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Paper Code: EC-601	**Roll No.**									

B. Tech.
(SEM VI) EVEN SEMESTER EXAMINATION 2015-16
MICROWAVE ENGINEERING

[Time: 3 hrs.] **[Max. Marks: 100]**

Note- Attempt all questions. ***All Questions carry equal marks.***

1. Attempt any four parts of the following. **[5x4=20]**
   a) What are Degenerate Modes? Explain why TEM mode cannot exist in metallic waveguides.
   b) Which mode in circular metal waveguide has got highest cut-off wavelength? What do the subscripts m and n indicate in TE_{mn} mode of a circular waveguide? Give two important applications of this waveguide.
   c) What is microstrip line? How does its characteristic impedance change with change in width to height ratio? Give a reason for using lower dielectric constant substrate in place of alumina at higher microwave frequencies.
   d) An air-filled circular waveguide having an inner radius of 1 cm, is excited in dominant mode at 10 GHz. Find :
      i) The cut-off frequency of dominant mode,
      ii) Guide wavelength,
      iii) Wave impedance, and
      iv) Bandwidth for operation in dominant mode only.
   e) Show that a rectangular cavity may be viewed as a rectangular waveguide shorted at both ends. Also find the resonance condition.
   f) A lossless parallel strip line has a conducting strip width w. The substrate dielectric separating the two conducting strips has a relative dielectric constant ε_r of 6 and a thickness d of 4 mm. Find out the required width w of the conducting strip in order to have a characteristic impedance of 50Ω and also calculate the strip-line capacitance.

2. Attempt any four parts of the following. **[5x4=20]**
   a) What is Magic Tee? Why is it called so? Explain the characteristics of the tee considering various input/output conditions.
   b) What is Circulator? How can a four port circulator can be realized using two magic tees and a gyrator?
   c) What is attenuation? Name various types of attenuators. Discuss any one of them.
   d) Give the basic constructional details of a phase shifter and describe, in brief, its principle of operation and working.
   e) Explain the working of E Plane Tee. Derive its [S] matrix when the main arm is perfectly matched and Power P is fed from Auxiliary Arm.
   f) Incident power for a 30 dB coupler is 560 MW. Calculate the power in the main arm and in auxiliary arm.

3. Attempt any two parts of the following. **[10x2=20]**
   a) What problems are encountered in extending the conventional multi-electrode tubes to microwave frequencies? Describe the principle of operation of reflex klystron oscillator.
   b) Explain principle of operation of Backward wave oscillator.
   c) Draw the schematic diagram of a cylindrical multi-cavity magnetron and describe its principle of operation.

4. Attempt any two parts of the following. **[10x2=20]**
   a) Why Gunn diodes are called Transferred Electron Devices? Give the mechanism of negative differential resistance in GaAs semiconductor. Describe the behavior of different modes of operation of a Gunn diode oscillator and give one of its applications.
   b) Explain the operating principle and working of the following:
      i) Microwave bipolar transistor
      ii) Microwave Tunnel diode.
   c) Describe the basic operating mechanism of TRAPATT diode using a suitable sketch. Why is drift through this diode much slower than through a comparable IMPATT diode?

5. Attempt any two parts of the following. **[10x2=20]**
   a) i) How is slotted line used for measurement of impedance of an unknown load?
      ii) Calculate the VSWR of a transmission system opearting at 15 GHz. The TE_{10} mode is propagating through the waveguide of dimensions 4.0 and 2.1 cm, respectively. The distance between two successive minima is 1.5 mm.
   b) What are various methods to measure Microwave power explain one low power measurement and one high power measurement method with relavant diagram.

   c) List the microwave components used to measure frequency, wave length and VSWR. Draw the Block diagram and explain the working of each component.