

**EC - 704**  
**BE VII Semester**  
Examination, December 2013  
**Microwave Engineering**

*Time : Three Hours*

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*Note:* Attempt one question from each unit.  
All questions carry equal marks.

**Unit<sup>1</sup> - I**

1. a) What are waveguides? Explain the propagation of electromagnetic wave in a rectangular waveguide.
- b) Differentiate between the concepts of group velocity and phase velocity as applied to wave guides. Derive the universal formula for the group velocity.

OR

2. a) Define and fully explain the meaning and consequences of the cutoff wavelength of a waveguide apart from the wall separation. What else determines the actual value of the cutoff wavelength for a signal of a given frequency.
- b) Derive the wave equation for a TM wave and obtain all the field components in a rectangular waveguide.

**Unit - II**

3. a) Explain the operation of H-Plane, E-Plane and E-H Plane Tee junction. Why is hybrid E-H phase Tee referred to as Magic Tee? What are its applications? What is done to

- b) What are ferrites? Why are these useful in microwaves? Mention their properties with the aid of diagram explain the operation of faraday rotation ferrite isolator.

OR

4. a) Define a microwave junction. How can it be described by scattering matrix. Derive the scattering matrix relation between the input and output of a  $n \times n$  junction.
- b) With the aid of a diagram, explain fully the operation of a two-hole waveguide directional coupler, also state its uses.

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**Unit - III**

5. a) With the aid of suitable sketch. Describe the construction of a PIN diode. What does PIN stand for? Briefly explain the operation of this diode.
- b) Explain fully Gunn effect, where by negative resistance and therefore oscillations are obtainable under certain conditions from bulk gallium arsenide and similar semiconductors. Why are Gunn devices called diodes?

OR

6. a) With the aid of suitable sketches, discuss the materials, construction and characteristics of microwave varactor. Discuss briefly how they are used as frequency multipliers.
- b) What is a parametric amplifier? Discuss its fundamentals in full and state the ways in which it differs from an orthodox amplifier.

**Unit - IV**

7. a) Explain how bunching takes place in the Klystron amplifier around the electron which passes the buncher cavity gap when the gap voltage is zero and becoming positive and also show how velocity modulation and current modulation occurs in Klystron amplifier.
- b) With the aid of schematic diagram describe the traveling wave tube. What is a slow wave structure? Why does the TWT need such a structure?

OR

8. a) Explain the operation of reflex Klystron Oscillator. Why is the transit so important in this device?
- b) Describe fully the effect of a dc axial field on the electrons traveling from the cathode to the anode of a magnetron, and then describe the combined effect of the axial magnetic field and the radial dc electric field. Define the cutoff field.

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**Unit - V**

9. a) Describe how can the power of a microwave generator be measured using Bolometer.
- b) Explain measurement of waveguide impedance at load port by slotted line.
- OR
10. a) Define and explain VSWR. How it is measured? Explain the double minimum method of measuring VSWR.
- b) Describe the operation of network analyzer and explain its use in measurements.