Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–VII • EXAMINATION – WINTER 2013

Subject Code: 173201 Date: 26-11-2013

Subject Name: Microwave and Satellite Communication

Time: 10:30 TO 01:00 Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** (i) Why TEM mode does not exist in a waveguide? Explain. **07**
(ii)Define the following terms.
(1) Phase velocity (2) Group velocity
(3) Guide wavelength (4) Dominant mode.

(b) A rectangular wave guide has dimensions 2.5 x 5 cm. Determine the guide wavelength, phase constant β and phase velocity V_p at a wavelength of 4.5 cm for the dominant mode. **07**

Q.2 **(a)** Explain the operation of E-plane Tee junction. Derive the scattering matrix for E-plane Tee. **07**

(b) How are waveguides different from normal two wire transmission lines? Discuss the similarities and dissimilarities. **07**

OR

(b) Determine the scattering parameters for a 10 dB direction coupler. The Directivity D= 30 dB. Assume that it is lossless and the VSWR at each port is 1.0 under matched conditions. Designate the ports in the main guide as 1 or 2 and the ports in the auxiliary guide as 3 and 4. **07**

Q.3 **(a)** Explain the working of TWT. **07**

(b) Explain the need of microwave tubes as compare to conventional tubes at microwave frequencies. **07**

OR

Q.3 **(a)** Discuss the application of PIN diode. **07**

(b) Explain the operation of Reflex klystron with necessary diagram. **07**

Q.4 **(a)** Explain the basic principles of a RADAR system. Give the applications and limitations of RADARs. **07**

(b) Military RADAR operates at 5 GHz with 2.5 MW power output. If the antenna diameter is 5 m, the receiver bandwidth is 1.6 MHz and has a 12 dB noise figure, what is the maximum detection range for 1 m^2 target. **07**

OR

Q.4 **(a)** Derive the RADAR range equation. Explain the factors that affect the maximum range of RADAR. **07**

(b) Explain three laws of Kepler's for planetary motion in detail. **07**

Q.5 **(a)** Define the following terms: **07**
(1)Apogee (2)Perigee (3)side real day (4)Mean anomaly

(b) The earth rotates once per sidereal day of 23h 56 min 4.09s. Calculate the radius of GEO satellite in Km. **07**

OR

Q.5 **(a)** Explain need of Telemetry, Tracking, command and monitoring system in satellite communication. **07**

(b) An earth station situated in the Docklands of London, England, needs to calculate the look angle to a geostationary satellite in the Indian ocean operated by Intelsat. The details of the earth station site and the satellite are as follows: **07**
Earth station latitude and longitude are 52.0^o N and 0^o
Satellite longitude (sub satellite point) is 66.0^o E.
Calculate the central angle γ, Elevation angle El, intermediate angle α, azimuth angle A_z.

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