JNTUA UNIVERSITY
PREVIOUS QUESTION PAPERS

Code: 9A04702

R09

B.Tech IV Year I Semester (R09) Supplementary Examinations June/July 2014

OPTICAL COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) Explain about the following: (i) Refractive index. (ii) Snell's law. (iii) Critical angle.
(b) Derive an expression for number of modes exists in step indexed fiber. Also explain about mode field diameter.

2 (a) Explain the mechanical properties of fibers.
(b) Explain about single mode fibers in detail.

3 (a) Explain about bending losses in optical fibers.
(b) Explain about intermodal dispersion and chromatic dispersion.

4 Explain about the following:
(a) Fiber connectors.
(b) Fiber couplers.
(c) Optical isolators and circulators.

5 (a) Derive an expression for threshold conditions of laser diode.
(b) Explain the following:
(i) Laser diode rate equation.
(ii) External quantum efficiency.
(iii) Resonant frequencies.

6 (a) Explain the different noises present in photodiodes.
(b) An InGaAs PIN photodiode has the following parameters at a wavelength of 1300 nm, I_D = 4 nA, η = 0.90, R_L = 1000 Ω and the surface leakage current is negligible. The incident optical power is 300 nW and the receiver bandwidth is 20 MHz. Find: (i) Quantum noise current. (ii) Dark current noise. (iii) Thermal noise current.

7 (a) Explain the following in respect of digital link:
(i) Point to point links. (ii) Power penalties.
(b) Explain about analog links in optical communication.

8 Explain about the following:
(a) Dielectric thin film filters.
(b) Phased array based devices.
(c) Tunable light sources.
(d) Passive optical couplers.

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Code: 9A04702

R09

B.Tech IV Year I Semester (R09) Supplementary Examinations, May 2013

OPTICAL COMMUNICATIONS

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
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1. (a) Discuss the advantages of optical fibers over conventional coaxial cables.
   (b) Discuss the mode theory of circular waveguide.

2. List out the requirements for selecting materials in optical fibers and also explain about the following :
   (a) Halid glass fibers.
   (b) Active glass fibers.
   (c) Plastic glass fibers.

3. (a) Explain about intrinsic and extrinsic absorption exists in optical fibers.
   (b) Explain about the following:
   (i) Material dispersion. (ii) Wave guide dispersion.

4. (a) Explain clearly about the mechanical misalignments.
   (b) Explain about fiber splicing.

5. (a) Explain different structure of lasers with neat sketches.
   (b) Explain the surface emitters and edge emitter LEDS.

6. (a) Explain about avalanche photo diode.
   (b) A photo diode has quantum efficiency of 65 %. When photons of energy 1.5×10^{-19} J are incident on it? (i) What is the wave length of the photo diode? (ii) Calculate the incident optical power required to obtain a photo current of 2.5 μA, when the photo diode is operating as described above.

7. (a) Derive an expression for carrier to noise ratio of analog link.
   (b) Explain about multi channel transmission techniques.

8. (a) Explain about broad cast and select WDM networks in detail.
   (b) Explain about the following:
   (i) Passive optical couplers. (ii) Active optical components.

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Code: 9A04702

B.TECH IV Year I Semester (R09) Regular Examinations, November 2012

OPTICAL COMMUNICATIONS

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) Derive an expression for multiple time difference $(\Delta t/_2)$ in the multipath dispersion of the optical fibre.

(b) Discuss the merits and drawbacks of cut bouls method of measurement of alternation.

2 (a) Discuss briefly about the leaky modes and mode coupling losses in the fibre optic communication.

(b) Find the radius of curvature R at which the number of modes decreases by 50 percent in a gladded index fiber take $\alpha = 2$, $\eta_2 = 1.5$, Δ = 0.01, a = 25 μm, λ = 1.3 μm.

3 (a) Briefly explain about the overall dispersion in single mode fibre.

(b) Explain about fiber of connects return losses.

4 An LED has a 500 μf space charge capacitance, 1.0 ρA saturation current and a 5 ns minority carrier lifetime find out the half current and 10 to 90 percent risk time when the drive current is (i) 50 mA and (ii) 100 mA respectively.

5 (a) List the factors involved in launching optical power from a light source to a fiber.

(b) What is a pig-tailed device? List out the advantages and disadvantages of pig tailing either as fibre optic source or as fiber optic detector.

6 (a) Explain the following terms:
(i) Quantum efficiency
(ii) Responsiuity

(b) Explain with the neat diagram the digital signal transmission through on optical data line.

7 Discuss the magnitude of different dispersions in various fibre and also explain how does this dispersion vary with a different operating wavelengths for the fiber in detail.

8 (a) Explain about the cut back technique and why it is called as destructive method.

(b) Define line coding and list its merits.

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Code: 9A04702

B.TECH IV Year I Semester (R09) Regular Examinations, November 2012

OPTICAL COMMUNICATIONS

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

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1 (a) Explain the function of each block with a help of neat block diagram of a digital optical fibre communication system.

(b) If a single mode fibre has a step index of 0.03, the core refractive index is 1.45 at the cut off wavelength 1300 nm, then calculate the core radius.

2 Explain the requirements to be satisfied by fiber materials used for fabricating optical fibres.

3 (a) What are the principle requirements of a good conducts design?

(b) A single mode fibre operating at the wavelength of 1.3 μm is found to have a total material dispersion of 2.81 ns and a total waveguide dispersion of 0.495 ns. Determine the received pulse width and approximate bit rate of the filter if the transmitted pulse has a width of 0.5 ns.

4 What is splicing? Explain about fusion splicing.

5 (a) Derive an expression for power coupling from a large surface emitting LED into smaller step index fiber.

(b) Distinguish between connection losses (intrinsic losses) and extrinsic losses.

6 (a) Draw the schematic block diagram of optical receiver and explain each block in detail.

(b) Discuss the difference between a dispersion limited and an attenuation limited fiber optic link.

7 Discuss about the point to point fibre optic link.

8 (a) Explain how intra modal dispersion measurements can be done by using time domain and frequency domain.

(b) If the output response of an optical fiber is Gaussian in shape, estimate the 3 dB electrical bandwidth of the filter for an RMS output pulse width of 0.5 ns.

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OPTICAL COMMUNICATIONS

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

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1 (a) What are the reasons for the signal to get distorted as it travels along a fibre?
(b) Using ray theory transmission approach, explain the following:
(i) Total internal reflection ad critical angle.
(ii) Acceptance angle.
(iii) Numeral aperture.

2 (a) Explain attenuation caused by absorption, scattering losses and bending losses.
(b) Find the cutoff wavelength for a step index fiber having core refractive index of 1.48, radius of core is 4.8 μm and relative index difference is 0.25%.

3 Explain material dispersion, waveguide dispersion and find expression for material and waveguide dispersion.

4 (a) What power is radiated by an LED if its quantum efficiency is 3% and the peak wavelength is 670 nm?
(b) Derive the expression for losing and threshold condition.

5 (a) Write expression for power coupled into a step index fiber from on LED source.
(b) A gaAs optical source with a refractive index of 3.6 is coupled to a silica fiber that has a refractive index is 1.48. If the fiber and the source are in close physical contact then find the fresnel reflection at the interface and power loss in dB.

6 (a) Explain the principle behind the operation of an avalanche photo diode.
(b) Give the comparison of PIN and ADP photo detector.

7 Explain the procedure to determine the maximum allowable R_2 and NR_2 data rates from rise time budget analysis.

8 (a) What are the underlying principles of the WDM techniques?
(b) List the advantages and disadvantages of using WDM in optical fiber communication system.

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B.TECH IV Year I Semester (R09) Regular Examinations, November 2012

OPTICAL COMMUNICATIONS

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

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1 (a) Explain in detail about the mode theory for circular waveguide.
(b) Compare step index and gradded index fibres in all aspects.

2 (a) Discuss briefly about radiation losses in the optical fiber.
(b) (i) Convert the optical signal powers of 5 mw and 20 μw to dBm.
(ii) Convert optical signal power of 0.3 mw and 80 nw to dBμ.

3 A multimode gradded index fiber exhibits the pulk broadening of 0.2 μs over a distance of 15 km estimate:
(i) Optimum bandwidth of fiber.
(ii) Dispersion per unit length.
(iii) Bandwidth length product.

4 (a) Explain in detail about the external coupling losses.
(b) A 10 μm core diameter single mode fiber has a normalised frequency number of 1.7. A fusion splice at a point along its length inhibits an inserted loss of 0.15 dB. Assuming only lateral misalignment contributes to the splice insertion loss; estimate the magnitude of the lateral misalignment.

5 (a) What is LASER diode? Compare its performance with that of LED.
(b) A practical surface LED has 50 μm diameter emitting area and operates at peak modulation current of 100 mA. What is BW of GaAL AS LED having a 2.0 μm active area thickness assume $B_r/10^{-10}$ cm^3/s, $\delta = 10^4$ cm/sec.

6 Describe about the RAPD structure.

7 (a) Write modified expression for SNR at the output of on ADP based analog receiver.
(b) Calculate the maximum bit rate that may be achieved on the fiber link length of 50 km without repeaters and using NR2 format. Transmitter rise time is 4 ns. Intermodal rise time is 5 ns. Intramodal rise time 1 ns. Receiver rise time is 2 ns.

8 Discuss measurement of fiber scattering loss by describing the use of the common scattering cells.

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Code: 9A04702 **R09**

B.Tech IV Year I Semester (R09) Regular & Supplementary Examinations December 2014

OPTICAL COMMUNICATIONS

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
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1 (a) Draw the block diagram of a fiber optic communication system.
(b) Explain about cylindrical fibers with neat diagrams.

2 (a) Explain in detail about single mode fibers with diagrams.
(b) Explain about graded index fibers with diagrams.

3 (a) How do you find whether an optical fiber link is limited by attenuation or by dispersion? Explain clearly.
(b) Derive an expression for pulse spreading in a step index multi mode fiber due to intermodal dispersion.

4 (a) Illustrate various types of misalignments resulting in losses while splicing and joining optical fibers.
(b) Write about optical circulators.

5 (a) Establish the threshold gain condition for lasing to occur in a fabry-perot resonator based laser diode.
(b) Write short notes on external quantum efficiency.

6 (a) Compare different photo detectors.
(b) Derive the expressions for photo detector noise and detector response time.

7 (a) With a neat block diagram, explain the process of digital signal transmission.
(b) Write short notes on line coding in optical links.

8 (a) Explain in detail diffraction gratings.
(b) What are tunable light sources? Explain them.

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Code: 9A04702

B.Tech IV Year I Semester (R09) Regular & Supplementary Examinations December/January 2013/14

OPTICAL COMMUNICATIONS

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 (a) With the help of electromagnetic spectrum, explain about the historical development of optical fiber communications.

(b) A graded index fiber has a core with a parabolic refractive index profile which has a diameter of 50 μm. The fiber has a NA of 0.2. Estimate the total number of guided modes propagating in the fiber when it is operating at a wavelength of 1 μm.

2 (a) What is MFD of single mode fiber? Explain with suitable structure.

(b) What are active glass fibers? Explain in detail.

3 (a) What is attenuation? Explain.

(b) When the mean optical power launched into an 8 km length of fiber is 120 μW, the mean optical power at the fiber output is 3 μW. Determine.
(i) The overall signal attenuation or loss in decibels through the fiber assuming there are no connectors or splices.
(ii) The signal attenuation per km for the fiber.
(iii) The overall signal attenuation for a 10 km optical link using the same fiber with splices at 1 km intervals, each giving an attenuation of 1 dB.
(iv) The numerical "Input/output" power ratio in (iii).

4 (a) What is a fiber coupler? Explain about three and four port couplers.

(b) A four port multimode fiber FBT coupler has 60 μW optical power launched into port 1. The measured output power at ports 2, 3 and 4 are 0.004, 26.0 and 27.5 μW respectively. Determine the excess loss, the insertion losses between the input and output ports, the crosstalk and the split ratio for the device.

5 (a) Define quantum efficiency and LED power. Explain.

(b) A planar LED is fabricated from gallium arsenide which has a refractive index of 3.6.
(i) Calculate the optical power emitted into air as a percentage of the internal optical power for the device when the transmission factor at the crystal-air interface is 0.68.
(ii) When the optical power generated internally is 50% of the electrical power supplied, determine the external power efficiency.

6 (a) Write short notes on fiber-to-fiber joints.

(b) What is the function of photo detector? Compare various photo detectors.

7 (a) What is the significance of system consideration in point-to-point fiber links? Explain.

(b) What is the source of power penalty? Explain.

8 (a) Discuss the following optical coupler parameters:
(i) Splitting ratio. (ii) Excess loss. (iii) Insertion loss. (iv) Cross talk.

(b) For a 2 x 2 fiber coupler, input power is 200 μW, throughput power is 90 μW, coupled power is 85 μW and cross talk power is 6.3 μW. Compute the performance parameters of the fiber coupler.

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B.Tech IV Year I Semester (R09) Regular & Supplementary Examinations December/January 2013/14

OPTICAL COMMUNICATIONS

(Electronics & Communication Engineering)

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1 (a) Draw the block diagram of optical fiber communication system and explain about each block.
(b) An optical fiber in air has an NA 0.4. Compare the acceptance angle for meridional rays with that for skew rays which change direction by 100 degrees at each reflection.

2 (a) Clearly explain the propagation modes in single-mode fibers.
(b) A single-mode fiber optical fiber has a beat length of 8 cm at 1300 nm. Determine modal birefringence (B_f) and birefringence(β).

3 (a) What is material absorption? Explain about intrinsic and extrinsic absorption.
(b) The polarization mode dispersion in a uniformly birefringent single-mode fiber is 300 ps/km. Calculate the maximum bit rate that may be obtained on a 20 km repeater less link assuming only polarization mode dispersion to occur.

4 (a) Explain about cylindrical and biconical ferrule connectors.
(b) A 32 x 32 port multimode fiber transmissive star coupler has 1 mW of optical power launched into a single input port. The average measured optical power at each output port is 14 μW. Calculate the total loss incurred by the star coupler and the average insertion loss through the device.

5 (a) With the help of neat diagram, explain the following LED structures:
(i) Planar LED. (ii) Dome LED.
(b) A DH surface emitter which has an emission area diameter of 50 μm is butt jointed to an 80 μm core step index fiber with a NA of 0.15. The device has a radiance of 30 Wsr^{-1} cm^{-2} at a constant operating drive current. Estimate the optical power coupled into the fiber if it is assumed that the Fresnel reflection coefficient at the index matched fiber surface is 0.01.

6 (a) Discuss the various lensing schemes for coupling improvement.
(b) What is the temperature effect on avalanche gain? Explain.

7 (a) Define CNR. Derive the mathematical form.
(b) Write short notes on multi-channel frequency modulation.

8 (a) What is WDM? Explain the features of WDM.
(b) Briefly discuss 2 x 2 passive optical coupler.

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B.Tech IV Year I Semester (R09) Regular & Supplementary Examinations December/January 2013/14

OPTICAL COMMUNICATIONS

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

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1 (a) What are advantages of optical fiber communication? Explain clearly.
(b) A typical relative refractive index difference for an optical fiber designed for long distance communication is 1%. Estimate the NA and solid acceptance angle in air for the fiber when the core index is 1.46. Further, calculate the critical angle at the core-cladding interface within the fiber. It may be assumed that the concepts of geometric optics hold for the fiber.

2 (a) Explain about glass fibers and plastic optical fibers.
(b) Explain the various mechanical properties of fibers.

3 (a) What is linear scattering? Explain about Rayleigh and Mie scattering.
(b) A 3.5 km length of two polarization mode PM fiber has a polarization crosstalk of 27 dB at its output end. Determine the mode coupling parameter for the fiber.

4 (a) What is fiber splices? Explain about Fusion and mechanical splices.
(b) A single mode fiber has the following parameters: Normalized frequency = 2.4, core refractive index = 1.46, core diameter = 8 μm and NA = 0.1. Estimate the total insertion loss of a fiber joint with a lateral misalignment of 1 μm and angular misalignment of 1 degree.

5 (a) Write short notes on LASER diode modes.
(b) A ruby LASER containing a crystal length 4 cm with a refractive index of 1.78. The peak emission wavelength from the device is 0.55 μm. Determine the number of longitudinal modes and their frequency separation.

6 (a) What is the source of power launching? Explain.
(b) What is detector response time? Explain.

7 (a) With a neat block diagram explain multi-channel amplitude modulation.
(b) What are different elements of an angle link? Explain.

8 (a) Explain the need of isolator in optical network. Give its principle of operation.
(b) Write short notes on fiber grating filters.

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B.Tech IV Year I Semester (R09) Regular & Supplementary Examinations December/January 2013/14

OPTICAL COMMUNICATIONS

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

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1 (a) What is the concept of total internal reflection? Explain with a suitable optical cable setup.

(b) A silica optical fiber with a core diameter large enough to be considered by ray theory analysis has a core refractive index of 1.5 and cladding refractive index of 1.47. Determine:
(i) The critical angle at the core-cladding interface.
(ii) The NA for the fiber.
(iii) The acceptance angle in air for the fiber.

2 (a) Explain about MCVD and PCVD processes.

(b) Write short notes on fiber optic cables.

3 (a) What is dispersion? Explain in detail.

(b) Two polarization maintaining fibers operating at a wavelength of 1.3 μm have beat lengths of 0.7 mm and 80 m. Determine the model birefringence in each case and comment on the results.

4 (a) What is fiber joint? Explain about single and multimode fiber joints.

(b) An optical fiber has a core refractive index of 1.5. Two lengths of the fiber with smooth and perpendicular (to the core axes) end faces are butted together. Assuming the fiber axes are perfectly aligned, calculate the optical loss in dB at the joint (due to Fresnel reflection) when there is a small air gap between the fiber end faces.

5 (a) What is threshold condition for LASER oscillation? Explain in detail.

(b) The total efficiency of an injection LASER with a GaAs active region is 18%. The voltage applied to the device is 2.5 volts and the band gap energy for GaAs is 1.43 eV. Calculate the external power efficiency of the device.

6 (a) What is fiber splicing? Explain.

(b) What are the physical principles of photo diode? Explain.

7 (a) Design an optical fiber link for transmitting 15 Mb/sec of data for a distance of 4 km with BER of 10^{-9}.

(b) Write short notes on error control in digital link.

8 (a) What is an optical circulator? Explain in detail.

(b) Explain the construction and applications of dielectric thin film filter.

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Code: 9A04702

R09

B.Tech IV Year I Semester (R09) Supplementary Examinations, May 2013

OPTICAL COMMUNICATIONS

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

*****

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   (b) Discuss the mode theory of circular waveguide.

2. List out the requirements for selecting materials in optical fibers and also explain about the following :
   (a) Halid glass fibers.
   (b) Active glass fibers.
   (c) Plastic glass fibers.

3. (a) Explain about intrinsic and extrinsic absorption exists in optical fibers.
   (b) Explain about the following:
   (i) Material dispersion. (ii) Wave guide dispersion.

4. (a) Explain clearly about the mechanical misalignments.
   (b) Explain about fiber splicing.

5. (a) Explain different structure of lasers with neat sketches.
   (b) Explain the surface emitters and edge emitter LEDS.

6. (a) Explain about avalanche photo diode.
   (b) A photo diode has quantum efficiency of 65 %. When photons of energy 1.5×10^{-19} J are incident on it? (i) What is the wave length of the photo diode? (ii) Calculate the incident optical power required to obtain a photo current of 2.5 μA, when the photo diode is operating as described above.

7. (a) Derive an expression for carrier to noise ratio of analog link.
   (b) Explain about multi channel transmission techniques.

8. (a) Explain about broad cast and select WDM networks in detail.
   (b) Explain about the following:
   (i) Passive optical couplers. (ii) Active optical components.

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Code: 13A04702 **R13**

B.Tech IV Year I Semester (R13) Regular Examinations November/December 2016

OPTICAL FIBER COMMUNICATION

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) What are Ray and Modes?
(b) Why do we prefer Step index single mode fiber for long distance communication?
(c) What are the two main causes of Intra Modal Dispersion?
(d) What are the Mechanisms which causes Absorption?
(e) Define Population Inversion.
(f) Write a short note on Fiber Splicing.
(g) What are the various noise sources and disturbances in optical pulse detection mechanism?
(h) List out the factors that the Response time depends on.
(i) What is Power Budget?
(j) Define Receiver Sensitivity.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Explain the Elements of an optical fiber Transmission link.

OR

3 Discuss the Mode theory of Circular Waveguides.

UNIT – II

4 Describe any two types of Losses in Optical Fiber Communication System.

OR

5 Explain the Design Optimization of Single mode fibers.

UNIT – III

6 (a) Explain LED Structure with neat sketch.
(b) A planar LED is fabricated from GaAs which has a refractive index of 3.6. (i) Calculate the optical power emitted into air as a percentage of the internal optical power for the device when the transmission factor at the crystal-air interface is 0.68. (ii) When the optical power generated internally is 50% of the electric power supplied, determine the external power efficiency.

OR

7 (a) Explain in detail the various Lensing schemes for coupling improvement.
(b) Discuss about Fibre splicing.

UNIT – IV

8 (a) Explain in detail the operation of Avalanche Photo Diode with its structure.
(b) A photo diode has a quantum efficiency of 65% when photons of energy of 1.5 x 10^{-19} J are incident upon it. (i) Find the operating wavelength of the photodiode. (ii) Calculate the incident optical power required to obtain a photo current of 2.5 μA when the photodiode is operating as described above.

OR

9 (a) Discuss any one type of Preamplifier in detail.
(b) Give the comparisons of photo detectors.

UNIT – V

10 Analyze the Power Budget of Optical Fibre Communication in terms of analog system design.

OR

11 Describe in detail about Rise time Budget of Optical Fibre Communication in-terms of digital system design.

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B.Tech IV Year I Semester (R13) Regular & Supplementary Examinations November/December 2017

OPTICAL FIBER COMMUNICATION

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) A light ray is incident from glass to air. Calculate critical angle $[\emptyset_C]$.
(b) State any two disadvantages of optical fiber communications.
(c) Define numerical aperture.
(d) For a 30 km long fiber attenuation is 0.8 dB/m at 1300nm. If a 200 micro watt power is launched into the fiber. Find the output power.
(e) A LED operating at 850nm has a spectral width of 45nm. What is the pulse spreading in nsec/km due to a material dispersion?
(f) State any two disadvantages of LED.
(g) A GaAs laser operating at 850nm and has a length of 500 μm, with given refractive index n = 3.7. Calculate frequency spacing.
(h) State the basic principle of fiber splicing.
(i) Define quantum limit.
(j) With reference to SNR at the receiver and transmission distance, compare digital communication link with analog communication link in optical fiber communication.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Define the following terms with respect to optical laws:

(a) Reflection.
(b) Total internal reflection.
(c) Refractive index.
(d) Snell's law.
(e) Critical angle.

OR

3 Draw a block diagram of a digital optical receiver showing its various components. Explain the function of each component. How is the signal used by the decision circuit related to the incident optical power?

UNIT – II

4 Explain in detail absorption, scattering and bending losses.

OR

5 Explain the signal distortion in optical waveguide. Discuss group delay and different types of dispersion in optical fiber communication.

UNIT – III

6 Compare the performance parameters of surface emitting LED and Edge emitting LED.

OR

7 What is a lensing scheme? With simple sketch, show different lensing schemes. State the drawbacks of lensing schemes.

UNIT – IV

8 With necessary sketches and expressions, explain avalanche photodiode (APD).

OR

9 With necessary block diagrams or sketches, explain low, high and trans impedance preamplifiers.

UNIT – V

10 Discuss in detail the major considerations for optical system design for digital link.

OR

11 Explain link power budget with necessary expressions. Design an optical fiber link for transmitting 15 MBPS of data for a distance of 4 km with a BER of 10^{-9}.

*****

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B.Tech IV Year I Semester (R13) Regular Examinations November/December 2016

OPTICAL FIBER COMMUNICATION

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) What are Ray and Modes?
(b) Why do we prefer Step index single mode fiber for long distance communication?
(c) What are the two main causes of Intra Modal Dispersion?
(d) What are the Mechanisms which causes Absorption?
(e) Define Population Inversion.
(f) Write a short note on Fiber Splicing.
(g) What are the various noise sources and disturbances in optical pulse detection mechanism?
(h) List out the factors that the Response time depends on.
(i) What is Power Budget?
(j) Define Receiver Sensitivity.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Explain the Elements of an optical fiber Transmission link.

OR

3 Discuss the Mode theory of Circular Waveguides.

UNIT – II

4 Describe any two types of Losses in Optical Fiber Communication System.

OR

5 Explain the Design Optimization of Single mode fibers.

UNIT – III

6 (a) Explain LED Structure with neat sketch.
(b) A planar LED is fabricated from GaAs which has a refractive index of 3.6. (i) Calculate the optical power emitted into air as a percentage of the internal optical power for the device when the transmission factor at the crystal-air interface is 0.68. (ii) When the optical power generated internally is 50% of the electric power supplied, determine the external power efficiency.

OR

7 (a) Explain in detail the various Lensing schemes for coupling improvement.
(b) Discuss about Fibre splicing.

UNIT – IV

8 (a) Explain in detail the operation of Avalanche Photo Diode with its structure.
(b) A photo diode has a quantum efficiency of 65% when photons of energy of 1.5 x 10^{-19} J are incident upon it. (i) Find the operating wavelength of the photodiode. (ii) Calculate the incident optical power required to obtain a photo current of 2.5 μA when the photodiode is operating as described above.

OR

9 (a) Discuss any one type of Preamplifier in detail.
(b) Give the comparisons of photo detectors.

UNIT – V

10 Analyze the Power Budget of Optical Fibre Communication in terms of analog system design.

OR

11 Describe in detail about Rise time Budget of Optical Fibre Communication in-terms of digital system design.

*****

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R13

B.Tech IV Year I Semester (R13) Supplementary Examinations June 2018

OPTICAL FIBER COMMUNICATION

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

1 Answer the following: (10 X 02 = 20 Marks)

(a) Define Snell's law.
(b) What is graded-index numerical aperture?
(c) Write short notes on core and cladding losses.
(d) Define intermodal distortion.
(e) Calculate the wavelength λ in micrometers for the band gap energy E_g of 2 eV.
(f) What is fiber splicing? What are splicing techniques?
(g) Define photo detector noise.
(h) Write short notes on probability of error and quantum limit.
(i) What is rise time budget?
(j) A digital fiber link operating at 1200 nm requires a BER of 10^{-6}. Calculate quantum limit in terms of quantum efficiency.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Write in brief about optical fiber modes and configurations.

OR

3 Differentiate single mode fiber and graded index fiber. Explain propagation modes in single mode fibers.

UNIT – II

4 Discuss the following for optical fibers:
(i) Scattering loss.
(ii) Waveguide dispersion.

OR

5 Explain in detail about the pulse broadening in graded index fibers.

UNIT – III

6 Explain in detail about laser diode modes and threshold conditions.

OR

7 Write in brief about:
(i) Non imaging microsphere.
(ii) Laser diode to fiber coupling.

UNIT – IV

8 What is an avalanche photodiode? What are the differences between APDs and PIN devices?

OR

9 With a schematic diagram, explain the working of optical receiver.

UNIT – V

10 Explain the optical power loss model for a point to point link and discuss link power budget.

OR

11 Explain the following:
(i) Relative intensity noise in digital systems.
(ii) Receiver sensitivity in digital systems.

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Code: 15A04701 **R15**

B.Tech IV Year I Semester (R15) Regular Examinations November/December 2018

OPTICAL FIBER COMMUNICATION

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) Write the classifications of optical fiber.
(b) What is principle of optical fiber?
(c) Define skew rays.
(d) What is meant by dispersion?
(e) List out any two advantages of optical fiber.
(f) Determine the numerical aperture of a step index fiber when the core refractive index n_1 = 1.5 and the cladding refractive index n_2 = 1.48.
(g) Define detector response time.
(h) Define quantum laser.
(i) What is meant by splicing?
(j) An optical signal has lost 85% its power after traversing 500 m of fiber. What is the loss in dB/km of this fiber?

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 With neat sketch, explain the elements of an optical fiber transmission link.

OR

3 Define Mode theory in fibers and explain in detail about Graded index fiber structure.

UNIT – II

4 Explain the following:

(a) Pulse broadening in graded index fiber.
(b) Waveguide dispersion.

OR

5 Explain the following:

(a) Intermodal dispersion.
(b) Scattering losses.

UNIT – III

6 Explain in detail about Edge Emitter LEDs (ELEDs).

OR

7 The radiative and non-radiative recombination lifetimes of the minority carriers in the active region of a double-heterojunction LED are 60 ns and 100 ns respectively. Determine the total carrier recombination lifetime and the power internally generated within the device when the peak emission wavelength is 0.87μm at a drive current of 40 mA.

UNIT – IV

8 Explain in detail about Avalanche Photo Diode principle and operation.

OR

9 Explain the following:

(a) Preamplifiers.
(b) Detector response time.

UNIT – V

10 Explain in detail about system design considerations and components choice.

OR

11 With necessary equations, explain the following:

(a) Rise time budget.
(b) Bandwidth budget.

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