

TEC-601

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Even Semester Examination 2017-18

B.TECH.(SEMESTER-VI)

MICROWAVE TECHNIQUES

Time: 03:00 Hours

Max Marks : 100

Note: Attempt all questions. All questions carry equal marks.

1. Attempt any FOUR parts of the following:

(5×4=20)

- (a) Explain how quasi TEM modes exist in a microstrip line?
- (b) An air filled rectangular waveguide of inside dimension 7cm ×4.5cm operates in the dominant TE_{10} mode.
 - i) Find cut-off frequency.
 - ii) Determine the phase velocity of the wave in the guide at frequency of 4.5 GHz.
 - iii) Determine the guided wavelength at the same frequency.
- (c) Explain the principle of travelling wave tube?
- (d) What are cavity resonators? How they are used in microwave frequency region.
- (e) Explain the limitation of conventional active devices at microwave frequency region.
- (f) Discuss the excitation mechanism of a slot lines.

2. Attempt any FOUR parts of the following:

- (a) Explain how current modulation is used in a klystron amplifier?
- (b) A microstrip line uses a substrate with $\epsilon_r=10.7$ and $d=0.6\text{mm}$. The strip width is $w=0.4\text{mm}$. Find ϵ_{eff} , Z_0 , and the microstrip wavelength at $f=3\text{ GHz}$.
- (c) Explain why TE_{00} mode does not exist in a rectangular waveguide.
- (d) What are the various techniques of impedance measurement?

- (e) Explain the role of circulator as a transmission device?
- (f) Mention the advantage and disadvantage of using planar transmission lines.

3. Attempt any TWO parts of the following: (10×2=20)

- (a) What is hybrid ring? Describe the physical structure and operation of a series-connected waveguide hybrid ring. Why is it called rat-race?
- (b) Discuss how the energy is saved in a resonator. A rectangular cavity resonator has a dimensions of $a=6$ cm, $b=3$ cm. Compute the resonant frequency of the dominant mode
 - i) For an air-filled cavity.
 - ii) For a dielectric-filled cavity of $\epsilon_r=3.45$.
- (c) Describe the modal propagation in a rectangular waveguide. Also explain the dispersion relation used in the waveguide.

4. Attempt any TWO parts of the following: (10×2=20)

- (a) State and explain the scattering matrix for magic tee. How this will behave as E or H plane tee explain with help of its s-matrix.
- (b) Discuss the dominant and degenerate mode in a rectangular waveguide. An air filled circular waveguide has a diameter of 4 cm and is to carry energy at a frequency of 8 GHz. Find all TE and TM modes for which transmission is possible?
- (c) With the help of poynting theorem derive the relation for power transmission in a rectangular waveguide. Mention the various kinds of power losses that are occurred in a rectangular waveguide?

5. Attempt any TWO parts of the following:

- (a) Describe the frequency measurement techniques.
- (b) Describe the working principle of reflex klystron.
- (c) Write short notes on
 - (i) Two hole directional coupler
 - (ii) Microwave isolator