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Seventh Semester B.E. Degree Examination, Feb./Mar. 2022 Microwaves and Antennas

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. With neat diagrams, explain the concept of reflex system. (10 Marks)
- b. Calculate the transit time at the cavity gap, transit angle and velocity of electron leaving the gap for 2- cavity klystron that operates at 4GHz with a DC beam voltage of 5kV and 2mm cavity gap. (06 Marks)
- c. Define VSWR. (04 Marks)

OR

- 2 a. Obtain the transmission line equations from fundamentals. (10 Marks)
- b. A transmission line has a resistance of $2\Omega/m$ with an inductance value of $8n H/m$. The conductance of the line is $0.5m mho/m$ and capacitance is $0.23p.F$. $f = 1GHz$. Find the characteristics impedance of the line and the propagation constant. (04 Marks)
- c. What is a Smith chart? Explain the different measurement that can be determined using a smith chart? (06 Marks)

Module-2

- 3 a. Explain the properties of S parameters as applicable to a microwave network. (10 Marks)
- b. Write short notes on : (10 Marks)
 - i) Coaxial connectors and adapters
 - ii) Attenuators.

OR

- 4 a. What is a Magic Tee? Explain its properties. Also determine its S-matrix. (10 Marks)
- b. Explain a directional coupler and write its S-matrix. (10 Marks)

Module-3

- 5 a. A certain microstripline has the following parameters.
 $\epsilon_r = 5.23$ $h = 7$ mils $t = 2.8$ mils $w = 10$ mils [Note : 1mil = 0.0254mm]. Calculate the characteristic impedance of line (Z_0). (04 Marks)
- b. Explain a parallel strip line, with neat diagram and relevant equations. (06 Marks)
- c. Define the following : (10 Marks)
 - i) Radiation Intensity
 - ii) Aperture of Antenna
 - iii) Beam area
 - iv) Directivity
 - v) Reduction pattern.

OR

- 6 a. Derive Friis transmission formula. (08 Marks)
- b. Compute the power received by an antenna in case of transmission over a distance of 150km at 500MHz. When gain G of antennas used are both 25dB. ($P_T = 200W$). (06 Marks)
- c. Obtain a relationship between directivity and effective aperture. (06 Marks)

**Module-4**

- 7 a. Plot the field pattern for an array of 2 isotropic sources with equal amplitude and same phase. Take $d = \lambda/2$. (07 Marks)
- b. Find Directivity of a source with a sine squared pattern (doughnut) (power pattern). (07 Marks)
- c. State and explain power theorem. (06 Marks)

OR

- 8 a. Obtain the field pattern for a linear uniform array of isotropic antennas for $n = 6$, $d = \frac{\lambda}{2}$, $\theta = -d_r$. (08 Marks)
- b. Obtain an expression for radiation resistance of a short dielectric dipole. (06 Marks)
- c. Define and explain the principle of pattern multiplication. (06 Marks)

Module-5

- 9 a. From fundamentals obtain the radiation resistance of a small loop antenna. (08 Marks)
- b. For a horn antenna, explain the horn antenna optimum dimensions. Explain with an example. (06 Marks)
- c. Explain the principle of working of a parabolic Reflector antenna. (06 Marks)

OR

- 10 a. Define helix geometry. Explain the practical design considerations for the monoflex axial mode helical antenna. (06 Marks)
- b. Explain the principle of a Yagi Uda Array Antenna. (08 Marks)
- c. Calculate the directivity of a horn antenna with $a_e \lambda = 10\lambda$ $a_H = 9\lambda$ (06 Marks)

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