B.E. (Electronics Engineering / Electronics & Telecommunication / Electronics & Communication Engineering / Electronics Design Technology) Sixth Semester

Fields and Radiating Systems

P. Pages : 2

Time : Three Hours

0330

Max. Marks : 80

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Notes :
1. Same answer book must be used for Both section.
2. All questions carry marks as indicated.
3. Answer **Three** questions from Section A and **Three** questions from Section B.
4. Due credit will be given to neatness and adequate dimensions.
5. Assume suitable data wherever necessary.
6. Illustrate your answers wherever necessary with the help of neat sketches.
7. Use of slide rule, Logarithmic tables, Steam tables, Mollier's chart, Drawing instruments, Thermodynamic tables for moist air, Psychrometric charts and Refrigeration charts is permitted.

SECTION – A

1. a) Derive expression for field components of TM waves guided by parallel conducting planes. Also sketch field patterns for TM_{10} and TM_{11} waves. **8**

 b) Draw and explain the attenuation Vs frequency characteristics of waveguide between parallel conducting planes. **5**

2. a) Show that the geometric mean of phase velocity (V_p) and group velocity (V_g) is always the free space velocity (v). **7**

 b) A pair of perfectly conducting planes are separated by 8 cm in air for the frequency of 5 GHz with TM_{10} mode excited. Find the following : **6**
 i) Cut off frequency.
 ii) Characteristics ware impedance.
 iii) Phase shift constant.
 iv) Wavelength.
 v) Group Velocity.
 vi) Attenuation at frequency 0.95 fc.

3. a) Derive the expression for field components of a TE wave guided by the Rectangular waveguide. **8**

 b) A hollow rectangular waveguide measures (3×1.5) cm internally and has 9 GHz signal propagating in it. Calculate cut off wave length, the guide wavelength, phase velocity, group velocity and characteristics impedance for the TE_{10} mode. **6**

4. a) What is standing wave pattern? Draw voltage and current distribution curves for following load conditions : **7**
 i) $Z_R = $ Short Circuit
 ii) $Z_R = $ Open Circuit
 iii) $Z_R = Z_0$
 iv) $Z_R = $ Inductive Load

b) Prove that input impedance of an infinite transmission line is equal to its characteristics impedance. **6**

5. a) By deriving the expression for input impedance of low loss transmission line. Prove that : $Z_0^2 = Z_{SC} \cdot Z_{OC}$. **7**

b) An impedance of $(50 + j50)\,\Omega$ is used as a load on transmission line of characteristics impedance $50\,\Omega$ using smith chart. **6**
Find :
i) Reflection coefficient in magnitude and phase.
ii) VSWR
iii) The distance of first voltage maxima from the load.

SECTION – B

6. a) Explain "Induction Field" and "Radiation Field". Prove that for distance $r = \dfrac{\lambda}{6}$ from the current element both the fields are equal. **7**

b) State the Reciprocity theorem applied to antenna and with the help of it prove that the effective length of a antenna for receiving is equal to its effective length as transmitting antenna. **7**

7. a) Given that average power radiated by a current carrying element is $\dfrac{\eta}{2}\,\dfrac{(WIdl\,\sin\theta)^2}{4\pi r \nu}$ find the expression for the total Radiated power. Also find Radiation Resistance. **8**

b) A transmitting antenna with an effective height of 100 m has a current of 100 amperes at a frequency of 300 KHz. **5**
Find :
i) Electric field strength at a distance of 100 km.
ii) Radiation Resistance.   iii) Power Radiated.

8. a) Explain difference between driven and parasitic elements in an antenna array. What is difference between reflector and director? **6**

b) Two isotropic radiators are placed at a distance of half wavelength and are fed with equal amplitude is phase and current. Derive the expression for radiated electric field and plot the same as a directional pattern. **7**

9. a) An end-fire array composed of $\dfrac{1}{2}$ radiators with axes at right angles to the line of the array required to have a power gain of 20. Determine the array length and the width of a major lobe between the nulls. **7**

b) Write short note on End – Fire array. **6**

10. a) Show that input Impedance of folded dipole antenna is four times that of a simple dipole antenna. **6**

b) Write short notes on **any two.** **7**
i) Cassegrain Antenna.
ii) Log periodic Antenna.
iii) Travelling Wave Antenna.

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