Total No. of Questions – [8] Total No. of Printed Pages 2+1

G.R. No.	

Paper Code: U359-134(ESE)

DECEMBER 2019/ENDSEM

T. Y. B. TECH. (E & Tc) (SEMESTER - I)

COURSE NAME: Electromagnetic Engineering

COURSE CODE: ETUA31174

(PATTERN 2017)

Time: [**2 Hours**] [Max. Marks: **50**]

(*) Instructions to candidates:

1) **Answer Q.1 ,Q.2, Q.3 ,Q.4, Q.5 OR Q.6, Q.7 OR Q.8**
2) **Figures to the right indicate full marks.**
3) **Use of scientific calculator is allowed**
4) **Use suitable data where ever required**

Q.1) a) Find constants a, b, c such that field V is irrotational and is given as
$V=(x+2y+az)\mathbf{a_x}+(bx-3y-z)\mathbf{a_y}+(4x+cy+2z)\mathbf{a_z}$ [6 marks]

OR

b) a) Find (scalar) distance between following points -
i) A(2, π/6,0) and B(1, π, 2) ii) P(1, π /4, 0) and Q(1,3 π /4, π) [6 marks]

Q.2) a) The spherical surfaces r=1m, 2m, 3m carry surface charge densities of 20 nC/m^2, -9 nC/m^2, 2nC/m^2 respectively, i) How much flux leaves surface with r=5m ii) Find **D** at P(1,-1,2) [6 marks]

OR

b) Derive Electric field intensity **E** due to infinite long conductor having uniform charge density ρ_l [6 marks]

Q.3) a) Derive Magnetic field intensity on axis of a circular loop carrying current I. [6 marks]

OR

b) An infinite long straight filament carrying current of 3 A is placed along z-axis. Calculate Magnetic field intensity at point P (1,2,1) [6 marks]

Q.4) a) Derive Boundary conditions for electric field crossing boundary between two different dielectrics. [4 marks]

OR

b) Determine whether given potential field satisfies Laplace's equation.
$V = x^2-y^2+z^2$ [4 marks]

Q. 5) a) Moist soil is having conductivity of 10^{-3} S/m and ε_r =2.5. If electric field intensity $\mathbf{E}=4.5\times10^{-6}\sin(8\times10^{9})t$, find conduction current density and displacement current density. [6 marks]

b) Write down Maxwell's equations in point form and integral form for time varying fields. [4 marks]

c) Write the following time harmonic field as phasors

$\mathbf{H}$ = 4 sin ωt $\mathbf{a_x}$ +3 cos ωt $\mathbf{a_y}$ [4 marks]

OR

Q.6) a) Derive expression for displacement current and hence corresponding Maxwell's equation for time varying field in point form. [6 marks]

b) In a non magnetic material (ε_r=0, $\mu=\mu_0$, σ=0), given $\mathbf{H}$= 30 cos($2\pi\times10^{8}t$-6x) $\mathbf{a_y}$ mA/m. Find Poynting vector **P.** [4 marks]

c) State and explain Poynting theorem. [4 marks]

Q.7) a) An electric field E in free space is given as $\mathbf{E}$ =800 cos($10^{8}t$ -βy) $\mathbf{a_z}$ V/m. Find β, λ, $\mathbf{H}$ at point P(0.1,1.5,0.4) at 8 nsec [6 marks]

b) Derive following parameters for plane waves in good conductors- α, β, u, η [4 marks]

c) Derive wave equation for free space in terms of $\mathbf{E}$. [4 marks]

OR

Q.8) a) The electromagnetic wave propagates in free space. Its fields are given by $\mathbf{E}$ = 30 π $e^{j(10^{8}t+\beta z)}\mathbf{a_x}$ V/m. $\mathbf{H}$ = H_0 $e^{j(10^{8}t+\beta z)}\mathbf{a_y}$ V/m. Find H_0 and β [6 marks]

b) In free space $\mathbf{E}$= 20 cos(ωt-50x) $\mathbf{a_y}$ V/m calculate $\mathbf{J_d}$, ω [4 marks]

c) Derive wave equation for free space in terms of $\mathbf{H}$. [4 marks]