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)

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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: 9A04606

R09

B.Tech III Year II Semester (R09) Supplementary Examinations May/June 2017

MICROWAVE ENGINEERING

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions

All questions carry equal marks

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1 An air filled rectangular waveguide has dimensions of a = 6 cm and b = 4 cm. The signal frequency is 3 GHZ. Compute the following for the TE_{10}, TE_{01} and TE_{11} modes.

(i) Cut off frequency.

(ii) Wavelength in the waveguide.

(iii) Phase constant and phase velocity in the waveguide.

(iv) Group velocity and wave impedance in the waveguide.

2 Derive the expressions for the field components due to TM wave in circular waveguide.

3 (a) What is the need of phase shifter? Name different types of phase shifter.

(b) Draw the diagram of dielectric phase shifter and explain the operation.

4 (a) Explain the operation of circulator.

(b) What is Faraday rotation?

5 (a) Explain the following with a neat diagram:

(i) Transit-angle effect.

(ii) Gain-Bandwidth product limitation.

(b) Discuss about reentrant cavities.

6 (a) What is Hull-voltage in a magnetron? Explain its significance.

(b) Explain about the magnetron oscillator with neat diagrams.

7 (a) What is Gunn effect? Explain this phenomenon using two-valley theory.

(b) What is time parameter for TED'S?

(c) List some of the power detecting elements.

8 (a) Write short notes on the measurement of noise factor.

(b) Calculate the SWR of a transmission system operating at 10 GHz. Assume TE_{10} wave transmission inside a waveguide of dimensions a = 4 cm, b = 2.5 cm. The distance measured between twice minimum power points=1 on a slotted line.

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Code: 13A04603 **R13**

B.Tech III Year II Semester (R13) Regular Examinations May/June 2016

MICROWAVE ENGINEERING

(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 short notes on dominant and degenerated modes in rectangular waveguides.

(b) Define: (i) Phase velocity. (ii) Group velocity.

(c) What is the significance of S-Matrix?

(d) Write a short note on Faraday rotation.

(e) List the applications of two cavity klystron amplifier.

(f) What is slow wave structure?

(g) Write a short note on negative resistance and cavity magnetrons.

(h) List the applications of Gunn diode.

(i) Define: (i) VSWR. (ii) Attenuation.

(j) Write short note on slotted line section.

PART – B

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

UNIT – I

2 (a) Explain the propagation of TM waves in rectangular wave guides with field components.

(b) A rectangular waveguide with dimension of 3 × 2 cms operates in TM_{11} mode at 10 GHz. Determine the characteristic wave impedance.

OR

3 (a) Explain the quality factor of cavity resonator

(b) For the dominant mode of operation in an air filled circular waveguide of inner diameter 4 cms. Find: (i) Cut off wavelength. (ii) Guided wave length. (iii) Cut off frequency.

UNIT – II

4 (a) Derive the scattering matrix of E-H plane tee junction.

(b) Explain about: (i) Coupling probe. (ii) Coupling loop.

OR

5 (a) Explain construction details and operation of isolator.

(b) Derive the scattering matrix of directional coupler.

UNIT – III

6 Draw the structure and explain the velocity modulation process in two cavity klystron amplifier.

OR

7 (a) Explain output power and efficiency in reflex klystron.

(b) With neat diagram explain the operation of helix TWT.

UNIT – IV

8 (a) An X-band pulsed conventional magnetron has the following parameters. Anode voltage V_o = 5.5 KV, Beam current I_0 = 4.5 A, Operating frequency f = 9×10^9 Hz, Resonant conductance $G_r = 2 \times 10^{-4}$ mho, Loaded conductance $G_l = 2.5 \times 10^{-5}$ mho, Vane capacitance C = 2.5 PF. Compute: (i) Angular resonant frequency. (ii) Unloaded quality factor. (iii) Loaded quality factor.

(b) Explain the following Gunn diode oscillation modes: (i) LSA mode. (ii) Quenched mode.

OR

9 (a) Explain the construction and equivalent circuit details of VARACTOR diode

(b) In a Gunn diode with active length of 20μm, the drift velocity of electrons is 2×10^7 cm/s. Calculate the rational frequency and critical voltage of the diode.

UNIT – V

10 (a) Explain the description of microwave bench.

(b) Explain the medium microwave power measurement with neat diagram.

OR

11 (a) Explain the double minimum method of measuring VSWR.

(b) Explain the impedance measurement using Reflectometer.

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Code: 9A04606

R09

B.Tech III Year II Semester (R09) Regular & Supplementary Examinations May/June 2015

MICROWAVE ENGINEERING

(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) Find expressions for the electric surface current density on the wall of a rectangular wave guide for a TE10 mode.

(b) A rectangular wave guide of cross section 5 cm × 2 cm is used to propagate TM11 mode at 9 GHz. Determine the cut off wave length and wave impedance.

2 An air filled waveguide with a cross section 2 X 1 cm transports energy in the TE10 mode at the rate of 0.5HP. The impressed frequency is 30 GHz. What is the peak value of electric field occurring in the waveguide?

3 What is the principle of phase shifter? Draw the diagram of dielectric phase shifter and discuss the working mechanism.

4 What ate Ferrites? Prove that for a ferrite, the permeability matrix is given by:

$$[\mu] = \begin{bmatrix} \mu & -jk & 0 \\ jk & \mu & 0 \\ 0 & 0 & \mu_0 \end{bmatrix}$$

5 (a) Distinguish between velocity modulation and current modulation.

(b) Explain the construction and working of a multicavity klystron.

6 (a) List various methods of beam focusing in TWT. Explain.

(b) Compare & contrast TWT & Klystron amplifier.

7 Discuss about the various Gunn oscillation modes in detail.

8 (a) What is spectrum analyzer? List the types of spectrum analyzer. List some application of spectrum analyzer.

(b) Describe a microwave bench.

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Code: 9A04606

R09

B.Tech III Year II Semester (R09) Regular & Supplementary Examinations June 2014

MICROWAVE ENGINEERING

(Electronics & Communication Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks

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1 What are the different power losses in rectangular waveguide? Derive expressions for them.

2 (a) What are cavity resonators? Discuss their desirable properties.
(b) Calculate the resonant frequency of rectangular cavity filled with dielectric with $\epsilon_r = 4$ and having dimensions a = 5 cm, b = 4 cm and d = 15 cm.

3 What is the principle of phase shifter? Draw the diagram of dielectric phase shifter and discuss the working mechanism.

4 (a) What is an isolator? Explain the principle of working.
(b) Show that the S-matrix of a lossless isolator is given by $[s] = \begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix}$.

5 With the help of Applegate diagram, explain the operation of a reflex klystron; show that the theoretical efficiency of reflex klystron is 27.78%.

6 (a) Explain the growth of oscillations in a traveling wave magnetron.
(b) Compare the features of rising sun magnetron with cavity magnetron.

7 (a) What is Gunn effect? Compare transistors and transfer electron devices (TED'S).
(b) Describe the construction, fabrication and encapsulation of Gunn diodes.

8 Discuss in detail the power measurement using microwave devices.

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