USN ☐☐☐☐☐☐☐☐☐☐   **15EC71**

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Microwaves and Antennas

Time: 3 hrs.   Max. Marks: 80

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. Smith chart are permitted.

Module-1

1   a. Describe basic principle and working mechanism of oscillation in Reflex Klystron through Apple gate diagram. **(06 Marks)**
     b. What is reflection co-efficient? Obtain an expression for the same. How it is related to standing wave ratio. **(06 Marks)**
     c. A microwave transmission line has a characteristic impedance of $Z_0 = 100 \underline{|53.13°}\ \Omega$ when it is terminated in a unknown load impedance Z_L, the transmission coefficient was observed to be $1.09 \underline{|35.34°}$. Find :
        i) Reflection coefficient
        ii) Terminating load impedance Z_L. **(04 Marks)**

OR

2   a. What are standing waves? How are they formed? Obtain expression for voltage standing wave and phase pattern of travelling wave. **(06 Marks)**
     b. A load impedance of $Z_L = 60 - j80\Omega$ is required to be matched to a 50Ω co-axial line by using a short circuited stub length 'ℓ' located at a distance 'd' from the load. The wave length of operation is 1 mtr. Using Smith chart find 'd' and 'ℓ'. **(06 Marks)**
     c. Obtain expression for line impedance interms of reflection coefficient. **(04 Marks)**

Module-2

3   a. Explain with neat sketches the construction and operation of a precision type variable attenuator. **(06 Marks)**
     b. Consider a losses H-plane TeeJunction with 50mw of power being fed into port(1) and other two ports(2) and (3) are terminated in matched termination. Calculate the power fed into each of the ports by the junction. **(04 Marks)**
     c. Discuss applications of Magic Tee. **(06 Marks)**

OR

4   a. Explain with neat sketches the construction and operation of a H-plane TeeJunction. List the characteristics and hence derive its S Matrix. **(10 Marks)**
     b. Give relations of Z, Y and ABCD parameter with S-parameter. **(06 Marks)**

Module-3

5   a. What are the losses encountered in microstriplines? Discuss briefly. **(06 Marks)**
     b. Find the directivity for the following pattern :
        i) Bidirectional sine squared pattern
        ii) Unidirectional cosine squared pattern. **(06 Marks)**
     c. Find the solid angle Ω in square degrees on a spherical surface for θ ranging between 20° and 40° and ϕ ranging between 30° and 70°. **(04 Marks)**

OR

6 a. Derive an expression for Aem for short dipole. **(06 Marks)**
  b. Obtain an expression for FRIS transmission formula used in radio communication link. **(06 Marks)**
  c. The normalized field pattern of an antenna is given by $E_n = \sin\theta \sin\phi$ where θ and ϕ ranges between 0 and e_{total}. Find the directivity by accurate method and approximate method. **(04 Marks)**

Module-4

7 a. Drive an expression for e total, peaks array factor, side lobes and nulls for linear uniform array for N-isotropic point sources of equal amplitude and spacing. **(06 Marks)**
  b. Obtain an expression for radiation resistance of dipole. **(06 Marks)**
  c. Find length of half wave dipole at 30 MHz. **(04 Marks)**

OR

8 a. Explain various forms of antenna arrays with neat diagram. **(06 Marks)**
  b. A linear array consists of 4 isotropic point sources. The distance between adjacent element $\lambda/2$. The power applied with equal magnitude and phase difference – d_r obtain field pattern and find BWFN and HPBW. **(10 Marks)**

Module-5

9 a. Derive expression for field component for general loop antenna. **(06 Marks)**
  b. Write general characteristics of Yagi-Uda Antenna. **(04 Marks)**
  c. Calculate directivity of 20 turn helix with $\alpha = 12°$ and circumstances equal to one wave length. **(06 Marks)**

OR

10 a. With neat sketch, explain design equation of Horn Antenna. **(06 Marks)**
   b. Write short note on :
   i) Helical antenna
   ii) Log periodic antenna. **(06 Marks)**
   c. Calculate the horn parameters :
   i) Length L
   ii) Width a
   iii) Flare angle θ
   iv) Flare angle ϕ
   If the month height b is 10λ.
   The horn is fed by a rectangular wave guide with TE$_{10}$ mode. **(04 Marks)**

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