Roll No .....



# EC-704

## B.E. VII Semester

Examination, December 2016

## Microwave Engineering

*Time : Three Hours*

*Maximum Marks : 70*

*Note:* i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

ii) All parts of each question are to be attempted at one place.

iii) All questions carry equal marks, out of which part A and B (Max. 50 words) carry 2 marks, part C (Max. 100 words) carry 3 marks, part D (Max. 400 words) carry 7 marks.

iv) Except numericals, Derivation, Design and Drawing etc.



### Unit - I

1. a) What is a mode? Define TEM, TM and TE mode.
   b) Explain group velocity and phase velocity.
   c) Write down the formulae of cut-off frequency, cut-off wavelength, and dominant mode for TE mode in a rectangular wave guide.
   d) Explain power flow, power losses and power handling capacity in a rectangular wave guide.

   OR

   Derive the wave equation for TM wave and obtain all the field components in a rectangular waveguide.

### Unit - II

2. a) Explain two port and four port network.
   b) Write short note on properties of ferrites.
   c) Write short note on properties of scattering matrix of reciprocal loss less passive network.
   d) Explain the working of hybrid T giving suitable diagram and scattering matrix of it.





OR

Discuss the working of a multi hole directional coupler giving suitable diagram and scattering matrix.

### Unit - III

3. a) Write the detection characteristics of microwave detector diodes.
   b) Write down the properties of PIN diode.
   c) Write a short note on varactor diode.
   d) Write short notes on the following :
      i) MASER ii) Gunn effect iii) BARITT

   OR

   Write short notes on the following :
   i) LASER ii) IMPATT iii) TRAPATT

### Unit - IV

4. a) Discuss velocity modulation and density modulation in microwave vacuum tube devices.
   b) Frequency pushing and pulling in magnetrons.
   c) Draw the applegate diagram of two cavity klystron and reflex klystron and explain bunching process clearly.
   d) Explain the working of a parallel plate magnetron and derive an expression for cut-off magnetic field for sustained oscillations.

   OR

   Explain the principle of operation of a two cavity klystron and derive an expression for its efficiency.

### Unit - V

5. a) Write a short note on square law detection.
   b) Write a short note on waveguide probe and detector mounts.
   c) Write a short note on VSWR measurement.
   d) Discuss high and medium power measurements and explain bolometer method of microwave power measurement.

   OR

   Write short notes on the following :
   i) Network analyzer
   ii) Measurement of scattering matrix parameters.

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