - test for goodness of fit, χ^2 - test for independence of attributes.

Textbooks:

1. Miller and Freunds, Probability and Statistics for Engineers, 7/e, Pearson, 2008.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.

Reference Books:

1. S. Ross, a First Course in Probability, Pearson Education India, 2002.
2. W. Feller, an Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.
3. B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc21_ma74/preview
2. https://onlinecourses.nptel.ac.in/noc22_mg31/preview

OPERATING SYSTEMS (A15401T)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
3	0	0	42	0	0	2	30	70	100

Course Objectives: The main objectives of the course is to make student

- Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection
- Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
- Illustrate different conditions for deadlock and their possible solutions.

Course Outcomes: After completion of the course, students will be able to

CO1	Describe the basics of the operating systems, mechanisms of OS to handle processes, threads, and their communication.
CO2	Understand the basic concepts and principles of operating systems, including process management, memory management, file systems, and Protection.
CO3	Make use of process scheduling algorithms and synchronization techniques to achieve better performance of a computer system.
CO4	Illustrate different conditions for deadlock and their possible solutions
CO5	Analyze the memory management and its allocation policies

UNIT - I

Operating Systems Overview: Introduction, Operating system functions, Operating systems operations, Computing environments, Free and Open-Source Operating Systems System Structures: Operating System Services, User and Operating-System Interface, system calls, Types of System Calls, system programs, Operating system Design and Implementation, Operating system structure, Building and Booting an Operating System, Operating system debugging

UNIT - II

Processes: Process Concept, Process scheduling, Operations on processes, Inter-process communication. Threads and Concurrency: Multithreading models, Thread libraries, Threading issues. CPU Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple processor scheduling.

UNIT – III

Synchronization Tools: The Critical Section Problem, Peterson’s Solution, Mutex Locks, Semaphores, Monitors, Classic problems of Synchronization. Deadlocks: system Model, Deadlock characterization, Methods for handling Deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

UNIT - IV

Memory-Management Strategies: Introduction, Contiguous memory allocation, Paging, Structure of the Page Table, Swapping. Virtual Memory Management: Introduction, Demand paging, Copy-on-write, Page replacement, Allocation of frames, Thrashing. Storage Management: Overview of Mass Storage Structure, HDD Scheduling.

UNIT - V

File System: File System Interface: File concept, Access methods, Directory Structure; File system Implementation: File-system structure, File-system Operations, Directory implementation, Allocation method, Free space management; File-System Internals: File- System Mounting,

Partitions and Mounting, File Sharing. Protection: Goals of protection, Principles of protection, Protection Rings, Domain of protection, Access matrix.

Textbooks:

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson , 2016

Reference Books:

1. Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018
2. Operating Systems: A Concept Based Approach, D.M Dhamdhare, 3rd Edition, McGraw- Hill, 2013

Online Learning Resources:

1. <https://nptel.ac.in/courses/106/106/106106144/>
2. <http://peterindia.net/OperatingSystems.html>

OBJECT-ORIENTED PROGRAMMING THROUGH JAVA (A15402T)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
3	0	0	42	0	0	2	30	70	100

Course Objectives: The learning objectives of this course are to:

- Identify Java language components and how they work together in applications
- Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
- Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
- Understand how to design applications with threads in Java
- Understand how to use Java api's for program development

Course Outcomes: After completion of the course, students will be able to

CO1	Analyze problems, design solutions using OOP principles, and implement them efficiently in Java.
CO2	Design and implement classes to model real-world entities, with a focus on attributes, behaviors, and relationships between objects
CO3	Demonstrate an understanding of inheritance hierarchies and polymorphic behaviour, including method overriding and dynamic method dispatch.
CO4	Apply Competence in handling exceptions and errors to write robust and fault-tolerant code.
CO5	Perform file input/output operations, including reading from and writing to files using Java I/O classes, graphical user interface (GUI) programming using JavaFX.
CO6	Choose appropriate data structure of Java to solve a problem

UNIT I: Object Oriented Programming: Basic concepts, Principles, Program Structure in Java: Introduction, Writing Simple Java Programs, Elements or Tokens in Java Programs, Java Statements, Command Line Arguments, User Input to Programs, Escape Sequences Comments, Programming Style.

Data Types, Variables, and Operators : Introduction, Data Types in Java, Declaration of Variables, Data Types, Type Casting, Scope of Variable Identifier, Literal Constants, Symbolic Constants, Formatted Output with printf() Method, Static Variables and Methods, Attribute Final, Introduction to Operators, Precedence and Associativity of Operators, Assignment Operator (=), Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.

Control Statements: Introduction, if Expression, Nested if Expressions, if–else Expressions, Ternary Operator?;, Switch Statement, Iteration Statements, while Expression, do–while Loop, for Loop, Nested for Loop, For–Each for Loop, Break Statement, Continue Statement.

UNIT II: Classes and Objects: Introduction, Class Declaration and Modifiers, Class Members, Declaration of Class Objects, Assigning One Object to Another, Access Control for Class Members, Accessing Private Members of Class, Constructor Methods for Class, Overloaded Constructor Methods, Nested Classes, Final Class and Methods, Passing Arguments by Value and by Reference, Keyword this.

Methods: Introduction, Defining Methods, Overloaded Methods, Overloaded Constructor Methods, Class Objects as Parameters in Method, Access Control, Recursive Methods, Nesting of

Methods, Overriding Methods, Attributes Final and Static.

UNIT III: Arrays: Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays, Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size, Sorting of Arrays, Search for Values in Arrays, Class Arrays, Two-dimensional Arrays, Arrays of Varying Lengths, Three-dimensional Arrays, Arrays as Vectors.

Inheritance: Introduction, Process of Inheritance, Types of Inheritances, Universal Super Class Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance, Multilevel Inheritance, Application of Keyword Super, Constructor Method and Inheritance, Method Overriding, Dynamic Method Dispatch, Abstract Classes, Interfaces and Inheritance.

Interfaces: Introduction, Declaration of Interface, Implementation of Interface, Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces, Static Methods in Interface, Functional Interfaces, Annotations.

UNIT IV: Packages and Java Library: Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path, Access Control, Packages in Java SE, Java.lang Package and its Classes, Class Object, Enumeration, class Math, Wrapper Classes, Auto-boxing and Autounboxing, Java util Classes and Interfaces, Formatter Class, Random Class, Time Package, Class Instant (java.time.Instant), Formatting for Date/Time in Java, Temporal Adjusters Class, Temporal Adjusters Class.

Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords throws and throw, try, catch, and finally Blocks, Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions.

Java I/O and File: Java I/O API, standard I/O streams, types, Byte streams, Character streams, Scanner class, Files in Java(Text Book 2)

UNIT V: String Handling in Java: Introduction, Interface Char Sequence, Class String, Methods for Extracting Characters from Strings, Comparison, Modifying, Searching; Class String Buffer.

Multithreaded Programming: Introduction, Need for Multiple Threads Multithreaded Programming for Multi-core Processor, Thread Class, Main Thread-Creation of New Threads, Thread States, Thread Priority- Synchronization, Deadlock and Race Situations, Inter-thread Communication - Suspending, Resuming, and Stopping of Threads.

Java Database Connectivity: Introduction, JDBC Architecture, Installing MySQL and MySQL Connector/J, JDBC Environment Setup, Establishing JDBC Database Connections, ResultSet Interface

Java FX GUI: Java FX Scene Builder, Java FX App Window Structure, displaying text and image, event handling, laying out nodes in scene graph, mouse events (Text Book 3)

Text Books:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson.

References Books:

1. The complete Reference Java, 11thedition, Herbert Schildt,TMH
2. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Resources:

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview

SOFTWARE ENGINEERING (A15403)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
3	0	0	42	0	0	2	30	70	100

Course Objectives: The objectives of this course are to introduce

- Software life cycle models, Software requirements and SRS document.
- Project Planning, quality control and ensuring good quality software.
- Software Testing strategies, use of CASE tools, Implementation issues, validation & verification procedures.

Course Outcomes: After completion of the course, students will be able to

CO1	Perform various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance
CO2	Analyse various software engineering models and apply methods for design and development of software projects.
CO3	Develop system designs using appropriate techniques.
CO4	Understand various testing techniques for a software project
CO5	Apply standards, CASE tools and techniques for engineering software projects
CO6	Develop Project Planning, quality control and ensuring good quality software.

UNIT I:

Introduction: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering. Software Life Cycle Models: Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model.

UNIT II:

Software Project Management: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management. Requirements Analysis And Specification: Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT III:

Software Design: Overview of the design process, How to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling. approaches to software design. Agility: Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2) Function-Oriented Software Design: Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review. User Interface Design: Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNIT IV:

Coding And Testing: Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing, Testing object-oriented programs, Smoke testing, and Some general issues associated with testing. Software Reliability And Quality Management: Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma.

UNIT V:

Computer-Aided Software Engineering (Case): CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment. Software Maintenance: Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost. Software Reuse: reuse- definition, introduction, reason behind no reuse so far, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.

Text Books:

1. Fundamentals of Software Engineering, Rajib Mall, 5th Edition, PHI.
2. Software Engineering A practitioner's Approach, Roger S. Pressman, 9th Edition, Mc- Graw Hill International Edition.

Reference Books:

1. Software Engineering, Ian Sommerville, 10th Edition, Pearson.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

Resources:

1. <https://nptel.ac.in/courses/106/105/106105182/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01260589506387148827_shared/overview
3. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview

OBJECT-ORIENTED PROGRAMMING THROUGH JAVA LAB (A15402P)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
0	0	3	0	0	42	1.5	30	70	100

Course Objectives: The aim of this course is to

- Practice object-oriented programming in the Java programming language
- Implement Classes, Objects, Methods, Inheritance, Exception, Runtime
- Polymorphism, User defined Exception handling mechanism
- Illustrate inheritance, Exception handling mechanism, JDBC connectivity
- Construct Threads, Event Handling, implement packages, Java FX GUI

Course Outcomes: After completion of the course, students will be able to

CO1	Demonstrate a solid understanding of Java syntax, including data types, control structures, methods, classes, objects, inheritance, polymorphism, and exception handling.
CO2	Apply fundamental OOP principles such as encapsulation, inheritance, polymorphism, and abstraction to solve programming problems effectively.
CO3	Familiar with commonly used Java libraries and APIs, including the Collections Framework, Java I/O, JDBC, and other utility classes.
CO4	Develop problem-solving skills and algorithmic thinking, applying OOP concepts to design efficient solutions to various programming challenges.
CO5	Proficiently construct graphical user interface (GUI) applications using Java FX
CO6	Develop new programs for solving typical computer science problems

Experiments covering the Topics:

- Object Oriented Programming fundamentals- data types, control structures
- Classes, methods, objects, Inheritance, polymorphism,
- Exception handling, Threads, Packages, Interfaces
- Files, I/O streams, JavaFX GUI

Sample Experiments:**Exercise – 1:**

- Write a JAVA program to display default value of all primitive data type of JAVA
- Write a java program that display the roots of a quadratic equation $ax^2+bx=0$. Calculate the discriminate D and basing on value of D, describe the nature of root.

Exercise - 2

- Write a JAVA program to search for an element in a given list of elements using binary search mechanism.
- Write a JAVA program to sort for an element in a given list of elements using bubble sort
- Write a JAVA program using StringBuffer to delete, remove character.

Exercise - 3

- Write a JAVA program to implement class mechanism. Create a class, methods and invoke them inside main method.
- Write a JAVA program implement method overloading.
- Write a JAVA program to implement constructor.
- Write a JAVA program to implement constructor overloading.

Exercise - 4

- Write a JAVA program to implement Single Inheritance
- Write a JAVA program to implement multi level I_1n_1 heritance

c) Write a JAVA program for abstract class to find areas of different shapes

Exercise - 5

- a) Write a JAVA program give example for “super” keyword.
- b) Write a JAVA program to implement Interface. What kind of Inheritance can be achieved?
- c) Write a JAVA program that implements Runtime polymorphism

Exercise - 6

- a) Write a JAVA program that describes exception handling mechanism
- b) Write a JAVA program Illustrating Multiple catch clauses • Write a JAVA program for creation of Java Built-in Exceptions
- Write a JAVA program for creation of User Defined Exception

Exercise - 7

- a) Write a JAVA program that creates threads by extending Thread class. First thread display “Good Morning “every 1 sec, the second thread displays “Hello “every 2 seconds and the third display “Welcome” every 3 seconds, (Repeat the same by implementing Runnable) b) Write a program illustrating **is Alive** and **join ()**
- c) Write a Program illustrating Daemon Threads.
- d) Write a JAVA program Producer Consumer Problem

Exercise – 8

- 8. Write a JAVA program that import and use the user defined packages
- 9. Without writing any code, build a GUI that display text in label and image in an ImageView (use JavaFX)
- 10. Build a Tip Calculator app using several JavaFX components and learn how to respond to user interactions with the GUI

Exercise – 9

- a) Write a java program that connects to a database using JDBC
- b) Write a java program to connect to a database using JDBC and insert values into it.
- c) Write a java program to connect to a database using JDBC and delete values from it

Textbooks:

1. JAVA one step ahead, Anitha Seth, B.L.Juneja, Oxford.
2. Joy with JAVA, Fundamentals of Object Oriented Programming, DebasisSamanta, MonalisaSarma, Cambridge, 2023.
3. JAVA 9 for Programmers, Paul Deitel, Harvey Deitel, 4th Edition, Pearson. References Books:
4. The complete Reference Java, 11th edition, Herbert Schildt,TMH
5. Introduction to Java programming, 7th Edition, Y Daniel Liang, Pearson

Online Resources:

1. <https://nptel.ac.in/courses/106/105/106105191/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_012880464547618816347_shared/overview

OPERATING SYSTEMS LAB (A15401P)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
0	0	3	0	0	42	1.5	30	70	100

Course Objectives: The main objectives of the course are to

- Provide insights into system calls, file systems, semaphores,
- Develop and debug CPU Scheduling algorithms, page replacement algorithms, thread implementation
- Implement Bankers Algorithms to Avoid the Dead Lock

Course Outcomes: After completion of the course, students will be able to

CO1	Trace different CPU Scheduling algorithms
CO2	Implement Bankers Algorithms to Avoid the Dead Lock
CO3	Evaluate Page replacement algorithms
CO4	Illustrate the file organization techniques
CO5	Illustrate Inter process Communication
CO6	Implement concurrent execution of threads

Experiments covering the Topics:

- UNIX fundamentals, commands & system calls
- CPU Scheduling algorithms, thread processing
- IPC, semaphores, monitors, deadlocks
- Page replacement algorithms, file allocation strategies
- Memory allocation strategies

Sample Experiments:

1. Practicing of Basic UNIX Commands.
2. Write programs using the following UNIX operating system calls fork, exec, getpid, exit, wait, close, stat, opendir and readdir
3. Simulate UNIX commands like cp, ls, grep, etc.,
4. Simulate the following CPU scheduling algorithms FCFS b) SJF c) Priority d) Round Robin
5. Control the number of ports opened by the operating system with Semaphore b) Monitors.
6. Write a program to illustrate concurrent execution of threads using pthreads library.
7. Write a program to solve producer-consumer problem using Semaphores.
8. Implement the following memory allocation methods for fixed partition First fit b) Worst fit c) Best fit
9. Simulate the following page replacement algorithms FIFO b) LRU c) LFU
10. Simulate Paging Technique of memory management.
11. Implement Bankers Algorithm for Dead Lock avoidance and prevention
12. Simulate the following file allocation strategies Sequential b) Indexed c) Linked

Reference Books:

1. Operating System Concepts, Silberschatz A, Galvin P B, Gagne G, 10th Edition, Wiley, 2018.
2. Modern Operating Systems, Tanenbaum A S, 4th Edition, Pearson, 2016
3. Operating Systems -Internals and Design Principles, Stallings W, 9th edition, Pearson, 2018
4. Operating Systems: A Concept Based Approach, D.M Dhamdhare, 3rd Edition, McGraw- Hill, 2013

Online Learning Resources:

1. <https://www.cse.iitb.ac.in/~mythili/os/>
2. <http://peterindia.net/OperatingSystems.html>

FULL STACK DEVELOPMENT – 1 (A15403)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
0	1	2	0	14	28	2	30	70	100

Course Objectives: The main objectives of the course are to

- Make use of HTML elements and their attributes for designing static web pages
- Build a web page by applying appropriate CSS styles to HTML elements
- Experiment with JavaScript to develop dynamic web pages and validate forms

Course Outcomes:

CO1	Design Websites.
CO2	Apply Styling to web pages.
CO3	Make Web pages interactive
CO4	Design Forms for applications.
CO5	Choose Control Structure based on the logic to be implemented.
CO6	Understand HTML tags, Attributes and CSS properties

Experiments covering the Topics:

- Lists, Links and Images
- HTML Tables, Forms and Frames
- HTML 5 and Cascading Style Sheets, Types of CSS
- Selector forms
- CSS with Color, Background, Font, Text and CSS Box Model
- Applying JavaScript - internal and external, I/O, Type Conversion
- JavaScript Conditional Statements and Loops, Pre-defined and User-defined Objects
- JavaScript Functions and Events
- Node.js

Sample Experiments:**1. Lists, Links and Images**

- Write a HTML program, to explain the working of lists.
- Note: It should have an ordered list, unordered list, nested lists and ordered list in an unordered list and definition lists.
- Write a HTML program, to explain the working of hyperlinks using <a> tag and href, target Attributes.
- Create a HTML document that has your image and your friend's image with a specific height and width. Also when clicked on the images it should navigate to their respective profiles.
- Write a HTML program, in such a way that, rather than placing large images on a page, the preferred technique is to use thumbnails by setting the height and width parameters to something like to 100*100 pixels. Each thumbnail image is also a link to a full sized version of the image. Create an image gallery using this technique

2. HTML Tables, Forms and Frames

- Write a HTML program, to explain the working of tables. (use tags: <table>, <tr>, <th>, <td> and attributes: border, rowspan, colspan)
- Write a HTML program, to explain the working of tables by preparing a timetable. (Note: Use <caption> tag to set the caption to the table & also use cell spacing, cell padding, border, rowspan, colspan etc.).
- Write a HTML program, to explain the working of forms by designing Registration form.

buttons,

list boxes using <select>&<option> tags, <text area> and two buttons ie: submit and reset. Use tables to provide a better view).

- d. Write a HTML program, to explain the working of frames, such that page is to be divided into 3 parts on either direction. (Note: first frame image, second frame paragraph, third frame hyperlink. And also make sure of using “no frame” attribute such that frames to be fixed).

3. HTML 5 and Cascading Style Sheets, Types of CSS

- a. Write a HTML program, that makes use of <article>, <aside>, <figure>, <figcaption>, <footer>, <header>, <main>, <nav>, <section>, <div>, tags.
- b. Write a HTML program, to embed audio and video into HTML web page.
- c. Write a program to apply different types (or levels of styles or style specification formats) - inline, internal, external styles to HTML elements. (identify selector, property and value).

4. Selector forms

- a. Write a program to apply different types of selector forms
 - a. Simple selector (element, id, class, group, universal)
 - b. Combinator selector (descendant, child, adjacent sibling, general sibling)
 - c. Pseudo-class selector
 - d. Pseudo-element selector
 - e. Attribute selector

5. CSS with Color, Background, Font, Text and CSS Box Model

- a. Write a program to demonstrate the various ways you can reference a color in CSS.
- b. Write a CSS rule that places a background image halfway down the page, tilting it horizontally. The image should remain in place when the user scrolls up or down.
- c. Write a program using the following terms related to CSS font and text:
 - i. font-size ii. font-weight iii. font-style
 - iv. text-decoration v. text-transformation vi. text-alignment
- d. Write a program, to explain the importance of CSS Box model using
 - i. Content ii. Border iii. Margin iv. padding

6. Applying JavaScript - internal and external, I/O, Type Conversion

- a. Write a program to embed internal and external JavaScript in a web page.
- b. Write a program to explain the different ways for displaying output.
- c. Write a program to explain the different ways for taking input.
- d. Create a webpage which uses prompt dialogue box to ask a voter for his name and age. Display the information in table format along with either the voter can vote or not

7. JavaScript Pre-defined and User-defined Objects

- a. Write a program using document object properties and methods.
- b. Write a program using window object properties and methods.
- c. Write a program using array object properties and methods.
- d. Write a program using math object properties and methods. Write a program using string object properties and methods.
- e. Write a program using regex object properties and methods.
- f. Write a program using date object properties and methods.
- g. Write a program to explain user-defined object by using properties, methods, accessors, constructors and display.

8. JavaScript Conditional Statements and Loops

- a. Write a program which asks the user to enter three integers, obtains the numbers from the user and outputs HTML text that displays the larger number followed by the words “LARGER NUMBER” in an information message dialog. If the numbers are equal, output HTML text as “EQUAL NUMBERS”.
- b. Write a program to display week days using switch case.
- c. Write a program to print 1 to 10 numbers using for, while and do-while loops.
- d. Write a program to print data in object using for-in, for-each and for-of loops
- e. Develop a program to determine whether a given number is an ‘ARMSTRONG NUMBER’ or not. [Eg: 153 is an Armstrong number, since sum of the cube of the digits is equal to the number i.e., $13 + 53 + 33 = 153$]
- f. Write a program to display the denomination of the amount deposited in the bank in terms of 100’s, 50’s, 20’s, 10’s, 5’s, 2’s & 1’s. (Eg: If deposited amount is Rs.163, the output should be 1-100’s, 1-50’s, 1-10’s, 1-2’s & 1-1’s)

9. Java script Functions and Events

- a. Design a appropriate function should be called to display
 - Factorial of that number
 - Fibonacci series up to that number
 - Prime numbers up to that number
 - Is it palindrome or not
- b. Design a HTML having a text box and four buttons named Factorial, Fibonacci, Prime, and Palindrome. When a button is pressed an appropriate function should be called to display
 11. Factorial of that number
 12. Fibonacci series up to that number
 13. Prime numbers up to that number
 14. Is it palindrome or not
- c. Write a program to validate the following fields in a registration page
 - i. Name (start with alphabet and followed by alphanumeric and the length should not be less than 6 characters)
 - ii. Mobile (only numbers and length 10 digits)
 - iii. E-mail (should contain format like xxxxxxx@xxxxxx.xxx)

Textbooks:

1. Programming the World Wide Web, 7th Edition, Robert W Sebesta, Pearson, 2013.
2. Web Programming with HTML5, CSS and JavaScript, John Dean, Jones & Bartlett Learning, 2019 (Chapters 1-11).
3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasan Subramanian, 2nd edition, APress, O’Reilly.

Web Links:

1. <https://www.w3schools.com/html>
2. <https://www.w3schools.com/css>
3. <https://www.w3schools.com/js/>
4. <https://www.w3schools.com/nodejs>
5. <https://www.w3schools.com/typescript>

DESIGN THINKING FOR INNOVATION (A19401)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P		CIE	SEE	Total
1	0	2	14	0	28	2	30	70	100

Course Objectives:

- The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes:

CO1	Define the concepts related to design thinking.
CO2	Explain the fundamentals of Design Thinking and innovation
CO3	Apply the design thinking techniques for solving problems in various sectors.
CO4	Analyse to work in a multidisciplinary environment
CO5	Evaluate the value of creativity
CO6	Formulate specific problem statements of real time issues

UNIT I Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT II Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT III Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations- Creativity to Innovation- Teams for innovation- Measuring the impact and value of creativity. Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value- based innovation.

UNIT IV Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications- Innovation towards product design- Case studies

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

UNIT V Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs-

Design thinking for Startups- Defining and ¹testing Business Models and Business Cases-

Developing & testing prototypes. Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Textbooks

- Tim Brown, Change by design, Harper Bollins (2009)
- Idris Mootee, Design Thinking for Strategic Innovation, 2013, John Wiley & Sons.

Reference Books

- David Lee, Design Thinking in the Classroom, Ulysses press
- Shruti N Shetty, Design the Future, Norton Press
- William Lidwell, Universal Principles of Design- Kritina Holden, Jill Butter.
- Chesbrough, H., The Era of Open Innovation – 2013

Online Learning Resources

- <https://nptel.ac.in/courses/110/106/110106124/>
- <https://nptel.ac.in/courses/109/104/109104109/>
- https://swayam.gov.in/nd1_noc19_mg60/preview

Community Service Project

.....Experiential learning through community engagement

Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development.
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will benefit with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

- Every student should put in 6 weeks for the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, housewives, etc
- A logbook must be maintained by each of the students, where the activities undertaken/involved to be recorded.
- The logbook has to be countersigned by the concerned mentor/faculty in charge.

- An evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programs of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project reports should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training.
-

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
 - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
 - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
 - Agriculture
 - Health
 - Marketing and Cooperation
 - Animal Husbandry
 - Horticulture
 - Fisheries
 - Sericulture
 - Revenue and Survey
 - Natural Disaster Management
 - Irrigation
 - Law & Order
 - Excise and Prohibition
 - Mines and Geology
 - Energy
 - Internet
 - Free Electricity
 - Drinking Water

EXPECTED OUTCOMES BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development.
- Improved ability to understand complexity and ambiguity

Personal Outcomes

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills.

Social Outcomes

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL (AUTONOMOUS)

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity.

Relationship with the Institution

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research.

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

- Improved institutional commitment.
- Improved student retention
- Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals.
- New energy, enthusiasm and perspectives applied to community work.
- Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions, and modifications. Colleges are expected to focus on specific local issues for this kind of project. The students are expected to carry out these projects with involvement, commitment, responsibility, and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of project. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting should be ensured.

For Engineering Students

1. Water facilities and drinking water availability
2. Health and hygiene
3. Stress levels and coping mechanisms
4. Health intervention programmes
5. Horticulture
6. Herbal plants
7. Botanical survey
8. Zoological survey
9. Marine products
10. Aqua culture

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11. Inland fisheries
12. Animals and species
13. Nutrition
14. Traditional health care methods
15. Food habits
16. Air pollution
17. Water pollution
18. Plantation
19. Soil protection
20. Renewable energy
21. Plant diseases
22. Yoga awareness and practice
23. Health care awareness programmes and their impact
24. Use of chemicals on fruits and vegetables
25. Organic farming
26. Crop rotation
27. Flourey culture
28. Access to safe drinking water
29. Geographical survey
30. Geological survey
31. Sericulture
32. Study of species
33. Food adulteration
34. Incidence of Diabetes and other chronic diseases

1. Human genetics
2. Blood groups and blood levels
3. Internet Usage in Villages
4. Android Phone usage by different people
5. Utilization of free electricity to farmers and related issues
6. Gender ration in schooling level- observation.

Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programs

Programs for School Children

1. Reading Skill Program (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Program on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Program on Socially

relevant themes. Programs for Women

Empowerment

1. Government Guidelines and Policy Guidelines
2. Women's Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social

Entrepreneurship General Camps

1. General Medical camps

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2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness
9. Programs on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days Programs for Youth Empowerment

Development	Common Programs
1. Leadership 2. Anti-alcoholism and Drug addiction 3. Anti-tobacco 4. Awareness on Competitive Examinations 5. Personality	

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programs in consonance with the Govt. Departments like –
 - i. Agriculture
 - ii. Health
 - iii. Marketing and Cooperation
 - iv. Animal Husbandry
 - v. Horticulture
 - vi. Fisheries
 - vii. Sericulture
 - viii. Revenue and Survey
 - ix. Natural Disaster Management
 - x. Irrigation
 - xi. Law & Order
 - xii. Excise and Prohibition
 - xiii. Mines and Geology
 - xiv. Energy

Role of Students:

- Students maynot have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also, with the Governmental Dep3artments. If the program is rolled out, the District Administration could be roped in for the successful deployment

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of the program.

- An in-house training and induction program could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service

Project Activity Duration: 8 weeks

1. Preliminary Survey (One Week)

- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secretariats could be aligned for the survey.

2. Community Awareness Campaigns (One Week)

- Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. Community Immersion Programme (Three Weeks)

Along with the Community Awareness Programmes, the student batch can also work with any one of the below-listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to experiential learning about the community and its dynamics. Programs could be in consonance with the Govt. Departments.

4. Community Exit Report (One Week)

- During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks' works to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University. Throughout the Community Service Project, a daily logbook need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.

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B. Tech – III Year I Semester

V SEMESTER (III YEAR)										
S.NO	Course Code	Title of the Course	Category	Periods per Week			Credits C	Scheme of Examination Maximum Marks		
				L	T	P		Internal	External	Total
1	A1CS501T	Introduction to Artificial Intelligence	PC	3	0	0	3	30	70	100
2	A1CS502T	Computer Networks	PC	3	0	0	3	30	70	100
3	A1CS503	Automata Theory and Compiler Design	PC	3	0	0	3	30	70	100
4	A1CS505h	Introduction to Quantum Technologies and Applications	ES	3	0	0	3	30	70	100
5	A1CS504a A1CS504b A1EC50T A1CS504c A1CS505d	Professional Elective-I 1. Software Testing Methodologies 2. Soft Computing 3. Microprocessors & Microcontrollers 4. Data Warehousing & Data Mining 5. Privacy and Security in Online social Media	PE	3	0	0	3	30	70	100
6		Open Elective-I	OE	3	0	0	3	30	70	100
7	A1CS501P	Introduction to Artificial Intelligence Lab	PC	0	0	3	1.5	30	70	100
8	A1CS502P	Computer Networks Lab	PC	0	0	3	1.5	30	70	100
9	A1CS506	Skill Enhancement course Full Stack Development – II	SEC	0	1	2	2	30	70	100
10	A1ES507	Tinkering Lab		0	0	2	1	30	70	100
11	A1CSP	Evaluation of Community Service Internship		-	-	-	2		.	100*
TOTAL				15	01	10	23			

* The marks for Mandatory Courses are not considered for calculating SGPA

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Professional Elective-I

S.No	Course Code	Course Name	Link
1	A1CS504as	Software Testing	https://onlinecourses.nptel.ac.in/noc25_cs113/preview
2	A1CS504bs	Privacy and Security in Online social media	https://onlinecourses.nptel.ac.in/noc25_cs116/preview

Open Elective – I

S.No.	Course Code	Course Name	Offered by the Dept.
1	A1EC505a	Electronic Circuits	ECE
2	A1HS505c	Mathematics for Machine Learning and AI	Mathematics
3	A1HS505d	Materials Characterization Techniques	Physics
4	A1HS505e	Chemistry of Energy Systems	Chemistry
5	A1HS505f	English for Competitive Examinations	Humanities
6	A1HS505g	Entrepreneurship and New Venture Creation	

S.No	Course Code	Course Name	Link
1	A1HS505fs	English Language for Competitive Exams	https://onlinecourses.nptel.ac.in/noc25_hs137/preview
2	A1HS505gs	Entrepreneurship	https://onlinecourses.nptel.ac.in/noc25_mg81/preview
3	A1ME505ks	Sustainable Energy Technologies	https://onlinecourses.nptel.ac.in/noc25_me178/preview
4	A1HS505cs	Mathematics for Machine Learning	https://onlinecourses.nptel.ac.in/noc25_ma61/preview

Note:

1. A student is permitted to register for Honours or a Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to their Minor from V Semester onwards.
2. A student shall not be permitted to take courses as Open Electives/Minor/Honours with content substantially equivalent to the courses pursued in the student's primary major.
3. A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline.

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B.Tech– III Year II Semester

VI SEMESTER (III YEAR)										
S.NO	Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal	External	Total
1	A1CS601T	Introduction to Machine Learning		3	0	0	3	30	70	100
2	A1CS602	Cloud Computing		3	0	0	3	30	70	100
3	A1CS603T	Cryptography & Network Security		3	0	0	3	30	70	100
4	A1CS604a A1CS604b A1CS604c A1CS604d	Professional Elective-II 1. Object Oriented Analysis and Design 2. Cyber Security 3. DevOps 4. Embedded Systems Design		3	0	0	3	30	70	100
5	A1CS605a A1CS605b A1CS605c A1CS605d	Professional Elective-III 1. Software Project Management 2. Mobile Adhoc Networks 3. Natural Language Processing 4. Distributed Operating System		3	0	0	3	30	70	100
6		Open Elective – II		3	0	0	3	30	70	100
7	A1CS601P	Introduction to Machine Learning Lab		0	0	3	1.5	30	70	100
8	A1CS603P	Cryptography & Network Security Lab		0	0	3	1.5	30	70	100
9	A12403	Skill Enhancement course Soft skills OR IELTS		0	1	2	2	30	70	100
10	A1ES608	Audit Course Technical Paper Writing & IPR		2	0	0	-			
TOTAL				20	1	08	23			
Mandatory Industry Internship of 08 weeks duration during summer vacation										

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Open Elective – II

S.No.	Course Code	Course Name	Offered by the Dept.
1	A1EC606a	Digital Electronics	ECE
2	A1HS606a	Optimization Techniques	Mathematics
3	A1HS606c	Physics Of Electronic Materials And Devices	Physics
4	A1HS606d	Chemistry Of Polymers And Applications	Chemistry
5	A1HS606e	Academic Writing and Public Speaking	Humanities
6	A1CS606b	Mathematical Foundation of Quantum Technologies	Computer Science

IV B.Tech I Semester (CSE)

VIII SEMESTER (IV YEAR)										
S.NO	Course Code	Title of the Course	Category	Periods per Week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal	External	Total
1	A1CS701	Deep Learning	PC	3	0	0	3	30	70	100
2	A1HS702a A1HS702b A1HS702c	Management Course- II 1. Management Science 2. Business Ethics and Corporate Governance 3. E-Business	PC	3	0	0	2	30	70	100
3	A1CS703a A1CS703b A1CS703c A1CS703d	Professional Elective-IV 1. Internet of Things 2. Software Architecture & Design Patterns 3. Blockchain Technology 4. Augmented Reality & Virtual Reality	PC	3	0	0	3	30	70	100
4	A1CS704a A1CS704b A1CS704c A1CS704d	Professional Elective-V 1. Agile methodologies 2. Metaverse 3. Computer Vision 4. Cyber Physical Systems	PE	3	0	0	3	30	70	100
5		Open Elective-I	OE	3	0	0	3	30	70	100
6		Open Elective-IV		3	0	0	3			
7	A1CS707	Skill Enhancement Course Prompt Engineering		0	1	2	2	30	70	100
8	A1AC708	Audit Course Gender Sensitization		2	0	0	-	30	70	100
9	A1II	Evaluation of Industry Interns		-	-	-	2	30	70	100
TOTAL				18	02	02	21			

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Open Elective – III

S.No	Course Code	Course Name	Offered by the Dept.
1	A1EC503T	Microprocessors and Microcontrollers	ECE
2	A1HS705a	Wavelet transforms and its Applications	Mathematics
3	A1HS705b	Smart Materials And Devices	Physics
4	A1HS705c	Green Chemistry And Catalysis For Sustainable Environment	Chemistry
5	A1HS705d	Employability Skills	Humanities
6	A1CS705e	Introduction to Quantum Mechanics	Computer Science

Open Elective – IV

S.No	Course Code	Course Name	Offered by the Dept.
1	A1EC706a	Transducers and Sensors	ECE
2	A1HS706b	Financial Mathematics	Mathematics
3	A1HS706c	Sensors And Actuators For Engineering Applications	Physics
4	A1HS706d	Chemistry Of Nanomaterials and Applications	Chemistry
5	A1HS706e	Literary Vibes	Humanities
6	A1CS706f	Quantum Computing	Computer Science

IV B.Tech II Semester (CSE)

VIII SEMESTER (IV YEAR)							
S.No.	Course code	Title	Category	L	T	P	Credits
1	A1CS801	Internship		-	-	24	4
	A1CS802	Project					8
Total							12

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COURSES OFFERED FOR H⁹ONOURS DEGREE IN CSE

S.No.	Course Code	Course Title	Contact Hours per week			Credits
			L	T	P	
1	A1CSH01	Quantum Computing	3	0	0	3
2	A1CSH02	No SQL Databases	3	0	0	3
3	A1CSH03	Software Defined Data Centre	3	0	0	3
4	A1CSH04	Robotics and Intelligent Systems	3	0	0	3
5	A1CSH05	Cloud Security	3	0	0	3
6	A1CSH06	No SQL Lab			3	1.5
7	A1CSH07	Quantum & Cloud Computing Lab			3	1.5

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INTRODUCTION TO ARTIFICIAL INTELLIGENCE(A1CS501T)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

This course is designed to:

- Introduce Artificial Intelligence
- Teach about the machine learning environment
- Present the searching Technique for Problem Solving
- Introduce Natural Language Processing and Robotics

Course Outcomes:

After completion of the course, students will be able to

CO1	Apply searching techniques for solving a problem
CO2	Design Intelligent Agents
CO3	Develop Natural Language Interface for Machines
CO4	Design mini robots
CO5	Summarize past, present and future of Artificial Intelligence.
CO6	Design philosophy Foundation

UNIT-I Introduction

Lecture 9Hrs

Introduction: What is AI, Foundations of AI, History of AI, The State of Art.

Intelligent Agents: Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

UNIT-II Solving Problems by searching

Lecture 9 Hrs

Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Strategies, Informed search strategies, Heuristic Functions, Beyond Classical Search: Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces, Searching with Nondeterministic Actions, Searching with partial observations, online search agents and unknown environments.

UNIT-III Reinforcement Learning & Natural Language Processing

Lecture 8Hrs

Reinforcement Learning: Introduction, Passive Reinforcement Learning, Active Reinforcement Learning, Generalization in Reinforcement Learning, Policy Search, applications of RL

Natural Language Processing: Language Models, Text Classification, Information Retrieval, Information Extraction.

UNIT-IV Natural Language for Communication

Lecture 8 Hrs

Natural Language for Communication: Phrase structure grammars, Syntactic Analysis, Augmented Grammars and semantic Interpretation, Machine Translation, Speech Recognition

Perception: Image Formation, Early Image Processing Operations, Object Recognition by appearance, Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.

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UNIT-V Robotics

Lecture 10Hrs

Robotics: Introduction, Robot Hardware, Robotic Perception, planning to move, planning uncertain movements, Moving, Robotic software architectures, application domains
Philosophical foundations: Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Agent Architectures, Are we going in the right direction, What if AI does succeed.

Textbooks:

1. Stuart J. Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", 3rd Edition, Pearson Education, 2019.

Reference Books:

Nilsson, Nils J., and Nils Johan Nilsson. Artificial intelligence: a new synthesis. Morgan Kaufmann, 1998.
Johnson, Benny G., Fred Phillips, and Linda G. Chase. "An intelligent tutoring system for the accounting cycle: Enhancing textbook homework with artificial intelligence." Journal of Accounting Education 27.1 (2009): 3039.

Online Learning Resources:

<http://peterindia.net/AILinks.html>

<http://nptel.ac.in/courses/106106139/>

<https://nptel.ac.in/courses/106/105/106105152/>

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III B.Tech I Semester

COMPUTER NETWORKS(A1CS502T)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

The course is designed to

- Understand the basic concepts of Computer Networks.
- Introduce the layered approach for design of computer networks
- Expose the network protocols used in Internet environment
- Explain the format of headers of IP, TCP and UDP ☐ Familiarize with the applications of Internet
- Elucidate the design issues for a computer network

Course Outcomes:

After completion of the course, students will be able to

CO1	Identify the software and hardware components of a computer network
CO2	Design software for a computer network
CO3	Develop new routing, and congestion control algorithms
CO4	Assess critically the existing routing protocols
CO5	Explain the functionality of each layer of a computer network
CO6	Choose the appropriate transport protocol based on the application requirements

UNIT I:

Introduction: Types of Computer Networks, Broadband Access Networks, Mobile and Wireless Access Networks, Content Provider Networks, Transit networks, Enterprise Networks, Network technology from local to global, Personal Area Networks, Local Area Networks, Home Networks, Metropolitan Area Networks, Wide Area Networks, Internetworks, Network Protocols, Design Goals, Protocol Layering, Connections and Reliability, Service Primitives, The Relationship of Services to Protocols, Reference Models, The OSI Reference Model, The TCP/IP Reference Model, A Critique of the OSI Model and Protocols, A Critique of the TCP/IP Reference Model and Protocols.

UNIT II:

The Data Link Layer: Guided Transmission Media, Persistent Storage, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics, Data Link Layer Design Issues, Services Provided To The Network Layer, Framing Error Control, Flow Control, Error Detection And Correction, Error-Correcting Codes, Error-Detecting Codes, Elementary Data Link Protocols, Initial Simplifying Assumptions Basic Transmission And Receipt, Simplex Link-Layer Protocols, Improving Efficiency, Bidirectional Transmission, Multiple Frames In Flight, Examples Of Full-Duplex, Sliding Window Protocols, The Channel Allocation Problem, Static Channel Allocation, Assumptions For Dynamic Channel Allocation, Multiple Access Protocols, Aloha, Carrier Sense Multiple Access Protocols, Collision-Free Protocols, Limited-Contention Protocols, Wireless LAN Protocols, Ethernet, Classic Ethernet Physical Layer, Classic Ethernet Mac Sublayer Protocol, Ethernet Performance, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10-Gigabit Ethernet, 40- And 100-Gigabit Ethernet, Retrospective On Ethernet.

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UNIT III:

The Network Layer: Network Layer Design Issues, Store-And-Forward Packet Switching, Services Provided To The Transport Layer, Implementation Of Connectionless Service, Implementation Of Connection-Oriented Service, Comparison Of Virtual-Circuit And Datagram Networks, Routing Algorithms In A Single Network, The Optimality Principle, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing Within a Network, Broadcast Routing, Multicast Routing, Anycast Routing, Traffic Management at The Network Layer, The Need for Traffic Management: Congestion, Approaches To Traffic Management, Internetworking, Internetworks: An Overview, How Networks differ, Connecting Heterogeneous Networks, Connecting Endpoints Across Heterogeneous Networks, Internetwork Routing: Routing Across Multiple Networks Supporting Different Packet Sizes: Packet Fragmentation, The Network Layer In The Internet, The IP Version 4 Protocol, IP Addresses, IP Version 6, Internet Control Protocols, Label Switching and MPLS, OSPF—An Interior Gateway Routing Protocol, BGP—The Exterior Gateway Routing Protocol, Internet Multicasting.

UNIT IV:

The Transport Layer: The Transport Service, Services Provided To The Upper Layers, Transport Service Primitives, Berkeley Sockets, An Example Of Socket Programming: An Internet File Server, Elements Of Transport Protocols, Addressing, Connection Establishment, Connection Release, Error Control And Flow Control, Multiplexing, Crash Recovery, Congestion Control, Desirable Bandwidth Allocation, Regulating The Sending Rate, Wireless Issues, The Internet Transport Protocols: UDP, Introduction To UDP, Remote Procedure Call, Real-Time Transport Protocols, The Internet Transport Protocols: TCP, Introduction To TCP, The TCP Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release.

UNIT V:

The Application Layer: Electronic Mail, Architecture and Services, The User Agent, Message Formats, Message Transfer, Final Delivery, The World Wide Web, Architectural Overview, Static Web Objects, Dynamic Web Pages and Web Applications, HTTP and HTTPS, Web Privacy, Content Delivery, Content and Internet Traffic, Server Farms and Web Proxies, Content Delivery Networks, Peer-To-Peer Networks, Evolution of The Internet.

Textbooks:

Andrew Tanenbaum, Feamster Wetherall, Computer Networks, 6th Edition, Global Edition.

Reference Books:

1. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw Hill Publication, 2017.
2. James F. Kurose, Keith W. Ross, “Computer Networking: A Top-Down Approach”, 6th edition, Pearson, 2019.
3. Youlu Zheng, Shakil Akthar, “Networks for Computer Scientists and Engineers”, Oxford Publishers, 2016.

Online Learning Resources:

<https://nptel.ac.in/courses/106105183/25>

<http://www.nptelvideos.in/2012/11/computer-networks.html>

<https://nptel.ac.in/courses/106105183/3>

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL

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III B.Tech I Semester

AUTOMATA THEORY AND COMPILER DESIGN(A1CS503)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

- To learn fundamentals of Regular and Context Free Grammars and Languages
- To understand the relation between Contexts free Languages, PDA and TM
- To study the various phases in the design of a compiler
- To understand the design of top-down and bottom-up parsers
- To understand syntax directed translation schemes
- To learn to develop algorithms to generate code for a target machine

Course Outcomes:

At the end of the course, the students will be able to:

CO1	Ability to design, develop, and implement a compiler for any language
CO2	Able to use LEX and YACC tools for developing a scanner and a parser
CO3	Able to design and implement LL and LR parsers
CO4	Able to design algorithms to perform code optimization in order to improve
CO5	To improve the performance of a program in terms of space and time complexity
CO6	Ability to design algorithms to generate machine code

Unit-I: Introduction to Automata and Regular Expressions

12 Hrs

Introduction, Alphabets, Strings and Languages, Chomsky Hierarchy, Automata and Grammars, Regular Grammar and Language, Finite Automata, Deterministic finite Automata (DFA), Nondeterministic finite Automata (NFA), Equivalence of NFA and DFA, Minimization of Finite Automata, Regular Expressions, Converting Regular Grammar and Expression into Finite Automata, Pumping lemma for regular sets, Closure properties of regular sets (Without proof).

UNIT-II: Context Free Grammars and Pushdown Automata

12 Hrs

Context Free Language, Context Free Grammar, Derivation and Parse tree, Ambiguity, Simplification of CFG's, Chomsky Normal Form, Greibach Normal Form, Push Down Automata (PDA), Design of PDA, Equivalence of PDA and CFL/CFG

UNIT-III: Turing Machines and Introduction to Compilers

12 Hrs

Turing Machine, TM Model, Language acceptance, Design of Turing Machine, Compilers, Phases of Compiler, The role of Lexical Analyzer, Input Buffering.

UNIT-IV: Parsers and Intermediate Code Generation

12 Hrs

Parser, Top-Down parsers: Recursive Descent Parsers, Predictive Parsers

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Bottom-up Parsers: Shift-Reduce Parsing, LR parsers, Intermediate Code Generation: Three address codes.

UNIT-V: Code Optimization and Code Generation

12 Hrs

Code Optimization: Peephole optimization, Basic blocks and flow graphs, DAG, Principles of Source Code Optimization, Code Generation: Issues in Design of Code Generation, Simple Code Generator.

Text Books:

1. Introduction to Automata theory languages and Computation, Hopcroft H.E. and Ullman Jeffrey.D, 3/e, 2006, Pearson Education, New Delhi, India.
2. Mishra K L P and Chandrasekaran N, “Theory of Computer Science - Automata, Languages and Computation”, 2/e, 2007, PHI, New Delhi, India.
3. Compilers: Principles, Techniques, and Tools, Updated 2e July 2023 Alfred V. Aho , Monica S. Lam, Ravi Sethi , Jeffrey D. Ullman , Sorav Bansal

Reference Books:

1. Introduction to Languages and Theory of Computation, John C Martin, 1/e, 2009, Tata McGraw Hill Education, Hyderabad, India.
2. Introduction to Theory of Computation, Sipser, 2/e, 2005, Thomson, Australia.
3. Compiler Construction: Principles And Practice, Kenneth C. Loudon, Thomson/ Delmar Cengage Learning, 2006.
4. Lex &yacc, Doug Brown, John Levine and Tony Mason, 2 nd Edition, O’reilly Media
5. Engineering a compiler, Keith Cooper and Linda Torczon, 2 nd Edition, Morgan Kaufmann, 2011.

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III B.Tech I Semester

INTRODUCTION TO QUANTUM TECHNOLOGIES AND APPLICATION (A1CS505h)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Outcomes : At the end of the course the student will be able to	
CO1:	Explain core quantum principles in a non-mathematical manner
CO2:	Compare classical and quantum information systems.
CO3:	Identify theoretical issues in building quantum computers.
CO4:	Discuss quantum communication and computing concepts.
CO5:	Recognize applications, industry trends, and career paths in quantum technology
UNIT – I	
Introduction to Quantum Theory and Technologies: The transition from classical to quantum physics, Fundamental principles explained conceptually: Superposition, Entanglement, Uncertainty Principle, Wave-particle duality, Classical vs Quantum mechanics – theoretical comparison, Quantum states and measurement: nature of observation, Overview of quantum systems: electrons, photons, atoms, The concept of quantization: discrete energy levels, Why quantum? Strategic, scientific, and technological significance, A snapshot of quantum technologies: Computing, Communication, and Sensing, National and global quantum missions: India's Quantum Mission, EU, USA, China	
UNIT – II	
Theoretical Structure of Quantum Information Systems: What is a qubit? Conceptual understanding using spin and polarization, Comparison: classical bits vs quantum bits, Quantum systems: trapped ions, superconducting circuits, photons (non-engineering view), Quantum coherence and decoherence – intuitive explanation, Theoretical concepts: Hilbert spaces, quantum states, operators – only interpreted in abstract, The role of entanglement and non-locality in systems, Quantum information vs classical information: principles and differences, Philosophical implications: randomness, determinism, and observer role	
UNIT – III	
Building a Quantum Computer – Theoretical Challenges and Requirements: What is required to build a quantum computer (conceptual overview)?, Fragility of quantum systems: decoherence, noise, and control, Conditions for a functional quantum system: Isolation, Error management, Scalability, Stability, Theoretical barriers: Why maintaining entanglement is difficult, Error correction as a theoretical necessity, Quantum hardware platforms (brief conceptual comparison), Superconducting circuits, Trapped ions, Photonics, Vision vs reality: what's working and what remains elusive, The role of quantum software in managing theoretical complexities	
UNIT – IV	

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Quantum Communication and Computing – Theoretical Perspective: Quantum vs Classical Information, Basics of Quantum Communication, Quantum Key Distribution (QKD), Role of Entanglement in Communication, The Idea of the Quantum Internet – Secure Global Networking, Introduction to Quantum Computing, Quantum Parallelism (Many States at Once), Classical vs Quantum Gates, Challenges: Decoherence and Error Correction, Real-World Importance and Future Potential
UNIT – V
Applications, Use Cases, and the Quantum Future: Real-world application domains: Healthcare (drug discovery), Material science, Logistics and optimization, Quantum sensing and precision timing, Industrial case studies: IBM, Google, Microsoft, PsiQuantum, Ethical, societal, and policy considerations, Challenges to adoption: cost, skills, standardization, Emerging careers in quantum: roles, skillsets, and preparation pathways, Educational and research landscape – India's opportunity in the global quantum race
Text Books:
1. Michael A Nielsen and Isaac L Chuang, Quantum Computation and Quantum Information, Cambridge University Press, Cambridge.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, Cambridge.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, Cambridge.
Reference Books:
1. David McMahon, Quantum Computing Explained, Wiley.
2. Phillip Kaye, Raymond Laflamme and Michele Mosca, An Introduction to Quantum Computing, Oxford University Press.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press.
4. Alastair I M Rae, Quantum Physics: A Beginner's Guide, Oneworld Publications.
5. Eleanor G Rieffel and Wolfgang H Polak, Quantum Computing: A Gentle Introduction, MIT Press.
6. Leonard Susskind, Art Friedman, Quantum Mechanics: The Theoretical Minimum, Basic Books.
7. Bruce Rosenblum and Fred Kuttner, Quantum Enigma: Physics Encounters Consciousness, Oxford University Press.
8. Giuliano Benenti, Giulio Casati and Giuliano Strini, Principles of Quantum Computation and Information, Volume I: Basic Concepts, World Scientific Publishing
9. K.B. Whaley et al., Quantum Technologies and Industrial Applications: European Roadmap and Strategy Document, Quantum Flagship, European Commission.
10. Department of Science & Technology (DST), Government of India, National Mission on Quantum Technologies & Applications – Official Reports and Whitepapers, MeitY/DST Publications.
Online Learning Resources:
1. https://www.coursera.org/learn/quantum-mechanics
2. https://nptel.ac.in/courses/106106232
Question Paper Pattern:

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Sessional Exam: The question paper for Sessional Examination shall be for 40 marks. The question paper shall consist of Four questions and all questions are compulsory. Question No.1 shall contain Five compulsory short answer questions for a total of Ten marks. Question No.2 to 4 shall be EITHER/OR Type for Ten marks each. Student shall Answer any one of them. Each of these questions may contain sub-questions.

End Examination: The question paper for End Examination shall be for 70 marks. The Question paper shall contain Six Questions and all questions are compulsory. Question No.1 shall contain Ten compulsory short answer questions for a total of Twenty marks (with Two short answer questions from each unit). Question No.2 to 6 shall be EITHER/OR Type for Ten marks each and shall cover one Unit of the Syllabus for each question. Student shall Answer any one of them. Each of these questions may contain sub-questions.

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III B.Tech I Semester

SOFTWARE TESTING METHODOLOGIES(A1CS504a)

(Professional Elective –I)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

- To study the fundamental concepts of software testing which includes objectives, process, criteria, strategies, and methods.
- To discuss various software testing types and levels of testing like black and white box testing along with levels unit test, integration, regression, and system testing.
- It also helps to learn the types of bugs, testing levels with which the student can very well identify a bug and correct as when it happens.
- It provides knowledge on transaction flow testing and data flow testing techniques so that the flow of the program is tested as well.
- To learn the domain testing, path testing and logic based testing to explore the testing process easier.

Course Outcomes:

CO1	Know the basic concepts of software testing and its essentials.
CO2	Able to identify the various bugs and correcting them after knowing the consequences of the bug.
CO3	Use of program's control flow as a structural model is the corner stone of testing.
CO4	Performing functional testing using control flow
CO5	Performing path testing using control flow graphs
CO6	To perform the transaction flow graphs.

UNIT-I

Lecture 9 Hrs

Introduction:-Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs, Flow graphs and Path testing:- Basics concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.

UNIT-II

Lecture 8Hrs

Transaction Flow Testing:-transaction flows, transaction flow testing techniques. Dataflow testing:- Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.

UNIT-III

Lecture8Hrs

Domain Testing:-domains and paths, Nice & ugly domains, domain testing, domains and interfaces testing, domain and interface testing, domains and testability.

UNIT-IV

Lecture 9Hrs

Paths, Path products and Regular expressions:- path products & path expression, reduction procedure, applications, regular expressions & flow anomaly detection. Logic Based Testing:-over view, decision tables, path expressions, kv charts, specifications.

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UNIT-V

Lecture9Hrs

State, State Graphs and Transition testing:- state graphs, good & bad state graphs, state testing, Testability tips. Graph Matrices and Application:-Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools

TEXT BOOKS

1. Software Testing techniques – Boris Beizer, Dreamtech, second edition.
2. Software Testing Tools – Dr. K.V.K.K. Prasad, Dreamtech.

REFERENCES BOOKS:

1. The craft of software testing – Brian Marick, Pearson Education.
2. Software Testing Techniques – SPD(Oreille)
3. Software Testing in the Real World – Edward Kit, Pearson.
4. Effective methods of Software Testing, Perry, John Wiley.
5. Art of Software Testing – Meyers, John Wiley.

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III B.Tech I Semester

SOFT COMPUTING(A1CS504b)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

- Familiarize with soft computing concepts
- Introduce and use the idea of fuzzy logic and use of heuristics based on human experience
- Familiarize the Neuro-Fuzzy modelling using Classification and Clustering techniques
- Learn the concepts of Genetic algorithm and its applications
- Acquire the knowledge of Rough Sets.

Course Outcomes:

CO1	Identify the difference between Conventional Artificial Intelligence to Computational Intelligence.
CO2	Understand fuzzy logic and reasoning to handle and solve engineering problems □
CO3	Apply the Classification techniques on various applications.
CO4	Perform various operations of genetic algorithms .
CO5	Perform various operations of Rough Sets.
CO6	Analyze the fuzzy making decisions

UNIT - I

Introduction to Soft Computing: Evolutionary Computing, "Soft" computing versus "Hard" computing, Soft Computing Methods, Recent Trends in Soft Computing, Characteristics of Soft computing, Applications of Soft Computing Techniques.

UNIT- II

Fuzzy Systems: Fuzzy Sets, Fuzzy Relations, Fuzzy Logic, Fuzzy Rule-Based Systems

UNIT- III

Fuzzy Decision Making, Particle Swarm Optimization.

UNIT- IV

Genetic Algorithms: Basic Concepts, Basic Operators for Genetic Algorithms, Crossover and Mutation Properties, Genetic Algorithm Cycle, Fitness Function, Applications of Genetic Algorithm.

UNIT- V

Rough Sets, Rule Induction, and Discernibility Matrix, Integration of Soft Computing Techniques.

TEXT BOOK:

1. Soft Computing – Advances and Applications - Jan 2015 by B.K. Tripathy and J. Anuradha – Cengage Learning

REFERENCE BOOKS:

1. S. N. Sivanandam & S. N. Deepa, “Principles of Soft Computing”, 2nd edition, Wiley India, 2008.

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2. David E. Goldberg, “Genetic Algorithms-In Search, optimization and Machine learning”, Pearson Education.
3. J. S. R. Jang, C.T. Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing”, Pearson Education, 2004.
4. G.J. Klir & B. Yuan, “Fuzzy Sets & Fuzzy Logic”, PHI, 1995.
5. Melanie Mitchell, “An Introduction to Genetic Algorithm”, PHI, 1998.
6. Timothy J. Ross, “Fuzzy Logic with Engineering Applications”, McGraw- Hill International editions, 1995.

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III B.Tech I Semester

MICROPROCESSORS AND MICROCONTROLLERS(A1EC50T)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

1. To comprehend the architecture, operation, and configurations of the 8086 microprocessors.
2. To get familiar with 8086 programming concepts, instruction set, and assembly language development tools.
3. To study the interfacing of 8086 with memory, peripherals, and controllers for various applications.
4. To learn the architecture, instruction set, and programming of the 8051 microcontrollers.
5. To understand microcontroller interfacing techniques, peripheral programming, and processor comparisons.

Course Outcomes:

At the end of this course, the students will be able to

CO1	Gain knowledge on the architecture, operation, and configurations of the 8086 microprocessors.
CO2	Get familiar with 8086 programming concepts, instruction set, and assembly language development tools
CO3	Know the interfacing of 8086 with memory, peripherals, and controllers for various applications.
CO4	Learn the architecture, instruction set, and programming of the 8051 microcontrollers.
CO5	Understand microcontroller interfacing techniques, peripheral programming, and processor comparisons.

UNIT-I

8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT-II

8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT-III

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDs, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

UNIT-IV

Microcontroller - Architecture of 8051 – Special Function Registers (SFRs) - I/O Pins Ports and Circuits - Instruction set -

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Addressing modes - Assembly language programming.

UNIT-V

Interfacing Microcontroller - Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

Textbooks:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition, 1994.
2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

References:

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.

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III B.Tech I Semester

DATA WAREHOUSING & DATA MINING(A1CS504c)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objective:

- Familiarize with mathematical foundations of data mining tools.
- Introduce classical models and algorithms in data warehouses and data mining.
- Investigate the kinds of patterns that can be discovered by association rule mining, classification and clustering.
- Explore data mining techniques in various applications like social, scientific and environmental context.

Course Outcomes:

Upon completion of the course, the students should be able to:

CO1	Design a Data warehouse system and perform business analysis with OLAP tools
CO2	Apply suitable pre-processing and visualization techniques for data analysis
CO3	Apply frequent pattern and association rule mining techniques for data analysis
CO4	Design appropriate classification and clustering techniques for data analysis
CO5	infer knowledge from raw data

UNIT- I:

Lecture 9Hrs

Basic Concepts – Data Warehousing Components – Building a Data Warehouse – Database Architectures for Parallel Processing – Parallel DBMS Vendors – Multidimensional Data Model – Data Warehouse Schemas for Decision Support, Concept Hierarchies -Characteristics of OLAP Systems – Typical OLAP Operations, OLAP and OLTP.

UNIT- II:

Lecture 9Hrs

Introduction to Data Mining Systems – Knowledge Discovery Process – Data Mining Techniques – Issues – applications- Data Objects and attribute types, Statistical description of data, Data Preprocessing – Cleaning, Integration, Reduction, Transformation and discretization, Data Visualization, Data similarity and dissimilarity measures.

UNIT- III:

Lecture 8 Hrs

Mining Frequent Patterns, Associations and Correlations – Mining Methods- Pattern Evaluation Method – Pattern Mining in Multilevel, Multi Dimensional Space – Constraint Based Frequent Pattern Mining, Classification using Frequent Patterns.

UNIT- IV:

Lecture 9Hrs

Decision Tree Induction – Bayesian Classification – Rule Based Classification – Classification by Back Propagation – Support Vector Machines — Lazy Learners – Model Evaluation and Selection-Techniques to improve Classification Accuracy. Clustering Techniques – Cluster analysis-Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of clustering – Clustering high dimensional data- Clustering with constraints, Outlier analysis-outlier detection methods.

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UNIT- V: WEKA TOOL

Lecture 8Hrs

Datasets – Introduction, Iris plants database, Breast cancer database, Auto imports database – Introduction to WEKA, The Explorer – Getting started, Exploring the explorer, Learning algorithms, Clustering algorithms, Association–rule learners.

TEXT BOOK:

1. Jiawei Han and Micheline Kamber, —Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.

REFERENCES:

1. Alex Berson and Stephen J.Smith, —Data Warehousing, Data Mining & OLAP, Tata McGraw – Hill Edition, 35th Reprint 2016.

2. K.P. Soman, Shyam Diwakar and V. Ajay, —Insight into Data Mining Theory and Practice, Eastern Economy Edition, Prentice Hall of India, 2006.

3. Ian H.Witten and Eibe Frank, —Data Mining: Practical Machine Learning Tools and Techniques, Elsevier, Second Edition.

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INTRODUCTION TO ARTIFICIAL INTELLIGENCE LAB(A1CS501P)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

- To teach the methods of implementing algorithms using artificial intelligence techniques
- To illustrate search algorithms
- To demonstrate the building of intelligent agents

Course Outcomes:

After completion of the course, students will be able to

CO1	Implement search algorithms
CO2	Solve Artificial intelligence problems
CO3	Design chat bot and virtual assistant
CO4	To demonstrate the building of intelligent agents
CO5	Design and implement algorithms

List of Experiments:

1. Write a program to implement DFS and BFS
2. Write a Program to find the solution for traveling salesman Problem
3. Write a program to implement Simulated Annealing Algorithm
4. Write a program to find the solution for the wumpus world problem
5. Write a program to implement 8 puzzle problem
6. Write a program to implement Towers of Hanoi problem
7. Write a program to implement A* Algorithm
8. Write a program to implement Hill Climbing Algorithm
9. Build a Chatbot using AWS Lex, Pandora bots.
10. Build a bot that provides all the information related to your college.
11. Build a virtual assistant for Wikipedia using Wolfram Alpha and Python
12. The following is a function that counts the number of times a string occurs in another string: # Count the number of times string s1 is found in string s2

```
def countsubstring(s1,s2):  
    count = 0  
    for i in range(0,len(s2)-len(s1)+1):  
        if s1 == s2[i:i+len(s1)]:  
            count += 1  
    return count
```


For instance, count substring ('ab','cabalaba') returns 2.
Write a recursive version of the above function. To get the rest of a string (i.e. everything but the first character).
13. Higher order functions. Write a higher-order function count that counts the number of elements in a list that satisfy a given test. For instance: count (lambda x: x>2, [1, 2, 3, 4, 5]) should return 3, as there are three elements in the list larger than 2. Solve this task without using any existing higher order function.
14. Brute force solution to the Knapsack problem. Write a function that allows you to generate random problem instances

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for the knapsack program. This function should generate a list of items containing N items that each have a unique name, a random size in the range 1 5 and a random value in the range 1..... 10.

Next, you should perform performance measurements to see how long the given knapsack solver take to solve different problem sizes. You should perform at least 10 runs with different randomly generated problem instances for the problem sizes 10,12,14,16,18,20 and 22. Use a backpack size of 2:5 x N for each value problem size N. Please note that the method used to generate random numbers can also affect performance, since different distributions of values can make the initial conditions of the problem slightly more or less demanding.

How much longer time does it take to run this program when we increase the number of items? Does the backpack size affect the answer?

Try running the above tests again with a backpack size of 1 x N and with 4:0 x N.

15. Assume that you are organising a party for N people and have been given a list L of people who, for social reasons, should not sit at the same table. Furthermore, assume that you have C tables (that are infinitely large).

Write a function layout (N,C,L) that can give a table placement (i.e. a number from 0 : : C -1) for each guest such that there will be no social mishaps.

For simplicity we assume that you have a unique number 0.....N-1 for each guest and that the list of restrictions is of the form [(X, Y)....] denoting guests X, Y that are not allowed to sit together. Answer with a dictionary mapping each guest into a table assignment, if there are no possible layouts of the guests you should answer False.

References:

1. David Poole, Alan Mack worth, Randy Goebel,” Computational Intelligence: a logical approach”, Oxford University Press, 2004.
2. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem solving”, Fourth Edition, Pearson Education, 2002.
3. J. Nilsson, “Artificial Intelligence: A new Synthesis”, Elsevier Publishers, 1998.
4. Artificial Neural Networks, B. Yagna Narayana, PHI
5. Artificial Intelligence, 2nd Edition, E.Rich and K.Knight, TMH.
6. Artificial Intelligence and Expert Systems, Patterson, PHI.

Online Learning Resources/Virtual Labs:

<https://www.tensorflow.org/><https://pytorch.org/>
<https://github.com/pytorch> <https://keras.io/>
<https://github.com/kerasteam>
<http://deeplearning.net/software/theano/>
<https://github.com/Theano/Theano><https://caffe2.ai/>
<https://github.com/caffe2>
[https://deeplearning4j.org/Scikit-learn:](https://deeplearning4j.org/Scikit-learn)
<https://scikit-learn.org/stable/>
<https://github.com/scikit-learn/scikit-learn>
<https://www.deeplearning.ai/>
<https://opencv.org/>
<https://github.com/qjwweee/keras-yolo3>
<https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-opencv/>
<https://developer.nvidia.com/cuda-math-library>
http://vlabs.iitb.ac.in/vlabs-dev/labs/machine_learning/labs/index.php

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COMPUTER NETWORKS LAB(A1CS502P)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

- To understand the different types of networks
- To discuss the software and hardware components of a network
- To enlighten the working of networking commands supported by operating system
- To impart knowledge of Net work simulator2/3
- To familiarize the use of networking functionality supported by JAVA
- To familiarize with computer networking tools.

Course Outcomes:

CO1	Understand working of wired and wireless networks.
CO2	Develop scripts for Simulating Wired and wireless Networks.
CO3	Analyze the data traffic using tools.
CO4	Develop JAVA programs for client-server communication.
CO5	Utilize networking commands proficiently to diagnose and troubleshoot the network issues

List of Activities/Experiments:

1. Study different types of Network cables (Copper and Fiber) and prepare cables (Straight and Cross) to connect Two or more systems. Use crimping tool to connect jacks. Use LAN tester to connect the cables.
 - Install and configure Network Devices: HUB, Switch and Routers. Consider both manageable and non-manageable switches. Do the logical configuration of the system. Set the bandwidth of different ports.
 - Install and Configure Wired and Wireless NIC and transfer files between systems in Wired LAN and Wireless LAN. Consider both adhoc and infrastructure mode of operation.
2. Work with the commands Ping, Tracert, Ipconfig, pathping, telnet, ftp, getmac, ARP, Hostname, Nbtstat, netdiag, and Nslookup
3. Find all the IP addresses on your network. Unicast, Multicast, and Broadcast on your network.
4. Use Packet tracer software to build network topology and configure using Distance vector routing protocol.
5. Use Packet tracer software to build network topology and configure using Link State routing protocol.
6. Using JAVA RMI Write a program to implement Basic Calculator.
7. Implement a Chatting application using JAVA TCP and UDP sockets.
8. Hello command is used to know whether the machine at the other end is working or not. Echo command is used to measure the round-trip time to the neighbor. Implement Hello and Echo commands using JAVA.
9. Using Wireshark perform the following operations:
 - Inspect HTTP Traffic
 - Inspect HTTP Traffic from a Given IP Address,
 - Inspect HTTP Traffic to a Given IP Address,
 - Reject Packets to Given IP Address,
 - Monitor Apache and MySQL Network Traffic.

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10. Install Network Simulator 2/3. Create a wired network using dumbbell topology. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metrics throughput, delay, jitter and packet loss.
11. Create a static wireless network. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metric throughput, delay, jitter and packet loss.
12. Create a mobile wireless network. Attach agents, generate both FTP and CBR traffic, and transmit the traffic. Vary the data rates and evaluate the performance using metric throughput, delay, jitter and packet loss.

Reference Books:

1. ShivendraS.Panwar, Shiwen Mao, Jeong-dong Ryoo, and Yihan Li, “TCP/IP Essentials:A Lab-Based Approach”, Cambridge University Press, 2004.
2. Cisco Networking Academy, “CCNA1 and CCNA2 Companion Guide”, Cisco Networking Academy Program, 3rd edition, 2003.
3. Elloitte Rusty Harold, “Java Network Programming”, 3rd edition, O'REILLY, 2011.

Online Learning Resources:

<https://www.netacad.com/courses/packet-tracer> - Cisco Packet Tracer.
Ns Manual, Available at: <https://www.isi.edu/nsnam/ns/ns-documentation.html>, 2011.
https://www.wireshark.org/docs/wsug_html_chunked/ -Wireshark.
<https://nptel.ac.in/courses/106105183/25>
<http://www.nptelvideos.in/2012/11/computer-networks.html>
<https://nptel.ac.in/courses/106105183/3>
http://vlabs.iitb.ac.in/vlabs-dev/labs_local/computer-networks/labs/explist.php

III B.Tech I Semester

FULL STACK DEVELOPMENT – II(A1CS506)**(Skill Enhancement Course)**

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives: The main objectives of the course are to

- Make use of Modern- day JavaScript with ES6 standards for designing Dynamic web pages
- Building robust & responsive User Interfaces using popular JavaScript library '**React.js**'. Building robust backend APIs using '**Express. js**'
- Establishing the connection between frontend (React) User interfaces and backend APIs (Express) with Data Bases(My SQL)
- Familiarize students with GitHub for remote repository hosting and collaborative development.

Course Outcomes:

CO1	Building fast and interactive UIs
CO2	Applying Declarative approach for developing web apps
CO3	Understanding ES6 features to embrace modern JavaScript
CO4	Building reliable APIs with Express. Js
CO5	Create and manage Git repositories, track changes, and push code to GitHub.

Experiments covering the Topics:

- Introduction to DOM (Document Object Model), Ecma Script (ES6) standards and features like Arrow functions, Spread operator, Rest operator, Type coercion, Type hoisting, String literals, Array and Object Destructuring.
- Basics of React. js like React Components, JSX, Conditional rendering
Differences between Real DOM and Virtual DOM.
- Important React.js concepts like React hooks, Props, React forms, Fetch API, Iterative rendering using JavaScript map() function.
- JavaScript runtime environment node. js and its uses, Express. js and Routing, Micro-Services architecture and MVC architecture, database connectivity using (My SQL)
- Introduction to My SQL, setting up MySQL and configuring, Databases, My SQL queries, subqueries, creating My SQL driver for database connectivity to Express. js server.
- Introduction to Git and GitHub and upload project& team collaboration

Sample Experiments:

1. Introduction to Modern JavaScript and DOM

- a. Write a JavaScript program to link JavaScript file with the HTML page
- b. Write a JavaScript program to select the elements in HTML page using selectors
- c. Write a JavaScript program to implement the event listeners
- d. Write a JavaScript program to handle the click events for the HTML button elements
- e. Write a JavaScript program to With three types of functions
 - i. Function declaration
 - ii. Function definition
 - iii. Arrow functions

2. Basics of React. js

- a. Write a React program to implement a counter button using react class components
- b. Write a React program to implement a counter button using react functional components
- c. Write a React program to handle the button click events in functional component
- d. Write a React program to conditionally render a component in the browser
- e. Write a React program to display text using String literals

3. Important concepts of React. js

- a. Write a React program to implement a counter button using React use State hook
- b. Write a React program to fetch the data from an API using React use Effect hook
- c. Write a React program with two react components sharing data using Props.
- d. Write a React program to implement the forms in react
- e. Write a React program to implement the iterative rendering using map() function.

4. Introduction to Git and GitHub**a. Setup**

- o Install Git on local machine.
- o Configure Git (user name, email).
- o Create GitHub account and generate a personal access token.

b. Basic Git Workflow

- o Create a local repository using git init
- o Create and add files → git add .
- o Commit files → git commit -m "Initial commit"
- o Connect to GitHub remote → git remote add origin <repo_url>
- o Push to GitHub → git push -u origin main

c. Branching and Collaboration

- o Create a branch → git checkout -b feature1
- o Merge branch to main → git merge feature1
- o Resolve merge conflicts (guided)

5. Upload React Project to GitHub

- o Create a new React app using npx create-react-app myapp
- o Initialize a git repo and push to GitHub
- o Use .gitignore to exclude node_modules
- o Create multiple branches: feature/navbar, feature/form
- o Practice merge and pull requests (can use GitHub GUI)

6. Introduction to Node. js and Express. js

- a. Write a program to implement the 'hello world' message in the route through the browser using Express
- b. Write a program to develop a small website with multiple routes using Express. js
- c. Write a program to print the 'hello world' in the browser console using Express. js
- d. Write a program to implement the CRUD operations using Express. js
- e. Write a program to establish the connection between API and Database using Express – My SQL driver

7. Introduction to My SQL

- a. Write a program to create a Database and table inside that database using My SQL Command line client
- b. Write a My SQL queries to create table, and insert the data, update the data in the table
- c. Write a My SQL queries to implement the subqueries in the My SQL command line client
- d. Write a My SQL program to create the script files in the My SQL workbench
- e. Write a My SQL program to create a database directory in Project and initialize a database. sql file to integrate the database into API

8. Team Collaboration Using GitHub

- o Form groups of 2–3 students
- o Create a shared GitHub repo
- o Assign tasks and work in branches
- o Use Issues, Pull Requests, and Code Reviews
- o Document code with README.md

Textbooks:

1. Web Design with HTML, CSS, JavaScript and JQuery Set Book by Jon Duckett
Professional JavaScript for Web Developers Book by Nicholas C. Zakas
2. John Dean, Web Programming with HTML5, CSS and JavaScript, Jones & Bartlett Learning, 2019.
3. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Vasam Subramanian, 2nd edition, APress, O'Reilly.
4. Learning PHP, MySQL, JavaScript, CSS & HTML5: A Step-by-Step Guide to Creating Dynamic Websites by Robin Nixon
5. AZAT MARDAN, Full Stack Java Script: Learn Back bone. js, Node.js and Mongo DB.2015

Reference Books:

1. Full-Stack JavaScript Development by Eric Bush.
2. Programming the World Wide Web, 7th Edition, Robert W Sebesta, Pearson, 2013.
3. Tomasz Dyl ,KamilPrzeorski , MaciejCzarnecki, Mastering Full Stack React Web Development 2017

Online Learning Resources:

1. <https://ict.iitk.ac.in/product/full-stack-developer-html5-css3-js-bootstrap-php-4/>
2. <https://www.w3schools.com/html>
3. <https://www.w3schools.com/css>

4. <https://www.w3schools.com/js/>
5. <https://www.w3schools.com/nodejs>
6. <https://www.w3schools.com/typescript>
7. <https://docs.github.com/>
8. <https://education.github.com/git-cheat-sheet-education.pdf>

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge.

Course objectives: The objectives of the course are to	
1	Encourage Innovation and Creativity
2	Provide Hands-on Learning and Impart Skill Development
3	Foster Collaboration and Teamwork
4	Enable Interdisciplinary Learning, Prepare for Industry and Entrepreneurship
5	Impart Problem-Solving mind-set

These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

List of experiments:

- 1) Make your own parallel and series circuits using breadboard for any application of your choice.
- 2) Design and 3D print a Walking Robot
- 3) Design and 3D Print a Rocket.
- 4) Temperature & Humidity Monitoring System (DHT11 + LCD)
- 5) Water Level Detection and Alert System
- 6) Automatic Plant Watering System
- 7) Bluetooth-Based Door Lock System
- 8) Smart Dustbin Using Ultrasonic Sensor

- 9) Fire Detection and Alarm System
- 10) RFID-Based Attendance System
- 11) Voice-Controlled Devices via Google Assistant
- 12) Heart Rate Monitoring Using Pulse Sensor
- 13) Soil Moisture-Based Irrigation
- 14) Smart Helmet for Accident Detection
- 15) Milk Adulteration Detection System
- 16) Water Purification via Activated Carbon
- 17) Solar Dehydrator for Food Drying
- 18) Temperature-Controlled Chemical Reactor
- 19) Ethanol Mini-Plant Using Biomass
- 20) Smart Fluid Flow Control (Solenoid + pH Sensor)
- 21) Portable Water Quality Tester
- 22) AI Crop Disease Detection
- 23) AI-based Smart Irrigation
- 24) ECG Signal Acquisition and Plotting

- 25) AI-Powered Traffic Flow Prediction
- 26) Smart Grid Simulation with Load Monitoring
- 27) Smart Campus Indoor Navigator
- 28) Weather Station Prototype
- 29) Firefighting Robot with Sensor Guidance
- 30) Facial Recognition Dustbin
- 31) Barcode-Based Lab Inventory System
- 32) Growth Chamber for Plants
- 33) Biomedical Waste Alert System
- 34) Soil Classification with AI
- 35) Smart Railway Gate
- 36) Smart Bin Locator via GPS and Load Sensors
- 37) Algae-Based Water Purifier
- 38) Contactless Attendance via Face Recognition

Students need to refer to the following links:

Course Outcomes: The students will be able to experiment, innovate, and solve real-world challenges.

- 1) <https://aim.gov.in/pdf/equipment-manual-pdf.pdf>
- 2) <https://atl.aim.gov.in/ATL-Equipment-Manual/>
- 3) <https://aim.gov.in/pdf/Level-1.pdf>
- 4) <https://aim.gov.in/pdf/Level-2.pdf>
- 5) <https://aim.gov.in/pdf/Level-3.pdf>

III B.Tech II Semester**INTRODUCTION TO MACHINE LEARNING(A1CS601T)**

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

- To introduce the fundamental concepts and types of machine learning.
- To develop a deep understanding of supervised and unsupervised learning algorithms.
- To understand mathematical foundations of learning models and algorithms.
- To evaluate model performance using appropriate statistical and analytical tools.
- To apply machine learning techniques to solve real-world problems using tools such as Scikit-learn.

Course Outcomes:

After completion of the course, students will be able to:

CO1	Understand and distinguish among different types of learning methods
CO2	Apply supervised and unsupervised learning algorithms to datasets.
CO3	Analyze model performance using cross-validation and error metrics.
CO4	Build, test, and improve machine learning models for classification and prediction.
CO5	Use Python-based libraries (e.g., Scikit-learn) to implement ML algorithms
CO6	To understand mathematical foundations of learning models and algorithms.

UNIT I: Introduction to Machine Learning and Linear Models

Definition and Scope of Machine Learning, Applications and Types of Learning: Supervised, Unsupervised, Reinforcement, Linear Regression: Least Squares, Cost Function, Gradient Descent, Polynomial Regression and Overfitting, Evaluation Metrics: RMSE, MAE, R^2 Score, Bias-Variance Trade off.

UNIT II: Classification Algorithms

Classification Overview and Decision Boundaries, Logistic Regression: Sigmoid Function and Cost, K-Nearest Neighbors (KNN), Naïve Bayes Classifier, Decision Trees and Random Forests, Model Evaluation: Confusion Matrix, Precision, Recall, F1-Score.

UNIT III: Support Vector Machines and Ensemble Methods

Support Vector Machines: Concepts, Kernels, Hyperplane and Margin Concepts, Kernel Tricks: RBF and Polynomial, Ensemble Learning: Bagging, Boosting, and Voting, Gradient Boosting, AdaBoost, and XGBoost, Model Tuning and Hyperparameter Optimization.

UNIT IV: Unsupervised Learning Techniques

Clustering Overview: Applications, K-Means Clustering Algorithm, Hierarchical Clustering, DBSCAN and Density-Based Methods, Principal Component Analysis (PCA) for Dimensionality Reduction, Silhouette Score, Davies-Bouldin Index for Cluster Validation.

UNIT V: Advanced Topics and Applications

Reinforcement Learning Basics and Markov Decision Processes, Introduction to Neural Networks and Deep Learning, Cross-Validation Techniques: k-Fold, Leave-One-Out, Feature Engineering and Feature Selection, Deployment of ML Models (Flask, Streamlit, etc.), Case Studies: Medical Diagnosis, Spam Detection, Credit Scoring.

Textbooks:

1. Tom Mitchell, **Machine Learning**, McGraw-Hill Education.
2. Aurélien Géron, **Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow**, O'Reilly Media.
3. Ethem Alpaydin, **Introduction to Machine Learning**, MIT Press.

Reference Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, **The Elements of Statistical Learning**, Springer.
2. Kevin P. Murphy, **Machine Learning: A Probabilistic Perspective**, MIT Press.
3. Christopher Bishop, **Pattern Recognition and Machine Learning**, Springer.

Online Learning Resources:

1. Coursera – Machine Learning by Andrew Ng (Stanford University)
2. Scikit-learn Documentation
3. Kaggle Learn – Machine Learning
4. Google's Machine Learning Crash Course
5. YouTube – StatQuest with Josh Starmer

III B.Tech II Semester

CLOUD COMPUTING(A1CS602)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

- To explain the evolving computer model called cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.

Course Outcomes(CO):

After completion of the course, students will be able to

CO1	Ability to create cloud computing environment
CO2	Ability to design applications for Cloud environment
CO3	Design & develop back up strategies for cloud data based on features.
CO4	Use and Examine different cloud computing services
CO5	Apply different cloud programming model as per need.
CO6	To describe the security aspects in cloud.

UNIT I Basics of Cloud computing**Lecture 8Hrs**

Introduction to cloud computing: Introduction, Characteristics of cloud computing, Cloud Models, Cloud Services Examples, Cloud Based services and applications

Cloud concepts and Technologies: Virtualization, Load balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined, Network function virtualization, Map Reduce, Identity and Access Management, services level Agreements, Billing.

Cloud Services and Platforms: Compute Services, Storage Services, Database Services, Application services, Content delivery services Analytics Services, Deployment and Management Services, Identity and Access Management services, Open Source Private Cloud software.

UNIT II Hadoop and Python**Lecture 9Hrs**

Hadoop Map Reduce: Apache Hadoop, Hadoop Map Reduce Job Execution, Hadoop Schedulers, Hadoop Cluster set up.

Cloud Application Design: Reference Architecture for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.

Python Basics: Introduction, Installing Python, Python data Types & Data Structures, Control flow, Function, Modules, Packages, File handling, Date/Time Operations, Classes.

UNIT III Python for Cloud computing Lecture 8Hrs

Python for Cloud: Python for Amazon web services, Python for Google Cloud Platform, Python for windows Azure, Python for Map Reduce, Python packages of Interest, Python web Application Framework, Designing a RESTful web API.

Cloud Application Development in Python: Design Approaches, Image Processing APP, Document Storage App, Map Reduce App, Social Media Analytics App.

UNIT IV Big data, multimedia and Tuning**Lecture 8Hrs**

Big Data Analytics: Introduction, Clustering Big Data, Classification of Big data Recommendation of Systems.

Multimedia Cloud: Introduction, Case Study: Live video Streaming App, Streaming Protocols, case Study: Video Trans coding App.

Cloud Application Bench marking and Tuning: Introduction, Work load Character is tics, Application Performance Metrics, Design Considerations for a Bench marking Methodology, Bench marking Tools, Deployment Prototyping, Load Testing & Bottleneck Detection case Study, Hadoop bench marking case Study.

UNIT V Applications and Issues in Cloud

Lecture 9Hrs

Cloud Security: Introduction, CSA Cloud Security Architecture, Authentication, Authorization, Identity Access Management, Data Security, Key Management, Auditing.

Cloud for Industry, Health care & Education: Cloud Computing for Health care, Cloud computing for Energy Systems, Cloud Computing for Transportation Systems, Cloud Computing for Manufacturing Industry, Cloud computing for Education.

Migrating in to a Cloud: Introduction, Broad Approaches to migrating into the cloud, the seven– step model of migration in to a cloud.

Organizational readiness and Change Management in The Cloud Age: Introduction, Basic concepts of Organizational Readiness, Drivers for changes: A frame work to comprehend the competitive environment, common change management models, change management maturity models, Organizational readiness self– assessment.

Legal Issues in Cloud Computing: Introduction, Data Privacy and security Issues, cloud contracting models, Jurisdictional issues raised by virtualization and at a location, commercial and business considerations, Special Topics.

Text books:

1. Cloud computing Ahands - on Approach ||By Arshdeep Bahga, Vijay Madiseti, Universities Press, 2016
2. Cloud Computing Principles and Paradigms: By RajKumar Buyya, James Broberg, Andrzej Goscinski, Wiley, 2016

Reference Books:

1. Masterin g Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S Thamarai Selvi, TMH
2. Cloud computing AHands-On Approach by Arshdeep Bahga and Vijay Madiseti.
3. Cloud Computing: A Practical Approach, Anthony T.Velte, To by J.Velte, Robert Elsenpeter, Tata Mc Graw Hill, rp 2011.
4. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
5. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese,O'Reilly, SPD, rp 2011.
6. Essentials of Cloud Computing by K.Chandrasekaran. CRC Press.

Online Learning Resources:

Cloud computing – Course (nptel.ac.in)

III B.Tech II Semester

CRYPTOGRAPHY & NETWORK SECURITY(A1CS603T)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

This course aims at training students to master the:

- The concepts of classical encryption techniques and concepts of finite fields and number theory
- Working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes, and message digests, and public key algorithms
- Design issues and working principles of various authentication protocols, PKI standards
- Various secure communication standards including Kerberos, IPsec, TLS and email
- Concepts of cryptographic utilities and authentication mechanisms to design secure applications

Course Out comes:

After completion of the course, students will be able to

CO1	Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory
CO2	Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication
CO3	Apply the knowledge of cryptographic check sums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
CO4	Demonstrate the ability to apply user authentication principles including Kerberos for secure authentication
CO5	Gain proficiency in securing web communications using TLS and HTTPS , manage secure remote access with SSH , and design firewall policies

UNIT-I**Lecture 9Hrs**

Computer and Network Security Concepts: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security, Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography, Block Ciphers: Traditional Block Cipher Structure, The Data Encryption Standard, Advanced Encryption Standard: AES Structure, AES Transformation Functions

UNIT II**Lecture 9Hrs****Number Theory:**

The Euclidean Algorithm, Modular Arithmetic, Fermat's and Euler's Theorems, The Chinese Remainder Theorem, Discrete Logarithms, Finite Fields: Finite Fields of the Form $GF(p)$, Finite Fields of the Form $GF(2^n)$. **Public Key Cryptography:** Principles, Public Key Cryptography Algorithms, RSA Algorithm, Diffie Hellman Key Exchange, Elliptic Curve Cryptography.

UNIT-III**Lecture 9Hrs**

Cryptographic Hash Functions: Application of Cryptographic Hash Functions, Requirements & Security, Secure Hash Algorithm, Message Authentication Functions, Requirements & Security, HMAC & CMAC. **Digital Signatures:** NIST Digital Signature Algorithm, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure

UNIT IV**Lecture 9Hrs**

User Authentication: Remote User Authentication Principles, Kerberos. Electronic Mail Security: Pretty Good Privacy (PGP) And S/MIME.

IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange.

UNIT V**Lecture 8Hrs**

Transport Level Security: Web Security Requirements, Transport Layer Security (TLS), HTTPS, Secure Shell (SSH)

Fire walls: Fire wall Characteristics and Access Policy, Types of Fire walls, Fire wall Location and Configurations.

Text books:

- 1) Cryptography and Network Security – William Stallings, Pearson Education, 8th Edition.
- 2) Cryptography, Network Security and Cyber Laws – Bernard Menezes, Cengage Learning, 2010 edition.

Reference Books:

- 1) Cryptography and Network Security – Behrouz A. Forouzan, Debdeep Mukhopadhyaya, McGraw Hill, 3rd Edition, 2015.
- 2) Network Security Illustrated, Jason Albanese and Wes Sonnenreich, MGH Publishers, 2003.

Online Learning Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105031/lecture>
- 2) [https://nptel.ac.in/courses/106/105/106105162/lecturebyDr.SouravMukhopadhyayIITKharagpur\[VideoLecture\]](https://nptel.ac.in/courses/106/105/106105162/lecturebyDr.SouravMukhopadhyayIITKharagpur[VideoLecture])
- 3) <https://www.mitel.com/articles/web-communication-cryptography-and-network-security-web-articles> by Mitel Power Connections

III B.Tech II Semester

OBJECT ORIENTED ANALYSIS AND DESIGN(A1CS604a)**(Professional Elective-II)**

Course	Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
	L	T	P	L	T	P	C	CIE	SEE	Total
	0	0	3	42	0	0	3	30	70	100

Objectives:

1. Describe the activities in the different phases of the object-oriented development lifecycle.
2. Understand the concepts of object-oriented model with the E-R and EER models.
3. Model a real-world application by using UML diagram.
4. Design architectural modelling.
5. Describing an application of UML.

Course Outcomes:

At the end of the course, student will be able to

CO1	The importance of modelling in UML.
CO2	Compare and contrast the object-oriented model with the E-R and EER models.
CO3	Design use case diagram. Design an application using deployment diagram.
CO4	Apply UML diagrams to build library application.
CO5	Design architectural modelling
CO6	Describe the activities in the different phases of the object-oriented development lifecycle.

UNIT – I**9 Hrs**

Introduction to UML: Importance of modelling, principles of modelling, object-oriented modelling, conceptual model of the UML, Architecture, Software Development Life Cycle.

UNIT – II**9 Hrs**

Basic Structural Modelling: Classes, Relationships, common Mechanisms, and diagrams.

Advanced Structural Modelling: Advanced classes, advanced relationships, Interfaces, Types and Roles, Packages. Class & Object Diagrams: Terms, concepts, modelling techniques for Class & Object Diagrams.

UNIT – III**9 Hrs**

Basic Behavioural Modelling-I: Interactions, Interaction diagrams.

Basic Behavioural Modelling-II: Use cases, Use case Diagrams, Activity Diagrams.

UNIT – IV**9 Hrs**

Advanced Behavioral Modelling: Events and signals, state machines, processes and Threads, time and space, state chart diagrams. Architectural Modelling: Component, Deployment, Component diagrams and Deployment diagrams.

UNIT – V**9 Hrs**

Patterns and Frameworks, Artifact Diagrams. Case Study: The Unified Library application.

Text Books:

1. Grady Booch, James Rumbaugh, Ivar Jacobson: The Unified Modelling Language User Guide, Pearson Education 2nd Edition.

2. Object-Oriented Analysis and Design with the Unified Process By John W. Satzinger, Robert B Jackson and Stephen D Burd, Cengage Learning.

Reference Books:

1. Meilir Page-Jones: Fundamentals of Object-Oriented Design in UML, Pearson Education.
2. Pascal Roques: Modelling Software Systems Using UML2, WILEY-Dreamtech India Pvt. Ltd.
3. Atul Kahate: Object Oriented Analysis & Design, The McGraw-Hill Companies.
4. Mark Priestley: Practical Object-Oriented Design with UML, TMH.
5. Applying UML and Patterns: An introduction to Object – Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

Cyber Security(A1CS604b)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

The course is designed to provide awareness on different cyber crimes, cyber offenses, tools and methods used in cybercrime.

Course Outcomes:

After completion of the course, students will be able to

CO1	Classify the cybercrimes and understand the Indian ITA 2000
CO2	Analyse the vulnerabilities in any computing system and find the solutions
CO3	Predict the security threats of the future
CO4	Investigate the protection mechanisms
CO5	Design security solutions for organizations

UNIT I Introduction to Cybercrime**Lecture 8Hrs**

Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT II Cyber Offenses: How Criminals Plan Them**Lecture 9Hrs**

Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing

UNIT III Cybercrime: Mobile and Wireless Devices**Lecture 9Hrs**

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices:

Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT IV Tools and Methods Used in Cybercrime**Lecture 8Hrs**

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT V Cyber Security: Organizational Implications**Lecture 8Hrs**

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Text books:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.

2. Introduction to Cyber Security, Chwan- Hwa(john) Wu, J. David Irwin. CRC Press T&F Group

Online Learning Resources:

<http://nptel.ac.in/courses/106105031/40>

III B.Tech II Semester

DevOps(A1CS604c)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Pre-requisite:

Fundamentals of software development and maintenance

Course Objectives:

- Understand collaboration and productivity by automating infrastructure and workflows
- Familiarize with continuous measuring applications performance

Course Outcomes: After completion of the course, students will be able to

CO1	Enumerate the principles of continuous development and deployment, automation of configuration management, inter-team collaboration, and IT serviceability
CO2	Describe Dev Ops & Dev Sec Ops methodologies and their key concepts
CO3	Illustrate the types of version control systems, continuous integration tools, continuous monitoring tools, and cloud models
CO4	Set up complete private infrastructure using version control systems and CI/CD tools
CO5	Understand collaboration and productivity by automating infrastructure and workflows

UNIT I**Lecture 8 Hrs**

Dev Ops: An Overview, Dev Ops: Origins, Dev Ops: Roots, Dev Ops: Practices Dev Ops: Culture.

Adopting Dev Ops: Developing the Playbook. Developing a Business Case for a Dev Ops: Developing the Business Case

UNIT II**Lecture 9 Hrs**

Completing the Business Model Canvas, Customer Segments, Value Segments, Value Propositions, Channels, Customer Relationships, Revenue Streams, Key Resources, Key Activities, Key Partnerships, Cost Structures. Dev Ops Plays for Optimizing the delivery Pipeline: Dev Ops as an optimization Exercise, Core Themes, The Dev Ops Plays, Specializing Core Plays

UNIT III**Lecture 8Hrs**

Dev Ops Plays for Driving Innovation: Optimize to Innovate, The Uber Syndrome, Innovation and the Role of Technology, Core Themes, play: Build a Dev Ops Platform, play: Deliver Micro services Architectures, play: DevOps an API Economy, play: Organizing for Innovation.

UNIT IV**Lecture 10 Hrs**

Scaling Dev Ops for the Enterprise: Core Themes, play: Dev Ops Center of Competency, play: Developing Culture of Innovation at Scale, play: Developing a Culture of continuous Improvement, play: Team Models for Dev Ops, play: Standardization of Tools and Process, play: Security Considerations for Dev Ops, Play: Dev Ops and Outsourcing.

UNIT V**Lecture 10 Hrs**

Leading Dev Ops Adoption in the Enterprise: Play: Dev Ops as a transformation Exercise, play: Developing a Culture of Collaboration and Trust, play: Dev Ops Thinking for the Line of Business, play: starting with Pilot Projects, Play: Rearing Unicorns on an Aircrafts Carrier. Appendix Case Study: Example Dev Ops Adoption Roadmap Organization Background, Roadmap Structure, Adoption Roadmap.

Text books:

1. Sanjeev Sharma, The Dev Ops Adoption Playbook, Published by John Wiley & Sons, Inc.2017

Reference Books:

1. Sanjeev Sharma & Bernie Coyne, Dev Ops for Dummies, Published by John Wiley & Sons, Inc.
2. Michael Huttermann, Dev Ops for Developers, Apress publishers,2012.

Online Learning Resources:

Learning Dev Ops with Terra form Infrastructure Automation Course | Udemy

III B.Tech II Semester

EMBEDDED SYSTEM DESIGN(A1CS604d)**Professional Elective-II**

Course	Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
	L	T	P	L	T	P	C	CIE	SEE	Total
	0	0	3	42	0	0	3	30	70	100

Objectives:

1. To understand the history, classification, and design process of embedded systems.
2. To explore the core components of embedded systems, including processors, memory, and I/O components.
3. To introduce onboard and external communication interfaces used in embedded systems.
4. To explain different firmware design approaches and programming techniques for embedded systems.
5. To provide an understanding of real-time operating systems and task management in embedded systems.

Course Outcomes:

After completing the course, the student will be able to

CO1	Classify embedded systems based on their purpose, generation, and complexity.
CO2	Identify and select appropriate hardware components for an embedded system design
CO3	Differentiate and implement various communication protocols like I2C, SPI, and CAN.
CO4	Develop firmware using assembly and high-level programming languages
CO5	Analyze and apply RTOS-based task scheduling and synchronization techniques.

UNIT I Introduction to Embedded Systems

History of embedded systems, Classification of embedded systems based on generation and complexity, Purpose of embedded systems, The embedded system design process-requirements, specification, architecture design, designing hardware and software, components, system integration, Applications of embedded systems, and characteristics of embedded systems.

UNIT II Typical Embedded System

Core of the embedded system-general purpose and domain specific processors, ASICs, PLDs, COTs; Memory-ROM, RAM, memory according to the type of interface, memory shadowing, memory selection for embedded systems, Sensors, actuators, I/O components: seven segment LED, relay, piezo buzzer, push button switch, other sub-systems: reset circuit, brownout protection circuit, oscillator circuit real time clock, watch dog timer.

UNIT III Communication Interface

Onboard communication interfaces-I2C, SPI, CAN, parallel interface; External communication interfaces-RS232 and RS485, USB, infrared, Bluetooth, Wi-Fi, ZigBe, GPRS, GSM.

UNIT IV Embedded Firmware Design and Development

Embedded firmware design approaches-super loop based approach, operating system based approach; embedded firmware development languages-assembly language based development, high level language based development.

UNIT V RTOS based Embedded System Design

Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling: non-pre-emptive and pre-emptive scheduling; task communication-shared memory, message passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/ Synchronization Issues, Task Synchronization Techniques

Text books:

1. Introduction to Embedded Systems - Shibu KV, Mc Graw Hill Education.
2. Computers as Components –Wayne Wolf, Morgan Kaufmann (second edition).

References:

1. Embedded System Design -Frank Vahid, Tony Grivargis, John Wiley.
2. Embedded Systems- An integrated approach - Lyla b das, Pearson education 2012.
3. Embedded Systems – Raj Kamal, TMH

III B.Tech II Semester

SOFTWARE PROJECT MANAGEMENT(A1CS605a)
(Professional Elective-III)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objective:

This course is designed to enable the students to understand the fundamental principles of Software Project management & will also have a good knowledge of the responsibilities of a project manager and how to handle them.

Course Out comes:

After completion of the course, students will be able to

CO1	Describe the fundamentals of Project Management
CO2	Recognize and use Project Scheduling Techniques
CO3	Familiarize with Project Control Mechanisms
CO4	Under stand Team Management
CO5	Recognize the importance of Project Documentation and Evaluation

UNIT-I**Lecture9Hrs**

Conventional Software Management: The water fall model, conventional software Management performance Evolution of Software Economics: software Economics. Pragmatic Software Cost Estimation Improving Software Economics: Reducing Software Product Size, Improving Software Processes, Improving Team Effectiveness, Improving Automation, Achieving Required Quality ,Peer Inspections.

UNIT-II**Lecture9Hrs**

The old way and the new: The principles of conventional software Engineering, principles of modern software management, transitioning to an iterative process.

Lifecycle phases: Engineering and production stages, inception, Elaboration, construction, transition phases.

Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts

UNIT-III**Lecture 9Hrs**

Work Flows of the process: Software process work flows, Inter Trans work flows. Check points of the Process: Major Milestones, Minor Milestones, Periodic status assessments. Iterative Process Planning: work break down structures, planning guidelines, cost and schedule estimating, Iteration planning process, Pragmatic planning

UNIT-IV**Lecture9Hrs**

Process Automation: Automation Building Blocks, The Project Environment.

Project Control and Process instrumentation: The seven core Metrics, Management indicators, quality indicators Tailoring the Process: Process discriminants. Managing people and organizing teams.

UNIT-V**Lecture9Hrs**

Project Organizations and Responsibilities: Line - of-Business Organizations, Project Organizations, evolution of Organizations.

Future Software Project Management: modern Project Profiles, Next generation Software economics, modern process

transitions.

Case Study: The Command Center Processing and Display System-Replacement(CCPDS-R)

Text books:

1. Software Project Management, Walker Royce, Pearson Education, 2012
2. Bob Hughes, Mike Cotterell and Rajib Mall "Software Project Management", 6th Edition, Mc Graw Hill Edition, 2017

Reference Books:

1. Pankaj Jalote, "Software Project Management in practice", 5th Edition, Pearson Education, 2017.
2. Murali K. Chemuturi, Thomas M. Cagley Jr. "Mastering Software Project Management: Best Practices, Tools and Techniques", J. Ross Publishing, 2010
3. Sanjay Mohapatra, "Software Project Management", Cengage Learning, 2011

Online Learning Resources:

<http://nptel.ac.in/courses/106101061/29>

III B.Tech II Semester

MOBILE ADHOC NETWORKS(A1CS605b)
(Professional Elective-III)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objective:

- Knowledge of mobile ad hoc networks, design and implementation issues, and available solutions.
- Knowledge of routing mechanisms and the three classes of approaches: proactive, on-demand, and hybrid.
- Knowledge of clustering mechanisms and the different schemes that have been employed, e.g., hierarchical, flat, and leaderless.
- Knowledge of the 802.11 Wireless Lan (WiFi) and Bluetooth standards.

Course Outcomes:

CO1	Describe the unique issues in ad-hoc/sensor networks.
CO2	Describe current technology trends for the implementation and deployment of wireless ad-hoc/sensor networks.
CO3	Discuss the challenges in designing MAC, routing and transport protocols for wireless ad-hoc/sensor networks.
CO4	Discuss the challenges in designing routing and transport protocols for wireless Adhoc/sensor networks.
CO5	Comprehend the various sensor network Platforms, tools and applications

UNIT- I**Introduction to Ad Hoc Networks:**

Characteristics of MANETs, Applications of MANETs and challenges of

MANETs -Routing in MANETs: Criteria for classification, Taxonomy of MANET routing algorithms, Topology based routing algorithms, Position based routing algorithms, Other routing algorithms.

UNIT -II**Data Transmission:**

Broadcast storm problem, Broadcasting, Multicasting and Geocasting -TCP over Ad Hoc:

TCP protocol overview, TCP and MANETs, Solutions for TCP over Ad hoc

UNIT- III**Basics of Wireless, Sensors and Applications:**

Applications, Classification of sensor networks, Architecture of sensor network, Physical layer, MAC layer, Link layer.

UNIT- IV**Data Retrieval in Sensor Networks:**

Routing layer, Transport layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs, Sensor Networks and mobile robots-Security:

Security in Ad Hoc networks, Key management, Secure routing, Cooperation in MANETs, Intrusion Detection systems.

UNIT- V

Sensor Network Platforms and Tools: Sensor Network Hardware, Berkeley motes, Sensor Network Programming Challenges, Node-Level Software Platforms -Operating System: Tiny OS -Imperative Language: nesC, Data flow style language: Tiny GALS, Node Level Simulators, ns-2 and its sensor network extension.

TEXT BOOKS:

1. Ad Hoc and Sensor Networks –Theory and Applications, Carlos Corderio Dharma P. Aggarwal,World Scientific Publications, March 2006,ISBN –981-256-681-3
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science, ISBN –978-1-55860-914-3 (Morgan Kauffman)

(Professional Elective-III)

III B.Tech II Semester

NATURAL LANGUAGE PROCESSING(A1CS605c)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objective

- Explain and apply fundamental algorithms and techniques in the area of natural language processing(NLP)
- Discuss approaches to syntax and semantics in NLP.
- Examine current methods for statistical approach to machine translation.
- Teach machine learning techniques used in NLP.

Course Out comes:

After completion of the course, students will be able to

CO1	Under stand the various NLP Applications and Organization of Natural language, able to learn and implement realistic applications using Python.
CO2	Apply the various Parsing techniques, Bayes Rule, Shannon's game, Entropy and Cross Entropy.
CO3	Under stand the fundamentals of CFG and parsers and mechanisms in ATN's.
CO4	Apply Semantic Interpretation and Language Modelling.
CO5	Apply the concept of Machine Translation and multilingual Information Retrieval systems and Automatic Summarization.

UNIT- I Introduction to Natural language

The Study of Language, Applications of NLP, Evaluating Language Understanding Systems, Different Levels of Language Analysis, Representations and Understanding, Organization of Natural language Understanding Systems, Linguistic Background: An outline of English Syntax.

UNIT- II Grammars and Parsing

Grammars and Parsing – Top – Down and Bottom-Up Parsers, Transition Network Grammars, Feature Systems and Augmented Grammars, Morphological Analysis and the Lexicon, Parsing with Features, Augmented Transition Networks, Bayes Rule, Shannon's game, Entropy and Cross Entropy.

UNIT- III Grammars for Natural Language

Grammars for Natural Language, Movement Phenomenon in Language, Gap Threading, Human Preferences in Parsing, Shift Reduce Parsers, Deterministic Parsers.

UNIT-IV**Semantic Interpretation**

Semantic & Logical form, Word senses & ambiguity, The basic logical form language, Encoding ambiguity in the logical Form, Verbs & States in logical form, The microroles, Speech acts & embedded sentences, Defining semantics structure model theory.

Language Modelling

Introduction, n-

Gram Models, Language model Evaluation, Parameter Estimation, Language Model Adaption, Types of Language Models, Language

Machine Translation

Survey: Introduction, Problems of Machine Translation, Is Machine Translation Possible, Brief History, Possible Approaches, Current Status. Anusarakaor Language Accessor: Background, Cutting the Gordian Knot, The Problem, Structure of Anusaraka System, User Interface, Linguistic Area, Giving up Agreement in Anusarsaka Output, Language Bridges.

Multilingual Information Retrieval

Introduction, Document Pre-processing, Monolingual Information Retrieval, CLIR, MLIR, Evaluation in Information Retrieval, Tools, Software and Resources.

Multilingual Automatic Summarization

Introduction, Approach to Summarization, Evaluation, How to Build a Summarizer, Competitions and Datasets.

Textbooks:

1. James Allen, Natural Language Understanding, 2nd Edition, 2003, Pearson Education.
2. Multilingual Natural Language Processing Applications: From Theory To Practice- Daniel M. Bikel and Imed Zitouni, Pearson Publications.
3. Natural Language Processing, A paninian perspective, Akshar Bharathi, Vineetchaitanya, Prentice –Hall of India.

Reference Books:

1. Charniak, Eugene, Statistical Language Learning, MIT Press, 1993.
2. Jurafsky, Dan and Martin, James, Speech and Language Processing, 2nd Edition, Prentice Hall, 2008.
3. Manning, Christopher and Henrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

Online Learning Resources: <https://nptel.ac.in/courses/106/105/106105158/http://www.nptelvideos.in/2012/11/natural-language-processing.html>

III B.Tech II Semester

DISTRIBUTED OPERATING SYSTEMS(A1CS605d)
(Professional Elective-III)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives

- To study, learn, and understand the main concepts of advanced operating systems (parallel processing systems, distributed systems, real time systems, network operating systems, and open source operating systems)
- Hardware and software features that support these systems.

Course Outcomes

CO1	Understand the design approaches of advanced operating systems
CO2	Analyze the design issues of distributed operating systems.
CO3	Evaluate design issues of multi processor operating systems.
CO4	Identify the requirements Distributed File System and Distributed Shared Memory.
CO5	Formulate the solutions to schedule the real time applications.

UNIT - I

Architectures of Distributed Systems: System Architecture Types, Distributed Operating Systems, Issues in Distributed Operating Systems, Communication Primitives. Theoretical Foundations: Inherent Limitations of a Distributed System, Lamport's Logical Clocks, Vector Clocks, Causal Ordering of Messages, Termination Detection.

UNIT - II

Distributed Mutual Exclusion: The Classification of Mutual Exclusion Algorithms, Non-Token –Based Algorithms: Lamport's Algorithm, The Ricart-Agrawala Algorithm, Maekawa's Algorithm, Token-Based Algorithms: Suzuki-Kasami's Broadcast Algorithm, Singhal's Heuristic Algorithm, Raymond's Heuristic Algorithm.

UNIT - III

Distributed Deadlock Detection: Preliminaries, Deadlock Handling Strategies in Distributed Systems, Issues in Deadlock Detection and Resolution, Control Organizations for Distributed Deadlock Detection, Centralized- Deadlock – Detection Algorithms, Distributed Deadlock Detection Algorithms, Hierarchical Deadlock Detection Algorithms

UNIT - IV

Multiprocessor System Architectures: Introduction, Motivation for multiprocessor Systems, Basic Multiprocessor System Architectures Multi Processor Operating Systems: Introduction, Structures of Multiprocessor Operating Systems, Operating Design Issues, Threads, Process Synchronization, Processor Scheduling. Distributed File Systems: Architecture, Mechanisms for Building Distributed File Systems, Design Issues

UNIT - V

Distributed Scheduling: Issues in Load Distributing, Components of a Load Distributed Algorithm, Stability, Load Distributing Algorithms, Requirements for Load Distributing, Task Migration, Issues in task Migration Distributed Shared Memory: Architecture and Motivation, Algorithms for Implementing DSM, Memory Coherence, Coherence Protocols, Design Issues

TEXT BOOK:

1. Advanced Concepts in Operating Systems, Mukesh Singhal, Niranjana G. Shivaratri, Tata Mc Graw- Hill Edition 2001

REFERENCE BOOK:

1. Distributed Systems: Andrew S. Tanenbaum, Maarten Van Steen, Pearson Prentice Hall, Edition – 2, 2007

III B.Tech II Semester

INTRODUCTION TO MACHINE LEARNING LAB(A1CS601P)**Course Objectives:**

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.

Course Outcomes (CO):

After completion of the course, students will be able to

CO1	Understand the Mathematical and statistical prospectives of machine learning algorithms through python programming
CO2	Appreciate the importance of visualization in the data analytics solution.
CO3	Derive insights using Machine learning algorithms

List of Experiments:**Note:**

- The programs can be implemented in either JAVA or Python.
 - For Problems 1 to 6 and 10, programs are to be developed without using the built-in classes or APIs of Java/Python.
 - Data sets can be taken from standard repositories (<https://archive.ics.uci.edu/ml/datasets.html>) or constructed by the students.
- Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
 - For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
 - Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
 - Build an Artificial Neural Network by implementing the Back-propagation algorithm and test the same using appropriate data sets.
 - Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
 - Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
 - Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
 - Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.
 - Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
 - Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select

appropriate data set for your experiment and draw graphs.

Projects

1. Predicting the Sale price of a house using Linear regression
2. Spam classification using Naïve Bayes algorithm
3. Predict car sale prices using Artificial Neural Networks
4. Predict Stock market trends using LSTM
5. Detecting faces from images

References:

1. Python Machine Learning Workbook for beginners, AI Publishing, 2020.

Online Learning Resources/ Virtual Labs:

- 1) [Machine Learning A-Z \(Python & R in Data Science Course\) | Udemy](#)
- 2) [Machine Learning | Coursera](#)

III B.Tech II Semester

CRYPTOGRAPHY AND NETWORK SECURITY LAB(A1CS603P)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	0	0	0	3	30	70	100

List of Experiments:

1. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value 'Hello world'. The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a Java program to perform encryption and decryption using the following algorithms
a. Ceaser cipher b. Substitution cipher c. Hill Cipher
4. Write a C/JAVA program to implement the DES algorithm logic.
5. Write a C/JAVA program to implement the Blowfish algorithm logic.
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Write the RC4 logic in Java Using Java cryptography; encrypt the text "Hello world" using Blowfish. Create your own key using Java key tool.
8. Write a Java program to implement RSA algorithm.
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
11. Calculate the message digest of a text using the MD5 algorithm in JAVA.

III B.Tech II Semester

SOFT SKILLS(A12403)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Code	Soft Skills		L	T	P	C
A12403			0	1	2	2
Pre-requisite		SemesterIV/V				
Course Objectives:						
- To encourage all round development of the students by focusing on soft skills - To make the students aware of critical thinking and problem-solving skills - To enhance healthy relationship and understanding within and outside an organization - To function effectively with heterogeneous teams						
Course Outcomes (CO):						
COs	Statements					Blooms level
CO1	List out various elements of soft skills					L1, L2,
CO2	Describe methods for building professional image					L1, L2
CO3	Apply critical thinking skills in problem solving					L3
CO4	Analyse the needs of an individual and team for well-being					L4
CO5	Assess the situation and take necessary decisions					L5
CO6	Create a productive work place atmosphere using social and work-life skills ensuring personal and emotional well-being					L6
SYLLABUS						
UNIT – I		Soft Skills & Communication Skills			Lecture Hrs	
Soft Skills - Introduction, Need - Mastering Techniques of Soft Skills – Communication Skills - Significance, process, types - Barriers of communication - Improving techniques						
Activities: Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self-expression – articulating with felicity (The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources) Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic. Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace. Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation						
UNIT – II		Critical Thinking			Lecture Hrs	
Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking - Positive thinking - Reflection						
Activities: Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues – placing the problem – finding the root cause - seeking viable solution – judging with rationale –						

evaluating the views of others - Case Study, Story Analysis		
UNIT – III	Problem Solving & Decision Making	Lecture Hrs
Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Team building - Effective decision making in teams – Methods & Styles Activities: Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision. Case Study & Group Discussion		
UNIT – IV	Emotional Intelligence & Stress Management	Lecture Hrs
Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips Activities: Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates		
UNIT – V	Corporate Etiquette	Lecture Hrs
Etiquette- Introduction, concept, significance - Corporate etiquette - meaning, modern etiquette, benefits - Global and local culture sensitivity - Gender Sensitivity - Etiquette in interaction- Cell phone etiquette - Dining etiquette - Netiquette - Job interview etiquette -Corporate grooming tips - Overcoming challenges Activities Providing situations to take part in the Role Plays where the students will learn about bad and good manners and etiquette - Group Activities to showcase gender sensitivity, dining etiquette etc. - Conducting mock job interviews - Case Study - Business Etiquette Games NOTE:- 1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill. 2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear.		
Prescribed Books:		
1. Mitra Barun K, <i>Personality Development and Soft Skills</i> , Oxford University Press, Pap/Cdr edition 2012 2. Dr Shikha Kapoor, <i>Personality Development and Soft Skills: Preparing for Tomorrow</i> , K I 2018 ,esuoH gnihsilbuP lanoitanretnI		
Reference Books		
1. Sharma, Prashant, <i>Soft Skills: Personality Development for Life Success</i> , BPB Publications 2018. 2. Alex K, <i>Soft Skills</i> S.Chand & Co, 2012 (Revised edition)		

III B.Tech II Semester

Technical Report Writing & IPR(A1ES608)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

1. To enable the students to practice the basic skills of research paper writing
2. To make the students understand the importance of IP and to educate them on the basic concepts of Intellectual Property Rights.
3. To practice the basic skills of performing quality literature review
4. To help them in knowing the significance of real life practice and procedure of Patents.
5. To enable them learn the procedure of obtaining Patents, Copyrights, & Trade Marks

Course Outcomes: On successful completion of this course, the students will be able to:

COURSE OUTCOMES: At the end of the course, students will be able to		Blooms Level
CO1	Identify key secondary literature related to their proposed technical paper writing	L1, L2
CO2	Explain various principles and styles in technical writing	L1, L2
CO3	Use the acquired knowledge in writing a research/technical paper	L3
CO4	Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, International Trademark etc.	L4
CO5	Evaluate different forms of IPR available at national & international level	L5
CO6	Develop skill of making search of various forms of IPR by using modern tools and techniques.	L3, L6

UNIT – I:

Principles of Technical Writing: styles in technical writing; clarity, precision, coherence and logical sequence in writing-avoiding ambiguity- repetition, and vague language -highlighting your findings-discussing your limitations -hedging and criticizing -plagiarism and paraphrasing .

UNIT – II:

Technical Research Paper Writing: Abstract- Objectives-Limitations-Review of Literature- Problems and Framing Research Questions- Synopsis

UNIT – III:

Process of research: publication mechanism: types of journals- indexing-seminars- conferences- proof reading –plagiarism style; seminar & conference paper writing; Methodology-discussion-results- citation rules

IT – IV:

Introduction to Intellectual property: Introduction, types of intellectual property, International organizations, agencies and treaties, Importance of intellectual property rights

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting and evaluating a trade mark, trade mark registration processes.

UNIT – V:

Law of copy rights: Fundamentals of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer. Patent law, intellectual property audits.

Textbooks:

1. Deborah. E. Bouchoux, *Intellectual Property Rights*, Cengage Learning India, 2013
2. Meenakshi Raman, Sangeeta Sharma. *Technical Communication: Principles and practices*. Oxford.

Reference Books:

1. R.Myneni, *Law of Intellectual Property*, 9th Ed, Asia law House, 2019.
2. Prabuddha Ganguli, *Intellectual Property Rights* Tata Mcgraw Hill, 2001
3. P.Naryan, *Intellectual Property Law*, 3rd Ed, Eastern Law House, 2007.
4. Adrian Wallwork. *English for Writing Research Papers* Second Edition. Springer Cham Heidelberg New York, 2016
5. Dan Jones, Sam Dragga, *Technical Writing Style*

Online Resources

1. <https://theconceptwriters.com.pk/principles-of-technical-writing/>
2. <https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html>
3. <https://www.ewh.ieee.org/soc/emcs/acstrial/newsletters/summer10/TechPaperWriting.html>
4. <https://www.manuscriptedit.com/scholar-hangout/process-publishing-research-paper-journal/>
5. <https://www.icsi.edu/media/website/IntellectualPropertyRightLaws&Practice.pdf>
6. <https://lawbhoomi.com/intellectual-property-rights-notes/>
7. <https://www.extension.purdue.edu/extmedia/ec/ec-723.pdf>

IV B.Tech I Semester

DEEP LEARNING(A1CS701)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

- Demonstrate the major technology trends driving Deep Learning
- Build, train, and apply fully connected deep neural networks
- Implement efficient (vectorized) neural networks
- Analyse the key parameters and hyper parameters in a neural network's architecture

Course Outcomes:

After completion of the course, students will be able to

CO1	Demonstrate the mathematical foundation of neural network
CO2	Describe the machine learning basics
CO3	Differentiate architecture of deep neural network
CO4	Build a convolutional neural network
CO5	Build and train RNN and LSTMs

UNIT-I

Lecture 8Hrs

Linear Algebra: Scalars, Vectors, Matrices and Tensors, Matrix operations, types of matrices, Norms, Eigen decomposition, Singular Value Decomposition, Principal Components Analysis.

Probability and Information Theory: Random Variables, Probability Distributions, Marginal Probability, Conditional Probability, Expectation, Variance and Covariance, Bayes' Rule, Information Theory. Numerical Computation: Overflow and Underflow, Gradient-Based Optimization, Constrained Optimization, Linear Least Squares.

UNIT-II

Lecture 9Hrs

Machine Learning: Basics and Under fitting, Hyper parameters and Validation Sets, Estimators, Bias and Variance, Maximum Likelihood, Bayesian Statistics, Supervised and Unsupervised Learning, Stochastic Gradient Descent, Challenges Motivating Deep Learning. Deep Feed forward Networks: Learning XOR, Gradient-Based Learning, Hidden Units, Architecture Design, Back-Propagation and other Differentiation Algorithms.

UNIT-III

Lecture 8Hrs

Regularization for Deep Learning: Parameter Norm Penalties, Norm Penalties as Constrained Optimization, Regularization and Under-Constrained Problems, Dataset Augmentation, Noise Robustness, Semi-Supervised Learning, Multi-Task Learning, Early Stopping, Parameter Tying and Parameter Sharing, Sparse Representations, Bagging and Other Ensemble Methods, Dropout, Adversarial Training, Tangent Distance, Tangent Prop and Manifold Tangent Classifier. Optimization for Training Deep Models: Pure Optimization, Challenges in Neural Network Optimization, Basic Algorithms, Parameter Initialization Strategies, Algorithms with Adaptive Learning Rates, Approximate Second-Order Methods, Optimization Strategies and Meta-Algorithms.

UNIT-IV

Lecture 9Hrs

Convolutional Networks: The Convolution Operation, Pooling, Convolution, Basic Convolution Functions, Structured Outputs, Data Types, Efficient Convolution Algorithms, Random or Unsupervised Features, Basis for Convolutional Networks.

UNIT V

Lecture 8Hrs

Sequence Modeling: Recurrent and Recursive Nets: Unfolding Computational Graphs, Recurrent Neural Networks, Bidirectional RNNs, Encoder-Decoder Sequence-to-Sequence Architectures, Deep Recurrent Networks, Recursive Neural Networks, Echo State Networks, LSTM, Gated RNNs, Optimization for Long-Term Dependencies, Auto encoders, Deep Generative Models.

Text books:

1. Ian Good fellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press,2016.
2. Josh Patterson and Adam Gibson, “Deep learning: A practitioner's approach”, O'Reilly Media, First Edition,2017.

Reference Books:

1. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O'Reilly, Shroff Publishers,2019.
2. Deep learning Cook Book, Practical recipes to get started Quickly, Douwe Osinga, O'Reilly, Shroff Publishers,2019.

Online Learning Resources:

1. <https://keras.io/datasets/>
2. <http://deeplearning.net/tutorial/deeplearning.pdf>
3. <https://arxiv.org/pdf/1404.7828v4.pdf>
4. <https://www.cse.iitm.ac.in/~miteshk/CS7015.html>
5. <https://www.deeplearningbook.org>
6. <https://nptel.ac.in/courses/106105215>

IV B.Tech I Semester

MANAGEMENT SCIENCE(A1HS702a)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Syllabus**UNIT-I: Ethics**

Introduction – Meaning – Nature, Scope, significance, Loyalty, and ethical behavior.. Value systems - Business Ethics - Types, Characteristics, Factors, Contradictions and Ethical Practices in Management - Corporate Social Responsibility – Issues of Management – Crisis Management.

LEARNING OUTCOMES:- After completion of this unit student will

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Understand the Ethics and different types of Ethics.
CO2	Understand business ethics and ethical practices in management
CO3	Understand the role of ethics in management
CO4	Apply the knowledge of professional ethics & technical ethics
CO5	Analyze corporate law, ethics, codes & principles
CO6	Evaluate corporate governance & corporate scams

- Understand the meaning of loyalty and ethical Behavior
- Explain various types of Ethics
- Analyze issues & crisis of management

UNIT-II: ETHICS IN MANAGEMENT

Introduction- Ethics in production, finance, Human resource management and Marketing Management - The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures - Culture and Individual Ethics – professional ethics and technical ethics.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the meaning of Ethics in various areas of management
- Compare and contrast professional ethics and technical ethics

- Develop ethical values in self and organization

UNIT-III : CORPORATE CULTURE

Introduction - Meaning, definition, Nature, and significance – Key elements of corporate culture, shared values, beliefs and norms, rituals, symbols and language - Types of corporate culture, hierarchical culture, market driven culture – Organization leadership and corporate culture, leadership styles and their impact on culture, transformational leadership and culture change.

LEARNING OUTCOMES:- After completion of this unit student will

- Define corporate culture
- Understand the key elements of corporate culture
- Analyze organization leadership and corporate culture

UNIT- IV: LEGAL FRAME WORK

Law and Ethics -Agencies enforcing Ethical Business Behavior - Legal Impact – Environmental Protection, Fair Trade Practices, legal Compliances, Safeguarding Health and wellbeing of Customers – Corporate law, Securities and financial regulations, corporate governance codes and principles.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand Law and Ethics
- Analyze Different fair trade practices
- Make use of Environmental Protection and Fair Trade Practices

UNIT -V: CORPORATE GOVERNANCE

Introduction - Meaning – Corporate governance code, transparency & disclosure -Role of auditors, board of directors and shareholders. Global issues, accounting and regulatory frame work - Corporate scams
- Committees in India and abroad, corporate social responsibility. BoDs composition, Cadbury Committee - Various committees - Reports - Benefits and Limitations.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand corporate governance code
- Analyze role of auditors, board of directors and shareholders in corporate governance
- Implementing corporate social responsibility in India.

Text books.

1. Murthy CSV: Business Ethics and Corporate Governance, HPH July 2017
2. Bholanath Dutta, S.K. Podder – Corporation Governance, VBH. June 2010

Reference books

1. Dr. K. Nirmala, KarunakaraReaddy. *Business Ethics and Corporate Governance*, HPH
2. H.R.Machiraju: *Corporate Governance*, HPH, 2013
3. K. Venkataramana, *Corporate Governance*, SHBP.
4. N.M.Khandelwal. *Indian Ethos and Values for Managers*

ONLINE RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc21_mg46/
2. <https://archive.nptel.ac.in/courses/110/105/110105138/>
3. https://onlinecourses.nptel.ac.in/noc21_mg54/
4. https://onlinecourses.nptel.ac.in/noc22_mg54/
5. <https://archive.nptel.ac.in/courses/109/106/109106117/>

BUSSINESS ETHICS AND COPERATE GOVERANCE(A1HS702b)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100
COURSE OUTCOMES: At the end of the course student will be able to									BTL
CO1	Remember E-Business & its nature, scope and functions.								L1
CO2	Understand E-market-Models which are practicing by the organizations								L2
CO3	Apply the concepts of E-Commerce in the present globalized world.								L3
CO4	Analyze the various E-payment systems & importance of net banking.								L4
CO5	Evaluate market research strategies & E-advertisements.								L5
CO6	Understand importance of E-security & control								L2

Syllabus**Unit-I: Electronic Business**

Introduction – Nature, meaning, significance, functions and advantages - Definition of Electronic Business - Functions of Electronic Commerce (EC)-Advantages & Disadvantages of E-Commerce –E-Commerce and E-Business, Internet Services, Online Shopping- E-Commerce Opportunities for Industries.

Learning Outcomes: -After completion of this unit student

- Understand the concept of E-Business
- Contrast and compare E-Commerce & E-Business
- Evaluate opportunities of E-commerce for industry

Unit-II: Electronic Markets and Business Models

Introduction –E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals -Business Models- Business to Business (B2B)-Business to Customers(B2C) - Business to Government(B2G)-Auctions-B2B Portals in India

Learning Outcomes: -After completion of this unit student will

- Understand the concept of business models
- Contrast and compare Vertical portal and Horizontal portals
- Analyze the B2B,B2C and B2G model

Unit-III: Electronic Payment Systems:

Introduction to electronic payment systems (EPS) -Types of electronic payments - Credit/debit cards, e-wallets, UPI, and crypto currencies -Smart cards and digital wallets: Features and usage -Electronic Fund Transfer (EFT): Role in business transactions -Infrastructure requirements and regulatory aspects of e-payments

Learning Outcomes: -After completion of this unit student will

- Understand the Electronic payment system
- Contrast and compare EFT and smart cards
- Analyze debit card and credit cards

Unit-IV:E-Security

Security risks and challenges in electronic commerce - Cyber threats - Phishing, hacking, identity theft, and malware - Digital Signatures & Certificates - Security protocols over public networks (HTTP, SSL, TLS) -Firewalls in securing e-business platforms.

Learning Outcomes: -After completion of this unit student will

- Understand E-Security
- Contrast and compare security protocols and public network
- Evaluate on Digital signature

Unit-V:E-Marketing:

Introduction – Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Market Research– – E-marketing planning: Online branding, social media marketing, and email marketing - E-business strategies: Digital advertising, content marketing, and analytics – E-Customer Relationship Management (eCRM) E-supply chain management (e-SCM)

Learning Outcomes: -After completion of this unit student will

- Understand the concept of online marketing
- Apply the knowledge of online marketing
- Compare e-CRM and e-SCM

Text Books:

1. Arati Oturkar&Sunil Khilari. *E-Business*. Everest Publishing House, 2022
2. P.T.S Joseph. *E-Commerce*, Fourth Edition, Prentice Hall of India, 2011

References:

1. Debjani, Kamalesh K Bajaj. *E-Commerce*, Second Edition Tata McGraw-Hill's, 2005
2. Dave Chaffey.*E-Commerce E-Management*, Second Edition, Pearson, 2012.
3. Henry Chan. *E-Commerce Fundamentals and Application*, RaymondLeathamWiley India 2007
4. S. Jaiswal. *E-Commerce* GalgotiaPublication Pvt Ltd., 2003.

E BUSINESS(A1HS702c)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

COURSE OUTCOMES: At the end of the course student will be able to	
CO1	Remember E-Business & its nature, scope and functions.
CO2	Understand E-market-Models which are practicing by the organizations
CO3	Apply the concepts of E-Commerce in the present globalized world.
CO4	Analyze the various E-payment systems & importance of net banking.
CO5	Evaluate market research strategies & E-advertisements.
CO6	Understand importance of E-security & control

Unit-I: Electronic Business

Introduction – Nature, meaning, significance, functions and advantages - Definition of Electronic Business - Functions of Electronic Commerce (EC)-Advantages & Disadvantages of E-Commerce –E-Commerce and E-Business, Internet Services, Online Shopping- E-Commerce Opportunities for Industries.

Learning Outcomes: -After completion of this unit student

- Understand the concept of E-Business
- Contrast and compare E-Commerce & E-Business
- Evaluate opportunities of E-commerce for industry

Unit-II: Electronic Markets and Business Models

Introduction –E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals -Business Models- Business to Business (B2B)-Business to Customers(B2C) - Business to Government(B2G)-Auctions-B2B Portals in India

Learning Outcomes: -After completion of this unit student will

- Understand the concept of business models
- Contrast and compare Vertical portal and Horizontal portals
- Analyze the B2B,B2C and B2G model

Unit-III: Electronic Payment Systems:

Introduction to electronic payment systems (EPS) -Types of electronic payments - Credit/debit cards, e-wallets, UPI, and crypto currencies -Smart cards and digital wallets: Features and usage -Electronic Fund Transfer (EFT): Role in business transactions -Infrastructure requirements and regulatory aspects of e-payments

Learning Outcomes: -After completion of this unit student will

- Understand the Electronic payment system
- Contrast and compare EFT and smart cards

- Analyze debit card and credit cards

Unit-IV:E-Security

Security risks and challenges in electronic commerce - Cyber threats - Phishing, hacking, identity theft, and malware - Digital Signatures & Certificates - Security protocols over public networks (HTTP, SSL, TLS) -Firewalls in securing e-business platforms.

Learning Outcomes: -After completion of this unit student will

- Understand E-Security
- Contrast and compare security protocols and public network
- Evaluate on Digital signature

Unit-V:E-Marketing:

Introduction – Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Market Research— E-marketing planning: Online branding, social media marketing, and email marketing - E-business strategies: Digital advertising, content marketing, and analytics – E-Customer Relationship Management (eCRM) E-supply chain management (e-SCM)

Learning Outcomes: -After completion of this unit student will

- Understand the concept of online marketing
- Apply the knowledge of online marketing
- Compare e-CRM and e-SCM

Text Books:

1. Arati Oturkar&Sunil Khilari. *E-Business*. Everest Publishing House, 2022
2. P.T.S Joseph. *E-Commerce*, Fourth Edition, Prentice Hall of India, 2011

References:

1. Debjani, Kamalesh K Bajaj. *E-Commerce*, Second Edition Tata McGraw-Hill's, 2005
2. Dave Chaffey.*E-Commerce E-Management*, Second Edition, Pearson, 2012.
3. Henry Chan. *E-Commerce Fundamentals and Application*, RaymondLeathamWiley India 2007
4. S. Jaiswal. *E-Commerce* GalgotiaPublication Pvt Ltd., 2003.
 1. Samuel C.Certo, *Modern Management*, 9/e, PHI, 2005

IV B.Tech I Semester

Internet of Things(A1CS703a)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:After **Course Objectives:**

- Understand the basics of Internet of Things and protocols.
- Discuss the requirement of IoT technology
- Introduce some of the application areas where IoT can be applied.
- Understand the vision of IoT from a global perspective, understand its applications, determine its market perspective using gateways, devices and data management

Course Outcomes:

After completion of the course, students will be able to

CO1	Understand general concepts of Internet of Things
CO2	Apply design concept to IoT solutions
CO3	Analyze various M2M and IoT architectures
CO4	Evaluate design issues in IoT applications
CO5	Create IoT solutions using sensors, actuators and Devices

UNIT- I Introduction to IoT

Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates

UNIT- II Prototyping IoT Objects using Microprocessor/Microcontroller

Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.

UNIT-III IoT Architecture and Protocols

Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak.

UNIT- IV Device Discovery and Cloud Services for IoT

Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

UNIT- V UAV IoT

Introduction to Unmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study FlytBase.

Text books:

1. Vijay Madiseti and Arshdeep Bahga, “ Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.
2. Handbook of unmanned aerial vehicles, K Valavanis; George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.

Reference Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, “ From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.
2. ArshdeepBahga, Vijay Madiseti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
3. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
4. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013
5. Cuno Pfister, Getting Started with the Internet of Things, O’Reilly Media, 2011, ISBN: 9781-4493- 9357-1
6. DGCA RPAS Guidance Manual, Revision 3 – 2020
7. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

Online Learning Resources:

1. <https://www.arduino.cc/>
2. <https://www.raspberrypi.org/>
3. <https://nptel.ac.in/courses/106105166/5>
4. <https://nptel.ac.in/courses/108108098/4>

IV B.Tech I Semester

SOFTWARE ARCHITECTURE AND DESIGN PATTERNS (A1CS703b)
(Professional Elective –IV)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

After completing this course, the student should be able to:

- To understand the concept of patterns and the Catalog.
- To discuss the Presentation tier design patterns and their affect on: sessions, client access, validation and consistency.
- To understand the variety of implemented bad practices related to the Business and Integration tiers.

Course Out comes:

CO1	To highlight the evolution of patterns.
CO2	To learn how to add functionality to designs while minimizing complexity
CO3	To learn what design patterns really are, and are not
CO4	To know about specific design patterns.
CO5	To learn how to use design patterns to keep code quality high without over design.

UNIT-I

Envisioning Architecture: The Architecture Business Cycle, What is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views. Creating an Architecture: Quality Attributes, Achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

UNIT- II

Analyzing Architectures: Architecture Evaluation, Architecture design decision making, ATAM, CBAM. Moving from one system to many: Software Product Lines, Building systems from off the shelf components, Software architecture in future.

UNIT- III

Patterns: Pattern Description, Organizing catalogs, role in solving design problems, Selection and usage. Creational and Structural patterns: Abstract factory, builder, factory method, prototype, singleton, adapter, bridge, composite, façade, flyweight.

UNIT- IV

Behavioural patterns: Chain of responsibility, command, Interpreter, iterator, mediator, memento, observer, state, strategy. template method, visitor.

UNIT- V

Case Studies: A-7E – A case study in utilizing architectural structures, The World Wide Web - a case study in interoperability,

Air Traffic Control – a case study in designing for high availability, Celsius Tech – a case study in product line development.

TEXT BOOKS:

1. Software Architecture in Practice, second edition, Len Bass, Paul Clements & Rick Kazman, Pearson Education, 2003.
2. Design Patterns, Erich Gamma, Pearson Education.

REFERENCES:

1. Beyond Software architecture, Luke Hohmann, Addison wesley, 2003.
2. Software architecture, David M. Dikel, David Kane and James R. Wilson, Prentice Hall PTR, 2001
3. Software Design, David Budgen, second edition, Pearson education, 2003
4. Head First Design patterns, Eric Freeman & Elisabeth Freeman, O'REILLY, 2007.
5. Design Patterns in Java, Steven John Metsker & William C. Wake, Pearson education, 2006
6. J2EE Patterns, Deepak Alur, John Crupi & Dan Malks, Pearson education, 2003.
7. Design Patterns in C#, Steven John metsker, Pearson education, 2004.
8. Pattern Oriented Software Architecture, F.Buschmann & others, John Wiley & Sons.

IV B.Tech I Semester

BLOCK CHAIN TECHNOLOGY(A1CS703c)**(Professional Elective –IV)**

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

- Understand how block chain systems (mainly Bit coin and Ethereum) work and to securely interact with them.
- Design, build, and deploy smart contracts and distributed applications.
- Integrate ideas from block chain technology into their own projects.

Course Outcomes (CO):

After completion of the course, students will be able to

CO1	Demonstrate the foundation of the Block chain technology and understand the processes in payment and funding.
CO2	Identify the risks involved in building Block chain applications.
CO3	Review of legal implications using smart contracts.
CO4	Choose the present landscape of Blockchain implementations and Understand Crypto currency markets
CO5	Examine how to profit from trading crypto currencies.

UNIT - I Introduction

Lecture 8Hrs

Introduction, Scenarios, Challenges Articulated, Block chain, Block chain Characteristics, Opportunities Using Block chain, History of Block chain. Evolution of Block chain: Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Block chain Evolution, Consortia, Forks, Public Block chain Environments, Type of Players in Block chain Ecosystem, Players in Market.

UNIT - II Block chain Concepts

Lecture 9Hrs

Block chain Concepts: Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on block chain, data storage on block chain, wallets, coding on block chain: smart contracts, peer-to-peer network, types of block chain nodes, risk associated with block chain solutions, life cycle of block chain transaction.

UNIT - III Architecting Block chain solutions

Lecture 9Hrs

Architecting Block chain solutions: Introduction, Obstacles for Use of Block chain, Block chain Relevance Evaluation Framework, Block chain Solutions Reference Architecture, Types of Block chain Applications. Cryptographic Tokens, Typical Solution Architecture for Enterprise Use Cases, Types of Block chain Solutions, Architecture Considerations, Architecture with Block chain Platforms, Approach for Designing Block chain Applications.

UNIT - IV Ethereum Block chain Implementation

Lecture 8Hrs

Ethereum Block chain Implementation: Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, My Ether Wallet, Ethereum Networks/Environments, Infura, Ether scan, Ethereum Clients, Decentralized Application, Metamask, Tuna Fish Use Case

UNIT - V Hyper ledger Block chain Implementation

Lecture 8Hrs

Hyper ledger Implementation: Introduction, Use Case – Car Ownership Tracking, Hyper ledger Fabric, Hyper ledger Fabric Transaction Flow, FabCar Use Case Implementation, Invoking Chain code Functions Using Client Application.

Advanced Concepts in Block chain: Introduction, Inter Planetary File System (IPFS), Zero Knowledge Proofs, Oracles, Self-Sovereign Identity, Block chain with IoT and AI/ML Quantum Computing and Block chain, Initial Coin Offering, Block chain Cloud Offerings, Block chain and its Future Potential.

Textbooks:

1. Ambadas, Arshad Sarfarz Ariff, Sham “Block chain for Enterprise Application Developers”, Wiley, 2020
2. Andreas M. Antonopoulos, “Mastering Bitcoin: Programming the Open Blockchain”, O’Reilly, 2017

Reference Books:

1. Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph Bambara, Paul R. Allen, Mc Graw Hill.
2. Blockchain: Blueprint for a New Economy, Melanie Swan, O’Reilly

Online Learning Resources:

<https://github.com/blockchainedindia/resources>

IV B.Tech I Semester

AUGMENTED REALITY AND VIRTUAL REALITY(A1CS703d)
(Professional Elective –IV)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Course Objective:

The primary objective of this course is to introduce students to the foundational principles and technologies of Virtual Reality (VR) and Augmented Reality (AR), along with the key devices, modeling techniques, and interaction mechanisms involved in creating immersive environments. The course will cover the essentials of VR and AR, including hardware, software, and human perception, as well as advanced concepts such as 3D modeling, interaction design, and audio rendering. Students will gain hands-on experience in the use of VR/AR systems and explore the challenges and methodologies for building interactive virtual environments.

Course Outcomes: At the end of the Course the student will be able to:

CO1	Understand the core concepts of Virtual Reality and Augmented Reality, and their differences.
CO2	Learn about the hardware and software components required for VR and AR systems, as well as the impact of human physiology and perception on the virtual experience.
CO3	Gain knowledge of input devices (trackers, navigation, and gesture interfaces) and output devices (graphics, sound displays, and haptic feedback).
CO4	Develop skills in modeling techniques, including geometric, kinematics, physical, and behavior modeling for VR and AR environments.
CO5	Explore the technologies and methodologies used to create Augmented Reality systems, including marker-based AR and AR software development.

UNIT – I**(10 Lectures)**

INTRODUCTION TO VIRTUAL REALITY (VR): Defining Virtual Reality, Key elements of virtual reality experience, Virtual Reality, Telepresence, Augmented Reality and Cyberspace. **Bird's-Eye View:** Hardware, Software, Human Physiology and Perception.

UNIT-II**(10 Lectures)**

Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation, interfaces and gesture interfaces.

Output Devices: Graphics displays, sound displays & haptic feedback.

UNIT-III**(10 Lectures)**

Modeling: Geometric modeling, Kinematics modeling, Physical modeling, Behaviour modeling, Model management.

UNIT-IV**(10 Lectures)**

Augmented Reality (AR): Taxonomy, Technology and Features of Augmented Reality, AR Vs VR, Challenges with AR, AR systems and functionality, Augmented Reality Methods, Visualization Techniques for Augmented Reality, Enhancing interactivity in AR Environments, Evaluating AR systems

AR software development : AR software, Camera parameters and camera calibration, Marker-based augmented reality, AR Toolkit.

UNIT-V**(10 Lectures)**

Interaction & Audio:

Interaction - Motor Programs and Remapping, Locomotion, Manipulation, Social Interaction. Audio -The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering.

Interaction - Motor Programs and Remapping, Locomotion, Manipulation, Social Interaction.

Audio -The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering. (from Text Book2)

TEXT BOOKS:

1. Virtual Reality Technology, Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons, Inc, 2017.
2. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016.

REFERENCES:

1. Rajesh K. Maurya, *Computer Graphics with Virtual Reality System*, 3rd Edition, Wiley Publication, 2018.
2. William R. Sherman and Alan B. Craig, *Understanding Virtual Reality Interface, Application, and Design*, 2nd Edition, Morgan Kaufmann Publishers, Elsevier, 2019.
3. Grigore C. Burdea, Philippe Coiffet, *Virtual Reality Technology*, 2nd Edition, Wiley, 2017.
4. K.S. Hale and K. M. Stanney, *Handbook on Virtual Environments*, 2nd Edition, CRC Press, 2015.

WEB REFERENCES:

1. <http://vr.cs.uiuc.edu/vrbook.pdf>
 1. <https://nptel.ac.in/courses/106/106/106106138/>

IV B.Tech I Semester

AGILE METHODOLOGIES(A1CS704a)
(Professional Elective –V)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

- To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
- To provide good understanding of software design and a set of software technologies and APIs.
- To carry out detailed examination and demonstration of Agile development and testing techniques.
- To discuss Agile software development

Course Out comes:

After completion of the course, students will be able to

CO1	Realize the importance of interacting with business stakeholders in determining the requirements for a software system
CO2	Perform iterative software development processes: how to plan them, how to execute them.
CO3	Point out the impact of social aspects on software development success.
CO4	Develop techniques and tools for improving team collaboration and software quality
CO5	Perform Software process improvement as an ongoing task for development teams.
CO6	Show how agile approaches can be scaled up to the enterprise level.

UNIT I AGILE METHODOLOGY**Lecture 9 Hrs**

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile

Documentations – Agile Drivers, Capabilities and Values

UNIT II AGILE PROCESSES**Lecture 8Hrs**

Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

UNIT III AGILITY AND KNOWLEDGE MANAGEMENT**Lecture 8 Hrs**

Agile Information Systems – Agile Decision Making - Earl_S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment, Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

UNIT IV AGILITY AND REQUIREMENTS ENGINEERING**Lecture 9 Hrs**

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

UNIT V AGILITY AND QUALITY ASSURANCE**Lecture 9 Hrs**

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development – Agile Approach in Global Software Development.

Text books:

1. David J. Anderson and Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
2. Hazza and Dubinsky, —Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.

Reference Books:

1. Craig Larman, —Agile and Iterative Development: A Manager's Guide, Addison-Wesley, 2004.
2. Kevin C. Desouza, —Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.

Online Learning Resources:

<https://www.nptelvideos.com/video.php?id=904>

IV B.Tech I Semester

METaverse(A1CS704b)
(Professional Elective –V)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

The main objectives of the course are to:

1. Present and discuss Metaverse characteristics, concepts and layers.
2. Explain and analyse Metaverse technologies, tools, platforms, and applications.
3. Discuss design theories and practices relevant to the Metaverse.
4. Explore cyber security and cybercrime in the Metaverse.
5. Examine open challenges in the Metaverse.

Course Out comes:

After completion of the course students are expected to be able to:

CO1	Under stand the characteristics, and interdisciplinary nature of the Metaverse, the opportunities and risks it presents.
CO2	Analyze Metaverse layers, the technologies used in creating them, as well as design theories and practices for Metaverse.
CO3	Examine and discuss Metaverse platforms, applications and the latest technological developments in this area.
CO4	Identify cyber security issues, understand cybercrime, and discuss the open challenges.
CO5	Building Metaverse Applications

Unit-1

Metaverse fundamentals: Metaverse evolution, Metaverse importance and characteristics, the interdisciplinary nature of the Metaverse, Metaverse opportunities and risks, Computer-mediated communication (social presence theory, social information processing theory, media richness theory, cyborg theory), Avatar-mediated communication.

Unit-2

The seven layers of Metaverse: ExperienceDiscovery, Creator economy, Spatial computing, Decentralization, Human interface, Infrastructure

Metaverse Technologies part I: AR/VR/MR/XR, 3D reconstruction, Game engines, Smart glasses, wearables, haptic devices, headsets and headwear.

Unit-3

Metaverse technologies part II: Blockchain, smart contracts, tokens, NFTs, Cryptography, Artificial Intelligence (AI), Internet of Things (IoT), Edge computing and 5G, 6G.Design theories and practices: Social presence and co-presence, Motion sickness and cybersickness, Uncanny valley, Sense of self- location, sense of agency and sense of body ownership, Universal simulation principle, Prototyping, Evaluation techniques (qualitative and quantitative).

Unit-4

Tools and technologies for Metaverse UX and UI: Tools and services for avatar systems, Spatial user interface design, Cross-platform user experience design, Multimodal user interface, Technologies and devices for human computer interaction in Metaverse, Metaverse platforms: Decentraland, SANDBOX, Roblox, Axie Infinity, uHive, Hyper Nation, Nakamoto (NAKA), Metahero (HERO), Star Atlas (ATLAS), Bloktopia (BLOK), Stageverse, Spatial, PalkaCity, Viverse, Sorare,

Illuvium, Upland, Second Life, Sansar, Sensorium Galaxy

Unit-5

Metaverse applications - part I: Gaming and entertainment, Travel and tourism, Education and learning, Remote working, Commerce and business, Metaverse applications - part II: Real estate, Banking and Finance, Healthcare, Social media, Fashion, Metaverse and cyber security: Cyber security concerns in Metaverse: Social engineering attacks, Data theft, Decentralization vs vulnerabilities, Cyber security risks in Metaverse: process, people, technology, Metaverse and cybercrime: Scam and theft, Rug pull, Money manipulation and wash trading, Money laundering, Metaverse challenges and open issues: Persistency, Interoperability and scalability, Maturity, Regulation, Usefulness and ease-of-use, Privacy and data security, Content creation, NFTs and creator economy, Social, legal and ethical issues in the Metaverse

Text books

The Metaverse, Terry Winters, Independently published, 2021, ISBN: 979-8450959283

Reference Books:

1. Ball, M., 2022, “The Metaverse and How It Will Revolutionize Everything“, Liveright, ISBN: 978-1324092032
2. Damar, M. (2021). Metaverse shape of your life for future: A bibliometric snapshot. Journal ofMetaverse, 1(1), 1–8.
3. Day, J. (2022) Metaverse will see cyber warfare attacks unlike anything before: 'Massively elevated', February 28. <https://www.express.co.uk/news/science/1570844/metaverse-news-cyber-warfare-attacks-virtual-worlds-russia-china-spt>.
4. Polyviou, A., Sharma K., Pappas, I.O.(2023). Training in the metaverse: Employing physiological data to improve how we build metaverses for businesses. The next generation internet: The role of metaverses, AR, VR, MR, and digital twins, Temple University Institute for Business and Information Technology Link: <https://ibit.temple.edu/nextgenerationinternet>
5. QuHarrison T. , Keeney, S., 2022, “The Metaverse Handbook: Innovating for the Internet's NextTectonic Shift”, Wiley, ISBN: 978-1119892526
6. The mistocleous, M., Christodoulou, K., & Katelaris, L. (2023). An Educational Metaverse Experiment: The first on-chain and in- Metaverse academic course. Information Systems. EMCIS2022. Lecture Notes in Business Information Processing, Springer, Cham.
7. Stephenson, N., 1992, “Snow Crash”, ISBN: 978-055338

IV B.Tech I Semester

COMPUTER VISION(A1CS704c)**(Professional Elective –V)**

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

The objective of this course is to understand the basic issues in computer vision and major approaches to address the methods to learn the Linear Filters, segmentation by clustering, Edge detection, Texture.

Course Outcomes:

After completing the course, you will be able to:

- Identify basic concepts, terminology, theories, models and methods in the field of computer vision,
- Describe known principles of human visual system,
- Describe basic methods of computer vision related to multi-scale representation, edge detection and detection of other primitives, stereo, motion and object recognition,
- Suggest a design of a computer vision system for a specific problem

UNIT-I LINEAR FILTERS

Lecture 8Hrs

Introduction to Computer Vision, Linear Filters and Convolution, Shift Invariant Linear Systems, Spatial Frequency and Fourier Transforms, Sampling and Aliasing Filters as Templates, Technique: Normalized Correlation and Finding Patterns, Technique: Scale and Image Pyramids.

UNIT-II EDGE DETECTION

Lecture 9Hrs

Noise- Additive Stationary Gaussian Noise, Why Finite Differences Respond to Noise, Estimating Derivatives - Derivative of Gaussian Filters, Why Smoothing Helps, Choosing a Smoothing Filter, Why Smooth with a Gaussian? Detecting Edges-Using the Laplacian to Detect Edges, Gradient-Based Edge Detectors, Technique: Orientation Representations and Corners.

UNIT- III TEXTURE

Lecture 9Hrs

Representing Texture –Extracting Image Structure with Filter Banks, Representing Texture using the Statistics of Filter Outputs, Analysis (and Synthesis) Using Oriented Pyramids –The Laplacian Pyramid, Filters in the Spatial Frequency Domain, Oriented Pyramids, Application: Synthesizing Textures for Rendering, Homogeneity, Synthesis by Sampling Local Models, Shape from Texture, Shape from Texture for Planes

UNIT-IV SEGMENTATION BY CLUSTERING

Lecture 8Hrs

What is Segmentation, Human Vision: Grouping and Gestalt, Applications: Shot Boundary Detection and Background Subtraction. Image Segmentation by Clustering Pixels, Segmentation by Graph- Theoretic Clustering. The Hough Transform, Fitting Lines, Fitting Curves

UNIT-V RECOGNIZATION BY RELATIONS BETWEEN TEMPLATES

Lecture 8Hrs

Finding Objects by Voting on Relations between Templates, Relational Reasoning Using Probabilistic Models and Search, Using Classifiers to Prune Search, Hidden Markov Models, Application: HMM and Sign Language Understanding, Finding People with HMM.

Text books:

1. David A. Forsyth, Jean Ponce, Computer Vision – A modern Approach, PHI, 2003.

Reference Books:

1. Geometric Computing with Clifford Algebras: Theoretical Foundations and Applications in Computer Vision and Robotics, Springer; 1 edition, 2001 by Sommer.
2. Digital Image Processing and Computer Vision, 1/e, by Sonka.
3. Computer Vision and Applications: Concise Edition (With CD) by Jack Academy Press, 2000.

Online Learning

Resources: <https://nptel.ac.in/courses/106105216> <https://nptel.ac.in/courses/108103174>

IV B.Tech I Semester

CYBER PHYSICAL SYSTEMS(A1CS704d)

Course	Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
	L	T	P	L	T	P	C	CIE	SEE	Total
	0	0	3	42	0	0	3	30	70	100

Objective:

The objective of this course is to provide students with a comprehensive understanding of the various techniques and methodologies used to design, secure, synchronize, and schedule operations within **Cyber- Physical Systems (CPS)**. The course will cover symbolic synthesis for CPS, security aspects, distributed synchronization, real-time scheduling, and model integration, with an emphasis on both basic principles and advanced techniques.

Course Out comes: Upon the Successful Completion of the Course, the Students would be able to:

CO1	Understand the core principles behind CPS
CO2	Identify Security mechanisms of Cyber physical systems
CO3	Under stand Synchronization in Distributed Cyber-Physical Systems
CO4	To Understand the Scheduling for Cyber-Physical Systems
CO5	To understand the various Cyber-Physical System models

UNIT - I

Symbolic Synthesis for Cyber-Physical Systems

Introduction and Motivation, Basic Techniques - Preliminaries, Problem Definition, Solving the Synthesis Problem, Construction of Symbolic Models, Advanced Techniques: Construction of Symbolic Models, Continuous-Time Controllers, Software Tools

UNIT - II

Security of Cyber-Physical Systems

Introduction and Motivation, Basic Techniques - Cyber Security Requirements, Attack Model, Countermeasures, Advanced Techniques: System Theoretic Approaches

UNIT - III

Synchronization in Distributed Cyber-Physical Systems: Challenges in Cyber-Physical Systems, A Complexity-Reducing Technique for Synchronization, Formal Software Engineering, Distributed Consensus Algorithms, Synchronous Lockstep Executions, Time-Triggered Architecture, Related Technology, Advanced Techniques

UNIT - IV

Real-Time Scheduling for Cyber-Physical Systems

Introduction and Motivation, Basic Techniques - Scheduling with Fixed Timing Parameters, Memory Effects, Multiprocessor/Multicore Scheduling, Accommodating Variability and Uncertainty

UNIT - V

Model Integration in Cyber-Physical Systems

Introduction and Motivation, Causality, Semantic Domains for Time, Interaction Models for Computational Processes,

Semantics of CPS DSMLs, Advanced Techniques, For Spec, The Syntax of CyPhyML, Formalization of Semantics, Formalization of Language Integration.

TEXT BOOKS:

1. Raj Raj kumar, Dion is io De Niz, and Mark Klein, Cyber-Physical Systems, Addison-Wesley Professional.
2. Rajeev Alur, Principles of Cyber-Physical Systems, MIT Press, 2015

IV B.Tech I Sem

DATABASE MANAGEMENT SYSTEMS
(Open Elective-III)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives: The main objective of the course is to

- Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
- Introduce the concepts of basic SQL as a universal Database language
- Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
- Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

Course Out comes: After completion of the course, students will be able to

CO1	Understand the basic concepts of database management systems
CO2	Analyze a given database application scenario to use ER model for conceptual design of the database
CO3	Utilize SQL proficiently to address diverse query challenges
CO4	Employ normalization methods to enhance database structure
CO5	Assess and implement transaction processing, concurrency control and database recovery protocols in databases.

UNIT I: Introduction: Data base system, Characteristics (Database Vs File System), Database Users, Advantages of Database systems, Database applications. Brief introduction of different Data Models; Concepts of Schema, Instance and data independence; Three tier schema architecture for data independence; Database system structure, environment, Centralized and Client Server architecture for the database.

Entity Relationship Model: Introduction, Representation of entities, attributes, entity set, relationship, relationship set, constraints, sub classes, super class, inheritance, specialization, generalization using ER Diagrams.

Unit II: Relational Model: Introduction to relational model, concepts of domain, attribute, tuple, relation, importance of null values, constraints (Domain, Key constraints, integrity constraints) and their importance, Relational Algebra, Relational Calculus. BASIC SQL: Simple Data base schema, data types, table definitions (create, alter), different DML operations (insert, delete, update).

UNIT III: SQL: Basic SQL querying (select and project) using where clause, arithmetic & logical operations, SQL functions(Date and Time, Numeric, String conversion).Creating tables with relationship, implementation of key and integrity constraints, nested queries, sub queries, grouping, aggregation, ordering, implementation of different types of joins, view(updatable and non-updatable), relational set operations.

UNIT IV: Schema Refinement (Normalization): Purpose of Normalization or schema refinement, concept of functional dependency, normal forms based on functional dependency Lossless join and dependency preserving decomposition, (1NF, 2NF and 3 NF), concept of surrogate key, Boyce- Codd normal form(BCNF), MVD, Fourth normal form(4NF), Fifth Normal Form (5NF).

UNIT V: Transaction Concept: Transaction State, ACID properties, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for Serializability, lock based, time stamp based, optimistic, concurrency protocols, Deadlocks, Failure Classification, Storage, Recovery and Atomicity, Recovery algorithm.

Introduction to Indexing Techniques: B+ Trees, operations on B+Trees, Hash Based Indexing:

Textbooks:

1. Database Management Systems, 3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)
2. Database System Concepts, 5th edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

Reference Books:

1. Introduction to Database Systems, 8th edition, C J Date, Pearson.
2. Database Management System, 6th edition, RamezElmasri, Shamkant B. Navathe, Pearson
3. Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning.

Web- Resources:

1. <https://nptel.ac.in/courses/106/105/106105175/>
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01275806667282022456_shared/overview

IV B.Tech I Sem

CYBER SECURITY
(Open Elective-III)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

The course is designed to provide awareness on different cyber crimes, cyber offenses, tools and methods used in cybercrime.

Course Outcomes:

After completion of the course, students will be able to

CO1	Classify the cybercrimes and understand the Indian ITA 2000
CO2	Analyse the vulnerabilities in any computing system and find the solutions
CO3	Predict the security threats of the future
CO4	Investigate the protection mechanisms
CO5	Design security solutions for organizations

UNIT- I Introduction to Cyber crime

Lecture 8Hrs

Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT- II Cyber Offenses: How Criminals Plan Them

Lecture 9Hrs

Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing

UNIT- III Cyber crime: Mobile and Wireless Devices

Lecture 9Hrs

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones,

Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT- IV Tools and Methods Used in Cyber crime

Lecture 8Hrs

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT- V Cyber Security: Organizational Implications

Lecture 8Hrs

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Textbooks:

1. Cyber Security: Under standing Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security , Chwan –Hwa (john) Wu ,J. DavidIrwin.CRC Press T&F Group

Online Learning Resources:

<http://nptel.ac.in/courses/106105031/40>

<http://nptel.ac.in/courses/106105031/39>

<http://nptel.ac.in/courses/106105031/38>

IV B.Tech I Sem

COMPUTER NETWORKS (Open Elective-IV)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course

Objectives:

The course is designed to

- Understand the basic concepts of Computer Networks.
- Introduce the layered approach for design of computer networks
- Expose the network protocols used in Internet environment
- Explain the format of headers of IP, TCP and UDP
- Familiarize with the applications of Internet
- Elucidate the design issues for a computer network

Course Outcomes:

After completion of the course, students will be able to

CO1	Identify the software and hardware components of a computer network
CO2	Design software for a computer network
CO3	Develop new routing, and congestion control algorithms
CO4	Assess critically the existing routing protocols
CO5	Explain the functionality of each layer of a computer network
CO6	Choose the appropriate transport protocol based on the application requirements

UNIT- I Computer Networks and the Internet

What Is the Internet? The Network Edge, The Network Core, Delay, Loss, and Throughput in Packet Switched Networks(Textbook 2), Reference Models, Example Networks, Guided Transmission Media, Wireless Transmission(Textbook 1)

UNIT- II The Data Link Layer, Access Networks, and LANs

Data Link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols (Textbook 1) Introduction to the Link Layer, Error-Detection and - Correction Techniques, Multiple Access Links and Protocols, Switched Local Area Networks

Link Virtualization: A Network as a Link Layer, Data Center Networking, Retrospective: A Day in the Life of a Web Page Request (Textbook 2)

UNIT -III The Network Layer

Routing Algorithms, Internetworking, The Network Layer in The Internet (Textbook 1)

UNIT IV The Transport Layer

Connectionless Transport: UDP (Textbook 2), The Internet Transport Protocols: TCP, Congestion Control (Textbook 1)

UNIT V Principles of Network Applications

Principles of Network Applications, The Web and HTTP, Electronic Mail in the Internet, DNS—The Internet's Directory Service, Peer-to-Peer Applications Video Streaming and Content Distribution Networks (Textbook 2)

Text books:

1. Andrew S.Tanenbaum, David j.wetherall, Computer Networks, 5th Edition, PEARSON.
2. James F. Kurose, Keith W. Ross, —Computer Networking: A Top-Down Approach, 6th edition, Pearson, 2019.

Reference Books:

1. Forouzan, Data communications and Networking, 5th Edition, Mc Graw Hill Publication.
2. Youlu Zheng, Shakil Akthar, —Networks for Computer Scientists and Engineers, Oxford Publishers, 2016.

Online Learning Resources:

<https://nptel.ac.in/courses/106105183/25>

<http://www.nptelvideos.in/2012/11/computer-networks.html>

<https://nptel.ac.in/courses/106105183/3>

IV B.Tech I Sem

INTERNET OF THINGS (Open Elective-IV)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

- Understand the basics of Internet of Things and protocols.
- Discuss the requirement of IoT technology
- Introduce some of the application areas where IoT can be applied.
- Understand the vision of IoT from a global perspective, understand its applications, determine its market perspective using gateways, devices and data management

Course Out comes:

After completion of the course, students will be able to

CO1	Understand general concepts of Internet of Things.
CO2	Apply design concept to IoT solutions
CO3	Analyze various M2M and IoT architectures
CO4	Evaluate design issues in IoT applications
CO5	Create IoT solutions using sensors, actuators and Devices

UNIT-I Introduction to IoT

Lecture 8Hrs

Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates

UNIT- II Prototyping IoT Objects using Microprocessor/Microcontroller

Lecture 9Hrs

Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.

UNIT- III IoT Architecture and Protocols

Lecture 8Hrs

Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak.

UNIT-IV Device Discovery and Cloud Services for IoT

Lecture 8Hrs

Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

UNIT-V UAV IoT

Lecture 10Hrs

Introduction to Unmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software – Ardupilot, Mission Planner, Internet

of Drones(IoD)- Case study Flyt Base.

Text books:

1. Vijay Madiseti and Arshdeep Bahga, — Internet of Things (A Hands-on-Approach)ll, 1st Edition, VPT, 2014.
2. Handbook of unmanned aerial vehicles, K Valavanis; George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.

Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, — From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligencell, 1st Edition, Academic Press, 2014.
2. ArshdeepBahga, Vijay Madiseti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
3. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
4. Francis daCosta, —Rethinking the Internet of Things: A Scalable Approach to Connecting Everythingll, 1st Edition, Apress Publications, 2013
5. Cuno Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011, ISBN: 9781-4493- 9357-1
6. DGCA RPAS Guidance Manual, Revision 3 – 2020
7. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

Online Learning Resources:

1. <https://www.arduino.cc/>
2. <https://www.raspberrypi.org/>
3. <https://nptel.ac.in/courses/106105166/5>
4. <https://nptel.ac.in/courses/108108098/4>

IV B.Tech I Sem

PROMPT ENGINEERING(A1CS707)
Skill Enhancement Course

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objective:

This course delves into prompt engineering principles, strategies, and best practices, a crucial aspect in shaping AI models' behaviour and performance. Understanding Prompt Engineering is a comprehensive course designed to equip learners with the knowledge and skills to effectively generate and utilize prompts in natural language processing (NLP) and machine learning (ML) applications. This course delves into prompt engineering principles, strategies, and best practices, a crucial aspect in shaping AI models' behaviour and performance.

Course Out comes:

CO1	Under standing the fundamentals and evolution of prompt engineering.
CO2	Gaining the ability to craft effective closed-ended, open-ended, and role-based prompts.
CO3	Learning to probe and stress-test AI models for bias and robustness.
CO4	Applying prompt optimization techniques and performance evaluation methods.
CO5	Mitigating bias and promoting ethical prompting practices in NLP/ML systems.

Module 1: Introduction to Prompt Engineering

- *Lesson 1: Foundations of Prompt Engineering*
 - Overview of prompt engineering and its significance in NLP and ML.
 - Historical context and evolution of prompt-based approaches.

Module 2: Types of Prompts and Their Applications

- *Lesson 2: Closed-Ended Prompts*
 - Under standing and creating prompts for specific answers.
 - Applications in question- answering systems.
- *Lesson 3: Open-Ended Prompts*
 - Crafting prompts for creative responses.
 - Applications in language generation models.

Module 3: Strategies for Effective Prompting

- *Lesson 4: Probing Prompts*

- Designing prompts to reveal model biases.
 - Ethical considerations in using probing prompts.
- *Lesson 5: Adversarial Prompts*
 - Creating prompts to stress-test models.
 - Enhancing robustness through adversarial prompting.

Module 4: Fine-Tuning and Optimizing with Prompts

- *Lesson 6: Fine-Tuning Models with Prompts*
 - Techniques for incorporating prompts during model training.
 - Balancing prompt influence and generalization.
- *Lesson 7: Optimizing Prompt Selection*
 - Methods for selecting optimal prompts for specific tasks.
 - Customizing prompts based on model behavior.

Module 5: Evaluation and Bias Mitigation

- *Lesson 8: Evaluating Prompt Performance*
 - Metrics and methodologies for assessing model performance with prompts.
 - Interpreting and analyzing results.
- *Lesson 9: Bias Mitigation in Prompt Engineering*
 - Strategies to identify and address biases introduced by prompts.
 - Ensuring fairness and inclusivity in prompt-based models.

Module 6: Real-World Applications and Case Studies

- *Lesson 10: Case Studies in Prompt Engineering*
- *Exploration of successful implementations and challenges in real-world scenarios.*
- *Guest lectures from industry experts sharing their experiences.*

Text books:

1. "Prompt Engineering in Action" – *Danny D. Sullivan*
2. "The Art of Prompt Engineering with Chat GPT: A Hands-On Guide" – *Nathan Hunter*.

Reference Books:

1. "Prompt Engineering in Practice" – *Michael F. Lewis*
2. "Mastering AI Prompt Engineering: The Ultimate Guide for Chat GPT Users" – *Adriano Damiao*
3. "Writing AI Prompts For Dummies" – *Stephanie Diamond and Jeffrey Allan*
4. "Prompt Engineering Guide" (Online Resource) – *promptingguide.ai*

Online Resource link :

<https://www.udemy.com/course/understanding-prompt-engineering/?couponCode=NVDINCTA35TRT>

(Common to All Branches of Engineering)**R23****Gender Sensitization(A1CS708)**

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

SYLLABUS

Course Outcomes (CO):		
COs	Statements	Blooms level
CO1	Understand the basic concepts of gender and its related terminology	L1, L2
CO2	Identify the biological, sociological, psychological and legal aspects of gender.	L1, L2
CO3	Use the knowledge in understanding how gender discrimination works in our society and how to counter it.	L3
CO4	Analyze the gendered division of labour and its relation to politics and economics.	L4
CO5	Appraise how gender-role beliefs and sharing behaviour are associated with more well-being in all culture and gender groups	L5
CO6	Develop students' sensibility with regard to issues of gender in contemporary India	L3

Unit-1 UNDERSTANDING GENDER

Introduction: Definition of Gender-Basic Gender Concepts and Terminology-Exploring Attitudes towards Gender-Construction of Gender-Socialization: Making Women, Making Men - Preparing for Womanhood. Growing up Male. First lessons in Caste.

Unit-2 GENDER ROLES AND RELATIONS

Two or Many? -Struggles with Discrimination-Gender Roles and Relations-Types of Gender Roles-Gender Roles and Relationships Matrix-Missing Women-Sex Selection and its Consequences- Declining Sex Ratio- Demographic Consequences-Gender Spectrum -

Unit-3 GENDER AND LABOUR

Division and Valuation of Labour-Housework: The Invisible Labor- —My Mother doesn't Work. —Share the Load. —Work: Its Politics and Economics -Fact and Fiction- Unrecognized

and Unaccounted work -Gender Development Issues-Gender, Governance and Sustainable

Development-Gender and Human Rights-Gender and Mainstreaming

Unit-4 GENDER-BASED VIOLENCE

The Concept of Violence- Types of Gender-based Violence-Gender-based Violence from a Human Rights Perspective-Sexual Harassment - Domestic Violence - Different forms of violence against women - Causes of violence, impact of violence against women - Consequences of gender-based violence

Unit-5 GENDER AND CULTURE

Gender and Film-Gender and Electronic Media-Gender and Advertisement-Gender and Popular Literature- Gender Development Issues-Gender Issues-Gender Sensitive Language- Just Relationships

Prescribed Books

1. A.Suneetha, Uma Bhugubanda, et al. *Towards a World of Equals: A Bilingual Textbook on Gender*, Telugu Akademi, Telangana, 2015.
2. Butler, Judith. *Gender Trouble: Feminism and the Subversion of Identity*. UK Paperback Edn. March 1990

Reference Books

1. Wtatt, Robin and Massood, Nazia, *Broken Mirrors: The dowry Problems in India*, London : Sage Publications, 2011
2. Datt, R. and Kornberg, J.(eds), *Women in Developing Countries, Assessing Strategies for Empowerment*, London: Lynne Rienner Publishers, 2002
3. Brush, Lisa D., *Gender and Governance*, New Delhi, Rawat Publication, 2007
4. Singh, Direeti, *Women and Politics World Wide*, New Delhi, Axis Publications, 2010
5. Raj Pal Singh, Anupama Sihag, *Gender Sensitization: Issues and Challenges* (English, Hardcover), Raj Publications, 2019
6. A.Revathy& Murali, Nandini, *A Life in Trans Activism*(Lakshmi Narayan Tripathi). The University of Chicago Press, 2016

Online Resources:

1. Understanding Gender

chrome- extension://kdpelmjpfafjppnhbloffcjpeomlnpah/https://www.arvindguptatoys.com/arvindgupta/kamla-gender1.pdf

https://onlinecourses.swayam2.ac.in/nou24_hs53/preview

2. Gender Roles and Relations

<https://www.plannedparenthood.org/learn/gender-identity/sex-gender-identity/what-are-gender-roles-and-stereotypes>

<https://www.verywellmind.com/understanding-gender-roles-and-their-effect-on-our-relationships-7499408>

https://onlinecourses.swayam2.ac.in/cec23_hs29/preview

3. Gender and Labour

<https://www.economicsobservatory.com/what-explains-the-gender-division-of-labour-and-how-can-it-be-redressed>

https://onlinecourses.nptel.ac.in/noc23_mg67/preview

4. GENDER-BASED VIOLENCE

https://eige.europa.eu/gender-based-violence/what-is-gender-based-violence?language_content_entity=en

<https://www.worldbank.org/en/topic/socialsustainability/brief/violence-against-women-and-girls>

https://onlinecourses.swayam2.ac.in/nou25_ge38/preview

5. GENDER AND CULTURE

<https://gender.study/psychology-of-gender/culture-impact-gender-roles-identities/>

<https://sociology.iresearchnet.com/sociology-of-culture/gender-and-culture/>

<https://archive.nptel.ac.in/courses/109/106/109106136/>

Abdulali Sohaila. —I Fought For My Life...and Won. Available online (at: <http://www.thealternative.in/lifestyle/i-fought-for-my-lifeand-won-sohaila-abdul/>)

OPEN ELECTIVES

III B.Tech I Semester

ELECTRONIC CIRCUITS(A1EC505a)**(Open Elective –I)**

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

1. To understand semiconductor diodes, their characteristics and applications.
2. To explore the operation, configurations, and biasing of BJTs.
3. To study the operation, analysis, and coupling techniques of BJT amplifiers.
4. To learn the operation, applications and uses of feedback amplifiers and oscillators.
5. To analyze the characteristics, configurations, and applications of operational amplifiers.

Course Outcomes:**At the end of this course, the students will be able to**

1. Understand semiconductor diodes, their characteristics and applications.
2. Explore the operation, configurations, and biasing of BJTs.
3. Gain knowledge about the operation, analysis, and coupling techniques of BJT amplifiers.
4. Learn the operation, applications and uses of feedback amplifiers and oscillators.
5. Analyze the characteristics, configurations, and applications of operational amplifiers.

UNIT-I

Semiconductor Diode and Applications: Introduction, PN junction diode – structure, operation and VI characteristics, Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Positive and Negative Clipping and Clamping circuits (Qualitative treatment only).

Special Diodes: Zener and Avalanche Breakdowns, VI Characteristics of Zener diode, Zener diode as voltage regulator, Construction, operation and VI characteristics of Tunnel Diode, LED, Varactor Diode, Photo Diode .

UNIT-II

Bipolar Junction Transistor (BJT): Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch and Amplifier, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self Bias, Bias Stability, Bias Compensation using Diodes.

UNIT-III

Single stage amplifiers: Classification of Amplifiers - Distortion in amplifiers, Analysis of CE, CC and CB configurations with simplified hybrid model.

Multistage amplifiers: Different Coupling Schemes used in Amplifiers - RC coupled amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifier; Multistage RC coupled BJT amplifier (Qualitative treatment only).

UNIT-IV

Feedback amplifiers: Concepts of feedback, Classification of feedback amplifiers, Effect of feedback on amplifier characteristics, Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedback Configurations (Qualitative treatment only).

Oscillators: Classification of oscillators, Condition for oscillations, RC Phase shift Oscillators, Generalized analysis of LC Oscillators-Hartley and Colpitts Oscillators, Wien Bridge Oscillator.

UNIT-V

Op-amp: Classification of IC'S, basic information of Op-amp, ideal and practical Op-amp, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential.

Applications of op-amp : Summing, scaling and averaging amplifiers, Integrator, Differentiator, phase shift oscillator and comparator.

TEXT BOOKS:

1. Electronics Devices and Circuits, J.Millman and Christos. C. Halkias, 3rd edition, Tata McGraw Hill, 2006.
2. Electronics Devices and Circuits Theory, David A. Bell, 5th Edition, Oxford University press. 2008.

REFERENCE BOOKS:

1. Electronics Devices and Circuits Theory, R.L.Boylestad, LouisNashelsky and K.Lal Kishore, 12th edition, 2006, Pearson, 2006.
2. Electronic Devices and Circuits, N.Salivahanan, and N.Suresh Kumar, 3rd Edition, TMH, 2012
3. Microelectronic Circuits, S.Sedra and K.C.Smith, 5th Edition, Oxford University Press

III B.Tech I Sem

MATHEMATICS FOR MACHINE LEARNING AND AI(A1HS505c)
(Open Elective 1)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

- To provide a strong mathematical foundation for understanding and developing AI/ML algorithms.
- To enhance the ability to apply linear algebra, probability, and calculus in AI/ML models.
- To equip students with optimization techniques and graph-based methods used in AI applications.
- To develop critical problem-solving skills for analysing mathematical formulations in AI/ML.

Course Outcomes:

After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Apply linear algebra concepts to ML techniques like PCA and regression.	L3 (Apply)
CO2	Analyze probabilistic models and statistical methods for AI applications.	L4 (Analyze)
CO3	Implement optimization techniques for machine learning algorithms.	L3 (Apply)
CO4	Utilize vector calculus and transformations in AI-based models.	L3 (Apply)
CO5	Develop graph-based AI models using mathematical representations.	L5 (Evaluate)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	1	-	-	-	-	-	-	1
CO2	3	3	2	3	2	-	-	-	-	-	-	2
CO3	3	3	3	3	2	1	-	-	-	-	-	2
CO4	3	3	2	2	1	-	-	-	-	-	-	1
CO5	3	3	3	3	2	-	-	-	-	-	-	2

• 3 = Strong Mapping, 2 = Moderate Mapping, 1 = Slight Mapping, - = No Mapping

UNIT I: Linear Algebra for Machine Learning(08)

Review of Vector spaces, basis, linear independence, Vector and matrix norms, Matrix factorization techniques, Eigenvalues, eigenvectors, diagonalization, Singular Value Decomposition (SVD) and Principal Component Analysis (PCA).

UNIT II: Probability and Statistics for AI(08)

Probability distributions: Gaussian, Binomial, Poisson. Bayes' Theorem, Maximum Likelihood Estimation (MLE), and Maximum a Posteriori (MAP). Entropy and Kullback-Leibler (KL) Divergence in AI, Cross entropy loss, Markov chains.

UNIT III: Optimization Techniques for ML(08)

Multivariable calculus: Gradients, Hessians, Jacobians. Constrained optimization: Lagrange multipliers and KKT conditions. Gradient Descent and its variants (Momentum, Adam) Newton's method, BFGS method.

UNIT IV: Vector Calculus & Transformations(08)

Vector calculus: Gradient, divergence, curl. Fourier Transform & Laplace Transform in ML applications.

UNIT V: Graph Theory for AI(08)

Graph representations: Adjacency matrices, Laplacian matrices. Bayesian Networks & Probabilistic Graphical Models. Introduction to Graph Neural Networks (GNNs).

Textbooks:

1. Mathematics for Machine Learning by Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press, 2020.
2. Pattern Recognition and Machine Learning by Christopher Bishop, Springer.

Reference Books:

1. Gilbert Strang, Linear Algebra and Its Applications, Cengage Learning, 2016.
2. Jonathan Gross, Jay Yellen, Graph Theory and Its Applications, CRC Press, 2018.

Web References:

- MIT– Mathematics for Machine Learning <https://ocw.mit.edu>
- Stanford CS229 – Machine Learning Course <https://cs229.stanford.edu/>

DeepAI – Mathematical Foundations for AI <https://deepai.org>

III B.Tech I Sem**MATERIALS CHARACTERIZATION TECHNIQUES(A1HS505d)**

(Common to all branches) (Open Elective-Interdisciplinary)

(Open Elective-I)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

COURSE OBJECTIVES	
1	To provide exposure to different characterization techniques.
2	To explain the basic principles and analysis of different spectroscopic techniques.
3	To elucidate the working of Scanning electron microscope - Principle, limitations and applications.
4	To illustrate the working of the Transmission electron microscope (TEM) - SAED patterns and its applications.
5	To educate the uses of advanced electric and magnetic instruments for characterization.

UNIT I Structure analysis by Powder X-Ray Diffraction**9H**

Introduction, Bragg's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherer and Williamson-Hall (W-H) Methods, Small angle X-ray scattering (SAXS) (in brief).

UNIT II Microscopy technique -1 –Scanning Electron Microscopy (SEM)**9H**

Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

UNIT III Microscopy Technique -2 - Transmission Electron Microscopy (TEM)**9H**

Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy

UNIT IV Spectroscopy techniques**9H**

Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques
– (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

UNIT V Electrical & Magnetic Characterization techniques**9H**

Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by

induction method, Vibrating sample Magnetometer (VSM) and SQUID.

Textbooks:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods – Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2013.
2. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan, John Wiley & Sons Ltd., 2008

Reference Books:

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville Banwell and Elaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction – Bernard Dennis Cullity & Stuart R Stocks, Prentice Hall, 2001 – Science.
3. Practical Guide to Materials Characterization: Techniques and Applications - Khalid Sultan – Wiley – 2021.
4. **Materials Characterization Techniques** - Sam Zhang, Lin Li, Ashok Kumar - CRC Press - 2008

NPTEL courses link :

1. <https://nptel.ac.in/courses/115/103/115103030/>
2. https://nptel.ac.in/content/syllabus_pdf/113106034.pdf
3. <https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/>

III B.Tech I Sem

CHEMISTRY OF ENERGY SYSTEMS(A1HS505e)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

COURSE OBJECTIVES	
1	To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
2	To understand the basic concepts of processing and limitations of Fuel cells & their applications.
3	To impart knowledge to the students about fundamental concepts of photo chemical cells, reactions and applications
4	Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.
5	To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method.
COURSE OUTCOMES	
CO1	➤ Solve the problems based on electrode potential, Describe the Galvanic Cell ➤ Differentiate between Lead acid and Lithium ion batteries, Illustrate the electrical double layer
CO2	➤ Describe the working Principle of Fuel cell, Explain the efficiency of the fuel cell ➤ Discuss about the Basic design of fuel cells, Classify the fuel cell
CO3	➤ Differentiate between Photo and Photo electrochemical Conversions, Illustrate the photochemical cells, Identify the applications of photochemical reactions, ➤ Interpret advantages of photoelectron catalytic conversion.
CO4	➤ Apply the photo voltaic technology, Demonstrate about solar energy and prospects ➤ Illustrate the Solar cells, Discuss about concentrated solar power
CO5	➤ Differentiate Chemical and Physical methods of hydrogen storage,

	Discuss the metal organic frame work, Illustrate the carbon and metal oxide porous structures ➤ Describe the liquification methods.

Mapping between Course Outcomes and Programme Outcomes

UNIT-1: Electrochemical Systems: Galvanic cell, Nernst equation, standard electrode potential, application of EMF, electrical double layer, polarization, Batteries- Introduction ,Lead-acid ,Nickel- cadmium, Lithium ion batteries and their applications.

UNIT-2: Fuel Cells: Fuel cell- Introduction, Basic design of fuel cell, working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency and applications.

UNIT-3: Photo and Photo electrochemical Conversions: Photochemical cells Introduction and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions and their applications.

UNIT-4: Solar Energy: Introduction and prospects, photovoltaic (PV) technology, concentrated solar power (CSP), Solar cells and applications.

UNIT-5: Hydrogen Storage: Hydrogen storage and delivery: State-of-the art, Established technologies, Chemical and Physical methods of hydrogen storage, Compressed gas storage, Liquid hydrogen storage, Other storage methods, Hydrogen storage in metal hydrides, metal organic frameworks (MOF), Metal oxide porous structures, hydrogel , and Organic hydrogen carriers.

Text books

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins

Reference Books:

1. Fuel Cell Hand Book 7th Edition, by US Department of Energy (EG&G technical services And corporation)
2. Hand book of solar energy and applications by ArvindTiwari and Shyam.
3. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
4. Hydrogen storage by Levine Klebonoff

III B.Tech I Sem

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Code	ENGLISH FOR COMPETITIVE EXAMINATIONS	
A1HS505f	(Open Elective-I) (Common to All Branches of Engineering)	
Course Objectives:		
1. To enable the students to learn about the structure of competitive English 2. To understand the grammatical aspects and identify the errors 3. To enhance verbal ability and identify the errors 4. To improve word power to answer competitive challenges 5. To make them ready to crack competitive exams		
Course Outcomes (CO):		Blooms Level
By the end of the program students will be able to		
▪ Identify the basics of English grammar and its importance		L1, L2
▪ Explain the use of grammatical structures in sentences		L1, L2
▪ Demonstrate the ability to use various concepts in grammar and vocabulary and their applications in everyday use and in competitive exams		L3
▪ Analyze an unknown passage and reach conclusions about it.		L4
▪ Choose the appropriate form of verbs in framing sentences		L5
▪ Develop speed reading and comprehending ability thereby perform better in competitive exams		L3
UNIT - I	GRAMMAR-1	Lecture Hrs
Nouns-classification-errors-Pronouns-types-errors-Adjectives-types-errors-Articles-definite-indefinite-Degrees of Comparison-Adverbs-types- errors-Conjunctions-usage-repositions-usage-Tag Questions, types-identifying errors- Practice		
UNIT - II	GRAMMAR-2	Lecture Hrs
Verbs-tenses- structure-usages- negatives- positives- time adverbs-Sequence of tenses--If Clause-Voice-active voice and passive voice- reported Speech-Agreement- subject and verb-Modals-Spotting Errors-Practices		
UNIT - III	VERBAL ABILITY	Lecture Hrs
Sentence completion-Verbal analogies-Word groups-Instructions-Critical reasoning-Verbal deduction-Select appropriate pair-Reading Comprehension-Paragraph-Jumbles-Selecting the proper statement by reading a given paragraph.		
UNIT - IV	READING COMPREHENSION AND VOCUBULARY	Lecture Hrs

Competitive Vocabulary :Word Building – Memory techniques-Synonyms, Antonyms, Affixes-Prefix & Suffix-One word substitutes-Compound words-Phrasal Verbs-Idioms and Phrases-Homophones-Linking Words-Modifiers-Intensifiers - Mastering Competitive Vocabulary- Cracking the unknowing passage-speed reading techniques- Skimming & Scanning-types of answering–Elimination methods		
UNIT - V	WRITING FOR COMPETITIVE EXAMINATIONS	Lecture Hrs
Punctuation- Spelling rules- Word order-Sub Skills of Writing- Paragraph meaning-salient features-types - Note-making, Note-taking, summarizing-precise writing- Paraphrasing-Expansion of proverbs-Essay writing-types		
Textbooks:		
1. Wren & Martin, <i>English for Competitive Examinations</i> , S.Chand & Co, 2021 2. <i>Objective English for Competitive Examination</i> , Tata McGraw Hill, New Delhi, 2014.		
Reference Books:		
1. Hari Mohan Prasad, <i>Objective English for Competitive Examination</i> , Tata McGraw Hill, New Delhi, 2014. 2. Philip Sunil Solomon, <i>English for Success in Competitive Exams</i> , Oxford 2016 3. Shalini Verma , <i>Word Power Made Handy</i> , S Chand Publications 4. Neira, Anjana Dev & Co. <i>Creative Writing: A Beginner's Manual</i> . Pearson Education India, 2008. 5. Abhishek Jain, <i>Vocabulary Learning Techniques Vol.I&II</i> ,RR Global Publishers 2013. 6. Michel Swan, <i>Practical English Usage</i> ,Oxford,2006.		

Online Resources

1. <https://www.grammar.cl/english/parts-of-speech.htm>
2. <https://academicguides.waldenu.edu/writingcenter/grammar/partsofspeech>
3. <https://learnenglish.britishcouncil.org/grammar/english-grammar-reference/active-passive-voice>
4. <https://languagetool.org/insights/post/verb-tenses/>
5. <https://www.britishcouncil.in/blog/best-free-english-learning-resources-british-council>
6. <https://www.careerride.com/post/social-essays-for-competitive-exams-586.aspx>

ENTREPRENEURSHIP AND NEW VENTURE CREATION(A1HS505g)
(Open Elective-I)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

COURSE OUTCOMES: At the end of the course, students will be able to								BTL
CO1	Develop an entrepreneurial mindset and appreciate the concept of entrepreneurship							L3
CO2	Comprehend the process of problem-opportunity identification through design thinking, identify market potential and customers while developing a compelling value proposition solution							L3
CO3	Analyze and refine business models to ensure sustainability and profitability							L3
CO4	Build Prototype for Proof of Concept and validate MVP of their practice venture idea							L4
CO5	Create business plan, conduct financial analysis and feasibility analysis to assess the financial viability of a venture							L5
CO6	Prepare and deliver an investible pitch deck of their practice venture to attract stakeholders							L6

UNIT-I: Entrepreneurship Fundamentals and context

Meaning and concept, attributes and mindset of entrepreneurial and intrapreneurial leadership, role models in each and their role in economic development. An understanding of how to build entrepreneurial mindset, skill sets, attributes and networks while on campus.

Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students – 16 industries to choose from), Venture Activity

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand the concept of Entrepreneur and Entrepreneurship in India
- Analyze recent trends in Entrepreneurship role in economic development
- Develop a creative mind set and personality in starting a business.

Unit II: Problem & Customer Identification

Understanding and analysing the macro-Problem and Industry perspective - technological, socioeconomic and urbanization trends and their implication on new opportunities - Identifying passion
 - identifying and defining problem using Design thinking principles - Analysing problem and validating with the potential customer - Understanding customer segmentation, creating and validating customer personas.

Core Teaching Tool: Several types of activities including Class, game, Gen AI, ‘Get out of the Building’ and Venture Activity.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand the problem and Customer identification.
- Analyze problem and validating with potential customer
- Evaluate customer segmentation and customer personas

Unit III: Solution design, Prototyping & Opportunity Assessment and Sizing

Understanding Customer Jobs-to-be-done and crafting innovative solution design to map to customer’s needs and create a strong value proposition - Understanding prototyping and Minimum Viable product (MVP) - Developing a feasibility prototype with differentiating value, features and benefits - Assess relative market position via competition analysis - Sizing the market and assess scope and potential scale of the opportunity.

Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

LEARNING OUTCOMES

At the end if the Unit, the learners will be able to

- Analyze jobs-to-be-done
- Evaluate customer needs to create a strong value proposition
- Design and draw prototyping and MVP

UNIT-IV: Business & Financial Model, Go-to-Market Plan

Introduction to Business model and types, Lean approach, 9 block lean canvas model, riskiest assumptions to Business models. Importance of Build - Measure – Lean approach.

Business planning: components of Business plan- Sales plan, People plan and financial plan. Financial Planning: Types of costs, preparing a financial plan for profitability using financial template, understanding basics of Unit economics and analysing financial performance.

Introduction to Marketing and Sales, Selecting the Right Channel, creating digital presence, building customer acquisition strategy.

Choosing a form of business organization specific to your venture, identifying sources of funds: Debt& Equity, Map the Start-up Life-cycle to Funding Options.

Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to:

- Understand lean approach in business models

- Apply business plan, sales plan and financial plan
- Analyze financial planning, marketing channels of distribution.
- Design their own venture and source of funds.

UNIT-V: Scale Outlook and Venture Pitch readiness

Understand and identify potential and aspiration for scale vis-a-vis your venture idea.
Persuasive Storytelling and its key components. Build an Investor ready pitch deck.

Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to

- Understand aspiration for scale
- Analyze venture idea and its key components
- Evaluate and build investors ready pitch

TEXT BOOKS

1. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha .
Entrepreneurship, McGrawHill, 11th Edition.(2020)
2. Ries, E. *The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses*. Crown Business,(2011).
3. Osterwalder, A., & Pigneur, Y. *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*. John Wiley & Sons. (2010).

REFERENCES

1. Simon Sinek, *Start with Why*, Penguin Books limited. (2011)
2. Brown Tim, *Change by Design Revised & Updated: How Design Thinking Transforms Organizations and Inspires Innovation*, Harper Business.(2019)
4. Namita Thapar (2022) *The Dolphin and the Shark: Stories on Entrepreneurship*, Penguin Books Limited
5. Saras D. Sarasvathy, (2008) *Effectuation: Elements of Entrepreneurial Expertise*, Elgar Publishing Ltd.

E-RESOURCES

Learning resource- Ignite 5.0 Course Wadhwani platform (Includes 200+ components of custom created modular content + 500+ components of the most relevant curated content)

IIIB.Tech. II Semester**DIGITAL ELECTRONICS(A1EC606a)
(Open Elective –II)**

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

1. To Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
2. To analyze combinational circuits like adders, subtractors, and code converters.
3. To explore combinational logic circuits and their applications in digital design.
4. To understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
5. To gain knowledge about programmable logic devices and digital IC's.

Course Outcomes:**At the end of this course, the students will be able to**

1. Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
2. Analyze combinational circuits like adders, subtractors, and code converters.
3. Explore combinational logic circuits and their applications in digital design.
4. Understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
5. Gain knowledge about programmable logic devices and digital IC's.

UNIT-I

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex- NOR operations, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

UNIT-II

Introduction to Combinational Design 1: Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display.

UNIT-III

Combinational Logic Design 2: Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

UNIT-IV

Sequential Logic Design: Latches, Flip-flops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, set up and hold times, Ripple counters, Shift registers.

UNIT-V

Programmable Logic Devices:ROM, Programmable Logic Devices (PLA and PAL).

Digital IC's:Decoder (74x138), Priority Encoder (74x148), multiplexer (74x151) and de-multiplexer (74x155), comparator (74x85).

TEXT BOOKS:

1. Digital Design, M.Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999.
2. Switching theory and Finite Automata Theory, ZviKohavi and NirahK.Jha, 2nd Edition, Tata McGraw Hill, 2005.

REFERENCE BOOKS:

1. Fundamentals of Logic Design, Charles H Roth,Jr., 5th Edition, Brooks/cole Cengage Learning, 2004.

III B.Tech II Sem

OPTIMIZATION TECHNIQUES(A1HS606a)
(Open Elective -II)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Outcomes:

After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Understand the meaning, purpose, tools of Operations Research and linear programming in solving practical problems in industry.	L2, L3
CO2	Interpret the transportation models' solutions and infer solutions to the real-world problems.	L3, L5
CO3	Develop mathematical skills to analyze and solve nonlinear programming models arising from a wide range of applications.	L3
CO4	Apply the concept of non-linear programming for solving the problems involving non-linear constraints and objectives	L2, L3
CO5	Apply the concept of unconstrained geometric programming for solving the problems involving non-linear constraints and objectives.	L3,L5

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	-	-	-	1
CO2	3	2	2	2	-	-	-	-	-	-	-	1
CO3	3	2	2	1	-	-	-	-	-	-	-	1
CO4	2	2	2	1	-	-	-	-	-	-	-	1
CO5	3	3	2	1	-	-	-	-	-	-	-	1

1-Slightly, 2-Moderately, 3-Substantially.

UNIT – I: Linear programming I

(08)

Introduction, Applications of Linear Programming, Standard form of a Linear Programming Problem, Geometry of Linear Programming Problems, Basic Definitions in Linear Programming. Simplex Method, Simplex Algorithm and Two phase Simplex Method, Big-M method.

UNIT – II Linear programming II: Duality in Linear Programming

(08)

Symmetric Primal-Dual Relations, General Primal-Dual Relations, Duality Theorem, Dual Simplex Method, Transportation Problem and assignment problem, Complementary slackness Theorem

UNIT – III Non-linear programming: Unconstrained optimization techniques

(08)

Introduction: Classification of Unconstrained minimization methods,

Direct Search Methods: Random Search Methods: Descent Method and Fletcher Powell Method, Grid Search Method

UNIT – IV Non-linear programming: Constrained optimization techniques

(08)

Introduction, Characteristics of a constrained problem, Random Search Methods, complex method, Sequential linear programming, Basic approach in methods of Feasible directions, Zoutendijk's method of feasible directions: direction finding problem, determination of step length, Termination criteria.

UNIT-V Geometric Programming

(08)

Unconstrained Minimization Problems: solution of unconstrained geometric programming using differential calculus and arithmetic-geometric inequality.

Constrained minimization Problems: Solution of a constrained geometric programming problem, primal-dual programming in case of less-than inequalities, geometric programming with mixed inequality constraints.

TEXT BOOK:

1. Singiresu S Rao., Engineering Optimization: Theory and Practices, New Age Int. (P) Ltd. Publishers, New Delhi.
2. J. C. Panth, Introduction to Optimization Techniques, (7-e) Jain Brothers, New Delhi.

REFERENCES:

1. Harvey M. Wagner, Principles of Operation Research, Printice-Hall of India Pvt. Ltd. New Delhi.
2. Peressimi A.L., Sullivan F.E., Vhl, J. J. Mathematics of Non-linear Programming, Springer – Verlag.

Web Reference:

- https://onlinecourses.nptel.ac.in/noc24_ee122/preview
- <https://archive.nptel.ac.in/courses/111/105/111105039/>
- https://onlinecourses.nptel.ac.in/noc21_ce60/preview

III B.Tech II Sem**PHYSICS OF ELECTRONIC MATERIALS AND DEVICES(A1HS606c)**

(Common to all branches) Open Elective-II

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100
Course Objectives									
1	To make the students to understand the concept of crystal growth, defects in crystals and thin films.								
2	To provide insight into various semiconducting materials and their properties.								
3	To develop a strong foundation in semiconductor physics and device engineering.								
4	To elucidate excitonic and luminescent processes in solid-state materials.								
5	To understand the principles, technologies, and applications of modern display systems.								

Syllabus:**UNIT-I Fundamentals of Materials Science****9H**

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. The basic idea of point, line, and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge).

UNIT II Semiconductors**9H**

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

UNIT III Physics of Semiconductor Devices:**9H**

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Heterojunctions, Transistors, MOSFETs.

UNIT IV Excitons and Luminescence:**9H**

Luminescence: Different types of luminescence, basic definitions, Light emission in solids, Inter-band luminescence, Direct and indirect gap materials.

Photoluminescence : General Principles of photoluminescence, Excitation and relaxation, OLED,

Quantum-dot.

Electro-luminescence : General Principles of electroluminescence, light emitting diode, diode laser.

UNIT V Display devices :

9H

LCD, three-dimensional display: Holographic display, light-field displays: Head-mounted display, MOEMS (Micro-Opto-Electro-Mechanical Systems) and MEMS displays.

Textbooks:

1. Principles of Electronic Materials and Devices-S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd., 4th edition, 2021.
2. Semiconductor physics & devices: basic principles, 4th Edition, McGraw-Hill, 2012.

Reference Books:

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning, 6th edition
2. Electronic Materials Science- Eugene A. Irene, Wiley, 2005
3. Electronic Components and Materials, Grover and Jamwal, Dhanpat Rai and Co., New Delhi., 2012.
4. An Introduction to Electronic Materials for Engineers-Wei Gao, Zhengwei Li, Nigel Sammes, World Scientific Publishing Co. Pvt. Ltd. 2nd Edition, 2011

NPTEL course links:

<https://nptel.ac.in/courses/113/106/113106062/>

https://onlinecourses.nptel.ac.in/noc20_ph24/preview

	Course Outcomes	Blooms Level
CO1	Understand crystal growth and thin film preparation	L1,L2
CO2	Summarize the basic concepts of semiconductors	L1,L2
CO3	Illustrate the working of various semiconductor devices	L1,L2, L3
CO4	Analyze various luminescent phenomena and the devices based on these concepts	L1,L2, L3
CO5	Explain the working of different display devices	L1,L2

III B.Tech –II Sem

CHEMISTRY OF POLYMERS AND APPLICATIONS(A1HS606d)

(Common to all branches)

Open Elective-II

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives	
1	To understand the basic principles of polymers
2	To understand natural polymers and their applications.
3	To impart knowledge to the students about synthetic polymers, their preparation and importance.
4	To enumerate the applications of hydrogel polymers
5	To enumerate applications of conducting and degradable polymers in engineering.
Course Outcomes	
CO1	Classify the polymers, Explain polymerization mechanism, Differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer
CO2	Describe the physical and chemical properties of natural polymers and Modified cellulotics.
CO3	Differentiate Bulk, solution, Suspension and emulsion polymerization, Describe fibers and elastomers, Identify the thermosetting and thermo polymers.
CO4	Identify types of polymer networks, Describe methods involve in hydrogel preparation, Explain applications of hydrogels in drug delivery,
CO5	Explain classification and mechanism of conducting and degradable polymers.

Unit – I: Polymers-Basics and Characterization:-

Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation, copolymerization and coordination polymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: End group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

Unit – II: Natural Polymers & Modified cellulotics

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications,

applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins

Modified cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

Unit – III: Synthetic Polymers

Addition and condensation polymerization processes– Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties. Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers(PE,PVC), Butadiene polymers(BUNA-S,BUNA-N), nylons, Urea-formaldehyde, phenol – formaldehyde, Melamine Epoxy and Ion exchange resins.

Unit-IV: Hydrogels of Polymer networks

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Applications of hydrogels in drug delivery.

Unit – V: Conducting and Degradable Polymers:

Conducting polymers: Introduction, Classification, Mechanism of conduction in Poly Acetylene, Poly Aniline, Poly Thiophene, Doping, Applications.

Degradable polymers: Introduction, Classifications, Examples, Mechanism of degradation, poly lactic acid, Nylon-6, Polyesters, applications.

Text Books:

1. A Text book of Polymer science, Billmayer
2. Polymer Chemistry – G.S.Mishra
3. Polymer Chemistry – Gowarikar

References Books:

1. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
2. Advanced Organic Chemistry, B.Miller, Prentice Hall
3. Polymer Science and Technology by Premamoy Ghosh, 3rd edition, McGraw-Hill, 2010.

III B.Tech –II Sem

ACADEMIC WRITING AND PUBLIC SPEAKING(A1HS606e)
(Common to All Branches of Engineering) OPEN ELECTIVE - II

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:		
- To encourage all round development of the students by focusing on writing skills - To make the students aware of non-verbal skills - To develop analytical skills - To deliver effective public speeches		
Course Outcomes (CO):		Blooms Level
By the end of the program students will be able to		
Understand various elements of Academic Writing		L1, L2
Identify sources and avoid plagiarism		L1, L2
Demonstrate the knowledge in writing a Research paper		L3
Analyse different types of essays		L4
Assess the speeches of others and know the positive strengths of speakers		L5
Build confidence in giving an impactful presentation to the audience		L3
UNIT - I	Introduction to Academic Writing	Lecture Hrs
Introduction to Academic Writing – Essential Features of Academic Writing – Courtesy – Clarity – Conciseness – Correctness – Coherence – Completeness – Types – Descriptive, Analytical, Persuasive, Critical writing		
UNIT - II	Academic Journal Article	Lecture Hrs
Art of condensation- summarizing and paraphrasing - Abstract Writing, writing Project Proposal, writing application for internship, Technical/Research/Journal Paper Writing – Conference Paper writing - Editing, Proof Reading - Plagiarism		
UNIT - III	Essay & Writing Reviews	Lecture Hrs
Compare and Contrast – Argumentative Essay – Exploratory Essay – Features and Analysis of Sample Essays – Writing Book Report, Summarizing, Book/film Review- SoP		
UNIT - IV	Public Speaking	Lecture Hrs
Introduction, Nature, characteristics, significance of Public Speaking – Presentation – 4 Ps of Presentation – Stage Dynamics – Answering Strategies – Analysis of Impactful Speeches- Speeches for Academic events		
UNIT - V	Public Speaking and Non-Verbal Delivery	Lecture Hrs
Body Language – Facial Expressions-Kinesics – Oculistics – Proxemics – Haptics – Chronemics - Paralanguage - Signs		
Textbooks:		
3. <i>Critical Thinking, Academic Writing and Presentation Skills</i> : MG University Edition Paperback – 1 January 2010 Pearson Education; First edition (1 January 2010)		
4. Pease, Allan & Barbara. <i>The Definitive Book of Body Language</i> RHUS Publishers, 2016		

Reference Books:

1. Alice Savage, Masoud Shafiei *Effective Academic Writing*, 2^{Ed}, 2014 .sserP ytisrevinU drofxO
2. Shalini Verma, *Body Language*, S Chand Publications 2011.
3. Sanjay Kumar and Pushpalata, *Communication Skills* 2E 2015, Oxford.
4. Sharon Gerson, Steven Gerson, *Technical Communication Process and Product*, Pearson, New Delhi, 2014
5. *Elbow, Peter. Writing with Power. OUP USA, 1998*

Online Learning Resources:

1. <https://youtu.be/NNhTIT81nH8>
2. <https://www.youtube.com/watch?v=478ccrWKY-A>
3. <https://www.youtube.com/watch?v=nzGo5ZC1gMw>
4. <https://www.youtube.com/watch?v=Qve0ZBmJMh4>
5. <https://courses.lumenlearning.com/publicspeakingprinciples/chapter/chapter-12-nonverbal-aspects-of-delivery/>
6. https://onlinecourses.nptel.ac.in/noc21_hs76/preview
7. <https://archive.nptel.ac.in/courses/109/107/109107172/#>
8. <https://archive.nptel.ac.in/courses/109/104/109104107/>

IV B.Tech – I Semester**MATHEMATICAL FOUNDATION OF QUANTUM TECHNOLOGIES(A1CS606b)
(OPEN ELECTIVE – III)**

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

- To provide a strong mathematical foundation for understanding Quantum Mechanics.
- To equip students with fundamental basis of the statistical theory, Conclusions from Experiments, Measurement, and reversibility.
- To enhance the ability to apply the concept in Thermodynamics, Reversibility and equilibrium problems and Macroscopic Measurement.
- To develop critical problem-solving skills for composite system and measuring process.

Course Outcomes:

After successful completion of this course, the students should be able to:

COs Statements Blooms level

CO1 Understand the Transformation theory and Hilbert space. L1 (Understand)

CO2 Analyze the properties and operators of Hilbert space and apply Eigen values to it. L3, L4 (Apply and Analyze)

CO3 Apply statistics to measure theory, uncertainty relations and radiation theory. L3 (Apply)

CO4 Evaluate problems on reversibility, equilibrium and macroscopic measurements. L5 (Evaluate)

CO5 Formulate problems of composite system and measuring process L6 (Formulation)

UNIT I: Introductory Considerations (08)

The origin of the Transformation Theory, The Original Formulation of Quantum Mechanics, The Equivalence of the two Theories: (i) The Transformation Theory, (ii) Hilbert Space.

UNIT II: Abstract Hilbert Space (10)

The definition of Hilbert space, The Geometry of Hilbert space, Degression on the Conditions A-E, Closed linear Manifolds, Operators in Hilbert space, The Eigen Value Problem, Continuation,

Initial Consideration concerning the Eigenvalue Problem, Degression on the Existence and Uniqueness of solutions of the Eigenvalue Problems, Cumulative operators, The Trace.

UNIT III: The Quantum Statistics (08)

The statistical assertions of quantum mechanics, the statistical interpretation, Simultaneous Measurability and Measurability in General, Uncertainty Relations, Projections as Propositions, Radiation Theory.

UNIT IV: Deductive development of the Theory and general considerations (08)

The fundamental basis of the statistical theory, Conclusions from Experiments.

Measurement and reversibility, Thermodynamics Considerations, Reversibility and equilibrium problems, The Macroscopic Measurement.

UNIT V: The measuring Process (06)

Formulation of the problems, Composite systems, discussion of the Measuring process.

Textbooks:

1. John von Neumann and Robert T Beyer, Mathematical Foundations of Quantum Mechanics, Princeton Univ. Press (1996).
2. Srinivas, M. D., Measurements and Quantum Probabilities, University Press, Hyderabad (2001).

Reference Books:

1. Leonard Schiff, Quantum Mechanics, Mc, Graw Hill (Education) (2010).
2. Parthasarathy. K. R., Mathematical Foundations of Quantum, Hindustan Book Agency, New Delhi.
3. Gerard Tesch, Mathematical Methods in Quantum Mechanics with application to Schrodinger operators, Graduate Studies in Mathematics, 99, AMS, Providence, 2009.

IV B.Tech – I Semester

MICROPROCESSORS AND MICROCONTROLLERS(A1EC503T)**(Open Elective –III)**

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

- 1) To comprehend the architecture, operation, and configurations of the 8086 microprocessors.
- 2) To get familiar with 8086 programming concepts, instruction set, and assembly language development tools.
- 3) To study the interfacing of 8086 with memory, peripherals, and controllers for various applications.
- 4) To learn the architecture, instruction set, and programming of the 8051 microcontrollers.
- 5) To understand microcontroller interfacing techniques, peripheral programming, and processor comparisons.

Course Outcomes:**At the end of this course, the students will be able to**

1. Gain knowledge on the architecture, operation, and configurations of the 8086 microprocessors.
2. Get familiar with 8086 programming concepts, instruction set, and assembly language development tools.
3. Know the interfacing of 8086 with memory, peripherals, and controllers for various applications.
4. Learn the architecture, instruction set, and programming of the 8051 microcontrollers.
5. Understand microcontroller interfacing techniques, peripheral programming, and processor comparisons.

UNIT I

8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT II

8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT III

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDs, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

UNIT IV

Microcontroller - Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits
- Instruction set - Addressing modes - Assembly language programming.

UNIT V

Interfacing Microcontroller - Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

Textbooks:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition, 1994.
2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

References:

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.

IV B.Tech I Sem

WAVELET TRANSFORMS AND ITS APPLICATIONS(A1HS705a)
(Open Elective-III)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Outcomes:

After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Understand wavelets and wavelet basis and characterize continuous and discrete wavelet transforms	L2, L3
CO2	Illustrate the multi resolution analysis and scaling functions	L3, L5
CO3	Implement discrete wavelet transforms with multirate digital filters	L3
CO4	Understand multi resolution analysis and identify various wavelets and evaluate their time- frequency resolution properties.	L2, L3
CO5	Design certain classes of wavelets to specification and justify the basis of the application of wavelet transforms to different fields	L3,L5

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	-	-	-	-	-	-	1
CO2	3	2	2	2	-	-	-	-	-	-	-	1
CO3	3	2	2	1	-	-	-	-	-	-	-	1
CO4	2	2	2	1	-	-	-	-	-	-	-	1
CO5	3	3	2	1	-	-	-	-	-	-	-	1

UNIT – I: Wavelets**(08)**

Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets -effectiveness of Wavelet Analysis -The Discrete Wavelet Transform- The Discrete-Time and Continuous Wavelet Transforms.

UNIT – II: A Multiresolution Formulation of Wavelet Systems**(08)**

Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

UNIT – III Filter Banks and the Discrete Wavelet Transform**(08)**

Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating -Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices

and Lifting - -Different Points of View.

UNIT – IV Time-Frequency and Complexity

(08)

Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.

UNIT-V Bases and Matrix Examples

(08)

Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

TEXT BOOK:

1. C. Sidney Burrus, Ramesh A. Gopinath, —Introduction to Wavelets and Wavelets Transforms, Prentice Hall, (1997).
2. James S. Walker, —A Primer on Wavelets and their Scientific Applications, CRC Press, (1999)..

REFERENCES:

1. RaghuvveerRao, —Wavelet Transforms, Pearson Education, Asia
2. C. S. Burrus, Ramose and A. Gopinath, Introduction to Wavelets and Wavelet Transform, Prentice Hall Inc.
1. <http://users.rowan.edu/~polikar/WAVELETS/WTtutorial.html>
2. <http://www.wavelet.org/>
3. <http://www.math.hawaii.edu/~dave/Web/Amara's%20Wavelet%20Page.htm>
4. <https://jqichina.wordpress.com/wp-content/uploads/2012/02/ten-lectures-of-waveletsefbc88e5b08fe6b3a2e58d81e8aeb2efbc891.pdf>

IV B.Tech I Sem

SMART MATERIALS AND DEVICES(A1HS705b)

(Common to all branches)

Open Elective-III

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives	
1	To provide exposure to smart materials and their engineering applications.
2	To impart knowledge on the basics and phenomenon behind the working of smart materials
3	To explain the properties exhibited by smart materials
4	To educate various techniques used to synthesize and characterize smart materials
5	To identify the required smart material for distinct applications/devices

UNIT I Introduction to Smart Materials**9H**

Historical account of the discovery and development of smart materials, Shape memory materials, chromoactive materials, magnetorheological materials, photoactive materials, Polymers and polymer composites (Basics).

UNIT II Properties of Smart Materials**9H**

Optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

UNIT III Synthesis of Smart Materials**9H**

Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Mechanical alloying and Thin film deposition techniques: Chemical etching, Spray pyrolysis.

UNIT IV Characterization Techniques**9H**

Powder X-ray diffraction, Raman spectroscopy (RS), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy (AFM).

UNIT V Smart Materials based Devices**9H**

Devices based on smart materials: Shape memory alloys in robotic hands, piezoelectric based devices, MEMS and intelligent devices.

Textbooks:

1. YaserDahman, Nanotechnology and Functional Materials for Engineers-, Elsevier, 2017
2. E. Zschech, C. Whelan, T. Mikolajick, Materials for Information Technology: Devices, Interconnects and Packaging Springer-Verlag London Limited 2005.

Reference Books:

1. Gauenzi, P., Smart Structures, Wiley, 2009.
2. Mahmood Aliofkhaezrai, Handbook of functional nanomaterials, Vol (1&2), Nova Publishers, 2014

3. Handbook of Smart Materials, Technologies, and Devices: Applications of Industry,4.0,Chaudhery

Mustansar Hussain, Paolo Di Sia, Springer,2022.

4. **Fundamentals of Smart Materials**,Mohsen Shahinpoor, Royal Society of Chemistry, 2020

NPTEL course link: https://onlinecourses.nptel.ac.in/noc22_me17/preview

IV B.Tech I Sem

(A1HS705c)	GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT (Common to all branches) Open Elective-III	Credits 3-0-0:3

Course Objectives	
1	To Understand Principle And Concepts Of Green Chemistry.
2	To Understand The Types Of Catalysis And Industrial Applications.
3	To Apply Green Solvents In Chemical Synthesis.
4	To Enumerate Different Sources Of Green Energy.
5	To Apply Alternative Greener Methods For Chemical Reactions

Course Outcomes	
CO1	Apply the Green chemistry Principles for day to day life as well as synthesis, describe the sustainable development and green chemistry, Explain economic and un-economic reactions, Demonstrate Polymer recycling.
CO2	Explain Heterogeneous catalyst and its applications in Chemical and Pharmaceutical Industries, Differentiate Homogeneous and Heterogeneous catalysis, Identify the importance of Bio and Photo Catalysis, Discuss Transition metal and Phase transfer Catalysis
CO3	Demonstrate Green solvents and importance, Discuss Supercritical carbon dioxide, Explain Supercritical water, recycling of green solvents.
CO4	Describe importance of Biomass and Solar Power, Illustrate Sonochemistry, Apply Green Chemistry for Sustainable Development; discuss the importance of Renewable resources, mechanochemical synthesis.
CO5	Discuss Alternative green methods like Photoredox catalysis, single electron transfer reactions (SET), Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.

UNIT 1: PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY

Introduction, Green chemistry Principles, sustainable development and green chemistry, E factor, atom economy, atom economic Reactions: Rearrangement and addition reactions and atom un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling

UNIT 2: CATALYSIS AND GREEN CHEMISTRY

Introduction, Types of catalysis, Heterogeneous catalysis: Basics of Heterogeneous Catalysis, Zeolite and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, and Phase transfer catalysis, Bio-catalysis and Photo-catalysis with examples.

UNIT 3: GREEN SOLVENTS IN CHEMICAL SYNTHESIS

Green Solvents: Concept, Tools and techniques for solvent selection, supercritical fluids: Super critical carbondioxide, super critical water, Polyethylene glycol (PEG), Ionic liquids, Recycling of green solvents.

UNIT 4: EMERGING GREENER TECHNOLOGIES

Biomass as renewable resource, Energy: Energy from Biomass, Solar Power, Chemicals from Renewable Feedstock's, Chemicals from Fatty Acids, Polymers from Renewable Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency, Mechanochemical synthesis.

UNIT 5: ALTERNATIVE GREENER METHODS

Photochemical Reactions - Examples, Advantages and Challenges, Photoredox catalysis, single electron transfer reactions (SET), Examples of Photochemical Reactions, Microwave-assisted Reactions and Sonochemical reactions, examples and applications.

Text Books :

1. M.Lancaster, GreenChemistryAnIntroductoryText,RoyalSocietyOfChemistry, 2002.
2. PaulT.AnastasAndJohnC.Warner,GreenChemistryTheoryAndPractice,4thEdition, OxfordUniversityPress, Usa

References :

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and AckmezMudhoo, CRC Press, 2010.
2. Edited by AlvisePerosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: GREENNANOSCIENCE,WILEY-VCH,2013.

IV B.Tech I Sem

EMPLOYABILITY SKILLS(A1HS705d)
OPEN ELECTIVE-III

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

- To encourage all round development of the students by focusing on productive skills
- To make the students aware of Goal setting and writing skills
- To enable them to know the importance of presentation skills in achieving desired goals.
- To help them develop organizational skills through group activities

To function effectively with heterogeneous teams

Course Outcomes (CO):		Blooms Level
CO1: Understand the importance of goals and try to achieve them		L1, L2
CO2: Explain the significance of self-management		L1, L2
CO3: Apply the knowledge of writing skills in preparing eye-catching resumes		L3
CO4: Analyse various forms of Presentation skills		L4
CO5: Judge the group behaviour appropriately		L5
CO6: Develop skills required for employability.		L3, L6
UNIT - I	Goal Setting and Self-Management	Lecture Hrs
Definition, importance, types of Goal Setting – SMART Goal Setting – Advantages-Motivation – Intrinsic and Extrinsic Motivation – Self-Management - Knowing about self – SWOC Analysis		
UNIT - II	Writing Skills	Lecture Hrs
Definition, significance, types of writing skills – Resume writing Vs CV Writing - E-Mail writing, Cover Letters - E-Mail Etiquette -SoP (Statement of Purpose)		
UNIT - III	Technical Presentation Skills	Lecture Hrs
Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics –Anxiety in Public speaking (Glossophobia)- PPT & Poster Presentation		
UNIT - IV	Group Presentation Skills	Lecture Hrs
Body Language – Group Behaviour - Team Dynamics – Leadership Skills – Personality Manifestation- Group Discussion-Debate –Corporate Etiquette		
UNIT - V	Job Cracking Skills	Lecture Hrs
Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success – Job searching skills - STAR method - FAQs- Answering Strategies – Mock Interviews		
Textbooks:		
1. Sabina Pillai, Agna Fernandez. <i>Soft Skills & Employability Skills</i> , 2014. Cambridge Publisher.		
2. <u>Alka Wadkar</u> . <i>Life Skills for Success</i> , Sage Publications, 2016.		
Reference Books:		

1. Gangadhar Joshi, *Campus to Corporate Paperback*, Sage Publications. 2015
2. [Sherfield Montgomery Moody](#), *Cornerstone Developing Soft Skills*, Pearson Publications. 4 Ed. 2008
3. Shikha Kapoor. *Personality Development and Soft Skills - Preparing for Tomorrow*. 1 Edition, Wiley, 2017.
4. M. Sen Gupta, *Skills for Employability*, Innovative Publication, 2019.
5. Steve Duck and David T McMahan, *The Basics of Communication Skills A Relational Perspective*, Sage press, 2012.

Online Learning Resources:

TRANSDUCERS AND SENSORS(A1EC706a)
(Open Elective –IV)

Course Objectives:

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

1. To understand characteristics of Instrumentation System and the operating principle of motion transducers.
2. To explore working principles, and applications of different temperature transducers and Piezo-electric sensors.
3. To provide knowledge on flow transducers and their applications.
4. To study the working principles of pressure transducers.
5. To introduce working principle and applications of force and sound transducers.

Course Outcomes:

After completing the course, the student will be able to,

1. Understand characteristics of Instrumentation System and the operating principle of motion transducers.
2. Explore working principles, and applications of different temperature transducers and Piezo-electric sensors.
3. Gain knowledge on flow transducers and their applications.
4. Learn the working principles of pressure transducers.
5. Understand the working principle and applications of force and sound transducers.

UNIT I

Introduction: General Configuration and Functional Description of measuring instruments, Static and Dynamic Characteristics of Instrumentation System, Errors in Instrumentation System, Active and Passive Transducers and their Classification.

Motion Transducers: Resistive strain gauge, LVDT, RVDT, Capacitive transducers, Piezo-electric transducers, seismic displacement pick-ups, vibrometers and accelerometers.

UNIT II

Temperature Transducers: Standards and calibration, fluid expansion and metal expansion type transducers - bimetallic strip, Thermometer, Thermistor, RTD, Thermocouple and their characteristics.

Hall effect transducers, Digital transducers, Proximity devices, Bio-sensors, Smart sensors, Piezo-electric sensors.

UNIT III

Flow Transducers: Bernoulli's principle and continuity, Orifice plate, Nozzle plate, Venture tube, Rotameter, Anemometers, Electromagnetic flow meter, Impeller meter and Turbid flow meter.

UNIT IV

Pressure Transducers: Standards and calibration, different types of manometers, elastic transducers, diaphragm bellows, bourdon tube, capacitive and resistive pressure transducers, high and low pressure measurement.

UNIT V

Force and Sound Transducers: Proving ring, hydraulic and pneumatic load cell, dynamometer and gyroscopes. Sound level meter, sound characteristics, Microphone.

TEXT BOOKS

1. A.K. Sawhney, —A course in Electrical and Electronics Measurements and Instrumentation, Dhanpat Rai & Co. 3rd edition Delhi, 2010.
2. Rangan C.S, Sarma G.R and Mani V S V, —Instrumentation Devices and Systems, TATA McGraw Hill publications, 2007.

REFERENCE BOOKS

1. Doebelin. E.O, —Measurement Systems Application and Design, McGraw Hill International, New York, 2004.
2. Nakra B.C and Chaudhary K.K, —Instrumentation Measurement and Analysis, Second Edition, Tata McGraw-Hill Publication Ltd. 2006.

IV B.Tech I Sem

FINANCIAL MATHEMATICS(A1HS706b)
(Open Elective-IV)

Course Objectives:

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

provide mathematical foundations for financial modelling, risk assessment and asset pricing.

2. To introduce stochastic models and their applications in pricing derivatives and interest rate modelling.
3. To develop analytical skills for fixed-income securities, credit risk, and investment strategies.
4. To equip students with computational techniques for pricing financial derivatives.

Course Outcomes:

After successful completion of this course, the students should be able to:

COs	Statements	Blooms level
CO1	Explain fundamental financial concepts, including arbitrage, valuation, and risk.	L2 (Understand)
CO2	Apply stochastic models, including Brownian motion and Stochastic Differential Equations (SDEs), in financial contexts.	L3 (Apply)
CO3	Analyze mathematical techniques for pricing options and financial derivatives.	L4 (Analyze)
CO4	Evaluate interest rate models and bond pricing methodologies.	L5 (Evaluate)
CO5	Utilize computational techniques such as Monte Carlo simulations for financial modeling.	L3 (Apply)

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	1	-	-	-	-	-	2	1
CO2	3	3	2	2	2	-	-	-	-	-	1	1
CO3	3	3	3	3	2	1	-	-	-	-	3	2
CO4	3	3	3	3	1	-	-	-	-	-	2	1
CO5	3	3	3	3	3	-	-	-	-	-	2	2

• 3 = Strong Mapping, 2 = Moderate Mapping, 1 = Slight Mapping, - = No Mapping

UNIT-I: Asset Pricing and Risk Management

(08)

Fundamental financial concepts: Returns, arbitrage, valuation, and pricing. Asset/Liability management, investment income, capital budgeting, and contingent cash flows. One-period model: Securities, payoffs, and the no-arbitrage principle. Option contracts: Speculation and hedging strategies, CAP Model, Efficient market hypothesis.

UNIT-II: Stochastic Models in Finance

(08)

Random Walks and Brownian Motion. Introduction to Stochastic Differential Equations (SDEs): Drift and diffusion. Ito calculus: Ito's Lemma, Ito Integral, and Ito Isometry.

UNIT-III: Interest Rate and Credit Modelling

(08)

Interest rate models and bond markets. Short-rate models: Vasicek, Cox-Ingersoll-Ross (CIR), Hull & White models, Credit risk modelling: Hazard function and hazard rate.

UNIT-IV: Fixed-Income Securities and Bond Pricing

(08)

Characteristics of fixed-income products: Yield, duration, and convexity. Yield curves, forward rates, and zero-coupon bonds. Stochastic interest rate models and bond pricing PDE. Yield curve fitting and calibration techniques, Mortgage Backed Securities.

UNIT-V: Exotic Options and Computational Finance

(08)

Stochastic volatility models and the Feynman-Kac theorem. Exotic options: Barriers, Asians, and Look backs. Monte Carlo methods for derivative pricing, Black-Scholes-Merton model: Derivation and applications.

Textbooks:

1. Ales Cerny, *Mathematical Techniques in Finance: Tools for Incomplete Markets*, Princeton University Press.
2. S.R. Pliska, *Introduction to Mathematical Finance: Discrete-Time Models*, Cambridge University Press.

Reference Books:

1. Ioannis Karatzas & Steven E. Shreve, *Methods of Mathematical Finance*, Springer, New York.
2. John C. Hull, *Options, Futures, and Other Derivatives*, Pearson.

Web References:

- MIT – Mathematics for Machine Learning <https://ocw.mit.edu>
- Coursera – Financial Engineering and Risk Management (Columbia University) <https://www.coursera.org/>
- National Stock Exchange (NSE) India – Financial Derivatives <https://www.nseindia.com/>

IV B.Tech I Sem

SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS(A1HS706c)
(Open Elective-IV)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

COURSE OBJECTIVES	
1	To provide exposure to various kinds of sensors and actuators and their engineering applications.
2	To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
3	To explain the operating principles of various sensors and actuators
4	To educate the fabrication of sensors
5	To explain the required sensor and actuator for interdisciplinary application

UNIT I Introduction to Sensors and Actuators**9H**

Sensors: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching.

Actuators: Functional diagram of actuators, Types of actuators and their basic principle of working: Pneumatic, Electromagnetic, Piezo-electric and Piezo-resistive actuators, Applications of Actuators.

UNIT II Temperature and Mechanical Sensors**9H**

Temperature Sensors: Types of temperature sensors and their basic principle of working: Thermo-resistive sensors: Thermistors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors

Mechanical Sensors: Types of Mechanical sensors and their basic principle of working: Force sensors: Strain gauges, Tactile sensors, Pressure sensors: Piezoresistive, Variable Reluctance Sensor (VRP).

UNIT III Optical and Acoustic Sensors**9H**

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo resistors based sensors, Photomultipliers, Infrared sensors: thermal, Passive Infra-Red, Fiber based sensors and Thermopiles

Acoustic Sensors: Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones

UNIT IV Magnetic and Electromagnetic Sensors**9H**

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magnetostrictive sensors and actuators.

UNIT V Chemical and Radiation Sensors**9H**

Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

Radiation Sensors: Principle and working of Ionization detectors, Scintillation detectors, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)

Textbooks:

1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2nd Edition, 2015
2. Sensors and Actuators, D.A.Hall and C.E.Millar, CRC Press, 1999

Reference Books:

1. Sensors and Transducers- D.Patranabis, Prentice Hall of India (Pvt) Ltd. 2003
2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC press 1999
3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley.
4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.

NPTEL course link: https://onlinecourses.nptel.ac.in/noc21_ee32/preview

	Course Outcomes	Blooms Level
CO1	Classify different types of Sensors and Actuators along with their characteristics	L1,L2
CO2	Summarize various types of Temperature and Mechanical sensors	L1,L2
CO3	Illustrates various types of optical and mechanical sensors	L1,L2
CO4	Analyze various types of Optical and Acoustic Sensors	L1,L2, L3
CO5	Interpret the importance of smart materials in various devices	L1,L2

IV B.Tech I Sem

CHEMISTRY OF NANOMATERIALS AND APPLICATIONS(A1HS706d)**(Open Elective-IV)**

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives	
1	To understand basics and characterization of nanomaterials.
2	To understand synthetic methods of nanomaterials.
3	To apply various techniques for characterization of nanomaterials.
4	To understand Studies of Nano-structured Materials
5	To enumerate the applications of advanced nanomaterials in engineering

Course Outcomes	
CO1	Classify the nanostructure materials; describe scope of nanoscience and importance technology.
CO2	Describe the top-down approach, Explain aerosol synthesis and plasma arc technique, Differentiate chemical vapor deposition method and electrode position method, Discuss about highenergy ball milling.
CO3	Discuss different technique for characterization of nanomaterial, Explain electron microscopy techniques for characterization of nanomaterial, Describe BET method for surface area analysis.
CO4	Explain synthesis and properties and applications of nanomaterials, Discuss about fullerenes and carbon nanotubes, Differentiate nanomagnetic materials and thermoelectric materials, nonlinear optical materials.
CO5	Illustrate advance engineering applications of Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

Unit – I

Basics and Characterization of Nanomaterials: Introduction, Scope of nanoscience and nanotechnology, nanoscience in nature, classification of nanostructured materials, importance of nanomaterials.

Unit – II

Synthesis of nanomaterials :Top-Down approach, Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electrodeposition method, highenergy ball milling method.

Synthetic Methods: Bottom-Up approach, Sol-gel synthesis, microemulsions or reverse micelles, co-

precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

UNIT-III

Techniques for characterization: Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination.

UNIT-IV

Studies of Nano-structured Materials: Synthesis, properties and applications of the following nanomaterials -fullerenes, carbon nanotubes, 2D-nanomaterial (Graphene), core-shell, magnetic nanoparticles, thermoelectric materials, non-linear optical materials.

UNIT-V

Advanced Engineering Applications of Nanomaterials: Applications of Nano Particle, nanorods, nano wires, Water treatment, sensors, electronic devices, medical domain, civil engineering, chemical engineering, metallurgy and mechanical engineering, food science, agriculture, pollutants degradation.

TEXT BOOKS:

1. **NANO: The Essentials:** T Pradeep, McGraw-Hill, 2007.
2. **Textbook of Nanoscience and nanotechnology:** B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Univ. Press, 2012.

REFERENCE BOOKS:

1. Concepts of Nanochemistry; LudovicoCademrtiri and Geoffrey A. Ozin& Geoffrey A. Ozin, Wiley-VCH, 2011.
2. **Nanostructures & Nanomaterials; Synthesis, Properties & Applications:** Guozhong Cao, Imperial College Press, 2007.

Nanomaterials

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IV B.Tech I Sem

LITERARY VIBES(A1HS706e) (Open Elective-IV)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives	
1	To inculcate passion for aesthetic sense and reading skills
2	To encourage respecting others' experiences and creative writing
3	To explore emotions, communication skills and critical thinking
4	To educate how books serve as the reflection of history and society
5	To provide practical wisdom and duty of responding to events of the times

Course Outcomes		Blooms Level
CO1	Identify genres, literary techniques and creative uses of language in literary texts.	L1, L2
CO2	Explain the relevance of themes found in literary texts to contemporary, personal and cultural values and to historical forces	L1, L2
CO3	Apply knowledge and understanding of literary texts when responding to others' problems and their own and make evidence-based arguments	L3
CO4	Analyze the underlying meanings of the text by using the elements of literary texts	L4
CO5	Evaluate their own work and that of others critically	L5
CO6	Develop as creative, effective, independent and reflective students who are able to make informed choices in process and performance	L3

UNIT I: Poetry

1. Ulysses- Alfred Lord Tennyson
2. Ain't I woman?-Sojourner Truth
3. The Second Coming-W.B. Yeats
4. Where the Mind is Without Fear-Rabindranath Tagore

UNIT II: Drama: *Twelfth Night*- William Shakespeare

1. Shakespeare -life and works
1. Plot & sub-plot and Historical background of the play
2. Themes and Criticism
3. Style and literary elements
4. Characters and characterization

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UNIT III: Short Story

1. The Luncheon - Somerset Maugham
2. The Happy Prince-Oscar Wilde
3. Three Questions – Leo Tolstoy
4. Grief –Antony Chekov

UNIT IV: Prose: Essay and Autobiography

1. My struggle for an Education-Booker T Washington
2. The Essentials of Education-Richard Livingstone
3. The story of My Life-Helen Keller
4. Student Mobs-JB Priestly

UNIT V: Novel: *Hard Times*- Charles Dickens

1. Charles Dickens-Life and works
2. Plot and Historical background of the novel
3. Themes and criticism
4. Style and literary elements
5. Characters and characterization

Text Books:

1. Charles Dickens.*Hard Times*. (Sangam Abridged Texts) Vantage Press, 1983
2. DENT JC. *William Shakespeare. Twelfth Night*. Oxford University Press, 2016.

References:

1. WJ Long. *History of English Literature*, Rupa Publications India; First Edition (4 October 2015)
2. RK Kaushik And SC Bhatia. *Essays, Short Stories and One Act Plays*, Oxford University Press .2018.
3. Dhanvel, SP. *English and Soft Skills*, Orient Blackswan, 2017.
4. *New Horizon*, Pearson publications, New Delhi 2014
5. Vimala Ramarao, *Explorations Volume-II*, Prasaraanga Bangalore University, 2014.
6. Dev Neira, Anjana & Co. *Creative Writing: A Beginner's Manual*. Pearson India, 2008.

Online Resources

<https://www.litcharts.com/poetry/alfred-lord-tennyson/ulysses>
<https://www.litcharts.com/lit/ain-t-i-a-woman/summary-and-analysis>
https://englishliterature.education/articles/poetry-analysis/the-second-coming-by-w-b-yeats-critical-analysis-summary-and-line-by-line-explanation/#google_vignette
<https://sirjitutorials.com/where-the-mind-is-without-fear-poem-notes-explanation/>
<https://www.litcharts.com/lit/twelfth-night/themes>
<https://smartenglishnotes.com/2021/11/28/the-luncheon-summary-characters-themes-and-irony/>

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IV B.Tech I Sem

QUANTUM COMPUTING(Open Elective-IV) (A1HS706f)

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	42	0	0	3	30	70	100

Course Objectives:

- To introduce the principles and mathematical foundations of quantum computation.
- To understand quantum gates, circuits, and computation models.
- To explore quantum algorithms and their advantages over classical ones.
- To develop the ability to simulate and write basic quantum programs.
- To understand real-world applications and the future of quantum computing in AI, cryptography, and optimization.

Course Outcomes:

Upon successful completion of this course, students will be able to:

- Explain the fundamental concepts of quantum mechanics used in computing.
- Construct and analyze quantum circuits using standard gates.
- Apply quantum algorithms like Deutsch-Jozsa, Grover's, and Shor's.
- Develop simple quantum programs using Qiskit or similar platforms.
- Analyze applications and challenges of quantum computing in real-world domains.

UNIT I: Fundamentals of Quantum Mechanics and Linear Algebra

Classical vs Quantum Computation, Complex Numbers, Vectors, and Matrices, Hilbert Spaces and Dirac Notation, Quantum States and Qubits, Superposition and Measurement, Tensor Products and Multi-Qubit Systems.

UNIT II: Quantum Gates and Circuits

Quantum Logic Gates: Pauli, Hadamard, Phase, Controlled Gates and CNOT, Unitary Operations and Reversibility, Quantum Circuit Representation, Quantum Teleportation, Simulation of Quantum Circuits.

UNIT III: Quantum Algorithms and Complexity

Quantum Parallelism and Interference, Deutsch and Deutsch-Jozsa Algorithms, Grover's Search Algorithm, Shor's Factoring Algorithm, Quantum Fourier Transform, Complexity Classes: BQP, P, NP, and QMA.

UNIT IV: Quantum Programming and Simulation Platforms

Introduction to Qiskit and IBM Quantum Experience, Writing Quantum Circuits in Qiskit, Measuring Qubits and Results, Classical-Quantum Hybrid Programs, Noisy Intermediate-Scale Quantum (NISQ) Systems, Limitations

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and Current State of Quantum Hardware.

UNIT V: Applications and Future of Quantum Computing

Quantum Machine Learning: Basics and Models, Quantum Cryptography and Quantum Key Distribution, Quantum Algorithms in AI and Optimization, Quantum Advantage and Supremacy, Ethical and Societal Impact of Quantum Technologies, Future Trends and Research Directions.

Textbooks:

1. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

Reference Books:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.

Online Learning Resources: 1. IBM Quantum Experience and Qiskit Tutorials 2. Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley

3. edX – The Quantum Internet and Quantum Computers 4. YouTube – Quantum Computing for the Determined by Michael Nielsen
5. Qiskit Textbook – IBM Quantum

HONOURS

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	QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce the fundamentals of quantum computing
- The problem-solving approach using finite dimensional mathematics

Course Outcomes

- Understand basics of quantum computing
- Understand physical implementation of Qubit
- Understand Quantum algorithms and their implementation
- Understand The Impact of Quantum Computing on Cryptography

UNIT - I

History of Quantum Computing: Importance of Mathematics, Physics and Biology. Introduction to Quantum Computing: Bits Vs Qubits, Classical Vs Quantum logical operations

UNIT - II

Background Mathematics: Basics of Linear Algebra, Hilbert space, Probabilities and measurements. Background Physics: Paul's exclusion Principle, Superposition, Entanglement and super-symmetry, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis. Background Biology: Basic concepts of Genomics and Proteomics (Central Dogma)

UNIT - III

Qubit: Physical implementations of Qubit. Qubit as a quantum unit of information. The Bloch sphere Quantum Circuits: single qubit gates, multiple qubit gates, designing the quantum circuits. Bell states.

UNIT - IV

Quantum Algorithms: Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor's factorization algorithm, Grover's search algorithm.

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UNIT - V

Noise and error correction: Graph states and codes, Quantum error correction, fault-tolerant computation. Quantum Information and Cryptography: Comparison between classical and quantum information theory. Quantum Cryptography, Quantum teleportation

TEXT BOOKS:

1. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge

REFERENCE BOOKS:

1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci
2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms

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(AUTONOMOUS)

	No SQL DATABASES	L	T	P	C
		3	0	0	3

Course Objectives:

- Discuss the history unstructured data
- To know non- relational databases and their importance in Data science.
- Under stand the differences between Relational and No SQL databases
- To explore the several types of No SQL data bases and understand the role in Big Data.

Course Out comes:

After completion of the course, students will be able to

- Explain and compare different types of No SQL database.
- Compare and contrast RDBMS with different No SQL databases.
- Define, compare and use the four types of No SQL databases (Document-oriented, Key Value pairs, Column-oriented and Graph
- Demonstrate the architecture, define objects, load data, query data and performance tune Column-oriented, Key-Value pair, Document and Graph databases.
- Evaluate No SQL database development tools and programming languages

UNIT I Overview and history of No SQL Data bases

Lecture 12Hrs

Definition of the four types of No SQL data bases. The value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The emergence of No SQL, Key Points.

UNIT II RDBMS Vs No SQL

Lecture 12Hrs

Comparison of relational databases to new No SQL stores, Mongo DB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges No SQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregated-Oriented Databases, Replication and Sharding, Map Reduce on databases, Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

UNIT III Document Data bases

Lecture 12Hrs

No-SQL Key-Value Databases using Mongo DB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analysis or Real Time Analytics.

UNIT IV Column Oriented Databases

Lecture 12Hrs

Column-oriented No SQL databases using Apache HBASE, Column-oriented No SQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters,

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Expiring Usage.

UNIT V Key Value Data bases

Lecture 12Hrs

No SQL Key-Value databases using Riak, Key-Value Data bases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multi operation Transactions, Query by Data, Operations by Sets, Firebase- Cloud hosted No SQL Database, Graph No SQL databases using Neo4j, No SQL database development tools and programming languages, Graph Databases features, consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.

Text books:

1. Sadalage, P. & Fowler, No SQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence, Wiley Publications, 1st Edition 2019.

Reference Books:

1. Redmond, E. & Wilson, J. (2012). Seven Databases in Seven Weeks: A Guide to Modern Databases and the No SQL Movement (1st Ed.). Raleigh, NC: The Pragmatic Programmers, LLC. ISBN-13: 978-1934356920 ISBN-10: 1934356921
2. Guy Harrison, Next Generation Database: No SQL and big data, Apress.

Online Learning Resources:

1. <https://www.ibm.com/cloud/learn/nosql-databases>
2. <https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp>
3. <https://www.geeksforgeeks.org/introduction-to-nosql/>
4. <https://www.javatpoint.com/nosql-databa>

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(AUTONOMOUS)

	SOFTWARE DEFINED DATA CENTER	L	T	P	C
		3	0	0	3

Course Objectives:

- Introduce conventional Data Centers followed by Modern Data Centers
- To discuss various software elements of modern data centers
- Explain Virtualization concepts for Data Centers
- Discuss Compute, Storage and Network virtualization

Course Out comes:

After completion of the course, students will be able to

- Understanding of difference between Conventional Data Center Vs Modern Data Centers
- Differentiate Cloud computing and Software Defined Data Centers
- Differentiate Virtualization with conventional techniques
- Explore the techniques of Software Defined Compute, Storage and Networking components
- Able Manage Software Defined Data Centers and Develop the techniques for future Data Centers.

UNIT I Introduction

Lecture 12Hrs

Data Center evolution, A history of Modern Data Center, Focus on cost reduction, Focus on Customer service in the business, Flattening of the IT organization, IT as an operational Expense, Monolithic Storage Array rise and fall, Move From Disk to Flash, Emergence of Convergence, The Role of Cloud computing.

UNIT II Emerging Data Center Trends

Lecture 12Hrs

Emergence of SDCC, Commoditization of Hardware, Software Defined – Compute, Storage, Networking and Security, Software Defined Storage (SDS), Hyper convergence, Hyper Converged Infrastructure(HCI) and SDS relationship, Flash in Hyper convergence, Modern IT business Requirements.

UNIT III Data Center Agility

Lecture 12Hrs

Principles and Strategies, Transform Data Center, Align Data Center and Business Needs, Server virtualization, VDI, Eliminate and Implement Monolithic to Hyper convergence, Full Stack Management.

UNIT V Hyper converged Infrastructure

Lecture

12Hrs Software Defined Storage, SDS comparison to Traditional Storage, SDS requirements, SDS in Hyper converged, Hyper convergence Design Model, Virtual Storageappliances, Appliance vs. Software/Reference Architecture,

UNIT V Future Data Centers

Lecture 12Hrs

Data growth, Storage capacity, flash storage deployment, Deployment Experiences SDS and HCI, IT transformations- Automation, Orchestration, Dev Ops, Open Standards and

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Interoperability, Performance Benchmarking Standards, Future Trends, Containers Instead of virtual machines, Open Source tools, Beyond Today's Flash, Pooling of Resources.

Text books:

1. Building a Modern Data Center, Principles and Strategies of Design, Scott D.Lowe, James Green, David Davis. Actual Tech Media, 2016.

Reference Books:

1. Data Center Handbook: Plan, Design, Build, and Operations of a Smart Data Center, Second Edition, HwaiyuGeng P.E., 2021 John Wiley & Sons.

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL (AUTONOMOUS)

	ROBOTICS AND INTELLIGENT SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand the basic concepts of robotics.
- Discuss the requirement of robotic technology
- Introduce robotics kinematics, dynamic analysis and programming.
- Understand the concepts of intelligent system and apply them to robotics

Course Out comes:

After completion of the course, students will be able to

- Understand general concepts of Robotics and intelligent systems.
- Understand robotics control systems
- Analyze and understand the various programming languages of robotics
- Understand Industrial robots and its applications
- Create IoT solutions using sensors, actuators and Devices

UNIT- I

Lecture 8Hrs

Introduction to Robotics : Back ground, Historical development, Robot Arm Kinematics and Dynamics, Manipulator Trajectory planning and Motion Control, Robot Sensing

UNIT- II

Lecture 9Hrs

Robot Arm Kinematics and Dynamics: Introduction to Kinematics, Direct and Inverse Kinematics Problem and solution, Dynamics introduction, Lagrange-Euler Formulation, Newton Euler Formulation, Generalized D'Alembert Equations of motion. Trajectory planning,

UNIT- III

Lecture 9Hrs

Sensing and Vision: Introduction to Sensing, Proximity Sensing, Touch Sensors, Force and Torque Sensing, Image acquisition, Illumination techniques, Imaging Geometry, Recognition and Interpretation.

UNIT IV

Lecture 8Hrs

Robot Programming Languages: Introduction to Robot Programming Languages, Characteristics of Robot Level Languages, three levels of robot programming, requirements of a robot programming language, Task Level Languages, problems peculiar to robot languages, Introduction to Robot

Operating System (ROS)

UNIT V

Lecture 8Hrs

Robot Intelligence: Introduction, State Space Search, Problem Reduction, Use of Predicate

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Logic, Means-Ends Analysis, Problem solving, Robot Learning, Robot Task Planning, Basic Problems in Task Planning, Expert systems and knowledge engineering.

Text books:

1. K.S. Fu, R.C. Gonzalez, C.S.G. Lee, Robotics : Control, Sensing, Vision and Intelligence
2. Aaron Martinez, Enrique Fernandez, Learning ROS for Robotics Programming: A practical, instructive, and comprehensive guide to introduce your self to ROS, the top-notch, leading robotics framework, PACKT publishing, Open Source.

Reference Books:

John J. Craig, Introduction to Robotics: Mechanics and Control, Addison Wesley publication, Third Edition.

Online Learning Resources

<https://nptel.ac.in/courses/107106090>

<https://nptel.ac.in/courses/112108298>

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
(AUTONOMOUS)

	CLOUD SECURITY	L	T	P	C
		3	0	0	3

Pre-requisites: Computer Networks, Cryptography and Network Security, Cloud Computing.

Course Objectives:

The course is designed to

- Understand the cloud security and privacy issues.
- Familiarize with the Threat Model and Cloud Attacks.
- Understand the Data Security and Storage.
- Analyze Security Management in the Cloud

Course Out comes:

After completion of the course, students will be able to

- Distinguish the various cloud security and privacy issues.
- Analyze the various threats and Attack tools.
- Describe the Data Security and Storage.
- Analyze the Security Management in the Cloud

UNIT I Over view of Cloud Computing

Lecture 9 Hrs

Overview of Cloud Computing: Introduction, Definitions and Characteristics, Cloud Service Models, Cloud Deployment Models, Cloud Service Platforms, Challenges Ahead.

Introduction to Cloud Security: Introduction, Cloud Security Concepts, CSA Cloud Reference Model, NIST Cloud Reference Model, NIST Cloud Reference Model.

UNIT II Cloud Security and Privacy Issues

Lecture 9 Hrs

Cloud Security and Privacy Issues: Introduction, Cloud Security Goals/Concepts, Cloud Security Issues, Security Requirements for Privacy, Privacy Issues in Cloud.

Infrastructure Security: The Network Level, the Host Level, the Application Level, SaaS Application Security, PaaS Application Security, IaaS Application Security.

UNIT III Threat Model and Cloud Attacks

Lecture 9 Hrs

Threat Model and Cloud Attacks: Introduction, Threat Model- Type of attack entities, Attack surfaces with attack scenarios, A Taxonomy of Attacks, Attack Tools-Network-level attack tools, VM-level attack tools, VMM attack tools, Security Tools, VMM security tools.

UNIT IV Data Security and Storage

Lecture 9Hrs

Information Security Basic Concepts, an Example of a Security Attack, Cloud Software Security Requirements, Rising Security Threats. Data Security and Storage: Aspects of Data Security, Data Security Mitigation, Provider Data and Its Security.

UNIT V Security Management in the Cloud

Lecture 9 Hrs

Evolution of Security Considerations, Security Concerns of Cloud Operating Models, Identity Authentication, Secure Transmissions, Secure Storage and Computation, Security

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Using Encryption Keys, Challenges of Using Standard Security Algorithms, Variations and Special Cases for Security Issues with Cloud Computing, Side Channel Security Attacks in the Cloud. Security Management in the Cloud- Security Management Standards, Availability Management, Access Control, Security Vulnerability, Patch, and Configuration Management.

Text books:

1. Preeti Mishra, Emmanuel S Pilli, Jaipur R C Joshi Graphic Era., —Cloud Security Attacks, Techniques, Tools, and Challenges, 1st Edition, 2022, CRC press.
2. Tim Mather, SubraKumaraswamy, and ShahedLati—Cloud Security and Privacy, 1st Edition, 2019, O'Reilly Media, Inc.

Reference Books:

1. Naresh Kumar Sehgal Pramod Chandra, P. Bhatt John M. Acken., —Cloud Computing with Security Concepts and Practices, 2nd Edition Springer nature Switzerland AG 2020.
2. Essentials of Cloud Computing by K. Chandrasekaran Special Indian Edition CRC press.
3. Raj kumar Buyya,—Cloud Computing Principles and Paradigms, John Wiley.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc19_cs64/preview
- <https://archive.nptel.ac.in/courses/106/105/106105167/>

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(AUTONOMOUS)

	No SQL Lab	L	T	P	C
		0	0	3	1.5

Course Outcomes:

Upon successful completion of the course, the student will be able to:

List of Experiments:

1. Mongo DB installation and configuration in windows.
2. Demonstrate how to create and drop a database in Mongo DB.
3. Creating the Collection in Mongo DB on the fly
4. Creating collection with options before inserting the documents and drop the collection created.
5. Mongo DB insert document
 - a. Insert single document
 - b. Insert multiple documents in collection
6. Querying all the documents in json format and Querying based on the criteria.
7. Mongo DB update document
 - a. Using update() method.
 - b. Using save() method.
8. MongoDB delete document from a collection.
 - a. Using remove() method.
 - b. Remove only one document matching your criteria
 - c. Remove all documents
9. Mongo DB Projection
10. limit(), skip(), sort() methods in Mongo DB
11. Mongo DB indexing
 - a. Create index in Mongo DB
 - b. Finding the indexes in a collection
 - c. Drop indexes in a collection
 - d. Drop all the indexes
12. Mongo DB with java and PHP
 - a. Create a simple application that uses Mongo DB with Java
 - b. Create a simple application that uses Mongo DB with PHP

Web References:

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(AUTONOMOUS)

	Quantum & Cloud Computing Lab	L	T	P	C
		0	0	3	1.5

Course Objectives (COs)

This course aims to:

1. Introduce fundamental quantum computing concepts such as qubits, superposition, and quantum gates using Qiskit.
2. Develop an understanding of quantum algorithms through practical implementation, including Deutsch's algorithm.
3. Provide hands-on experience in cloud computing by simulating cloud environments, VM allocation, and scheduling policies.
4. Analyze cloud resource management techniques such as load balancing and deployment models.
5. Explore cloud security challenges by simulating cyber threats like Denial of Service (DoS) attacks.

Course Out comes (CLOs)

By the end of this course, students will be able to:

1. Implement and compare classical and quantum bits using Qiskit.
2. Design and analyze quantum circuits using logic gates and linear algebra principles.
3. Simulate and evaluate cloud computing infrastructures including data centers, VM allocation, and scheduling policies.
4. Apply resource provisioning techniques to optimize cloud performance and load balancing.
5. Assess cloud security threats by implementing and analyzing DoS attack simulations.

Quantum Computing Lab:

1. Simulating Classical vs Quantum Bits
 - Implement **classical bits and qubits** using Qiskit.
 - Compare **bit flip** vs **quantum superposition** using Hadamard gates.
2. Quantum Logic Gates Implementation
 - Implement and visualize basic **quantum gates** (X, Y, Z, H, S, T).
 - Apply these gates to single and multiple qubits.
3. Linear Algebra in Quantum Computing
 - Represent **quantum states** using matrices and vectors.
 - Perform **matrix operations** (addition, multiplication, tensor product).
4. Deutsch's Algorithm Implementation
 - Demonstrate quantum parallelism using **Deutsch's algorithm**. Compare results with classical computation.

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Cloud Computing Lab:

1. **Simulation of a Simple Cloud Data Center:** Create a cloud environment with multiple **Hosts, Virtual Machines (VMs), and Cloudlets**.
2. **VM Allocation and Scheduling Policies:** Implement and compare **Time-Shared and Space-Shared** VM allocation policies.
3. **Resource Provisioning and Load Balancing :** Simulate dynamic **resource allocation** for better load balancing.
4. **Cloudlet Scheduling Algorithms:** Implement and compare FCFS (First-Come-First-Serve), Round Robin, and Priority-Based Scheduling.
5. **Performance Analysis of Cloud Deployment Models :** Simulate and compare **Public, Private, Hybrid, and Community Cloud** environments.
6. **Simulating Denial of Service (DoS) Attacks:** Implement a scenario where multiple requests overload a cloud server.

TEXT BOOKS:

1. Shashank Tiwari, Professional No SQL, Wrox Press, Wiley, 2011, ISBN: 978-0-470-94224-6
2. Pramod Sadalage and Martin Fowler, No SQL Distilled, Addison-Wesley Professional, 2012.

REFERENCE BOOKS:

1. Dan McCreary and Ann Kelly, Making Sense of No SQL, Manning Publications, 2013.
2. Gaurav Vaish, Getting Started with No SQL, Packt Publishing, 2013.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

MINORS

BUILDING PLANNING & CONSTRUCTION TECHNOLOGY

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A01M01	Construction Materials	3	-	0	3
2	23A01M02	Construction Methods	3	-	0	3
3	23A01M03	Building Planning And Drawing	3	-	0	3
4	23A01M04	Surveying	3	-	0	3
5	23A01M05	Concrete Technology	3	-	0	3
6	23A01M06	Concrete Technology Lab	0	0	3	1.5
7	23A01M07	Surveying Lab	0	0	3	1.5

ENERGY SYSTEMS

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A02M01	Energy Audit and Management	3	-	0	3
2	23A02M02	Energy Management in Building	3	-	0	3
3	23A02M03	Energy Storage Technologies	3	-	0	3
4	23A02M04	Energy Scenario and Energy Policy	3	-	0	3
5	23A02M05	Waste Energy Management	3	-	0	3
6	23A02M06	Project in Energy Systems	-	-	6	3

MICRO GRID TECHNOLOGY

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A02M07	Futuristic Power Systems	3	0	0	3
2	23A02M08	Power Electronic Converters for Energy Sources	3	0	0	3
3	23A02M09	Microgrid Power and Control Architecture	3	0	0	3
4	23A02M10	Microgrid System Design	3	0	0	3
5	23A02M11	Analysis of Smart Grid Systems	3	0	0	3
6	23A02M12	Project in Micro Grid Technology	0	0	6	3

3D PRINTING

S. No.	Course Code	Title	L	T	P	Credits
1	23A03M01	Material Science & Engineering	3	0	0	3
2	23A03M02	Additive Manufacturing	3	0	0	3
3	23A03M03	Material Characterization Techniques	3	0	0	3
4	23A03M04	3D Printing Materials and Applications	3	0	0	3
5	23A03602T	CAD/CAM	3	0	0	3
6	23A03M05	Computer Aided Machine Drawing	0	0	3	1.5
7	23A03607	3D Printing Lab	0	0	3	1.5
Total			15	0	6	18

INDUSTRIAL ENGINEERING

S. No.	Course Code	Title	L	T	P	Credits
1	23A03M06	Production Planning & Control	3	0	0	3
2	23A03M07	Marketing Management	3	0	0	3
3	23A03M08	Supply Chain Management	3	0	0	3
4	23A03M09	Strategic Management for Competitive Advantage	3	0	0	3
5	23A03M10	Six Sigma & Lean Manufacturing	3	0	0	3
6	23A03M11	Applied Project Work	0	0	6	3
Total			15	0	6	18

EMBEDDED SYSTEMS AND IOT

S.No.	Course Code	Title	L	T	P	Credits
1	23A04M01	Embedded Systems Technology	3	0	0	3
2	23A04M02	Real Time Embedded systems design and Analysis	3	0	0	3
3	23A04M03	Principles of IoT	3	0	0	3
4	23A04703b	Wireless Sensor Networks	3	0	0	3
5	23A04M04	Industrial Internet of things	3	0	0	3
6	23A04M05	Principles of IoT Lab	0	0	3	1.5
7	23A04M06	Industrial Internet of things Lab	0	0	3	1.5
Total			15	0	06	18

ELECTRONIC SYSTEMS

S. No.	Course Code	Title	L	T	P	Credits
1	23A04505	Electronic Circuits	3	0	0	3
2	23A04506	Digital Electronics	3	0	0	3
3	23A04M07	Principles of Communication Engineering	3	0	0	3
4	23A04M08	Electronic Instrumentation	3	0	0	3
5	23A04503T	Microprocessors and Microcontrollers	3	0	0	3
6	23A04M09	Electronic Circuits and Digital Electronics Lab	0	0	3	1.5
7	23A04503P	Microprocessors and Microcontrollers Lab	0	0	3	1.5
Total			15	0	06	18

COMPUTER SCIENCE AND ENGINEERING

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A05M01	Data Structures And Algorithms	3	-	0	3
2	23A32502	Software Engineering	3	-	0	3
3	23A05M02	Computer Organization	3	-	0	3
4	23A05M03	Web Technologies	3	-	0	3
5	23A37401T	Computer Networks	3	-	0	3
6	23A05M04	Data Structures and Algorithms Lab	0	0	3	1.5
7	23A05M05	Web Technologies Lab	0	0	3	1.5

CYBER SECURITY

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A38502	Introduction to Cyber Security	3	-	0	3
2	23A37601T	Cyber Crimes & Digital Forensics	3	-	0	3
3	23A05601T	Cryptography & Network Security (Pre-requisite: Computer Networks)	3	-	0	3
4	23A35703a	Cyber Laws and Security Policies	3	-	0	3
5	23A05701b	Blockchain Technology	3	-	0	3
6	23A37502P	Cyber Security Lab	0	0	3	1.5
7	23A05601P	Cryptography & Network Security Lab	0	0	3	1.5

INTERNET OF THINGS

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A35M01	Introduction to IoT	3	-	0	3
2	23A37503	Wireless Sensor Networks for CS	3	-	0	3
3	23A35H01	Communication Protocols for IoT	3	-	0	3
4	23A35H04	Industrial IoT	3	-	0	3
5	23A37501T	Cloud Computing	3	-	0	3
6	23A32503P	IoT Lab	0	0	3	1.5
7	23A37501P	Cloud Computing Lab	0	0	3	1.5

DATA SCIENCE

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A32M01	Introduction to Data Science	3	-	0	3
2	23A32M02	Statistical Learning for Data Science	3	-	0	3
3	23A32M03	Data Engineering	3	-	0	3
4	23A32M04	Machine learning fundamentals	3	-	0	3
5	23A32M05	Data Science applications	3	-	0	3
6	23A32M06	Data Science Practice Lab (R/Python)	0	0	3	1.5
7	23A32M07	Statistical Learning & ML Lab	0	0	3	1.5

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A33M01	Introduction to Artificial Intelligence	3	-	0	3
2	23A33M02	Machine Learning Fundamentals	3	-	0	3
3	23A33M03	Deep Learning & Neural Networks	3	-	0	3
4	23A31501	Natural Language Processing	3	-	0	3
5	23A30604a	Computer Vision	3	-	0	3
6	23A33M04	AI & ML Lab	0	0	3	1.5
7	23A33M05	NLP & Computer Vision Lab	0	0	3	1.5

DATA ANALYTICS

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A32M06	Introduction to Data Analytics	3	-	0	3
2	23A32M03	Data Engineering	3	-	0	3
3	23A30603b	Predictive Analytics	3	-	0	3
4	23A32M07	Big Data Analytics (Hadoop, Spark)	3	-	0	3
5	23A32M08	Data Analytics with Power BI/Tableau/Matplotlib	3	-	0	3
6	23A32M09	Data Analytics Tools Lab	0	0	3	1.5
7	23A32M10	Big Data & NoSQL Lab	0	0	3	1.5

DATA SCIENCE AND ANALYTICS

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A32M01	Introduction to Data Science	3	-	0	3
2	23A32M02	Statistical Learning for Data Science	3	-	0	3
3	23A32M11	Data Visualization & Exploratory Data Analysis	3	-	0	3
4	23A30601	Big Data Analytics	3	-	0	3
5	23A32602	Recommender Systems	3	-	0	3
6	23A32M12	Data Visualization & EDA Lab	0	0	3	1.5
7	23A32M13	Recommender System Lab	0	0	3	1.5

PROGRAMMING & COMPUTATIONAL INTELLIGENCE

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A30M01	Python for AI & Data Science	3	-	0	3
2	23A30M02	Data Structures & Algorithms for AI	3	-	0	3
3	23A30603a	Reinforcement Learning	3	-	0	3
4	23A30M03	Quantum Computing for AI	3	-	0	3
5	23A30M04	Edge AI & IoT	3	-	0	3
6	23A30M05	Python & DS Lab	0	0	3	1.5
7	23A30M06	RL & Quantum AI Lab	0	0	3	1.5

AI APPLICATIONS & EMERGING TECHNOLOGIES

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A30M07	AI in Finance & Business Analytics	3	-	0	3
2	23A30M08	Ethical AI & Responsible AI	3	-	0	3
3	23A31701	Generative AI & Prompt Engineering	3	-	0	3
4	23A31702b	AI in Cybersecurity	3	-	0	3
5	23A31703c	HealthCare AI	3	-	0	3
6	23A30M09	Generative AI Lab	0	0	3	1.5
7	23A44503	AI Applications Lab	0	0	3	1.5

QUANTUM COMPUTING

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A32603	Introduction to Quantum Computing	3	-	0	3
2	23A54601b	Mathematical Foundations for Quantum Computing	3	-	0	3
3	23A32M14	Quantum Algorithms	3	-	0	3
4	23A32M15	Quantum Information and Communication	3	-	0	3
5	23A32M16	Quantum Machine Learning (QML)	3	-	0	3
6	23A32M17	Quantum Algorithms Lab	0	0	3	1.5
7	23A32M18	Quantum Programming and Simulation Lab	0	0	3	1.5

QUANTUM TECHNOLOGIES

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	23A32M19	Foundations of Quantum Technologies	3	-	0	3
2	23A32M20	Solid State Physics for Quantum Technologies	3	-	0	3
3	23A32M21	Quantum Optics Prerequisites for Quantum Technologies	3	-	0	3
4	23A32M22	Introduction to Quantum Communication	3	-	0	3
5	23A32M23	Introduction to Quantum Sensing	3	-	0	3
6	23A32M24	Quantum Communication and Sensing Lab	0	0	3	1.5
7	23A32M25	Quantum Devices and Materials Lab	0	0	3	1.5

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
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Course Code	CONSTRUCTION MATERIALS					L	T	P	C					
23A01M01						3	0	0	3					
Course Objectives :- 1. To Understand the Types, Physical Characteristics, Testing, and Deterioration of Natural and Artificial Stones Used In Construction.(L2) 2. To Explain and Classify Various Structural Clay Products Such As Bricks, Tiles, Terracotta, Porcelain, and their Manufacturing Processes and Applications.(L2) 3. To Analyze and Apply the Knowledge of Cement, Aggregates, and Admixtures To Evaluate the Properties of Fresh and Hardened Concrete, Including Mix Design. (L3) 4. To Evaluate and Apply the Knowledge of Wood and Timber—Its Properties, Preservation, Defects, Testing, and Uses In Building Construction. (L3) 5. To Understand and Interpret the Composition, Application Techniques, and Properties of Paints, Varnishes, Enamels, and Surface Finishes.(L2)														
Course Outcomes :- Upon Successful Completion of the Course, the Student Will Be Able To: 1. Identify the Characteristics, Types, Deterioration, and Applications of Building Stones. (L2) 2. Classify and Evaluate the Quality and Suitability of Bricks, Tiles, and Other Structural Clay Products. (L3) 3. Analyze the Properties and Mix Design of Cement, Aggregates, and Concrete For Construction Use. (L4) 4. Assess Timber Based On Its Properties, Preservation Methods, and Applications In Building Works. (L3) 5. Explain the Properties, Preparation, and Application of Paints, Varnishes, and Polishes For Surface Protection. (L2)														
CO – PO Articulation Matrix														
Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2	2	–	2	2	2	–	–	–	–	–	3	2
CO 2	3	2	2	2	2	2	–	–	–	–	–	–	3	2
CO 3	3	3	3	3	3	–	–	–	–	–	–	2	3	3
CO 4	3	2	2	–	2	2	–	–	–	–	–	–	3	2
CO 5	2	2	1	–	2	1	2	–	–	–	–	–	2	2
UNIT – I														
STONES Introduction - Rock-Forming Minerals - Classification of Rocks - Quarrying of Stones - Seasoning of Stone - Dressing of Stone - Uses of Stones - Characteristics of Good Building Stones - Testing of Stones - Deterioration of Stones - Durability of Stones - Preservation of Stones - Selection of Stones - - Common Building Stones - Artificial Stones - Applications of Stones.														
UNIT – II														
STRUCTURAL CLAY PRODUCTS Introduction - Physical Properties of Clays - Classification of Bricks - Ingredients of Good Brick Earth - Characteristics of Good Brick - Manufacturing of Bricks - Different Forms of Bricks - Testing of Bricks - Defects of Bricks - Clay Tiles - Fire-Clay Bricks Or Refractory Bricks – Terracotta – Porcelain – Stoneware – Earthenware – Glazing – Majolica - Application of Clay Products.														
UNIT – III														
CEMENT & CONCRETE Introduction - Portland Cement - Chemical Composition - Hydration of Cement- Manufacture of Cement - Testing of Cement - Types of Cement – AGGREGATES - Classification of Aggregates - Fine Aggregate & Coarse Aggregate - Testing of Aggregates - Quality of Mixing & Curing Water – Admixtures For Concrete - Principles of Mix Design - Fresh and Hardened Properties .														
UNIT – IV														

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL

(AUTONOMOUS)

WOOD

Introduction - Classification of Trees - Growth of Trees - Classification of Timber (IS: 399) - Structure of Timber - Characteristics of Good Timber - Seasoning of Timber - Defects In Timber - Diseases of Timber - Decay of Timber - Preservation of Timber (IS: 401) - Fire Resistance of Timber - Testing of Timber (IS: 1708) - Suitability of Timber For Specific Uses - Properties of Wood - Wood Products - Applications of Wood and Wood-Products

UNIT – V

Paints, Enamels and Varnishes

Introduction - Composition of Oil Paint - Characteristics of An Ideal Paint - Preparation of Paint - Covering Power of Paints - Pigment Volume Concentration (P.V.C.) - Painting Plastered Surfaces - Painting Wood Surfaces - Painting Metal Surfaces - Defects - Enamel - Distemper - Water Wash and Colour Wash - Varnish - French Polish - Wax Polish - Miscellaneous Paints

Text Books:-

1. **S.K. Duggal**, *Building Materials*, New Age International Pvt. Ltd., 3rd Revised Edition, 2008.
2. P.C. Varghese, *Building Materials*, PHI Learning Pvt. Ltd., 2nd Edition, 2015.

Reference Books:-

1. M. L. Gambhir, *Building Materials*, Tata McGraw Hill Publishing Co. Ltd., 4th Edition, 2013.
2. S. S. Bhavikatti, *Building Materials*, Vikas Publishing House Pvt. Ltd., 3rd Edition, 2015.
3. B. C. Punmia, *Building Materials*, Laxmi Publications Pvt. Ltd., 2010.
4. Jagadish, Venkatarama Reddy, *Alternate Building Materials and Technology*, New Age International Publishers, 2010.
5. Surendra Singh, *Engineering Materials*, Vikas Publishing House Pvt. Ltd., 2014.
6. P. D. Kulkarni et al., *Civil Engineering Materials*, Tata McGraw Hill Publishing Co. Ltd., 2008.

Online Resources :-

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
(AUTONOMOUS)

Course Code	CONSTRUCTION METHODS										L	T	P	C
23A01M02											3	0	0	3
Course Objectives :-														
1. To Understand the Importance, Types, and Selection of Foundations For Various Site Conditions. (L2) 2. To Identify and Apply Construction Techniques of Different Types of Masonry and Structural Components.(L3) 3. To Describe and Evaluate Different Types and Techniques of Plastering Used In Construction. (L2) 4. To Examine the Properties, Applications, and Construction Methods of Various Flooring Types.(L4) 5. To Analyze and Design Basic Components of Industrial Structures With Emphasis On Modern Techniques and Materials.(L4)														
Course Outcomes :-														
Upon Successful Completion of This Course, the Student Will Be Able To:														
1. Understand Various Types of Foundations, their Functions, and Methods To Improve Soil Bearing Capacity.(L2) 2. Apply Knowledge of Masonry Types, Bonds, and Composite Construction Methods In Practical Construction.(L3) 3. Identify Types of Plastering, Defects, and Special Techniques Used In Surface Finishing. (L2) 4. Analyze Different Flooring Materials, Laying Techniques, and Repair Methods. (L4) 5. Design and Assess Components of Industrial Structures Such as Pebs, Trusses, and Roofing Systems.(L6)														
CO – PO Articulation Matrix														
Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2	–	–	2	2	2	–	–	–	–	2	3	2
CO 2	3	3	2	–	2	2	–	–	–	–	–	2	3	3
CO 3	3	2	–	–	2	1	–	–	–	–	–	2	2	2
CO 4	3	3	2	2	3	1	–	–	–	–	–	3	3	3
CO 5	3	3	3	3	3	2	2	–	–	–	–	3	3	3
UNIT – I														
FOUNDATIONS														
Introduction To Foundations - Importance of Foundations In Construction - Functions of A Foundation - Factors Affecting the Choice of Foundations - Types of Foundations - Shallow Foundations: Strip Footing, Isolated Footing, Combined Footing, Raft Foundation - Deep Foundations: Pile Foundations, Well Foundations - Site Investigation For Foundations - Soil Testing Methods, Bearing Capacity of Soils ,Methods of Improving Bearing Capacity.														
UNIT – II														
MASONRY														
Introduction To Masonry Construction - Definition and Importance of Masonry - Comparison of Different Types of Masonry - Types of Masonry Construction - Brick Masonry: Stretcher, Header, English, Flemish Bonds - Stone Masonry: Random Rubble Masonry, Coursed Rubble Masonry, Ashlar Masonry -Concrete Block Masonry:Hollow Blocks, Solid Blocks, Interlocking Blocks - Composite Masonry: Brick-Stone Composite Masonry - Lintels, Arches, and Copings - Construction Techniques and Materials Used														
UNIT – III														
PLASTERING														
Introduction To Plastering - Purpose and Importance of Plastering - Materials Used In Plastering (Cement, Lime, Gypsum) - Types of Plastering - Lime Plaster, Cement Plaster, Gypsum Plaster, Stucco Plaster - Methods of Plastering -Single Coat, Double Coat, and Three-Coat Plastering - Defects In Plastering and Remedies - Cracking, Peeling, Efflorescence, Blistering - Special Plastering Techniques -Waterproof Plastering, Decorative														

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Plastering		
UNIT – IV		
FLOORING Introduction To Flooring - Importance and Requirements of Good Flooring - Types of Flooring - Hard Flooring: Stone (Marble, Granite, Kota), Concrete Flooring , Ceramic and Vitrified Tiles - Resilient Flooring: PVC, Linoleum, Rubber Flooring - Wooden Flooring: Solid Wood, Laminated Wood, Parquet Flooring - Special Flooring: Epoxy Flooring, Mosaic Flooring, Terrazzo Flooring - Construction Methods of Flooring - Laying of Different Floor Materials - Sub-Base Preparation and Finishing - Defects In Flooring and Repair Techniques - Cracking, Dampness, Uneven Settlement		
UNIT – V		
INDUSTRIAL STRUCTURES Introduction To Industrial Structures - Requirements of Industrial Buildings - Structural Components - Types of Industrial Structures - Steel Structures: Components of Steel Buildings (Trusses, Columns, Girders) - Pre-Engineered Buildings (PEB): Concept, Advantages, and Applications - Portal Frames and Space Frames: Design and Construction Considerations - Roofing Systems In Industrial Buildings - Trusses, Shell Roofs, Domes, Vaults - Construction of Warehouses and Sheds : Material Selection, Structural Stability Considerations - Factories and Large-Span Structures, Construction Techniques For Long-Span Structures , Fire Resistance and Safety Measures - Special Considerations For Industrial Buildings - Ventilation and Lighting Requirements, Vibration Control and Noise Reduction Techniques		
Text Books :-		
1. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, <i>Building Construction</i> , Laxmi Publications (P) Ltd., New Delhi, 2008. 2. P.C. Varghese, <i>Building Construction</i> , PHI Learning Pvt. Ltd., 2nd Edition, 2017.		
Reference Books:-		
1. Sushil Kumar, <i>Building Construction</i> , Standard Publishers Distributors, New Delhi, 2013 2. S. S. Bhavikatti, <i>Building Construction</i> , Vikas Publishing House Pvt. Ltd., 2nd Edition, 2016. 3. Dr. S. C. Rangwala, <i>Building Construction</i> , Charotar Publishing House, 26th Edition, 2014. 4. R. L. Peurifoy, <i>Construction Planning, Equipment and Methods</i> , McGraw Hill Education, 8th Edition, 2010		
Online Resources :-		

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
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Course Code	BUILDING PLANNING AND DRAWING	L	T	P	C
23A01M03		3	0	0	3

Course Objectives :-

1. To Understand the Principles of Building Planning and Regulatory Requirements For Residential and Public Structures. (L2)
2. To Apply Functional Planning Skills For Residential, Public, and Commercial Buildings Including Vastu and Barrier-Free Concepts. (L3)
3. To Analyze and Prepare Building Plans and Elevations For Industrial and Special-Purpose Structures. (L4)
4. To Utilize Computer-Aided Drafting Tools To Develop Architectural and Working Drawings. (L3)
5. To Evaluate Planning Strategies In Compliance With National Codes and Sustainability Standards. (L5)

Course Outcomes :-

Upon Completion of This Course, the Student Will Be Able To:

1. Understand the Objectives and Principles of Building Planning, and Interpret National and Local Building Regulations. (L2)
2. Apply Functional Planning Techniques For Various Residential Building Layouts and Integrate Vastu Principles. (L3)
3. Design and Draw Public, Commercial, and Industrial Buildings as Per Functional and Universal Design Standards. (L6)
4. Develop Detailed Plans, Elevations, and Sections Using CAD Software For Residential and Non-Residential Buildings. (L3)
5. Evaluate and Prepare Service Drawings, Submission Drawings, and Working Drawings In Compliance With Municipal Regulations. (L5)

CO – PO Articulation Matrix

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2	–	–	–	2	2	1	–	–	–	2	2	3
CO 2	3	2	3	–	2	–	–	–	2	–	–	2	3	3
CO 3	3	3	3	–	2	–	–	–	2	–	–	2	3	3
CO 4	2	–	2	–	3	–	–	–	–	–	–	2	3	3
CO 5	3	2	3	–	3	2	2	2	2	2	–	3	3	3

UNIT – I

BUILDING PLANNING PRINCIPLES & REGULATIONS

Introduction To Building Planning - Objectives of Planning - Principles of Planning - Orientation of Buildings - Building Bye-Laws and Regulations - Necessity of Building Bye-Laws - National Building Code (NBC) Provisions - Local Municipal and Development Authority Regulations - Setbacks and Open Space Requirements - Floor Area Ratio (FAR) and Floor Space Index (FSI) , Height Regulations and Ground Coverage - Lighting, Ventilation, and Fire Safety Regulations - Natural Lighting and Ventilation Standards - Fire-Resistant Construction and Safety Measures - Concepts of Green Building and Sustainable Planning - Energy-Efficient Building Design - Passive Solar Architecture

UNIT – II

RESIDENTIAL BUILDINGS

Classification of Residential Buildings - Individual Houses, Duplex Houses, Apartments, Row Houses, Villas - Functional Requirements of A Residential Building - Zoning and Space Requirements For Different Rooms - Circulation and Connectivity - Types of Residential Plans - Single-Bedroom, Double-Bedroom, and Multi-Storey Residential Plans - Preparation of Building Plans - Plan, Elevation, and Section of A Simple Residential Building - Vastu Considerations In Residential Planning - Orientation of Rooms as Per Traditional Indian Architectural Practices.

UNIT – III

PUBLIC and COMMERCIAL BUILDINGS

Classification of Public Buildings - Educational Buildings (Schools, Colleges, Universities) - Institutional

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Buildings (Hospitals, offices, Banks) - Recreational Buildings (Theatres, Auditoriums, Stadiums) - Functional Requirements and Planning of Public Buildings - Planning of Commercial Buildings - Shopping Malls, Hotels, office Buildings - Preparation of Drawings For Public Buildings - Plan, Elevation, and Section of A Public/Commercial Building - Universal Design and Barrier-Free Planning - Provision For Differently-Abled Individuals - Ramps, Lifts, Tactile Paving, and Accessible Washrooms		
UNIT – IV		
INDUSTRIAL and SPECIAL STRUCTURES		
Introduction To Industrial Buildings - Functional Planning of Industries - Layout of Factory Buildings - Types of Industrial Structures - Warehouses, Godowns, Cold Storage Facilities - Special Purpose Buildings - Parking Structures, Bus Terminals, Railway Stations, Airports - Planning of Multi-Storied Buildings - Structural Aspects and Service Provisions - Vertical Circulation (Lifts, Escalators, Staircases) - Preparation of Drawings For Industrial Buildings – Plan, Elevation, and Section of An Industrial Shed Or Warehouse		
UNIT – V		
COMPUTER-AIDED DRAWING (CAD) and WORKING DRAWINGS		
Introduction To CAD In Building Drawing - Importance of CAD In Modern Construction - Software Used (Autocad, Revit, Sketchup) - Preparation of Working Drawings - Detailed Plans, Elevations, and Sections – Site Plan, Key Plan, and Service Plans - Structural Drawings and Detailing - Footing Details, Column Layouts, Slab Reinforcement - Preparation of Submission Drawings - Sanction Drawings as Per Municipal Regulations - Approval Process and Documentation - Service Drawings - Electrical, Plumbing, and HVAC (Heating, Ventilation, and Air Conditioning) Drawings.		
Text Books :-		
1. M. G. Shah, C. M. Kale, <i>Building Drawing</i>, Tata McGraw Hill Publishing Co. Ltd., 2nd Edition, 2012. 2. Gurucharan Singh, <i>Building Drawing</i>, Standard Publishers Distributors, 9th Edition, 2015.		
Reference Books:-		
1. K. R. Karnan, <i>Building Planning and Drawing</i>, Scitech Publications (India) Pvt. Ltd., 2016. 2. S. P. Bindra, <i>Building Drawing and Detailing</i>, Dhanpat Rai Publishing Co., 2014. 3. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, <i>Building Planning and Drawing</i>, Laxmi Publications Pvt. Ltd., 2011.		
Online Resources :-		

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
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Course Code	SURVEYING	L	T	P	C
23A01M04		3	0	0	3

Course Objectives :-

The Objectives of This Course Are To Enable the Students To:

1. Understand the Principles, Classifications, and Fundamental Techniques of Surveying Including Chain, Compass, Levelling, and Plane Table Surveys. **(L2)**
2. Apply Basic Surveying Instruments and Techniques For Measurement of Distances, Angles, Levels, Areas, and Volumes. **(L3)**
3. Analyze and Compute Traverse Data, Horizontal and Vertical Angles Using theodolites and Trigonometric Levelling Methods. **(L4)**
4. Evaluate the Use of Modern Surveying Instruments Like Total Stations, GPS, and Remote Sensing Tools For Spatial Data Acquisition. **(L5)**
5. Interpret Photogrammetric Data For Topographic Mapping, Aerial Triangulation, and Preparation of Maps Using Stereoscopy. **(L5)**

Course Outcomes :-

After Successful Completion of the Course, the Student Will Be Able To:

1. To Understand the Basic Principles, Classifications, and Techniques of Surveying Using Chain, Compass, Levelling, and Plane Table Methods. **(L2)**
2. To Apply Appropriate Methods For Levelling, Contouring, and Calculating Areas and Volumes For Civil Engineering Projects. **(L3)**
3. To Analyze and Compute Angular Measurements, Traverses, and Heights Using theodolites and Trigonometric Levelling. **(L4)**
4. To Utilize Modern Surveying Tools Such as EDM, Total Station, GPS, Drones, and Lidar For Advanced Spatial Data Collection. **(L3)**
5. To Evaluate and Interpret Photogrammetric Data For Map Preparation, Stereoscopy, Aerial Triangulation, and Mosaics. **(L5)**

CO – PO Articulation Matrix

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2	2	–	2	–	–	–	1	2	–	–	3	2
CO 2	3	3	2	2	2	–	1	–	–	1	–	–	3	3
CO 3	3	3	2	2	3	–	–	–	–	2	–	2	3	2
CO 4	3	2	2	2	3	–	2	–	–	2	–	2	3	3
CO 5	2	3	2	3	3	–	2	2	–	1	–	2	3	3

UNIT – I

Introduction and Basic Concepts: Introduction, Objectives, Classification and Principles of Surveying, Surveying Accessories. Introduction To Compass, Leveling and Plane Table Surveying.

Linear Distances- Approximate Methods, Direct Methods- Chains- Tapes, Ranging, Tape Corrections.

Prismatic Compass- Bearings, Included Angles, Local Attraction, Magnetic Declination, and Dip –Systems and W.C.B and Q.B Systems of Locating Bearings

UNIT – II

Leveling- Types of Levels, Methods of Levelling, and Determination of Levels, Effect of Curvature of Earth and Refraction.

Contouring- Characteristics and Uses of Contours, Methods of Contour Surveying.

Areas - Determination of Areas Consisting of Irregular Boundary and Regular Boundary.

Volumes -Determination of Volume of Earth Work In Cutting and Embankments For Level Section, Capacity of Reservoirs.

UNIT – III

Theodolite Surveying: Types of theodolites, Temporary Adjustments, Measurement of Horizontal Angle By Repetition Method and Reiteration Method, Measurement of Vertical Angle, Trigonometrical Leveling When Base Is Accessible and Inaccessible.

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Traversing: Methods of Traversing, Traverse Computations and Adjustments, Introduction To Omitted Measurements.		
UNIT – IV		
Curves: Types of Curves and their Necessity, Elements of Simple, Compound, Reverse Curves. Introduction To Tacheometric Surveying. Modern Surveying Methods: Principle and Types of E.D.M. Instruments, Total Station- Advantages and Applications. Introduction To Global Positioning System. Introduction To Drone Survey and Lidarsurvey(Light Detection and Ranging).		
UNIT – V		
Photogrammetry Surveying: Introduction, Basic Concepts, Perspective Geometry of Aerial Photograph, Relief and Tilt Displacements, Terrestrial Photogrammetry, Flight Planning; Stereoscopy, Ground Control Extension For Photographic Mapping- Aerial Triangulation, Radial Triangulation, Methods; Photographic Mapping- Mapping Using Paper Prints, Mapping Using Stereo-Plotting Instruments, Mosaics, Map Substitutes.		
Text Books :-		
1. S. K. Duggal, <i>Surveying</i> (Vol. 1 & 2), Tata McGraw Hill Publishing Co. Ltd., New Delhi, 5th Edition, 2019. 2. C. Venkatramaiah, <i>Textbook of Surveying</i> , Universities Press, 1st Edition, 2011.		
Reference Books:-		
1. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, <i>Surveying</i> (Vol. 1), Laxmi Publications (P) Ltd., New Delhi, 18th Edition, 2024. 2. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, <i>Surveying</i> (Vol. 2), Laxmi Publications (P) Ltd., New Delhi, 17th Edition, 2022. 3. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, <i>Surveying</i> (Vol. 3), Laxmi Publications (P) Ltd., New Delhi, 16th Edition, 2023. 4. A. M. Chandra, <i>Plane Surveying and Higher Surveying</i> , New Age International Pvt. Ltd., New Delhi, 3rd Edition, 2015. 5. N. Basak, <i>Surveying and Levelling</i> , Tata McGraw Hill Publishing Co. Ltd., New Delhi, 4th Edition, 2014. 6. K. R. Arora, <i>Surveying</i> (Vol. 1, 2 & 3), Standard Book House, Delhi, 12th Edition, 2015.		
Online Resources :-		
https://Onlinecourses.Nptel.Ac.In/Noc20_Ce18/Preview		

RAVINDRA COLLEGE OF ENGINEERING FOR WOMEN, KURNOOL
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Course Code	CONCRETE TECHNOLOGY										L	T	P	C
23A01M05											3	0	0	3
Course Objectives :- The Objectives of This Course Are To Enable the Student To: 1. Understand the Composition, Properties, Specifications, and Testing Methods For Concrete Materials. [L1] 2. Learn the Methods of Concrete Production Including Mixing, Transportation, Placing, Compaction, and Curing. [L2] 3. Acquire Knowledge On the Behavior of Fresh and Hardened Concrete and Factors Influencing Performance. [L3] 4. Develop the Ability To Design Concrete Mixes Using Standard Methods For Normal and High Strength Concrete. [L4] 5. Explore Special Concretes, Quality Control Measures, and Durability Aspects. [L4]														
Course Outcomes :- After completing this course, the student will be able to: CO1: Explain the chemical and physical properties of cement, aggregates, water, and admixtures as per IS standards. [L2] CO2: Describe the manufacturing process of concrete, including equipment, methods, and curing techniques. [L2] CO3: Analyze the fresh and hardened properties of concrete including workability, strength, and microstructure. [L4] CO4: Design concrete mix proportions using ACI and IS methods for normal and high-strength concrete. [L4] CO5: Evaluate the behavior and performance of concrete under various conditions, including shrinkage, creep, corrosion, thermal effects, and special concrete types. [L5]														
CO – PO Articulation Matrix														
CO \ PO/PS O	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	3	2	-	-	2	-	2	-	-	2	-	1	3	2
CO2	3	3	2	2	2	-	-	-	-	2	-	1	3	2
CO3	3	3	3	3	3	-	2	-	1	3	-	2	3	3
CO4	3	3	3	2	3	-	-	-	1	3	-	2	3	3
CO5	3	3	3	3	3	1	3	2	1	3	-	2	2	3
UNIT – I														
Materials For Making Concrete: Cement - Chemical Composition, Physical Properties; Tests, I.S. Specifications; Different Types – Aggregates - Classification, Mechanical Properties, and Tests, Grading Requirements, Sampling of Aggregate; Water - Quality of Water, Permissible Impurities As Per I.S; – Mineral Admixtures: Fly Ash, GGBS, Silica Fume, Metakaolin, Rice Husk Ash, Etc. Chemical Admixtures - Accelerators, Retarders, Water Reducing Agents, Super Plasticizers, Air Entrainers, Water Proofer.														
UNIT – II														
Concrete: Manufacture of Concrete, Measurement of Materials, Storage and Handling, Batching Plant and Equipment Mixing - Types of Mixers, Transportation of Concrete, Pumping of Concrete, Placing of Concrete, Under Water Concreting, Compaction of Concrete, Curing of Concrete, Ready Mixed Concrete. Mix Design - Nominal Mixes and Design Mixes, Factors Influencing Mix Design; ACI Method and I.S Method, Design For High Strength Mixes.														
UNIT – III														
Fresh, Hardened Properties of Concrete: Fresh Concrete - Workability, Tests For Workability, Cohesion, Segregation, and Bleeding; Hardened Concrete- Factors Affecting Strength of Concrete, Strength of Concrete In Compression, Tension, and Flexure; Stress- Strain Characteristics and Elastic Properties; Introduction To Microstructural Properties of Concrete														
UNIT – IV														
Mix Design - Factors Influencing Mix Proportion - Mix Design By ACI Method and I.S. Code Method - Design of High Strength Concrete. Strength of Concrete - Shrinkage and Temperature Effects - Creep of Concrete - Permeability of Concrete - Durability of Concrete - Corrosion - Causes and Effects - Remedial Measures-thermal Properties of Concrete - Micro Cracking of Concrete.														
UNIT – V														

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Special Concrete - Lightweight Concrete - Fibre Reinforced Concrete - Polymer-Polymer Modified Concrete - Ferrocement - Mass Concrete - Ready Mix Concrete- Self Compacting Concrete- Quality Control - Sampling and Testing-Acceptance Criteria.
Text Books :-
1. Properties of Concrete, AM Nevelli, Prentice Hall Publishers, 2012, 5th Edition. 2. Concrete Technology: theory and Practice, M.L. Gambhir, Tata Mc Graw Hill Publishers, 2017, 5th Edition.
Reference Books:-
1. P. Kumar Mehta , Paulo J.M. Monteiro, Concrete: Microstructure, Properties, and Materials, Mcgraw Hill Education,2014 2. Concrete Technology: theory and Practice, M. S. Shetty and A. K. Jain, S Chand Co., Publishers, 2018. 3. Concrete Technology, J.J. Brooks and A. M. Neville, Pearson, 2019, 2nd Edition. 4. Santakumar A.R., Concrete Technology, Oxford University Press, New Delhi, 2007.
Online Resources :-

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Course Code	CONCRETE TECHNOLOGY LAB					L	T	P	C					
23A01M06						3	0	0	3					
Course Objectives :- The Objectives of This Course Are To: 1. Understand the Physical Properties and Behavior of Cement and Aggregates. [L1] 2. Gain Hands-On Experience In Determining the Fresh and Hardened Properties of Concrete. [L2] 3. Conduct Standard Laboratory Procedures For Assessing the Quality of Concrete Materials. [L3] 4. Familiarize With Concrete Mix Design Using IS Method. [L4] 5. Interpret Experimental Data For Evaluating the Performance of Concrete. [L5]														
Course Outcomes :- After Completing This Course, the Student Will Be Able To: CO1: Determine the Physical Properties of Cement Through Standard Tests Such As Fineness, Consistency, Setting Time, Soundness, and Compressive Strength. [L3] CO2: Assess the Properties of Fine and Coarse Aggregates and Evaluate the Workability of Fresh Concrete Using Standard Test Methods. [L3] CO3: Prepare, Cure, and Test Concrete Specimens To Determine Compressive and Tensile Strength, and Analyze Stress-Strain Behavior. [L4] CO4: Apply the IS Method For Concrete Mix Design and Verify the Mix Through Testing. [L4] CO5: Demonstrate the Use of Non-Destructive Testing Equipment To Assess the Quality of Hardened Concrete. [L3]														
CO – PO Articulation Matrix														
Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2	–	–	–	–	–	–	–	–	–	1	3	2
CO 2	3	2	–	–	–	–	–	–	–	–	–	1	3	2
CO 3	3	2	2	1	2	–	–	–	–	–	–	1	3	2
CO 4	3	3	3	2	2	–	–	–	–	–	–	2	3	2
CO 5	3	2	3	2	2	–	–	–	–	–	–	2	3	3
CO 6	3	2	2	2	2	–	–	–	–	–	–	2	3	3
1. Determination of Fineness and Specific Gravity of Cement. 2. Determination of Consistency of Standard Cement Paste. 3. Determination of Initial and Final Setting Times of Cement. 4. Determination of Compressive Strength of Cement. 5. Determination of Soundness of Cement By La-Chatalier’s Apparatus. 6. Determination of Fineness Modulus of Coarse and Fine Aggregates. 7. Determination of Percentage of Voids, Bulk Density, Specific Gravity of Course and Fine Aggregates. 8. Workability Tests: Slump Cone Test, Compaction Factor Test, Vee-Bee Consistometer, Flow Test. 9. Preparing and Curing Concrete Specimens For Tests & Determination of Compressive Strength of Concrete Cubes. 10. Study of Stress - Strain Characteristics of Concrete and Tests For Tensile Strength of Concrete. 11. Experiments To Demonstrate the Use of Non-Destructive Test Equipment. 12. Mix Design: IS Code Method.														
Text/ Reference Books :- 1. Concrete Technology: theory and Practice, M.L. Gambhir, Tata Mc Graw Hill Publishers, 2017, 5th Edition.														
Online Resources :-														

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Course Code	SURVEYING LAB	L	T	P	C
23A01M07		3	0	0	3

Course Objectives :-

After completing this course, the student will be able to:

1. Understand and perform different types of surveying techniques including chain, compass, plane table, and Theodolite surveying. [L2]
2. Apply methods of leveling and contouring for field measurements and building layouts. [L3]
3. Interpret and plot survey data accurately to prepare maps and plans. [L3]
4. Use modern surveying instruments like Total Station for precise measurements. [L3]
5. Develop skills to set out curves and perform traversing for practical civil engineering projects. [L3]

Course Outcomes :-

After completing this course, the student will be able to:

CO1: Conduct chain, compass, and plane table surveys, and accurately plot survey details. [L3]

CO2: Perform leveling operations including fly leveling, profile leveling, and contouring for terrain mapping. [L3]

CO3: Use theodolite for precise measurement of horizontal angles and set out simple curves. [L4]

CO4: Operate Total Station equipment for accurate data collection and site layout. [L4]

CO5: Prepare field survey maps and layouts for building and civil engineering projects based on survey data. [L4]

CO – PO Articulation Matrix

Course Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	3	2	-	1	-	-	-	1	2	-	-	3	2
CO2	3	3	2	-	1	-	-	-	1	2	-	-	3	2
CO3	3	3	3	-	2	-	-	-	1	3	-	-	3	3
CO4	3	3	3	-	2	-	-	-	1	3	-	-	3	3
CO5	3	3	3	-	2	-	-	-	1	3	-	-	3	3

1. Chain Survey - Traversing and Plotting of Details
2. Compass Survey - Traversing With Compass and Plotting
3. Plane Table Survey - Method of Radiation and Intersection
4. Levelling - Fly Leveling - Plane of Collimation Method
5. Levelling - Fly Leveling - Rise and Fall Method
6. Levelling - Longitudinal and Cross Sectioning
7. Levelling - Contour Surveying
8. Layout of Buildings
8. Profile Levelling and Cross Sectioning.
9. Grid Contouring
10. Theodolite Surveying - Measurement of Horizontal Angle By Method of Repetition and Reiteration
11. Setting Out of Simple Curves - Linear Methods
12. Description of Total Station

Text Books :-

Surveying and Levelling By N.N.Basak, TMH Publication 2. Surveying By B.C. Punamia, A.K. Jain and A.K. Jain, Vol. 1, Laxmi Publications (P) Ltd., New Delhi

Reference Books:-

Online Resources :-

Online Resources:

<https://Nptel.Ac.In/Courses/105/107/105107122/>

<https://Nptel.Ac.In/Courses/105/104/105104101/>

[Http://Sl-Iitr.Vlabs.Ac.In/Sl-Iitr/](http://Sl-Iitr.Vlabs.Ac.In/Sl-Iitr/)

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L	T	P	C
3	0	0	3

(23A02M01) ENERGY AUDIT AND MANAGEMENT

Course Objectives:

- Able to understand the basic concepts of Energy Audit and Management, Principles and objectives of Energy management and Basics of Thermal, Electrical energy management
- Able to apply the fundamental concepts for development of energy management systems
- Able to Design Energy Audit reports
- Able to analyze designed energy management systems

Course Outcomes:

CO1: Understanding the Fundamentals of Energy Auditing and Conservation. -**L2**

CO2: Analyzing Energy Audit Concepts and Techniques -**L3**

CO3: Designing and Implementing Energy Management Programs -**L5**

CO4: Managing Thermal Energy and Implementing Energy Conservation Techniques **L4**

CO5: Implementing Electrical Energy Management and Conservation -**L4**

UNIT I

Introduction:

Basic elements and measurements - Mass and energy balances – Scope of energy auditing industries - Evaluation of energy conserving opportunities.

UNIT II

Energy Audit Concepts:

Need of Energy audit - Types of energy audit – Energy management (audit) approach - understanding energy costs - Bench marking – Energy performance - Matching energy use to requirement - Maximizing system efficiencies - Optimizing the input energy requirements - Duties and responsibilities of energy auditors- Energy audit instruments - Procedures and Techniques.

UNIT III

Principles and Objectives of Energy Management:

Design of Energy Management Programs - Development of energy management systems – Importance - Indian need of Energy Management - Duties of Energy Manager - Preparation and presentation of energy audit reports - Some case study and potential energy savings.

UNIT IV

Thermal Energy Management:

Energy conservation in boilers - steam turbines and industrial heating systems - Application of FBC - Cogeneration and waste heat recovery - Thermal insulation - Heat exchangers and heat pumps - Building Energy Management.

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UNIT V

Electrical Energy Management:

Supply side Methods to minimize supply-demand gap- Renovation and modernization of power plants - Reactive power management – HVDC - FACTS - Demand side - Conservation in motors - Pumps and fan systems – Energy efficient motors. Demand side management.

Textbooks:

1. Hamies, Energy Auditing and Conservation; Methods Measurements, Management and Case study, Hemisphere, Washington, 1980.
2. Energy Management: W.R.Murphy, G.Mckay

Reference Books:

1. Energy Management Principles: C.B.Smith
2. Efficient Use of Energy : I.G.C.Dryden
3. Energy Economics A.V.Desai
4. Guide book for National Certification Examination for Energy Managers and Energy Auditors (Could be downloaded from www.energymanagertraining.com).

Online Learning Resources: . <https://nptel.ac.in/courses/108106022>

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(23A02M02) ENERGY MANAGEMENT IN BUILDING

Course Objectives:

- Able to understand the significance of energy management in buildings, Ventilation and Air conditioning aspects, Climate influence, energy usage estimation and technological options for energy management
- Able to apply the Energy management concepts for building designs
- Able to analyze different conditions for preparation of efficient energy management system for a building
- Able to design efficient energy management systems for buildings

Course Outcomes:

CO1: Understanding the Fundamentals of Energy Use in Buildings Apply the Energy management concepts for building designs -**L2**

CO2: Analyzing Indoor Environmental Requirements and Their Impact on Energy Use -**L3**

CO3: Examining the Role of Climate and Environmental Factors in Building Energy Use -**L3**

CO4: Evaluating Energy Utilization and Heat Transfer in Building Envelopes **L4**

CO5: Implementing Energy Management Strategies for Buildings -**L5**

UNIT I

Overview of the Significance of Energy use and Energy Processes in Building:

Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications – Concepts of energy efficient building.

UNIT II

Indoor Environmental Requirement and Management:

Thermal comfort – Ventilation and air quality - Air-conditioning requirement - Visual perception – Illumination requirement - Auditory requirement – Concept of sick building syndrome – Significance in energy management in buildings.

UNIT III

Climate:

Solar radiation and their influences - The sun-earth relationship and the energy balance on the earth's surface – Climate – Wind - Solar radiation - Temperature – Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

UNIT IV

END-USE:

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Energy utilization and requirements – Lighting and day lighting – End-use energy requirements – Status of energy use in buildings – Estimation of energy use in a building - Heat gain and thermal performance of building envelope – Steady and non steady heat transfer through the glazed window and the wall – Standards for thermal performance of building envelope – Evaluation of the overall thermal transfer – Concepts of window management.

UNIT V

Energy Management Options:

Energy audit and energy targeting – Technological options for energy management – Modifications for energy efficient buildings for Indian conditions. Energy Management for large tower buildings.

Textbooks:

1. Heating and Cooling of Buildings – Design for Efficiency, J. Krieder and A. rabl, McGraw Hill, 1994.
2. Mechanical and Electrical Equipment for Buildings, S. M. Guinness and Reynolds, Wiley, 1989.

Reference Books:

1. Energy Design for Architects, Shaw, Aee Energy Books, 1991.
2. Energy Conservation in Buildings – Royal Institute of Architecture, Canada.
3. Publication of CBRI, Roorkee – Energy Management in Buildings.

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(23A02M03) ENERGY STORAGE TECHNOLOGIES

Course Outcomes:

CO1: Understanding the Basics of Batteries and Their Performance Characteristics -L2

CO2: Analyzing Primary Battery Types and Their Applications -L3

CO3: Exploring Advanced Battery Technologies and Their Applications -L4

CO4: Assessing Energy Storage for Renewable Energy Systems -L4

CO5: Understanding and Applying Supercapacitors in Energy Storage -L4

UNIT I

Batteries:

Types-battery characteristics - voltage, current, capacity, volumetric energy density, specific energy density, charge rate, cycle life, internal resistance, energy efficiency, shelf life, battery management system, SoC, SoH estimation techniques. Testing of batteries, battery charging method, Factors affecting the battery performance.

UNIT II

Primary Batteries:

Fabrication, performance aspects, packing and rating of alkaline manganese, silver oxide cells. Lithium primary batteries-Lithium/Manganese Dioxide, Lithium/Carbon Monofluoride, Lithium/Thionyl chloride, Lithium/Sulfur Dioxide, Lithium/Iodine, Lithium-Aluminum/Iron Disulfide.

UNIT III

Advanced Batteries:

Advanced Lead Acid Battery -design, performance aspects, Pb-Acid batteries for transportation, nickel-metal hydride batteries, zinc- alkaline batteries, ZEBRA Battery (Na/NiCl₂) -NaS Battery-Lithium-Ion Battery-Lithium- Polymer Battery, Li-air batteries, Li-S batteries, Sodium -ion batteries.

UNIT IV

Storage for Renewable Energy Systems:

Solar energy, Wind energy, pumped hydro energy, Energy storage in Micro-grid and Smart grid, Energy Management with storage systems, Battery SCADA, Increase of energy conversion efficiencies by introducing energy storage. Superconducting Magnetic Energy Storage (SMES), charging methodologies, Photo galvanic cells, semiconductor solar batteries (SC-SB), thermo-ionic converter s, dye-sensitized solar cells (DSSC).

UNIT V

Supercapacitors and Fuel Cells:

Fundamentals of electrochemical Supercapacitors, electrode and electrolyte interfaces and their capacitances, charge-discharge characteristics, energy/power density, design, fabrication, operation and evaluation, thermal management. Supercapacitors for transportation applications - aqueous and organic based supercapacitors, Pseudo and asymmetric supercapacitors. Advance battery-supercapacitors hybrids for auto, space and marine applications. Fuel Cells working Principle and Construction.

TEXT BOOKS:

1. Dell, Ronald M. Rand and David A. J., —Understanding Batteriesl, Royal Society of Chemistry, 2001.

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2. Vladimir S. Bagotsky, Alexander M. Skundin, Yuriy VM. Volfkovich., —Electrochemical power sources : Batteries, fuel cells, and supercapacitorsl, John Wiley & Sons, Inc.,2015.

REFERENCES:

1. Lindon David, —Handbook of Batteriesl, McGraw Hill, 2002.
2. Kiehne H. A., —Battery Technology Handbookl, Expert Verlag, Renningen Malsheim, 2003.
3. AuliceScibioh M. and Viswanathan B., —Fuel Cells – Principles and Applicationsl, University Press, 2006.
4. A.G.Ter-Gazarian, —Energy Storage for Power Systemsl, The Institution of Engineering and Technology (IET) Publication, UK, 2011.

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(23A02M04) ENERGY SCENARIO AND ENERGY POLICY

Course Objectives:

The student able to:

- Understand the basic concepts of Energy scenario and Energy policy
- Apply the concepts to strengthen energy system
- Analyze the different scenarios around the globe
- Implementation of suitable Energy policy for existing systems

Course Outcomes:

CO1: Understanding the Global Energy Scenario and Its Impact on Economic Development-L2

CO2: Analyzing International Energy Policies and Treaties -L3

CO3: Understanding the Indian Energy Scenario and Policy Framework -L2

CO4: Evaluating Global Energy Issues and Energy Security -L3

CO5: Exploring Energy Conservation and Sustainable Development- L4

UNIT I

Global Energy Scenario:

Role of energy in economic development and social transformation - Energy and GDP - GNP and its dynamics - Energy sources and overall Energy demand and availability - Energy consumption in various sectors and its changing pattern - Depletion of energy sources and impact exponential rise in energy consumption on economies of countries

UNIT II

Energy Policies:

International Energy Policies of G-8 Countries - G-20 Countries - OPEC Countries - EU Countries - International Energy Treaties (Rio, Montreal, Kyoto) - INDO-US Nuclear Deal.

UNIT III

Indian Energy Scenario:

Energy resources and Sector wise energy Consumption pattern Impact of energy on economy and development - National and State Level Energy policies and Issues - Status of Nuclear and Renewable Energy and Power Sector reforms. Energy policy 2030

UNIT IV

Energy Policy:

Global Energy Issues - Energy Security - Energy Vision Energy Pricing and Impact of Global Variations Energy Productivity (National and Sector wise productivity).

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UNIT V

Energy Conservation:

Act – 2001 and its features - Electricity Act – 2003 and its features - Energy Crisis - Future energy options - Need for use of new and renewable energy sources - Energy for Sustainable development.

Textbooks:

1. Energy for a sustainable World: Jose Golden berg, Thomas Johan son, AKN. Reddy, Robert Williams (Wiley Eastern).
2. Energy Policy, B.V. Desai (Wiley Eastern)

Reference Books:

1. Modeling approach to long term demand and energy implication, J.K.Parikh
2. Energy Policy and Planning, B.Bukhootsow
3. TEDDY Year Book Published by Tata Energy Research Institute(TERI) World Energy Resources, Charles E. Brown, _International Energy Outlook‘ - EIA annual Publication
4. BEE Reference book: no. 1/2/3/4

Online Learning Resources: 1. <https://nptel.ac.in/courses/109106161>

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(23A02M05) **WASTE ENERGY MANAGEMENT**

Course Outcomes:

CO1: Understanding and Characterizing Different Types of Waste -L2

CO2: Analyzing Thermo-Chemical Waste Conversion Methods and Their Environmental Impacts -L3

CO3: Exploring Bio-Chemical Conversion Technologies for Waste to Energy-L4

CO4: Evaluating Energy Production from Waste Plastics and Waste Heat Recovery-L4

CO5: Analyzing Environmental and Health Impacts of Waste-to-Energy Conversion and Case Studies-L3

UNIT I

Characterization Of Wastes :

Agricultural residues and wastes including animal wastes; industrial wastes; municipal solid wastes. Waste processing types and composition of various types of wastes; Characterization of Municipal Solid Waste, Industrial waste and Biomedical Waste, waste collection and transportation; waste processing-size reduction, separation; waste management hierarchy, waste minimization and recycling of Municipal solid waste.

UNIT II

Thermo Chemical Conversion:

Incineration, pyrolysis, gasification of waste using gasifiers, environmental and health impacts of incineration; strategies for reducing environmental impacts. Energy production from wastes through incineration, energy production through gasification of wastes, Energy production through pyrolysis and gasification of wastes, syngas utilization.

UNIT III

Bio-Chemical Conversion:

Anaerobic digestion of sewage and municipal wastes, direct combustion of MSW-refuse derived solid fuel, industrial waste, agro residues, anaerobic digestion biogas production, and present status of technologies for conversion of waste into energy, design of waste to energy plants for cities, small townships and villages. Energy production from wastes through fermentation and trans esterification. Cultivation of algal biomass from waste water and energy production from algae, Energy production from organic wastes through anaerobic digestion and fermentation.

UNIT IV

Energy Production From Waste Plastics, Gas Cleanup Waste, Heat Recovery:

Concept of conversion efficiency, energy waste, waste heat recovery classification, advantages and applications, commercially viable waste heat recovery devices.

UNIT V

Environmental and Health Impacts-Case Studies: Environmental and health impacts of waste to energy conversion, Industrial waste management – Hazardous waste management – E-waste management -EV Batteries – Mobile Chargers - case studies of commercial waste to energy plants, waste to energy- potentials and constraints in India, eco- technological alternatives for waste to energy conversions.

TEXT BOOKS:

1. Parker, Colin and Roberts, —Energy from Waste – An Evaluation of Conversion Technologies, Elsevier Applied Science, 1985.
2. Khandelwal, K. C. and Mahdi, S. S., —Biogas Technology - A Practical Hand Book, Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

REFERENCES:

1. Robert C. Brown, —Thermo-chemical Processing of Biomass: Conversion into Fuels, Chemicals and Power, John Wiley and Sons, USA, 2019
2. Sergio Capareda, —Introduction to Biomass Energy Conversions, CRC Press, USA, 2013.
3. Krzysztof J Ptasiński, —Efficiency of Biomass Energy: An Exergy Approach to Biofuels, Power, and Biorefineries, John Wiley & Sons, USA, 2013.
4. Vesilind, P.A., and Worrell W. A, —Solid Waste Engineering, 2nd Ed, Cengage India, 2016.

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(23A02M07) FUTURISTIC POWER SYSTEMS

Course Objectives:

1. To explore the state of the art and future trends in power systems.
2. To understand the technical, economic and social challenges in power system evolution.
3. To realize the role and importance of Microgrids in futuristic power systems.

Course Outcomes

Upon successful completion of this course, the learner will be able:

1. To solicit the importance of large scale renewable energy integration with existing grid infrastructure. L1
2. To understand the importance and utility of Energy storage systems in futuristic power systems. L2
3. To explore large scale micro-grid deployment with RES and ESS integration. L3
4. To understand the role of communication and IT Infrastructure in power system and related challenges. L2
5. To explore the potential of Microgrids and its importance in Indian context. L3

UNIT-I

Introduction:

Present status of worldwide scenario of electricity generation, transmission and distribution; Energy infrastructure- Resilience and Security; Social, Technical and economic challenges; Major trends driving power system evolution; State of the art technologies in power system.

UNIT-II

Renewable Energy Integration:

Review of renewable energy (RE) resources and systems: Solar- PV, Solar Thermal, Wind, Biomass, Micro-hydro and Fuel Cell, comparison of various RE resources; Renewable Energy Policies and present status of integration with existing grid; Large scale integration of renewable energy-Technical challenges, enabling technologies, International requirements;

Renewable energy forecasting

UNIT-III

Energy Storage Systems (ESS):

Review of energy storage components: Battery, VRB, Ultra-capacitor, Fuel Cells, Pumped Hydro-Storage and flywheels, comparison of ESS technologies; Importance of ESS in futuristic power systems; Aggregated ESS, Distributed ESS; Applications of ESS: Energy Management (Load Leveling and Peak Shifting), Fluctuation Suppression (Intermittency Mitigation), Uninterruptible Power System Low-Voltage Ride Through; Placement of the ESS to Improve

Power Quality, Voltage Regulation Using ESS, ESS as Spinning Reserve.

UNIT-IV**Micro-grid and Smart-grid:**

Micro-grid evolution: Micro-grid concept, importance in futuristic power system, basic architectures and control, objectives and state of the art technologies; Microgrid as a building block of Smart-grid; Smart-grid concept, Smart Grid versus conventional electrical networks, Smart-grid infrastructure, Smart Grid communication system and its cyber security,

International standard IEC 61850 and its application to Smart-grid;

Microgrids /smart grid and Electric Vehicles integration. Technical, Economic, Environmental and Social Benefits of Microgrid Operation. Microgrids for Rural Electrification, Review of Microgrid Best Practices through Case Studies: Strategic Planning, Operations: Commercial and Financial Considerations; Technical and Social Context.

UNIT-V**Communication and IT infrastructure:**

Requirements of Communication and IT infrastructure in futuristic power systems: various communication protocols, comparison of performance; IEEE standard: IEEE 802.11 Mesh Networking, IEEE 802.15.4-Wireless Sensor Networks; Communications Technologies for Smart metering; Cyber security issues and mitigation techniques.

Text Books:-

1. Microgrids Architectures and Control Edited by Nikos Hatziaargyriou, IEEE and Wiley, 2014
2. Energy Storage for Sustainable Microgrid by David Wenzhong Gao, Elsevier, 2015
3. Introduction to the Smart Grid- Concepts, Technologies and Evolution by Salman K. Salman, IET, 2017
4. Energy Storage Systems and Components by Alfred Rufer, CRC Press, 2018

Reference Books:-

1. Energy Efficiency and Renewable Energy Handbook Edited by D. Yogi Goswami and Frank Kreith, 2nd Edition- 2016, CRC
2. Clean Energy Microgrids, Edited by Shin'ya Obara and Jorge Morel IET, 2017
3. Hybrid-Renewable Energy Systems in Microgrids- Integration, Developments and Control edited by Hina Fathimaby *et al.*, Elsevier WoodHead Publishing, 2018
4. Smart Microgrids: Lessons from Campus Microgrid Design and Implementation edited by Hassan Farhangi, CRC Press 2017

Website Reference / Video Courses:

1. NPTEL Web Course on: DC Microgrid And Control System Prof. Avik Bhattacharya, IIT Roorkee
2. NPTEL Web Course on Electronics and Distributed Generation Dr. Vinod John Department of Electrical Engineering IISc Bangalore
3. NPTEL Web Course on Introduction to Smart Grid, PROF. N.P. PADHY Department of Electrical Engineering IIT Roorkee PROF. PREMALATA JENA Department of Electrical Engineering
4. NPTEL Web Course on Electric vehicles and Renewable energy, Prof. Ashok Jhunjhunwala, Prof. Prabhjot Kaur, Prof. Kaushal Kumar Jha and Prof. L Kannan, IIT Madras

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(23A02M08) POWER ELECTRONIC CONVERTERS for ENERGY SOURCES

Course Objectives

1. To illustrate the design philosophies used in the domain of microgrid power converters.
2. To explore the control implementations in power converters for voltage, current and power regulation for various DC and AC energy sources

Course Outcomes

Upon successful completion of this course, the learner will be able to:

1. Select and size various passive and active components for power converters L3
2. Design power converters used with DC energy resources with their control implementation L5
3. Design power converters used with AC energy resources with their control implementation L5
4. Understand the design considerations of power conditioning unit for ESS, SPV and Wind applications. L2
5. Understand the design and selection aspects of various auxiliary systems and components used in PCUs L2

UNIT-I

Selection of components for Power Electronics Converters (PEC):

Selection and Sizing of capacitors and magnetic components for PECs, design of Magnetic Components; Selection and sizing of Power Devices, Commonly used software tools for selection and sizing; Heatsink- selection and sizing.

UNIT-II

Design and Control of DC-DC Converters:

Design of Buck and Boost converters, Design examples; Design of Bidirectional Converters. Design of gate driver circuits; Review of DC-DC converter modelling; Closed loop PI controller design for buck and boost converters; Current control mode and voltage control mode.

UNIT-III

Design and Control of DC-AC converters:

Design of Inverter for standalone applications; Design of grid connected Inverter with different grid synchronization strategies- ZCD, PLL; Strategies for Control of voltage, current and power output.

UNIT-IV

Design of PCU for SPV and Wind Application:

Various topologies of Power Converter Unit (PCU) for SPV and Wind energy systems. Design considerations of PCU for SPV and Wind energy Systems and Design Examples.

UNIT-V**Design of PCU for ESS Applications and Design of Auxiliary System and Interfaces:**

Design consideration for BDC converter based PCU for batteries and Ultra-capacitors. Design of current and voltage sensor interfaces; Design considerations for auxiliary power supplies; Design of protection and snubber components: Introduction to Digital Signal Processors (DSP) and microcontroller interfaces

Text Books:-

1. Power Electronic Converters for Microgrids by Suleiman M. Sharkh, Mohammad A. Abusara, Georgios I. Orfanoudakis Babar Hussain, IEEE and Wiley, 2014
2. Control Circuits In Power Electronics Practical Issues In Design And Implementation Edited by Miguel Castilla, IET, 2016
3. Control and Dynamics in Power Systems and Microgrids by Lingling Fan, CRC Press, 2017
4. Integrated Power Electronic Converters and Digital Control, by Ali Emadi, Alireza Khaligh, Zhong Nie, and Young Joo, Lee 2009, CRC Press.

Reference Books:-

1. Cooperative Synchronization in Distributed Microgrid Control by Ali Bidram, Vahidreza Nasirian Ali Davoudi, and Frank L. Lewis, Springer, 2017
2. Hybrid-Renewable Energy Systems in Microgrids- Integration, Developments and Control edited by Hina Fathimaby et al., Elseiver WoodHead Publishing, 2018
3. Smart Microgrids- Lessons from Campus Microgrid Design and Implementation edited by Hassan Farhangi, CRC Press 2017
4. Energy Storage Systems and Components by Alfred Rufer, CRC Press, 2018
5. Microgrids Design and Implementation edited by Antonio Carlos Zambroni de Souza and Miguel Castilla, Springer, 2019
6. Microgrids Architectures and Control Edited by Nikos Hatziargyriou, IEEE and Wiley, 2014
7. Energy Storage for Sustainable Microgrid by David Wenzhong Gao, Elsevier, 2015

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(23A02M09) MICROGRID POWER and CONTROL ARCHITECTURE

Course Objectives:

1. To study various power and control architectures adopted in DC and AC Microgrids.
2. To explore various control strategies used in power control
3. To take insight into operations stability and protection issues related to Microgrids

Course Outcomes:

Upon successful completion of this course, the learner will be able to:

1. Understand various types Microgrids based on applications, power and control architecture. L2
2. Illustrate various power control strategies adopted in DC, AC and Hybrid Microgrids L3
3. Compare and contrast various control architectures used DC, AC and Hybrid Microgrids also various aspects related to stability in Microgrids L4
4. Illustrate the various operational challenges in Microgrids L3
5. Comprehend the various aspects related to the stability in Microgrids L4

UNIT-I

Microgrid Power Architecture:

Types of Microgrid system, AC and DC and Hybrids Microgrids, Application based Suitability of Microgrid type; Review of power architecture of various Microgrids deployed world-wide. Comparison of various Microgrid power architectures.

UNIT-II

AC Microgrid and Control Architecture:

Black-start operation, Grid Synchronisation- various Grid synchronization methods, Grid forming and grid following operations; Power Control- Real and reactive power control in AC Microgrid, simple droop control and other variants of droop control, Unit Power Flow Control, Feeder power flow control and Mixed mode control, source optimization; Centralized, decentralised, distributed and hierarchical control architecture, Local and system / supervisory level control strategies, Multi Agent System (MAS) Based Control; Control approaches used in AC Microgrids deployed worldwide. Microgrid standards IEEE

1547 series. Communication in AC Microgrids

UNIT-III

DC Microgrid and Control Architecture:

Power sharing in DC Microgrids, source optimization; Control approaches: Centralized, decentralised, distributed and hierarchical control architecture. Control approaches used in hybrid Microgrids. Communication in DC/Hybrid Microgrids

UNIT-IV

Operational Control in Microgrids:

Energy management in Microgrids, coordinated control, load management, grid synchronisation and islanding, Anti-islanding schemes; Various Architectural and Operational Challenges in Microgrid, Optimal operation of Microgrids.

UNIT-V

Microgrid Stability & Protection:

Steady-state and dynamic stability in AC and DC Microgrids, Methods to improve the stability in Microgrids; introduction to small signal and large signal stability analysis in Microgrids. Fault scenarios in DC and AC Microgrids, Protection in DC and AC Microgrids, adaptive protection, Fault current source (FCS) based protection; Protection challenges in islanded and autonomous modes of operation and ways to mitigate.

Text Books:-

1. Microgrids Design and Implementation edited by Antonio Carlos Zambroni de Souza and Miguel Castilla, Springer, 2019
2. Microgrids Architectures and Control Edited by Nikos Hatziargyriou, IEEE and Wiley, 2014
3. Cooperative Synchronization in Distributed Microgrid Control by Ali Bidram, Vahidreza Nasirian Ali Davoudi, and Frank L. Lewis, Springer, 2017
4. Control Circuits In Power Electronics Practical Issues In Design And Implementation Edited by Miguel Castilla, IET, 2016

Reference Books:-

1. Control and Dynamics in Power Systems and Microgrids by Lingling Fan, CRC Press, 2017
2. Hybrid-Renewable Energy Systems in Microgrids- Integration, Developments and Control edited by Hina Fathimaby et al., Elseiver WoodHead Publishing, 2018
3. Urban DC Microgrid Intelligent Control and Power Flow Optimization by Manuela Sechilariu and Fabrice Locment, 2016 Elsevier
4. Integrated Power Electronic Converters and Digital Control, by Ali Emadi, Alireza Khaligh, Zhong Nie, and Young Joo, Lee 2009, CRC Press.
5. Island Power Systems by Lukas Sigrist, Enrique Lobato, Francisco M. Echavarren Ignacio Egido, and Luis Rouco, CRC Press, 2016

Website Reference / Video Courses:

1. NPTEL Web Course on: DC Microgrid and Control System Prof. Avik Bhattacharya, IIT Roorkee
2. NPTEL Web Course on Electronics and Distributed Generation Dr. Vinod John Department of Electrical Engineering IISc Bangalore
3. NPTEL Web Course on Introduction to Smart Grid, PROF. N.P. PADHY Department of Electrical Engineering IIT Roorkee PROF. PREMALATA JENA Department of Electrical Engineering
4. NPTEL Web Course on Electric vehicles and Renewable energy, Prof. Ashok Jhunjhunwala, Prof. Prabhjot Kaur, Prof. Kaushal Kumar Jha and Prof. L Kannan, IIT Madras

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(23A02M10) MICROGRID SYSTEM DESIGN

Course Objectives:

1. To illustrate the design philosophies used in the domain of Microgrid.
2. To explore the selection of power and control architecture of Microgrids
3. To study the design aspects of AC Microgrid, DC Microgrid and their auxiliary systems

Course Outcomes:

Upon successful completion of this course, the learner will be able to:

1. Select and size various Microgrid energy resources L3
2. Select the power and control architecture of the Microgrid L3
3. Select and design the Microgrid's communication architecture. L3
4. Illustrate the design aspects DC and AC Microgrids with their control strategies. L4
5. Illustrate the implementation of the Microgrid islanding detection and anti-islanding scheme/ blackstart operation L4

UNIT-I

Selection/ Sizing of Microgrid Energy Resources

Factors affecting the selection and sizing of energy resources for Microgrid applications, dependency on type of loads connected, Selection/ Sizing: Renewable energy resources, Energy Storage components. Hybrid combination of RES and ESS.

UNIT-II

Selection of Power and Control Architecture:

Factors affecting the selection of Microgrid power and control architecture; Design Consideration for control implementation; Sensors: Selection of sensors and design of sensor Interfaces, design of control Interfaces. Design considerations for DSP/ Microcontroller interfaces

UNIT_III

Selection and Design of Communication Architecture:

Design considerations for selection of communication network for Microgrid applications; Design and implementation of communication links/ interfaces. Microgrid controller programming for Data transfer on communication network. Practical design considerations for Communication networks.

UNIT-IV

Design of DC and AC Microgrid:

Design DC Power Conditioning Units for RES and ESS, Unidirectional and Bidirectional Converter design, implementation of Control loop with DSP; Programming for Power sharing and Energy Management algorithms; Design of Protection system for DC Microgrid Design AC Power Conditioning Units for RES and ESS, Unidirectional and Bidirectional Converter design, implementation of Control loop with DSP; Grid Synchronization. Programming for Power sharing and Energy Management algorithms; Design of Protection system for AC

Microgrid.

UNIT-V

Islanding in Microgrids:

Selection and implementation of Islanding detection and anti-islanding scheme; Black- start and Autonomous operations in Microgrids;

Text Books:-

1. Microgrids Design and Implementation edited by Antonio Carlos Zambroni de Souza and Miguel Castilla, Springer, 2019
2. Microgrids Architectures and Control Edited by Nikos Hatzargyriou, IEEE and Wiley, 2014
3. Power Electronic Converters For Microgrids by Suleiman M. Sharkh, Mohammad A. Abusara, Georgios I. Orfanoudakis Babar Hussain, IEEE and Wiley, 2014

Reference Books:-

1. Energy Storage for Sustainable Microgrid by David Wenzhong Gao, Elsevier, 2015
2. Cooperative Synchronization in Distributed Microgrid Control by Ali Bidram, Vahidreza Nasirian Ali Davoudi, and Frank L. Lewis, Springer, 2017
3. Energy Efficiency and Renewable Energy Handbook Edited by D. Yogi Goswami and Frank Kreith, 2nd Edition- 2016, CRC
4. Control Circuits In Power Electronics Practical Issues In Design And Implementation Edited by Miguel Castilla, IET, 2016
5. Hybrid-Renewable Energy Systems in Microgrids- Integration, Developments and Control edited by Hina Fathimaby et al., Elseiver WoodHead Publishing, 2018
6. Urban DC Microgrid Intelligent Control and Power Flow Optimization by Manuela Sechilariu and Fabrice Locment, 2016 Elsevier
7. Integrated Power Electronic Converters and Digital Control, by Ali Emadi, Alireza Khaligh, Zhong Nie, and Young Joo, Lee 2009, CRC Press.

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(23A02M11) ANALYSIS of SMART GRID SYSTEMS

Course Outcomes:

CO-1 Understand the analysis and planning of smart grids L2

CO-2 Evaluate the tools for modeling and analysis of smart grid L3

CO-3 Analyze and synthesize the smart grid operation L4

CO-4 Assess the influence of distributed generation in smart grid on power systems L4

UNIT-I

Introduction:

Conventional power systems and Smart grid, definition of smart grid, need for smart grid, Smart grid architecture, smart grid domains, enablers of smart grid, Communication architecture and protocols for smart grid, smart grid priority standards and regulation, smart-grid activities in India.

UNIT-II

Systems of non linear equations:

Fixed point iteration, Newton Raphson Iteration, Continuation methods, Power system application: power flow, regulating transformer, Fast decoupled load flow, PV curves and continuation power flow, three phase power flow

UNIT-III

Smart Grid Security analysis:

Concept of security, Security analysis and monitoring, factors affecting power system security, detection of network problems, an overview of security analysis. Contingency analysis for generator and line outages by Interactive Linear Power Flow (ILPF) method, Fast decoupled inverse Lemma based approach, network sensitivity factors, Contingency selection, concentric relaxation and bounding.

UNIT-IV

Smart Grid Operation and Planning: Economic Dispatch, Optimal Power Flow, Load forecasting, Operation of smart grid system, Load Dispatch Centre functions, preventive, Emergency and Restorative, control objectives of a smart distribution system, Operational bottlenecks in smart grid. Planning Aspects of smart grid, Planning and operation Standards.

UNIT-V

Distributed Generation in Smart Grid:

Renewable-based Distributed generations, Energy Storage Technologies, Modeling, Control of energy storage system, Short- mid -long term application of energy storage system in smart grids.

Text Books:

1. Muhammad Kamran, Fundamentals of Smart Grid Systems, Academic Press, 2022
2. Mariesa L Crow, Computational methods for Electric Power Systems, CRC Press, NW, 2016, 3rd Edition.
3. Francisco D'íaz-González, Andreas Sumper and Oriol Gomis-Bellmunt, Energy Storage in Power Systems, John Wiley & Sons Ltd, 2016

Reference Books:

1. Prabha Kundur, Power System Stability and Control, McGraw Hill Education, 2006, 1st Edition.
2. Math H. J. Bollen, Fainan Hassan, Integration of Distributed Generation in the Power System, Wiley, 2011
3. A. Mahaboob Subahani, G. R. Kanagachidambaresan, M. Kathires, Integration of Renewable Energy Sources with Smart Grid, Willey, 2021
4. J. Ekanayake, N. Jenkins, K. Liyanage, J. Wu, A. Yokoyama, Smart Grid: Technology and Applications, John Wiley & Sons, 2015, 1st Edition.
5. Ali Keyhani, Design of smart power grid renewable energy systems, Wiley, 2019, 3rd Edition. Other

Online Learning Resource:

1. <https://nptel.ac.in/courses/108/104/108104052/>

23A04505	<u>ELECTRONIC CIRCUITS</u>	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand semiconductor diodes, their characteristics and applications.
2. To explore the operation, configurations, and biasing of BJTs.
3. To study the operation, analysis, and coupling techniques of BJT amplifiers.
4. To learn the operation, applications and uses of feedback amplifiers and oscillators.
5. To analyze the characteristics, configurations, and applications of operational amplifiers.

Course Outcomes:

At the end of this course, the students will be able to

1. Understand semiconductor diodes, their characteristics and applications.
2. Explore the operation, configurations, and biasing of BJTs.
3. Gain knowledge about the operation, analysis, and coupling techniques of BJT amplifiers.
4. Learn the operation, applications and uses of feedback amplifiers and oscillators.
5. Analyze the characteristics, configurations, and applications of operational amplifiers.

UNIT-I

Semiconductor Diode and Applications: Introduction, PN junction diode – structure, operation and VI characteristics, Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Positive and Negative Clipping and Clamping circuits (Qualitative treatment only).

Special Diodes: Zener and Avalanche Breakdowns, VI Characteristics of Zener diode, Zener diode as voltage regulator, Construction, operation and VI characteristics of Tunnel Diode, LED, Varactor Diode, Photo Diode .

UNIT-II

Bipolar Junction Transistor (BJT): Principle of Operation, Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch and Amplifier, Transistor Biasing and Stabilization - Operating point, DC & AC load lines, Biasing - Fixed Bias, Self Bias, Bias Stability, Bias Compensation using Diodes.

UNIT-III

Single stage amplifiers: Classification of Amplifiers - Distortion in amplifiers, Analysis of CE, CC and CB configurations with simplified hybrid model.

Multistage amplifiers: Different Coupling Schemes used in Amplifiers - RC coupled amplifiers, Transformer Coupled Amplifier, Direct Coupled Amplifier; Multistage RC coupled BJT amplifier (Qualitative treatment only).

UNIT-IV

Feedback amplifiers: Concepts of feedback, Classification of feedback amplifiers, Effect of feedback on amplifier characteristics, Voltage Series, Voltage Shunt, Current Series and Current Shunt Feedback Configurations (Qualitative treatment only).

Oscillators: Classification of oscillators, Condition for oscillations, RC Phase shift Oscillators, Generalized analysis of LC Oscillators-Hartley and Colpitts Oscillators, Wien Bridge Oscillator.

UNIT-V

Op-amp: Classification of IC'S, basic information of Op-amp, ideal and practical Op-amp, 741 op-amp and its features, modes of operation-inverting, non-inverting, differential.

Applications of op-amp : Summing, scaling and averaging amplifiers, Integrator, Differentiator, phase shift oscillator and comparator.

TEXT BOOKS:

1. Electronics Devices and Circuits, J.Millman and Christos. C. Halkias, 3rd edition, Tata McGraw Hill, 2006.
2. Electronics Devices and Circuits Theory, David A. Bell, 5th Edition, Oxford University press. 2008.

REFERENCE BOOKS:

1. Electronics Devices and Circuits Theory, R.L.Boylestad, LouisNashelsky and K.Lal Kishore, 12th edition, 2006, Pearson, 2006.
2. Electronic Devices and Circuits, N.Salivahanan, and N.Suresh Kumar, 3rd Edition, TMH, 2012
3. Microelectronic Circuits, S.Sedra and K.C.Smith, 5th Edition, Oxford University Press.

23A04506	<u>DIGITAL ELECTRONICS</u>	L	T	P	C
		3	0	0	3

Course Objectives:

1. To Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
2. To analyze combinational circuits like adders, subtractors, and code converters.
3. To explore combinational logic circuits and their applications in digital design.
4. To understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
5. To gain knowledge about programmable logic devices and digital IC's.

Course Outcomes:

At the end of this course, the students will be able to

1. Learn Boolean algebra, logic simplification techniques, and combinational circuit design.
2. Analyze combinational circuits like adders, subtractors, and code converters.
3. Explore combinational logic circuits and their applications in digital design.
4. Understand sequential logic circuits, including latches, flip-flops, counters, and shift registers.
5. Gain knowledge about programmable logic devices and digital IC's.

UNIT-I

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

UNIT-II

Introduction to Combinational Design 1: Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display.

UNIT-III

Combinational Logic Design 2: Decoders, Encoders, Priority Encoder, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

UNIT-IV

Sequential Logic Design: Latches, Flip-flops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, set up and hold times, Ripple counters, Shift registers.

UNIT-V

Programmable Logic Devices: ROM, Programmable Logic Devices (PLA and PAL).

Digital IC's: Decoder (74x138), Priority Encoder (74x148), multiplexer (74x151) and de-multiplexer (74x155), comparator (74x85).

TEXT BOOKS:

1. Digital Design, M.Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999.
2. Switching theory and Finite Automata Theory, ZviKohavi and NirahK.Jha, 2nd Edition, Tata McGraw Hill, 2005.

REFERENCE BOOKS:

1. Fundamentals of Logic Design, Charles H Roth,Jr., 5th Edition, Brooks/cole Cengage Learning, 2004.

23A04M07	<u>PRINCIPLES OF COMMUNICATION ENGINEERING</u>	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand the fundamentals of communication systems and amplitude modulation techniques.
2. To learn about the angle modulation techniques and bandwidth considerations in communication systems.
3. To gain knowledge on pulse analog modulation and multiple access techniques used in digital communication systems.
4. To examine pulse modulation and digital modulation techniques used in modern communication systems.
5. To study wireless communication systems, cellular networks, and GSM technology.

Course Outcomes:

At the end of this course, the students will be able to

1. Understand the fundamentals of communication systems and amplitude modulation techniques.
2. Learn about the angle modulation techniques and bandwidth considerations in communication systems.
3. Gain knowledge on pulse analog modulation and multiple access techniques used in digital communication systems.
4. Get familiar with pulse modulation and digital modulation techniques used in modern communication systems.
5. Know about wireless communication systems, cellular networks, and GSM technology.

UNIT I :

Analog communication-I: Elements of communication systems, need for Modulation, Modulation Methods, Baseband and carrier communication Amplitude Modulation(AM),Generation of AM signals, Rectifier detector, Envelope detector, sideband and carrier power of AM, Double side band suppressed carrier(DSB-SC) modulation & its demodulation, Switching modulators, Ring modulator, Balanced modulator, Single sideband(SSB) transmission, VSB Modulation.

UNIT II :

Analog communication-II : Angle Modulation & Demodulation: Concept of instantaneous frequency Generalized concept of angle modulation, Bandwidth of angle modulated waves- Narrow band frequency modulation (NBFM); and Wide band FM (WBFM),Phase modulation, Pre-emphasis & De-emphasis, Illustrative Problems.

UNIT III :

Digital communications-I (Qualitative Approach only): Pulse Analog Modulation Techniques

: Pulse analog modulation techniques, Generation and detection of Pulse amplitude modulation, Pulse width modulation, Pulse position modulation

Multiple Access Techniques: Introduction to multiple access techniques, FDMA, TDMA, CDMA, SDMA: Advantages and applications

UNIT IV:

Digital communications-II (Qualitative Approach only): Pulse Code Modulation, DPCM, Delta modulation, Adaptive delta modulation, Overview of ASK, PSK, QPSK, BPSK and M-PSK techniques.

UNIT V

Wireless communications (Qualitative Approach only): Introduction to wireless communication systems, Examples of wireless communication systems, comparison of 2G and 3G cellular networks, Introduction to wireless networks, Differences between wireless and fixed telephone networks, Introduction to Global system for mobile(GSM), GSM services and features.

TEXT BOOKS

1. H Taub, D. Schilling and Gautam Sahe, —Principles of Communication Systems, TMH, 2007, 3rd Edition.
2. George Kennedy and Bernard Davis, —Electronics & Communication Systems, 4th Edition, TMH 2009.
3. Wayne Tomasi, —Electronic Communication System: Fundamentals Through Advanced, 2nd edition, PHI, 2001.

REFERENCE BOOKS

1. Simon Haykin, —Principles of Communication Systems, John Wiley, 2nd Edition.
2. Sham Shanmugam, —Digital and Analog communication Systems, Wiley-India edition, 2006.
3. Theodore. S. Rappaport, —Wireless Communications, Pearson Education, 2nd Edition, 2002.

23A04M08	<u>ELECTRONIC INSTRUMENTATION</u>	L	T	P	C
		3	0	0	3

Course Objectives:

1. To study the working principle, operation, and applications of analog and digital measuring instruments.
2. To explore the working principles, construction, and applications of oscilloscopes in signal analysis.
3. To learn about the bridge circuits for measurement of resistance, inductance, and capacitance.
4. To understand the principles and operation of various signal generators used in electronic applications.
5. To gain knowledge about the operation and applications of transducers in measurement systems.

Course Outcomes:

At the end of this course, the students will be able to

1. Know the working principle, operation, and applications of analog and digital measuring instruments.
2. Get familiar with the working principles, construction, and applications of oscilloscopes in signal analysis.
3. Learn about the bridge circuits for measurement of resistance, inductance, and capacitance.
4. Understand the principles and operation of various signal generators used in electronic applications.
5. Gain knowledge about the operation and applications of transducers in measurement systems.

UNIT I

Measuring Instruments: Introduction, Errors in Measurement, Accuracy, Precision, Resolution and Significant figures. Basic PMMC Meter- construction and working, DC and AC Voltmeters- Multirange, Range extension, DC Ammeter, Multimeter for Voltage, Current and resistance measurements.

Digital Instruments: Digital Voltmeters – Introduction, DVM's based on V-T, V-F and Successive approximation principles, Resolution and sensitivity, General specifications, Digital Multimeters, Digital frequency meters, Digital measurement of time.

UNIT II

Oscilloscopes: Introduction, Block diagram of CRO, Basic principle of CRT, CRT Construction and features, vertical amplifiers, horizontal deflection system- sweep, trigger pulse, delay line, sync selector circuits. Dual beam and dual trace CROs, Sampling and Digital storage oscilloscopes.

UNIT III

Bridges: DC Bridges for Measurement of resistance - Wheat stone bridge, Kelvin's Bridge, AC Bridges for Measurement of inductance- Maxwell's bridge, Hay's Bridge, Anderson bridge, Measurement of capacitance - Schearing Bridge, Wien Bridge, Errors and precautions in using bridges.

UNIT IV

Signal Generators: Introduction, Fixed and variable AF oscillator, Standard signal generator, Laboratory type signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator, Sweep frequency generator.

UNIT V

Transducers: Introduction, Types of Transducers, Electrical transducers, Selecting a transducer, Resistive transducer, Strain gauges, Piezoelectric transducer, Photoelectric transducer, Photovoltaic transducer, Temperature transducers-RTD, LVDT.

TEXT BOOKS

1. H.S.Kalsi, —Electronic Instrumentation, Third edition, Tata McGraw Hill, 2010.
2. A.D. Helfrick and W.D. Cooper, —Modern Electronic Instrumentation and Measurement Techniques, PHI, 6th Edition, 2010.

REFERENCE BOOKS

1. A.K. Sawhney, Dhanpat Rai & Co., —A course in Electrical and Electronic Measurements and Instrumentation, 9th Edition, 2010.
2. David A. Bell, —Electronic Instrumentation & Measurements, PHI, 2nd Edition, 2006.

23A04503T	<u>MICROPROCESSORS AND MICRO CONTROLLERS</u>	L	T	P	C
		3	0	0	3

Course Objectives:

1. To comprehend the architecture, operation, and configurations of the 8086 microprocessors.
2. To get familiar with 8086 programming concepts, instruction set, and assembly language development tools.
3. To study the interfacing of 8086 with memory, peripherals, and controllers for various applications.
4. To learn the architecture, instruction set, and programming of the 8051 microcontrollers.
5. To understand microcontroller interfacing techniques, peripheral programming, and processor comparisons.

Course Outcomes:

At the end of this course, the students will be able to

1. Gain knowledge on the architecture, operation, and configurations of the 8086 microprocessors.
2. Get familiar with 8086 programming concepts, instruction set, and assembly language development tools.
3. Know the interfacing of 8086 with memory, peripherals, and controllers for various applications.
4. Learn the architecture, instruction set, and programming of the 8051 microcontrollers.
5. Understand microcontroller interfacing techniques, peripheral programming, and processor comparisons.

UNIT I

8086 Architecture: Main features, pin diagram/description, 8086 microprocessor family, internal architecture, bus interfacing unit, execution unit, interrupts and interrupt response, 8086 system timing, minimum mode and maximum mode configuration.

UNIT II

8086 Programming: Program development steps, instructions, addressing modes, assembler directives, writing simple programs with an assembler, assembly language program development tools.

UNIT III

8086 Interfacing: Semiconductor memories interfacing (RAM, ROM), Intel 8255 programmable peripheral interface, Interfacing switches and LEDs, Interfacing seven segment displays, software and hardware interrupt applications, Intel 8251 USART architecture and interfacing, Intel 8237a DMA controller, stepper motor, A/D and D/A converters, Need for 8259 programmable interrupt controllers.

UNIT IV

Microcontroller - Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits - Instruction set - Addressing modes - Assembly language programming.

UNIT V

Interfacing Microcontroller - Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

Textbooks:

1. Microprocessors and Interfacing – Programming and Hardware by Douglas V Hall, SSSP Rao, Tata McGraw Hill Education Private Limited, 3rd Edition, 1994.
2. K M Bhurchandi, A K Ray, Advanced Microprocessors and Peripherals, 3rd edition, McGraw Hill Education, 2017.
3. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, 2nd edition, Pearson, 2012.

References:

1. Ramesh S Gaonkar, Microprocessor Architecture Programming and Applications with the 8085, 6th edition, Penram International Publishing, 2013.
2. Kenneth J. Ayala, The 8051 Microcontroller, 3rd edition, Cengage Learning, 2004.

23A04M09	ELECTRONIC CIRCUITS AND DIGITAL ELECTRONICS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

1. To study the characteristics and applications of semiconductor diodes and transistors.
2. To design and analyze rectifiers, amplifiers, and oscillator circuits.
3. To implement basic Op-Amp applications.
4. To develop the ability to design and implement combinational and sequential logic circuits.
5. To utilize universal gates for logic circuit realization and clock generation.
6. To design and implement essential digital components like adders, multiplexers, flip-flops, encoders, and decoders.

Course Outcomes:

At the end of this course, the students will be able to

1. Interpret the characteristics of diodes and transistors for circuit design.
2. Construct and evaluate rectifiers, amplifiers, and oscillator circuits.
3. Implement basic Op-Amp applications.
4. Construct and implement combinational and sequential circuits using logic gates.
5. Design digital systems using universal gates, multiplexers, and comparators.
6. Develop and realize fundamental digital components such as adders, converters, flip-flops, encoders, and decoders.

ELECTRONIC CIRCUITS

List of Experiments: (Any 06 Experiments are to be conducted)

1. P-N Junction Diode Characteristics
2. Zener Diode as voltage regulator
3. Half Wave Rectifiers (without and with filter)
4. Full Wave Rectifiers (without and with filter)
5. CB Characteristics
6. CE Characteristics
7. CE Amplifier
8. CC Amplifier
9. Clippers
10. Clampers
11. Hartley & Colpitt's Oscillators.
12. Op-Amp applications-Adder, subtractor, comparator

DIGITAL ELECTRONICS LAB

List of Experiments: (Any 6 Experiments are to be conducted)

1. Realization of Boolean Expressions using Gates
2. Design and realization of logic gates using universal gates
3. Generation of clock using NAND / NOR gates
4. Design a 4 – bit Adder / Subtractor
5. Design and realization of a 4 – bit Gray to Binary and Binary to Gray Converter
6. Design and realization of 8x1 MUX using 2x1 MUX
7. Design and realization of 4 bit comparator
8. Design and realization of Flip-Flops.
9. Design and realization of Encoders
10. Design and realization of Decoders
11. Design and realization of Comparator.

23A04503P	<u>MICRO PROCESSORS AND MICRO CONTROLLERS LAB</u>	L	T	P	C
		0	0	3	1.5

Course Objectives:

1. To become skilled in 8086 Assembly Language programming.
2. To understand the detailed software and hardware structure of the microprocessor.
3. Train their practical knowledge through laboratory experiments.
4. To understand and learn 8051 Microcontroller.
5. To acquire knowledge on microprocessors and microcontrollers, interfacing various peripherals, and configuring.

Course Outcomes:

At the end of this course, the students will be able to

1. Formulate a program and implement algorithms using Assembly language.
2. Describe an Assembly language program for the 8086 Microprocessor.
3. Develop programs for different applications in the 8086 Microprocessor.
4. Interface peripheral devices with 8086 and 8051.
5. Use an Assembly/Embedded C programming approach for solving real-world problems.

List of Experiments: (Any TEN of the experiments are to be conducted)

1. **Programs for 16 Bit Arithmetic Operations** (Using various addressing modes)
 - a) Write an ALP to Perform Addition and Subtraction of Multi precision numbers.
 - b) Write an ALP to Perform Multiplication and division of signed and unsigned Hexadecimal numbers.
 - c) Write an ALP to find square, cube and factorial of a given number.
2. **Programs Involving Bit Manipulation Instructions**
 - a) Write an ALP to find the given data is positive or negative.
 - b) Write an ALP to find the given data is odd or even.
 - c) Write an ALP to find Logical ones and zeros in a given data.
3. **Programs on Arrays for 8086**
 - a) Write an ALP to find Addition/subtraction of N no_s.
 - b) Write an ALP for finding largest/smallest no.
 - c) Write an ALP to sort given array in Ascending/descending order.
4. **Programs on String Manipulations for 8086**
 - a) Write an ALP to find String length.
 - b) Write an ALP for Displaying the given String.
 - c) Write an ALP for Comparing two Strings.
 - d) Write an ALP to reverse String and Checking for palindrome.

5. Programs for Digital Clock Design Using 8086

- a) Write an ALP for Designing clock using INT 21H Interrupt.
- b) Write an ALP for Designing clock using DOS Interrupt Functions.
- c) Write an ALP for Designing clock by reading system time.

6. Interfacing Stepper Motor with 8086

- a) Write an ALP to 8086 processor to Interface a stepper motor and operate it in clockwise by choosing variable step-size.
- b) Write an ALP to 8086 processor to Interface a stepper motor and operate it in Anti-clockwise by choosing variable step-size.

7. Interfacing ADC/DAC with 8086

- a) Write an ALP to 8086 processor to Interface ADC.
- b) Write an ALP to 8086 processor to Interface DAC and generate Square Wave/Triangular Wave/Step signal.

8. Communication between Two Microprocessors

- a) Write an ALP to have Parallel communication between two microprocessors using 8255
- b) Write an ALP to have Serial communication between two microprocessor kits using 8251.

9. Programs using Arithmetic and Logical Instructions for 8051

- a) Write an ALP to 8051 Microcontroller to perform Arithmetic operations like addition, subtraction,
- b) Multiplication and Division.
- c) Write an ALP to 8051 Microcontroller to perform Logical operations like AND, OR and XOR.
- d) Programs related to Register Banks.

10. Programs to Verify Timers/Counters of 8051

- a) Write a program to create a delay of 25msec using Timer0 in mode 1 and blink all the Pins of P0.
- b) Write a program to create a delay of 50 μ sec using Timer1 in mode 0 and blink all the Pins of P2.
- c) Write a program to create a delay of 75msec using counter0 in mode 2 and blink all the Pins of P1.
- d) Write a program to create a delay of 80 μ sec using counter1 in mode 1 and blink all the Pins of P3.

11. UART Operation in 8051

- a) Write a program to transfer a character serially with a baud rate of 9600 using UART.
- b) Write a program to transfer a character serially with a baud rate of 4800 using UART.
- c) Write a program to transfer a character serially with a baud rate of 2400 using UART.

12. Interfacing LCD with 8051

- a) Develop and execute the program to interface 16*2 LCD to 8051.
- b) Develop and execute the program to interface LCD to 8051 in 4-bit or 8-bit mode.

Reference Books:

1. Kenneth.J.Ayala. The 8051 microcontroller, 3rd edition, Cengage learning, 2010.
2. Advanced microprocessors and peripherals-A.K ray and K.M.Bhurchandani, TMH, 2nd edition 2006.
3. The 8051 Microcontroller and Embedded Systems: Using Assembly and C by Muhammad Ali Mazidi, Janice Gillispie Mazidi, Second Edition.

23A04M01	<u>EMBEDDED SYSTEMS TECHNOLOGY</u>	L	T	P	C
		3	0	0	3

Course Objectives:

To introduce the fundamental concepts and classifications of embedded systems.
 To explore the architecture and processor models used in embedded system design.
 To study different communication interfaces and protocols in embedded systems.
 To understand rapid prototyping using platforms like Arduino and sensor modules.
 To develop embedded GUI interfacing and analyze case studies of real-world embedded applications.

Course Outcomes:

After completing the course, the student will be able to,

1. Understand the basics of embedded systems, including their history, classification, and processor selection.
2. Analyze different embedded processor architectures, including ARM, RISC, and application-specific processors.
3. Evaluate various communication interfaces and protocols, such as UART, USB, SPI, I2C, and Zigbee.
4. Implement rapid prototyping techniques using Arduino, sensors, and wearable system modules.
5. Develop and interface embedded GUI systems, including LCDs, touchscreens, and VGA cameras, for real-world applications.

UNIT-I

Introduction to Embedded system: Introduction to Embedded Systems, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Embedded Processor Requirements, Features, Types, RISC Processors, Harvard Architecture, Super Harvard Architecture, Selection of Processors & Microcontrollers.

UNIT-II

Architecture of Embedded System Processor: Embedded processor models, ARM core processor, Application specific processor like network processors, multimedia processors, industrial processors, superscalar processor, Advanced RISC processors. Architecture of Embedded OS, Categories of Embedded OS, Application Software, Communication Software, Development and Testing Tools

UNIT-III

Communication Interfaces: Need for Communication Interfaces, OSI Reference Model, Basic of Networks, Network Topology, RS232/UART, RS422/RS485, USB, Infrared, Ethernet, IEEE 802.11, Bluetooth, SPI, I2C, CAN, Wifi, FlexRay, LIN Bus, Zigbee.

UNIT-IV

Rapid prototyping: Arduino platform, hardware and software, Sensor's modules, Robo Control modules, 3D printing module, ADC module, wearable systems. etc.

UNIT-V

Embedded GUI interfacing: Arduino based graphic LCD, Touch screen, joy stick, VGA camera interfacing and programming in Python. Creative applications of Arduino

Design Examples & Case Studies of Embedded System: Digital Thermometer, Navigation Systems, Smart Card, RF Tag.

Text Books :

1. David Simon, —An embedded Software Primer|| Pearson Publication, 2021.
2. Frank Vahid, —Embedded system — A unified Hardware Software Introduction|| John Wiley and Sons, 2005.

Reference Books :

1. Tammy Noergaard, || Embedded System Architecture||, Elsevier publication, 2014.

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23A04M02	<u>REAL TIME EMBEDDED SYSTEMS DESIGN AND ANALYSIS</u>	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand the fundamental concepts of Real-Time Operating Systems (RTOS), kernel architecture, and synchronization mechanisms.
2. To study real-time embedded software development using Linux, RT Linux, and RTOS programming techniques.
3. To explore real-time task scheduling techniques, including table-driven, cyclic, EDF, and RMA scheduling.
4. To analyze real-time hardware architectures, software stacks, and best practices for embedded system programming.
5. To examine real-time communication protocols, database systems, and validation techniques for embedded systems.

Course Outcomes:

After completing the course, the student will be able to,

1. Explain the architecture of RTOS, task scheduling, and synchronization mechanisms such as semaphores, mutexes, and message queues.
2. Demonstrate proficiency in real-time embedded software development using Linux, RT Linux, and various RTOS platforms.
3. Apply real-time scheduling algorithms to optimize task execution and system performance.
4. Analyze real-time embedded hardware architectures and software stacks for efficient system integration.
5. Implement real-time communication protocols and perform validation and verification of embedded systems using case studies.

UNIT-I

Introduction to RTOS: Overview Of RTOS, Architecture of Kernel, Task & Task Scheduler, ISR, Semaphore, Mutex, Mailbox, Message Queues, Event Registers, Pipes, Signals, Timers, Memory Management, Priority Inversion Problem.

UNIT-II

Real Time Embedded Software: Linux, RT Linux, multiprocessor software developments, data flow graph, Study and programming of RTOS like RTX51, Free RTOS etc. timing diagram analysis for fixed and dynamic priority software services.

UNIT-III

Real time Scheduling: Scheduling Real-Time Tasks: Types of Schedulers Table-driven scheduling Cyclic schedulers EDF RMA, Priority Pre-emptive Scheduler State Machine for Linux and VxWorks, Comparison of Cyclic Executive, Introduction to Worst Case Analysis, Example of scheduling, Real-Time Scheduling and Rate Monotonic Least Upper Bound.

UNIT-IV

Overview of Real-time Hardware Architectures and Software Stacks: Embedded Linux on the Raspberry Pi ARM A-Series System-on-Chip processors, Tracing Linux kernel and network stack events. Best Practices for RTES Programming, System Integration Testing (Hardware, Firmware, and Software),

UNIT-V

Real Time Communication:RT Services Communication and Synchronization, Performance of two Real-Time communication Protocols, Real time communication over network, Real Time database.

Verification and Validation of RTES project:Using Point-to-point Serial and TCP/IP for Embedded Systems, Case Study of Coding for Sending Application Layer Byte Streams on A TCP/IP Network Using RTOS. Building a simple Linux multi-service system using POSIX real-time extensions on Raspberry Pi 3b using sequencing and methods to log and verify agreement between theory and practice.

Text Books :

1. —Embedded Real-time systems, Prasad Dreamtech Wiley Publication, 2003.
2. "Real-Time Systems: Theory and Practice, " Rajib Mall Pearson, 2008.

Reference Books :

1. —Real-Time Systems Design and Analysis, Philip Laplante, 2nd Edition, Prentice Hall, 2013.

23A04M03	<u>PRINCIPLES OF IOT</u>	L	T	P	C
		3	0	0	3

Course Objectives:

1. To introduce the fundamental concepts, characteristics, and design principles of the Internet of Things (IoT).
2. To explore IoT components, communication protocols, and networking techniques.
3. To understand IoT system management, including platform design and application development.
4. To study networking and computing in IoT, including Python-based IoT programming and cloud integration.
5. To analyze IoT cloud platforms, data analytics, and real-world IoT applications in smart cities, homes, and industries.

Course Outcomes:

After completing the course, the student will be able to,

1. Understand the fundamentals of IoT, including its architecture, characteristics, and challenges.
2. Analyze IoT communication protocols and networking techniques used in wireless sensor networks and M2M communication.
3. Design and manage IoT platforms, including device integration, service models, and application development.
4. Implement IoT networking and computing techniques, including cloud storage, APIs, and Python-based IoT programming.
5. Develop and evaluate IoT applications in real-world domains such as smart cities, connected vehicles, and industrial automation.

UNIT-I

Introduction & Basic of IoT : Definition, Characteristics, Physical and Logical Designs, challenges, Technological trends in IOT, IoT Examples, M2M.

UNIT-II

IoT: Components, Communication and Networking: Introduction to Sensing and Networking: Sensing & actuation, Wireless Sensor network, Sensor nodes, Communication Protocols, M2M Communication, Networking Hardware, Networking Protocols.

UNIT-III

IoT System Management: Network Operator Requirements, IoT Platform Design Specification – Requirements, Process, Domain Model, Service, IoT Level, Function, Operational view, Device and Component Integration, Application development.

UNIT-IV

Networking and Computing: File Handling, Python Packages for IoT, IoT Physical Servers – Cloud Storage Models, Communication APIs.

UNIT-V

IoT Clouds and Data Analytics: REST ful Web API, Amazon Web Services for IoT, Apache Hadoop, Batch Data Analysis, Chef, Chef Case Studies, Puppet, NETCONF-YANG

IoT Applications: Case studies: smart cities, smart home, connected vehicles, Industrial IOT.

Text Books :

1. Kamal, R., ||Internet of Things – Architecture and Design Principles|| 1st Edition, Mcgraw Hill, 2017.
2. Simone Cirani, ||Internet of Things-Architectures, Protocols and Standards||, WILEY, 2018.

Reference Books :

1. Alessandro Bassi, || Enabling Things to Talk- Designing IoT solutions with the IoT Architectural Reference Model||, Springer, 2013.

23A04703b	<u>WIRELESS SENSOR NETWORKS</u>	L	T	P	C
		3	0	0	3

Course Objectives:

1. To introduce the fundamental concepts and architecture of wireless sensor networks.
2. To explore various network architectures, optimization techniques, and design principles for wireless sensor networks.
3. To study MAC protocols, routing techniques, and addressing mechanisms for efficient sensor network communication.
4. To understand the infrastructure establishment of sensor networks, including topology control and synchronization.
5. To provide knowledge on sensor network platforms, programming challenges, and simulation tools.

Course Outcomes:

After completing the course, the student will be able to,

1. Learn the fundamental concepts and architecture of wireless sensor networks.
2. Explore various network architectures, optimization techniques, and design principles for wireless sensor networks.
3. Gain knowledge of MAC protocols, routing techniques, and addressing mechanisms for efficient sensor network communication.
4. Understand the infrastructure establishment of sensor networks, including topology control and synchronization.
5. Grasp the knowledge on sensor network platforms, programming challenges, and simulation tools.

UNIT I

Overview of Wireless Sensor Networks: Single-Node Architecture - Hardware Components- Network Characteristics- unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks- Types of wireless sensor networks.

UNIT II

Architectures: Network Architecture- Sensor Networks-Scenarios- Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT III

Networking Sensors: MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - SMAC, - B-MAC Protocol, IEEE 802.15.4 standard and ZigBee, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols Energy-Efficient Routing, Geographic Routing.

UNIT IV

Infrastructure Establishment: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V

Sensor Network Platforms and Tools :Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming.

Textbooks:

1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, —Wireless Sensor Networks-An Information Processing Approach", Elsevier, 2007

Reference Books:

1. Waltenegus Dargie , Christian Poellabauer, —Fundamentals Of Wireless Sensor Networks Theory And Practice, By John Wiley & Sons Publications, 2011
2. Kazem Sohraby, Daniel Minoli, & Taieb Znati, —Wireless Sensor Networks-Technology, Protocols, and Applications, John Wiley, 2007.
3. Anna Hac, —Wireless Sensor Network Designs, John Wiley, 2003

23A04M04	<u>INDUSTRIAL INTERNET OF THINGS</u>	L	T	P	C
		3	0	0	3

Course Objectives:

1. To understand the fundamental concepts of the Industrial Internet of Things (IIoT), its market potential, and applications in various industries.
2. To study the methodologies, networking protocols, and wireless communication technologies used in IIoT deployments.
3. To explore data-driven analytics in IIoT, including big data processing, machine learning algorithms, and neural networks.
4. To analyze IP and non-IP protocols used in IIoT, such as WPAN, Bluetooth, Zigbee, and MQTT.
5. To examine IoT cloud platforms, data analytics techniques, and their applications in industrial robotics and asset monitoring.

Course Outcomes:

After completing the course, the student will be able to,

1. Explain the key differences between IoT and IIoT, sensor calibration, placement, and the role of communication systems in IIoT applications.
2. Demonstrate knowledge of IIoT methodologies, including operating systems, networking protocols, and wireless sensor networks.
3. Apply data analytics techniques, including big data processing and machine learning, to industrial IoT applications.
4. Analyze and implement IP and non-IP communication protocols for efficient IIoT connectivity and data exchange.
5. Utilize IoT cloud platforms for device localization, tracking, and robotics applications in industrial environments.

UNIT-I

Introduction IIoT; Market Size and Potential: Definition, IoT v IIoT, Next Generation Sensors, Sensor's calibration and validate sensor measurements, placement of IoT devices, sensors, low-cost communication system design, Top application areas include manufacturing, oil & gas, Embedded systems in the Automotive and Transportation market segment.

UNIT-II

IIoT Methodology :Top operating systems used in IIoT deployments, Networking and wireless communication protocols used in IIoT deployments. Smart Remote Monitoring Unit, components of monitoring system, control and management, Wireless Sensor Networ(WSN).

UNIT-III

Data driven Analytics of IIoT: Implementing of industrial IoT Data flow, big data and how to prepare data for machine learning algorithms, Machine Learning algorithms, supervised learning & Un-supervised learning algorithms, Basics of neural network,activation functions, back-propagation.

UNIT-IV

IP and Non-IP Protocols for IoT: WPAN, IEEE 802.15.4, Bluetooth, NFC, 6LoWPAN; RFID, Zigbee Wireless HART Protocol, MQTT, IP and Non-IP Protocols, REST, CoAP

UNIT-V

IoT Clouds and Data Analytics: Develops a physics-based and data-driven digital equipment model to monitor assets and systems, Introduction to device localization and tracking; different types of localization techniques, Radio-Frequency Identification (RFID) and fingerprinting, Device diversity/heterogeneity issue in IIoT networks

Internet of Robotic Things (IoRT): Introduction to stationary and mobile robots, Brief introduction to localization, mapping, planning, and control of robotic systems; Introduction to cloud-enabled robotics; Applications of IIoT in robotics; Architectures for IoRT, Examples and case studies: Open issues and challenges.

Text Books :

1. —Industry4.0: The Industrial Internet of Things, Alasdair Gilchrist, Apress, 2016—
2. Introduction to Industrial Internet of Things and Industry4.0, Sudip Misra, Chandana Roy, Anadarup Mukherjee, CRC Press, 2021

Reference Books :

1. —Handson Industrial Internet of Things, Giacomo Veneri, Antonio Capasso, Packt Press, 2018.

23A04M05	<u>PRINCIPLES OF IOT LAB</u>	L	T	P	C
		0	0	3	1.5

Course Objectives:

1. To understand the fundamentals of IoT through hands-on experiments with sensors, actuators, and microcontrollers.
2. To develop skills in interfacing various sensors and actuators with microcontrollers like Arduino, ESP32, and Raspberry Pi.
3. To explore IoT communication frameworks such as HTTP, MQTT, and cloud-based data logging platforms like ThingSpeak.
4. To gain experience in remote monitoring and control of IoT devices using mobile and web applications.
5. To learn UAV/Drone integration with IoT through flight controller programming and GPS-based navigation.

Course Outcomes:

After completing the course, the student will be able to,

1. Demonstrate the ability to control and monitor sensors and actuators using microcontrollers and IoT platforms.
2. Implement IoT-based applications using cloud services like ThingSpeak and mobile applications like Blynk.
3. Develop web-based IoT applications using HTTP and MQTT protocols for remote device management.
4. Apply IoT principles in real-world applications such as home automation, security systems, and industrial monitoring.
5. Integrate UAV/Drone technologies with IoT for automated navigation and data acquisition.

List of Experiments: (Any 10 Experiments are to be conducted)

1. Serial Monitor, LED, Servo Motor - Controlling

- Controlling actuators through Serial Monitor. Creating different led patterns and controlling them using push button switches. Controlling servo motor with the help of joystick.

2. Distance Measurement of an object

- Calculate the distance to an object with the help of an ultrasonic sensor and display it on an LCD.

3. LDR Sensor, Alarm and temperature, humidity measurement

- Controlling relay state based on ambient light levels using LDR sensor.
- Basic Burglar alarm security system with the help of PIR sensor and buzzer.
- Displaying humidity and temperature values on LCD

4. Experiments using Raspberry Pi

- Controlling relay state based on input from IR sensors

- Interfacing stepper motor with R-Pi
- Advanced burglar alarm security system with the help of PIR sensor, buzzer and keypad. (Alarm gets disabled if correct keypad password is entered)
- Automated LED light control based on input from PIR (to detect if people are present) and LDR(ambient light level)

5. IOT Framework

- Upload humidity & temperature data to ThingSpeak, periodically logging ambient light level to ThingSpeak.

6. Controlling LEDs, relay & buzzer using Blynk app

7. HTTP Based

- Introduction to HTTP. Hosting a basic server from the ESP32 to control various digital based actuators (led, buzzer, relay) from a simple web page.

8. Displaying various sensor readings on a simple web page hosted on the ESP32.

9. MQTT Based

- Controlling LEDs/Motors from an Android/Web app, Controlling AC Appliances from an android/web app with the help of relay.

10. Displaying humidity and temperature data on a web-based application

11. UAV/Drone:

- Demonstration of UAV elements, Flight Controller
- Mission Planner flight planning design

12. Python program to read GPS coordinates from Flight Controller

Reference:

1. Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley Publications, 2012.
2. Alexander Osterwalder, and Yves Pigneur – Business Model Generation – Wiley, 2011
3. ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
4. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.

Online Learning Resources/Virtual Labs:

<https://www.arduino.cc/>

<https://www.raspberrypi.org/>

23A04M06	<u>INDUSTRIAL INTERNET OF THINGS LAB</u>	L	T	P	C
		0	0	3	1.5

Course Objectives:

1. To understand the fundamental concepts of IIoT, including its architecture, challenges, and differences from IoT.
2. To explore IIoT components such as sensors, actuators, and control systems for industrial applications.
3. To study various communication technologies and protocols like IEEE 802.15.4, ZigBee, BLE, and MQTT for IIoT applications.
4. To learn data visualization techniques and methods for connecting IIoT devices to the web.
5. To analyze data retrieval techniques and machine-to-machine (M2M) interactions for IIoT-based automation.
6. To gain hands-on experience with PLCs, SCADA, and real-time control systems used in industrial automation.

Course Outcomes:

After completing the course, the student will be able to,

1. Explain the architecture, challenges, and fundamental concepts of IIoT and differentiate it from IoT.
2. Demonstrate the interfacing of sensors and actuators with microcontrollers like Raspberry Pi and NodeMCU for industrial automation.
3. Implement communication protocols such as MQTT, ZigBee, and Bluetooth to enable seamless IIoT connectivity.
4. Develop web-based dashboards for real-time visualization and control of IIoT devices.
5. Retrieve, analyze, and transmit industrial data using web-based interactions and M2M communication.
6. Implement PLC-based automation, Boolean logic programming, and process control using SCADA for industrial applications.

(All the modules need to be conducted and minimum one project to be done)

MODULE 1: Introduction & Architecture

What is IIoT and connected world? The difference between IoT and IIoT, Architecture of IIoT, IOT node, Challenges of IIOT. Practice

1. Introduction to Arduino, Introduction to raspberry Pi.

<https://www.youtube.com/watch?v=AQdLQV6vhbk>

MODULE 2: IIOT Components

Fundamentals of Control System, introductions, components, closed loop & open loop system.

Introduction to Sensors (Description and Working principle): What is sensor? Types of sensors, working principle of basic Sensors -Ultrasonic Sensor, IR sensor, MQ2, Temperature and Humidity Sensors (DHT-11).Digital switch, Electro Mechanical switches.

Practice

1. Measurement of temperature & pressure values of the process using raspberry pi/node mcu.
2. Modules and Sensors Interfacing (IR sensor, Ultrasonic sensors, Soil moisture sensor) using Raspberry pi/node mcu.
3. Modules and Actuators Interfacing (Relay, Motor, Buzzer) using Raspberry pi/node mcu.

MODULE 3: Communication Technologies of IIoT

Communication Protocols: IEEE 802.15.4, Zig Bee, Bluetooth, BLE, NFC, RFID Industry standards communication technology (MQTT), wireless network communication.

Practice

1. Demonstration of MQTT communication.

MODULE 4: Visualization and Data Types of IIoT

Connecting an Arduino/Raspberry pi to the Web: Introduction, setting up the Arduino/Raspberry pi development environment, Options for Internet connectivity with Arduino, Configuring your Arduino/Raspberry pi board for the IoT.

Practice

1. Visualization of diverse sensor data using dashboard (part of IoT's _control panel')
2. Sending alert message to the user. ways to control and interact with your environment)

MODULE 5: Retrieving Data

Extraction from Web: Grabbing the content from a web page, Sending data on the web, Troubleshooting basic Arduino issues, Types of IoT interaction, Machine to Machine interaction (M2M).

Practice

1. Device control using mobile Apps or through Web pages.
2. Machine to Machine communication.

MODULE 6: Control & Supervisory Level of Automation

Programmable logic controller (PLC), Real-time control system, Supervisory Control & Data Acquisition (SCADA).

Practice

1. Digital logic gates programming using ladder diagram.
2. Implementation of Boolean expression using ladder diagram.
3. Simulation of PLC to understand the process control concept.

Projects:

IIoT based smart energy meter

Smart Agriculture system

Automation using controller via Bluetooth

Temperature controlled Fan/cooler using controller

Automatic streetlight

Smart Baggage Tracker

Textbooks

1. The Internet of Things in the Industrial Sector, Mahmood, Zaigham (Ed.) (Springer Publication)
2. Industrial Internet of Things: Cybermanufacturing System, Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat (Springer Publication).
3. Industrial IoT Challenges, Design Principles, Applications, and Security by Ismail Butun (editor)

23A03M01	MATERIAL SCIENCE & ENGINEERING	L	T	P	C
		3	0	0	3

UNIT I

Structure of Metals & Constitution of Alloys

Structure of Metals: Crystal Structures: Unit cells, Metallic crystal structures, Imperfection in solids: Point, Line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Constitution of Alloys: Necessity of Alloying, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron-Iron-carbide diagram and microstructural aspects of ferrite, cementite, austenite, ledeburite, and cast iron.

UNIT II

Steels & Cast irons

Steels: Plain carbon steels, use and limitations of plain carbon steels. AISI& BIS classification of steels. Classification of alloy steels. Microstructure, properties and applications of alloy steels- stainless steels and tool steels.

Cast irons: Microstructure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.

UNIT III

Heat Treatment of Steels:

Annealing, tempering, normalizing and hardening, isothermal transformation diagrams for Fe-Fe₃C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening - carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, and vacuum and plasma hardening

UNIT IV

Non-ferrous Metals and Alloys

Microstructure, properties and applications of copper, aluminium, titanium, nickel and their alloys. Study of Al-Cu phase diagram

UNIT V

Ceramics, Polymers and Composites

Structure, properties and applications of ceramics, polymers and composites. Introduction to super alloys and nanomaterials.

Text Book(s)

1. V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
2. R.Balasubramaniam, Callister's Material Science and Engineering, 2/e, Wiley India, 2014.

References

1. Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
2. S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
3. L.H.Van Vlack, Elements of Material Science and Engineering, 6/e, Pearson Education, 2008.
4. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.

Online Learning resources

<https://nptel.ac.in/courses/113107078>

<https://nptel.ac.in/courses/112107767>

<https://nptel.ac.in/courses/113104073>

23A03M02	ADDITIVE MANUFACTURING	L	T	P	C
		3	0	0	3

Course Objectives:

- Familiarize of additive manufacturing / rapid prototyping and its applications in various fields.
- Impart reverse engineering technologies.
- Explain different processes available in additive manufacturing.

UNIT – I

Introduction to Additive Manufacturing (AM) Systems: History and Development of AM, Need of AM, Difference between AM and CNC, Classification of AM Processes: Based on Layering Techniques, Raw Materials and Energy Sources, AM Process Chain, Benefits and Applications of AM, Representation of 3D model in STL format, RP data formats: SLC, CLI, RPI, LEAF, IGES, CT, STEP, HP/GL.

UNIT – II

CAD & Reverse Engineering: Basic Concept, Digitization techniques, Model Reconstruction, Data Processing for Additive Manufacturing Technology: CAD model preparation, Part Orientation and support generation, Model Slicing, Tool path Generation, Software's for Additive Manufacturing Technology: MIMICS, MAGICS. Reverse Engineering (RE) –Meaning, Use, RE – The Generic Process, Phase of RE Scanning, Contact Scanners, Noncontact Scanners, Point Processing, Application Geometric Model, Development.

UNIT – III

Solid and

Liquid Based AM Systems: Stereolithography (SLA): Principle, Process, Materials, Advantages, Limitations and Applications. Solid Ground Curing (SGC): Principle, Process, Materials, Advantages, Limitations, Applications. Fusion Deposition Modeling (FDM): Principle, Process, Materials, Advantages, Limitations, Applications. Laminated Object Manufacturing (LOM): Principle, Process, Materials, Advantages, Limitations, Applications.

UNIT – IV

Powder Based AM Systems: Principle and Process of Selective Laser Sintering (SLS), Advantages, Limitations and Applications of SLS, Principle and Process of Laser Engineered Net Shaping (LENS), Advantages, Limitations and Applications of LENS, Principle and Process of Electron Beam Melting (EBM), Advantages, Limitations and Applications of EBM.

UNIT – V

Other Additive Manufacturing Systems: Three Dimensional Printing (3DP): Principle, Process, Advantages, Limitations and Applications. Ballistic Particle Manufacturing (BPM): Principle, Process, Advantages, Limitations, Applications. Shape Deposition Manufacturing (SDM): Principle, Process, Advantages, Limitations, Applications.

Text Books:

1. Ian Gibson, David W. Rosen, Brent Stucker, —Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1st edition, Springer, 2010.
2. Chua C.K., Leong K.F. and Lim C.S., —Rapid Prototyping: Principles and Applications, 2nd edition, World Scientific Publishers, 2003.
3. Liou W. Liou, Frank W., Liou, —Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development, CRC Press, 2007.

Reference Books:

1. Pham D.T. and Dimov S.S., —Rapid Manufacturing; The Technologies and Application of RPT and Rapid Tooling, Springer, London 2001.
2. Gebhardt A., —Rapid prototyping, Hanser Gardener Publications, 2003.
3. Hilton P.D. and Jacobs P.F., —Rapid Tooling: Technologies and Industrial Applications, CRC Press, 2005.
4. RafiqNoorani, —Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.

Online Learning resources

<https://nptel.ac.in/courses/112103306>

<https://nptel.ac.in/courses/112104312>

<https://nptel.ac.in/courses/112101623>

<https://nptel.ac.in/courses/113108632>

23A03M03	MATERIALS CHARACTERIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

UNIT — I:

STRUCTURE ANALYSIS BY POWDER X-RAY DIFFRACTION

Introduction, Bragg's law of diffraction, Intensity of Diffracted beams —factors affecting Diffraction Intensities - structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherrer and WH Methods, Small angle X-ray scattering (SAXS) (in brief).

UNIT — II:

MICROSCOPY TECHNIQUE -1—SCANNING ELECTRON MICROSCOPY (SEM)

Introduction, Principle, Construction and working principle of Scanning Electron Microscope, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

UNIT — III:

MICROSCOPY TECHNIQUE -2 - TRANSMISSION ELECTRON MICROSCOPY (TEM)

Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantages and Limitations of Transmission Electron Microscopy.

UNIT — IV:

SPECTROSCOPY TECHNIQUES

Principle, Experimental arrangement, Analysis and Advantages of the spectroscopic techniques — (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

UNIT — V:

ELECTRICAL & MAGNETIC CHARACTERIZATION TECHNIQUES

Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID (Superconducting Quantum Interference Device)

Text Books:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods — **Yang** Leng — John Wiley & Sons (Asia) Pvt. Ltd. 2008
2. Micro structural Characterization of Materials - David Brandon, Wayne D Kalpan, **John** Wiley & Sons Ltd., 2008.

Reference Books:

1. Fundamentals of Molecular Spectroscopy — IV Ed. — Colin Neville Banwell and Elaine M. McCash, Tata McGraw-Hill, 2008.
2. Elements of X-ray diffraction — Bernard Dennis Cullity & Stuart R Stocks, Prentice Hall ,2001 — Science.

Online Learning resources

<https://nptel.ac.in/courses/113105100>

<https://nptel.ac.in/courses/112107767>

23A03M04	3D PRINTING MATERIALS & APPLICATIONS	L	T	P	C
		3	0	0	3

UNIT I

Introduction to 3D Printing

Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

UNIT II

Solid and Liquid Based RP Systems

Working Principle, Materials, Advantages, Limitations and Applications of Fusion Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Stereo lithography (SLA), Direct Light Projection System (DLP) and Solid Ground Curing (SGC).

UNIT III

Powder Based & Other RP Systems

Powder Based RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Laser Engineered Net Shaping (LENS) and Electron Beam Melting (EBM).

Other RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Three Dimensional Printing (3DP), Ballistic Particle Manufacturing (BPM) and Shape Deposition Manufacturing (SDM).

UNIT IV

Rapid Tooling & Reverse Engineering

Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.

Reverse Engineering (RE): Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development

UNIT V

Errors in 3D Printing and Applications:

Pre-processing, processing and post-processing errors, Part building errors in SLA, SLS, etc. Software: Need for software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, Solid View, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP. Applications: Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

Textbooks:

1. Chee Kai Chua and Kah Fai Leong, —3D Printing and Additive Manufacturing Principles and Applications| 5/e, World Scientific Publications, 2017.
2. Ian Gibson, David W Rosen, Brent Stucker, —Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing|, Springer, 2/e, 2010.

Reference Books:

1. Frank W.Liou, —Rapid Prototyping & Engineering Applications, CRC Press, Taylor & Francis Group, 2011.
2. Rafiq Noorani, —Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.

Online Learning Resources:

- NPTEL Course on Rapid Manufacturing.
- <https://nptel.ac.in/courses/112/104/112104265/>
- <https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/>
- <https://slideplayer.com/slide/6927137/>
- <https://www.mdpi.com/2073-4360/12/6/1334>
- <https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf>
- <https://lecturenotes.in/subject/197>
- https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilo.pdfcompressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
- <https://www.youtube.com/watch?v=NkC8TNts4B4>.

23A03602T	CAD/CAM	L	T	P	C
		3	0	0	3

UNIT-I

Overview of CAD/CAM: Product cycle, CAD, CAM and CIM. CAD Tools, CAM Tools, Utilization in an Industrial Environment, Evaluation criteria. CAD data structure, Data base management systems.

Computer Graphics: Co-ordinate systems, Graphics package functions, 2D and 3D transformations, clipping, hidden line / surface removal color, shading.

UNIT-II

Geometric Modeling: Representation techniques, Parametric and non-parametric representation, various construction methods, wire frame modeling, synthetic curves and their representations, surface modeling, synthetics surfaces and their representations. Solid modeling, solid representation, fundamentals, introduction to boundary representations, constructive solid geometry representations

UNIT- III

Numerical Control: NC, NC Modes, NC Elements, NC Machine tools and their structure, Machining center, types and features. Controls in NC, CNC systems, DNC systems. Adaptive control machining systems, types of adaptive control.

CNC Part Programming: Fundamentals, NC word, NC Nodes, canned cycles, cutter radius compensation, length compensation, computed assisted part programming using APT: Geometry statements, motion statements, post process statements, auxiliary statements, macro statement program for simple components.

UNIT -IV

Group Technology & FMS: Part Family, Classification and Coding, advantages & limitations, Group technology machine cells, benefits. FMS: Introduction, components of FMS, material handling systems, Computer control systems, advantages. Computer Aided Quality Control: Terminology in Quality control, Inspection and testing, Contact inspection methods - optical and non-optical, integration of CAQC with CAD and CIM.

UNIT- V

Computer Aided Processes Planning: Retrieval type and Generative type, benefits Machinability data systems, Computer generated time standards.

Computer integrated production planning: Capacity planning, shop floor control, MRP-I, MRP- II, CIMS benefits. Trends in manufacturing systems: Concepts of Reconfigurable manufacturing, Sustainable manufacturing and lean manufacturing.

Textbooks:

1. Mikell P. Groover, Emory W. Zimmers , CAD/CAM, 5/e, Pearson Prentice Hall of India, Delhi, 2008.
2. Ibrahim Zeid, R.Siva Subramanian, CAD/CAM: Theory and Practice, 2/e, Tata McGraw-Hill, Delhi, 2009.

Reference Books:

1. P. N. Rao, CAD/CAM: Principles and applications, 3/e, Tata McGraw-Hill, Delhi, 2017.
2. P. Radhakrishnan, S. Subramanyan& V. Raju, CAD/CAM/CIM, 3/e, New Age International Publishers, 2008.
3. Computer Aided Manufacturing, 3/e, Tien Chien Chang, Pearson, 2008.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc20_me44/preview
- <https://www.youtube.com/watch?v=EgKc9L7cbKc>
- <https://www.youtube.com/watch?v=KXFpTb9cBpY>
- https://web.iitd.ac.in/~hegde/cad/lecture/L01_Introduction.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1530947994.pdf
- https://www.iare.ac.in/sites/default/files/lecture_notes/CAD_CAM_LECTURE_NOTES.pdf

23A03M05	COMPUTER AIDED MACHINE DRAWING	L	T	P	C
		0	0	3	1.5

I. The following contents are to be done by any 2D software package

Conventional representation of materials and components:

Detachable joints: Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint and foundation bolts.

Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

Welded joints: Lap joint and T joint with fillet, butt joint with conventions.

Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.

Couplings: rigid – Muff, flange; flexible – bushed pin-type flange coupling, universal coupling, Oldhams' coupling.

II. The following contents to be done by any 3D software package

Sectional views

Creating solid models of complex machine parts and create sectional views.

Assembly drawings: (Any four of the following using solid model software)

Lathe tool post, tool head of shaping machine, tail stock, machine vice, gate valve, carburettor, piston, connecting rod, eccentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, universal coupling,

Manufacturing drawing:

Representation of limits, fits and tolerances for mating parts. Use any four parts of above assembly drawings and prepare manufacturing drawing with dimensional and geometric tolerances.

Text books:

1. K.L.Narayana, P.Kannaiah and K.Venkat Reddy, Production Drawing, New Age International Publishers, 3/e, 2014
2. Software tools/packages- Auto CAD, Solid works or equivalent.

Reference Books:

1. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata Mcgraw-Hill, NY, 2000.
2. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
3. N.D.Bhatt, Machine Drawing, Charotar, 50/e, 2014.

Online Learning Resources:

<https://eeedocs.files.wordpress.com/2014/02/machinedrawing.pdf>

23A03607	3D PRINTING PRACTICE (Lab)	L	T	P	C
		0	0	3	1.5

Course Objectives:

Students undergoing this course would

- Understand different methods of 3D Printing.
- Gain knowledge about simulation of FDM process
- Estimate time and material required for manufacturing a 3D component

Module 1:

Introduction to Prototyping, Working of 3D Printer, Types of 3D printing Machines:

Exp 1: Modelling of Engineering component and conversion of STL format.

Exp 2: Slicing of STL file and study of effect of process parameter like layer thickness, orientation, and infill on build time using software.

Exercise 1 : Component-1

Exercise 2 : Component-2

Module 2:

Exp 1 : 3D Printing of modelled component by varying layer thickness.

Exp 2 : 3D Printing of modelled component by varying orientation.

Exp 3: 3D Printing of modelled component by varying infill.

Module 3:

Study on effect of different materials like ABS, PLA, Resin etc, and dimensional accuracy.

Module 4:

Identifying the defects in 3D Printed components.

Module 5

Exp1: Modelling of component using 3D Scanner of real life object of unknown dimension in reverse engineering.

Exp 2: 3D Printing of above modelled component.

References:

1. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1/e, Springer, 2010.
2. Chua C.K., Leong K.F. and Lim C.S., Rapid Prototyping: Principles and Applications, 2/e, World Scientific Publishers, 2003.

Online Learning Resources/Virtual Labs:

- <https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/>
- <https://slideplayer.com/slide/6927137/>
- <https://www.mdpi.com/2073-4360/12/6/1334>
- <https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf>
- <https://lecturenotes.in/subject/197>
- https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
- <https://www.youtube.com/watch?v=NkC8TNts4B4>

(23A03M06) **PRODUCTION PLANNING & CONTROL**

Course objectives: The objectives of the course are to	
1	Understand the various components and functions of production planning and control
2	Explain the importance of Work study.
3	Familiarize with the terminology of product planning, process planning
4	Impart knowledge On Production Scheduling Policies and its Types.
5	Teach the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP). .

Course Outcomes: On successful completion of the course, the student will be able to,		
CO1	Students can able to prepare production planning and control activities.	L2
CO2	Understand the concepts of Work study.	L1, L2
CO3	Analyse the Pre requisite information needed for process planning	L2, L3
CO4	Understand the Scheduling techniques.	L1, L2
CO5	Students can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).	L3, L4

UNIT - I**Introduction**

Objectives and benefits of planning and Control-Functions of production Control-Types of production-job- batch and continuous-Product development and design-Marketing aspect - Functional aspects-Operational Aspect-Durability and dependability aspect aesthetic aspect. Profit consideration-Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

UNIT - II**Work Study**

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

UNIT - III**Product Planning And Process Planning**

Product planning-Extending the original product information-Value Analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning-Steps in process planning-Quantity determination in batch production-Machine capacity, balancing-Analysis of process capabilities in a multi-product system.

UNIT - IV**Production Scheduling**

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance – Flow production scheduling- Batch production scheduling-Product sequencing – Production Control systems- Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting- Manufacturing lead time-Techniques for aligning completion times and due dates.

UNIT – V

Inventory Control And Recent Trends In PPC

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system - Ordering cycle system-Determination of Economic order quantity and economic lot size-ABC analysis - Recorder Procedure-Introduction to computer integrated production planning systems-elements of Just in Time Systems-Fundamentals of MRP II and ERP.

Textbooks:

1. James. B. Dilworth,| Operations management – Design, Planning and Control for manufacturing and services| McGraw Hill International edition 1992.
2. Mart and Telsang, —Industrial Engineering and Production Management|, First edition, S. Chand and Company, 2000.

Reference Books:

1. Chary. S.N., —Theory and Problems in Production & Operations Management|, Tata McGraw Hill, 1995.
2. Elwood S.Buffa, and Rakesh K.Sarin, —Modern Production / Operations Management|, 8th Edition John Wiley and Sons, 2000.
3. Jain. K.C. & Aggarwal. L.N., —Production Planning Control and Industrial Management|, Khanna Publishers, 1990.
4. Kanishka Bedi, —Production and Operations management|, 2nd Edition, Oxford university press, 2007.
5. Melynk, Denzler, —Operations management – A value driven approach| Irwin McGraw hill.

Online Learning Resources:

<https://www.youtube.com/watch?v=yYIVumq6sVM>
<https://nptel.ac.in/courses/110107141>
<https://nptel.ac.in/courses/112107143>
<https://www.youtube.com/watch?v=Q7KpUY8spmM>

L T P C
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(23A03M07) MARKETING MANAGEMENT

Course objectives: The objectives of the course are to	
1	Developing and understanding of ideas and nuances of modern marketing.
2	Describe the process to formulate and manage the B2B marketing strategy including all key components.
3	Explain the techniques to conduct market analysis practices including market segmentation and targeting.
4	Compare and contrast different perspectives that characterize the study of consumer behavior.
5	Explain the role of IMC in the overall marketing program.

Course Outcomes: On successful completion of the course, the student will be able to,		
CO1	Knowledge of analytical skills in solving marketing related problem.	L2, L4
CO2	Awareness of marketing management process	L2, L3
CO3	Identify the scope and significance of Marketing in Domain Industry	L1, L2
CO4	Examine marketing concepts and phenomenon to current business events In the Industry.	L6, L4
CO5	illustrate market research skills for designing innovative marketing strategies for business firms	L3, L4

UNIT – I

Introduction

Marketing – Definitions - Conceptual frame work – Marketing environment: Internal and External - Marketing interface with other functional areas – Production, Finance, Human Relations Management, Information System. Marketing in global environment – Prospects and Challenges.

UNIT – II

Marketing Strategy

Marketing strategy formulations – Key Drivers of Marketing Strategies - Strategies for Industrial Marketing – Consumer Marketing — Services marketing – Competitor analysis - Analysis of consumer and industrial markets – Strategic Marketing Mix components.

UNIT - III

Marketing Mix Decisions

Product planning and development – Product life cycle – New product Development and Management – Market Segmentation – Targeting and Positioning – Channel Management – Advertising and sales promotions – Pricing Objectives, Policies and methods.

UNIT - IV

Buyer Behaviour

Understanding industrial and individual buyer behaviour - Influencing factors – Buyer Behaviour Models – Online buyer behaviour - Building and measuring customer satisfaction – Customer relationships management – Customer acquisition, Retaining, Defection.

UNIT – V

Marketing Research & Trends In Marketing

Marketing Information System – Research Process – Concepts and applications: Product – Advertising – Promotion – Consumer Behaviour – Retail research – Customer driven organizations – Cause related marketing – Ethics in marketing – Online marketing trends.

Textbooks:

1. Philip Kotler and Kevin Lane Keller, Marketing Management, PHI 14/e, 2012
2. Paul Baines, Chris Fill and Kelly Page, Marketing, Oxford University Press, 2/e, 2011.
3. Kotler, Philip (2002) Marketing Management, Millennium Edition. Intl ed. US: Prentice Hall, 2002

Reference Books:

1. Philip Kotler and Kevin Lane Keller, Marketing Management, PHI 14th Edition, 2012
2. KS Chandrasekar, —Marketing management-Text and Cases, Tata McGraw Hill, First edition, 2010
3. Lamb, Hair, Sharma, McDaniel – Marketing – An Innovative approach to learning and teaching- A South Asian perspective, Cengage Learning — 2012
4. Paul Baines, Chris Fill and Kelly Page, Marketing, Oxford University Press, 2/e, 2011.
5. Michael R. Czinkota & Masaaki Kotabe, Marketing Management, Cengage, 2000.

Online Learning Resources:

<https://nptel.ac.in/courses/110104068>

<https://www.youtube.com/watch?v=uTifDBH80HU&list=PLPjSqITyvDeUgSjU9XcEdZmd5Epz1L-Yn>

<https://www.youtube.com/watch?v=XD7Ie16qMT4&list=PLNsppmbLKJ8JSbzCxO8TYG8HDxxO5sSmV>

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(23A03M08) SUPPLY CHAIN MANAGEMENT

Course objectives: The objectives of the course are to	
1	Provide Knowledge on logistics and supply chain management
2	Enable students in designing the distribution network
3	Train the students in knowing the supply chain Analysis
4	Impart knowledge on Dimensions of logistic
5	know the recent trends in supply chain management

Course Outcomes: On successful completion of the course, the student will be able to,		
CO1	Understand the strategic role of logistic and supply chain management in the cost reduction and offering best service to the customer	L2
CO2	Understand Advantages of SCM in business	L2
CO3	Apply the knowledge of supply chain Analysis	L4, L2
CO4	Analyze reengineered business processes for successful SCM implementation	L6, L4
CO5	Evaluate Recent trend in supply chain management	L3, L4

UNIT-1

Introduction to Supply Chain Management

Supply chain - objectives - importance - decision phases - process view -competitive and supply chain strategies - achieving strategic fit – supply chain drivers - obstacles – framework - facilities - inventory-transportation-information-sourcing-pricing.

UNIT-2

Designing the distribution network

Role of distribution - factors influencing distribution - design options - e-business and its impact – distribution networks in practice –network design in the supply chain - role of network -factors affecting the network design decisions modelling for supply chain. Role of transportation - modes and their performance – transportation infrastructure and policies - design options and their trade-offs tailored transportation.

UNIT-3

Supply Chain Analysis.

Sourcing - In-house or Outsource - 3rd and 4th PLs - supplier scoring and assessment, selection - design collaboration - Procurement process - Sourcing planning and analysis. Pricing and revenue management for multiple customers, perishable products, seasonal demand, bulk and spot contracts.

UNIT-4

Dimensions of Logistics

A macro and micro dimension - logistics interfaces with other areas - approach to analyzing logistics systems - logistics and systems analysis - techniques of logistics system analysis - factors affecting the

cost and importance of logistics. Demand Management and Customer Service Outbound to customer logistics systems - Demand Management –Traditional Forecasting - CPFRP - customer service - expected cost of stock outs - channels of distribution.

UNIT-5

Recent Trends in Supply Chain Management-Introduction, New Developments in Supply Chain Management, Outsourcing Supply Chain Operations, Co-Maker ship, The Role of E-Commerce in Supply Chain Management, Green Supply Chain Management, Distribution Resource Planning, World Class Supply Chain Management

TEXT BOOKS:

1. Sunil Chopra and Peter Meindl, Supply Chain Management – —Strategy, Planning and Operationll, 3rd Edition, Pearson/PHI, 2007.
2. Supply Chain Management by Janat Shah Pearson Publication 2008.

REFERENCE BOOKS:

1. A Logistic approach to Supply Chain Management – Coyle, Bardi, Longley, Cengage Learning, 1/e
2. Donald J Bowersox, Dand J Closs, M Bixby Coluper, —Supply Chain Logistics Managementll, 2nd edition, TMH, 2008.
3. Wisner, Keong Leong and Keah-Choon Tan, —Principles of Supply Chain Management A Balanced Approachll, Cengage Learning, 1/e
4. David Simchi-Levi et al, —Designing and Managing the Supply Chainll – Concepts

Online Learning Resources:

<https://nptel.ac.in/courses/109105494>

<https://nptel.ac.in/courses/110108056>

<https://nptel.ac.in/courses/110106045>

<https://nptel.ac.in/courses/110105141>

(23A03M09) STRATEGIC MANAGEMENT FOR COMPETITIVE ADVANTAGE

Course objectives: The objectives of the course are to	
1	Explain Strategic Management concepts and their use in business
2	Provide information pertaining to Business, Corporate and Global Reforms
3	Learn various steps in strategic implementation.
4	Acquaint the learners with recent developments and trends in the business corporate world
5	Provide importance of corporate Governance and Ethical Issues.

Course Outcomes: On successful completion of the course, the student will be able to,		
CO1	Understand new forms of Strategic Management concepts and their use in business	L1,L2
CO2	Summarize strategic formulation process.	L2, L3
CO3	Develop analytical skills to solve cases and to provide strategic solutions	L3, L4
CO4	Understand Strategic Evaluation, Monitoring and Control	L1, L2
CO5	Create awareness on corporate Governance and Ethical Issues.	L3, L4

Unit I

Basic concepts

Basic Concepts of Strategic Management, Strategic Management Process, Vision, Mission and Goals, Benefits and Risks of Strategic Management, Levels of Strategies Concepts of corporate strategy, Corporate, Business and Operational Level Strategy, Functional Strategies: Human Resource Strategy, Marketing Strategy, Financial Strategy, Operational Strategy Business Environment: Components of Environment Micro and Macro and Environmental Scanning. Competitive Analysis - Competition and Competitor Analysis, Porter Five Forces Model Internal Corporate analysis, Sustainability, Value Chain Analysis.

Unit II

Strategic Formulation:

Strategic Choices and Importance, Formulation of Alternative Strategies: Generic Strategies, Grand Strategy, Diversification Mergers, Acquisitions, Takeovers, Joint Ventures, Diversification, Turnaround, Divestment and Liquidation. Strategic Analysis and Choice: Issues and Structures, Corporate Portfolio Analysis-SWOT Analysis, BCG Matrix, GE Nine Cell Matrix, Hofer's Matrix, ETOP-Environmental Threat and Opportunity Profile, Strategic Choice-Factors and Importance.

Unit III

Strategic Implementation:

Strategy Implementation - Strategy and Structure Steps, Importance and Problems, Resource Allocation-Importance & Challenges Strategic 7S Framework; Management of Change Strategy Implementation - Organizational culture and Leadership; Functional Strategies.

Unit IV

Strategic Evaluation, Monitoring and Control - Strategic Controls; Balanced Scorecard; Strategy map Evaluation and Control: Importance, Limitations and Techniques Budgetary Control: Advantages, Limitations. Corporate Restructuring Strategies: Concept, Need and Forms, Corporate Renewal Strategies: Concept, Internal and External factors and Causes.

Unit V

Corporate Governance and Ethical Issues, Corporate Social Responsibility and sustainability, Strategic Enablers: Innovation and Entrepreneurship, Knowledge Management, Technology Management. Public Private Participation: Importance, Problems and Governing Strategies of PPP Model. Information technology Driven Strategies: Importance, Limitations and contribution of IT sector in Indian Business. Start-up Business Strategies and Make in India Model: Process of business startups and its Challenges, Growth Prospects and government initiatives in Make in India Model with reference to National manufacturing, Contribution of Make in India Policy in overcoming industrial sickness

TEXT BOOKS:

1. Strategic Management, A Dynamic Perspective-Concepts and Cases– Mason A. Carpenter, Wm. Gerard Sanders, Prashant Salwan, Published by Dorling Kindersley (India) Pvt Ltd, Licensees of Pearson Education in south Asia.
2. Strategic Management and Competitive Advantage-Concepts Jay B. Barney, William S. Hesterly, Published by PHI Learning Private Limited, New Delhi.
3. Strategic Management Formulation, Implementation and Control, Pearce & Robinson, McGraw-Hill Publications.

REFERENCE BOOKS:

1. Crafting and Executing Strategy – The Quest for Competitive Advantage, Thomson & Strickland, McGraw-Hill Publications, 21st edition.
2. Exploring Strategy – Text and Cases, Gerry Johnson, Richard Whittington, Kevan Scholes, Duncan Angwin, and Patrick Regner, Pearson, 10th edition.
3. Strategic Management - Planning for Domestic and Global Competition, John A. Pearce II, Richard B. Robinson, Amita Mital, McGraw Hill Education, 14th edition.
4. Contemporary Strategy Analysis – Text and Cases, Robert M. Grant, 8th ed, John Wiley & Sons Inc.
5. Strategic Management – An Integrated Approach, Charles Hill & Gareth Jones, Cengage Learning, 9th edition.

Online Learning Resources:

<https://nptel.ac.in/courses/110105161>

<https://nptel.ac.in/courses/110108161>

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(23A03M10) SIX SIGMA & LEAN MANUFACTURING

Course objectives: The objectives of the course are to	
1	Teach the students, the basic concepts of six sigma and lean manufacturing.
2	Expose with various quality issues in Inspection.
3	Gain Knowledge on quality control and its applications to real time.
4	Know the extent of cellular manufacturing and 5S.
5	Understand the importance of Quality standards in manufacturing.

Course Outcomes: On successful completion of the course, the student will be able to,		
CO1	Summarize various techniques that are related to the six-sigma and lean manufacturing	L2
CO2	Outline the concepts of cellular manufacturing, JIT and TPM	L2, L3
CO3	Illustrate the principles and implementation of 5S techniques	L1, L2
CO4	Discuss procedure and principles of value stream mapping	L6, L4
CO5	Determine the reliability function using six-sigma.	L3, L4

UNIT — 1

Introduction to Six-Sigma

Probabilistic models-Six Sigma measures-Yield-DPMO-Quality level-Reliability function using Six Sigma- MTTF using Six Sigma-Maintenance free operating period- Availability using Six- Sigma - Point availability-Achieved availability-Operational Availability-Examples.

UNIT — II

The Elements of Six Sigma and their Determination

The Quality Measurement Techniques: SQC, Six Sigma, Cp and Cpk- The Statistical quality control (SQC) methods-The relationship of control charts and six sigma-The process capability index (Cp)- Six sigma approach-Six sigma and the 1.5 a shift-The Cpk Approach Versus Six Sigma-Cpk and process average shift- Negative Cpk-Choosing six sigma or Cpk-Setting the process capability index-Examples.

UNIT — III

Introduction to Lean Manufacturing

Conventional Manufacturing versus Lean Manufacturing — Principles of Lean Manufacturing — Basic elements of lean manufacturing — Introduction to LM Tools.

UNIT — IV

Cellular Manufacturing, JIT, TPM

Cellular Manufacturing — Types of Layout, Principles of Cell layout, Implementation. JIT — Principles of JIT and Implementation of Kanban. TPM — Pillars of TPM, Principles and implementation of TPM.

UNIT — V:

Set Up Time Reduction, TQM, 5S, VSM 10

Set up time reduction — Definition, philosophies and reduction approaches. TQM Principles and implementation. 5S Principles and implementation - Value stream mapping procedure and principles.

Text Books:

1. U Dinesh Kumar, Crocker, Chitra and Harithe Saranga, Reliability and Six Sigma, Springer Publishers.
2. Sung H. Park, Six Sigma for Quality and Productivity Promotion, Asian Productivity Organization

Reference Books:

1. Sammy G. Shina, Six Sigma for Electronics Design and Manufacturing, McGraw-Hill.
2. Design and Analysis of Lean Production Systems, Ronald G. Askin & Jeffrey B. Goldberg, John Wiley & Sons, 2003.
3. **Mikell P. Groover** (2002) Automation, Production Systems and **CIM**.
4. **Rother M.** and Shook J, 1999 Learning to See: Value Stream Mapping to Add Value and Eliminate Muda` , Lean Enterprise Institute, Brookline, MA.

Online Learning Resources:

<https://nptel.ac.in/courses/110105123>

<https://nptel.ac.in/courses/110105039>

23A05M01	DATA STRUCTURES & ALGORITHMS	L	T	P	C
		3	0	0	3

Course Objectives:

The main objectives of the course is to

- provide knowledge on advance data structures frequently used in Computer Science domain
- Develop skills in algorithm design techniques popularly used
- Understand the use of various data structures in the algorithm design

Course Outcomes:

After completion of the course, students will be able to

1. Illustrate the working of the advanced tree data structures and their applications (L2)
2. Understand the Graph data structure, traversals and apply them in various contexts. (L2)
3. Use various data structures in the design of algorithms (L3)
4. Recommend appropriate data structures based on the problem being solved (L5)
5. Analyze algorithms with respect to space and time complexities (L4)

UNIT – I:

Introduction to Algorithm Analysis, Space and Time Complexity analysis, Asymptotic Notations.

AVL Trees – Creation, Insertion, Deletion operations and Applications

B-Trees – Creation, Insertion, Deletion operations and Applications

UNIT – II:

Heap Trees (Priority Queues) – Min and Max Heaps, Operations and Applications

Graphs – Terminology, Representations, Basic Search and Traversals, Connected Components and Biconnected Components, applications

Divide and Conquer: The General Method, Quick Sort, Merge Sort, Strassen's matrix multiplication, Convex Hull

UNIT – III:

Greedy Method: General Method, Job Sequencing with deadlines, Knapsack Problem, Minimum cost spanning trees, Single Source Shortest Paths

Dynamic Programming: General Method, All pairs shortest paths, Single Source Shortest Paths– General Weights (Bellman Ford Algorithm), Optimal Binary Search Trees, 0/1 Knapsack, String Editing, Travelling Salesperson problem

UNIT – IV:

Backtracking: General Method, 8-Queens Problem, Sum of Subsets problem, Graph Coloring, 0/1 Knapsack Problem

Branch and Bound: The General Method, 0/1 Knapsack Problem, Travelling Salesperson problem

UNIT – V:

NP Hard and NP Complete Problems: Basic Concepts, Cook's theorem

NP Hard Graph Problems: Clique Decision Problem (CDP), Chromatic Number Decision Problem (CNDP), Traveling Salesperson Decision Problem (TSP)

NP Hard Scheduling Problems: Scheduling Identical Processors, Job Shop Scheduling.

Textbooks:

1. Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh, 2nd Edition Universities Press
2. Computer Algorithms in C++, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, 2nd Edition University Press

Reference Books:

1. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
2. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill
3. The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.
4. Data Structures using C & C++: Langsam, Augenstein & Tanenbaum, Pearson, 1995
5. Algorithms + Data Structures & Programs, N. Wirth, PHI
6. Fundamentals of Data Structures in C++: Horowitz Sahni & Mehta, Galgotia Pub.
7. Data structures in Java, Thomas Standish, Pearson Education Asia

Online Learning Resources:

1. https://www.tutorialspoint.com/advanced_data_structures/index.asp
2. <http://peterindia.net/Algorithms.html>
3. https://www.youtube.com/playlist?list=PLDN4rrl48XKpZkf03iYFl-O29szjTrs_O

23A32502	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

The objectives of this course are to introduce

- Software life cycle models, Software requirements and SRS document.
- Project Planning, quality control and ensuring good quality software.
- Software Testing strategies, use of CASE tools, Implementation issues, validation & verification procedures.

Course Outcomes:

After completion of the course, students will be able to

1. Perform various life cycle activities like Analysis, Design, Implementation, Testing and Maintenance (L3)
2. Analyse various software engineering models and apply methods for design and development of software projects. (L4)
3. Develop system designs using appropriate techniques. (L3)
4. Understand various testing techniques for a software project. (L2)
5. Apply standards, CASE tools and techniques for engineering software projects (L3)

UNIT I:

Introduction: Evolution, Software development projects, Exploratory style of software developments, Emergence of software engineering, Notable changes in software development practices, Computer system engineering.

Software Life Cycle Models: Basic concepts, Waterfall model and its extensions, Rapid application development, Agile development model, Spiral model.

UNIT II:

Software Project Management: Software project management complexities, Responsibilities of a software project manager, Metrics for project size estimation, Project estimation techniques, Empirical Estimation techniques, COCOMO, Halstead's software science, risk management.

Requirements Analysis And Specification: Requirements gathering and analysis, Software Requirements Specification (SRS), Formal system specification, Axiomatic specification, Algebraic specification, Executable specification and 4GL.

UNIT III:

Software Design: Overview of the design process, How to characterize a good software design? Layered arrangement of modules, Cohesion and Coupling. approaches to software design.

Agility: Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Other Agile Process Models, Tool Set for the Agile Process (Text Book 2)

Function-Oriented Software Design: Overview of SA/SD methodology, Structured analysis, Developing the DFD model of a system, Structured design, Detailed design, and Design Review.

User Interface Design: Characteristics of a good user interface, Basic concepts, Types of user interfaces, Fundamentals of component-based GUI development, and user interface design methodology.

UNIT IV:

Coding And Testing: Coding, Code review, Software documentation, Testing, Black-box testing, White-Box testing, Debugging, Program analysis tools, Integration testing, Testing object-oriented programs, Smoke testing, and Some general issues associated with testing.

Software Reliability And Quality Management: Software reliability. Statistical testing, Software quality, Software quality management system, ISO 9000. SEI Capability maturity model. Few other important quality standards, and Six Sigma.

UNIT V:

Computer-Aided Software Engineering (Case): CASE and its scope, CASE environment, CASE support in the software life cycle, other characteristics of CASE tools, Towards second generation CASE Tool, and Architecture of a CASE Environment.

Software Maintenance: Characteristics of software maintenance, Software reverse engineering, Software maintenance process models and Estimation of maintenance cost.

Software Reuse: reuse- definition, introduction, reason behind no reuse so far, Basic issues in any reuse program, A reuse approach, and Reuse at organization level.

Text Books:

1. Fundamentals of Software Engineering, Rajib Mall, 5th Edition, PHI.
2. Software Engineering A practitioner's Approach, Roger S. Pressman, 9th Edition, Mc-Graw Hill International Edition.

Reference Books:

1. Software Engineering, Ian Sommerville, 10th Edition, Pearson.
2. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

e-Resources:

- 1) <https://nptel.ac.in/courses/106/105/106105182/>
- 2) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01260589506387148827_shared/overview
- 3) https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview

23A05M02	COMPUTER ORGANIZATION	L	T	P	C
		3	0	0	3

Course Objectives:

- To learn the fundamentals of computer organization and its relevance to classical and modern problems of computer design
- To understand the structure and behavior of various functional modules of a computer.
- To learn the techniques that computers use to communicate with I/O devices
- To acquire the concept of pipelining and exploitation of processing speed.
- To learn the basic characteristics of multiprocessors

Course Outcomes (CO):

After completion of the course, students will be able to

- Understand computer architecture concepts related to the design of modern processors, memories and I/Os
- Identify the hardware requirements for cache memory and virtual memory
- Design algorithms to exploit pipelining and multiprocessors
- Understand the importance and trade-offs of different types of memories.
- Identify pipeline hazards and possible solutions to those hazards

UNIT - I

Basic Structure of Computer: Computer Types, Functional Units, Basic operational Concepts, Bus Structure, Software, Performance, Multiprocessors and Multicomputer.

Machine Instructions and Programs: Numbers, Arithmetic Operations and Programs, Instructions and Instruction Sequencing, Addressing Modes, Basic Input/output Operations, Stacks and Queues, Subroutines, Additional Instructions.

UNIT - II

Arithmetic: Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed-operand Multiplication, Fast Multiplication, Integer Division, Floating-Point Numbers and Operations.

Basic Processing Unit: Fundamental Concepts, Execution of a Complete Instruction, Multiple-Bus Organization, Hardwired Control, and Multi programmed Control.

UNIT - III

The Memory System: Basic Concepts, Semiconductor RAM Memories, Read-Only Memories, Speed, Size and Cost, Cache Memories, Performance Considerations, Virtual Memories, Memory Management Requirements, Secondary Storage.

UNIT - IV

Input/Output Organization: Accessing I/O Devices, Interrupts, Processor Examples, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces.

UNIT - V

Pipelining: Basic Concepts, Data Hazards, Instruction Hazards, Influence on Instruction Sets.

Large Computer Systems: Forms of Parallel Processing, Array Processors, The Structure of General-Purpose multiprocessors, Interconnection Networks.

Textbooks:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, —Computer Organization, 5th Edition, McGraw Hill Education, 2013.

Reference Books:

1. M.Morris Mano, —Computer System Architecture, 3rd Edition, Pearson Education.
2. Themes and Variations, Alan Clements, —Computer Organization and Architecture, CENGAGE Learning.
3. SmrutiRanjanSarangi, —Computer Organization and Architecture, McGraw Hill Education.
4. John P.Hayes, —Computer Architecture and Organization, McGraw Hill Education

Online Learning Resources:

<https://nptel.ac.in/courses/106/103/106103068/>

23A05M03	WEB TECHNOLOGIES	L	T	P	C
		3	0	0	3

Course Objectives:

The course is designed to Introduce the key technologies that have been developed as part of the birth and maturation of the World Wide Web.

Course Outcomes:

- Understand the Web essentials.
- Develop web pages using XHTML
- Apply style to web pages using CSS
- Write scripts for client side
- Develop and transform XML documents.

UNIT I

Web Essentials: Clients, Servers, and Communication, The Internet, Basic Internet protocols, WWW, HTTP request message, HTTP response message, Web clients, Web Servers, Case study.

UNIT II

Markup Languages: XHTML 1.0, An introduction to HTML, Basic XHTML syntax and semantics, fundamental HTML elements, Relative URLs, Lists, Tables, Frames, Forms, Defining XHTML's abstract syntax, Creating HTML documents.

UNIT III

Cascading Style Sheets: Introduction, features, core syntax, style sheets and HTML, style rule cascading and inheritance, text properties, Box model, normal flow box layout, beyond the normal flow, lists, tables, cursor styles.

UNIT IV

Client-side programming - JavaScript: Basic syntax, variables and data types, statements, operators, literals, functions, objects, Arrays, built-in objects, JavaScript debuggers.

UNIT V

Representing Web Data-XML: Documents and vocabularies, Versions and declaration, Namespaces, Ajax, DOM and SAX parsers, transforming XML documents, XPath, XSLT, Displaying XML documents in Web browsers.

Textbooks:

1. J.C. Jackson, Web technologies: A computer science perspective, Pearson.
- 2.

Reference Books:

1. Sebesta, Programming world wide web, Pearson.
2. Dietel and Nieto, Internet and World Wide Web –How to program, Pearson Education
3. Chris Bates, Web Programming, building internet applications, 2nd edition, WILEY, Dreamtech

Online Learning Resources:

<http://getbootstrap.com/>

<https://www.w3schools.com/whatis/>

<https://nptel.ac.in/courses/106105084>

23A37401T	COMPUTER NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives:

- To introduce the principles and mathematical foundations of quantum computation.
- To understand quantum gates, circuits, and computation models.
- To explore quantum algorithms and their advantages over classical ones.
- To develop the ability to simulate and write basic quantum programs.
- To understand real-world applications and the future of quantum computing in AI, cryptography, and optimization.

Course Outcomes:

Upon successful completion of this course, students will be able to:

- Explain the fundamental concepts of quantum mechanics used in computing.
- Construct and analyze quantum circuits using standard gates.
- Apply quantum algorithms like Deutsch-Jozsa, Grover's, and Shor's.
- Develop simple quantum programs using Qiskit or similar platforms.
- Analyze applications and challenges of quantum computing in real-world domains.

UNIT I: Fundamentals of Quantum Mechanics and Linear Algebra

Classical vs Quantum Computation, Complex Numbers, Vectors, and Matrices, Hilbert Spaces and Dirac Notation, Quantum States and Qubits, Superposition and Measurement, Tensor Products and Multi-Qubit Systems.

UNIT II: Quantum Gates and Circuits

Quantum Logic Gates: Pauli, Hadamard, Phase, Controlled Gates and CNOT, Unitary Operations and Reversibility, Quantum Circuit Representation, Quantum Teleportation, Simulation of Quantum Circuits.

UNIT III: Quantum Algorithms and Complexity

Quantum Parallelism and Interference, Deutsch and Deutsch-Jozsa Algorithms, Grover's Search Algorithm, Shor's Factoring Algorithm, Quantum Fourier Transform, Complexity Classes: BQP, P, NP, and QMA.

UNIT IV: Quantum Programming and Simulation Platforms

Introduction to Qiskit and IBM Quantum Experience, Writing Quantum Circuits in Qiskit, Measuring Qubits and Results, Classical-Quantum Hybrid Programs, Noisy Intermediate-Scale Quantum (NISQ) Systems, Limitations and Current State of Quantum Hardware.

UNIT V: Applications and Future of Quantum Computing

Quantum Machine Learning: Basics and Models, Quantum Cryptography and Quantum Key Distribution, Quantum Algorithms in AI and Optimization, Quantum Advantage and Supremacy, Ethical and Societal Impact of Quantum Technologies, Future Trends and Research Directions.

Textbooks:

1. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information, Cambridge University Press, 10th Anniversary Edition, 2010.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. Chris Bernhardt, Quantum Computing for Everyone, MIT Press, 2019.

Reference Books:

1. David McMahon, Quantum Computing Explained, Wiley, 2008.
2. Phillip Kaye, Raymond Laflamme, Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007.
3. Scott Aaronson, Quantum Computing Since Democritus, Cambridge University Press, 2013.

Online Learning Resources:

1. **IBM Quantum Experience and Qiskit Tutorials**
2. **Coursera – Quantum Mechanics and Quantum Computation by UC Berkeley**
3. **edX – The Quantum Internet and Quantum Computers**
4. **YouTube – Quantum Computing for the Determined by Michael Nielsen**
5. **Qiskit Textbook – IBM Quantum**

23A05M04	DATA STRUCTURES & ALGORITHMS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

The objectives of the course is to

- acquire practical skills in constructing and managing Data structures
- apply the popular algorithm design methods in problem-solving scenarios

Course Outcomes:

After completion of the course, students will be able to

- Design and develop programs to solve real world problems with the popular algorithm design methods. (L5)
- Demonstrate an understanding of Non-Linear data structures by developing implementing the operations on AVL Trees, B-Trees, Heaps and Graphs. (L2)
- Critically assess the design choices and implementation strategies of algorithms and data structures in complex applications. (L5)
- Utilize appropriate data structures and algorithms to optimize solutions for specific computational problems. (L3)
- Compare the performance of different of algorithm design strategies (L4)

Experiments covering the Topics:

- Operations on AVL trees, B-Trees, Heap Trees
- Graph Traversals
- Sorting techniques
- Finding Biconnected components in a graph
- Shortest path algorithms using greedy Method
- 0/1 Knapsack Problem using Dynamic Programming and Backtracking
- Travelling Salesperson problem using Branch and Bound
- N-Queens Problem using Backtracking
- Job Sequencing using Branch and Bound

Sample Programs:

1. Construct an AVL tree for a given set of elements which are stored in a file. And implement insert and delete operation on the constructed tree. Write contents of tree into a new file using in-order.
2. Construct B-Tree an order of 5 with a set of 100 random elements stored in array. Implement searching, insertion and deletion operations.
3. Construct Min and Max Heap using arrays, delete any element and display the content of the Heap.
4. Implement BFT and DFT for given graph, when graph is represented by
 - a) Adjacency Matrix
 - b) Adjacency Lists
5. Write a program for finding the biconnected components in a given graph.
6. Implement Quick sort and Merge sort and observe the execution time for various input sizes (Average, Worst and Best cases).
7. Compare the performance of Single Source Shortest Paths using Greedy method when the graph is represented by adjacency matrix and adjacency lists.
8. Implement Job Sequencing with deadlines using Greedy strategy.
9. Write a program to solve 0/1 Knapsack problem Using Dynamic Programming.
10. Implement N-Queens Problem Using Backtracking.
11. Use Backtracking strategy to solve 0/1 Knapsack problem.
12. Implement Travelling Sales Person problem using Branch and Bound approach.

Reference Books:

1. Fundamentals of Data Structures in C++, Horowitz Ellis, SahniSartaj, Mehta, Dinesh, 2nd Edition, Universities Press
2. Computer Algorithms/C++ Ellis Horowitz, SartajSahni, SanguthevarRajasekaran, 2nd Edition, University Press
3. Data Structures and program design in C, Robert Kruse, Pearson Education Asia
4. An introduction to Data Structures with applications, Trembley & Sorenson, McGraw Hill

Online Learning Resources:

1. <http://cse01-iiith.vlabs.ac.in/>
2. <http://peterindia.net/Algorithms.html>

23A05M05	WEB TECHNOLOGIES LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- Learn website development using HTML, CSS, JavaScript.
- Understand the concepts of responsive web development using the bootstrap framework
- Make use of the JQueryjavascript library to provide interactiveness to the websites.
- Discover how to use Google Charts to provide a better way to visualize data on a website
- Learn Content Management Systems to speed the development process

Course Outcomes (CO):

After completion of the course, students will be able to

- Construct web sites with valid HTML, CSS, JavaScript
- Create responsive Web designs that work on phones, tablets, or traditional laptops and widescreen monitors.
- Develop websites using jQuery to provide interactivity and engaging user experiences
- Embed Google chart tools in a website for better visualization of data.
- Design and develop web applications using Content Management Systems like WordPress

Sample Programs:

1. Create a Basic HTML document
2. Create your Profile Page
3. Create a Class Timetable (to merge rows/columns, use rowspan/colspan)
4. Create a Student Hostel Application Form
5. Make the Hostel Application Form designed in Module -4 beautiful using CSS (add colors, backgrounds, change font properties, borders, etc.)
6. Style the Hostel Application Form designed in Module-5 still more beautiful using Bootstrap
7. Analyse various HTTP requests (initiators, timing diagrams, responses) and identify problems if any.
8. Design a simple calculator using JavaScript to perform sum, product, difference, and quotient operations:
9. Design & develop a Shopping Cart Application with features including Add Products, Update Quantity, Display Price (Sub-Total & Total), Remove items/products from the cart.
10. Validate all Fields and Submit the Hostel Application Form designed in Module-6 using JQuery
11. Develop an HTML document to illustrate each chart with real-time examples.
12. Develop an E-learning website using any CMS (for example WordPress)

References:

1. Deitel and Deitel and Nieto, —Internet and World Wide Web - How to Program, Prentice Hall, 5th Edition, 2011.
2. Web Technologies, Uttam K. Roy, Oxford Higher Education., 1st edition, 10th impression, 2015.
3. Stephen Wynkoop and John Burke —Running a Perfect Website, QUE, 2nd Edition, 1999.
4. Jeffrey C and Jackson, —Web Technologies A Computer Science Perspective Pearson Education, 2011.
5. Gopalan N.P. and Akilandeswari J., —Web Technology, Prentice Hall of India, 2011.

Online Learning Resources/Virtual Labs:

- a. HTML: <https://html.spec.whatwg.org/multipage/>
- b. HTML: <https://developer.mozilla.org/en-US/docs/Glossary/HTML5>
- c. CSS: <https://www.w3.org/Style/CSS/>
- d. Bootstrap - CSS Framework: <https://getbootstrap.com/>
- e. BrowserDeveloperTools: https://developer.mozilla.org/enUS/docs/Learn/Common_questions/What_are_browser_developer_tools
- f. Javascript: <https://developer.mozilla.org/en-US/docs/Web/JavaScript>
- g. JQuery: <https://jquery.com>
- h. Google Charts: <https://developers.google.com/chart>
- i. Wordpress: <https://wordpress.com>

23A38502	INTRODUCTION TO CYBER SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

- Develop a foundational comprehension of cybersecurity concepts, encompassing threats, vulnerabilities, and protective strategies.
- Identify and categorize common cyber threats, understand their propagation, and implement effective countermeasures.
- Explore techniques for ensuring data integrity, authentication, and data availability, while comprehending cryptographic controls.
- Develop skills to respond to cybersecurity incidents, execute disaster recovery plans, and enhance system availability.
- Analyse the ethical dimensions of cybersecurity, understand professional responsibilities, and uphold ethical standards in the field.

Course Outcomes:

- Demonstrate various cyber threats and vulnerabilities, understanding their potential impact on digital assets.
- Implement proactive measures to mitigate cyber threats and protect against common attack vectors.
- Apply cryptographic techniques to ensure data integrity, authenticity, and confidentiality.
- Develop incident response plans and disaster recovery strategies to minimize the impact of cybersecurity incidents.
- Understand to ethical principles and professional responsibilities while making informed decisions in the realm of cybersecurity

UNIT I

Cybersecurity Essentials and Cube :The Cybersecurity World, Cyber Criminals versus Cybersecurity Specialists, Common Threats, Spreading Cybersecurity Threats, The Three Dimensions of the Cybersecurity Cube, CIA Triad, States of Data, Cybersecurity Countermeasures, IT Security Management Framework.

UNIT II

Cybersecurity Threats, Vulnerabilities, Attacks and Protecting Secrets: Introduction, Governance, Managing Cloud Security Risk, Compliance, Legal Issues in Cloud, Audit, CSA Tools.

UNIT III

Data Integrity: Types of Data Integrity Controls, Digital Signatures, Certificates, Database Integrity Enforcement.

UNIT IV

Data Availability and Recovery: High Availability, Measures to Improve Availability, Incident Response, Disaster Recovery.

UNIT: V

Protecting a Cybersecurity Domain :Defending Systems and Devices, Server Hardening, Network Hardening, Physical and Environmental Security, Cybersecurity Domains, Ethics of Working in Cybersecurity.

Text Books:

1. CISSP (ISC)2 Certified Information Systems Security Professional Official Study Guide, Mike Chapple, James Michael Stewart and Darril Gibson, 9th Edition
2. Cybersecurity: The Beginner's Guide, Dr.ErdalOzkaya, Packt Publishing Limited, 2019.

Reference Books:

1. Cybersecurity Essentials, Charles J. Brooks, Christopher Grow, Philip Craig and Donald Short, 1st edition, Sybex.
2. Network Security Essentials, William Stallings, 6th edition, Pearson Education, 2018

23A37601T	CYBER CRIMES & DIGITAL FORENSICS	L	T	P	C
		3	0	0	3

Course Objectives:

- To analyze how to conduct a digital forensics investigation and validate forensics data.
- Understand the impact of cyber crime in real time applications
- Discover the various methods to find the cyber crime
- Apply the forensics technology
- Develop the laws to control cyber crime

Course Outcomes:

- Understand the fundamentals of cybercrime.
- Understand the various cybercrime issues.
- Understand different investigation tools for cybercrime.
- Understand basics of Forensic Technology and Practices.
- Analyze different laws, ethics and evidence handling procedures.

UNIT I

Introduction: Introduction and Overview of Cyber Crime, Nature and Scope of Cyber Crime, Types of Cyber Crime: Social Engineering, Categories of Cyber Crime, Property Cyber Crime.

UNIT II

Cyber Crime Issues: Unauthorized Access to Computers, Computer Intrusions, White collar Crimes, Viruses and Malicious Code, Internet Hacking and Cracking, Virus Attacks, Pornography, Software Piracy, Intellectual Property, Mail Bombs, Exploitation, Stalking and Obscenity in Internet, Digital laws and legislation, Law Enforcement Roles and Responses.

UNIT III

Investigation: Introduction to Cyber Crime Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Hands on Case Studies. Encryption and Decryption Methods, Search and Seizure of Computers, Recovering Deleted Evidences, Password Cracking.

UNIT IV

Digital Forensics: Introduction to Digital Forensics, Forensic Software and Hardware, Analysis and Advanced Tools, Forensic Technology and Practices, Forensic Ballistics and Photography, Face, Iris and Fingerprint Recognition, Audio Video Analysis, Windows System Forensics, Linux System Forensics, Network Forensics.

UNIT V

Laws and Acts: Laws and Ethics, Digital Evidence Controls, Evidence Handling Procedures, Basics of Indian Evidence ACT IPC and CrPC, Electronic Communication Privacy ACT, Legal Policies

TEXT BOOKS:

1. Nelson Phillips and EnfingerSteuart, —Computer Forensics and Investigations, Cengage Learning, New Delhi, 2009.
2. Kevin Mandia, Chris Prosise, Matt Pepe, —Incident Response and Computer Forensics —, Tata McGraw -Hill, New Delhi, 2006.

REFERENCE BOOKS:

1. Robert M Slade, Software Forensics, Tata McGraw - Hill, New Delhi, 2005.
2. Bernadette H Schell, Clemens Martin, —Cybercrimel, ABC – CLIO Inc, California, 2004.
3. —Understanding Forensics in IT —, NIIT Ltd, 2005.

23A05601T	CRYPTOGRAPHY & NETWORK SECURITY	L	T	P	C
		3	0	0	3

Course Objectives:

This course aims at training students to master the:

- The concepts of classical encryption techniques and concepts of finite fields and number theory
- Working principles and utilities of various cryptographic algorithms including secret key cryptography, hashes, and message digests, and public key algorithms
- Design issues and working principles of various authentication protocols, PKI standards
- Various secure communication standards including Kerberos, IPsec, TLS and email
- Concepts of cryptographic utilities and authentication mechanisms to design secure applications

Course Outcomes:

- After completion of the course, students will be able to
- Identify information security goals, classical encryption techniques and acquire fundamental knowledge on the concepts of finite fields and number theory
- Compare and apply different encryption and decryption techniques to solve problems related to confidentiality and authentication
- Apply the knowledge of cryptographic checksums and evaluate the performance of different message digest algorithms for verifying the integrity of varying message sizes.
- Apply different digital signature algorithms to achieve authentication and create secure applications
- Apply network security basics, analyse different attacks on networks and evaluate the performance of firewalls and security protocols like TLS, IPsec, and PGP
- Apply the knowledge of cryptographic utilities and authentication mechanisms to design secure applications

UNIT I

Computer and Network Security Concepts: Computer Security Concepts, The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, A Model for Network Security,

Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Steganography,

Block Ciphers: Traditional Block Cipher Structure, The Data Encryption Standard, **Advanced Encryption Standard:** AES Structure, AES Transformation Functions

UNIT II

Number Theory: The Euclidean Algorithm, Modular Arithmetic, Fermat's and Euler's Theorems, The Chinese Remainder Theorem, Discrete Logarithms,

Finite Fields: Finite Fields of the Form $GF(p)$, Finite Fields of the Form $GF(2^n)$.

Public Key Cryptography: Principles, Public Key Cryptography Algorithms, RSA Algorithm, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography.

UNIT III

Cryptographic Hash Functions: Application of Cryptographic Hash Functions, Requirements & Security, Secure Hash Algorithm, Message Authentication Functions, Requirements & Security, HMAC & CMAC. Digital Signatures: NIST Digital Signature Algorithm, Distribution of Public Keys, X.509 Certificates, Public-Key Infrastructure

UNIT IV

User Authentication: Remote User Authentication Principles, Kerberos.

Electronic Mail Security: Pretty Good Privacy (PGP) And S/MIME.

IP Security: IP Security Overview, IP Security Policy, Encapsulating Security Payload, Combining Security Associations, Internet Key Exchange.

UNIT V

Transport Level Security: Web Security Requirements, Transport Layer Security (TLS), HTTPS, Secure Shell (SSH)

Firewalls: Firewall Characteristics and Access Policy, Types of Firewalls, Firewall Location and Configurations.

Textbooks:

1. Cryptography and Network Security-William Stallings, Pearson Education, 7th Edition.
2. Cryptography, Network Security and Cyber Laws–Bernard Menezes, Cengage Learning, 2010 edition.

Reference Books:

1. Cryptography and Network Security-Behrouz A Forouzan, Debdeep Mukhopadhyaya, McGraw Hill, 3rd Edition, 2015.
2. Network Security Illustrated, Jason Albanese and Wes Sonnenreich, MGH Publishers, 2003.

Online Learning Resources:

1. <https://nptel.ac.in/courses/106/105/106105031/lecture>
2. <https://nptel.ac.in/courses/106/105/106105162/lecture>
3. <https://www.mitel.com/articles/web-communication-cryptography-and-network->

23A35703a	CYBER LAWS AND SECURITY POLICIES	L	T	P	C
		3	0	0	3

Course Objectives:

- Gain an understanding of the evolution and jurisprudence of cyber law in India, including the IT Act 2000.
- Learn about digital signatures, e-governance, and their legal implications under the IT Act.
- Understand the legal framework for electronic contracts, their formation, and international perspectives.
- Explore taxation issues in cyberspace, cybercrimes, electronic evidence, and their adjudication under the IT Act.

Course Outcomes

- Learn evolution and key aspects of Indian cyber law, including recent amendments.
- Gain knowledge about the legalities of digital signatures and the role of e-governance in the IT Act.
- Develop an understanding of the legalities involved in electronic contracts and international conventions.
- Adapt in understanding and analyzing cybercrime, electronic evidence, and intellectual property rights in the context of IT.

UNIT - I

Introduction: History of Internet and World Wide Web, Need for cyber law, Cybercrime on the rise, Important terms related to cyber law.

Cyber law in India: Need for cyber law in India, History of cyber law in India.

Information Technology Act, 2000: Overview of other laws amended by the IT Act, 2000, National Policy on Information Technology 2012.

UNIT - II

Overview of the Information Technology Act, 2000: Applicability of the Act, Important provisions of the Act: Digital signature and Electronic signature, Digital Signature under the IT Act, 2000, E-Governance Attribution, Acknowledgement and Dispatch of Electronic Records, Certifying Authorities, Electronic Signature Certificates, Duties of Subscribers, Penalties and Offences, Intermediaries.

UNIT - III

Overview of rules issued under The IT Act, 2000, Electronic Commerce, Electronic Contracts, CyberCrimes, Cyber Frauds.

UNIT - IV

Regulatory Authorities: Department of Electronics and Information Technology, Controller of Certifying Authorities (CCA), Cyber Appellate Tribunal, Indian Computer Emergency Response Team (ICERT), Cloud Computing, Case Laws.

UNIT - V

Introduction to Cybercrime and procedure to report Cyber crime: procedure to report cybercrime, some basic rules for safe operations of the computer and internet, the criminal law (amendment) act, 2013: legislative remedies for online harassment and cyberstalking in India.

TEXT BOOKS:

1. Text book on —Cyber Law, 2 Ed Rp 2023, Pavan Duggal, Universal Law Publishing.
2. Text book on —Indian Cyber law on Cybercrimes, Pavan Duggal,

REFERENCE BOOKS:

1. Debby Russell and Sr. G.T Gangemi, "Computer Security Basics (Paperback)", 2nd Edition, O'Reilly Media, 2006.
2. Thomas R. Peltier, —Information Security policies and procedures: A Practitioner's Reference, 2nd Edition Prentice Hall, 2004.
3. Kenneth J. Knapp, —Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions, IGI Global, 2009.
4. Thomas R Peltier, Justin Peltier and John Blackley, Information Security Fundamentals, 2nd Edition, Prentice Hall, 1996.

23A05701b	BLOCK CHAIN TECHNOLOGY	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand how block chain systems (mainly Bit coin and Ethereum) work and to securely interact with them.
- Design, build, and deploy smart contracts and distributed applications.
- Integrate ideas from block chain technology into their own projects.

Course Outcomes (CO):

After completion of the course, students will be able to

- Demonstrate the foundation of the Block chain technology and understand the processes in payment and funding. Identify the risks involved in building Block chain applications.
- Review of legal implications using smart contracts.
- Choose the present landscape of Blockchain implementations and Understand Crypto currency markets
- Examine how to profit from trading crypto currencies.

UNIT - I

Introduction: Introduction, Scenarios, Challenges Articulated, Blockchain, Blockchain Characteristics, Opportunities Using Blockchain, History of Blockchain. Evolution of Blockchain: Evolution of Computer Applications, Centralized Applications, Decentralized Applications, Stages in Blockchain Evolution, Consortia, Forks, Public Blockchain Environments, Type of Players in Blockchain Ecosystem, Players in Market.

UNIT - II

Blockchain Concepts: Introduction, Changing of Blocks, Hashing, Merkle-Tree, Consensus, Mining and Finalizing Blocks, Currency aka tokens, security on blockchain, data storage on blockchain, wallets, coding on blockchain: smart contracts, peer-to-peer network, types of blockchain nodes, risk associated with blockchain solutions, life cycle of blockchain transaction.

UNIT - III

Architecting Blockchain solutions: Introduction, Obstacles for Use of Blockchain, Blockchain Relevance Evaluation Framework, Blockchain Solutions Reference Architecture, Types of Blockchain Applications. Cryptographic Tokens, Typical Solution Architecture for Enterprise Use Cases, Types of Blockchain Solutions, Architecture Considerations, Architecture with Blockchain Platforms, Approach for Designing Blockchain Applications.

UNIT - IV

Ethereum Block chain Implementation: Introduction, Tuna Fish Tracking Use Case, Ethereum Ecosystem, Ethereum Development, Ethereum Tool Stack, Ethereum Virtual Machine, Smart Contract Programming, Integrated Development Environment, Truffle Framework, Ganache, Unit Testing, Ethereum Accounts, My Ether Wallet, Ethereum Networks/Environments, Infura, Ether scan, Ethereum Clients, Decentralized Application, Metamask, Tuna Fish Use Case Implementation, Open Zeppelin in Contracts

UNIT - V Hyper ledger Block chain Implementation: Introduction, Use Case – Car Ownership Tracking, Hyper ledger Fabric, Hyper ledger Fabric Transaction Flow, FabCar Use Case Implementation, Invoking Chain code Functions Using Client Application.

Advanced Concepts in Blockchain: Introduction, Inter Planetary File System (IPFS), Zero Knowledge Proofs, Oracles, Self-Sovereign Identity, Blockchain with IoT and AI/ML Quantum Computing and Blockchain, Initial Coin Offering, Blockchain Cloud Offerings, Blockchain and its Future Potential.

Textbooks:

1. Ambadas, Arshad SarfarzAriff, Sham —Blockchain for Enterprise Application Developers, Wiley, 2020
2. Andreas M. Antonopoulos, —Mastering Bitcoin: Programming the Open Blockchain, O'Reilly, 2017

Reference Books:

1. Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions, Joseph Bambara, Paul R. Allen, Mc Graw Hill.
2. Blockchain: Blueprint for a New Economy, Melanie Swan, O'Reilly

Online Learning Resources:

<https://github.com/blockchainedindia/resources>

23A37502P	CYBER SECURITY LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

To get practical exposure of Cyber security threats and Forensics tools.

Course Outcomes:

- Get the skill to identify cyber threats/attacks.
- Get the knowledge to solve security issues in day-to-day life.
- Able to use Autopsy tools
- Perform Memory capture and analysis
- Demonstrate Network analysis using Network miner tools

List of Experiments

1. Perform an Experiment for port scanning with nmap
2. Set Up a honeypot and monitor the honeypot on the network
3. Install Jscript/Cryptool tool (or any other equivalent) and demonstrate Asymmetric, symmetric crypto algorithm, Hash and Digital/PKI signatures.
4. Generate minimum 10 passwords of length 12 characters using open SSL command
5. Perform practical approach to implement Footprinting-Gathering target information using Dmitry-Dmagic, UAtester
6. Working with sniffers for monitoring network communication (Wireshark).
7. Using Snort, perform real time traffic analysis and packet logging.
8. Perform email analysis using the Autopsy tool.
9. Perform Registry analysis and get boot time logging using process monitor tool
10. Perform File type detection using Autopsy tool
11. Perform Memory capture and analysis using FTK imager tool
12. Perform Network analysis using the Network Miner tool

TEXT BOOKS:

1. Real Digital Forensics for Handheld Devices, E. P. Dorothy, Auerback Publications, 2013.
2. The Basics of Digital Forensics: The Primer for Getting Started in Digital Forensics, J. Sammons, Syngress Publishing, 2012.

REFERENCE BOOKS:

1. Handbook of Digital Forensics and Investigation, E. Casey, Academic Press, 2010.
2. Malware Forensics Field Guide for Windows Systems: Digital Forensics Field Guides, C. H. Malin, E. Casey and J. M. Aquilina, Syngress, 2012.
3. The Best Damn Cybercrime and Digital Forensics Book

23A05601P	CRYPTOGRAPHY AND NETWORK SECURITY LAB	L	T	P	C
		0	0	3	1.5

Course Objective:

To provide hands-on experience in implementing cryptographic algorithms and security techniques using programming tools.

Course Outcomes:

Upon successful completion of the course, the student will be able to:

1. **CO1:** Implement basic encryption techniques such as XOR, AND, Caesar, and substitution ciphers.
2. **CO2:** Apply symmetric key algorithms (DES, AES, Blowfish, RC4) for secure data encryption and decryption.
3. **CO3:** Demonstrate the use of asymmetric key algorithms (RSA, Diffie-Hellman) in secure communication.
4. **CO4:** Analyze and implement cryptographic hash functions such as SHA-1 and MD5.
5. **CO5:** Utilize programming tools like Java Cryptography Architecture and key management tools for practical security implementation.

List of Experiments:

1. Write a C program that contains a string (char pointer) with a value `__Hello world__`. The program should XOR each character in this string with 0 and displays the result.
2. Write a C program that contains a string (char pointer) with a value `__Hello world__`. The program should AND or and XOR each character in this string with 127 and display the result.
3. Write a Java program to perform encryption and decryption using the following algorithms
 - a. Ceasercipher
 - b. Substitution cipher
 - c. Hill Cipher
4. Write a C/JAVA program to implement the DES algorithm logic.
5. Write a C/JAVA program to implement the Blowfish algorithm logic.
6. Write a C/JAVA program to implement the Rijndael algorithm logic.
7. Write the RC4 logic in Java Using Java cryptography; encrypt the text `—Hello worldl` using Blowfish. Create your own key using Java key tool.
8. Write a Java program to implement RSA algorithm.
9. Implement the Diffie-Hellman Key Exchange mechanism using HTML and JavaScript.
10. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.
11. Calculate the message digest of a text using the MD5 algorithm in JAVA.

Textbooks:

- 1) Cryptography and Network Security –William Stallings, Pearson Education, 7th Edition.
- 2) Cryptography, Network Security and Cyber Laws –Bernard Menezes, Cengage Learning, 2010 edition.

Reference Books:

- 1) Cryptography and Network Security-Behrouz A Forouzan, Debdeep Mukhopadhyaya, Mc-GrawHill, 3rd Edition, 2015.
- 2) Network Security Illustrated ,Jason Albanese and Wes Sonnenreich, MGH Publishers, 2003.

23A35M01	INTRODUCTION TO IOT	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand the basics of Internet of Things and protocols.
- Discuss the requirement of IoT technology
- Introduce some of the application areas where IoT can be applied.
- Understand the vision of IoT from a global perspective, understand its applications, determine its market perspective using gateways, devices and data management

Course Outcomes:

After completion of the course, students will be able to

- Understand general concepts of Internet of Things.
- Apply design concept to IoT solutions
- Analyze various M2M and IoT architectures
- Evaluate design issues in IoT applications
- Create IoT solutions using sensors, actuators and Devices

UNIT I

Introduction to IoT: Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication. Caesar cipher b. Substitution cipher c. Hill Cipherization models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates.

UNIT II

Prototyping IoT Objects using Microprocessor / Microcontroller: Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.

UNIT III

IoT Architecture and Protocols: Architecture Reference Model Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LoWPAN, RPL, CoAP, MQTT, IoT frameworks Thing Speak.

UNIT IV

Device Discovery and Cloud Services for IoT: Device discovery capabilities – Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

UNIT V

UAV IoT: Introduction to Unmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller (ESC), GPS, IMU, Ultra sonic sensors; UAV Software – Ardupilot, Mission Planner, Internet of Drones (IoD)- Case study FlytBase.

Textbooks:

1. VijayMadiseti and ArshdeepBahga, —Internet of Things (A Hands-on-Approach) I, 1st Edition, VPT, 2014.
2. Handbook of unmanned aerial vehicles, K Valavanis; George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.

Reference Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, —From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence I, 1st Edition, Academic Press, 2014.
2. Arshdeep Bahga, Vijay Madiseti —Internet of Things: A Hands-On Approach, Universities Press, 2014.
3. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.
4. Francis da Costa, —Rethinking the Internet of Things: A Scalable Approach to Connecting Everything I, 1st Edition, Apress Publications, 2013
5. Cuno Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011, ISBN: 978-1-4493-9357-1
6. DGCA RPAS Guidance Manual, Revision 3 – 2020
7. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

Online Learning Resources:

1. <https://www.arduino.cc/>
2. <https://www.raspberrypi.org/>
3. <https://nptel.ac.in/courses/106105166/5>
4. <https://nptel.ac.in/courses/108108098/4>

23A37503	WIRELESS SENSOR NETWORKS FOR CS	L	T	P	C
		3	0	0	3

Course Objectives:

- To acquire the knowledge about various architectures and applications of Sensor Networks
- To understand issues, challenges and emerging technologies for wireless sensor networks
- To learn about various routing protocols and MAC Protocols
- To understand various data gathering and data dissemination methods
- To Study about design principals, node architectures, hardware and software required for implementation of wireless sensor networks.

Course Outcomes:

Upon completion of the course, the student will be able to:

- Analyze and compare various architectures of Wireless Sensor Networks
- Understand Design issues and challenges in wireless sensor networks
- Analyze and compare various data gathering and data dissemination methods.
- Design, Simulate and Compare the performance of various routing and MAC protocol

Unit I

Characteristics Of WSN: Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks -Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, MicaMote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.

Unit II

Medium Access Control Protocols: Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts - Contention- based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.

Unit III

Routing And Data Gathering Protocols Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations -Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

Unit IV

Embedded Operating Systems: Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS- OSPM - EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules- Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM.

Unit V

Applications Of WSN: WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling.

TEXT BOOKS

1. KazemSohraby, Daniel Minoli andTaiebZnati, — Wireless Sensor Networks Technology, Protocols, and Applications—, John Wiley & Sons,2007.
2. Holger Karl and Andreas Willig, —Protocols and Architectures for Wireless Sensor NetworksI, John Wiley & Sons, Ltd, 2005.

REFERENCEBOOKS

1. K.AkkayaandM.Younis,—Asurveyofroutingprotocolsinwireless sensor networksI, Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349
2. PhilipLevis,—TinyOSProgrammingI
3. AnnaHa'c,—WirelessSensorNetworkDesignsI,JohnWiley&SonsLtd,

23A35H01	COMMUNICATION PROTOCOLS FOR IOT	L	T	P	C
		3	0	0	3

Course Objectives:

In this course, learners will be going to learn about various protocols designed for the implementation of the Internet of Things (IoT) applications.

Course Outcomes:

- Understand fundamentals of IoT architecture outline and standards.
- Understand and analyze different architectural views.
- Understand the importance of IoT Data Link Layer & Network Layer Protocols.
- Understand the importance of Iot Transport & Session Layer Protocols.

UNIT - I

Introduction:IoT architecture outline, standards - IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics.

Unit - II

Iot Reference Architecture: Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant Architectural views. Real-World Design Constraints- Introduction, Technical Design constraints.

UNIT - III

IoT Data Link Layer: PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, ZWave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7

UNIT - IV

Network Layer Protocols: Network Layer-IPv4,IPv6, 6LoWPAN, 6TiSCH,ND, DHCP, ICMP, RPL, CORPL, CARP.

UNIT - V

IOT Transport & Session Layer Protocols: Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)- (TLS, DTLS) – Session Layer-HTTP, CoAP, XMPP, AMQP, MQTT.

TEXT BOOKS:

1. Daniel Minoli, —Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications, ISBN: 978-1-118-47347-4, Willy Publications ,2016
2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, —From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligencel,1st Edition, Academic Press, 2015.

REFERENCE BOOKS:

1. Bernd Scholz-Reiter, Florian Michahelles, —Architecting the Internet of Things, ISBN 978-3-64219156-5 e-ISBN 978-3-642-19157-2, Springer, 2016.
2. N. Ida, Sensors, Actuators and Their Interfaces, Scitech Publishers, 2014.

23A35H04	INDUSTRIAL IOT	L	T	P	C
		3	0	0	3

Course Objectives:

- Acquire theoretical knowledge on Industrial Internet of Things.
- Apply suitable machine learning techniques for data handling and to gain knowledge from it.
- Evaluate the performance of algorithms for sensors and data transmission.

Course Outcomes:

- Understand the characteristics of Internet of Things and its industry strategies.
- Apply various Internet of Things models to appropriate problems.
- Identify and integrate more than one technology to enhance the performance.
- Understand the sensors and data transmission used in Internet of Things.
- Analyse the co-occurrence of data to find interesting frequent patterns.
- Pre-process the data before applying to any real-world problem and can evaluate its performance.

UNIT I

Overview of Internet of Things: Introduction, IOT Architecture, Application –based IOT protocols, Cloud Computing, Fog Computing, Sensor Cloud, Big Data.

Overview of Industry 4.0 and Industrial Internet of Things: IIoT- Prerequisites of IIOT, Basics of CPS, CPS and IIOT, Applications of IIoT.

UNIT II

Industrial Internet of Things: Introduction, Industrial Internet Systems, Industrial sensing, Industrial sensing, Industrial Processes.

Business Models and Reference Architecture of IIoT: Definition of a business model, Business models of IOT, Business models of IIOT.

UNIT III

Key and On-site Technologies: Key Technologies:Off-site Technologies- Introduction, Cloud Computing- Necessity, Cloud Computing and IIot, Industrial Cloud Platform Providers, SLA, Requirements of Industry 4.0, Fog Computing.

On-site Technologies- Introduction, Augmented Reality- History, Categorization, Applications, Virtual Reality- History, Categorization, Applications.

UNIT IV

Sensors and Data Transmission Sensors: Introduction to Sensors, Characteristics-Sensor calibration, Sensor profile, Operating voltage, Sensor Categories. Actuators:Introduction, Thermal Actuators, Hydraulic Actuators, Pneumatic Actuators, Electromechanical Actuators.

Industrial Data Transmission: Foundation fieldbus, Profibus, HART, Interbus, Bitbus.

UNIT V

Machine Learning and Data Science in Industries: Introduction, Machine Learning, Categorization on ML, Applications and Data Science of ML in industries, Deep Learning, Applications of Deep Learning in industries.

Applications of Healthcare in Industries: Smart Devices, Advanced Technologies using in Healthcare, Open Research Issues to be Addressed.

Textbooks:

1. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.
- 2.

Reference Books:

1. Industrial IoT. Available online: <https://medium.com/iotforall/whatproduct-managers-need-to-know-about-industrial-iot-8c92eec1d9d2>
2. IIoT Cloud Platforms. Available online: <https://fr.farnell.com/willthere-be-a-dominant-iiot-cloud-platform>.
3. Kajima, T. and Kawamura, Y., 1995. Development of a high-speed solenoid valve: Investigation of solenoids. IEEE Transactions on industrial electronics, 42(1), pp.1-8.

Online Learning Resources:

1. <https://www.coursera.org/learn/industrial-internet-of-things>
2. <https://www.coursera.org/specializations/developing-industrial-iot>

23A37501T	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives:

- To explain the evolving computer model called cloud computing.
- To introduce the various levels of services that can be achieved by cloud.
- To describe the security aspects in cloud.

Course Outcomes (CO):

After completion of the course, students will be able to

- Ability to create cloud computing environment
- Ability to design applications for Cloud environment
- Design & develop backup strategies for cloud data base don features.
- Use and Examine different cloud computing services.
- Apply different cloud programming model asperneed.

UNIT-I

Introduction to cloud computing: Introduction, Characteristics of cloud computing, Cloud Models, Cloud Services Examples, Cloud Based services and applications

Cloud concepts and Technologies: Virtualization, Load balancing, Scalability and Elasticity, Deployment, Replication, Monitoring, Software defined, Network function virtualization, Map Reduce, Identity and Access Management, services level Agreements, Billing.

Cloud Services and Platforms: Compute Services, Storage Services, Database Services, Application services, Content delivery services, Analytics Services, Deployment and Management Services, Identity and Access Management services, Open Source Private Cloud software.

UNIT-II

Hadoop MapReduce: Apache Hadoop, Hadoop Map Reduce Job Execution, Hadoop Schedulers, Hadoop Cluster setup.

Cloud Application Design: Reference Architecture for Cloud Applications, Cloud Application Design Methodologies, Data Storage Approaches.

Python Basics: Introduction, Installing Python, Python data Types & Data Structures, Control flow, Function, Modules, Packages, File handling, Date/Time Operations, Classes.

UNIT-III

Python for Cloud: Python for Amazon web services, Python for Google Cloud Platform, Python for windows Azure, Python for MapReduce, Python packages of Interest, Python web Application Framework, Designing a RESTful web API.

Cloud Application Development in Python :Design Approaches, Image Processing APP, Document Storage App, MapReduce App, Social Media Analytics App.

UNIT-IV

Big Data Analytics: Introduction, Clustering Big Data, Classification of Bigdata Recommendation of Systems. Multimedia Cloud: Introduction, Case Study: Live video Streaming App, Streaming Protocols, case Study: Video Transcoding App.

Cloud Application Benchmarking and Tuning: Introduction, Workload Characteristics, Application Performance Metrics, Design Considerations for a Benchmarking Methodology, Benchmarking Tools, Deployment Prototyping, Load Testing & Bottleneck Detection case Study, Hadoop benchmarking case Study.

UNIT-V

Cloud Security: Introduction, CSA Cloud Security Architecture, Authentication, Authorization, Identity Access Management, Data Security, Key Management, Auditing.

Cloud for Industry, Healthcare & Education: Cloud Computing for Health care, Cloud computing for Energy Systems, Cloud Computing for Transportation Systems, Cloud Computing for Manufacturing Industry, Cloud computing for Education.

Migrating into a Cloud: Introduction, Broad Approaches to migrating into the cloud, the seven– step model of migration into a cloud.

Organizational readiness and Change Management in The Cloud Age: Introduction, Basic concepts of Organizational Readiness, Drivers for changes: A frame work to comprehend the competitive environment, common change management models, change management maturity models, Organizational readiness self – assessment.

Legal Issues in Cloud Computing: Introduction, Data Privacy and security Issues, cloud contracting models, Jurisdiction a issues raised by virtualization and data location, commercial and Business considerations, Special Topics.

Textbooks:

1. Cloud computing A hands-on Approach|| By ArshdeepBahga, Vijay Madiseti, Universities Press, 2016
2. Cloud Computing Principles and Paradigms: By Raj Kumar Buyya, James Broberg, Andrzej, Goscinski, Wiley, 2016.

Reference Books:

1. Mastering Cloud Computing by RajkumarBuyya, Christian Vecchiola, SThamaraiSelvi, TMH
2. Cloud computing A Hands-On Approach by ArshdeepBahga and Vijay Madiseti.
3. Cloud Computing: A Practical Approach, Anthony T. Velte, Toby J. Velte, Robert Elsenpeter, Tata McGraw Hill, rp2011.
4. Enterprise Cloud Computing, Gautam Shroff, Cambridge University Press, 2010.
5. Cloud Application Architectures: Building Applications and Infrastructure in the Cloud, George Reese, O _Reilly, SPD, rp2011.
6. Essentials of Cloud Computing by K. Chandrasekaran. CRC Press.

23A32503P	INTERNET OF THINGS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To introduce components such as WiFi, Bluetooth, Temperature, Moisture sensors
- To know the Micro controller such as Arduino
- To know the System on Chip (SOC) / Single Board Computer such as Raspberry Pi
- To understand HTTP IoT protocols and perform Experiments for data transmission
- To understand UAV/Drones and Internet of Drones Experiments

Course Outcomes: After completion of the course, students will be able to

- Know the various IoT sensors and understand the functionality
- Design and analyze IoT experiments and transfer the data to IoT Clouds
- Design the IoT systems for real time applications
- Understand Drones and Perform Internet of Drones Experiments

Experiments using ESP32**1. Serial Monitor, LED, Servo Motor - Controlling**

Experiment1: Controlling actuators through Serial Monitor. Creating different led patterns and controlling them using push button switches. Controlling servo motor with the help of joystick.

2. Distance Measurement of an object

Experiment 2: Calculatethe distance to an object with the help of an ultrasonic sensor and display it on an LCD.

3. LDR Sensor, Alarm and temperature, humidity measurement

Experiment 3: Controlling relay state based on ambient light levels using LDR sensor. Basic Burglar alarm security system with the help of PIR sensor and buzzer. Displaying humidity and temperature values on LCD

4. Experiments using Raspberry Pi**Experiment 4:**

- Controlling relay state based on input from IR sensors
- Interfacing stepper motor with R-Pi
- Advanced burglar alarm security system with the help of PIR sensor, buzzer and keypad. (Alarm gets disabled if correct keypad password is entered)
- Automated LED light control based on input from PIR (to detect if people are present) and LDR(ambient light level)

5. IOT Framework

Experiment 5: Upload humidity & temperature data to ThingSpeak, periodically logging ambient light level to ThingSpeak Experiment 6: Controlling LEDs, relay & buzzer using Blynk app

6. HTTP Based

Experiment 7: Introduction to HTTP. Hosting a basic server from the ESP32 to control various digital based actuators (led, buzzer, relay) from a simple web page.

Experiment 8: Displaying various sensor readings on a simple web page hosted on the ESP32.

7. MQTT Based

Experiment 9: Controlling LEDs/Motors from an Android/Web app, Controlling AC Appliances from an android/web app with the help of relay.

Experiment 10: Displaying humidity and temperature data on a web-based application

8. UAV/Drone:

Experiment 11:

- Demonstration of UAV elements, Flight Controller
- Mission Planner flight planning design

Experiment 12:

Python program to read GPS coordinates from Flight Controller

References:

1. Adrian McEwen, Hakim Cassimally - Designing the Internet of Things, Wiley Publications, 2012.
2. Alexander Osterwalder, and Yves Pigneur – Business Model Generation – Wiley, 2011
3. ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
4. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C. Raman, CRC Press.

Online Learning Resources/Virtual Labs:

<https://www.arduino.cc/>

<https://www.raspberrypi.org/>

23A37501P	Cloud Computing Lab	L	T	P	C
		0	0	3	1.5

Course Objectives:

- Demonstrate application development using Cloud
- Explain features of Hadoop

Course Outcomes (CO):

On completion of this course, the students will be able to:

- Configure various virtualization tools such as Virtual Box, VMware workstation.
- Design and deploy a web application in a PaaS environment.
- Learn how to simulate a cloud environment to implement new schedulers.
- Install and use a generic cloud environment that can be used as a private cloud.
- Manipulate large data sets in a parallel environment.

List of Experiments:

1. Install VirtualBox/VMware Workstation with different flavours of Linux or windows OS on top of windows operating systems.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Install Google App Engine. Create hello world app and other simple web applications using python/java.
4. Use GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using try stack (Online Open stack Demo Version)
8. Install Hadoop single node cluster and run simple applications like wordcount
9. Establish an AWS account. Use the AWS Management Console to launch an EC2 instance and connect to it.
10. Develop a Guestbook Application using Google App Engine
11. Develop a Serverless Web App using AWS
12. Design a Content Recommendation system using AWS
13. Design a Cloud based smart traffic management system
14. Design Cloud based attendance management system
15. Design E-learning cloud-based system
16. Using Amazon Lex build a Chatbot

References:

- https://www.vmware.com/products/workstation-pro/workstation-pro_evaluation.html.
- <http://code.google.com/appengine/downloads.html>
- <http://code.google.com/appengine/downloads.html>

Online Learning Resources/Virtual Labs:

Google Cloud Computing Foundations Cour

23A32M01	INTRODUCTION TO DATA SCIENCE	L	T	P	C
		3	-	-	3

Course Objectives (COs)

The course aims to:

- Provide a foundational understanding of data science processes and applications.
- Introduce key tools and techniques such as Python, statistics, data cleaning, visualization, and machine learning.
- Develop practical skills in data analysis, interpretation, and data storytelling.
- Enable students to work on real-world datasets using data science techniques.
- Prepare students for advanced studies or industry roles in data science and analytics.

Course Outcomes

After completing this course, students will be able to:

CO No.	Course Outcome	BTL
CO1	Explain the data science lifecycle and its importance in business and research.	L2
CO2	Use Python and libraries like Pandas, NumPy, and Matplotlib for data handling.	L3
CO3	Perform data cleaning, transformation, and visualization effectively.	L3
CO4	Apply basic machine learning models for classification and regression.	L3
CO5	Interpret data analysis results and communicate findings clearly.	L4

Unit I: Introduction to Data Science: What is Data Science?, Role of Data Scientist, Data Science Process (Problem definition, data collection, preprocessing, modeling, evaluation), Applications of Data Science in different domains, Tools: Jupyter, Anaconda, Python/R Overview

Unit II: Data Handling and Preprocessing: Introduction to NumPy and Pandas, Reading data from CSV, Excel, SQL, Data Wrangling: Missing values, duplicates, outliers, Data transformation: Scaling, encoding, Feature engineering basics

Unit III: Data Visualization: Importance of visualization, Visualization libraries (Matplotlib, Seaborn), Histograms, Boxplots, Pairplots, Heatmaps, Dashboards and Storytelling with Data, Real-time data dashboards (Optional)

Unit IV: Statistical Foundations for Data Science: Descriptive Statistics, Probability and Probability Distributions, Inferential Statistics: Hypothesis Testing, Confidence Intervals, Correlation and Causation, Use of Scipy/Statsmodels for statistical analysis

Unit V: Introduction to Machine Learning: Supervised vs Unsupervised Learning, Classification and Regression problems, Basic ML Algorithms: Linear Regression, Logistic Regression, KNN, Decision Trees, Model Evaluation Metrics: Accuracy, Precision, Recall, F1-Score, Overfitting and Underfitting

Textbooks

1. **Joel Grus** – *Data Science from Scratch: First Principles with Python*, O'Reilly.
2. **Cathy O'Neil and Rachel Schutt** – *Doing Data Science*, O'Reilly.
3. **Wes McKinney** – *Python for Data Analysis*, O'Reilly.

Reference Books

1. **Jake VanderPlas** – *Python Data Science Handbook*, O'Reilly.
2. **Andreas Müller & Sarah Guido** – *Introduction to Machine Learning with Python*.
3. **Han, Kamber, & Pei** – *Data Mining: Concepts and Techniques*, Morgan Kaufmann.

Online Courses

NPTEL / SWAYAM:

- NPTEL: Introduction to Data Science
 - Instructor: Prof. RaghunathanRengasamy, IIT Madras

Coursera:

- **IBM Data Science Professional Certificate**
Link: coursera.org
- **Introduction to Data Science in Python (University of Michigan)**
Link: coursera.org

23A32M02	STATISTICAL LEARNING FOR DATA SCIENCE	L	T	P	C
		3	-	0	3

Course Objectives (COs)

The course aims to:

- Introduce fundamental concepts of statistical learning and its importance in data science.
- Develop understanding of regression, classification, and resampling methods.
- Build skills in model assessment, selection, and regularization techniques.
- Apply statistical learning methods to real-world datasets.
- Interpret, communicate, and evaluate data-driven models.

Course Outcomes

CO No	Course Outcome	Cognitive Level (BT Level)
CO1	Understand the basics of statistical learning and data representation.	Understand (L2)
CO2	Apply linear regression, logistic regression, and classification techniques.	Apply (L3)
CO3	Evaluate models using resampling methods and cross-validation.	Evaluate (L5)
CO4	Analyze regularization methods like Ridge and Lasso to avoid overfitting.	Analyze (L4)
CO5	Create and interpret statistical learning models in practical scenarios.	Create (L6)

Unit I: Introduction to Statistical Learning: What is Statistical Learning?, Supervised vs Unsupervised Learning, Model Accuracy vs Interpretability, Bias-Variance Trade-off, Curse of Dimensionality, Applications of Statistical Learning

Unit II: Linear and Polynomial Regression: Simple Linear Regression. Multiple Linear Regression, Polynomial Regression, Assumptions of Linear Models, Model Diagnostics and Performance Metrics (R^2 , RMSE), Variable Selection Techniques

Unit III: Classification Methods: Logistic Regression, Discriminant Analysis (LDA, QDA), Naïve Bayes Classifier, K-Nearest Neighbors, Confusion Matrix, Precision, Recall, F1-Score

Unit IV: Resampling and Model Assessment: Train-Test Split, Cross Validation (k-Fold, LOOCV), Bootstrap Methods, Model Selection and Hyperparameter Tuning

Unit V: Regularization & Advanced Topics: Ridge Regression, Lasso Regression, Shrinkage Methods, Principal Component Regression (PCR), Partial Least Squares (PLS), Introduction to Support Vector Machines.

Textbooks

1. **Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani**
An Introduction to Statistical Learning with Applications in R – Springer
(Free PDF: <https://www.statlearning.com/>)
2. **Trevor Hastie, Robert Tibshirani, Jerome Friedman**
The Elements of Statistical Learning – Springer

Reference Books

1. **Norman Matloff** – *Statistical Regression and Classification: from R to Data Science*
2. **Chris Bishop** – *Pattern Recognition and Machine Learning*
3. **T. Ryan** – *Modern Regression Methods*

Online Courses (Free + Paid)

NPTEL / SWAYAM:

- NPTEL: Introduction to Statistical Learning
 - Instructor: Prof. Balaraman Ravindran (IIT Madras)

23A32M03	DATA ENGINEERING	L	T	P	C
		3	-	0	3

Course Objectives (COs)

- Understand the data engineering lifecycle, tools, and platforms.
- Gain proficiency in building scalable data pipelines using batch and streaming systems.
- Explore data storage formats, data lakes, and warehouses.
- Learn about workflow orchestration, scheduling, and data quality.
- Apply data engineering techniques in real-time and big data environments.

Course Outcomes (COs with Bloom's Levels)

CO No	Course Outcome	Bloom's Level
CO1	Understand the foundations of data engineering tools, platforms, and data lifecycle.	Understand (L2)
CO2	Design and implement batch and streaming data pipelines.	Apply (L3)
CO3	Analyze data storage and querying using file formats, data lakes, and warehouses.	Analyze (L4)
CO4	Evaluate orchestration and workflow management tools.	Evaluate (L5)
CO5	Build end-to-end data engineering workflows and troubleshoot data quality issues.	Create (L6)

Unit I: Introduction to Data Engineering: What is Data Engineering?, Data Engineering vs Data Science, Data Lifecycle and Architectures, Roles and Responsibilities of a Data Engineer, Tools Overview: Hadoop, Spark, Kafka, Airflow, Hive.

Unit II: Data Storage and Formats: Structured, Semi-structured, and Unstructured Data, File Formats: CSV, JSON, Parquet, Avro, ORC, Data Warehousing Concepts (Star/Snowflake Schema), Data Lakes vs Data Warehouses, Cloud Storage Solutions (S3, Azure Blob, GCS)

Unit III: Batch and Stream Processing: ETL vs ELT, Batch Processing with Apache Spark, Stream Processing with Apache Kafka and Spark Streaming, Windowing, Late Events, and Watermarks, Lambda and Kappa Architectures.

Unit IV: Workflow Orchestration & Data Quality: Introduction to Apache Airflow, DAGs, Operators, Scheduling, Data Lineage and Observability, Data Profiling, Cleaning, Validation, Ensuring Data Quality with GreatExpectations

Unit V: End-to-End Pipeline and Case Studies: Designing a Data Pipeline: Source to Sink, Real-time Analytics with Kafka + Spark + Cassandra, Monitoring and Logging, CI/CD in Data Engineering (using GitHub Actions or Jenkins), Case Studies: Fraud Detection, Log Analysis, and Recommendation Engine.

Textbooks

1. **Andreas François Vermeulen**, *The Data Engineering Cookbook* – Packt
2. **Joe Reis and Matt Housley**, *Fundamentals of Data Engineering* – O'Reilly, 2022
3. **Anurag Bhardwaj**, *Data Engineering with Apache Spark, Delta Lake, and Lakehouse* – Packt

Reference Books

1. *Designing Data-Intensive Applications* – Martin Kleppmann (O'Reilly)
2. *Streaming Systems: The What, Where, When, and How of Large-Scale Data Processing* – Tyler Akidau

Online Courses

NPTEL / SWAYAM

- NPTEL: Big Data Computing
- NPTEL: Cloud Computing and Distributed Systems

23A32M04	MACHINE LEARNING FUNDAMENTALS	L	T	P	C
		3	-	0	3

Course Objectives

- Understand core concepts of supervised, unsupervised, and reinforcement learning.
- Learn foundational algorithms for classification, regression, and clustering.
- Analyze model performance using evaluation metrics and tuning methods.
- Gain practical knowledge in implementing ML models using datasets.
- Understand the mathematical and probabilistic foundations of ML algorithms.

Course Outcomes (with Cognitive Levels)

CO No	Course Outcome	Bloom's Level
CO1	Understand the concepts and assumptions behind key ML algorithms.	Understand (L2)
CO2	Apply various supervised and unsupervised learning techniques.	Apply (L3)
CO3	Analyze the strengths and limitations of different machine learning models.	Analyze (L4)
CO4	Evaluate model performance using metrics and validation techniques.	Evaluate (L5)
CO5	Design and implement complete ML solutions for real-world problems.	Create (L6)

Unit I: Introduction to Machine Learning:

Definition and Scope of ML, Types of Learning: Supervised, Unsupervised, Reinforcement, Basic Terminology: Instance, Feature, Label, Training and Testing Sets, Applications and Challenges, Python Libraries: scikit-learn, pandas, numpy

Unit II: Supervised Learning – Regression & Classification

Linear Regression, Polynomial Regression, Logistic Regression, k-Nearest Neighbors (k-NN), Decision Trees and Random Forests, Naïve Bayes Classifier

Unit III: Unsupervised Learning & Dimensionality Reduction,

k-Means Clustering, Hierarchical Clustering, Principal Component Analysis (PCA), t-SNE, Autoencoders (Intro Only). Association Rule Mining,

Unit IV: Model Evaluation and Tuning

Confusion Matrix, Precision, Recall, F1-Score, ROC-AUC, Bias-Variance Tradeoff, Cross-Validation, Hyperparameter Tuning: Grid Search & Random Search, Overfitting&Underfitting

Unit V: Advanced Topics & Real-time Applications

Introduction to Neural Networks (Perceptron), Introduction to SVMs, Feature Engineering & Selection, Real-world Use Cases: Spam Detection, Credit Scoring, Medical Diagnosis, Ethical AI and Model Explainability (XAI – Intro Only).

Textbooks

1. **Tom M. Mitchell**, *Machine Learning*, McGraw-Hill, 1997.

23A32M05	Data Science Applications	L	T	P	C
		3	-	0	3

Course Objectives

- Understand key domains where data science plays a transformative role.
- Learn how data is collected, preprocessed, and analyzed in different domains.
- Explore application-driven problem-solving using real-world datasets.
- Evaluate models and interpret data science outputs effectively.
- Gain hands-on exposure to tools and techniques used in data science applications.

Course Outcomes (COs) with Bloom's Levels

CO No	Course Outcome	Bloom's Level
CO1	Explain the role and impact of data science across various application areas.	Understand (L2)
CO2	Apply suitable data science methods to domain-specific datasets.	Apply (L3)
CO3	Analyze domain-specific problems using exploratory and predictive techniques.	Analyze (L4)
CO4	Evaluate model effectiveness and insights in practical use cases.	Evaluate (L5)
CO5	Design data-driven solutions for real-world problems.	Create (L6)

Unit I: Introduction to Data Science & Domains

Definition and Workflow of Data Science. Lifecycle of a Data Science Project, Overview of Applications: Healthcare, Finance, Retail, Manufacturing, Agriculture, Education, and Smart Cities, Ethical Considerations in Data Science.

Unit II: Data Science in Healthcare and Finance,

Use cases: Disease prediction, EHR data, medical imaging, outbreak modelling, Predictive modeling for diagnosis (e.g., Diabetes prediction), Applications in FinTech: Fraud detection, Risk scoring, Credit analytics, Time series analysis in financial markets.

Unit III: Data Science in Retail, Marketing & Customer Analytics

Market basket analysis, Recommendation Systems, Customer Segmentation using Clustering, Churn Prediction Models, Sentiment Analysis for Customer Feedback.

Unit IV: Data Science in Smart Cities, Agriculture & Education

Traffic prediction, Waste management using ML, IoT-enabled Smart Farming and Yield prediction, Adaptive Learning and Student Performance Prediction, Case studies with real-world datasets.

Unit V: Tools, Case Studies, and Deployment

Case Studies on End-to-End Projects, Tools: Python, Jupyter, Power BI, Tableau, Deploying Models: APIs, Streamlit, Flask, Interpreting Results and Storytelling, Recent Advances and Future Directions

Textbooks

1. **Joel Grus**, *Data Science from Scratch*, O'Reilly, 2nd Edition.

2. **Cathy O'Neil & Rachel Schutt**, *Doing Data Science*, O'Reilly Media.
3. **V. K. Jain**, *Data Science and Big Data Analytics*, Khanna Publishing.

Reference Books

1. **Wes McKinney**, *Python for Data Analysis*, O'Reilly.
2. **Sebastian Raschka**, *Machine Learning with Python Cookbook*, Packt.
3. **Bill Franks**, *Taming the Big Data Tidal Wave*, Wiley.

Online Courses

NPTEL / SWAYAM

- NPTEL – Data Science for Engineers
- SWAYAM – Data Science Applications

23A32M06	DATA SCIENCE PRACTICE LAB (R/Python)	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To introduce basic data analysis using R/Python.
- To understand data wrangling, visualization, and preprocessing.
- To develop skills in exploratory data analysis and simple ML models.

Course Outcomes:

- Apply Python/R for real-time data handling.
- Perform data visualization and preprocessing.
- Build basic machine learning models.

Experiments:

1. Introduction to Python/R and IDE setup
2. Data Types, Variables, and Operators
3. Reading and writing CSV/Excel data
4. Data Cleaning and Wrangling (nulls, types, etc.)
5. Exploratory Data Analysis with Matplotlib/ggplot2
6. Correlation and Covariance Calculation
7. Linear Regression implementation
8. Classification using KNN
9. Clustering using K-Means
10. Data Visualization using Seaborn
11. Building simple ML pipeline using scikit-learn
12. Data analysis on real-world dataset

23A32M07	STATISTICAL LEARNING & ML LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To explore statistical methods for data science.
- To apply statistical learning to predictive modeling.

Course Outcomes:

- Utilize statistical models in data science tasks.
- Implement regression and classification algorithms.

Experiments:

1. Introduction to probability distributions
2. Descriptive statistics on datasets
3. Hypothesis testing
4. Linear Regression and visualization
5. Logistic Regression for classification
6. Decision Trees
7. Random Forests
8. Confusion Matrix and Accuracy metrics
9. Cross-validation techniques
10. Feature scaling and encoding
11. Principal Component Analysis
12. Regression or Classification on dataset

23A33M01	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

Course Objectives

- Understand the fundamental concepts and historical evolution of Artificial Intelligence.
- Learn various problem-solving approaches using AI algorithms.
- Gain insights into knowledge representation, reasoning, and planning techniques.
- Explore basic machine learning and neural network models.
- Familiarize with real-world AI applications and ethical implications.

Course Outcomes (COs)

CO No	Course Outcome	Bloom's Level
CO1	Explain the foundational principles and history of AI.	Understand (L2)
CO2	Apply AI techniques for problem-solving and decision-making.	Apply (L3)
CO3	Analyze search strategies and knowledge representation models.	Analyze (L4)
CO4	Evaluate the effectiveness of learning algorithms and intelligent agents.	Evaluate (L5)
CO5	Design simple AI-based systems or prototypes using AI concepts.	Create (L6)

Unit I: Introduction to Artificial Intelligence

Definition and applications of AI, History and evolution of AI, Intelligent agents – types and environments, AI techniques: Symbolic AI, Sub-symbolic AI

Unit II: Problem Solving and Search Strategies

Problem formulation, Uninformed search: BFS, DFS, Uniform Cost, Informed search: Greedy, A* search, Local search: Hill climbing, Simulated annealing, Constraint satisfaction problems

Unit III: Knowledge Representation and Reasoning

Propositional and First-Order Logic, Forward and backward chaining, Rule-based systems and ontologies, Semantic networks, frames, Uncertainty: Bayesian reasoning, fuzzy logic

Unit IV: Machine Learning Basics

Overview of supervised, unsupervised, reinforcement learning, Decision Trees, k-NN, Naïve Bayes, Basic concepts of neural networks and perceptron, Training and testing datasets, Evaluation metrics: Accuracy, precision, recall, F1-score

Unit V: Applications of AI and Ethical Issues

AI in Robotics, NLP, Vision, Healthcare, Finance, Chatbots and virtual assistants, AI biases, fairness, explainability, Social and legal implications of AI, Future trends: AGI, ethical AI

Textbooks

1. **Stuart Russell & Peter Norvig**, *Artificial Intelligence: A Modern Approach*, 4th Edition, Pearson
2. **Elaine Rich, Kevin Knight**, *Artificial Intelligence*, 3rd Edition, McGraw-Hill
3. **Dan W. Patterson**, *Introduction to Artificial Intelligence and Expert Systems*, PHI

Reference Books

1. **Kevin Murphy**, *Machine Learning: A Probabilistic Perspective*, MIT Press
2. **Nils J. Nilsson**, *The Quest for Artificial Intelligence*, Cambridge
3. **Tom Mitchell**, *Machine Learning*, McGraw-Hill

Online Courses

1. **CourseraAI For Everyone – Andrew Ng**

23A33M02	MACHINE LEARNING FUNDAMENTALS	L	T	P	C
		3	0	0	3

Course Objectives

- Understand core concepts of supervised, unsupervised, and reinforcement learning.
- Learn foundational algorithms for classification, regression, and clustering.
- Analyze model performance using evaluation metrics and tuning methods.
- Gain practical knowledge in implementing ML models using datasets.
- Understand the mathematical and probabilistic foundations of ML algorithms.

Course Outcomes (with Cognitive Levels)

CO No	Course Outcome	Bloom's Level
CO1	Understand the concepts and assumptions behind key ML algorithms.	Understand (L2)
CO2	Apply various supervised and unsupervised learning techniques.	Apply (L3)
CO3	Analyze the strengths and limitations of different machine learning models.	Analyze (L4)
CO4	Evaluate model performance using metrics and validation techniques.	Evaluate (L5)
CO5	Design and implement complete ML solutions for real-world problems.	Create (L6)

Unit I: Introduction to Machine Learning:

Definition and Scope of ML, Types of Learning: Supervised, Unsupervised, Reinforcement, Basic Terminology: Instance, Feature, Label, Training and Testing Sets, Applications and Challenges, Python Libraries: scikit-learn, pandas, numpy

Unit II: Supervised Learning – Regression & Classification

Linear Regression, Polynomial Regression, Logistic Regression, k-Nearest Neighbors (k-NN), Decision Trees and Random Forests, Naïve Bayes Classifier

Unit III: Unsupervised Learning & Dimensionality Reduction,

k-Means Clustering, Hierarchical Clustering, Principal Component Analysis (PCA), t-SNE, Autoencoders (Intro Only). Association Rule Mining,

Unit IV: Model Evaluation and Tuning

Confusion Matrix, Precision, Recall, F1-Score, ROC-AUC, Bias-Variance Tradeoff, Cross-Validation, Hyperparameter Tuning: Grid Search & Random Search, Overfitting&Underfitting

Unit V: Advanced Topics & Real-time Applications

Introduction to Neural Networks (Perceptron), Introduction to SVMs, Feature Engineering & Selection, Real-world Use Cases: Spam Detection, Credit Scoring, Medical Diagnosis, Ethical AI and Model Explainability (XAI – Intro Only)

Textbooks

1. **Tom M. Mitchell**, *Machine Learning*, McGraw-Hill, 1997.

23A33M03	DEEP LEARNING & NEURAL NETWORKS	L	T	P	C
		3	0	0	3

Course Objectives

- Understand the fundamentals of deep learning and neural networks.
- Analyze and implement feedforward, convolutional, and recurrent neural networks.
- Learn key optimization techniques and regularization methods.
- Explore architectures like CNN, RNN, LSTM for various applications.
- Apply deep learning models to real-world problems in vision, NLP, and speech.

Course Outcomes (COs)

CO No	Course Outcome	Bloom's Level
CO1	Explain the structure and working of deep neural networks.	Understand (L2)
CO2	Analyze the learning process and optimization strategies in deep learning.	Analyze (L4)
CO3	Apply CNNs and RNNs to practical problems like image and sequence processing.	Apply (L3)
CO4	Evaluate the performance of models using loss functions and regularization.	Evaluate (L5)
CO5	Design and implement deep learning models using modern frameworks.	Create (L6)

Unit I: Introduction to Deep Learning

Basics of machine learning and need for deep learning, Biological and artificial neurons, Activation functions: Sigmoid, Tanh, ReLU, Leaky ReLU, Perceptron and Multi-Layer Perceptron (MLP), Backpropagation algorithm

Unit II: Optimization and Regularization

Cost functions: Cross-entropy, MSE, Gradient descent, SGD, Momentum, RMSProp, Adam, Overfitting and underfitting, Regularization: L1, L2, Dropout, Batch Normalization, Weight initialization techniques

Unit III: Convolutional Neural Networks (CNN)

Convolution operation, filters, feature maps, Pooling layers, padding, stride, CNN architectures: LeNet, AlexNet, VGGNet, ResNet, Applications in image classification and object detection.

Unit IV: Recurrent Neural Networks (RNNs) and LSTMs

Sequence modeling basics, RNN architecture and backpropagation through time, Vanishing/exploding gradient problems, Long Short-Term Memory (LSTM) and GRU, Applications: Text generation, machine translation, time-series

Unit V: Generative Models and Applications

Autoencoders and Variational Autoencoders (VAE), Generative Adversarial Networks (GANs), Transfer learning and pre-trained models, Deep learning applications in vision, NLP, healthcare, Deployment considerations (TensorFlow Lite, ONNX, etc.)

Textbooks

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville – *Deep Learning*, MIT Press
2. François Chollet – *Deep Learning with Python*, Manning Publications
3. Josh Patterson & Adam Gibson – *Deep Learning: A Practitioner's Approach*, O'Reilly

Reference Books

1. Michael Nielsen – *Neural Networks and Deep Learning* (online free book)
2. Nikhil Buduma – *Fundamentals of Deep Learning*, O'Reilly
3. Simon Haykin – *Neural Networks and Learning Machines*, Pearson

Online Courses

1. Coursera [Deep Learning Specialization](#) – Andrew Ng

23A31501	NATURAL LANGUAGE PROCESSING (NLP)	L	T	P	C
		3	0	0	3

Course Objectives

- Understand the foundational concepts of NLP and linguistics.
- Explore text preprocessing and linguistic analysis techniques.
- Apply NLP techniques for syntactic and semantic analysis.
- Utilize NLP tools for information retrieval, summarization, and sentiment analysis.
- Design and build machine learning and deep learning models for NLP applications.

Course Outcomes (COs)

CO No	Course Outcome	Bloom's Level
CO1	Understand language structure and basic NLP pipeline.	Understand (L2)
CO2	Apply text processing and feature extraction techniques.	Apply (L3)
CO3	Analyze syntactic and semantic structures using NLP tools.	Analyze (L4)
CO4	Evaluate NLP models and select suitable algorithms for various tasks.	Evaluate (L5)
CO5	Design NLP-based solutions using ML/DL models for real-world applications.	Create (L6)

Unit I: Introduction to NLP & Linguistics

NLP tasks and applications. Components of NLP: Morphology, syntax, semantics, pragmatics, Linguistic essentials: POS tagging, Lemmatization, Stemming, Language modeling: N-grams, Smoothing techniques, Perplexity

Unit II: Text Processing & Feature Engineering

Text preprocessing: Tokenization, normalization, stopwords removal, Feature extraction: Bag of Words, TF-IDF, Word embeddings (Word2Vec, GloVe), Dimensionality reduction: PCA, LSA

Unit III: Syntax & Parsing Techniques

POS tagging algorithms: Rule-based, HMM, CRF, Syntax trees and dependency parsing, Context-Free Grammars (CFG), CYK algorithm

Unit IV: Semantics & Discourse Processing

Named Entity Recognition (NER). Word Sense Disambiguation (WSD). Semantic similarity and clustering. Sentiment analysis and emotion detection

Unit V: NLP with Machine Learning & Deep Learning

Text classification using Naïve Bayes, SVM, RNN, LSTM, GRU for sequence modelling, Transformer-based models (BERT, GPT), Applications: Chatbots, Translation, Summarization

Textbooks

1. **Daniel Jurafsky and James H. Martin** – *Speech and Language Processing*, Pearson
2. **Steven Bird, Ewan Klein, Edward Loper** – *Natural Language Processing with Python*, O'Reilly
3. **Yoav Goldberg** – *Neural Network Methods in NLP*, Morgan & Claypool

Reference Books

1. **Jacob Eisenstein** – *Introduction to Natural Language Processing*, MIT Press
2. **Chris Manning** – Stanford NLP resources (online)
3. **Allen & Unwin** – *Foundations of Statistical Natural Language Processing*

Online Courses

1. Coursera-Natural Language Processing Specialization – DeepLearning.AI

23A30604a	COMPUTER VISION	L	T	P	C
		3	0	0	3

Course Objectives

- Understand the fundamentals of image formation, representation, and basic processing.
- Explore key concepts of feature detection, segmentation, and motion tracking.
- Apply machine learning and deep learning techniques in visual recognition tasks.
- Analyze real-time applications of computer vision in various domains.
- Implement and evaluate computer vision algorithms using Python/OpenCV frameworks.

Course Outcomes (COs)

CO No	Course Outcome	Bloom's Level
CO1	Understand the principles of digital image formation and transformation.	Understand (L2)
CO2	Apply computer vision algorithms for image enhancement and feature extraction.	Apply (L3)
CO3	Analyze object recognition, detection, and classification techniques.	Analyze (L4)
CO4	Evaluate deep learning models for vision tasks like segmentation and tracking.	Evaluate (L5)
CO5	Design and implement real-world computer vision applications.	Create (L6)

Unit I: Fundamentals of Computer Vision

Introduction to computer vision and image formation, Camera models: pinhole, orthographic, perspective, Digital images: pixels, intensity, channels, color spaces (RGB, HSV, YCbCr), Basic image operations: filtering, edge detection (Sobel, Canny)

Unit II: Image Processing and Feature Detection

Histograms, thresholding, contrast adjustment, Convolution, Gaussian smoothing, Laplacian, Feature detection: corners (Harris, FAST), blobs (LoG, DoG), edges, SIFT, SURF, ORB for local features

Unit III: Image Segmentation and Object Recognition

Region-based segmentation: region growing, split and merge, Clustering: K-means, Mean-shift, Morphological operations, Object detection: Haar cascades, HOG + SVM, Viola-Jones

Unit IV: Motion Analysis and 3D Vision

Optical flow: Horn-Schunck, Lucas-Kanade, Background subtraction, moving object detection, Structure from Motion (SfM), Stereo vision, depth estimation

Unit V: Deep Learning in Computer Vision

Introduction to CNNs (Convolutional Neural Networks), Architectures: LeNet, AlexNet, VGG, ResNet, Object detection using YOLO, SSD, Faster R-CNN, Image segmentation using U-Net, Mask R-CNN, Applications: face recognition, self-driving cars, surveillance

Textbooks

1. **Richard Szeliski** – *Computer Vision: Algorithms and Applications*, Springer
2. **Gonzalez & Woods** – *Digital Image Processing*, Pearson
3. **Simon Prince** – *Computer Vision: Models, Learning, and Inference*, Cambridge University Press

Reference Books

1. **Gary Bradski & Adrian Kaehler** – *Learning OpenCV*, O'Reilly
2. **David Forsyth & Jean Ponce** – *Computer Vision: A Modern Approach*, Pearson
3. **Ian Goodfellow et al.** – *Deep Learning*, MIT Press (for Unit V)

Online Courses

1. Coursera- Computer Vision Specialization – University of Michigan

23A33M04	AI & ML LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To understand core AI and ML techniques.
- To implement models using Python libraries.

Course Outcomes:

- Develop supervised and unsupervised ML models.
- Evaluate model performance using metrics.

Experiments:

1. Introduction to AI/ML libraries: NumPy, Pandas
2. Supervised vs Unsupervised Learning demo
3. Linear Regression implementation
4. Decision Tree Classifier
5. Naive Bayes Classifier
6. K-Means Clustering
7. SVM classifier
8. Hyperparameter tuning
9. Model evaluation techniques
10. Deployment with Flask API (demo)
11. Model saving and loading using pickle

23A33M05	NLP & COMPUTER VISION LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To implement basic NLP and CV pipelines.
- To work with image and text datasets.

Course Outcomes:

- Build NLP pipelines (tokenization to classification).
- Perform image preprocessing and recognition.

Experiments:

1. Text preprocessing (tokenization, stemming, etc.)
2. Bag of Words and TF-IDF models
3. Text classification using Logistic Regression
4. Named Entity Recognition (NER)
5. Sentiment Analysis
6. Image reading and manipulation using OpenCV
7. Image filtering and transformations
8. Face detection using Haar cascades
9. CNN model using TensorFlow/Keras
10. Image classification with pre-trained models
11. Text-to-Image and Image Captioning (intro)

23A32M06	INTRODUCTION TO DATA ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce the fundamental concepts of data analytics.
- To understand the process of collecting, cleaning, analyzing, and interpreting data.
- To gain insights into exploratory data analysis (EDA) and visualization techniques.
- To apply statistical and machine learning techniques to draw inferences from data.
- To use analytical tools (like Python/R) to solve real-world data problems.

□ Course Outcomes (COs)

CO No	Course Outcome	Bloom's Level
CO1	Understand the core concepts and applications of data analytics.	Understand (L2)
CO2	Prepare and preprocess data for analysis using appropriate techniques.	Apply (L3)
CO3	Analyze data using descriptive and inferential statistical methods.	Analyze (L4)
CO4	Visualize data insights through various graphical representations.	Evaluate (L5)
CO5	Apply data analytics tools for solving domain-specific problems.	Create (L6)

Unit I: Introduction to Data Analytics

Data, Information, and Knowledge, Types of data: Structured, Unstructured, Semi-Structured, Phases of the Data Analytics Lifecycle, Introduction to Business Analytics, Tools for data analytics: Excel, Python, R, SQL.

Unit II: Data Collection and Preprocessing

Sources of data: Databases, APIs, Web Scraping, Handling missing data and outliers, Data cleaning, transformation, normalization, Feature engineering and selection, Data partitioning and sampling techniques.

Unit III: Descriptive and Inferential Statistics

Central tendency and dispersion: Mean, Median, Mode, Standard Deviation, Correlation and covariance, Probability distributions: Normal, Binomial, Poisson, Hypothesis testing, t-test, Chi-square test, Confidence intervals and p-values.

Unit IV: Exploratory Data Analysis (EDA) and Visualization

Univariate, Bivariate, Multivariate Analysis, Histograms, Boxplots, Scatter plots, Pair plots, Heatmaps and correlation matrices, Data dashboards and storytelling using visualizations, Tools: Matplotlib, Seaborn, Plotly, Tableau basics.

Unit V: Data-Driven Decision Making

Predictive analytics vs descriptive analytics, Introduction to regression and classification, Clustering and segmentation basics, Model evaluation metrics: Accuracy, Precision, Recall, F1-score, Case studies in marketing, healthcare, finance, operations

Textbooks

1. **V. Uday Shankar** – *Data Analytics*, Cengage Learning
2. **P. N. Murthy** – *Introduction to Data Analytics*, Himalaya Publishing
3. **Anil Maheshwari** – *Data Analytics Made Accessible*, Amazon Independent

Reference Books

1. **Foster Provost & Tom Fawcett** – *Data Science for Business*, O'Reilly
2. **Joel Grus** – *Data Science from Scratch*, O'Reilly
3. **Wes McKinney** – *Python for Data Analysis*, O'Reilly
4. **Allen Downey** – *Think Stats*, Green Tea Press

Recommended Online Courses

Platform	Course Title	Link
Coursera	<u>Introduction to Data Analytics – IBM</u>	

23A32M03	DATA ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce the architecture, components, and workflow of modern data engineering systems.
- To provide knowledge on ingestion, storage, and processing of large-scale data.
- To apply tools and techniques like ETL, data pipelines, and distributed processing frameworks.
- To explore data modeling, warehousing, and real-time data processing.
- To build scalable and maintainable data systems with cloud and open-source technologies.

Course Outcomes (COs) with Bloom's Cognitive Levels

CO No	Course Outcome	Bloom's Level
CO1	Understand core concepts of data engineering and data pipelines.	Understand (L2)
CO2	Apply data ingestion, transformation, and storage techniques.	Apply (L3)
CO3	Analyze big data processing frameworks and streaming systems.	Analyze (L4)
CO4	Evaluate data warehousing models and real-time processing strategies.	Evaluate (L5)
CO5	Design and implement scalable data engineering workflows.	Create (L6)

Unit I: Introduction to Data Engineering

What is Data Engineering?, Role of Data Engineer in the data ecosystem, Types of data: Structured, Semi-structured, Unstructured, Data Lifecycle: Collection to Consumption, Introduction to ETL and ELT processes.

Unit II: Data Ingestion and Storage

Batch vs Streaming data, Data ingestion tools: Sqoop, Flume, Kafka, Logstash, Structured storage: Relational DBs, Data Lakes, File formats: CSV, JSON, Avro, Parquet, ORC, NoSQL overview: HBase, MongoDB, Cassandra.

Unit III: Distributed Data Processing

Hadoop ecosystem: HDFS, MapReduce, YARN, Apache Spark: RDD, DataFrame, and SQL APIs, Data cleaning and transformation techniques, Resource allocation and job scheduling in Spark, Introduction to cloud-based data processing (AWS/GCP).

Unit IV: Data Warehousing & Modeling

Concepts of OLTP vs OLAP, Star and Snowflake Schemas, Fact and Dimension tables, Data Warehousing tools: Amazon Redshift, Google BigQuery, Snowflake, Data modeling tools: dbt (data build tool), ER diagrams.

Unit V: Real-Time Data Engineering and Pipelines

Streaming with Apache Kafka and Spark Streaming, Message Queues and Pub/Sub systems, Lambda and Kappa architectures, Monitoring and logging tools: Prometheus, Grafana, Case study: End-to-end data pipeline implementation.

Textbooks

1. **Andreas François Vermeulen** – *Data Engineering with Python*, Packt Publishing
2. **V. Uday Shankar** – *Big Data Analytics & Data Engineering*, Cengage Learning
3. **Sam Newman** – *Building Microservices*, O'Reilly (for data infrastructure components)

Reference Books

1. **Bill Inmon** – *Building the Data Warehouse*, Wiley
2. **Tom White** – *Hadoop: The Definitive Guide*, O'Reilly
3. **Jules S. Damji et al.** – *Learning Spark: Lightning-Fast Big Data Analysis*, O'Reilly
4. **Noel Markham** – *Learning Apache Kafka*, Packt Publishing

Recommended Online Courses

Platform	Course Title	Link
Coursera	<u>Data Engineering on Google Cloud – Google</u>	

23A30603b	PREDICTIVE ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the fundamentals of predictive analytics and modeling.
- To learn statistical, machine learning, and probabilistic techniques used for prediction.
- To build and evaluate predictive models for various types of data.
- To apply data preprocessing, feature engineering, and model tuning techniques.
- To explore real-world use cases of predictive analytics in business, health, and industry.

Course Outcomes with Bloom's Cognitive Levels

CO No	Course Outcome	Bloom's Level
CO1	Understand key concepts, tools, and algorithms used in predictive analytics.	Understand (L2)
CO2	Apply classification and regression techniques for prediction problems.	Apply (L3)
CO3	Analyze model performance using error metrics and validation techniques.	Analyze (L4)
CO4	Evaluate predictive models in real-world applications and domains.	Evaluate (L5)
CO5	Design complete predictive analytics pipelines with preprocessing to prediction.	Create (L6)

Unit I: Introduction to Predictive Analytics

Basics of predictive analytics, Types of predictive models: Classification vs Regression, Predictive modeling workflow, Applications in finance, healthcare, marketing, etc., Introduction to supervised learning.

Unit II: Data Preparation and Feature Engineering

Data cleaning and preprocessing, Handling missing values, outliers, Categorical encoding, normalization, scaling, Feature selection and dimensionality reduction (PCA, LDA), Feature importance.

Unit III: Regression and Classification Models

Linear Regression, Ridge & Lasso Regression, Logistic Regression, K-Nearest Neighbors (KNN), Decision Trees, Random Forests, Model diagnostics: R^2 , MAE, RMSE, Confusion Matrix, AUC

Unit IV: Advanced Predictive Modeling

Support Vector Machines (SVM), Ensemble Models: Bagging, Boosting, XGBoost, Model selection and hyperparameter tuning, Cross-validation, Grid Search, Avoiding overfitting/underfitting.

Unit V: Real-Time Predictive Analytics and Deployment

Case studies: Predictive maintenance, customer churn, disease prediction, Tools: Python (scikit-learn, pandas), R, AutoML, Model interpretability: SHAP, LIME, Model deployment using Flask, FastAPI, or cloud (AWS/GCP), Ethics in predictive analytics.

Textbooks

1. **Dean Abbott** – *Applied Predictive Analytics: Principles and Techniques*, Wiley
2. **Galit Shmueli et al.** – *Data Mining for Business Analytics: Concepts, Techniques, and Applications*, Wiley
3. **John D. Kelleher et al.** – *Fundamentals of Machine Learning for Predictive Data Analytics*, MIT Press

Reference Books

1. **Trevor Hastie, Robert Tibshirani, Jerome Friedman** – *The Elements of Statistical Learning*
2. **Ian H. Witten, Eibe Frank, Mark A. Hall** – *Data Mining: Practical Machine Learning Tools and Techniques*
3. **Tom Fawcett** – *Data Science for Business*, O'Reilly

Online Courses

Platform	Course Title & Link
Coursera	<u>Advanced Predictive Modeling</u> – University of Washington

23A32M07	BIG DATA ANALYTICS (Hadoop, Spark)	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the need and concepts of Big Data and its ecosystem.
- To study architectures and tools such as Hadoop and Spark for large-scale data processing.
- To explore Hadoop Distributed File System (HDFS) and MapReduce programming.
- To learn in-memory computation using Apache Spark.
- To implement big data solutions using real-time tools for analytics and decision-making.

Course Outcomes (COs) with Cognitive Levels

CO No	Course Outcome	Bloom's Level
CO1	Explain the concepts, characteristics, and challenges of Big Data.	Understand (L2)
CO2	Apply HDFS and MapReduce programming for large-scale data processing.	Apply (L3)
CO3	Analyze and optimize data pipelines using Spark RDDs and DataFrames.	Analyze (L4)
CO4	Evaluate Big Data tools and frameworks for distributed processing.	Evaluate (L5)
CO5	Design end-to-end Big Data workflows for analytics use cases.	Create (L6)

UNIT I: Introduction to Big Data

Characteristics of Big Data: Volume, Velocity, Variety, Veracity, and Value, Challenges of Big Data, Traditional vs. Big Data systems, Big Data architecture: Storage, processing, analytics, Introduction to Hadoop Ecosystem

UNIT II: Hadoop Distributed File System (HDFS) and MapReduce

HDFS Architecture, Blocks, NameNode&DataNode, File Read/Write operations, MapReduce Architecture, Developing MapReduce programs (Word Count Example), Combiners, Partitioner, and Counters

UNIT III: Apache Spark and RDDs

Need for Apache Spark over Hadoop, Spark architecture and components, Spark RDDs and transformations/actions, DataFrames and Spark SQL, Working with Spark MLlib for basic ML tasks

UNIT IV: Big Data Tools and Streaming

YARN architecture, Sqoop: Import/export between RDBMS and Hadoop, Flume: Ingesting streaming data, Kafka for distributed messaging, Spark Streaming: DStreams, windowing, real-time analytics

UNIT V: Big Data Applications and Case Studies

Social media analytics, IoT data pipelines, Retail analytics (recommendation engines, customer sentiment), Fraud detection, End-to-End Mini Project: Data ingestion, processing, and visualization

Textbooks

1. **Tom White**, *Hadoop: The Definitive Guide*, O'Reilly Media
2. **Jules S. Damji et al.**, *Learning Spark: Lightning-Fast Big Data Analysis*, O'Reilly
3. **VenkatAnkam**, *Big Data Analytics Using Spark*, Wiley

Reference Books

1. **Chuck Lam**, *Hadoop in Action*, Manning
2. **Alex Holmes**, *Hadoop in Practice*, Manning Publications
3. **P. J. Sadalage& M. Fowler**, *NoSQL Distilled*, Addison-Wesley
4. **Sridhar Alla**, *Big Data Analytics with Hadoop 3*, Packt Publishing

Online Courses

Platform	Course Title & Link
Coursera	<u>Big Data Specialization</u> – UC San Diego

23A32M08	DATA ANALYTICS WITH POWER BI / TABLEAU / MATPLOTLIB	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the fundamentals of data visualization and storytelling using analytics tools.
- To learn practical implementation of visual analytics using Power BI, Tableau, and Matplotlib.
- To develop dashboards, custom reports, and interactive charts.
- To explore real-world datasets and generate insights.
- To design end-to-end data pipelines and reporting workflows.

Course Outcomes (COs) with Bloom's Cognitive Levels

CO No	Course Outcome	Bloom's Level
CO1	Understand data analytics lifecycle and fundamentals of visualization tools.	Understand (L2)
CO2	Apply Power BI, Tableau, and Matplotlib to visualize structured data.	Apply (L3)
CO3	Analyze visual trends and compare different types of charting techniques.	Analyze (L4)
CO4	Evaluate dashboards and performance metrics for decision-making.	Evaluate (L5)
CO5	Design interactive data dashboards and business visual reports.	Create (L6)

UNIT I: Introduction to Data Visualization & BI

What is data analytics and visualization?, Importance of business intelligence, Types of charts and graphs, Visualization best practices and perception, Introduction to tools: Power BI, Tableau, and Python/Matplotlib

UNIT II: Power BI for Data Analytics

Power BI interface and data sources, Data transformations using Power Query, DAX (Data Analysis Expressions) basics, Visualizations: Bar, Line, Area, Pie, Tree Maps, Report publishing and dashboard sharing

UNIT III: Tableau for Data Analytics

Tableau workspace and connecting to datasets, Dimensions vs. Measures, Filters, Parameters, and Calculated Fields, Visualizations: Heatmaps, Maps, Scatter Plots, Building Interactive Dashboards

UNIT IV: Matplotlib&Seaborn (Python Visualization)

Introduction to Matplotlib architecture, Basic plots: line, bar, pie, histogram, Subplots, customization (color, label, grid), Seaborn: heatmaps, boxplots, pairplots, Exporting and saving visuals

UNIT V: Real-time Case Studies and BI Projects

Designing end-to-end dashboards for: Sales analytics, Healthcare data, IoT or Sensor data dashboards, Social media analytics, Performance monitoring and KPI analysis, BI deployment best practices

Textbooks

1. **Alberto Ferrari & Marco Russo**, *Introducing Microsoft Power BI*, Microsoft Press.
2. **Joshua N. Milligan**, *Learning Tableau*, Packt Publishing.
3. **AdrienChauveau**, *Data Visualization with Python and Matplotlib*, Packt Publishing.

Reference Books

1. **Ben Jones**, *Storytelling with Data in Tableau*, O'Reilly.
2. **Jake VanderPlas**, *Python Data Science Handbook*, O'Reilly.
3. **Cole NussbaumerKnafllic**, *Storytelling with Data*, Wiley.

Online Courses

Platform	Course Title & Link
Coursera	<u>Data Visualization with Tableau</u> – UC Davis

23A32M09	DATA ANALYTICS TOOLS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To visualize and interpret data using modern tools.
- To create dashboards and analytical views.

Course Outcomes:

- Use BI tools for analytical visualizations.
- Interpret datasets using graphical methods.

Experiments:

1. Introduction to Power BI / Tableau interface
2. Loading data and transforming in BI tools
3. Creating bar, pie, and line charts
4. Cross filters and slicers
5. Using DAX in Power BI
6. Map visualization
7. Dashboards creation
8. Connecting to real-time data
9. Storytelling with data
10. Introduction to Matplotlib for comparison
11. Using Seaborn and Plotly

23A32M10	BIG DATA & NOSQL LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To process big datasets using distributed systems.
- To implement NoSQL solutions.

Course Outcomes:

- Handle large datasets using Hadoop/Spark.
- Perform CRUD operations in NoSQL.

Experiments:

1. Introduction to HDFS and Hadoop
2. MapReduce word count example
3. Spark RDD operations
4. DataFrames and Spark SQL
5. PySpark ML basics
6. Connecting MongoDB to Python
7. CRUD operations in MongoDB
8. Indexing and Aggregation
9. Replication and Sharding demo
10. Case study: Big Data pipeline
11. Real-time analytics using Spark Streaming

DATA SCIENCE AND ANALYTICS

23A32M01	INTRODUCTION TO DATA SCIENCE	L	T	P	C
		3	0	0	3

Course Objectives (COs)

The course aims to:

- Provide a foundational understanding of data science processes and applications.
- Introduce key tools and techniques such as Python, statistics, data cleaning, visualization, and machine learning.
- Develop practical skills in data analysis, interpretation, and data storytelling.
- Enable students to work on real-world datasets using data science techniques.
- Prepare students for advanced studies or industry roles in data science and analytics.

Course Outcomes

After completing this course, students will be able to:

CO No.	Course Outcome	BTL
CO1	Explain the data science lifecycle and its importance in business and research.	L2
CO2	Use Python and libraries like Pandas, NumPy, and Matplotlib for data handling.	L3
CO3	Perform data cleaning, transformation, and visualization effectively.	L3
CO4	Apply basic machine learning models for classification and regression.	L3
CO5	Interpret data analysis results and communicate findings clearly.	L4

Unit I: Introduction to Data Science: What is Data Science?, Role of Data Scientist, Data Science Process (Problem definition, data collection, preprocessing, modeling, evaluation), Applications of Data Science in different domains, Tools: Jupyter, Anaconda, Python/R Overview.

Unit II: Data Handling and Preprocessing: Introduction to NumPy and Pandas, Reading data from CSV, Excel, SQL, Data Wrangling: Missing values, duplicates, outliers, Data transformation: Scaling, encoding, Feature engineering basics.

Unit III: Data Visualization: Importance of visualization, Visualization libraries (Matplotlib, Seaborn), Histograms, Boxplots, Pairplots, Heatmaps, Dashboards and Storytelling with Data, Real-time data dashboards (Optional).

Unit IV: Statistical Foundations for Data Science: Descriptive Statistics, Probability and Probability Distributions, Inferential Statistics: Hypothesis Testing, Confidence Intervals, Correlation and Causation, Use of Scipy/Statsmodels for statistical analysis.

Unit V: Introduction to Machine Learning: Supervised vs Unsupervised Learning, Classification and Regression problems, Basic ML Algorithms: Linear Regression, Logistic Regression, KNN, Decision Trees, Model Evaluation Metrics: Accuracy, Precision, Recall, F1-Score, Overfitting and Underfitting.

Textbooks

1. **Joel Grus** – *Data Science from Scratch: First Principles with Python*, O'Reilly.
2. **Cathy O'Neil and Rachel Schutt** – *Doing Data Science*, O'Reilly.
3. **Wes McKinney** – *Python for Data Analysis*, O'Reilly.

Reference Books

1. **Jake VanderPlas** – *Python Data Science Handbook*, O'Reilly.
2. **Andreas Müller & Sarah Guido** – *Introduction to Machine Learning with Python*.
3. **Han, Kamber, & Pei** – *Data Mining: Concepts and Techniques*, Morgan Kaufmann.

Online Courses

NPTEL / SWAYAM:

- NPTEL: Introduction to Data Science
 - Instructor: Prof. RaghunathanRengasamy, IIT Madras

Coursera:

- **IBM Data Science Professional Certificate**
Link: coursera.org
- **Introduction to Data Science in Python (University of Michigan)**
Link: coursera.org

23A32M02	STATISTICAL LEARNING FOR DATA SCIENCE	L	T	P	C
		3	0	0	3

Course Objectives (COs)

The course aims to:

- Introduce fundamental concepts of statistical learning and its importance in data science.
- Develop understanding of regression, classification, and resampling methods.
- Build skills in model assessment, selection, and regularization techniques.
- Apply statistical learning methods to real-world datasets.
- Interpret, communicate, and evaluate data-driven models.

Course Outcomes

CO No	Course Outcome	Cognitive Level (BT Level)
CO1	Understand the basics of statistical learning and data representation.	Understand (L2)
CO2	Apply linear regression, logistic regression, and classification techniques.	Apply (L3)
CO3	Evaluate models using resampling methods and cross-validation.	Evaluate (L5)
CO4	Analyze regularization methods like Ridge and Lasso to avoid overfitting.	Analyze (L4)
CO5	Create and interpret statistical learning models in practical scenarios.	Create (L6)

Unit I: Introduction to Statistical Learning: What is Statistical Learning?, Supervised vs Unsupervised Learning, Model Accuracy vs Interpretability, Bias-Variance Trade-off, Curse of Dimensionality, Applications of Statistical Learning

Unit II: Linear and Polynomial Regression: Simple Linear Regression. Multiple Linear Regression, Polynomial Regression, Assumptions of Linear Models, Model Diagnostics and Performance Metrics (R^2 , RMSE), Variable Selection Techniques

Unit III: Classification Methods: Logistic Regression, Discriminant Analysis (LDA, QDA), Naïve Bayes Classifier, K-Nearest Neighbors, Confusion Matrix, Precision, Recall, F1-Score

Unit IV: Resampling and Model Assessment: Train-Test Split, Cross Validation (k-Fold, LOOCV), Bootstrap Methods, Model Selection and Hyperparameter Tuning

Unit V: Regularization & Advanced Topics: Ridge Regression, Lasso Regression, Shrinkage Methods, Principal Component Regression (PCR), Partial Least Squares (PLS), Introduction to Support Vector Machines.

Textbooks

1. **Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani**
An Introduction to Statistical Learning with Applications in R – Springer
(Free PDF: <https://www.statlearning.com/>)
2. **Trevor Hastie, Robert Tibshirani, Jerome Friedman**
The Elements of Statistical Learning – Springer

Reference Books

1. **Norman Matloff** – *Statistical Regression and Classification: from R to Data Science*
2. **Chris Bishop** – *Pattern Recognition and Machine Learning*
3. **T. Ryan** – *Modern Regression Methods*

Online Courses (Free + Paid)

NPTEL / SWAYAM:

- NPTEL: Introduction to Statistical Learning
 - Instructor: Prof. Balaraman Ravindran (IIT Madras)

23A32M11	DATA VISUALIZATION & EXPLORATORY DATA ANALYSIS	L	T	P	C
		3	0	0	3

Course Objectives

- To understand the role of data visualization and EDA in the data science lifecycle.
- To explore data types, distributions, missing values, and outliers using statistical and visual methods.
- To gain expertise in using tools such as Python (Matplotlib, Seaborn, Plotly) or R for EDA.
- To develop meaningful, interactive visualizations for both univariate and multivariate data.
- To interpret trends and communicate data-driven insights effectively through dashboards and storytelling.

Course Outcomes (COs) with Cognitive Levels

CO No	Course Outcome	Bloom's Level
CO1	Understand the significance of data exploration and visualization in the data analysis process.	Understand (L2)
CO2	Identify and preprocess anomalies, missing data, and data types through exploratory methods.	Analyze (L4)
CO3	Apply visual and statistical techniques to univariate, bivariate, and multivariate data.	Apply (L3)
CO4	Evaluate different chart types and visualization libraries/tools for effective communication.	Evaluate (L5)
CO5	Create storytelling dashboards and dynamic visual reports for real-world datasets.	Create (L6)

Unit I: Introduction to EDA and Data Types

What is Exploratory Data Analysis?, Types of Data (Categorical, Numerical, Ordinal), Central tendency & dispersion: Mean, Median, Mode, Variance, StdDev, Importance of visualization in EDA

Unit II: Data Cleaning & Preprocessing

Handling missing values and imputation. Detecting and handling outliers, Feature engineering basics, Data transformations (scaling, normalization, encoding)

Unit III: Data Visualization Tools & Techniques

Univariate visualizations: Histogram, Boxplot, Violin plot, Pie chart, Bivariate and Multivariate visualizations: Scatter plot, Heatmaps, Pairplot, Time series plots, Density plots, Introduction to Matplotlib, Seaborn, Plotly, and Tableau

Unit IV: Advanced Data Visualization Concepts

Interactive visualizations: Hover, Zoom, Filters, Geospatial visualization using Folium or Mapbox, Visual perception principles (Gestalt, color theory), Visual storytelling and design best practices

Unit V: Dashboards & Real-World Case Studies

Creating dashboards using Power BI/Tableau/Plotly Dash, Building EDA pipelines with Python/R, Case studies: Finance, Healthcare, Social media, IoT, Interpreting visualizations for decision-making

Textbooks

1. **Alberto Cairo**, *The Truthful Art: Data, Charts, and Maps for Communication*, New Riders.
2. **Nathan Yau**, *Visualize This: The FlowingData Guide to Design, Visualization, and Statistics*, Wiley.
3. **Hadley Wickham**, *R for Data Science*, O'Reilly (for R users).

Reference Books

1. **Ben Fry**, *Visualizing Data: Exploring and Explaining Data with the Processing Environment*, O'Reilly.
2. **Claus O. Wilke**, *Fundamentals of Data Visualization*, O'Reilly.
3. **Scott Murray**, *Interactive Data Visualization for the Web*, O'Reilly.

Online Courses

Platform	Course Title & Link
Coursera	<u>Data Visualization with Python</u> – IBM

23A30601	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives (COs)

- Understand the fundamentals of Big Data, its characteristics, and challenges.
- Learn key tools and technologies for storing, processing, and analyzing Big Data (Hadoop, Spark, etc.).
- Explore advanced analytical techniques including MapReduce, machine learning on Big Data, and real-time analytics.
- Develop skills to design and implement Big Data solutions for real-world problems.
- Gain hands-on experience with Big Data frameworks and platforms.

Course Outcomes (COs) with Cognitive Levels

CO No	Course Outcome	Bloom's Cognitive Level
CO1	Understand the core concepts and architecture of Big Data and related technologies.	Understand (L2)
CO2	Analyze Big Data processing frameworks like Hadoop and Spark for scalability and efficiency.	Analyze (L4)
CO3	Apply MapReduce programming model to solve Big Data problems.	Apply (L3)
CO4	Evaluate different storage options (HDFS, NoSQL) and processing techniques for Big Data.	Evaluate (L5)
CO5	Create end-to-end Big Data analytics pipelines using relevant tools and platforms.	Create (L6)

Unit I: Introduction to Big Data

Definition and Characteristics (Volume, Velocity, Variety, Veracity, Value), Challenges of Big Data, Traditional Data Processing vs Big Data Analytics, Overview of Big Data applications.

Unit II: Big Data Technologies and Ecosystem

Hadoop Framework: HDFS, YARN, MapReduce, Apache Spark: Architecture and Components, NoSQL Databases (HBase, Cassandra, MongoDB), Data ingestion tools (Sqoop, Flume)

Unit III: MapReduce Programming Model

MapReduce fundamentals, Writing Map and Reduce functions, Job configuration and execution, Hands-on example: Word count, log analysis.

Unit IV: Advanced Big Data Analytics

Machine Learning on Big Data using MLlib (Spark), Real-time analytics and streaming data (Spark Streaming, Kafka), Graph processing (GraphX), Data visualization of Big Data

Unit V: Big Data Project and Case Studies

Designing Big Data solutions for healthcare, finance, social media analytics, Performance optimization and security considerations, Cloud-based Big Data platforms (AWS EMR, Google BigQuery), Case studies and project presentations.

Textbooks

1. **Viktor Mayer-Schönberger, Kenneth Cukier**, *Big Data: A Revolution That Will Transform How We Live, Work, and Think*, Houghton Mifflin Harcourt.
2. **Tom White**, *Hadoop: The Definitive Guide*, O'Reilly Media.
3. **Jules S. Damji, Brooke Wenig, Tathagata Das, Denny Lee**, *Learning Spark: Lightning-Fast Big Data Analysis*, O'Reilly Media.

Reference Books

1. **Raj Kamal**, *Big Data Analytics*, McGraw-Hill Education.
2. **Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos**, *Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data*, McGraw-Hill.
3. **AnandRajaraman, Jeffrey David Ullman**, *Mining of Massive Datasets*, Cambridge University Press.

Online Courses

Platform

Course Title & Link

Coursera [Big Data Specialization by University of California San Diego](#)

23A32602	RECOMMENDER SYSTEMS	L	T	P	C
		3	0	0	3

Course Objectives (COs)

- Understand the fundamental concepts and techniques of recommender systems.
- Explore different types of recommendation approaches: content-based, collaborative filtering, and hybrid methods.
- Learn about evaluation metrics and methods to assess recommender system performance.
- Understand challenges such as scalability, sparsity, and cold-start problems.
- Gain hands-on experience implementing and tuning recommender algorithms using real-world datasets.

Course Outcomes (COs) with Cognitive Levels

CO No	Course Outcome	Bloom's Cognitive Level
CO1	Explain the basic principles and types of recommender systems.	Understand (L2)
CO2	Analyze various recommendation algorithms including collaborative and content-based filtering.	Analyze (L4)
CO3	Apply different algorithms to build practical recommender system models.	Apply (L3)
CO4	Evaluate the performance of recommender systems using appropriate metrics.	Evaluate (L5)
CO5	Design hybrid recommender systems that address common challenges.	Create (L6)

Unit I: Introduction to Recommender Systems

Definition and applications (e-commerce, media, social networks), Types of recommender systems: content-based, collaborative filtering, hybrid, Overview of user-item interactions

Unit II: Content-Based Recommendation

Item profiles and user profiles, Similarity measures (cosine similarity, Pearson correlation), Building content-based recommenders, Advantages and limitations

Unit III: Collaborative Filtering Techniques

User-based collaborative filtering, Item-based collaborative filtering, Matrix factorization techniques (SVD, PCA), Addressing sparsity and scalability issues.

Unit IV: Evaluation of Recommender Systems

Metrics: Precision, Recall, F1-score, RMSE, MAE, Cross-validation and train-test split, Handling cold-start and diversity, Case studies on real-world evaluation.

Unit V: Advanced Topics and Hybrid Systems

Hybrid recommender systems (weighted, switching, feature combination), Context-aware recommendations, Deep learning in recommender systems, Privacy, ethics, and future trends

Textbooks

1. **Charu C. Aggarwal**, *Recommender Systems: The Textbook*, Springer, 2016.
2. **Francesco Ricci, Lior Rokach, Bracha Shapira, Paul B. Kantor (Editors)**, *Recommender Systems Handbook*, Springer, 2015.

Reference Books

1. **Dietmar Jannach, Markus Zanker, Alexander Felfernig, Gerhard Friedrich**, *Recommender Systems: An Introduction*, Cambridge University Press, 2010.
2. **Joseph A. Konstan, John Riedl**, *Collaborative Filtering Recommender Systems*, Now Publishers, 2012.
3. **Guibing Guo, Jie Zhang, Neil Yorke-Smith**, *Deep Learning Based Recommender System*, Springer, 2020.

Online Courses

Platform

Course Title & Link

Coursera [Recommender Systems Specialization by University of Minnesota](#)

23A32M12	DATA VISUALIZATION & EDA LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To explore and visualize datasets.
- To derive insights through analysis.

Course Outcomes:

- Conduct EDA on datasets.
- Create meaningful visualizations.

Experiments:

1. Importing data from different sources
2. Handling missing values and outliers
3. Univariate and bivariate analysis
4. Boxplots, Histograms, Heatmaps
5. Correlation matrix
6. Using pandas profiling
7. Data visualization using Plotly
8. Pairplots and violin plots
9. Feature engineering basics
10. Time series visualization
11. Dashboards with Streamlit

23A32M13	RECOMMENDER SYSTEM LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To understand collaborative and content filtering.
- To build and test recommender models.

Course Outcomes:

- Build simple recommender systems.
- Evaluate recommender performance.

Experiments:

1. Introduction to recommender systems
2. User-item interaction matrix
3. Cosine similarity for recommendations
4. Collaborative filtering – user-based
5. Collaborative filtering – item-based
6. Content-based filtering
7. Surprise library intro
8. Building SVD model
9. Hybrid recommender
10. Evaluation metrics (RMSE, MAE)
11. Recommendation visualization

23A30M01	PYTHON FOR AI & DATA SCIENCE	L	T	P	C
		3	0	0	3

Course Objectives (COs)

- Understand the fundamentals of Python programming relevant to AI and Data Science.
- Learn to handle, process, and visualize data using Python libraries.
- Apply Python-based techniques to build AI and machine learning models.
- Explore advanced AI concepts and implement them using Python.
- Develop skills to work with real-world datasets and AI applications using Python.

Course Outcomes (COs)

CO No	Course Outcome	Bloom's Cognitive Level
CO1	Understand Python programming basics and syntax for AI and Data Science applications.	Understand (L2)
CO2	Apply Python libraries for data manipulation and visualization.	Apply (L3)
CO3	Analyze data sets and extract meaningful insights using Python tools.	Analyze (L4)
CO4	Evaluate machine learning models implemented with Python.	Evaluate (L5)
CO5	Design and implement AI solutions using Python programming.	Create (L6)

Unit 1: Python Programming Fundamentals for AI & Data Science

Introduction to Python: Features and Setup, Data Types and Variables, Control Structures: Conditional Statements and Loops, Functions and Modules, Exception Handling, File Handling in Python, Introduction to Object-Oriented Programming, Introduction to Python IDEs and Notebooks

Unit 2: Data Handling and Preprocessing Using Python Libraries

Introduction to NumPy: Arrays and Operations, Pandas for Data Manipulation: Series and DataFrames, Handling Missing Data, Data Cleaning and Transformation, Data Aggregation and Grouping, Working with Dates and Time in Pandas, Data Input/Output: CSV, Excel, JSON, Introduction to Data Preprocessing Techniques

Unit 3: Data Visualization Techniques in Python

Introduction to Matplotlib: Basic Plotting, Customizing Plots and Graphs, Seaborn for Statistical Visualizations, Plotting Categorical Data, Plotting Time Series Data, Pairplots, Heatmaps, and Correlation Plots, Interactive Visualizations with Plotly, Visualizing Distributions and Outliers

Unit 4: Machine Learning Basics with Python

Introduction to Scikit-learn, Supervised Learning Algorithms: Linear Regression, Logistic Regression, Unsupervised Learning: K-Means Clustering, Model Evaluation Metrics: Accuracy, Precision, Recall, F1-score, Cross-validation and Hyperparameter Tuning, Feature Selection and Engineering, Overfitting and Underfitting Concepts, Introduction to Pipeline and Model Persistence

Unit 5: Advanced AI Applications with Python

Introduction to Neural Networks with Keras and TensorFlow, Building and Training Deep Learning Models, Natural Language Processing with Python (NLTK, SpaCy), Computer Vision Basics with OpenCV, Reinforcement Learning Overview, Transfer Learning and Pretrained Models, Deploying AI Models with Flask API, Ethical Considerations and Best Practices in AI

Textbooks

1. **Jake VanderPlas**, *Python Data Science Handbook*, O'Reilly, 2016.
2. **Sebastian Raschka, VahidMirjalili**, *Python Machine Learning*, Packt, 2019.
3. **AurélienGéron**, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, O'Reilly, 2019.

Reference Books

1. **Wes McKinney**, *Python for Data Analysis*, O'Reilly, 2017.
2. **Joel Grus**, *Data Science from Scratch: First Principles with Python*, O'Reilly, 2019.
3. **Francois Chollet**, *Deep Learning with Python*, Manning, 2018.

Online Courses

Platform	Course Title & Link
Coursera	Applied Data Science with Python Specialization – University of Michigan

23A30M02	DATA STRUCTURES & ALGORITHMS FOR AI	L	T	P	C
		3	0	0	3

Course Objectives (COs)

- Understand fundamental data structures and algorithms relevant to AI applications.
- Learn how to implement and analyze algorithms for efficient data processing in AI systems.
- Apply data structures and algorithms to solve AI problems such as search, optimization, and learning.
- Analyze algorithmic complexity and optimize AI solutions for performance.
- Develop skills to design AI algorithms using appropriate data structures.

Course Outcomes (COs)

CO No	Course Outcome	Bloom's Cognitive Level
CO1	Understand basic and advanced data structures used in AI applications.	Understand (L2)
CO2	Implement and apply fundamental algorithms for problem-solving in AI.	Apply (L3)
CO3	Analyze the time and space complexity of algorithms.	Analyze (L4)
CO4	Evaluate different algorithmic approaches and choose appropriate ones for AI problems.	Evaluate (L5)
CO5	Design efficient algorithms and data structures for AI systems.	Create (L6)

Unit 1: Fundamentals of Data Structures for AI

Introduction to Data Structures and Algorithms, Arrays and Linked Lists, Stacks and Queues, Trees: Basic Terminology and Binary Trees, Graphs: Representation and Terminologies, Hashing and Hash Tables, Recursion and Recursive Algorithms, Complexity Analysis: Big-O Notation

Unit 2: Searching and Sorting Algorithms in AI

Linear Search and Binary Search, Bubble Sort, Selection Sort, Insertion Sort, Merge Sort and Quick Sort, Heap Sort and Counting Sort, Search Algorithms in Graphs: DFS and BFS, Heuristic Search: A* Algorithm, Algorithm Design Techniques: Divide and Conquer, Performance Analysis of Sorting and Searching Algorithms

Unit 3: Advanced Data Structures and Their Applications in AI

Balanced Trees: AVL Trees and Red-Black Trees, B-Trees and B+ Trees, Trie and Suffix Trees, Priority Queues and Heaps, Disjoint Set Union (Union-Find), Graph Algorithms: Minimum Spanning Tree (Kruskal, Prim), Shortest Path Algorithms (Dijkstra, Bellman-Ford), Application of Advanced Data Structures in AI

Unit 4: Algorithms for AI Problem Solving

Backtracking Algorithms, Branch and Bound Technique, Dynamic Programming and Memoization, Greedy Algorithms and their applications, Optimization Algorithms in AI, Local Search Algorithms, Evolutionary Algorithms and Genetic Algorithms, Complexity Classes: P, NP, NP-Complete, NP-Hard

Unit 5: Designing AI Algorithms with Data Structures

Designing Efficient Search Algorithms for AI, Data Structures for Knowledge Representation, Graph-based Algorithms for Social Network Analysis, Tree-based Algorithms in Decision Making (Decision Trees), Algorithms for Natural Language Processing, Algorithms for Computer Vision Tasks, Parallel and Distributed Algorithms in AI, Case Studies: Implementing AI Algorithms using Data Structures.

Textbooks

1. **Mark Allen Weiss**, *Data Structures and Algorithm Analysis in C++*, Pearson.
2. **Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein**, *Introduction to Algorithms*, MIT Press.
3. **Nils J. Nilsson**, *Artificial Intelligence: A New Synthesis*, Morgan Kaufmann (for AI algorithm context).

Reference Books

1. **Richard E. Neapolitan, KumarssNaimipour**, *Foundations of Algorithms*, Jones & Bartlett Publishers.
2. **R. S. Salaria**, *Data Structures and Algorithms*, Khanna Publishing House.
3. **Stuart Russell, Peter Norvig**, *Artificial Intelligence: A Modern Approach*, Pearson.

Online Courses

Platform	Course Title & Link
Coursera	Algorithms Specialization – Stanford University

23A30603a	REINFORCEMENT LEARNING	L	T	P	C
		3	0	0	3

Course Objectives (COs)

- Understand the fundamental concepts and principles of reinforcement learning (RL).
- Learn various RL algorithms including model-free and model-based methods.
- Analyze the mathematical foundations and performance of RL algorithms.
- Apply reinforcement learning techniques to real-world problems and AI applications.
- Develop skills to design, implement, and evaluate RL systems effectively.

Course Outcomes (COs)

CO No	Course Outcome	Bloom's Cognitive Level
CO1	Understand core concepts such as Markov Decision Processes, policies, and rewards in RL.	Understand (L2)
CO2	Implement fundamental RL algorithms like Dynamic Programming, Monte Carlo, and Temporal Difference.	Apply (L3)
CO3	Analyze convergence, stability, and exploration-exploitation trade-offs in RL algorithms.	Analyze (L4)
CO4	Evaluate the effectiveness of different RL algorithms on benchmark tasks.	Evaluate (L5)
CO5	Design and develop advanced RL solutions for complex environments.	Create (L6)

Unit 1: Introduction and Foundations of Reinforcement Learning

Overview of Reinforcement Learning, Key Elements: Agent, Environment, States, Actions, Rewards, Markov Decision Process (MDP) - Definition and Properties, Policies and Value Functions, Bellman Equations for State and Action Values, Concept of Return and Discount Factor, Exploration vs Exploitation dilemma, Examples of RL in Real World.

Unit 2: Dynamic Programming and Monte Carlo Methods

Policy Evaluation with Dynamic Programming, Policy Improvement and Policy Iteration, Value Iteration Algorithm, Monte Carlo Prediction and Control, First-visit and Every-visit MC Methods, On-policy vs Off-policy MC Methods, Importance Sampling in Monte Carlo, Applications of Dynamic Programming and Monte Carlo in RL.

Unit 3: Temporal Difference Learning

Introduction to Temporal Difference (TD) Learning, TD(0) Algorithm and its Properties, TD Prediction and Control Methods, SARSA Algorithm (On-policy TD Control), Q-Learning Algorithm (Off-policy TD Control), Eligibility Traces and TD(λ), Function Approximation in TD Learning, Convergence and Stability Analysis.

Unit 4: Policy Gradient and Advanced Methods

Policy Gradient Theorem, REINFORCE Algorithm, Actor-Critic Methods, Deep Reinforcement Learning (DRL) Overview, Deep Q Networks (DQN), Trust Region Policy Optimization (TRPO), Proximal Policy Optimization (PPO), Exploration Strategies (ϵ -greedy, Boltzmann, UCB).

Unit 5: Applications and Recent Advances in Reinforcement Learning

Multi-agent Reinforcement Learning, Hierarchical Reinforcement Learning, Inverse Reinforcement Learning, RL in Robotics and Autonomous Systems, RL for Game Playing (Chess, Go, Atari), Safety and Ethics in RL, Transfer Learning and Meta-RL, Case Studies and Research Trends

Textbooks

1. **Richard S. Sutton and Andrew G. Barto**, *Reinforcement Learning: An Introduction*, 2nd Edition, MIT Press, 2018.
2. **Csaba Szepesvári**, *Algorithms for Reinforcement Learning*, Morgan & Claypool Publishers, 2010.

Reference Books

1. **Marco Wiering and Martijn van Otterlo (Editors)**, *Reinforcement Learning: State-of-the-Art*, Springer, 2012.
2. **Deep Reinforcement Learning Hands-On** by Maxim Lapan, Packt Publishing, 2018.
3. **David Silver's Lecture Notes and Videos** on Reinforcement Learning (available online).

Online Courses

Platform	Course Title & Link
Coursera	Reinforcement Learning Specialization – University of Alberta

23A30M03	QUANTUM COMPUTING FOR AI	L	T	P	C
		3	0	0	3

Course Objectives (COs)

- Understand foundational concepts of quantum computing and its significance in Artificial Intelligence (AI).
- Explore quantum algorithms relevant to AI applications.
- Analyze the advantages and challenges of applying quantum computing in AI.
- Develop skills to implement basic quantum algorithms for AI tasks.
- Investigate emerging trends and research in Quantum AI.

Course Outcomes (COs)

CO No	Course Outcome	Bloom's Cognitive Level
CO1	Understand principles of quantum computing and their implications for AI.	Understand (L2)
CO2	Explain key quantum algorithms used in AI applications.	Understand (L2)
CO3	Apply quantum computing techniques to solve basic AI problems.	Apply (L3)
CO4	Analyze the benefits and limitations of quantum computing in AI contexts.	Analyze (L4)
CO5	Design and implement quantum algorithms for AI applications.	Create (L6)

Unit 1: Introduction to Quantum Computing and AI

Classical Computing vs Quantum Computing, Qubits and Quantum States, Quantum Superposition and Entanglement, Quantum Gates and Circuits, Measurement in Quantum Systems, Basic Quantum Algorithms Overview, Introduction to Artificial Intelligence, Intersection of Quantum Computing and AI

Unit 2: Quantum Algorithms for AI

Quantum Search Algorithm (Grover's Algorithm), Quantum Fourier Transform, Quantum Amplitude Amplification, Quantum Phase Estimation, Variational Quantum Algorithms (VQA), Quantum Annealing and Optimization, Quantum Approximate Optimization Algorithm (QAOA), Quantum Machine Learning Overview

Unit 3: Quantum Machine Learning (QML) Fundamentals

Quantum Data Encoding and State Preparation, Quantum Support Vector Machines (QSVM), Quantum Neural Networks (QNN), Quantum Clustering Algorithms, Quantum Principal Component Analysis (QPCA), Hybrid Quantum-Classical Models, Quantum Kernel Methods, Challenges in QML

Unit 4: Quantum AI Applications and Implementations

Quantum Reinforcement Learning Basics, Quantum Natural Language Processing (QNLP), Quantum Image Processing, Quantum Optimization for AI Problems, Error Correction and Noise in Quantum AI Systems, Quantum Hardware for AI (Qubits technologies), Performance Evaluation of Quantum AI Algorithms, Case Studies of Quantum AI Applications

Unit 5: Advanced Topics and Future Directions

Designing Quantum Circuits for AI Tasks, Quantum AI Programming Frameworks (Qiskit, Cirq, etc.), Scalability and Resource Management in Quantum AI, Ethical and Security Implications of Quantum AI, Quantum AI Research Trends, Integration of Quantum AI with Classical AI, Quantum AI for Big Data Analytics, Emerging Quantum Technologies and AI

Textbooks

1. Michael A. Nielsen and Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press, 2010.
2. Maria Schuld and Francesco Petruccione, *Supervised Learning with Quantum Computers*, Springer, 2018.
3. Peter Wittek, *Quantum Machine Learning: What Quantum Computing Means to Data Mining*, Academic Press, 2014.

Reference Books

1. Seth Lloyd, *Quantum Machine Learning: An Applied Approach*, MIT Press, 2020.
2. Vlatko Vedral, *Introduction to Quantum Information Science*, Oxford University Press, 2006.
3. Jacob Biamonte et al., "Quantum Machine Learning," *Nature*, 2017.
4. Research papers and IEEE articles on Quantum AI and Quantum Machine Learning.

Online Courses and Tutorials

Platform	Course Title & Link
IBM Qiskit	Introduction to Quantum Computing and Qiskit
Coursera	Quantum Machine Learning by University of Toronto

23A30M04	EDGE AI & IOT	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce the concept of Edge Computing and its integration with AI and IoT.
- To explore AI model deployment on edge devices.
- To understand IoT protocols, architectures, and security issues.
- To apply Edge AI techniques for real-time decision-making.
- To analyze case studies of Edge AI applications in smart systems.

Course Outcomes

CO No	Course Outcome	Bloom's Level
CO1	Understand the fundamentals of Edge Computing and IoT systems.	Understand (L2)
CO2	Explain the architecture and protocols used in IoT and Edge AI.	Understand (L2)
CO3	Apply machine learning models to edge devices for real-time inference.	Apply (L3)
CO4	Analyze the constraints and trade-offs in deploying AI models on edge devices.	Analyze (L4)
CO5	Design and evaluate edge-based AI systems for real-world applications.	Create (L6)

UNIT 1: Introduction to Edge Computing and IoT

Introduction to IoT: Definition, architecture, components, IoT vs Edge Computing, Edge, Fog, and Cloud Computing – Differences, Edge AI Overview – Concept and Applications, Characteristics and Benefits of Edge AI, Edge Devices: Microcontrollers, SBCs, Smart Cameras, Industry 4.0 and Smart Systems, Use Cases: Smart Home, Healthcare, Industry

UNIT 2: IoT and Edge AI Architectures & Communication Protocols

IoT Architectures: 3-Layer, 5-Layer, Middleware, Edge AI Pipeline Architecture, MQTT, CoAP, HTTP, and AMQP Protocols, Data Collection and Preprocessing at the Edge, Real-time Data Transmission and Synchronization, Sensor Networks and Wireless Protocols (BLE, Zigbee, LoRaWAN), Communication Challenges in IoT, Interoperability and Integration Frameworks

UNIT 3: AI and ML for Edge Devices

AI/ML Workflow Overview: Training vs Inference, Model Compression Techniques (Quantization, Pruning), Knowledge Distillation for Edge AI, TinyML and Lightweight Model Deployment, Edge ML Frameworks: TensorFlow Lite, ONNX, PyTorch Mobile, Case Study: Deploying a CNN on Raspberry Pi, Energy and Latency Considerations, Model Evaluation Metrics for Edge AI

UNIT 4: Edge AI System Design and Optimization

Hardware Selection: MCU, MPU, FPGA, ASIC, Power Consumption and Thermal Constraints, Model Accuracy vs Performance Tradeoffs, Data Management and Storage on Edge Devices, Federated Learning at the Edge, Edge-to-Cloud Integration Patterns, Edge AI Application Lifecycle, Security and Privacy at the Edge

UNIT 5: Applications and Case Studies of Edge AI &IoT

Smart City Applications: Traffic, Waste, Lighting, Healthcare Monitoring Systems using Edge AI, Industrial Automation with Edge-enabled Sensors, Agriculture: Soil Health, Irrigation, Crop Monitoring, Surveillance & Real-time Video Analytics, Edge AI for Predictive Maintenance, AI on Drones and Autonomous Vehicles, Building Scalable Edge AI Solutions

Textbooks

1. **"Edge AI: Convergence of Edge Computing and Artificial Intelligence"** – Xiaofei Wang, Springer, 2020.
2. **"Internet of Things: Principles and Paradigms"** – RajkumarBuyya, Amir VahidDastjerdi, Elsevier, 2016.
3. **"TinyML: Machine Learning with TensorFlow Lite on Arduino and Ultra-Low-Power Microcontrollers"** – Pete Warden, Daniel Situnayake, O'Reilly Media, 2019.

Reference Books

1. **"Architecting the Internet of Things"** – Dieter Uckelmann, Springer.
2. **"Hands-On Edge Analytics with Azure IoT"** – ArvindRavulavaru, Packt Publishing.
3. Research papers from **IEEE IoT Journal, ACM Transactions on IoT, Nature Electronics (Edge AI)**.

Online Courses

Platform	Course Title & Link

Coursera	AI for Edge Computing – IBM

23A30M05	PYTHON & DS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To strengthen programming and DS skills for AI.

Course Outcomes:

- Apply Python for solving AI-related problems.
- Use appropriate data structures in solutions.

Experiments:

1. Python basics and data types
2. Functions and recursion
3. Lists, Tuples, Sets
4. Dictionaries and comprehension
5. Stacks and Queues
6. Linked Lists implementation
7. Searching and Sorting
8. Tree traversals
9. Graph representation and DFS/BFS
10. Recursion with memoization
11. Implement AI heuristic search (A*)

23A30M06	RL & QUANTUM AI LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To introduce RL and Quantum concepts in AI.

Course Outcomes:

- Apply RL to solve simple tasks.
- Demonstrate basics of quantum circuits.

Experiments:

1. Intro to OpenAI Gym
2. RL environment setup
3. Q-learning implementation
4. Policy gradient methods
5. CartPole balancing with RL
6. Quantum computing basics (Qiskit)
7. Quantum circuits & gates
8. Superposition and entanglement
9. Quantum teleportation simulation
10. Quantum ML (VQC intro)
11. Reinforcement learning with function approximation
12. RL/Quantum hybrid demo

23A30M07	AI IN FINANCE & BUSINESS ANALYTICS	L	T	P	C
		3	0	0	3

Course Objectives

- Understand the fundamentals and applications of AI in finance and business.
- Explore machine learning and deep learning techniques for financial data modeling.
- Analyze predictive analytics for stock market, risk, and fraud detection.
- Develop AI-based solutions for customer segmentation, churn prediction, and pricing.
- Evaluate ethical, regulatory, and technological challenges in deploying AI in business.

Course Outcomes

CO No	Course Outcome	Bloom's Level
CO1	Understand financial systems and analytics tools for business insights	Understand (L2)
CO2	Apply AI/ML models for risk assessment, fraud detection, and market prediction	Apply (L3)
CO3	Analyze customer behavior using segmentation and recommendation systems	Analyze (L4)
CO4	Evaluate AI tools for performance optimization in business decisions	Evaluate (L5)
CO5	Design intelligent business systems using ethical AI techniques	Create (L6)

UNIT 1: Introduction to AI in Finance & Business

Overview of Financial Systems and Analytics, Introduction to Artificial Intelligence and ML in Business, Business Intelligence vs. Business Analytics, Types of Financial Data (Transactional, Time-Series, Textual), Use Cases of AI in Banking, Insurance, and Stock Markets, Tools for Business Analytics: Python, Power BI, Tableau, Descriptive, Predictive, and Prescriptive Analytics, Case Study: AI in Robo-Advisory Systems

UNIT 2: Machine Learning for Financial Analytics

Data Preprocessing for Financial Applications, Regression for Stock Price Prediction, Classification Models for Credit Scoring, Clustering for Customer Segmentation, Time Series Analysis using ARIMA, LSTM, Portfolio Optimization using Reinforcement Learning, AI in Algorithmic Trading Strategies, Model Validation Techniques: Cross-validation, A/B Testing

UNIT 3: AI for Risk, Fraud, and Compliance

Credit Risk Modeling using Decision Trees and XGBoost, Fraud Detection using Anomaly Detection Models, Real-Time Risk Scoring Systems, Anti-Money Laundering (AML) Compliance Models, Sentiment Analysis for Financial News and Tweets, Predictive Maintenance and Financial Risk Analysis, Explainable AI in Financial Decision Systems, Case Study: Fraud Detection in Credit Card Transactions

UNIT 4: AI for Business Process Optimization

Customer Lifetime Value Prediction, Churn Prediction using Ensemble Models, Dynamic Pricing Models using AI, AI in Demand Forecasting, Chatbots for Customer Support and Financial Advisory, Recommendation Systems in E-Commerce and Retail, Optimization in Supply Chain Analytics, AI-driven Marketing Campaigns and ROI Analysis

UNIT 5: Ethics, Deployment, and Future Trends

Ethics of AI in Finance: Bias, Fairness, and Transparency, Regulatory Frameworks (GDPR, RBI, SEBI, PSD2), Data Privacy and Governance in Financial Institutions, Explainable AI (XAI) for Auditing and Trust, Scalable AI Architectures (ML Ops in Business), Fintech Innovations: Blockchain, AI, and Smart Contracts, Generative AI and Large Language Models in Business Analytics, Designing AI-Powered Financial Products (Use Case Projects)

Textbooks

1. —**Artificial Intelligence in Finance** by Yves Hilpisch – O'Reilly
2. —**Applied Artificial Intelligence in Finance** by Yves Hilpisch – Wiley
3. —**Business Analytics: The Science of Data-Driven Decision Making** by U. Dinesh Kumar – Wiley India

Reference Books

1. —**Machine Learning for Financial Risk Management** by Abdullah Karasan – Springer
2. —**Data Science for Business** by Foster Provost & Tom Fawcett – O'Reilly
3. —**Machine Trading** by Ernest Chan – Wiley
4. Research Articles from **Journal of Financial Data Science**, **Harvard Business Review**, and **ACM Transactions on Management Information Systems**

Online Courses

Platform	Course Title & Link

Coursera	<u>AI in Finance by NYIF</u>
edX	Artificial Intelligence in Business

23A30M08	ETHICAL AI & RESPONSIBLE AI	L	T	P	C
		3	0	0	3

Course Objectives

- Understand the ethical foundations and challenges in AI systems.
- Explore fairness, accountability, transparency, and interpretability in AI.
- Identify social, legal, and cultural impacts of deploying AI at scale.
- Learn frameworks for responsible AI governance and regulations.
- Design and evaluate AI systems with ethical and responsible principles.

Course Outcomes

CO No	Course Outcome	Bloom's Level
CO1	Explain ethical theories and values applied to AI systems	Understand (L2)
CO2	Identify bias, fairness, and accountability issues in AI systems	Analyze (L4)
CO3	Evaluate the ethical impact of AI across industries and society	Evaluate (L5)
CO4	Recommend design choices for building responsible AI applications	Apply (L3)
CO5	Develop AI solutions aligned with global policies and ethical standards	Create (L6)

UNIT 1: Foundations of AI Ethics

Introduction to AI and Ethics, Ethical Theories: Utilitarianism, Deontology, Virtue Ethics, AI's Role in Society: Risks and Benefits, Data Ethics and Consent, AI Decision-Making vs. Human Judgment, Algorithmic Responsibility and Trust, Moral Machine Experiment and Human-AI Dilemmas, Case Study: Ethical Challenges in Autonomous Vehicles

UNIT 2: Bias, Fairness & Discrimination in AI

Understanding Algorithmic Bias, Types of Bias: Historical, Sampling, Label, Measurement, Disparate Impact and Fairness Metrics, Mitigating Bias: Pre-processing, In-processing, Post-processing, Audit and Testing of AI Systems, Intersectionality and Social Justice in AI, Case Study: Racial Bias in Facial Recognition Systems, Tools for Fair AI: IBM AI Fairness 360, Fairlearn

UNIT 3: Explainability, Transparency & Accountability

Explainability vs Interpretability, Model-Agnostic vs. Intrinsic Explainability, SHAP, LIME, and Counterfactual Explanations, Black-Box vs. Glass-Box Models, Accountability Frameworks for AI Developers, Documentation: Datasheets for Datasets, Model Cards, Role of Human Oversight, Case Study: Transparent Credit Scoring Systems

UNIT 4: Responsible AI Governance & Regulations

AI Governance Frameworks (OECD, NITI Aayog, EU AI Act), Ethics Guidelines from IEEE, UNESCO, ISO/IEC, Legal Responsibility and Liability in AI, Data Protection Laws: GDPR, HIPAA, Ethics Boards and Risk Assessment Models, AI Ethics in Industry: Google, Microsoft, Meta Case Studies, Inclusive Design and Accessibility, Open Source & Community Involvement in Responsible AI

UNIT 5: Emerging Topics & Global Perspective

Ethical Issues in Generative AI (ChatGPT, DALL·E), Deepfakes and Information Manipulation, Autonomous Weapons and AI in Warfare, AI and Climate Change Mitigation, Emotional AI, Neuro

AI, and Human Rights, AI in Healthcare, Finance, and Education: Ethical Outlook, Cultural and Geopolitical Dimensions of AI Deployment, Capstone Project: Designing a Responsible AI Use Case

Textbooks

1. —**Ethics of Artificial Intelligence and Robotics** – Stanford Encyclopedia of Philosophy
2. —**Ethics of Artificial Intelligence** by Markus D. Dubber, Frank Pasquale, Sunit Das
3. —**Weapons of Math Destruction** by Cathy O’Neil
4. —**Artificial Unintelligence: How Computers Misunderstand the World** by Meredith Broussard

Reference Books

1. —**Rebooting AI** by Gary Marcus and Ernest Davis
2. —**The Ethical Algorithm** by Michael Kearns and Aaron Roth
3. **IEEE Standards for Ethically Aligned Design**
4. **UNESCO Recommendations on Ethics of AI**

Online Courses

Platform Course Title & Link

Coursera [AI For Everyone by Andrew Ng](#)

23A31701	GENERATIVE AI & PROMPT ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives

- Understand the fundamental principles behind generative models, including transformers and diffusion models.
- Explore various architectures like GPT, DALL·E, BERT, and Stable Diffusion.
- Learn prompt engineering strategies to guide LLMs effectively for various tasks.
- Develop skills to build applications using Generative AI APIs (e.g., OpenAI, Hugging Face).
- Evaluate the ethical considerations and limitations of generative AI systems.

Course Outcomes

CO No	Course Outcome	Bloom's Level
CO1	Understand foundational concepts of generative AI and prompt engineering	Understand (L2)
CO2	Apply effective prompting techniques for text/image/code generation	Apply (L3)
CO3	Analyze different types of generative models and their applications	Analyze (L4)
CO4	Evaluate the performance and output quality of various generative AI tools	Evaluate (L5)
CO5	Design AI-powered solutions using LLMs and prompt design	Create (L6)

UNIT 1: Introduction to Generative AI

What is Generative AI? – Overview and History, Applications: Text, Images, Code, Audio, Video, Probabilistic Models vs Generative Models, GANs (Generative Adversarial Networks): Intuition, Autoencoders and Variational Autoencoders, Transformers: Architecture and Attention, Pretraining vs Fine-tuning, Introduction to GPT, BERT, DALL·E, Stable Diffusion

UNIT 2: Prompt Engineering Techniques

What is Prompt Engineering?, Few-shot, One-shot, and Zero-shot Prompting, Role-based Prompting (e.g., —Act as...), Chain-of-Thought Prompting, Prompt Templates and Variables, Prompt Evaluation and Refinement, Prompt Injection Attacks & Defenses, Prompting for Text Summarization, Translation.

UNIT 3: Architectures & Tools for Generative AI

OpenAI GPT-3, GPT-4: Capabilities & APIs, Hugging Face Transformers and Pipelines, DALL·E and Stable Diffusion for Image Generation, Midjourney & Open-Source Diffusion Models, LangChain for Prompt Chaining, Fine-tuning vs Instruction Tuning, Codex for Code Generation, Tool Use: Notebooks, APIs, VS Code Extensions

UNIT 4: Use Cases & Application Development

Chatbots & Virtual Assistants with LLMs, Content Generation for Marketing & Blogs, Educational Aids: Auto-Grading & Explanations, Code Generation & Refactoring (Copilot, Codex), Image Generation for Design & Advertising, AI Writing Assistants (e.g., Jasper, Writer.ai), Prompt-Based App Development with LangChain, Evaluating Output Quality: Human-AI Feedback Loop

UNIT 5: Ethical AI & Future Trends

AI Hallucinations and Misinformation, Bias, Fairness, and Toxicity in Generative AI, Copyright, Plagiarism, and Data Usage Issues, Red Teaming & Safety Testing for LLMs, OpenAI Usage Guidelines and Safety Layers, Explainability & Interpretability in Generative Models, The Future: AGI, Multimodal AI, and Prompt Agents, Capstone Project: Design & Deploy a Prompt-Driven Application

Textbooks

1. —**You Look Like a Thing and I Love You** – Janelle Shane
2. —**Deep Learning with Python** – François Chollet
3. —**Prompt Engineering Guide** – DAIR.AI (Open Source)
4. —**Generative Deep Learning** – David Foster

Reference Books

1. —**Hands-On Generative Adversarial Networks** – Josh Kalin
2. —**Transformers for Natural Language Processing** – Denis Rothman
3. —**Natural Language Processing with Transformers** – Lewis Tunstall et al.
4. OpenAI Cookbook (GitHub)
5. Hugging Face Transformers Documentation

Online Courses

Platform	Course Title

Coursera	<u>Prompt Engineering for ChatGPT</u>

23A31702b	AI IN CYBER SECURITY	L	T	P	C
		3	0	0	3

Course Objectives

- Understand the foundational principles of cybersecurity and AI integration.
- Explore how AI/ML techniques can detect, prevent, and mitigate cybersecurity threats.
- Learn about anomaly detection, malware classification, intrusion detection, and phishing detection using AI.
- Analyze ethical issues, limitations, and adversarial attacks in AI-driven cybersecurity systems.
- Implement AI models for real-time threat intelligence and response.

Course Outcomes (COs)

CO No	Course Outcome	Bloom's Level
CO1	Explain the fundamentals of AI and its applications in cybersecurity	Understand (L2)
CO2	Apply machine learning models for intrusion and anomaly detection	Apply (L3)
CO3	Analyze malware and phishing threats using AI techniques	Analyze (L4)
CO4	Evaluate and compare different AI-based cybersecurity frameworks	Evaluate (L5)
CO5	Design secure AI-based threat detection and response systems	Create (L6)

UNIT 1: Introduction to Cybersecurity & AI

Overview of Cybersecurity Threat Landscape, Fundamentals of Artificial Intelligence & Machine Learning, Categories of Threats: Malware, Phishing, Ransomware, Traditional vs AI-based Threat Detection Systems, Role of AI in Cybersecurity: Overview, AI in Endpoint, Network, and Application Security, AI Workflow in Threat Detection Systems, Challenges of Implementing AI in Cybersecurity

UNIT 2: Intrusion Detection and Anomaly Detection using AI

What is Intrusion Detection System (IDS)?, Signature-based vs Anomaly-based IDS, ML Techniques for Anomaly Detection, Feature Engineering for Network Traffic, Classification Algorithms for IDS (SVM, KNN, RF), Real-time Threat Monitoring Using AI, Evaluation Metrics: Accuracy, ROC, Precision/Recall, Tools: Snort, Suricata, and Open Source AI IDS Models

UNIT 3: Malware Analysis and Phishing Detection

Introduction to Malware Analysis, Static vs Dynamic Malware Analysis Techniques, Malware Classification Using Machine Learning, Phishing Attack Patterns and Features, Email Header and URL-based Phishing Detection, NLP for Textual Content Analysis, Feature Extraction from Executables and Emails, Dataset: Maling, PhishTank, VirusShare

UNIT 4: Adversarial Attacks and AI Model Robustness

Introduction to Adversarial Machine Learning, Poisoning, Evasion, and Inference Attacks, Adversarial Example Generation (FGSM, PGD), Model Robustness Evaluation Techniques, Defense Mechanisms: Input Sanitization, Adversarial Training, Privacy Attacks: Membership Inference & Model Inversion, Explainable AI in Cybersecurity.

UNIT 5: AI for Cyber Threat Intelligence & Incident Response

Threat Intelligence Frameworks and Standards (STIX/TAXII), AI-Powered SIEM (Security Information and Event Management), NLP for Threat Report Analysis, Entity Recognition in Cyber Threat Reports, Predictive Analytics for Threat Forecasting, AI in SOC (Security Operations Center) Automation, Use of LLMs (like GPT) for Incident Summary and Analysis, Capstone Project: Build AI-Based Cyber Threat Detection System

Textbooks

1. —**Artificial Intelligence for Cybersecurity** – Alessandro Parisi
2. —**Machine Learning and Security** – Clarence Chio & David Freeman
3. —**Cybersecurity and Artificial Intelligence** – Rashmi Agrawal, Vishal Jain

Reference Books

1. —**Hands-On Machine Learning for Cybersecurity** – Soma Halder, Sinan Ozdemir
2. —**Blue Team Field Manual** – Alan J White
3. NIST and MITRE ATT&CK Framework Guidelines
4. Research papers from IEEE/ACM Digital Library on Adversarial AI

Online Courses

Platform	Course Title

Coursera	<u>AI For Cybersecurity</u>

23A31703c	HEALTH CARE AI	L	T	P	C
		3	0	0	3

Course Objectives:

- To provide a foundational understanding of AI applications in healthcare.
- To familiarize students with medical data types, preprocessing, and ethical considerations.
- To explore ML and DL algorithms tailored for diagnosis, prognosis, and treatment recommendations.
- To expose students to real-world healthcare systems and AI solutions like predictive modeling, EHRs, and medical imaging.
- To enable students to design, evaluate, and deploy AI-driven healthcare applications.

Course Outcomes:

After completing this course, students will be able to:

- Understand the scope, challenges, and benefits of AI in healthcare.
- Apply data preprocessing and modeling techniques specific to biomedical data.
- Analyze the performance of ML/DL models in clinical contexts.
- Develop AI-driven applications for tasks like disease diagnosis, drug discovery, and patient monitoring.
- Evaluate ethical, legal, and societal implications of AI in healthcare.

UNIT I: Introduction to AI in Healthcare: Overview of Healthcare Systems and Data Ecosystem – (U), AI in Clinical Decision Support Systems (CDSS) – (U), Types of Medical Data: EHRs, Imaging, Genomic, Sensor Data – (U), Applications of AI in Diagnosis, Prognosis, and Monitoring – (A), Use Cases: Radiology, Pathology, Oncology, Cardiology – (A), Limitations and Challenges of AI in Healthcare , AI for Telemedicine and Remote Patient Monitoring – (A)

UNIT II: Medical Data Preprocessing and Feature Engineering: Data Cleaning, Imputation, and Normalization for Clinical Data – (A), Handling Missing Values, Outliers, and Bias – (A), Feature Engineering from EHRs and Time-Series Data – (A), Text Mining for Medical Notes using NLP – (A), Encoding Diagnosis and Procedure Codes (ICD, CPT) – (U), Temporal Pattern Extraction from Clinical Sequences ,Data Privacy, Anonymization, and HIPAA Compliance – (AN)

UNIT III: Machine Learning & Deep Learning in Healthcare: Supervised Learning for Risk Prediction and Classification – (A), Unsupervised Learning for Patient Segmentation – (A), Deep Learning for Medical Imaging: CNNs, Transfer Learning – (A), Recurrent Neural Networks for Time-series Clinical Data ,Survival Analysis and Time-to-Event Prediction – (A), Model Evaluation Metrics: Sensitivity, Specificity, AUC – (E), Handling Imbalanced Datasets in Healthcare – (E), Interpretability in Medical ML Models (LIME, SHAP) – (E)

UNIT IV: Specialized Healthcare AI Applications : AI for Disease Diagnosis: Diabetes, Cancer, Heart Disease – (A), AI in Medical Imaging: X-ray, MRI, CT Scan Analysis – (A), Predictive Modeling for ICU Admission & Mortality Risk – (A), AI in Genomics and Personalized Medicine ,Drug Discovery and Repurposing with AI ,Chatbots and Virtual Health Assistants – (A), Remote Monitoring using IoT&Wearables + AI – (A), Designing an End-to-End AI Solution for a Medical Use Case – (C)

UNIT V: Ethics, Regulation, and Future Directions in Healthcare AI: Ethical AI in Healthcare: Bias, Fairness, and Accountability ,Regulatory Landscape: FDA Approval, CE Marking – (E), Explainable AI and Clinical Trust – (E), Federated Learning for Privacy-Preserving AI ,Clinical Trials and AI Decision-Support Tools – (E), Case Studies: Google DeepMind, IBM Watson Health, PathAI ,Responsible Deployment of AI in Healthcare Settings – (E), Capstone: Building a Responsible Healthcare AI Proposal – (C)

Textbooks:

1. Jiang, Fei et al. – Artificial Intelligence in Healthcare: Past, Present and Future.
2. Kevin Frick – Introduction to Healthcare AI.
3. Eric Topol – Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again.

Reference Books:

1. Mathias Goyen – AI in Medical Imaging.
2. Bertalan Meskó – The Guide to the Future of Medicine: Technology and The Human Touch.
3. Peter Szolovits – Artificial Intelligence in Medicine (Morgan Kaufmann).

Online Learning Resources:

- Coursera: AI for Medicine Specialization (offered by DeepLearning.AI)
<https://www.coursera.org/specializations/ai-for-medicine>
- HarvardX: Data Science in Healthcare (edX)
<https://online-learning.harvard.edu/course/data-science-healthcare>

23A30M09	GENERATIVE AI LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To explore generative AI tools and techniques.

Course Outcomes:

- Use text and image generation models.
- Develop simple prompt-based applications.

Experiments:

1. Intro to LLMs and Generative AI
2. Text generation with GPT models
3. Prompt engineering for Q&A systems
4. Image generation using DALL-E / Stable Diffusion
5. Text summarization
6. Chatbot creation using LLM API
7. Fine-tuning LLMs
8. Sentiment and emotion generation
9. Story or poem generation task
10. Prompt optimization and testing
11. Mid-journey/Runway ML tools (demo)
12. Mini project using Generative AI

23A44503	AI APPLICATIONS LAB	L	T	P	C
		0	0	3	1.5

Course Objectives:

- To implement domain-specific AI solutions.

Course Outcomes:

- Develop healthcare/finance/cybersecurity AI use-cases.

Experiments:

1. Health dataset preprocessing
2. Disease prediction (Diabetes/COVID)
3. Financial fraud detection
4. Credit scoring system
5. Business dashboard using AI tools
6. AI in intrusion detection
7. Threat classification using ML
8. Explainable AI (SHAP/LIME)
9. Domain-specific dataset handling
10. Model fairness and bias checking
11. Deployment using Flask or Streamlit
12. Mini project on any domain

23A32603	INTRODUCTION TO QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives

- Understand quantum mechanics principles in computing.
- Explore qubits, quantum gates, and circuits.
- Analyze the advantages of quantum algorithms.
- Study entanglement, superposition, and interference.
- Investigate real-world applications and platforms.

Course Outcomes (COs)

CO Code	Description	Bloom's Level
CO1	Explain concepts of quantum mechanics	Understand(L1)
CO2	Illustrate quantum gates/circuits	Apply(L3)
CO3	Analyze algorithms (e.g., Shor, Grover)	Analyze(L4)
CO4	Evaluate communication protocols	Evaluate(L5)
CO5	Develop quantum programs on IBM Q	Create(L6)

Unit I: Qubits and Quantum Foundations

Classical Bits vs Qubits, Postulates of Quantum Mechanics, Superposition and Probability Amplitudes, Dirac Notation (Bra-Ket), Bloch Sphere Representation, Measurement in Quantum Systems, Quantum State Collapse

Unit II: Quantum Gates and Circuits

Quantum Logic Gates: Pauli-X, Y, Z; Hadamard (H); Phase (S, T), Controlled Gates: CNOT, Toffoli, Unitary and Reversible Operations, Quantum Circuit Representation, Building Basic Quantum Circuits, Quantum Parallelism and Interference, No-Cloning Theorem and Quantum Gate Simulation

Unit III: Quantum Algorithms

Need for Quantum Algorithms, Deutsch and Deutsch-Jozsa Algorithm, Grover's Search Algorithm (Quadratic Speed-up), Shor's Factoring Algorithm (Exponential Speed-up), Simon's Algorithm (Overview), Complexity Comparison: Classical vs Quantum

Unit IV: Entanglement and Quantum Communication

Quantum Entanglement and Bell States, Quantum Teleportation Protocol, Superdense Coding, Quantum Key Distribution: BB84, E91 Protocols, Decoherence and Quantum Noise, Quantum Error Correction Codes (Bit Flip, Phase Flip, Shor Code)

Unit V: Quantum Platforms and Applications

Overview of Quantum Programming Platforms: IBM Qiskit, Microsoft Q#, Google Cirq, Quantum Circuit Simulation using Qiskit, Executing Code on Real Quantum Hardware (IBM Q). Quantum Applications in: Cryptography, Machine Learning, Optimization, Chemistry, Building and Testing a Sample Quantum Program

Textbooks

1. **Michael A. Nielsen & Isaac L. Chuang** – *Quantum Computation and Quantum Information*, Cambridge University Press, 10th Anniversary Edition.
2. **David McMahon** – *Quantum Computing Explained*, Wiley.
3. **Bernhardt, Chris** – *Quantum Computing for Everyone*, MIT Press.

Reference Books

1. **Mermin, N. David** – *Quantum Computer Science: An Introduction*, Cambridge University Press.
2. **William H. Press et al.** – *Numerical Recipes in C: The Art of Scientific Computing* (for simulation background)
3. **Rieffel&Polak** – *Quantum Computing: A Gentle Introduction*, MIT Press.

Online Courses & Resources

Platform	Course Name	Link
IBM Qiskit	<u>IBM Qiskit Textbook</u>	Hands-on, beginner-friendly curriculum for quantum programming
Coursera	<i>Quantum Mechanics for Scientists and Engineers</i> by Stanford (Leonard Susskind)	<u>Link</u>

23A54601b	MATHEMATICAL FOUNDATIONS FOR QUANTUM COMPUTING	L	T	P	C
		3	0	0	3

Course Objectives

- Cover linear algebra & complex vector spaces.
- Model quantum states mathematically.
- Apply probability theory to measurements.
- Study eigenvalues and transformations.
- Prepare for algorithm analysis with rigor.

Course Outcomes (COs)

CO Code	Description	Bloom's Level
CO1	Understand complex numbers & linear algebra	Understand
CO2	Apply vector space & Dirac notation	Apply
CO3	Analyze unitary & Hermitian operators	Analyze
CO4	Evaluate eigen decomposition in quantum ops	Evaluate
CO5	Create models using probability theory	Create

Unit I: Foundations of Complex Vector Spaces

Complex Numbers: Polar form, Euler's formula, Vectors in $\mathbb{C}^n$, Inner Product Spaces, Dirac Notation (Bra-Ket), Hilbert Space: Definitions and Properties, Orthogonality and Completeness, Norms, Metrics, and Distance in Complex Spaces

Unit II: Matrix Algebra and Operators

Matrix Multiplication and Linear Transformations, Special Matrices: Identity, Diagonal, Unitary, Tensor Products of Matrices and Vectors, Kronecker Product Applications, Unitary and Invertible Operators, Quantum Gates as Linear Operators

Unit III: Eigen Concepts and Quantum Observables

Eigenvalues and Eigenvectors, Hermitian Operators and Spectral Theorem, Quantum Observables and Expectation Values, Commutators and Compatibility, Measurement Operators and Matrix Diagonalization, Applications in Quantum Gate Analysis

Unit IV: Quantum Measurement & Probability

Basics of Probability Theory in Quantum Systems, Born's Rule and Measurement Probabilities, Projection Postulate, Density Matrix Formalism, Mixed States and Pure States, Trace, Partial Trace, and Operator Sums

Unit V: Advanced Structures in Quantum Math (CO5 – Create)

Group Theory Basics: Symmetry, Permutations, Pauli Group, Clifford Group, and their roles, Fourier Transform in Quantum Context, Gram-Schmidt Orthogonalization, Lie Groups and Lie Algebras, Use of Lie Algebra in Hamiltonian Formulation

Textbooks

1. **Nielsen & Chuang** – *Quantum Computation and Quantum Information*, Cambridge University Press
2. **Brian C. Hall** – *Quantum Theory for Mathematicians*, Springer
3. **T.S. Blyth & E.F. Robertson** – *Basic Linear Algebra*, Springer

Reference Books

1. **Roman S.** – *Advanced Linear Algebra*, Springer
2. **Axler, Sheldon** – *Linear Algebra Done Right*, Springer
3. **Shankar, R.** – *Principles of Quantum Mechanics*, Springer
4. **W. Greiner** – *Quantum Mechanics: An Introduction*, Springer

Online Courses & Resources

Platform	Course Name	Link
MIT OpenCourseWare	<i>Linear Algebra (Gilbert Strang)</i>	<u>Link</u>
edX	<i>Mathematics for Quantum Computing</i> by TUDelft	<u>Link</u>
Khan Academy	<i>Linear Algebra, Probability & Statistics</i>	<u>Link</u>
Quantum Country	<i>Spaced Repetition & Essays on Quantum Math</i>	<u>Link</u>

23A32M14	QUANTUM ALGORITHMS	L	T	P	C
		3	0	0	3

Course Objectives

- Understand algorithm design principles in the quantum domain.
- Use mathematical tools such as linear algebra and probability in algorithm analysis.
- Implement quantum algorithms and compare them with classical equivalents.
- Study key applications in cryptography, database search, and optimization.

Course Outcomes (COs)

CO Code	Description	Bloom's Level
CO1	Understand quantum algorithm building blocks	Understand
CO2	Analyze well-known quantum algorithms	Analyze
CO3	Apply quantum algorithms to application domains	Apply
CO4	Evaluate efficiency and complexity of algorithms	Evaluate
CO5	Create and simulate quantum algorithms	Create

Unit I: Mathematical Tools for Quantum Algorithms

Review of Complex Numbers & Linear Algebra for Quantum Computing, Inner Product Spaces, Hilbert Spaces, Dirac Notation and Interpretations, Quantum State Vectors and Superposition, Overview of Quantum Gates and Operators, Building Block Concepts for Algorithmic Design

Unit II: Quantum Circuits and Operations

Quantum Gates: X, H, Z, CNOT, Toffoli, Quantum Circuits: Representation and Simulation, Quantum Teleportation Protocol, Circuit-based Measurement and State Collapse, Reversible Computing and Unitary Evolution, Applying Circuits to Small-scale Problems

Unit III: Search and Oracle-Based Algorithms

Deutsch's Algorithm: Problem and Solution Strategy, **Simon's Algorithm:** Period-finding and Speed-up Over Classical, **Grover's Search Algorithm:** Amplitude Amplification, Oracle Construction in Grover's Algorithm, Circuit Analysis and Complexity Comparison, Limitations and Applications in Database Search

Unit IV: Fourier-Based & Cryptographic Algorithms (CO4 – Evaluate)

Quantum Fourier Transform (QFT): Theory and Circuit, **Phase Estimation Algorithm:** Foundations and Usage, **Shor's Algorithm:** Integer Factorization and Discrete Logarithms, Modular Arithmetic and Period Finding, Cryptographic Implications of Quantum Algorithms, Efficiency Analysis vs Classical RSA Factorization

Unit V: Advanced & Hybrid Quantum Algorithms (CO5 – Create)

Variational Quantum Eigensolver (VQE), Quantum Approximate Optimization Algorithm (QAOA), Quantum Machine Learning (QML): Classification & Clustering, Hybrid Quantum-

Classical Models, IBM Qiskit&Cirq for Implementation, Building Custom Quantum Algorithms for NISQ Devices

Textbooks

1. **Michael A. Nielsen & Isaac L. Chuang** – *Quantum Computation and Quantum Information*, Cambridge University Press
2. **Cristopher Moore & Stephan Mertens** – *The Nature of Computation*, Oxford University Press
3. **Eleanor G. Rieffel& Wolfgang Polak** – *Quantum Computing: A Gentle Introduction*, MIT Press

Reference Books

1. **Gideon Amir** – *Quantum Algorithms via Linear Algebra*, MIT Press
2. **S. Jordan** – *Quantum Algorithm Zoo*, [Online repository]
3. **T. G. Wong** – *Quantum Algorithm Design Techniques*
4. **Roland, Cerf** – *Quantum Search Algorithms*, Springer

Online Courses & Resources

Platform	Course Name	Link
edX (MIT)	<i>Quantum Algorithms for Cybersecurity</i>	Link
Coursera	<i>Quantum Computing by University of London</i>	Link
Qiskit Textbook	<i>Algorithms & Quantum Machine Learning Modules</i>	Link
Braket (AWS)	<i>Quantum Computing Developer Tools & Tutorials</i>	Link

23A32M15	QUANTUM INFORMATION AND COMMUNICATION	L 3	T 0	P 0	C 3

Course Objectives

- Understand the principles of quantum information theory.
- Explore quantum entropy, fidelity, and mutual information.
- Study quantum communication protocols and networks.
- Analyze quantum key distribution and cryptographic security.
- Implement protocols like teleportation and superdense coding.

Course Outcomes (COs)

CO Code	Description	Bloom's Level
CO1	Understand quantum information concepts	Understand
CO2	Apply quantum communication protocols	Apply
CO3	Analyze fidelity, entropy, and data transfer limits	Analyze
CO4	Evaluate quantum cryptographic techniques	Evaluate
CO5	Create and simulate quantum communication models	Create

Unit I: Quantum Information Basics

Classical vs Quantum Information, Density matrices and mixed states, Quantum entropy and Shannon entropy, Von Neumann entropy, Quantum data compression,

Unit II: Quantum Communication Protocols

Quantum teleportation, Superdense coding, Quantum repeaters and communication channels, No-cloning theorem, Quantum channel capacity

Unit III: Fidelity, Distance & Information Theory

Fidelity and trace distance, Quantum mutual information, Holevo bound, Information trade-offs in communication, Channel noise and error modeling

Unit IV: Quantum Cryptography

Principles of quantum cryptography, BB84 and B92 key distribution protocols, Eavesdropping and security analysis, Quantum bit commitment, Post-quantum cryptography relevance

Unit V: Applications & Tools

Quantum internet: architecture and challenges, Networked quantum systems, Simulation using Qiskit, NetSquid, QuTiP, IBM Q Network and cloud-based setups, Practical implementation of QKD in simulation

Textbooks

1. Michael A. Nielsen & Isaac L. Chuang – *Quantum Computation and Quantum Information*, Cambridge University Press
2. Mark M. Wilde – *Quantum Information Theory*, Cambridge University Press
3. John Watrous – *The Theory of Quantum Information*, Cambridge University Press

Reference Books

1. Peter W. Shor – *Foundations of Quantum Computing* (Lecture notes)
2. Charles H. Bennett & Gilles Brassard – *Original Papers on QKD (BB84)*
3. Stephanie Wehner – *Quantum Communication Networks*, arXiv

Online Courses & Resources

Platform	Course Name	Link
Coursera	<i>Quantum Cryptography</i> by University of Geneva	<u>Coursera Link</u>
edX	<i>Quantum Information Science I</i> (Harvard/MIT)	<u>edX Course</u>
Qiskit	<i>Quantum Information Applications in Qiskit Textbook</i>	Qiskit Info
QuTech	<i>Quantum Internet Tutorials & Tools</i>	QuTech

23A32M16	QUANTUM MACHINE LEARNING (QML)	L	T	P	C
		3	0	0	3

Course Objectives

- Introduce the fundamentals of quantum-enhanced machine learning.
- Understand quantum data encoding and kernel methods.
- Explore quantum algorithms for supervised and unsupervised learning.
- Analyze hybrid quantum-classical architectures.
- Implement QML models using frameworks like Qiskit and PennyLane.

Course Outcomes (COs)

CO Code	Description	Bloom's Level
CO1	Understand foundations of quantum machine learning	Understand
CO2	Apply QML algorithms to datasets	Apply
CO3	Analyze quantum kernels, data encoding, and models	Analyze
CO4	Evaluate hybrid quantum-classical models	Evaluate
CO5	Create and simulate QML models using frameworks	Create

Unit I: Introduction to QML

Need for QML: Why quantum for ML?, Classical vs quantum machine learning, Quantum states as information carriers, Data encoding: amplitude, angle, basis encoding, Introduction to quantum feature space.

Unit II: QML Algorithms – Supervised Learning

Quantum classifiers (quantum SVMs, qNN), Quantum perceptron, Variational quantum classifiers (VQC), Quantum kernels, Cost functions in quantum models

Unit III: QML Algorithms – Unsupervised Learning

Quantum k-means and clustering, Quantum PCA, Quantum generative models (QGANs), Dimensionality reduction and similarity metrics, Performance analysis and limitations

Unit IV: Hybrid Models & Optimization (CO4 – Evaluate)

Variational Quantum Circuits (VQCs), Hybrid quantum-classical training loops, Barren plateaus and optimization issues, Quantum gradient descent and parameter shift rule, Comparative study of classical and QML models

Unit V: QML Tools and Case Studies (CO5 – Create)

Implementing QML with Qiskit Machine Learning, PennyLane and TensorFlow Quantum integration, Case studies: quantum-enhanced fraud detection, NLP, Quantum datasets and benchmark models, Project: design a small QML application

Textbooks

1. Maria Schuld, Francesco Petruccione – *Machine Learning with Quantum Computers*, Springer
2. Peter Wittek – *Quantum Machine Learning: What Quantum Computing Means to Data Mining*, Academic Press

Reference Books

1. Jacob Biamonte – *Quantum Machine Learning*, Nature, 2017
2. Seth Lloyd – *Quantum algorithms for supervised/unsupervised learning* (Research papers)
3. Vojtěch Havlíček – *Supervised Learning with Quantum-Enhanced Feature Spaces*, Nature, 2019

Online Courses & Resources

Platform	Course Name	Link
edX	<i>Quantum Machine Learning</i> by UTS	edX Course
Qiskit	<i>Qiskit Machine Learning Module</i>	Qiskit ML
Xanadu	<i>QML with PennyLane (Free online textbook)</i>	PennyLane QML Book
Coursera	<i>Quantum Machine Learning</i> by University of Toronto	Coursera

23A32M17	QUANTUM ALGORITHMS LAB	L	T	P	C
		0	0	3	1.5

Experiments (12)

1. Deutsch Algorithm
2. Deutsch-Jozsa
3. Grover's Algorithm
4. QFT Visualization
5. Shor's Algorithm
6. QRNG Implementation
7. Bell State Entanglement
8. Bernstein-Vazirani Algorithm
9. Quantum Teleportation
10. Phase Estimation
11. Circuit Simulation
12. Mini-Project: RSA Key Breaking

23A32M18	QUANTUM PROGRAMMING AND SIMULATION LAB	L	T	P	C
		0	0	3	1.5

Experiments (12)

1. State Vector Simulation (Qiskit)
2. Bell State Implementation
3. Deutsch-Jozsa Circuit
4. Grover's Search in Qiskit
5. QFT Circuit in Python
6. Shor Algorithm Simulation
7. Quantum Teleportation in Code
8. VQE (Hybrid Circuit)
9. QAOA Simulation
10. Quantum Random Number Generator
11. Comparison: Real vs Simulated Runs
12. Mini-Project: Quantum Password Cracker

Textbooks & References

- Michael Nielsen & Isaac Chuang – *Quantum Computation and Quantum Information*
- Eric R. Johnston et al. – *Programming Quantum Computers*
- David McMahon – *Quantum Computing Explained*
- Gilbert Strang – *Introduction to Linear Algebra*
- Sarah Kaiser & Chris Granade – *Learn Quantum Computing with Python and Q#*

Online Resources

- IBM Qiskit Textbook: <https://qiskit.org/learn>
- Microsoft Q# Documentation: <https://learn.microsoft.com/en-us/azure/quantum/>
- Coursera: *Introduction to Quantum Computing*
- edX: *Quantum Computing Fundamentals, Quantum Algorithms*

(23A32M19) **Foundations of Quantum Technologies****Course Objectives**

- Introduce the fundamental quantum mechanics concepts essential for quantum technologies.
- Build strong mathematical foundations for quantum state modeling.
- Develop understanding of superposition, entanglement, and measurement.
- Explain the physical principles behind quantum devices.
- Prepare students for advanced studies in quantum computation, communication, sensing, and materials.

Course Outcomes (COs)

CO Code	Description	Bloom's Level
CO1	Understand postulates of quantum mechanics for quantum technologies	Understand
CO2	Apply linear algebra and Dirac notation to quantum state analysis	Apply
CO3	Analyze superposition, entanglement, and measurement processes	Analyze
CO4	Evaluate quantum systems through operators and probability amplitudes	Evaluate
CO5	Create mathematical models for simple quantum systems	Create

Syllabus Content**UNIT I – Quantum Mechanics Foundations***(Cognitive Level: Understand)*

Classical vs Quantum systems, Wave-particle duality, Schrödinger equation (Time-dependent and Time-independent), Postulates of Quantum Mechanics, Quantum states and state vectors, Complex Hilbert spaces, Dirac notation (Bra-Ket notation), Probabilistic interpretation of quantum mechanics

UNIT II – Linear Algebra for Quantum Systems*(Cognitive Level: Apply)*

Complex vector spaces and inner products, Orthonormal basis and orthogonality, Linear operators and transformations, Unitary operators and Hermitian operators, Tensor products for multi-qubit systems, Eigenvalues and Eigenvectors, Commutators and anti-commutators, Representing quantum states with matrices

UNIT III – Superposition, Measurement, and Entanglement*(Cognitive Level: Analyze)*

Principle of superposition, Measurement postulate, Probability amplitudes and Born rule, State collapse upon measurement, Entanglement and Bell states, EPR paradox and non-locality, Density matrices and mixed states, Quantum decoherence

UNIT IV – Operators and Quantum Dynamics*(Cognitive Level: Evaluate)*

Time evolution operators, Hamiltonian and energy eigenstates, Quantum harmonic oscillator(brief overview), Unitary evolution and Schrödinger equation solutions, Quantum tunnelling, Adiabatic theorem basics, Operator algebra in quantum systems, Expectation values and observables

UNIT V – Quantum Technologies Building Blocks*(Cognitive Level: Create)*

Basic qubit systems (spin-1/2, photon polarization, superconducting qubits), Two-level quantum systems modelling, Bloch sphere representation, Quantum logic gates fundamentals, Multi-qubit systems: controlled operations, Introduction to decoherence and quantum error correction, Quantum

technologies: hardware platforms overview, Basic quantum circuit modeling using simulators (Qiskit or Q# demo examples)

Textbooks

- 1□. Michael A. Nielsen & Isaac L. Chuang – *Quantum Computation and Quantum Information*
- 2□. N. David Mermin – *Quantum Computer Science: An Introduction*
- 3□. David McMahon – *Quantum Computing Explained* (Wiley)

Reference Books

- 1□. Griffiths, D. – *Introduction to Quantum Mechanics*
- 2□. Sakurai, J.J. – *Modern Quantum Mechanics*
- 3□. ohnWatrous – *The Theory of Quantum Information*
- 4□. V.K. Krishnan – *Linear Algebra and its Applications to Quantum Computing*

Online Courses & Resources

Platform	Course Title
MIT OpenCourseWare	Quantum Physics I, II (MIT OCW 8.04 & 8.05)
edX (Berkeley)	Quantum Mechanics and Quantum Computation

(23A32M20) Solid State Physics for Quantum Technologies

Course Objectives

- Understand fundamental solid-state physics principles relevant to quantum technologies.
- Study the electronic properties of materials used in quantum hardware.
- Explore quantum confinement and nanostructures for qubit implementation.
- Analyze crystal structures, band theory, and defects influencing quantum devices.
- Build foundations for material selection and engineering for quantum systems.

Course Outcomes (COs)

CO Code	Description	Bloom's Level
CO1	Understand crystal structures and band theory	Understand
CO2	Apply knowledge of semiconductors, insulators, and conductors in quantum materials	Apply
CO3	Analyze quantum confinement effects and low-dimensional systems	Analyze
CO4	Evaluate defects, phonons, and interactions in solid-state systems	Evaluate
CO5	Create models for quantum device material systems	Create

Syllabus Content

UNIT I – Crystal Structure and Electronic Properties(*Cognitive Level: Understand*)

Crystal lattices and unit cells, Bravais lattices, Miller indices, Reciprocal lattice and Brillouin zones, Atomic bonding in solids (covalent, ionic, metallic, van der Waals), X-ray diffraction and crystal structure determination, Electronic structure of solids, Free electron theory, Energy bands: metals, semiconductors, and insulators

UNIT II – Semiconductor Physics for Quantum Devices(*Cognitive Level: Apply*)

Intrinsic and extrinsic semiconductors, Charge carriers: electrons, holes, effective mass, Carrier concentration and Fermi level, p-n junctions and semiconductor heterostructures, Quantum wells and quantum dots as qubits, Superconductors and Josephson junctions, Semiconductor fabrication basics, Materials for quantum hardware: Si, GaAs, diamond NV centers, topological insulators

UNIT III – Quantum Confinement and Low-Dimensional Systems(*Cognitive Level: Analyze*)

Quantum size effects: nanowires, nanotubes, 2D materials, Quantum dots: discrete energy levels, Quantum Hall effect, Topological quantum materials, Spintronics and spin qubits, Quantum confinement in superconducting qubits, Heterostructure-based quantum devices, Valleytronics and emerging 2D materials (MoS₂, graphene)

UNIT IV – Lattice Vibrations and Phonon Interactions(*Cognitive Level: Evaluate*)

Lattice vibrations and phonons, Heat capacity and thermal conductivity of solids, Electron-phonon interaction, Decoherence in solid-state qubits due to phonons, Magnetic impurities and Kondo effect, Defects and dislocations in crystals, Dopants and quantum impurity systems, Nuclear spin environments and coherence times

UNIT V – Materials for Quantum Technologies(*Cognitive Level: Create*)

Material engineering for superconducting qubits, NV centers in diamond for quantum sensing, Topological materials for robust qubits, Photonic crystal materials for optical qubits, Hybrid quantum

systems: coupling different materials, Fabrication challenges and material purity, Advances in quantum materials research, Designing material systems for long coherence time

Textbooks

- 1□. Charles Kittel – *Introduction to Solid State Physics*
2. Michael A. Nielsen & Isaac Chuang – *Quantum Computation and Quantum Information*
- 3□. Simon L. Altmann – *Band Theory of Solids*

Reference Books

- 1□. Ashcroft & Mermin – *Solid State Physics*
- 2□. Yu & Cardona – *Fundamentals of Semiconductors: Physics and Materials Properties*
- 3□. David Awschalom – *Semiconductor Spintronics and Quantum Computation*
- 4□. Dieter Vollhardt – *Introduction to the Theory of Many-Body Systems*

Online Courses & Resources

Platform	Course Title
MIT OpenCourseWare	Solid State Physics (MIT 8.231)
edX	Quantum Materials and Devices (U. Tokyo)
Coursera	Quantum Materials (École Polytechnique)

(23A32M21) Quantum Optics Prerequisites for Quantum Technologies

Course Objectives

- Introduce fundamentals of light-matter interaction relevant for quantum technologies.
- Explain the quantization of electromagnetic fields.
- Study the role of photons as quantum information carriers.
- Explore coherent states, squeezed states, and single-photon sources.
- Prepare for quantum sensing, communication, and photonic quantum computing applications.

Course Outcomes (COs)

CO Code	Description	Bloom's Level
CO1	Understand quantum nature of light	Understand
CO2	Apply Maxwell's equations to optical fields	Apply
CO3	Analyze interaction of photons with matter	Analyze
CO4	Evaluate coherence, squeezing, and quantum noise	Evaluate
CO5	Create models for photonic quantum systems	Create

Syllabus Content

UNIT I – Classical and Quantum Description of Light(**Cognitive Level: Understand**)

Review of electromagnetic waves, Maxwell's equations for light propagation, Plane waves, polarization, Poynting vector, Classical interference, diffraction, coherence, Blackbody radiation & Planck's hypothesis, Photoelectric effect, Photons as quantized light energy, Introduction to quantum theory of radiation

UNIT II – Quantization of Electromagnetic Field(**Cognitive Level: Apply**)

Harmonic oscillator quantization, Field quantization in free space, Photon number (Fock) states, Coherent states and classical-quantum correspondence, Vacuum fluctuations and zero-point energy, Single-mode vs multi-mode quantization, Spontaneous and stimulated emission, Quantum field operators and commutation relations

UNIT III – Light-Matter Interaction(**Cognitive Level: Analyze**)

Two-level atom model, Absorption, stimulated emission, spontaneous emission, Einstein coefficients, Rabi oscillations, Jaynes-Cummings model, Resonant and non-resonant interaction, Cavity Quantum Electrodynamics (Cavity-QED), Atom-photon entanglement

UNIT IV – Quantum Coherence and Quantum Noise(**Cognitive Level: Evaluate**)

Classical vs quantum coherence, First- and second-order coherence functions, Photon antibunching, Hanbury Brown and Twiss experiment, Quantum squeezing of light, Phase-sensitive amplification, Quantum noise, shot noise, and standard quantum limit, Quantum nondemolition measurements

UNIT V – Quantum Photonics Applications(**Cognitive Level: Create**)

Single-photon sources (quantum dots, NV centers, SPDC), Entangled photon pair generation, Photonic qubits and linear optical quantum computing, Quantum key distribution with photons, Photonic integrated circuits, Quantum sensors based on squeezed light, Quantum metrology using entangled photons, Designing experiments for quantum optics labs

Textbooks

- 1□. Mark Fox – *Quantum Optics: An Introduction* 2□.
Rodney Loudon – *The Quantum Theory of Light* 3□.
M. O. Scully & M. S. Zubairy – *Quantum Optics*

Reference Books

- 1□. Stephen Barnett – *Quantum Information*
2□. Peter Meystre – *Elements of Quantum Optics*
3□. Michel Le Bellac – *Quantum Physics*
4□. D. F. Walls & G. J. Milburn – *Quantum Optics*

Online Courses & Resources

Platform	Course Title
MIT OpenCourseWare	Quantum Optics (MIT 8.421)
edX	Principles of Photonics (EPFL)
Coursera	Quantum Optics 1 & 2 (U. Rochester)
YouTube	Quantum Optics Lectures (Various universities)

(23A32M22) Introduction to Quantum Communication

Course Objectives

- Introduce fundamental principles of quantum communication.
- Study quantum key distribution (QKD) protocols.
- Analyze quantum teleportation, entanglement swapping, and quantum repeaters.
- Evaluate quantum security principles and their advantages.
- Prepare students for designing secure communication protocols for future quantum networks.

Course Outcomes (COs)

CO Code	Description	Bloom's Level
CO1	Understand quantum communication concepts	Understand
CO2	Apply quantum entanglement to communication protocols	Apply
CO3	Analyze QKD protocols and teleportation mechanisms	Analyze
CO4	Evaluate security of quantum communication	Evaluate
CO5	Design quantum communication networks and protocols	Create

Syllabus Content

UNIT I – Introduction to Quantum Communication(**Cognitive Level: Understand**)

Classical communication vs quantum communication, No-cloning theorem and quantum information security, Qubits and qubit transmission channels, Quantum entanglement fundamentals, EPR paradox and Bell's inequalities, Quantum states and measurement, Role of superposition and measurement collapse, Overview of quantum internet and its architecture

UNIT II – Quantum Key Distribution (QKD) Protocols(**Cognitive Level: Apply**)

Classical cryptography limitations, BB84 protocol, B92 protocol, E91 entanglement-based protocol, Decoy-state QKD, Device-independent QKD, Practical implementation challenges in QKD, Experimental QKD systems (fiber, free-space, satellites)

UNIT III – Quantum Teleportation and Entanglement Distribution(**Cognitive Level: Analyze**)

Quantum teleportation protocol, Entanglement swapping, Quantum repeaters for long-distance communication, Error sources in quantum teleportation, Resource requirements for teleportation, Entanglement purification techniques, Bell state measurements, Applications of teleportation in distributed quantum computing

UNIT IV – Quantum Networks and Quantum Internet(**Cognitive Level: Evaluate**)

Architecture of quantum networks, Quantum routers and switching, Quantum memories and storage nodes, Distributed entanglement generation and management, Multiparty quantum communication Blind quantum computing, Performance metrics for quantum networks (fidelity, key rate), Challenges in large-scale quantum network deployment

UNIT V – Advanced Quantum Communication Protocols and Applications(**Cognitive Level: Create**)

Quantum secure direct communication, Quantum digital signatures, Position-based quantum cryptography, Quantum secret sharing, Post-quantum cryptography overview, Quantum cloud communication protocols, Building hybrid quantum-classical communication models, Future directions in quantum communication technology

Textbooks

1. M. Nielsen & I. Chuang – *Quantum Computation and Quantum Information*
2. Mark M. Wilde – *Quantum Information Theory*
3. Scarani – *Quantum Cryptography: A Primer*

Reference Books

1. Vedran Dunjko – *Introduction to Quantum Communication and Cryptography*
2. Norbert Lütkenhaus – *Practical Security in Quantum Key Distribution*
3. David McMahon – *Quantum Computing Explained*
4. Bouwmeester et al. – *The Physics of Quantum Information*

Online Courses & Resources

Platform	Course Title
edX	Quantum Cryptography (ETH Zurich)
Coursera	Quantum Communication (Delft University of Technology)
MIT OpenCourseWare	Quantum Information Science (MIT 6.443)
YouTube	Quantum Internet & Quantum Networking Tutorials
IBM Qiskit	Qiskit tutorials on quantum teleportation and QKD

(23A32M23) Introduction to Quantum Sensing

Course Objectives

- Introduce the principles of quantum sensing and metrology.
- Explain how quantum superposition and entanglement enhance measurement sensitivity.
- Study applications of quantum sensors across multiple domains.
- Analyze noise, decoherence, and quantum limits on measurement.
- Prepare students to design and analyze quantum-enhanced sensors.

Course Outcomes (COs)

CO Code	Description	Bloom's Level
CO1	Understand the basic principles of quantum sensing	Understand
CO2	Apply quantum superposition and entanglement to sensing	Apply
CO3	Analyze quantum sensor architectures	Analyze
CO4	Evaluate sensitivity and error limits in quantum measurements	Evaluate
CO5	Design quantum sensing systems for real-world applications	Create

Syllabus Content

UNIT I – Introduction to Quantum Sensing and Metrology(**Cognitive Level: Understand**)

Classical vs quantum sensing, Precision limits: Standard Quantum Limit (SQL), Quantum metrology fundamentals, Heisenberg limit, Quantum phase estimation for precision measurements, Quantum non-demolition measurements, Quantum error correction in sensing, Importance of coherence and entanglement in sensors

UNIT II – Quantum Measurement Principles(**Cognitive Level: Apply**)

Superposition and interference in measurement, Quantum Fisher information, Squeezed states for noise reduction, Photon counting and single-photon detectors, Spin-based measurements (NV centers, trapped ions), Ramsey interferometry, Quantum state tomography, Applications of quantum-enhanced interferometry

UNIT III – Quantum Sensor Technologies(**Cognitive Level: Analyze**)

Atomic clocks (optical & microwave), Gravimeters and accelerometers, Magnetometers (SQUIDs, NV centers), Quantum gyroscopes, Quantum imaging & super-resolution microscopy, Quantum lidar and radar, Force and electric field sensing, Photonic quantum sensing systems

UNIT IV – Decoherence, Noise, and Error Mitigation in Quantum Sensing(**Cognitive Level: Evaluate**)

Sources of decoherence in quantum sensors, Thermal noise and quantum noise sources, Quantum back-action, Squeezing and noise reduction techniques, Dynamical decoupling techniques, Noise spectroscopy for sensor calibration, Robust error mitigation protocols, Evaluating sensitivity vs noise tradeoffs

UNIT V – Advanced Applications and Future Quantum Sensing Systems(**Cognitive Level: Create**)

Quantum sensing for biological and medical imaging, Navigation and positioning without GPS, Quantum-enhanced gravitational wave detection (LIGO), Quantum-enhanced environmental

monitoring, Sensors for national defense and security, Space-based quantum sensors, Integrated quantum photonic sensing platforms, Design of hybrid quantum-classical sensor systems

Textbooks

- 1□. Christian L. Degen, F. Reinhard, P. Cappellaro – *Quantum Sensing*
- 2□. Giovannetti, Lloyd & Maccone – *Advances in Quantum Metrology*
- 3□. David Budker & Derek F. Jackson Kimball – *Optical Magnetometry*

Reference Books

- 1□. Kurt Jacobs – *Quantum Measurement Theory and its Applications*
- 2□. Helmut Rauch – *Neutron Interferometry*
- 3□. M. O. Scully & M. S. Zubairy – *Quantum Optics (Chapters on Metrology)*
- 4□. Vlatko Vedral – *Introduction to Quantum Information Science*

Online Courses & Resources

Platform	Course Title
edX	Quantum Sensing & Metrology (LMU Munich)
Coursera	Quantum Optics and Sensing (University of Colorado Boulder)
MIT OpenCourseWare	Quantum Measurement and Sensing (MIT)
YouTube	Quantum Sensing Lectures
IBM Qiskit	Tutorials on Quantum Phase Estimation

(23A32M24) Quantum Communication and Sensing Lab

Lab Objectives:

- Simulate and analyze quantum communication protocols.
- Implement quantum key distribution (QKD) and teleportation.
- Perform quantum sensing simulations for precision measurements.
- Evaluate sensor performance with noise and decoherence.
- Gain hands-on experience with quantum simulation tools.

List of Experiments (12 Experiments)

1. Simulation of Qubits and Bloch Sphere Visualization
2. Implementation of BB84 Quantum Key Distribution Protocol
3. Simulation of B92 and E91 QKD Protocols
4. Quantum Entanglement Generation and Bell Inequality Testing
5. Quantum Teleportation Protocol using Qiskit/Cirq
6. Simulation of Quantum Repeaters and Entanglement Swapping
7. Noise and Decoherence Modeling in Quantum Communication Channels
8. Ramsey Interferometry Simulation for Quantum Sensing
9. Implementation of NV Center Magnetometry Simulation
10. Quantum Gravimeter and Accelerometer Simulation
11. Quantum Phase Estimation for High-Precision Metrology

Platforms & Tools:

- IBM Qiskit
- Google Cirq
- RigettiPyQuil
- Quantum Inspire
- MATLAB / Python with quantum libraries

(23A32M25) QUANTUM DEVICES AND MATERIALS LAB

Lab Objectives:

- Simulate quantum devices and materials behavior.
- Explore quantum optics and solid-state quantum systems.
- Model quantum dots, superconductors, and photonic devices.
- Perform quantum simulation of condensed matter systems.
- Build foundational skills for quantum hardware understanding.

List of Experiments (12 Experiments)

1. Simulation of Single-Qubit Optical Devices
2. Modeling Quantum Dots and Energy Level Transitions
3. Simulation of Two-Level Atom and Rabi Oscillations
4. Quantum Harmonic Oscillator: Energy Levels Visualization
5. Spin-1/2 Systems and Magnetic Resonance Simulation
6. Superconducting Qubits Circuit Simulation
7. Josephson Junction Modeling for Quantum Circuits
8. Quantum Photonic Interferometer Simulation
9. Simulation of NV Centers in Diamond for Quantum Sensing
10. Solid-State Quantum Materials Simulation (Band Structures)
11. Modeling Quantum Light-Matter Interactions (Jaynes-Cummings Model)

Platforms & Tools:

- QuTiP (Quantum Toolbox in Python)
- Qiskit Nature / Qiskit Metal
- MATLAB Simulink
- COMSOL Multiphysics (for materials simulation)
- Silvaco TCAD (for device-level modeling)