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**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR**  
(AUTONOMOUS)**B.Tech III Year II Semester Regular Examinations, May 2019****MICROWAVE ENGINEERING**

(Electronics and Communication Engineering)

Time: 3 hours

Max. Marks: 60

(Answer all Five Units 5 x 12 = 60 Marks)

**UNIT-I**

- 1 a Explain the wave impedance of a rectangular waveguide and derive the expression for the wave impedance of TE and TM modes. 8M
- b For a wave guide having cross section  $3\text{cm} \times 2\text{cm}$ , compute the cut-off frequency in the TE<sub>01</sub> mode. Also, calculate the phase velocity and guide wavelength at a frequency equal to 50% above the cut-off frequency. 4M

**OR**

- 2 a Show that a waveguide works like a high pass filter. 7M
- b A wave guide operating in TE<sub>10</sub> mode has dimensions  $a = 2.26\text{ cm}$  and  $b = 1\text{ cm}$ . The measured guide wave length is  $4\text{ cm}$ . Find i. Cut off frequency of the propagating mode. 5M  
ii. The frequency of operation. iii. Maximum frequency of propagation in this mode.

**UNIT-II**

- 3 a Derive the S-matrix for directional coupler. 6M
- b Using the properties of scattering matrix of a lossless, reciprocal microwave junction, prove that for a four port network if all the four ports are matched, the device shall be a directional coupler. 6M

**OR**

- 4 a Explain the following (i) Waveguide windows (ii) Screws. 6M
- b A 20db directional coupler gives 3 dbm in output power through coupled port. If the Isolation specified as 55 dB, find the power available at the Isolated Port. 6M

**UNIT-III**

- 5 a Define and explain current modulation with neat diagrams and required expressions. 7M
- b Write any two limitations of conventional tubes at Microwave frequencies. 5M

**OR**

- 6 a In an O-type traveling wave tube, the acceleration voltage is  $4000\text{ V}$  and the magnitude of the axial electric field is  $4\text{ V/m}$ . The phase velocity on the slow wave structure is 1.10 times the average electron velocity. The operating frequency is  $2\text{ GHz}$ . Determine the magnitude of velocity function. 7M
- b Discuss about the differences between a TWT and a Klystron. 5M

**UNIT-IV**

- 7 a Give the classification of solid state microwave devices along with examples? 7M
- b An n-type GaAs Gunn diode has following parameters: Electron drift velocity:  $v_d = 2.5 \times 10^5\text{ m/s}$ . Negative electron mobility:  $\mu_n = 0.015\text{ m}^2/\text{v. s}$ . Relative dielectric constant:  $\epsilon_r = 13.1$ . Determine the criterion for classifying the modes of operation. 5M

**OR**

- 8 a What is parametric amplifier? 6M
- b Explain it as an amplifier and frequency converter. 6M

**UNIT-V**

- 9 a What is spectrum analyzer? List the types of spectrum analyzer. List some application of Spectrum analyzer. 7M
- b Describe a microwave bench. 5M

**OR**

- 10 a Discuss in detail about measurement of attenuation. 7M
- b Write short notes on "Reflection co-efficient and Insertion loss measurement at microwave frequencies". 5M

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