

9231A

[This question paper contains two printed pages]

Unique Paper Code : 2513010015
Name of the Course : B.Sc. (H) Electronics (NEP))
Name of the Paper : Transmission Lines, Antenna and Wave Propagation (DSE)
Semester : VI
Duration : 3 Hours
Maximum Marks : 90

(Write your Roll No. on the top immediately on the receipt of this question paper)

Question No.-1 is compulsory, Attempt five questions in all.

All questions carry equal marks.

(Use of scientific calculator is allowed)

- Q1. (a) What are phase matching condition for oblique incidence. (3)
(b) In free space $E(z, t) = 10 \sin(\omega t + \beta z) \hat{a}_y V/m$. Find $H(z, t)$. (3)
(c) Show that the input impedance of shorted line with $\beta l < \pi/2$ acts as an inductor. (3)
(d) What is waveguide resonator. What is resonating frequency of resonator operating in transverse electric mode. (3)
(e) Explain how quarter-wave transformer is used for impedance matching. (3)
(f) Define the term- electrostatic field, inductive field and far field region of an antenna. (3)
- Q2. (a) Derive the expressions for Fresnell's equations for oblique incidence with electric field intensity vector perpendicular to plane of incidence. (10)
(b) Prove Snell's law for a plane wave at oblique incidence. (8)
- Q3. (a) What is difference between phase velocity and group velocity of a wave. (6)
(b) Find the input impedance and standing wave ratio of – shorted line, open circuited line and matched line. (8)
(c) Find the Standing wave ratio of a transmission line with characteristic impedance 75Ω and load impedance 35Ω . (4)
- Q4. (a) Find the expression for input impedance of a lossless transmission line of characteristic impedance Z_0 and load impedance Z_L . (10)
(b) Prove that maximum power is delivered to the load when reflection coefficient is zero. (8)
- Q5. (a) Derive the electric and magnetic field expressions for Transverse Magnetic mode in a rectangular waveguide. (10)
(b) Which type of mode is not supported by hollow rectangular waveguide and why. (3)

(c) A rectangular waveguide with dimension $a = 2.5\text{cm}$ and $b = 1\text{cm}$ is to operate below 10.5GHz . How many TE and TM modes can the waveguide transmit if the guide is filled with a medium characterized by $\sigma = 0$, $\mu_r = 1$, $\epsilon_r = 4$. Calculate the cut-off frequencies of the modes. (5)

Q6. (a) Explain antenna characteristics- Antenna Patterns, Radiation Intensity, Directive Gain and Power Gain. (12)

(b) Show that the directive gain of the Hertzian dipole is $G_d(\theta, \Phi) = 1.5\sin^2(\theta)$. (6)

Q7. (a) Derive the Radar range equation. (12)

(b) A Radar transmitting at 3GHz radiates 200kW . Determine signal power density at range 100 km if the effective area of the radar antenna is 10m^2 . (6)