G 1063 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, MAY 2015

Seventh Semester

Branch : Electronics and Communication Engineering

EC 010 703—MICROWAVE ENGINEERING (EC)

(New Scheme—2010 Admission onwards)

[Improvement/Supplementary]

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions.*
Each question carries 3 *marks.*

1. Dominant mode is propagated through a waveguide of breadth 10 cm at frequency of 2.5 GHz. Find the cut-off wavelength, phase velocity, and guide wavelength.
2. A reflex klystron operates under the following condition :

   V_0 = 600V, L = 1mm, e/m = 1.759×10^{11}, f_r = 9 GHz. A tube is oscillating at f_r at the peak of the n = 2 mode. Assume that the transit time through the gap and beam loading can be neglected. Find the value of the repeller voltage.
3. Write a equivalent circuit of a PIN diode and explain its operation.
4. A transmission line has a characteristic impedance of $50 + j\ 0.01\ \Omega$ and is terminated in a load impedance of $73 - j\ 42.5\ \Omega$. Calculate the voltage standing wave ratio.
5. Draw the structure of a microstrip line and briefly explain its operation.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Write a block diagram of a microwave system and briefly explain each block and also state any four applications of microwaves.
7. Draw the schematic diagram of a reflex klystron oscillator, and explain its operation.
8. With the doping profile, explain the principle of operation of IMPATT diode.
9. Explain the procedure of measurement of microwave power using Bolometer bridge.
10. Explain how Monolithic Microwave Integrated Circuits (MMIC) is grown on a substrate. Also state the advantages offered by MMIC's over discrete circuits.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each question carries 12 *marks.*

11. (a) Draw the structure of a Magic-Tee. Explain its properties and derive the S-matrix for the same.

    (b) Explain the principle of operation of a Faraday-rotation isolator.

Or

12. (a) State and prove Symmetric property of an S-matrix.

    (b) Draw the structure of a four-port circulator and explain its principle of operation.

13. (a) Draw the schematic diagram of a four-cavity klystron amplifier and explain the principle of operation.

    (b) What are the characteristics of a two-cavity klystron amplifier ?

Or

14. What are the classifications of magnetron oscillator ? Draw the schematic diagram of a cylindrical magnetron and explain its principle of operation.

15. (a) Write the equivalent circuit for a parametric amplifier and explain me circuit operation.

    (b) A TRAPATT diode has doping concentration $N_A = 2 \times 10^{15}$ cm^{-3} and a current density A = 20 kA/cm^2. Calculate the avalanche-zone velocity.

Or

16. (a) With the schematic diagram of n-type GaAs diode, explain the GLNN effect.

    (b) An n-type GaAs Gunn diode has Electron density $n = 10^{18}$ cm^{-3}. Electron density at lower valley $n_1 = 10^{10}$ cm^{-3}. Electron density at upper valley $n_u = 10^8$ cm^{-3}. At a temperature T = 300° K, determine the conductivity of the diode.

    (c) With the equivalent circuit, explain Schottky barrier diode.

17. Draw the block diagram for impedance measurement. Explain the procedure in detail.

Or

18. Draw the block diagram, for microwave frequency and VSWR measurements. Explain the procedure in detail.

19. Explain the various types of losses in microstrip lines in detail.

Or

20. (a) A microstrip line has $\epsilon_r = 5.23$, $h = 7$ mils, $t = 2.8$ mils. and $w = 10$ mils. Calculate the characteristic impedance Z_0 of the line.

    (b) Explain MMIC fabrication techniques in detail.

[5 × 12 = 60 marks]