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## EC-604(N)

B. E. (Sixth Semester) EXAMINATION, June, 2011

(Electronics & Communication Engg. Branch)

MICROWAVE ENGINEERING

[EC-604(N)]

Time : Three Hours

Maximum Marks : 100

Minimum Pass Marks : 35

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

### Unit-I

1. (a) Show that TEM and  $TM_{0n}$  modes do not exist in a uniform homogeneous rectangular waveguide. 8
- (b) The axial magnetic field in a rectangular waveguide which is airfilled is given as :

$$H_z = 10 [e^{-jK_z z} + 0.2 e^{jK_z z}] \cos 146 y \text{ A/m}$$

at frequency of 9 GHz. Here  $z$  and  $y$  are measured in metres.

Determine the expression for complex E-field distribution at plane  $z = 0.01 \text{ m}$ . 12

2. Explain modal voltage and modal current of a propagating waveguide mode.

An airfilled rectangular waveguide of dimensions  $3 \text{ cm} \times 1 \text{ cm}$  propagates dominant mode field at 8 GHz.

P. T. O.

The w.g. is matched and modal voltage is 2 volts. Determine the power absorbed by the matched load. Derive the expressions used and state the assumptions made.

#### Unit-II

3. Explain the scattering matrix of a microwave network.  
A two port matched attenuator gives attenuation of 1.5 dB with phase shift of 45 degrees lag. Assuming symmetry determine :
  - (a) Complete scattering matrix of a attenuator.
  - (b) Complex reflection coefficient at input port when output port is short circuited.
4. Explain the following :
  - (a) Hybrid T junction
  - (b) Ferrite isolator

#### Unit-III

5. Explain two-valley model theory of Gunn effect. Explain the circuit arrangement of Gunn diode oscillator explaining LSA mode of operation.
6. Explain how a varactor diode is used as a parametric amplifier. A varactor has figure of merit equal to 6. It is used as up convertor for 0.2 GHz signal using a pump of 3 GHz. Determine the approximate gain of the up convertor explaining the formula used.

#### Unit-IV

7. (a) Explain the effect of repeller voltage variation on the output of reflex klystron.  
(b) Explain the working of TWT.

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8. The anode diameter of an eight cavity magnetron is 3 cm. The cavities are tuned at 5 GHz to work in  $\pi$ -mode. Determine approximate circumferential velocity of electron beam to give oscillations. Give necessary derivations, explanations and assumptions made in your answer.

**Unit - V**

9. Explain the electronic method of measurement of microwave frequency. The transfer oscillator frequencies measured for two consecutive beats with an unknown microwave signal are 215088001 Hz and 234021334 Hz. Estimate the frequency of microwave signal giving derivation of formula and discussing accuracy of the measurement.
10. Explain slotted line arrangement for measurement of load impedance at a port. The VSWR measured is 2.7 and distance of voltage minima is 1.20 cm from load port in a measurement where guide wavelength is measured as 4.93 cm. Calculate the normalised impedance of the port.