

# CBBCS SCHEME



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15EC71

## Seventh Semester B.E. Degree Examination, Dec.2019/Jan.2020 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. List four applications of Reflex Klystron. (04 Marks)  
b. Derive transmission line equations in voltage and current forms. (06 Marks)  
c. A transmission line is terminated in a resistive load of  $1000\Omega$  and has  $L = 9\mu\text{H/m}$  and  $C = 100\text{pF/m}$ . Calculate reflection coefficient and standing wave ratio. (06 Marks)

OR

- 2 a. Define reflection coefficient. Derive an expression for reflection coefficient at load in terms of characteristic impedance and load impedance. (08 Marks)  
b. Explain microwave system with the aid of a diagram. (08 Marks)

### Module-2

- 3 a. For a two port network with mismatched load derive an expression for input reflection coefficient. (06 Marks)  
b. Draw the diagram of Magic-Tee. Derive S-matrix of Magic Tee. (10 Marks)

OR

- 4 a. What is a reciprocal device? Write five point comparison among [S], [Z] and [Y] matrices. (06 Marks)  
b. Given  $[z] = \begin{bmatrix} 3 & 7 \\ 2 & 5 \end{bmatrix}$ . Find S-matrix. (05 Marks)  
c. Explain coaxial line fixed alternator with a diagram. (05 Marks)

### Module-3

- 5 a. Derive characteristic impedance of micro-strip lines. (08 Marks)  
b. Define the following terms with respect to antennas :  
i) Beam area  
ii) Radiation intensity  
iii) Beam efficiency  
iv) Directivity. (08 Marks)

OR

- 6 a. Describe ohmic skin losses and radiation losses in micro-strip lines. (10 Marks)  
b. A parabolic reflector antenna is circular in cross section with a diameter of 1.22m. If the maximum effective aperture is 55% of the physical aperture, calculate gain of the antenna in dB at 20 GHz. (06 Marks)



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Module-4

- 7 a. Prove that directivity for a source with unidirectional pattern of  $U_m \cos^n \theta$ , where 'n' can be any number, can be expressed as  $D = 2(n + 1)$ . (06 Marks)  
b. Obtain field expression of two isotropic point sources of same amplitude and phase. (10 Marks)

OR

- 8 a. State and explain power theorem. (06 Marks)  
b. Derive an expression for radiation resistance of short electric dipole. (10 Marks)

Module-5

- 9 a. Find directivity and radiation resistance of a loop antenna with diameter of  $2\lambda$ . (06 Marks)  
b. Write a short note on Helical antenna geometry. (06 Marks)  
c. What is the directivity in dB of a rectangular horn antenna, which has physical aperture of  $81\lambda^2$ , with aperture efficiency 89%? (04 Marks)

OR

- 10 a. Derive radiation resistance of a small single turn circular loop antenna with uniform phase current. (08 Marks)  
b. Draw the structure of a pyramidal horn antenna. Use the principle of equality of path length and bring out the optimum horn dimensions. (08 Marks)

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