KINGS

COLLEGE OF ENGINEERING

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

QUESTION BANK

SUB.NAME : ELECTROMAGNETIC FIELDS SUBJECT CODE : EC 2253
YEAR / SEMESTER : II / IV

UNIT- I - STATIC ELECTRIC FIELDS

PART-A (2 Marks)

1. Describe what are the source of electric field and magnetic fields?
2. What is a scalar quantity?
3. What is a vector quantity?
4. Define vector product of two vectors.
5. Find the dot product of the vectors A and B if $A = 2a_x - 3a_y + 4a_z$, $B = -a_x + 2a_y + 2a_z$.
6. Write down expression for x,y,z in terms of spherical co-ordinates r,θ and Φ.
7. Represent point P (0, 1, 1) m given in Cartesian co-ordinates in spherical co-ordinates.
8. Give any three co ordinate systems.
9. Express the value of differential volume in rectangular and cylindrical co-ordinate systems.
10. Write expression for differential length in cylindrical and spherical co- ordinates.
11. What is physical significance of divergence of D?
12. Express the divergence of a vector in the three system of orthogonal Co-ordination.
13. State divergence theorem.
14. State Stoke's theorem.
15. How is the unit vectors defined in three co ordinate systems?

PART-B (16 Marks)

1. The electric field in a spherical co-ordinate is given by $E = r\rho_r / 5\varepsilon$. Show that closed $\int E.dS = \int (\nabla .E) Dv$. (16)
2. a. State and prove divergence theorem. (8)

b. What are the major source of electromagnetic fields (8)

3.Check validity of the divergence theorem considering the field D=2xy ax+x^2ay c/m^2 and the rectangular parallelepiped formed by the planes x=0,x=1,y=0,y=2 &z=0,z=3. (16)

4 .A vector field D = [5r^2/4]Ir is given in spherical co-ordinates. Evaluate both sides of divergence theorem for the volume enclosed between r=1&r=2. (16)

5. Given A= 2r cosΦ+Riφ in cylindrical co-ordinates .for the contour x=0 to 1, y= 0 to1, verify Stoke's theorem (16)

6. Explain three co-ordinate systems. (16)

7. a. A uniform line charge ρ_L =25Nc/m lies on the x=3m and y=4m in free space. Find the electric field intensity at a point (2, 3and 15) m. (8)

b. Given that potential V=10sinθcosΦ/r2 find the electric flux density D at (2, π/2,0) (8)

8. State and prove Gauss law and explain applications of Gauss law. (16)

9. Derive an expression for the electric field due to a straight and infinite uniformly charged wire of length 'L' meters and with a charge density of +λ c/m at a Point P which lies along the perpendicular bisector of wire. (16)

10. A circular disc of radius 'a' m is charged uniformly with a charge density of σ c/ m^2.find the electric field at a point 'h' m from the disc along its axis. (16)

11. Define the potential difference and absolute potential. Give the relation between potential and field intensity. (16)

12. Derive an expression for potential due to infinite uniformly charged line and also derive potential due to electric dipole. (16)

UNIT II STATIC MAGNETIC FIELD

PART-A (2 Marks)

1. Define Lorentz law of force.
2. State Biot-Savart Law.
3. State Ampere's circuital law.
4. What is the difference between scalar and vector magnetic potential.
5. Define Magnetic Moment.
6. What is magnetic dipole moment?
7. Can a magnetic field exist in a good conductor if it is static or time varying? Explain.
8. Define magnetic vector potential.

PART- B (16 Marks)

1. Derive the expression for magnetic field intensity and magnetic flux density due to finite and infinite line. (16)

2. Derive the expressions for magnetic field intensity and magnetic flux density due to circular coil. (16)

3. a. Derive an expression for force between two current carrying conductors (8)

   b. An iron ring with a cross sectional area of 3cm square and mean circumference of 15 cm is wound with 250 turns wire carrying a current of 0.3A. The relative permeability of ring is 1500.Calculate the flux established in the ring. (8)

4. a. Derive the expression for torque developed in a rectangular closed circuit carrying current I in a uniform field. (8)

   b. State Ampere's circuital law and explain any two applications of Ampere's Circuital law. (8)

UNIT III ELECTRIC AND MAGNETIC FIELDS IN MATERIALS

PART-A (2 Marks)

1. Write the Poisson's and Laplace equations**.**
2. Obtain Poisson's equation from Gauss's law
3. What is displacement current?
4. What is a capacitor?
5. Define Magnetic dipole.
6. What is magnetic dipole moment?
7. Define magnetization.
8. Define magnetic susceptibility.
9. What is the relation between relative permeability and susceptibility?
10. What are the different types of magnetic materials?
11. Define magnetic flux?
12. Define mmf?
13. Define Reluctance and permeance?
14. State the boundary conditions at the interface between two perfect dielectrics.
15. Write down the magnetic boundary conditions.
16. Write the point form of Ohm's law.
17. Define self inductance.
18. Define Mutual inductance.

PART-B (16 Marks)

1. Derive the boundary conditions of the normal and tangential components of electric field at the interface of two media with different dielectrics. (16)

2. a. Derive an expression for the capacitance of a parallel plate capacitor having two dielectric media. (8)

b. Obtain the expression for the energy stored in magnetic field (8)

3. Drive an expression for energy stored and energy density in an Electrostatic field (16)

4. a. Derive an expression for the capacitance of two wire transmission line. (8)

b. Derive an expression for capacitance of co-axial cable. (8)

5 Derive the boundary conditions of the normal and tangential components of magnetic field at the inter face of two media with different dielectrics. (16)

6. a. Derive the expression for co-efficient of coupling. (8)

b. Prove Laplace's and Poisson's equations. (8)

UNIT- IV

TIME VARYING ELECTRIC AND MAGNETIC FIELDS

1. State Faraday's law of induction.
2. State lenz's law
3. Give the equation of transformer emf
4. What is motional electric field?
5. What is motional emf?
6. What is the emf produced by moving loop in time varying field?
7. What is time harmonic field?
8. Give time harmonic Maxwell's equation in point form. Assume time factor $e^{-i\omega t}$.
9. Distinguish between Field theory and Circuit theory
10. Write Maxwell's equation in point and integral form for good conductors.
11. What is significance of displacement current density?
12. In a material for which σ= 5s/m and ε_r= 1 and E=250 sin 10^{10t} (V/m).find the conduction and displacement current densities.
13. Define Poynting vector.
14. State Poynting Theorem.

PART-B (16 Marks)

1. With necessary explanation, derive the Maxwell's equation in differential and integral forms (16)

2. a. Write short notes on faradays law of electromagnetic induction. (8)

b. The magnetic field intensity in free space is given as H=H0sinθ ay t A/m. Where θ=ωt-βz and β is a constant quantity. Determine the displacement current density. (8)

3. a. What is the physical significance of the poynting vector? (4)

b. State and explain the pointing theorem. (12)

UNIT- V

ELECTROMAGNETIC WAVES

1. Define a Wave.
2. Mention the properties of uniform plane wave.
3. Write down the wave equation for E and H in free space.
4. Write down the wave equation for E and H in a conducting medium.
5. Define intrinsic impedance or characteristic impedance.
6. Calculate the characteristic impedance of free space.
7. Define propagation constant**.**
8. Define skin depth δ
9. What is lossy dielectric medium?
10. For a loss dielectric material having μ_r=1, ε_r=48, σ=20s/m. calculate the propagation constant at a frequency of 16 GHz
11. Define Polarization**.**
12. Define Circular Polarization.
13. Define Elliptical polarization.
14. Define Linear Polarization.

PART-B (16 Marks)

1. A plane wave propagating through a medium with ε_r=8, μr=2 has E=0.5 sin (10^8t-βz) az v/m. Determine
   - (i) β
   - (ii) The loss tangent
   - (iii) wane impedance
   - (iv) wave velocity
   - (v) magnetic field (16)

2. Derive a wave equation for non dissipative medium making use of Maxwell equations and field vectors E and H. (16)

3. A plane sinusoidal electromagnetic wave traveling in space has E_{max}=150μV/m.

   (i)Find the accompanying H_{max}

(ii)Propagation is in X direction and H is oriented in Y direction. What is the direction of E.

(iii) Compute the average power transmitted. (16)

4. Define wave. Derive the free space electromagnetic wave equation. (16)

5. Discuss about the plane waves in lossy dielectrics. (16)

6. Discuss about the plane waves in lossless dielectrics. (16)

7. Briefly explain about the wave incident

(i) Normally on perfect conductor

(ii) Obliquely to the surface of perfect conductor. (16)

******* ALL THE BEST **********