CBCS SCHEME

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18EC63

Sixth Semester B.E. Degree Examination, July/August 2022
Microwave 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. Making use of functional block diagram explain the working of reflex Klystron oscillator. Also discuss modes of oscillation. **(10 Marks)**

b. A transmission line has the following parameters, R = 2Ω, G = 0.5mho/m, f = 1GHz, L = 8nH/m, C = 0.23PF.
Calculate :
i) Characteristic impedance
ii) Propagation constant. **(04 Marks)**

c. List the characteristics of smith chart. **(06 Marks)**

OR

2 a. A reflex Klystron is to be operated at frequency of 10GHz, with DC beam voltage 300V, repeller space 0.1cm for 1 mode, calculate P_{RFMax} and corresponding repeller voltage for a beam current of 20mA. **(04 Marks)**

b. Derive the equation of transmission line with possible solution. **(10 Marks)**

c. A certain transmission line has the characteristics impedance of 75 + j0.01Ω and is terminated in a load impedance of 70 + j50Ω.
Compute :
i) The reflection coefficient
ii) Transmission coefficient
iii) Standing wave ratio. **(06 Marks)**

Module-2

3 a. Prove that impedance and admittance matrices are symmetrical for a reciprocal junction. **(05 Marks)**

b. List the characteristics of magic – T when all the ports are terminated with matched load. Also derive the expression of S-matrix for magic T. **(10 Marks)**

c. In a H-plane T junction compute power delivered to the loads of 40Ω and 60Ω connected to arms 1 and 2 when a 10mW power is delivered to the matched port 3. **(05 Marks)**

OR

4 a. Derive the S-matrix representation for multiport network. Also define the losses interms of S-parameters. **(08 Marks)**

b. Explain briefly precision type variable attenuator. **(05 Marks)**

c. What are waveguide tees? Explain its basic types with neat diagram. **(07 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 of 6(beryllium oxide) and thickness 'd' of 4 meter. Calculate :
   i) The required width 'w' of the conducting strip in order to have a characteristic impedance of 50Ω.
   ii) Strip line capacitance
   iii) Strip line inductance
   iv) Phase velocity. **(08 Marks)**

b. Explain the following terms related to antenna system :
   i) Directivity
   ii) Beam area
   iii) Radiation pattern. **(06 Marks)**

c. Determine the directivity of the system if radiation intensity is given by $U = U_m \text{ Sin } \theta \sin^2\phi$ using Exact method. Given that $0 \le \theta \le \pi$ and $0 \le \phi \le \pi$. **(06 Marks)**

OR

6 a. A microwave relay link is to be designed such a way that the transmitting and receiving antennas are separated to 30 statute miles. The directive gains of both the antennas are equal to 45db. Assuming both antennas are lossless and matched at 3GHz. Find what power is transmitted by the transmitter to have received power of 1MW. **(06 Marks)**

b. Explain briefly losses in micro–strip line. **(06 Marks)**

c. Calculate the directivity of the source with pattern $U = U_m \sin \theta^2 \sin^3\phi$ using :
   i) Exact method
   ii) Approximate method, where $0 \le \theta \le \pi$ and $0 \le \phi \le \pi$. **(08 Marks)**

Module-4

7 a. Obtain the field 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 is $\frac{\lambda}{2}$. **(10 Marks)**

b. Make use of poynthing theorem derive the expression for radiation resistance of short dipole with uniform current. **(10 Marks)**

OR

8 a. Derive an array factor expression in case of linear array of 'n' isotropic point sources of equal amplitude and spacing. **(10 Marks)**

b. Starting from electric and magnetic potential, obtain the far field components for short dipole. **(10 Marks)**

Module-5

9 a. Derive the far field expression for small loop antenna. **(08 Marks)**

b. Explain the constructional details for following antenna :
   i) Yogi – uda array
   ii) Parabolic reflector. **(12 Marks)**

OR

10 a. Derive the expression for radiation resistance of loop antenna. **(10 Marks)**

b. Find the length L, H-plane aperture and flare angle θ_E and θ_H of pyramidal horn for which E –plane operators is 10λ horn is fed by a rectangular waveguide with TE_{10} mode. Assume $\delta = 0.2\lambda$ in E – plane and 0.375λ in H – plane. Also find E – plane, H – plane beam widths are directivity. **(10 Marks)**

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