CBCS SCHEME

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15TE63

Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Microwave Theory 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. Describe the operation of the reflex klystron oscillator with the aid of suitable diagram. **(08 Marks)**

b. A certain transmission line has a characteristic impedance of $75 + j0.01\Omega$ and it is terminated in a load impedance of $70 + j50\Omega$. Compute:
i) The reflection co-efficient
ii) The transmission coefficient
iii) Show that transmission coefficient equals the algebraic sum of 1 plus the reflection coefficient. **(08 Marks)**

OR

2 a. A lossless line of characteristic impedance $R_o = 50\Omega$ is to be matched to a load $Z_l = \left[\frac{50}{2 + j(2+\sqrt{3})}\right]^{\Omega}$ by means of a short circuited stub. The characteristic impedance of the stub is 100Ω. Find the stub position and length of the stub so that a match is obtained. **(08 Marks)**

b. A reflux Klystron is to be operated at a frequency of 10GHz with the following specifications:
D.C. beam voltage = 300V
Repeller space = 0.1cm
Mode = $1\frac{3}{4}$ mode.
Calculate: i) P_{RFmax} ii) Repeller voltage for a beam current of 20mA. **(04 Marks)**

c. List the applications of the Smith Chart. **(04 Marks)**

Module-2

3 a. Prove that impedance matrices are symmetrical for a reciprocal microwave junction. **(08 Marks)**

b. Define the terms directivity and directional coupling as used with directional coupler and explain their significance. **(08 Marks)**

OR

4 a. Define insertion loss, return loss for multiport networks. **(06 Marks)**

b. Explain the operation of Faraday rotation ferrite isolator. **(06 Marks)**

c. What are the applications of magic-Tee in microwave networks? **(04 Marks)**

Module-3

5 a. Define: Radiation intensity, effective height of an antenna. **(08 Marks)**

b. A lossless parallel strip line has a conducting strip width W. The substrate dielectric separating the two conducting strips has a relative dielectric constant $\in_{rd}$ of 6 and a thickness of 4mm (d). Calculate:

i) The required width w of the conducting strip in order to have a characteristic impedance of 50Ω.

ii) The strip line capacitance

iii) The strip line inductance

iv) The phase velocity of the wave in parallel strip line. **(08 Marks)**

OR

6 a. Show that the effective height and effective aperature are related via radiation resistance and intrinsic impedance of space. **(08 Marks)**

b. A coplanar strip line carries an average power of 250mw and peak current of 100mA. Determine the characteristic impedance of the coplanar strip line. **(04 Marks)**

c. Define: HPBW of an antenna. **(04 Marks)**

Module-4

7 a. Obtain the expression for field pattern E of two isotropic point sources of equal amplitude and same phase. Assume two sources are separated by λ/2. Plot the pattern. **(08 Marks)**

b. A source has a sine squarrel radiation intensity power pattern. Find its directivity. **(04 Marks)**

c. Obtain the pattern factor for the full wave thin linear antenna. **(04 Marks)**

OR

8 a. Obtain the expression for radiation resistance of a short electric dipole. **(08 Marks)**

b. Obtain the total field expression at a large distance for linear arrays of 'n' isotropic-point sources of equal amplitude and spacing. **(08 Marks)**

Module-5

9 a. Derive an expression for the instantaneous electric field E_θ at a large distance 'r' from a loop antenna of radius 'a'. **(10 Marks)**

b. A 16-turn helical beam antenna has a circumference of λ and turn spacing of λ/4 what is i) HPBW ii) axial ratio iii) Power pattern. **(06 Marks)**

OR

10 a. With the aid of appropriate sketches, explain Horn antenna design considerations. **(08 Marks)**

b. With the aid of neat diagram, describe the design considerations of log-periodic antenna. What are the applications of log-periodic antenna array? **(08 Marks)**

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