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**Question Paper Code : 11222**

**B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2016**

**Seventh Semester**

**Electronics and Communication Engineering**

**EC 1402A – MICROWAVE ENGINEERING**

**(Regulations 2008)**

**Time : Three Hours**

**Maximum : 100 Marks**

**Answer ALL questions.**

**PART – A (10 × 2 = 20 Marks)**

1. A shunt impedance  $Z$  is connected across a transmission line with characteristic impedance  $Z_0$ . Find the S matrix of the junction.
2. Differentiate : ABCD and S parameters.
3. A 5 dB coupling factor and 20 dB directivity, coupler is having incident power 1 mw. How much power is coupled into coupled port ?
4. Differentiate Ferrite phase shifter from PIN diode phase shifter.
5. Compare TWTA and Klystron Amplifier.
6. A pulsed cylindrical magnetron is operated with the following parameters :  
Anode voltage 25 kV  
Beam current 25A  
Magnetic flux density  $0.34 \text{ Wb/m}^2$   
Radius of anode cylinder 10 cm  
Radius of cathode cylinder 5 cm.  
Calculate angular frequency.

7. State the basic differences between a low - frequency transistor and a microwave transistor.
8. Define transit time.
9. If the width of the waveguide is 4 cm and the distance between successive minima is 3 cm, calculate the wavelength of the signal.
10. Name the different errors possible in microwave measurements.

**PART - B (5 × 16 = 80 marks)**

11. (a) (i) A three port circulator has an insertion loss of 1 dB. Isolation 30 dB and VSWR = 1.5. Find the S matrix. (8)
- (ii) State and prove the properties of S matrix. (8)

**OR**

- (b) (i) Show using S matrix theory that a lossless non-reciprocal two port microwave device cannot be constructed. (8)
  - (ii) Explain the relationship between Y-Z and ABCD parameters with S parameters. (8)
12. (a) Describe, with diagram, the principles of operation of a 3-port circulator. Derive the S-matrix for circulator and write down the S-matrices for a clock-wise and anti-clockwise circulator.

**OR**

- (b) Describe the working of Bethe-hole directional coupler. A directional coupler is having coupling factor = 10 dB and directivity = 40 dB, determine S-matrix of this coupler assuming ideal coupler.

13. (a) Compare the performance, characteristics and applications of the following devices :

- (i) Klystron amplifier.
- (ii) TWT amplifier.
- (iii) Magnetron
- (iv) Klystron oscillator.

**OR**

(b) A 250 kW pulsed cylindrical magnetron is operated with the following parameters : Anode voltage = 25 kV; peak anode current = 25 A; magnetic induction = 0.035 T; radius of cathode = 4.0 cm and radius of the anode = 8.0 cm. Calculate : (i) the efficiency of magnetron (ii) the cyclotron frequency (iii) the cut off magnetic field and (iv) the cut-off voltage.

14. (a) Explain the structure and mechanism of operation of Tunnel diode and Varactor diode.

**OR**

- (b) (i) Discuss the modes of operation of Gunn diode. (8)
- (ii) Explain the working of two-diode and four-diode PIN switches. (8)

15. (a) Describe the measurement of power using

- (i) Bolometer method
- (ii) Calorimeter method.

**OR**

- (b) (i) With the help of block diagram, discuss the measurement of high VSWR.
- (ii) How calibration is performed on a network analyzer to characterize the measurement errors ?