QPC: RD19BTECH035 AR 19 Reg. No

GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Third Semester – Regular) Examinations, December – 2020

BPCEL 3040 /BPCEE3040 – Electromagnetic Fields

(EE& EEE)

Time: 2hrs Maximum: 50 Marks

The figures in the right hand margin indicate marks.

PART – A: (Multiple Choice Questions) **(1 x 10 =10 Marks)**

Q.1. Answer *ALL* questions

a. At cartesian point (-3,4,-1), which of these is incorrect?
   (i) $\rho = -5$ (ii) R=√26
   (iii) Θ=$\tan^{-1}$(5/-1) (iv) φ =$\tan^{-1}$(4/-3)

b. Where surfaces $\rho = 2$ *and* $z = 1$ *intersect is*
   (i) an infinite plane (ii) a circle
   (iii) a semi-infinite plane (iv) a cylinder

c. Which of these is not valid at point (0, 4,0)?
   (i) $a_\varphi = -a_x$ (ii) $a_\theta = -a_z$
   (iii) $a_r = 4a_y$ (iv) $a_\rho = a_y$

d. Which of the following potentials does not satisfy Laplace's equation?
   (i) V=2x+5 (ii) V=10 xy
   (iii) V=r cosφ (iv) V=10/r

e. Which of these statements is not characteristics of a static magnetic field?
   (i) It is solenoidal (ii) It is conservative
   (iii) It has no sinks or sources (iv) Magnetic flux lines are always closed

f. Point charges Q_1 = 1nC and Q_2 = 2nC are at a distance apart. Which of the following statements are incorrect?
   (i) The force on Q1 is repulsive (ii) The force on Q_2 is the same in magnitude as that of Q1
   (iii) As the distance between them decreases, the force on Q_1 increases linearly and a point charge Q_3=-3nC located at the mid point between Q_1 and Q_2 experiences no net force (iv) The force on Q_2 is along the line joining them

g. By saying that the electrostatic field is conservative, we do not mean that
   (i) It is the gradient of a scalar potential (ii) Its circulation is identically zero
   (iii) Its curl is identically zero (iv) The potential difference between any two points is zero

h. Suppose a uniform electric field exists in the room in which are working, such that the lines of force are horizontal and at aright angles to one wall. As you walk towards the wall from which the lines of force emerge in to the room, are you walking toward
   (i) Points of higher potential? (ii) Points are lower potential?
   (iii) Points of the same potential? (equipotential line?) (iv) None of the above

i. A loop is rotating about the y-axis in a magnetic field B=B0 sin w tax Wb/m2. The voltage induced in the loop is due to
   (i) Motional emf (ii) Transformer emf
   (iii) A combination of motional and transformer emf (iv) None of the above

j. What is the major factor for determining whether a medium is free space, a lossless dielectric, a lossy dielectric or a good conductor?

(i) Attenuation constant (ii) Constitutive parameters (Є, σ, μ)
(iii) Loss tangent (iv) Reflection coefficient

PART – B: (Short Answer Questions) (2 x 5=10 Marks)

Q.2. Answer ***ALL*** questions

a. State Divergence theorem and its significance?
b. Give the expression for energy stored in static electric field?
c. What is potential gradient?
d. Define Vector Magnetic Potential and its unit?
e. What is the Wave equation in free space?

PART – C: (Long Answer Questions) (6 x 5=30 Marks)

Answer ***ANY FIVE*** questions Marks

3. Explain the cylindrical coordinate system and relationship between cartesian to cylindrical system, write transformation of vector 'A' in matrix form? (6)
4. Find the curl of the following vectors: (6)
   (a) $A = e^{xy}a_x + \sin xy\, a_y + \cos^2 xz a_z$
   (b) $B = \rho z^2 \cos\varphi a_\rho + z \sin^2 \varphi a_z$
   (c) $C = r\cos\theta a_r - 1/r \sin\theta a_\theta + 2r^2 \sin\theta a_\varphi$
5. Derive the relation between electric field intensity and electric potential. (6)
6. Write the general procedures for solving Poisson's or Laplace's Equation? (6)
7. Given the magnetic vector potential A equal to $-\rho^2/4\ a_z$Wb/m. Calculate the total magnetic flux crossing the surface $\varphi=\pi/2$, $1 \le \rho \le 2$ m, $0 \le z \le 5$m. (6)
8. Derive the magnetic field intensity 'H' for a infinite sheet current using ampers's Circuit law? (6)
9. State the Faraday's laws of electromagnetic induction and derive the expressions for the motional e.m.f.s.? (6)
10. In a lossless dielectric for which $\eta=60\pi, \mu_{r=1}$ and $\mathbf{H}=-0.1\cos(\omega t-z)a_x+0.5\sin(\omega t-z)a_y$ A/m, calculate ε_r, ω and **E.** (6)

--- End of Paper ---