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15EC71

Seventh Semester B.E. Degree Examination, Dec.2018/Jan.2019
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. Derive the general transmission line equation to find voltage and current on the line interms of position 'z' and time 't'. **(07 Marks)**

b. Describe the different mode curve in the case of reflex klystron. **(05 Marks)**

c. A transmission line has a characteristic impedance of 50 + j0.01Ω and terminated in a load impedance of 73 – j42.5Ω calculate : i) reflection coefficient ii) SWR. **(04 Marks)**

OR

2 a. Define relection coefficient. Derive the equation for reflection coefficient at the load end at a distance 'd' from the load. **(06 Marks)**

b. Describe the mechanism of oscillation of reflex klystron. **(06 Marks)**

c. A transmission line has the following parameters : R = 2Ω/m, G = 0.5mmho/m, f = 1GHz, L = 8nH/m, C = 0.23pF/m. Calculate : i) characteristic impedance ii) propagation constant. **(04 Marks)**

Module-2

3 a. State and explain the properties of S – matrix. **(07 Marks)**

b. With a neat diagram, explain the working of precession type variable attenuator. **(06 Marks)**

c. A 20mW signal is fed into one of the collinear port 1 of a lossless H-plane T junction. Calculate the power delivered through each port when other ports are terminated in matched load. **(03 Marks)**

OR

4 a. What is magic Tee? Derive its scattering matrix. **(06 Marks)**

b. Discuss different types of coaxial connectors. **(04 Marks)**

c. 2 transmission lines of characteristic impedance Z_1 and Z_2 are joined at plane PP'. Express S–parameters in terms of impedance when each line is matched terminated. **(06 Marks)**

Module-3

5 a. Explain the construction and field pattern for microstrip line. **(06 Marks)**

b. Explain the following terms as related to antenna system :
i) directivity ii) beam efficiency iii) effective aperture. **(06 Marks)**

c. The effective apertures of transmitting and receiving antennas in a communication system are $8\lambda^2$ and $12\lambda^2$ respectively. With a separation of 1.5km between them. The EM wave travelling with frequency of 6 MHz and the total input power is 25KW. Find the power received by the receiving antenna. **(04 Marks)**

OR

6 a. Explain co-planar strip line and shielded strip line. **(06 Marks)**

b. Write a note on antenna field zones. **(06 Marks)**

c. An antenna has a field pattern given by $E(\theta) = \cos^2\theta$ for $0 \le \theta \le \pi/2$. Find the beam area and directivity. **(04 Marks)**

Module-4

7 a. Derive an expression and draw the field pattern for an array of 2 isotropic point sources with same amplitude and phase spaced $\lambda/2$ apart. **(06 Marks)**

b. Show that the radiation resistance of $\lambda/2$ antenna is 73Ω. **(06 Marks)**

c. A source has a radiation –intensity power pattern given by $U = U_m\sin^2\theta$ for $0 \le \theta \le \pi$; $0 \le \phi \le 2\pi$. Find the total power and directivity. Draw pattern. **(04 Marks)**

OR

8 a. Derive the expressions for the far field components of short dipole. **(06 Marks)**

b. Explain the principle of pattern multiplication with an example. **(06 Marks)**

c. A source has a cosine radiation intensity pattern given by $U = U_m\cos\theta$ for $0 \le \theta \le \pi/2$ and $0 \le \phi \le 2\pi$. Find the total power and directivity. **(04 Marks)**

Module-5

9 a. Derive the expression for strength $E\phi$ and $H\theta$ in case of small loop. **(06 Marks)**

b. Explain the working and design considerations of Log-periodic antenna. **(06 Marks)**

c. A 16-turn helical beam antenna has a circumference of λ and turn spacing of $\lambda/4$. Find : i) HPBW ii) axial ratio iii) directivity. **(04 Marks)**

OR

10 a. Show that the radiation resistance of small loop is $31171\left(\frac{A}{\lambda^2}\right)^2$. **(05 Marks)**

b. Write a short notes on :
i) Yagi Uda array ii) parabolic reflector. **(06 Marks)**

c. Determine the length L, H-plane aperture and flare angles θ_E and θ_H of a pyramidal horn for which the E-plane aperture $a_E = 10\lambda$. Let $\delta = 0.2\lambda$ in the E-plane and 0.375λ in the H-plane. Also determine beam widths and directivity. **(05 Marks)**

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