JAYA ENGINEERING COLLEGE

THIRUNINRAVUR

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

SUBJECT CODE: EC6403

SUBJECT NAME: ELECTROMAGNETIC FIELDS

YEAR/SEM: II/IV

UNIT- I

STATIC ELECTRIC FIELDS

PART-B (16 Marks)

1. State and explain Coulomb's law. **(Nov 2009) (May 2008) (Nov 2011) (Nov 2010)**
2. State and prove Gauss law.
3. State and explain stoke's theorem. **(Nov 2008) (May 2009) (May 2014)**
4. Define electric potential. Derive an expression for potential due to point charge.
5. Explain about applications of Gauss law.
6. Define the potential difference and absolute potential. Give the relation between potential and field intensity.
7. Transform the vector field W= 10 ax-8ay+6az c/m^2 to cylindrical coordinate system at p(10,-8,6).
8. Given the cylindrical coordinates of vector field H=20ar-10aφ+3az at P(5,2,-1).
9. Express the vector in Cartesian coordinate system.
10. State and prove divergence theorem. **(Nov 2008) (May 2009) (May 2014)**
11. Derive potential difference for different configurations.
12. Derive electric field intensity due to point, line, surface and volume charge distributions.
13. Derive Electrostatic energy and energy density for static electric field.
14. Check validity of the divergence and curl theorem considering the field D=2xy ax+x2ay c/m^2 and the rectangular parallel piped formed by the planes x=0,x=1,y=0,y=2 &z=0,z=3. (16)
15. Explain three co-ordinate systems. (16)
16. a) A uniform line charge ρL =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

b) Given that potential V=10sinθcosΦ/r2 find the electric flux density D at (2, π/2,0) (16) **(Nov 2008)**

17. State and prove Gauss law and explain applications of Gauss law. (16) **(May 2009) (Nov 2006) (Nov 2014) (**Nov **2011)**
18. Given two points A(x=2, y=3, z= -1) and B(r=4, θ=25, ϕ= 120) find both spherical coordinates and Cartesian coordinates for A and B. Also find curl H for (2rcos ϕar – 4r sin ϕ + 3az). **(May 2011)**

UNIT II

CONDUCTORS AND DIELCTRIC

PART-B (16 Marks)

1. Derive the boundary conditions of the normal and tangential components of electric field at the Inter face of two media with different dielectrics. (16) **(Nov 2008) (May 2014) (Nov 2014)**
2. Derive an expression for the energy stored and energy density in a capacitor. **(Nov 2014) (May 2009)**
3. Drive an expression for energy stored and energy density in an Electrostatic field (16) **(Nov 2014)**
4. Derive an expression for the capacitance of parallel plate. (8)
5. Derive an expression for capacitance of co-axial cable. (8) **(May 2009) (Nov 2006)**
6. Derive Biot Savart's law and amperes law? **(May 2010)(May 2012)**
7. State and explain continuity equation.
8. State and explain poisson's and Laplace's equation.
9. Define electric polarization and derive expression for the same.
10. Derive an expression for the capacitance of a spherical capacitor with conducting shells of radius a and b. **(May 2009) (Nov 2006) (Nov 2014)**
11. Derive the expression for the continuity equation of current in differential form and also derive the expression for inductance of a solenoid with N turns and l metre length carrying a current of I amperes. **(Nov 2011)**
12. Solve the Laplace equation for the potential field in the homogenous region between the two concentric conducting spheres with radius a and b and v=0 at r=b and $v=v_o$ at r=a; Find the capacitance between the two concentric spheres. (8) **(Apr 2011)**
13. Derive the expression for the energy of a point charge distribution. Three point charges -1nc, 4nc, 3nc are located at (0, 0, and 0) (0, 0, and 1) (1, 0, and 0) respectively, Find the energy in the system. **(May 2010)**

UNIT III

STATIC MAGNETIC FIELD

PART- B (16 Marks)

1. State and explain Biot-savart's law.
2. Obtain the expression for magnetic field intensity due to infinite long straight wire carrying a steady current I. **(May 2010) (Nov 2010) (May 2012)**
3. Derive the expression for H due to finite length wire carrying a steady current I.
4. Derive the expression for H due to circular loop carrying current I at the centre. **(Nov2010) (Nov 2009)**

5. State and prove Ampere's circuital law. **(May 2009) (May 2014)**
6. State and explain point form of Ampere's circuital law.
7. Write short note on vector and scalar magnetic potentials. **(May 2009) (Nov 2012) (May 2010) (Dec 2010)**
8. State and derive static magnetic field laws.
9. An iron ring with a cross sectioned of 3 cm2 and a mean circumference of 15 cm is wound with 250 turns wire carrying a current of 0.3A. The relative permeability of the ring is 1500. Calculate the flux established in the ring?
10. Find the magnetic field at the centre of a square loop which carries a steady current I. let R is the distance from centre to side. Find the field at the centre of the n-sided polygon carrying a steady current I. Again, let R be the distance from the centre to any side. Find the formula in the limit n tends to infinity. Find the magnetic field a distance h above the center of a circular loop of radius R, Which carries a steady current I. (16) **(May 2014) (Nov 2012)**
11. Using Ampere circuital law determine the magnetic field intensity due to a infinite long wire carrying a current I, also if a differential current element Idz is located at the origin of free space, obtain the expression for vector magnetic field potential due to the current element and hence find the magnetic field intensity at the point. (r, pi, z) **(Nov 2011)**

UNIT- IV

MAGNETIC FORCES AND MATERIALS

PART-B (16 Marks)

1. Obtain the expression for the energy stored in magnetic field **(Nov 2014)**
2. Derive an expression for the inductance of solenoid.
3. Derive an expression for the inductance of co-axial cable.
4. Derive an expression for the inductance of toroid**(Nov 2012) (May 2012) (April 2009) (Nov 2010)**
5. Derive an expression for the inductance of Transmission lines.
6. Derive expression for self and mutual inductions
7. State and explain magnetization.
8. Obtain boundary condition between two magnetic materials. **(May 2010) (May 2009) (Dec 2006)**
9. Explain the Nature of magnetic materials
10. Derive expression for force on moving charge
11. Derive expression for force on differential current element
12. Derive expression for force on torque on closed loop circuit

UNIT- V

TIME VARYING FIELDS AND MAXWELL'S EQUATIONS

PART-B (16 Marks)

1. Derive the Maxwell's equation in differential and integral forms (16) **(May 2010) (Nov 2008) (May 2014)(Nov 2014) (May 2009)**
2. Derive Maxwell's four equations in point form and in differential form (16) **(Dec 2009)**
3. A. What is the physical significance of the pointing vector? And explain it in detail? Derive the expression for total power flow in coaxial cable? (16) **(Nov 2012) (Nov 2014)**
4. Derive general field relations for time varying electric and magnetic fields using Maxwell's equation? **(May 2010)**
5. On the basis of the analysis of the transmission line compare circuit theory and field theory
6. With necessary explanation, derive the Maxwell's equation in differential and integral forms
7. What do you mean by displacement current? Write down the expression for the total current density?
8. Explain briefly about the motional emf and derive an expression for it?
9. Discuss the pointing vector and pointing theorem? Also derive the ampere circuital law. **(Nov 2008) (May 2014) (Nov 2012)(May 2011)(Nov 2011)**
10. Define faradays laws. What are the different ways of emf generation? Explain with governing equation and suitable example for each? Also derive the differential and integral form of faradays law. **(May 2010)(May 2014) (May 2012)**
11. Derive the relationship between electric and magnetic fields?
12. Explain complex, average and instantaneous poynting vector. (16) **(May 2012) (Dec 2009)**
13. Explain the following terms: Motional emf and transformer emf, also find the amplitude of displacement current density in the air near car antenna where the field strength of FM signal is $E = 80 \cos (6.227 \times 10^8 t - 2.092y)\, a_Z$ **(May 2009)**
14. Derive the modified form of ampere circuital law in integral and differential forms. **(May 2010)**
16. Generate Ampere's law for time varying fields. Also list the Maxwell's equations in integral and point form for free space conditions **(Nov 2010)**
17. Derive an expression for displacement current density J_d, and also give the physical interpretation of Maxwell's equation. **(Nov 2011)**