Reg. No. :

Question Paper Code : 90198

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019
Third Semester
Electrical and Electronics Engineering
EE8391 – ELECTROMAGNETIC THEORY
(Regulations 2017)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions

PART – A **(10×2=20 Marks)**

1. State Coulombs law.
2. Given vector field $\vec{G} = (y-1)\vec{a_x} + 2x\vec{a_y}$. Find this vector field at P(2, 3, 1) and its projection on $\vec{B} = 5\vec{a_x} - \vec{a_y} + 2\vec{a_z}$.
3. How is electric energy stored in a capacitor ?
4. What are equipotential surfaces ?
5. Write down the expression for magnetic field at the centre of the circular coil.
6. What is energy density in magnetic field ?
7. Mention the significance of displacement current.
8. State Maxwell's fourth equation.
9. What will happen when the wave is incident obliquely over dielectric-dielectric boundary ?
10. Define skin depth.

PART – B (5×13=65 Marks)

11. a) Calculate the line integral of the vector field $\vec{F} = 2x\hat{i} + 3y\hat{j} + 4z\hat{k}$ along the following two paths joining the origin to the point P(1, 1, 1).

i) Along a straight line joining the origin to P.

ii) Along a path parameterized by $x = t$, $y = t^2$, $z = t^3$.

From the result of this problem, can you conclude that the force is conservative ? If so, determine a potential function for this vector field.

(OR)

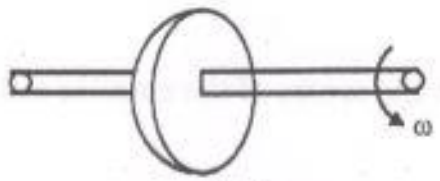
b) Calculate the flux of the vector field $\vec{F} = xy\hat{i} + yz\hat{j} + zx\hat{k}$ over the surface of a unit cube whose edges are parallel to the axes and one of the corners is at the origin. Use this result to illustrate the divergence theorem.

12. a) Find Electric Field due to a charged ring on its axis.

(OR)

b) If $\varphi(r, \theta, \phi)$ satisfies Laplace's equation inside a sphere, show that the average of $\varphi(r, \theta, \phi)$ over the surface is equal to the vale of the potential at the origin.

13. a) A long cylindrical wire has a current density flowing in the direction of its length whose density is $J = J_0 r$, where r is the distance from the cylinder's axis. Find the magnetic field both inside and outside the cylinder.



(OR)

b) Derive Vector potential for a Uniform Magnetic field.

14. a) A charge q is moving with a uniform velocity $\vec{v}$. Obtain its Poynting vector and show that the energy propagates along with the moving charge.

(OR)

b) A conductor 1 cm in length is paralle to z-axis and rotates at radius of 25 cm at 1200 rpm. Find induced voltage, if the radial field is given by $\vec{B} = 0.5\vec{a}_r$ T.

15. a) Discuss the propagation of electromagnetic wave at the interface between two dielectric media.

(OR)

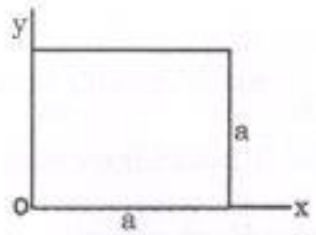
b) A circularly polarized electromagnetic wave is given by :

$\vec{E} = E_0 \sin(kz - \omega t)\hat{x} + E_0 \cos(kz - \omega t)\hat{y}$.

Show that the average value of the Poynting vector for the wave is equal to the sum of the Poynting vectors of its components.

PART – C **(1×15=15 Marks)**

16. a) A square loop of side a lies in the xy plane, as shown. A magnetic field exists in the region directed along the z direction and varies with time and space as $\vec{B} = B_0 t^2 x\hat{k}$, where B_0 is appropriately dimensioned. Calculate the emf developed in the loop. If the x component of the induced electric field is zero, obtain an expression for the electric field induced and show that the line integral of the electric field correctly gives the emf calculated.



(OR)

b) Obtain an expression for the Laplacian operator in the cylindrical coordinates.