Code: 13A04603

R13

B.Tech III Year II Semester (R13) Regular & Supplementary Examinations May/June 2017

MICROWAVE ENGINEERING

(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 is a dominant mode?

(b) For a cavity of dimensions 3 cm x 2 cm x 7 cm filled with air and made of copper, find the resonant frequency.

(c) Why H-plane T junction called as current junction?

(d) What is the coupling factor of a directional coupler?

(e) What is bunching process?

(f) What is a slow wave structure? Write two examples.

(g) What is a cross field tube?

(h) What is population inversion in Gunn diode?

(i) What are different methods used for power calculation.

(j) What is a double minimum method?

PART – B

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

UNIT – I

2 (a) Enumerate the basic advantages of microwaves.

(b) Draw the EM spectrum and list all the frequency ranges involved in microwave bands.

(c) Briefly explain the applications of microwaves.

OR

3 Deduce the electromagnetic field relations for the dominant mode in a rectangular waveguide from the Maxwell's equations.

UNIT – II

4 What is a magic Tee junction. Derive the S matrix of a magic Tee.

OR

5 (a) Explain the operation of circulator with a neat diagram.

(b) A signal power 32mW is fed into one of the collinear ports of loss less H-Plane Tee. Determine the powers in the remaining ports when other ports are terminated by means of matched load.

UNIT – III

6 Explain the construction, operation, operating characteristics of reflex klystron oscillator with a neat diagram.

OR

7 With a neat sketch, explain the structure and principle of operation of TWT Amplifier.

UNIT – IV

8 What are the bulk properties of GUNN diode that give rise to negative resistance?

OR

9 Why pi-mode operation is preferred in cylindrical type magnetron? Give its working principle with neat sketches.

UNIT – V

10 Give the measurement procedure for Q factor of a resonant cavity and attenuation constant at microwave frequencies.

OR

11 (a) Draw a neat sketch of a MW test bench for impedance measurements using reflectometer.

(b) Two identical directional are used in a waveguide to sample the incident and reflected powers. The output of the two coupler is found to be 2.5mW and 0.15mW. Find the values of VSWR in the wave guide.

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Code: 13A04603 **R13**

B.Tech III Year II Semester (R13) Supplementary Examinations December 2017

MICROWAVE ENGINEERING

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

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

(a) Define dominant mode.
(b) Why TEM waves are not propagated through the waveguide?
(c) Write the scattering matrix for an ideal waveguide section.
(d) State Faradays rotation in non-reciprocal devices.
(e) List the applications of reflex Klystron.
(f) How does the convection current can be expressed in TWT?
(g) Name the elements that exhibit Gunn effect.
(h) Define Hull cut off.
(i) What are the different blocks that frame the microwave test bench?
(j) Express the characteristics of VSWR meter.

PART – B

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

UNIT – I

2 (a) Express the three cases which determines the propagation constant γ_g in the rectangular waveguide.

(b) A TE_{11} mode is propagating through circular waveguide, the radius of the guide is 5 cm, a guide contains an air dielectric.

(i) Determine cutoff frequency.
(ii) Determine the wavelength λ_g in the guide for an operating frequency of 3 GHZ.
(iii) Determine the wave impedance Z_g in the guide.

OR

3 Elucidate in detail about Q factor of a cavity resonator with equivalent circuit.

UNIT – II

4 Explain the function of four port circulator and derive its scattering matrix.

OR

5 Illustrate the working principle of resistive card variable attenuator with neat sketch.

UNIT – III

6 Describe the mechanism of operation of two cavity klystron amplifier with Applegate diagram.

OR

7 Draw the schematic diagram of travelling wave tube with its simplified circuit and explain about the amplification process.

UNIT – IV

8 With neat sketch, illustrate the concept of Hartree condition in magnetron.

OR

9 (a) The drift velocity of electron is 3 x 10^7 cm/s through the active region of length 15μm. Calculate the natural frequency of the Gunn diode and the critical voltage.

(b) Using Manley-Rowe power relation, demonstrate the concepts of parametric amplifier and state its applications.

UNIT – V

10 Explain in detail about the microwave power measurement using power meter with neat sketch.

OR

11 Draw the block diagram and describe the principle of measurement of impedance of a unknown load using slotted section waveguide method.

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Code: 13A04603 **R13**

B.Tech III Year II Semester (R13) Supplementary Examinations December 2018

MICROWAVE ENGINEERING

(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 is dominant mode? Write the dominant modes in rectangular waveguide.
(b) Define phase and group velocities.
(c) What is meant by Faraday rotation?
(d) Write applications of isolator.
(e) Define efficiency.
(f) What is electron bunching in klystron tube?
(g) Define Hartee condition.
(h) Write the applications of varactor diode.
(i) Define double minima method.
(j) What is slotted section, why it is used?

PART – B

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

UNIT – I

2 (a) Write the applications of microwaves in detail and the EM spectrum and list the frequency ranges in microwave bands.
(b) Discuss about TM waves propagation in rectangular wave guide with field components.

OR

3 (a) Write the differences between rectangular and cylindrical cavity resonators.
(b) Explain about resonant frequencies and coupling coefficients of resonators.

UNIT – II

4 (a) Write the principle and operation of magic tee and derive its scattering matrix.
(b) Explain the construction details of isolator and write its applications.

OR

5 (a) Derive the scattering matrix of H-plane tee and write its operation.
(b) Write different types of attenuators explain each type.

UNIT – III

6 (a) Draw and explain about two-cavity klystron amplifier and write its applications.
(b) Draw and explain about TWT tube in detail.

OR

7 (a) Explain the operations of reflex klystron with neat diagram.
(b) Derive output power and efficiency in reflex klystron.

Contd. in page 2

UNIT – IV

8 (a) Write the different types of magnetron and explain cylindrical travelling wave magnetron.
(b) Explain about 'Hartree resonance conditions'.

OR

9 (a) Explain the construction details of varactor diode and draw its equivalent circuit.
(b) Explain about avalanche transists time devices in briefly.

UNIT – V

10 (a) Explain the measurement of attenuator by using microwave bench set-up.
(b) Write measurement of law and medium VSWR.

OR

11 (a) Explain the measurement procedure of impedance by using microwave bench setup.
(b) Explain measurement procedure of microwave frequency by using MW bench set-up.

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Code: 13A04603 **R13**

B.Tech III Year II Semester (R13) Supplementary Examinations May/June 2019

MICROWAVE ENGINEERING

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

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

(a) Define dominant mode and degenerate mode.
(b) What is dominant mode of a rectangular waveguide for TE and TM modes and why?
(c) What is an attenuator?
(d) What is directional coupler?
(e) Why multi-cavity klystrons are preferred?
(f) State the limitations of conventional tubes at microwave frequencies.
(g) What is transferred electron effect?
(h) State the power output and efficiency of magnetron.
(i) State various methods for measuring attenuation.
(j) List the methods used for measuring the low and high VSWR.

PART – B

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

UNIT – I

2 A rectangular wave guide is filled by dielectric material of $\varepsilon_r = 9$ and has dimensions of 7 × 3.5 cm. It operates in the dominant TE mode.
(i) Determine the cut off frequency.
(ii) Find the phase velocity in the guide at a frequency of 2 GHz.
(iii) Find the guided wave length at 2GHz.

OR

3 Obtain the expression for power transmission in waveguide.

UNIT – II

4 List the applications of circulator. Derive the S matrix for circulator with neat diagram.

OR

5 Discuss in detail about the principle of working of an E-plane Tee junction with neat schematics. Derive the S matrix.

UNIT – III

6 Explain briefly about linear beam tubes and crossed field tubes. State the advantages of TWT.

OR

7 Draw the schematic diagram of two cavity klystron amplifier. Explain briefly the working principle and its draw backs.

UNIT – IV

8 (a) Write short notes on “LSA mode in GUNN diode”.
(b) Describe the operation of IMPATT diode.

OR

9 (a) Write short notes on “8 cavity magnetron”.
(b) Write a brief note on RWH theory.

UNIT – V

10 Explain the measurement of microwave power using bolometer method.

OR

11 Explain the measurement of Q of a cavity resonator.

*****

Code: 15A04703 **R15**

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

MICROWAVE ENGINEERING

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

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

(a) Differentiate waveguide and resonator.

(b) For a frequency of 6 GHz and plane separation of 3 cm, find the group velocity for dominant mode in a rectangular waveguide.

(c) What is the need of matching networks?

(d) Mention the purpose of isolator.

(e) Compare two cavity klystron and travelling wave tube.

(f) Name any four examples for slow wave structures.

(g) Draw V-I characteristics of Gunn diode.

(h) What is the PI-mode of operation in magnetron?

(i) State any three properties of S-matrix.

(j) What are the precautions follow to do experiment using microwave bench setup?

PART – B

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

UNIT – I

2 Derive the field expressions for TE_{mnp} mode in a rectangular cavity resonator.

OR

3 A rectangular wave guide is filled by dielectric material of $\varepsilon_r = 9$ and has dimensions of 7 x 3.5 cm, it operates in the dominant TE mode. Find cut off frequency, phase velocity in guide at 2 GHz.

UNIT – II

4 What is Faraday rotation? Explain how a 4 port circulator operates with the use of 2 magic tees and one Gyrator.

OR

5 What is phase shifter? Describe its principle of operation with a neat sketch. Give its applications.

UNIT – III

6 Describe the necessary theory and working of reflex klystron.

OR

7 A TWT operates under the following parameters: Beam voltage $V_0 = 3$kV, beam current $I_0 = 30$mA, characteristic impedance of helix $Z_0 = 10\Omega$, circuit length N = 50, frequency f = 10 GHz. Determine: (i) The gain parameter. (ii) The output power gain A_p in decides (iii) Four propagation constants.

UNIT – IV

8 With the use of two valley theory, explain how negative resistance is created in Gunn diodes?

OR

9 Explain the principle of operation of TRAPATT diode with suitable diagram.

UNIT – V

10 How to measure attenuation of given microwave signal using microwave bench setup? Explain.

OR

11 Obtain the S-matrix for series Tee.

*****

Code: 15A04703 **R15**

B.Tech IV Year I Semester (R15) Supplementary Examinations June/July 2019

MICROWAVE ENGINEERING

(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 is the dominant mode in rectangular waveguide?
(b) Draw the structure and field lines of microstrip line.
(c) Write the relation between isolation, coupling factor and directivity and define each one.
(d) List the advantages of microwaves.
(e) Differentiate klystron and TWT.
(f) If the input power P_i = 30 watt and the output power P_o = 10 watt, calculate the attenuation in dB.
(g) What is the Gunn effect?
(h) Name the materials used in Gunn diode.
(i) Write the S-matrix for isolator and explain it.
(j) Mention the applications of magic tee.

PART – B

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

UNIT – I

2 A rectangular cavity resonator has the following dimension: a = 5 cm, b = 2 cm and d = 15 cm. Calculate: (i) The resonant frequency of the dominant mode TE_{101} for an air filled cavity.
(ii) Dielectric filled cavity of $\varepsilon r = 4$.

OR

3 Discuss the following terms with respect to microstrip line:

(a) Effective dielectric constant.
(b) Characteristics impedance.
(c) Quality factor.

UNIT – II

4 Explain the principle of operation of an isolator. What is the significance of using isolator in microwave circuits?

OR

5 What is meant by microwave attenuator? Explain the functioning of flap and vane attenuators.

UNIT – III

6 Derive the expressions for propagation constants in TWT and explain.

OR

7 Describe the limitations of conventional tubes at microwave frequencies.

Contd. in page 2

UNIT – IV

8 An X-band pulsed cylindrical magnetron has the following parameters: Anode voltage V_0 = 26 kV, Beam current I_0 = 27A, magnetic flux density B_O = 0.336 Wb/m^2, Radius of cathode cylinder a = 5 cm, radius of vane edge to centre b = 10 cm.
Compute: (i) The cyclotron angular frequency.
(ii) The cutoff voltage for fixed B_0.
(iii) The cutoff magnetic flux density for fixed V_0.

OR

9 What is IMPATT diode? Explain the principle of operation.

UNIT – V

10 Derive scattering matrix of shunt tee using S-parameter theory.

OR

11 Draw the block schematic of a typical microwave bench and explain the functionality of each component.

*****

Code: 15A04703 **R15**

B.Tech IV Year I Semester (R15) Supplementary Examinations June/July 2019

MICROWAVE ENGINEERING

(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 is the dominant mode in rectangular waveguide?
(b) Draw the structure and field lines of microstrip line.
(c) Write the relation between isolation, coupling factor and directivity and define each one.
(d) List the advantages of microwaves.
(e) Differentiate klystron and TWT.
(f) If the input power P_i = 30 watt and the output power P_o = 10 watt, calculate the attenuation in dB.
(g) What is the Gunn effect?
(h) Name the materials used in Gunn diode.
(i) Write the S-matrix for isolator and explain it.
(j) Mention the applications of magic tee.

PART – B

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

UNIT – I

2 A rectangular cavity resonator has the following dimension: a = 5 cm, b = 2 cm and d = 15 cm. Calculate: (i) The resonant frequency of the dominant mode TE_{101} for an air filled cavity.
(ii) Dielectric filled cavity of $\varepsilon r = 4$.

OR

3 Discuss the following terms with respect to microstrip line:

(a) Effective dielectric constant.
(b) Characteristics impedance.
(c) Quality factor.

UNIT – II

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Compute: (i) The cyclotron angular frequency.
(ii) The cutoff voltage for fixed B_0.
(iii) The cutoff magnetic flux density for fixed V_0.

OR

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UNIT – V

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OR

11 Draw the block schematic of a typical microwave bench and explain the functionality of each component.

*****

Code: 13A04603

SS

B.Tech III Year II Semester (R15) Regular & Supplementary Examinations May/June 2019

MICROWAVE ENGINEERING

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

*****

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

(a) List the typical applications of microwaves.
(b) Explain briefly about impossibility of TEM modes.
(c) Give the properties of S-matrix.
(d) Mention the applications of hybrid Tee junction.
(e) State the limitations of conventional tubes at microwave frequencies.
(f) Write the classification of microwave tubes.
(g) What is negative resistance in Gunn diode?
(h) What is the principle of IMPATT diode?
(i) Define the method for measuring VSWR<10.
(j) List the devices used in microwave bench setup.

PART – B

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

UNIT – I

2 A rectangular waveguide has dimensions 2.5 X 5 cms. Determine the guide wavelength, phase constant and phase velocity at a wavelength of 4.5 cms for dominant mode.

OR

3 Explain the wave impedance of a rectangular waveguide and derive the expression for the wave impedance of TE and TM modes.

UNIT – II

4 Discuss about E-H plane Tee junction. Why a hybrid E-H plane Tee referred to as magic Tee? Derives the scattering matrix for E-H plane Tee junction.

OR

5 Explain the two-hole directional coupler and write applications of directional couplers.

UNIT – III

6 What are the assumptions for calculation of RF power in Reflex Klystron? List the drawbacks of klystron amplifiers.

OR

7 List out different types of magnetrons. Write the basic modes of operation in magnetron.

UNIT – IV

8 (a) Explain the working Magnetron with π mode oscillation.
(b) Discuss the applications of microwave semiconductor devices.

OR

9 (a) Derive the criterion for classifying the modes of operation for Gunn effect diodes.
(b) Mention the applications of Gunn diode amplifier.

UNIT – V

10 Explain the measurement of attenuation using power ratio method with neat block diagram.

OR

11 Explain the high power measurements using calorimetric method.

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Code: 15A04703

R15

B.Tech IV Year I Semester (R15) Supplementary Examinations October 2020

MICROWAVE ENGINEERING

(Electronics & Communication Engineering)

Time: 3 hours

Max. Marks: 70

PART – A

(Compulsory Question)

*****

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

(a) Define quality factor of a cavity resonator.
(b) Define guide wavelength.
(c) Mention the applications of Waveguide window.
(d) Mention the applications of H Plane TEE junction.
(e) List out the classification of microwave tubes.
(f) What is re-entrant cavity?
(g) Mention Hartree conditions.
(h) What are transferred electronic devices?
(i) Define VSWR.
(j) Mention the applications of Isolator.

PART – B

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

UNIT – I

2 Explain the propagation of TM waves in a rectangular waveguide with suitable equation and field patterns.

OR

3 (a) Compare waveguides with 2 wire transmission lines.
(b) Derive expression for resonant frequency in a rectangular cavity resonator.

UNIT – II

4 (a) A 90W power source is connected to the input of a DC with a coupling factor of C = 25dB, directivity d = 35dB, insertion loss = 0.5dB. Find the output powers through the main waveguide coupled port and isolated port. Assume all ports are perfectly matched.
(b) Explain about the Rotary vane phase shifter.

OR

5 (a) Explain probe, aperture and loop coupling mechanisms.
(b) Explain the principle of Faraday rotation in ferrites.

UNIT – III

6 (a) Explain the construction and working of two cavity klystron with applegate diagram.
(b) Derive expressions for efficiency of reflex klystron.

OR

7 (a) Explain the concept of electronic tuning in reflex klystron with suitable equations.
(b) Derive expressions for output power of two cavity reflex klystron.

Contd. in page 2

UNIT – IV

8 (a) Explain the operation of a parametric amplifier.
(b) Derive Hull's cut-off voltage equation.

OR

9 (a) What are transferred electronic devices? List out the conditions for RWH theory to be satisfied by a semiconductor material.
(b) Write a note on IMPATT Diode.

UNIT – V

10 (a) Draw the block schematic of a typical microwave bench and explain the functionality of each component and their features.
(b) Derive the scattering matrix of circulator.

OR

11 (a) Derive the scattering matrix of E-H Plane (Hybrid or magic) TEE junction.
(b) Explain the procedure of microwave frequency measurement.

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