A   **Reg. No. :**

Question Paper Code: 57403

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

Seventh Semester

Electronics and Communication Engineering

15UEC703-MICROWAVE ENGINEERING

(Regulation 2015)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. It is a passive device which allows the flow of optical signal power in only one   CO1- R
    direction and preventing reflections in the backward direction.

    (a) Fiber slice   (b) Optical fiber connector   (c) Optical isolator   (d) Optical coupler

2. Scattering matrix for a lossless network is: CO1- R

    (a) Unitary   (b) Symmetric   (c) Identity matrix   (d) Null matrix

3   An M-Si-M BARITT diode has the following parameters: relative dielectric   CO2- R
    constant of silicon is 11.8, silicon length is 6 μm, donar concentration is
    2.8×10^{21} per m3. Find the breakdown voltage.

    (a) 154.36 V   (b)257.36 V   (c)120 V   (d) 110 V

4. The number of semiconductor layers in a TRAPATT diode is: CO2- R

    (a) Two   (b) Three   (c) Four   (d) One

5. Reflex Klystron is a   CO3- R

    (a) Amplifier   (b) Oscillator   (c) Attenuator   (d) Filter

6. Magnetrons are generally operated at frequencies _____   CO3- R

    (a) Visible light frequency   (b) Below microwave frequency

    (c) Above microwave frequency   (d) Infra-red frequency

7. The substrate of an MMIC must be a _____ to accommodate the   CO4- R
fabrication of all the type of devices.

(a) Semiconductor   (b) Insulator   (a) Metal   (d) None of the above

8. In MOSFET fabrication how many diffusion processes are needed?   CO4- R

(a) 3   (b) 1   (c) 4   (d) 2

9. Which of the following method can be used to measure the scattering parameter   CO5- R

(a) Cavity perturbation method   (b) Deschamps method

(c) Slotted line method   (d) Reflectometer method

10. High power measurements are generally done by   CO5- R

(a) Power meter   (b) Calorimetric watt meter   (c) Bolometer   (d) None of the above

PART – B (5 x 2= 10 Marks)

11. What do you meant by microwave junction and name some commonly used   CO1- U
microwave junctions?

12. Find the resonant frequency of IMPATT diode with the following parameters: CO2 R

(a) Carrier drift velocity = 2×10^7 cm/s
(b) Drift region length = 6 μm

13. Differentiate between TWT and klystron.   CO3- U

14. Give the three classification of electronic circuit based on circuit technology.   CO4- R

15. What is a VSWR meter?   CO5- U

PART – C (5 x 16= 80Marks)

16. (a)   Explain in detail the following microwave circuits with its   CO1- U   (16)

characteristics and S parameter

(i) Hybrid Tee

(ii) Hybrid ring

Or

2

57403

(b) (i) Explain the principle of operation of E-plane Tee and derive its scattering matrix   CO1- App   (8)

(ii) Explain about directional coupler. Derive the scattering matrix of an ideal directional coupler.   CO1- App   (8)

17. (a) Describe the four modes of operation of Gunn diode with respect to doping levels and time at which the process occurs.   CO2- Ana   (16)

Or

(b) Give the physical description, operation and power efficiency of IMPATT diode   CO2- Ana   (16)

18. (a) (i) A two cavity klystron has beam voltage V_0=20 kV, beam current I_0= 2 A, dc electron beam current density $\rho = 10^{-6}$ C/m3, signal voltage = 10 V (rms), shunt resistance of the cavity is 10 kΩ, the total shunt resistance including the load is 30 kΩ with operating frequency f= 8 GHz and beam coupling coefficient $\beta = 1$. Calculate the following.   CO3- Ana   (8)

1. the plasma frequency

2. the reduced plasma frequency for R= 0.5

3. the induced current in the output cavity

4. the induced voltage in the output cavity

5. the output power delivered to the load

6. the power gain

7. the electronic efficiency

(ii) Derive the convection current of a helix travelling wave tube. CO3- Ana (8)

Or

(b) Explain in detail about cylindrical magnetron. CO3- Ana (16)

19. (a) Explain the different techniques used in the fabrication of Monolithic microwave integrated circuits. CO4- U (16)

Or

(b) Give the details of basic materials used for MMIC fabrication. CO4- U (16)

20. (a) With neat diagrams write about the impedance measurement of a reactive discontinuity and impedance measurement by reflectometer. CO5- U (16)

Or

(b) Explain in detail about dielectric constant measurement of a solid. CO5- U (16)

4