CBCS SCHEME

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21EC62

Sixth Semester B.E./B.Tech. Degree Examination, June/July 2025
Microwave Theory 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 operating principle of 9 Gunn-decode with neat energy band diagram and I-V-Characteristics. **(08 Marks)**

b. A Telephone Line has R = 6 Ω/km, L = 2.2 mH/km, C = 0.005 mF/km and G = 0.05 m mho/km. Determine Z_0, α, β at 1 KHz frequency and also find phase – velocity V_p (m=milli). **(08 Marks)**

c. What are standing waves? Obtain expressions for VSWR interms of reflection coefficient(P). **(04 Marks)**

OR

2 a. Derive the transmission line equations in voltage and current forms. **(08 Marks)**

b. A 50 Ω lossless line connects a matched signal of 100 KHz to a load of 100 Ω. The load power is 100 mW. Calculate :
i) Voltage reflection coefficient (P)
ii) VSWR of the load
iii) Position of first V_{min} and V_{max}
iv) Imp at V_{min} and V_{max} and value of V_{min} and V_{max}. **(08 Marks)**

c. Explain briefly single stub impedance matching technique. **(04 Marks)**

Module-2

3 a. Derive the S-matrix representation of a multiport network. **(08 Marks)**

b. What is circulator? Explain the operating principle of 4 port circulator. **(06 Marks)**

c. What is attenuators? Explain its different types briefly. **(06 Marks)**

OR

4 a. Derive the S-matrix for Magic –T. **(08 Marks)**

b. What are waveguide Tees? Explain briefly each type. **(08 Marks)**

c. Write a note on Faraday's rotation Isolator. **(04 Marks)**

Module-3

5 a. Explain the construction of micro-strip line. **(05 Marks)**

b. Discuss the different types of losses occurs in micro-strip lines. **(05 Marks)**

c. A micro-strip line composed of zero – thickness copper conductors on a substrate having E_r = 8.4, tan δ = 0.0005 and thickness 2.4 mm. If the line width is 1 mm and operated at 10 GHz, calculate :
i) Characteristics impedance Z_0
ii) Attenuation due to conductor loss and dielectric loss. **(10 Marks)**

OR

6 a. Define following parameters with respect to antenna.
   i) Radiation pattern
   ii) Radiation intensity
   iii) Beam Area (ΩA). **(08 Marks)**

   b. Explain the radio-communication link and derive Friis transmission formula. **(06 Marks)**

   c. An antenna has normalized field pattern given by $E_n = \cos^3\theta$; where θ is polar angle in spherical co-ordinates and it varies from 0 to π. Find the HPBW and directivity. **(06 Marks)**

Module-4

7 a. Derive an expression for radiation resistance of a short-dipole antenna. **(08 Marks)**

   b. Explain and derive the array of two isotropic point sources of same amplitudes and phase. **(08 Marks)**

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

OR

8 a. Explain with neat diagram linear array of n-isotropic point sources of equal amplitude and spacing. **(10 Marks)**

   b. Write a note on short dipole antenna. **(05 Marks)**

   c. Write short notes on Thin linear antenna. **(05 Marks)**

Module-5

9 a. Derive an expression for radiation resistance of a small-loop antenna. **(10 Marks)**

   b. Explain the rectangular horn antenna and its basic types. **(10 Marks)**

OR

10 a. Explain the operational modes of a Helicast antenna. **(10 Marks)**

   b. Explain Yagi-Uda array with the help of neat diagram. **(10 Marks)**

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