



# CBCS SCHEME

15EC71

## Seventh Semester B.E. Degree Examination, July/August 2021 Microwave and Antennas

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions.

- 1 a. Derive the general transmission line equation to find voltage and current on the line in terms of position 'z' and time 't'. (08 Marks)  
b. With a neat diagram, explain the operation of Reflex Klystron. (08 Marks)
- 2 a. Define transmission coefficient. Derive the equation for transmission coefficient of power transmission line. (08 Marks)  
b. A transmission line has a characteristic impedance of  $75 + j0.01\Omega$  and is terminated in a load impedance of  $70 + j50\Omega$ . Compute :  
i) Reflection coefficient  
ii) Transmission coefficient  
iii) Verify relation between reflection and transmission coefficient  
iv) Verify  $T = 1 + \Gamma$ . (08 Marks)
- 3 a. Explain non-reciprocal phase shifter with a neat diagram. (08 Marks)  
b. In an H-plane T-junction, compute power delivered to the loads of  $40\Omega$  and  $60\Omega$  connected to arms 1 and 2 when a  $10\text{mw}$  power is delivered to the matched port 3. (08 Marks)
- 4 a. What are waveguide tees? Explain its types. (08 Marks)  
b. Briefly explain the applications of Magic - T. (08 Marks)
- 5 a. Explain the losses in microstrip lines. (08 Marks)  
b. A lossless parallel strip line has a conducting strip width  $w$ , the substrate dielectric constant  $\epsilon_{rd}$  of 6 (BeO) and a thickness 'd' of 4mm. Calculate :  
i) Width  $w$  of the strip to have a characteristic impedance of  $50\Omega$   
ii) Strip-line capacitance  
iii) Strip-line inductance  
iv) Phase velocity of wave in parallel strip line. (08 Marks)
- 6 a. Define directivity. Derive the relation between :  
i) Directivity and beam solid angle  
ii) Directivity and effective aperture. (08 Marks)  
b. Show that maximum effective aperture of  $\lambda/2$  dipole ( $A_{em}$ ) =  $0.13\lambda^2$  and Directivity = 1.63. (08 Marks)

- 7 a. Derive an expression and draw the field pattern for an array of two isotropic point sources with equal amplitude and opposite phase. (08 Marks)
- b. Find the power and directivity of :
- i)  $U = U_m \sin^2 \theta$  for  $0 \leq \theta \leq \pi$  ;  $0 \leq \phi \leq 2\pi$
- ii)  $U = U_m \cos^2 \theta$  for  $0 \leq \theta \leq \pi/2$  ;  $0 \leq \phi \leq 2\pi$ . (08 Marks)
- 8 a. Derive the radiation resistance of thin  $\lambda/2$  antenna. (08 Marks)
- b. Explain :
- i) Power theorem
- ii) Multiplication pattern. (08 Marks)
- 9 a. Derive the radiation resistance of small loop. (08 Marks)
- b. Explain in brief with neat figure.
- i) Horn Antenna
- ii) Yagi Uda Antenna. (08 Marks)
- 10 a. With neat diagram, explain the following
- i) Log periodic antenna
- ii) Helical antenna. (08 Marks)
- b. Find the directivity, beam width and effective area of the parabolic reflector for which the reflector diameter is 6m and aperture efficiency is 0.65. The frequency of operation is 10GHz. (08 Marks)

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