Printed Pages – 7

328456 (28)

BE (4th Semester)

Examination, Nov-Dec 2021

Branch : Et & T

ELECTROMAGNETIC FIELDS & TRANSMISSION LINES (NEW)

Time Allowed : Three Hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note : (a) Part (a) of each question is compulsory.

(b) Attempt any two parts from (b), (c), (d).

Unit-I

Q. 1. (a) Define divergence of a vector and write the expression associated with different co-ordinate system ? 2

(b) Given point P(–2, 6, 3) and vector $A = ya_x + (x + z)\, a_y$, express P and A in cylindrical coordinate system. 7

(c) Three equal point charges of 2 μC are in free space at (0, 0, 0), (2, 0, 0) and (0, 2, 0), respectively. Find the net force on $Q_4 = 5$ μC at (2, 2, 0). 7

(d) Three parallel line charges $P_{L1} = 5$ nC/m, $P_{L2} = 4$ nC/m and $P_{L3} = -6$ nC/m are located at (0, 0), (3, 0) and (0, 4) m, respectively. Find D and E. 7

Unit-II

Q. 2. (a) Define Gauss's law and mention its application for D at different charge distribution. 2

(b) An electric dipole represented by 0.1 a_y nC-m is at origin. Find the potential at point (0, 10, 0). 7

(c) Consider concentric shells in free space in which V = 0 Volts and r = 10 cm and V = 10 Volts at r = 20 cm. Find E and D. 7

(d) In a spherical region, the electric displacement is given by $D = 10\ r^2\ a_r\ mC/m^2$. Find the total charge enclosed by the volume specified by r = 40 cm $\theta = \frac{\pi}{4}$ and $\phi = 2\pi$. 7

Unit-III

Q. 3. (a) If a magnetic field $H = 3a_x + 2a_y$ A/m exists at a point in free space, what is the magnetic flux density at the point ? 2

(b) Define Biot-Savart's law and derive the expression for magnetic field due to infinitely long current element. 7

(c) An electron has a velocity of 1 km/s along a_x in magnetic field whose magnetic flux density is $B = 0.2\ a_x - 0.3\ a_y + 0.5\ a_z$ Wb/m^2. 7

(i) Determine the electric field intensity if no force is applied to the electron

(ii) Also find the force on the electron under the influence of both E and B when

$E = (a_x + a_y + a_z)$ kV/m

(d) Two homogeneous, linear and ISO isotropic media have an interface at $x = 0$. $x < 0$ describes medium 1 and $x > 0$ describes

medium 2. $\mu_{r_1} = 2$, $\mu_{r_2} = 5$. The magnetic field in medium 1 is $150\ a_x - 400\ a_y + 250\ a_z$ A/m. 7

Calculate :

(i) Magnetic field in medium 2

(ii) Magnetic flux density in medium 1

Unit-IV

Q. 4. (a) Define Faraday's law and write the Maxwell's equation derived from it. 2

(b) Given $E = 10 \sin (wt - \beta z)\ a_y$ V/m in free space, determine D, B, H. 7

(c) Write the Maxwell's equation in time varying fields both in differential and integral form and also write its word statement. 7

(d) State and prove Poynting theorem. 7

Unit-V

Q. 5. (a) Define standing wave ration in transmission line and express its relation with reflection coefficient. 2

(b) Derive an equation for transmission line terminated by load impedance Z_L. 7

(c) Explain quarter wave transformer (matching) technique in transmission line. 7

(d) A lossless transmission line of length 100 m long has an inductance of 28 μH and a capacitance of 20 nF. Find : 7

(i) Propagation velocity

(ii) Phase constant at an operating frequency of 100 kHz

(iii) Characteristic impedance of line