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15EC71

## Seventh Semester B.E. Degree Examination, Feb./Mar. 2022 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. Explain the construction and operation of the Reflex Klystron using schematic diagram. (07 Marks)
- b. With relevant diagram, explain function of each block (component) of microwave system. (05 Marks)
- c. A reflex klystron is to be operated at frequency of 10 GHz, with dc beam voltage 300 V, repeller space 0.1 cm for  $1\frac{3}{4}$  mode. Calculate maximum RF power and corresponding repeller voltage for a beam current of 20 mA. (04 Marks)

**OR**

- 2 a. With relevant graphs, explain the mode curves of reflex klystron and operating characteristics of it. (06 Marks)
- b. Derive an expression for transmission coefficient of microwave transmission line. Give relationship between transmission coefficient and reflection coefficient. (06 Marks)
- c. A certain transmission line has a characteristic impedance of  $200 + j20$  ( $\Omega$ ) and is terminated in a load impedance of  $300 + j30$  ( $\Omega$ ). Calculate :  
(i) the reflection coefficient (04 Marks)  
(ii) the transmission coefficient.

### Module-2

- 3 a. With suitable diagram and matrix, explain the Scattering representation of the multiport network. (06 Marks)
- b. A 20 mw signal is fed into one of collinear port 1 of a lossless H plane T junction. Calculate the power delivered through each port when other ports are terminated in a matched load. (04 Marks)
- c. With suitable diagram, explain the characteristics of Magic-Tee using Scattering matrix representation. (06 Marks)

**OR**

- 4 a. Briefly explain about Z and Y Matrices formulation of multiport networks. (05 Marks)
- b. Explain the operation of microwave attenuators such as coaxial line fixed attenuator and waveguide attenuator, with diagrams. (06 Marks)
- c. Explain the different types of coaxial connectors and adapters. (For explanation diagram or figures can be used) (05 Marks)

### Module-3

- 5 a. Explain the construction of micro strip line with diagram. Derive an expression for effective Dielectric constant and characteristic impedance of micro strip line. (08 Marks)
- b. Explain the significance of an antenna in microwave communication. And also give definitions of Antenna. Mention the basic antenna elements. Important properties of antenna and functions of antenna. (08 Marks)



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OR

- 6 a. Briefly explain about parallel striplines and coplanar striplines with diagrams. (06 Marks)  
b. Explain the Radio Communication link with relevant diagram. (05 Marks)  
c. Explain the Antenna field zones with diagram. And also explain the energy flow near a dipole antenna. (05 Marks)

**Module-4**

- 7 a. Explain the power patterns in antenna system showing the diagrams of spherical coordinates for a point source of radiation in free space, polar power pattern of isotropic source, power pattern and relative power pattern for same source. (08 Marks)  
b. Explain the principles of pattern multiplication. Give examples of pattern multiplication. Write the relevant diagrams. (08 Marks)

OR

- 8 a. Explain the operation of the short electric dipole with relevant diagram and its equivalent. And also explain the fields of a short dipole with relation of dipole to coordinates and geometry for short dipole. Derive the relevant expressions. (08 Marks)  
b. Explain the operation of the thin linear antenna with approximate natural current distribution for thin, linear, center-fed antenna of various lengths. And also give relations for symmetrical, thin, linear, centre-fed antenna of length L with expressions. (08 Marks)

**Module-5**

- 9 a. Explain the Loop Antenna considering the small loop (circular and square loop of equal area). Give relations of square loop to coordinates. And also sketch the construction for finding far field of the square loop. Derive relevant expressions. (08 Marks)  
b. Explain the operation of the Yagi-Uda Array antenna showing with one reflector and seven directors, with relevant diagram. Explain the history also. (08 Marks)

OR

- 10 a. Explain the types and operating principles of Horn Antennas. Mention the types of rectangular and circular horn antennas. Derive the relevant expressions. (08 Marks)  
b. Explain the parabola-general properties. Draw the relevant diagrams. And also show the :  
(i) Line source and cylindrical parabolic reflector  
(ii) Point source and parabolic reflector. (08 Marks)

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