Code No: R1932041 **R19** **SET - 1**

III B. Tech II Semester Regular Examinations, June-2022

WIRED AND WIRELESS TRANSMISSION DEVICES

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 75

Answer any **FIVE** Questions **ONE** Question from **Each unit**

All Questions Carry Equal Marks

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UNIT-I

1. a) Derive the wave equation for a TE wave and mention dominant mode. [8M]
   b) Explain the losses of micro strip lines. [7M]

(OR)

2. a) A rectangular wave-guide has a cross section of 1.5 cm × 0.8 cm, σ = 0, μ = μ_0 and ∈ = 4$\in_0$. The magnetic field component is given as [8M]

$$H_x = 2 \sin \frac{\pi x}{a} \cos \frac{3\pi y}{b} \sin(\pi \times 10^{11} t - \beta z)\, A/m$$

   Determine:
   (i) The mode of operation
   (ii) The cut off frequency
   (iii) The phase constant
   (iv) The propagation constant
   (v) The wave impedance.
   b) Obtain the relation between phase velocity and group velocity. [7M]

UNIT-II

3. a) Define the half-power beam width and directivity of an antenna. And derive the relation between them. [8M]
   b) An antenna has a radiation resistance of 72 Ω, a loss resistance of 8 Ω and a power gain of 12 dB. Determine the antenna efficiency and its directivity. [7M]

(OR)

4. a) Draw the current distribution of an antenna with different lengths. [8M]
   b) Distinguish between directive gain and power gain. [7M]

UNIT-III

5. a) Derive the field components and radiation resistance of a half wave dipole. [8M]
   b) Find the radiation resistance of a loop antenna of diameter 0.5 m operating at a frequency of 1 MHz. [7M]

(OR)

6. a) What is linear array? Compare Broad side array and End fire array. [8M]
   b) What is binomial array antenna? What its basic principle of working? Mention the advantages and disadvantages. [7M]

UNIT-IV

7. a) Sketch and explain the constructional modes of a helical antenna. [8M]
   b) Distinguish between resonant and non-resonant antennas. [7M]

(OR)

8. a) Explain about electromagnetic horn antenna. What are the various types of horn and their practical applications? [8M]
   b) Explain the various feeding mechanisms used in parabolic reflector antennas. [7M]

UNIT-V

9. a) Classify the wave propagation based on frequency range. [8M]
   b) Draw the block diagram of basic antenna measurement setup. Explain each part. [7M]

(OR)

10. a) Derive the basic equation of free space propagation. [8M]
    b) Explain how the E-H radiation patterns are measured. [7M]

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Code No: R1932041 **R19** **SET - 2**

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UNIT-I

1. a) Analyze the wave equation for a TE wave and all the field components in a rectangular wave guide. [8M]
   b) Distinguish between the properties of TEM mode of propagation and that of TE and TM type of propagation. [7M]

(OR)

2. a) An air filled rectangular wave guide has dimensions of 0.9" × 0.4" and is supporting T E_{10} mode at a frequency of 9800 MHz. Calculate the wave guide impedance. Calculate the percentage change in this impedance for a 10% increase in the operating frequency. [8M]
   b) Derive the Characteristic impedance of a micro strip lines. [7M]

UNIT-II

3. a) What is meant by the effective area of an antenna? How is it related to the gain? [8M]
   b) Explain the working principle of a 2-wire antenna? [7M]

(OR)

4. a) Explain the following: [8M]
      (i) Beam area
      (ii) Radiation intensity
      (iii) Beam efficiency
      (iv) Directivity.
   b) Explain briefly radiation mechanism in single wire antenna. [7M]

UNIT-III

5. a) Discuss about loop antenna. What are the disadvantages of loop antenna? What are applications loop antennas? [8M]
   b) Calculate the power gain of a half wave dipole whose ohmic losses and directive gain are 7 ohms and 1.64 respectively. [7M]

(OR)

6. a) What is uniform linear array? Discuss the application of linear array and also explain the advantages and disadvantage of linear array? [8M]
   b) Explain the Half-Wavelength Folded Dipole. [7M]

UNIT-IV

7. a) Derive the construction and basic principles of operation of a helical antenna under [8M]
   i) normal mode of operation
   ii) axial mode of operation
   b) Describe the working of microstrip antenna. List the advantages of microstrip antenna. [7M]

(OR)

8. a) What is optimum horn? Explain its important features with equations. [8M]
   b) Explain the principle of working of lens antenna. [7M]

UNIT-V

9. a) Describe the troposphere and explain how ducts can be used for microwave propagation. [7M]
   b) Briefly explain the terms: (i) LOS and Radio Horizon (ii) Effective Earth's radius. [8M]

(OR)

10. a) Discuss the basic characteristics of ground wave propagation. [8M]
    b) What are the factors that affect the propagation of radio waves? [7M]

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Code No: R1932041 **R19** **SET - 3**

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Answer any **FIVE** Questions **ONE** Question from **Each unit**

All Questions Carry Equal Marks

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UNIT-I

1. a) Derive the expressions for cut off frequency, phase constant, group velocity, and phase velocity and wave impedance in rectangular waveguide, for TE modes. [8M]
   b) Explain about dominant and degenerate modes. Draw the sketches of TE and TM mode analysis [7M]

(OR)

2. a) Describe the method of designating the modes of transmission in rectangular waveguides. Why is transmission in the dominant mode most often used in waveguides? [8M]
   b) Show that the TEM, TM_{01} and TM_{10} modes does not exist in a rectangular waveguide. [7M]

UNIT-II

3. a) Derive the relation between directivity and effective aperture of an antenna. [8M]
   b) The radiation resistance of an antenna is 72 Ω and loss resistance is 8 Ω. What is the directivity in db if the power gain is 16? [7M]

(OR)

4. a) Explain the following terms: [8M]
      (i) Beam width
      (ii) Omni directional pattern
      (iii) Side lobe level
      (iv) Field pattern of antenna
   b) Explain the radiation from two-wire antenna. [7M]

UNIT-III

5. a) What is the radiation resistance of antenna? Derive the expression for radiation resistance of half wave length dipole antenna. [8M]
   b) Compare far fields of small loop antenna and short dipole antenna. [7M]

(OR)

6. a) Design Yagi-Uda antenna of 6 elements to provide gain of 12 dB if the operating frequency is 200 MHz. [8M]
   b) Explain the principal of pattern multiplication with an example. [7M]

UNIT-IV

7. a) Discuss advantages of microstrip antennas. Draw the radiation characteristics of rectangular microstrip antenna. [8M]
   b) Sketch and explain the construction, operation of a helical antenna. [7M]

(OR)

8. a) Illustrate the geometrical features of parabolic reflectors. List out the advantages. [8M]
   b) Explain the radiation characteristics of a pyramidal horn antenna with neat diagrams. How is it different from other horn antennas? [7M]

UNIT-V

9. a) Deduce an expression for the critical frequency of an ionized region in terms of its maximum ionization density. [8M]
   b) At what frequency a wave must propagate for the D-region to have an index of refraction 0.5? Given N = 400 electron/c.c. for D-region. [7M]

(OR)

10. a) Define Wave tilt of Ground Wave. Draw the equivalent circuit of a ground. [8M]
    b) Explain the 3-antenna method of measurement of the gain of a horn antenna with necessary relations. [7M]

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UNIT-I

1. a) Derive the wave equations for TM mode in Rectangular Wave guide. [8M]
   b) Starting with the equation for the propagation constant of a mode in a rectangular wave guide, Derive the expression $\lambda = \frac{\lambda_g \lambda_c}{\lambda_g^2 + \lambda_c^2}$, where λ_g is the guide wave length and λ_c is the cutoff wave length. [7M]

(OR)

2. a) Determine the group velocity and phase velocity for a dominant mode propagating through a waveguide of breadth 10 cm at frequency 2.5 GHz. [8M]
   b) Explain the importance of Q-factor estimation in microstrip lines. [7M]

UNIT-II

3. a) What are principle planes? How the antenna beam width is defined in such planes? [8M]
   b) An antenna has a loss resistance 10 ohms, power gain of 20 and directivity 22, calculate its radiation resistance. [7M]

(OR)

4. a) Define the terms: [8M]
      (i) Bandwidth
      (ii) Polarization
      (iii) Effective aperture area.
   b) Draw the equivalent circuit of an antenna. How the EM fields are detached from an antenna? Explain. [7M]

UNIT-III

5. a) Derive the expression for far field components of a small loop antenna. [8M]
   b) Derive the expression for effective area and effective height of dipole antenna. [7M]

(OR)

6. a) Derive the expression for array factor of a linear broadside array of N isotropic elements. [8M]
   b) Find the array factor and plot the normalized radiation pattern of a broadside array of 5 isotropic radiators of spacing $\lambda/2$. [7M]

UNIT-IV

7. a) Discuss various feeding techniques of microstrip antenna. Also list any five applications of patch antennas. [8M]
   b) Write short notes on travelling wave antenna. Explain various types of travelling wave antennas. [7M]

(OR)

8. a) Explain the characteristics of 90^o corner reflector with the help of image principle. [8M]
   b) Write short notes on lens antenna. Discuss different types of lens antennas with neat sketches. [7M]

UNIT-V

9. a) Derive the LOS distance equation in space wave propagation. [8M]
   b) Explain about directivity measurement procedure of a given test antenna. [7M]

(OR)

10. a) Derive the field strength equation at receiving antenna in space wave propagation technique. [8M]
    b) List different sources of errors in antenna measurements. [7M]

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