CBCS SCHEME

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15EC71

Seventh Semester B.E. Degree Examination, Aug./Sept. 2020
Microwaves and Antennas

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain the operation of Reflex Klystron with the help of neat sketch. **(06 Marks)**

b. A two-cavity Klystron operates at 5 GHz with a DC beam voltage of 10KV and 2mm cavity gap. For a given input RF voltage, the magnitude of the gap voltage is 100V. Calculate the transit time at the cavity gap, the transit angle, and velocity of the electrons leaving the gap. **(06 Marks)**

c. Define standing wave and standing wave ratio. **(04 Marks)**

OR

2 a. Derive transmission line equations. **(06 Marks)**

b. A certain transmission line has a characteristic impedance of 75 + j0.01Ω and is terminated in load impedance of 70 + j50Ω. Compute : i) reflection coefficient ii) transmission coefficient. **(06 Marks)**

c. Mention characteristics of Smith chart with the help of necessary equations. **(04 Marks)**

Module-2

3 a. Write short notes on :
i) Attenuator
ii) Phase shifters. **(08 Marks)**

b. Explain the properties of S-parameters for junction of ports having common characteristic impedance. **(08 Marks)**

OR

4 a. A 20 MW signal is fed into one of the collinear part 1 of a lossless H plane T junction. Calculate the power delivered through each port when other ports are terminated in matched load. **(04 Marks)**

b. Write the characteristics of Magic Tee. Also obtain scattering matrix for Magic Tee. **(08 Marks)**

c. Write short notes on : Coaxial connectors and adapters. **(04 Marks)**

Module-3

5 a. A microstrip line is composed of zero thickness copper conductors on a substrate having $\epsilon_r = 8.4$ $\tan\delta = 0.0005$ and thickness 2.4mm. If the line width is 1mm and operated at 10 GHz, calculate :
i) The characteristic impedance ii) the attenuation due to conductor loss and dielectric loss. **(08 Marks)**

b. Define the following :
i) Beam area
ii) Radiation resistance
iii) Beam efficiency
iv) Radiation intensity. **(08 Marks)**

OR

6 a. Obtain effective aperture and directivity of a half wave dipole. **(05 Marks)**
b. Derive Friis transmission formula. **(05 Marks)**
c. Obtain relationship between directivity and effective aperture. **(06 Marks)**

Module-4

7 a. Define power theorem. **(04 Marks)**
b. Find the directivity 'D' for the following sources with radiation intensity.
i) $U = U_m \sin^2\theta,\ 0 \le \theta \le \pi,\ 0 \le \phi \le 2\pi$ ii) $U = U_m \cos^2\theta,\ 0 \le \theta \le \pi/2,\ 0 \le \phi \le \pi/2$. **(05 Marks)**
c. Plot the field pattern for an array of two isotropic point sources with equal amplitude and same phase. Take $d = \lambda/2$. **(07 Marks)**

OR

8 a. Obtain the field pattern for a linear uniform array of isotropic antennas, satisfy the following $n = 5$, $d = \lambda/2$, $\delta = -d_r$. **(06 Marks)**
b. Derive an expression for radiation resistance of a short electric dipole. **(06 Marks)**
c. Explain principle of pattern multiplication with the help of suitable example. **(04 Marks)**

Module-5

9 a. Compare far fields of small loop and short electric dipole. **(04 Marks)**
b. Obtain an expression for radiation resistance of a loop antenna. **(06 Marks)**
c. Develop an expression for the field intensity ratio in the aperture plane for a parabolic reflector. **(06 Marks)**

OR

10 a. Determine the length L, H-plane aperture and flare angles θ_E and θ_H of a pyramidal horn for which the Eplane aperture $a_E = 10\lambda$. The horn is fed by a rectangular waveguide with TE_{10} mode. Let $\delta = 0.2\lambda$ in the Eplane and 0.375λ in the H plane. Also find the directivity. **(06 Marks)**
b. Define helix geometry. Explain practical design considerations for the monofilar axial mode helical antenna. **(06 Marks)**
c. Explain Yagi – Uda array with the help of diagram. **(04 Marks)**

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