CBCS SCHEME

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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 interms 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 40Ω and 60Ω connected to arms 1 and 2 when a 10mw 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 $\in_{rd}$ of 6 (BeO) and a thickness 'd' of 4mm. Calculate :
i) Width w of the strip to have a characteristic impedance of 50Ω
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 (Aem) = $0.13\lambda^2$ 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 $0 \le \theta \le \pi$; $0 \le \phi \le 2\pi$

ii) $U = U_m \cos^2\theta$ for $0 \le \theta \le \pi/2$; $0 \le \phi \le 2\pi$. **(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 apperature efficiency is 0.65. The frequency of operation is 10GHz. **(08 Marks)**

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