CBCS SCHEME

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18EC63

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. Explain the principle of working of Reflex Klystron. **(08 Marks)**

b. A Reflex Klystron operates at 10GHx with beam voltage 300V , Repeller space = 1mm for $1\frac{3}{4}$ mode . Calculate $P_{R\,max}$ and corresponding repeller voltage for a beam current of 18mA. **(06 Marks)**

c. Explain Microwave system, with the help of neat diagram. **(06 Marks)**

OR

2 a. Define Reflection coefficient and transmission coefficient of a transmission line. Derive and expression for each of them. **(08 Marks)**

b. The input impedance of an antenna is $(73 + j42.5)\Omega$ at 900 MHz. Calculate the voltage standing wave ratio. **(04 Marks)**

c. Mention the characteristics of Smith chart. **(08 Marks)**

Module-2

3 a. State and explain the properties of 'S' matrix. **(08 Marks)**

b. Explain precision type variable attenuator, with a neat sketch. **(06 Marks)**

c. Explain H plane T junction. Derive its 'S' matrix. **(06 Marks)**

OR

4 a. Write the characteristics of Magic Tee. Derive scattering matrix for Magic Tee. **(08 Marks)**

b. Impedance matrix of a simple device is given by $\begin{bmatrix} 4 & 2 \\ 2 & 4 \end{bmatrix}$. Find its scattering matrix. **(08 Marks)**

c. Write a note on Phase shifters. **(04 Marks)**

Module-3

5 a. Explain the construction and field pattern of Microstrip line. **(06 Marks)**

b. Discuss different types of losses in Microstrip line. **(06 Marks)**

c. Define the following with respect to antenna :
i) Directivity ii) Antenna beam efficiency
iii) Field zones iv) Effective aperture. **(08 Marks)**

OR

6 a. Derive the relationship between Maximum effective aperture and Directivity. **(06 Marks)**

b. Show that Maximum effective aperture of a half wave ($\lambda/2$) antenna is $0.13\lambda^2$. **(06 Marks)**

c. Two identical transmitting and receiving antenna with gain of 15dBi at 2.45 GHz are separated by a distance of 3km. If the transmitted power is 20W, then calculate the received power. **(08 Marks)**

Module-4

7 a. Find the directivity of an antenna whose radiation intensity is given by $U = U_m \cos^4\theta \sin^2\phi$, $0 \le \theta \le \pi/2$, $0 \le \phi \le 2\pi$. **(06 Marks)**

b. Derive an expression for the field pattern for 'n' isotropic point sources of same amplitude and phase. **(08 Marks)**

c. Draw the field pattern of a broadside array with number element (n) = 5 and spacing (d) = $\lambda/2$. **(06 Marks)**

OR

8 a. Obtain an expression for the field pattern of two isotropic point sources with equal amplitude and phase. Also plot the field pattern. Assume $d = \lambda/2$. **(08 Marks)**

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

c. Explain the principle of pattern multiplication. **(04 Marks)**

Module-5

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

b. A Coaxial feed pyramidal horn antenna is designed at 915 MHz with aperture A = 50cm and B = 40cm and horn length from neck to mouth = 27.5cm. Assuming efficiency of 72%. Find approximate gain of the horn antenna. **(06 Marks)**

c. A parabolic dish antenna provides a power gain of 50dB at 10GHz with 70% efficiency. Find i) HPBW ii) FNBW iii) Diameter. **(06 Marks)**

OR

10 a. Explain Yagi – Uda array with the help of neat diagram. **(06 Marks)**

b. A helical antenna with a flat circular ground plane is to be designed to operate in axial mode for a gain of $26dB_i$ at 5.8 GHz. Calculate i) Diameter of the helix ii) Minimum number of turns. **(08 Marks)**

c. Find the radiation resistance of circular loop antenna of radius 0.32m , Operating at 1MHz. The radius of a wire used is 0.4mm conductivity of the wire is 57 ms/m and $\mu_r = 1$. **(06 Marks)**

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