CBCS SCHEME

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15EC71

Seventh Semester B.E. Degree Examination, July/August 2022
Microwaves and Antennas

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. With the aid of neat sketches, describe Reflex Klystron operation. What do you understand by velocity modulation? **(10 Marks)**

b. Derive the expressions for attenuation and phase constants for RF lines. **(06 Marks)**

OR

2 a. Describe the importance and significance of transit time and mode curve of reflex Klystron tube. **(08 Marks)**

b. A lossless line of characteristic impedance $R_0 = 50\Omega$ is to be matched to a load $Z_\ell = 50/(2+J(2+\sqrt{3})$ ohms by means of a lossless short circuitedstub. The characteristic impedance of the stub is 100Ω. Find the stub position (closest to the load) and length so that a match is obtained (using smith chart). **(08 Marks)**

Module-2

3 a. Justify "Microwave circuits are analysed using scattering parameters and not by the measurement of z, y and ABCD parameters". **(06 Marks)**

b. Show that impedance and admittance matrices are symmetrical for a reciprocal junction. **(04 Marks)**

c. With the aid of neat sketch, explain the working of a Magic–Tee. What are the applications of Magic Tee? **(06 Marks)**

OR

4 a. State and prove symmetry and phase shift property of S-parameters, for junction of ports having common characteristic impedance. **(08 Marks)**

b. A lossless air filled rectangular waveguide has internal dimensions of 'a' cm X 'b' cm. If a = 2b and the cut off frequency of the TE_{02} mode is 12 GHz. Find the cut off frequency of dominant mode. **(04 Marks)**

c. Describe the working of microwave phase shifters. **(04 Marks)**

Module-3

5 a. Write a brief note on coplanar and shielded strip lines. **(06 Marks)**

b. Prove that effective height and effective aperature are related via radiation resistance and the intrinsic impedance of the space. **(06 Marks)**

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

OR

6 a. Obtain the expressions for characteristic impedance and attenuation losses of a parallel strip lines. **(06 Marks)**

b. Derive Frii's transmission formula. **(06 Marks)**

c. Define aperture efficiency of an antenna. **(04 Marks)**

Module-4

7 a. A source with a unidirectional radiation intensity pattern is given by :
$U = U_m COS\theta$
where n is any number n = 1, 2, 3 . . .
Show that the directivity of the source is D = 1(n + 1). **(04 Marks)**

b. Derive expression for total field at par point 'P' when two point sources with currents in equal magnitude but in opposite phase and are separated by $\lambda/2$ apart. Draw the field pattern. **(10 Marks)**

c. What are parasitic arrays? **(02 Marks)**

OR

8 a. Using electric and magnetic potentials obtain the far field components of a short dipole. **(08 Marks)**

b. Write the far – field E_θ of a symmetrical, center fed thin linear antenna. Write pattern factors for $\lambda/2$, full wave, three half wave antenna. **(08 Marks)**

Module-5

9 a. Derive the instantaneous electric field at a large distance 'r' from a loop antenna of any radius a. **(08 Marks)**

b. Describe Log-periodic array geometry. What is the basic concept of LPDA? What is YUCOLP array? **(08 Marks)**

OR

10 a. Discuss the practical design considerations for the axial mode helical antenna. List the important applications of helical antenna. **(08 Marks)**

b. With the aid of diagram, explain Fermat's principle as applicable to the horn antenna design. **(06 Marks)**

c. What is Aperture matched horn? **(02 Marks)**

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