CBCS SCHEME

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15EC71

Seventh Semester B.E. Degree Examination, June/July 2019
Microwave 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. Discuss mechanism of oscillation in Reflex Klystron with schematic. **(06 Marks)**

b. A Reflex Klystron is to be operated at 10GHz with dc beam voltage 300V, repeller space 0.1cm for $1\frac{3}{4}$ mode. Calculate P_{RFmax} and corresponding repeller voltage for a beam current of 20mA. **(05 Marks)**

c. A transmission line has the following parameters:
R = 2Ω/m, G = 0.5mho/m, f = 1GHz, L = 8nH/m and C = 0.23 PF.
Calculate its characteristics impedance and propagation constant. **(05 Marks)**

OR

2 a. A line of 400Ω is connected to a load of 200 + j300Ω which is excited by a matched generator at 800MHz. Find the location and length of a single stub nearest to the load to produce an impedance match. **(08 Marks)**

b. A certain transmission line has a characteristic impedance of 75 + j0.01Ω and is terminated in a load impedance of 75 + j50Ω. Compute: i) Reflection coefficient ii) The transmission coefficient. **(04 Marks)**

c. What are the high frequency limitations of conventional vacuum tube / transistors? **(04 Marks)**

Module-2

3 a. Show that impedance and admittance matrices are symmetrical for a reciprocal junction. **(06 Marks)**

b. In a H-plane T-junction, compute power delivered to the loads 40ohm and 60ohm connected to arms 1 and 2 when 10mw power is delivered to matched port 3. Assume characteristics impedance of line = 50ohm. **(04 Marks)**

c. Two transmission lines of characteristic impedance z_1 and z_2 are joined at plane pp′. Express S-parameters in terms of impedances. **(06 Marks)**

OR

4 a. Discuss the following properties of S-parameters:
i) Symmetry of [S] for a reciprocal network
ii) Unitary property for a lossless junction. **(08 Marks)**

b. A magic T is terminated at collinear ports 1 and 2 and difference port 4 by impedances of reflection coefficients $\gamma_1 = 0.5$, $\gamma_2 = 0.6$ and $\gamma_4 = 0.8$ respectively. If 1W power is fed at sum port 3, calculate the power reflected at port 3 and power transmitted to other three ports. **(08 Marks)**

Module-3

5 a. A lossless parallel strip line has a conducting strip width W. The substrate dielectric separating the two conducting strips has a relative dielectric constant ε_{rd} of 6 and a thickness d of 4mm. Calculate: i) The required width W of the conducting strip in order to have a characteristic impedance of 50Ω ; ii) The strip-line capacitance. **(04 Marks)**

b. Discuss different types of losses in microstrip lines. **(06 Marks)**

c. Calculate the exact directivity for 3 dimensional source having the pattern $U = U_m \sin^2\theta \sin^3\phi$ where $0 \le \theta \le \pi$, $0 \le \phi \le \pi$. **(06 Marks)**

OR

6 a. Show that maximum effective aperture of a $\lambda/2$ depole antenna is $0.13\lambda^2$. **(06 Marks)**

b. With the aid of schematic diagram explain coplanar strip line. **(05 Marks)**

c. Compute the power received by receiving antenna kept at a distance of 100km by a transmitter radiating at 3MHz. Assume $G_T = 40$ and $G_R = 15$ and $P_T = 1000$ kW. Derive the relation used. **(05 Marks)**

Module-4

7 a. Obtain the fields pattern for two point source situated symmetrically with respect to the origin. Two sources are feed with equal amplitude and equal phase signals. Assume distance between two sources = $\lambda/2$. **(08 Marks)**

b. Derive the expression for radiation resistance of short electric dipole. **(08 Marks)**

OR

8 a. Derive an array factor expression in case of linear array of 'n' isotropic point source of equal amplitude and spacing. **(08 Marks)**

b. Obtain the expression for field of dipole in general for the case of thin linear antenna. **(08 Marks)**

Module-5

9 a. Obtain the expression for radiation resistance of small loop antenna. **(08 Marks)**

b. With neat diagram explain the operation of log-periodic antenna. **(08 Marks)**

OR

10 a. Determine the length L_1 H-plane aperture and flare angle θ_E and θ_H of a pyramidal horn for which the E-plane aperture $a_E = 10\lambda$. The horn is fed by a rectangular waveguide with TE_{10} mode. Let $\delta = 0.2\lambda$ in the E plane and 0.375λ in the H plane. Also find what are beam widths and what is the directivity. **(08 Marks)**

b. Discuss the following antenna types (i) Helical Antenna (ii) Yagi-uda-array. **(08 Marks)**

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