(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 3094 Roll No. | | | | | | | | | | |

B. Tech.

(SEM. VI) THEORY EXAMINATION 2010-11

MICROWAVE AND RADAR ENGINEERING

Time : 3 Hours *Total Marks : 100*

Note :—Attempt **all** questions.Each questions carry equal marks.

1. Attempt any **four** parts of the following :— **(5×4=20)**

(a) Derive the wave equation for a TM Wave and obtain all the field components in rectangular waveguide. Derive it for TM_{11} mode of propagation.

(b) Define the following :

(i) Dominant mode

(ii) Phase Velocity

(iii) Group Velocity.

(c) A TE_{11} wave is propagating through an air filled circular waveguide. If diameter of the guide is 10 cm and given the root of the Bessel function is X'np=1.841, then find :

(i) Cut-off frequncy

(ii) Wavelength in the waveguide for a frequency of 3 GHz.

(d) What do you mean by microwave cavities ? Describe the Rectangular cavity Resonator.

(e) Explain micro-strip lines and discuss the various type of losses in micro-strip lines.

(f) What are the various ways in which wave guide can be exited. Explain them with figures.

2. Attempt any **four** parts of the following :— **(5×4=20)**

(a) Describe in detail the operation of a 2-Hole direction coupler. Calculate the coupling factor if the power in primary waveguide is 72 mw and power delivered to Coupling port is 8 mw.

(b) What do you understand by Scattering (S) parameters ? Write down properties of Scattering matrix.

(c) Explain the characteristics of Hybrid Tees.

(d) Explain the working and applications of circulator. Are they reciprocal or Non reciprocal device ?

(e) Give methods of measuring impedance of a terminating load in microwave system. Explain any one in detail.

(f) Two identical 30 dB directional coupler are used to sample incident and reflected power in a waveguide. If VSWR = 2 and output of the coupler sampling incident power = 4.5 mw. What is the value of reflected power ?

3. Attempt any **four** parts of the following : 5×4=20

(a) Discuss the performance of magnetrons and lists its important applications.

(b) Differentiate between Klystron and TWT.

(c) A two cavity Klystron is operated at 10 GHz with V_0 = 1200 V, I_0 = 30 mA, d = 1 mm, L = 4 cm and R_{sh} = 40 kΩ. Neglecting beam loading, calculate : input RF Voltage V for a maximum output voltage and Voltage gain.

(d) Explain Gunn effect using the two valley theory.

(e) Explain operation of IMPATT Diode with support of figures.

(f) Explain the principle of operation and working of reflex Klystron Oscillator.

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

(a) What is a PIN Diode ? Describe the construction of a PIN Diode and also its characteristics.

(b) Derive the Radar Range equation. Explain the factors that affect the maximum range of a radar.

(c) Explain :

(i) Maximum Unambiguous Range

(ii) Pulsed Radar System.

5. Attempt any **two** parts of the following : (10×2=20)

(a) How do you distinguish stationary targets and moving targets ? Explain the principle and working of a MTI Radar.

(b) Write short notes on :

(i) Blind speed

(ii) Monopulse tracking

(iii) Radar Clutter

(c) Explain following with support of figures :

(i) Radar Antennas

(ii) Radar Displays.