Paper:Transmission Lines, Antenna and Wave propagation (DSE)

Course : B.Sc. (H) Electronics **Mock Examination Semester : VI**
Duration : 3.5 hours **Maximum Marks : 75**

Instructions for candidates

1.There are seven questions in all, out of which you have to attempt any five questions.
2. All questions carry equal marks

Q1.(a)What do you understand by reflection of plane wave at oblique incidence? Explain. Find the expression for Fresnal's equation for parallel polarization.
(b) A uniform plane wave in air with $E = 8 \cos (at - Ax - 3z)\, a_y$ V/m is incident on a dielectric slab ($z \geq 0$) with $\mu_r = 1.0$, $\varepsilon_r = 2.5$, $\sigma = 0$. Find (a) The polarization of the wave (b) The angle of incidence (c) The reflected E field (d) The transmitted H field. (7,8)

Q2. (a) Derive the expressions for propagation constant and characteristics impedance in terms of lumped parameters of a transmission line.
(b)A distortionless line has $Zo = 60\ \Omega$, $\alpha = 20$ mNp/m, $u = 0.6c$, where c is the speed of light in a vacuum. Find R, L, G, C, and λ at 100 MHz. (7,8)

Q3. (a) Derive the field expressions for TM mode in a rectangular waveguide. Also find the cut-off frequency, cut-off wavelength, intrinsic impedance and phase constant of TM mode of propagation.
(b)A standard air-filled rectangular waveguide with dimensions a = 8.636 cm, b = 4.318 cm is fed by a 4-GHz carrier from a coaxial cable. Determine if a TE10 mode will be propagated. If so, calculate the phase velocity and the group velocity. (7,8)

Q4.(a) Obtain the expression for electric field and magnetic field of a Hertzian Dipole Antenna at far zone.
(b) An electric dipole of length 50 cm is situated in free space. If the maximum value of the current is 25A and its frequency is 10MHz, determine the electric and magnetic fields in the far zone, average power density and radiation resistance. (8,7)

Q5.(a) What are transmission lines and it'sapplications. Derive the expression for the input impedance of a distortion less transmission line of characteristics impedance Z_0 and load impedance Z_L.
(b)A 30-m-long lossless transmission line with $Z_o = 50\ \Omega$ operating at 2 MHz is terminated with a load $Z_L = 60 + j40$ 0. If $u = 0.6c$ on the line, find (a) The reflection coefficient (b) The standing wave ratio and (c) The input impedance (7,8)

Q6.(a) What do mean by an isolator? Explain. What are the its applications?
(b)An air-filled rectangular waveguide of dimensions a = 4 cm, b = 2 cm transports energy in the dominant mode at a rate of 2 mW. If the frequency of operation is 10 GHz, determine the peak value of the electric field in the waveguide. (7,8)

Q7. (a) Derive the radar equation? Define (i) Antenna Pattern (ii) Radiation Intensity (iii) Directive Gain (iv) Power Gain.
(b) A magnetic field strength of 5 μA/m is required at a point on $\theta = \pi/2$, 2 km from an antenna in air. Neglecting ohmic loss, how much power must the antenna transmit if it is (a) A Hertzian dipole of length $\lambda/25$? (b) A half-wave dipole? (c) A quarter-wave monopole? (d) A 10-turn loop antenna of radius $\rho_o = \lambda/20$? (8,7)

Physical Constants; $\varepsilon_o = 8.854 \times 10^{-12}$ F/m; $\mu_o = 4\pi \times 10^{-7}$ H/m; $c = 3 \times 10^8$ m/s