CBCS Scheme

USN | | | | | | | | | | |

15TE63

Sixth Semester B.E. Degree Examination, June/July 2018
Microwave Theory and Antennas

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing one full question from each module.
2. Smith Chart is permitted.

Module-1

1 a. What are the high frequency limitations of conventional vacuum tubes/transistors? **(04 Marks)**

b. Describe the construction and working of a microwave tube that can be used as a low power microwave oscillator. **(08 Marks)**

c. A Reflex Klystras to be operated at frequency of 10GHz with d.c. beam voltage 300V, repeller space 0.1cm for '$1\frac{3}{4}$'mode. Calculate P_{RFmax} and corresponding repeller voltage for a beam current of 20mA. **(04 Marks)**

OR

2 a. Derive the transmission line equations by the method of distributed circuit theory. **(08 Marks)**

b. What is a stub? A single stub is used in shunt to match a lossless line of 400Ω to a load of 800 – j300Ω. The frequency of operation is 3GHz. Determine the 'location' of the stub from the load and the 'length' of the stub using Smith Chart. **(08 Marks)**

Module-2

3 a. Explain the following losses in microwave circuits/devices in terms of S-parameters:
i) Insertion loss ii) Transmission loss iii) Reflection loss iv) Return loss. **(08 Marks)**

b. Two transmission lines of characteristic impedance Z_1 and Z_2 are joined at plane P – P^1. Explain the S-parameters in terms of impedances. **(08 Marks)**

OR

4 a. With a neat diagram, explain the working of precision type variable attenuator. **(08 Marks)**

b. Stating the features of magic tee, with a neat diagram, explain the function of magic tee and deduce its s-matrix. **(08 Marks)**

Module-3

5 a. Explain with neat diagram, the structure and field pattern of microstrip line and derive expression for characteristic impedance 'Z_0'. **(08 Marks)**

b. A lossless parallel strip line has a conducting strip width of 'W', the substrate dielectric separating the two conducting strips has a relative dielectric constant t_{rd} of '6' and thickness 'd' of 4mm. Calculate:
i) The required width 'w' of the conducting strip in order to have a characteristic impedance of 50Ω.
ii) The strip line capacitance.
iii) The strip line inductance.
iv) The phase velocity of the wave. **(08 Marks)**

OR

6 a. Define the following parameters of an antenna: i) Directivity ii) Beam area. **(06 Marks)**

b. An antenna has a field pattern given by $E(\theta) = \cos\theta \cos 2\theta$ for $0 \le \theta \le 90°$. Find: i) HPBW ii) Beam width between first nulls. **(04 Marks)**

c. State and prove Friis transmission formula. **(06 Marks)**

Module-4

7 a. State and prove power theorem and explain its application to an isotropic source. **(04 Marks)**

b. Explain the principle of pattern multiplication with an example. **(08 Marks)**

c. The radiation intensity of an antenna is given by

$U = U_m \sin\theta$ for $0 \le \theta \le \pi$, $0 < \phi \le 2\pi$ and Find Directivity 'D'. **(04 Marks)**

OR

8 a. Derive expression for radiation resistance of a short electric dipole. **(08 Marks)**

b. Show that the radiation resistance of a linear $\lambda/2$ antenna with sinusoidal current distribution is equal to 73Ω. **(08 Marks)**

Module-5

9 a. The diameter of a circular loop antenna is 0.04λ. How many turns of antenna will give a radiation resistance of 36Ω? **(06 Marks)**

b. Explain the features and practical design consideration of a Mono filar Helical Antenna. **(10 Marks)**

OR

10 a. With a neat diagram, explain the operation of log-periodic antenna. **(08 Marks)**

b. Obtain the radiation resistance of a Small Loop Antenna. **(08 Marks)**

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