

# 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  $Z_L = 50/(2 + j(2 + \sqrt{3}))$  ohms by means of a lossless short circuited stub. The characteristic impedance of the stub is  $100\Omega$ . 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 aperture 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)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.  
2. Any revealing of identification, appeal to evaluator and/or equations written eg. 42.8 = 50, will be treated as malpractice.

**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  $n = 1, 2, 3 \dots$   
 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  $E_\theta$  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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