Electromagnetic Theory Question Bank

UNIT- I
FUNDAMENTALS

PART- A (2 MARKS)

1. What are the source of electric field and magnetic fields?
2. Give any three co ordinate systems.
3. Express the value of differential volume in rectangular and cylindrical Co-ordinate systems
4. Write expression for differential length in cylindrical and spherical co- ordinates.
5. What is physical significance of divergence of D.
6. Express the divergence of a vector in the three system of orthogonal Co-ordination.
7. State divergence theorem.
8. State Stoke's theorem.
9. How is the unit vectors defined in three co ordinate systems?

PART- B

1 (a) The electric field in a spherical co-ordinate is given by E=(r/5)ar. Show that closedE.dS=(.E)dv.

1(b) State and proof divergence theorem

2. Check validity of the divergence theorem considering the field D=2xy ax +x2ay c/m2 and the rectangular parallelepiped formed by the planes x=0,x=1,y=0,y=2 &z=0,z=3.

3. A vector field D=[5r2/4]Ir is given in spherical co-ordinates. Evaluate both sides of divergence theorem for the volume enclosed between r=1&r=2.

4. Given A= 2r cosIr+rI in cylindrical co-ordinates .for the contour x=0 to1 y=0 to1 , verify stoke's theorem

5. Explain three co-ordinate system.

6. Determine the divergence of these vector fields
i. P=x2yz ax+xy az
ii. Q=sin a+2z a+zcos az
iii. T=(1/r2)cos ar + r sincos a + cos a

7. (a) Discuss about curl of a vector
7. (b) Derive an expression for curl of a vector
7. (c) State stoke's theorem

8. (a) Define divergence, gradient, curl in spherical co-ordinate system with mathematical expression
8. (b) Prove that divergence of a curl of a vector is zero ,using stoke's theorem

UNIT- II

ELECTROSTATICS

PART- A (2 MARKS)

1. State coulombs law.
2. State Gauss law for electric fields
3. Define electric flux & electric flux density
4. Define electric field intensity
5. Name few applications of Gauss law in electrostatics
6. Define potential difference.
7. Define potential.
8. Give the relation between electric field intensity and electric flux density.
9. Give the relationship between potential gradient and electric field.
10. Define current density.
11. Write down the expression for capacitance between two parallel plates.
12. State point form of ohms law.
13. Define dielectric strength.

PART- B

1. State and proof gauss law .and explain applications of gauss law.

2. Drive 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 + c/m at a point P which lies along the perpendicular bisector of wire.

3 . (a) Explain poissons and lapace's equations.

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

4. A circular disc of radius'a' m is charged uniformly with a charge density of c/ m2.find the electric field at a point 'h' m from the disc along its axis.

5 (a).Define the potential difference and absolute potential. Give the relation between potential and field intensity.

5.(b) A circular disc of 10 cm radius is charged uniformly with a total charge10-10c.find the electric field at a point 30 cm away from the disc along the axis.

6. Derive the boundary conditions of the normal and tangential components of electric field at the inter face of two media with different dielectrics.

7. Derive an expression for the capacitance of a parallel plate capacitor having two dielectric media.

8. Derive an expression for the capacitance of two wire transmission line.

9. Drive an expression for energy stored and energy density in electrostatic field.

10 (a) Derive an expression for capacitance of concentric spheres.

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

11 (a) Explain and derive the polarization of a dielectric materials.

11 (b) List out the properties of dielectric materials.

12.The capacitance of the conductor formed by the two parallel metal sheets, each 100cm2,in area separated by a dielectric 2mm thick is , 2×10-10 micro farad .a potential of 20KV is applied to it . find

(i) Electric flux
(ii) Potential gradient in kV/m
(iii) The relative permittivity of materials
(iv) Electric flux density.

13. (a) Derive an expression for series and parallel plate capacitor.

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

UNIT- III

MAGNETOSTATICS

PART- A (2 MARKS)

1. State Biot –savarts law.
2. State Ampere circuital law
3. Write the relation between magnetic flux density and field intensity
4. Write the relation between relative permeability and suspectibility
5. Define magnetic flux density
6. Write down the magnetic boundary conditions.
7. Give the force on a current element.
8. Define magnetic moment.
9. State Gauss law for magnetic field.
10. What is magnetic susceptibility
11. Define magnetic dipole.
12. Give torque on closed circuits
13. Define magnetization.
14. List the types of magnetic materials

PART- B

1. Derive the expressions for magnetic field intensity due to finite and infinite line

2. Derive the expressions for magnetic flux intensity due to solenoid of the coil.

3. Derive the expressions for magnetic field intensity due to toroidal coil and circular coil.

4. Derive an expressions for energy stored and energy density in magnetic field.

5. (a) Derive an expressions for self inductance of two wire transmission line.

5. (b) Derive an expressions for force between two current carrying conductors.

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

6.(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.

7. Explain Magnetic materials and scalar and vector magnetic potentials.

8. Derive the expressions for boundary conditions in magnetic fields.

9. A solenoid 25cm long ,1cm mean diameter of the coil turns a uniformlyDistributed windings of 2000 turns .the solenoid is placed in uniform field of 2 tesla flux density. a current of 5a is passed through the winding.Determine the
(i) Maximum torque on the solenoid&

(ii) Maximum force on the solenoid
(iii) Compute the magnetic moment on the solenoid.

10 (a).Derive the expression for co-efficient of coupling in terms of mutual and self inductance.

10 (b). Calculate the inductance of a solenoid of 200 turns wound tightly on a cylindrical tube of 6cm diameter .The length of the tube is 60cm and the solenoid is air.

11 (a) Define and explain biot –savart law .

11 (b) Find H at the centre of an equivalent triangular loop of side 4m carrying current of 5A.

UNIT- IV

ELECTRODYNAMIC FIELDS

PART- A (2 MARKS)

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 motinal emf ?
6. What is the emf produced by moving loop in time varying field?7. What is time harmonic field ?
7. Give time harmonic maxwell's equation in point form. assume time factor e-it.
8. Distingush between Field theory and Circuit theory
9. Write Maxwell's equation in point and integral form for good conductors.
10. What Is significance of displacement current density?
11. In a material for which = 5s/m and r= 1 and E=250 sin 1010t (V/m) find the conduction and displacement current densities.

PART- B

1. What are the different ways of EMF generation? Explain with the governing equations and suitable practical examples.

2. With necessary explanation, derive the Maxwell's equation in differential and integral forms .

3. (a) What do you mean by displacement current? write down the expression for the total current density.

3. (b) In a material for which =5 s/m and r=1 and E=250 sin 1010t (V/m).find the conduction and displacement current densities.

4 .(a) Find the total current in a circular conductor of radius 4mm if the current density varies according to J=104/R A/m2 .

4. (b) Given the conduction current density in a lossy dielectric as Jc=0.02 sin 109 t A/m2 .find the displacement current density if =103 mho/m and r=6.5 .

5 (a) Explain the relation between field theory and circuit theory.

5 (b)The magnetic field intensity in free space is given as H=H0sin ay t A/m.where = t-z and is a constant quantity. Determine the displacement current density.

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

6 (b) Show that the ratio of the amplitudes of the conduction current density and displacement current density is , for the applied field amplitude ratio if the applied field is E=Em e-t/ where is real.

7. Derive General field relation for time varying electric and magnetic fields using Maxwell's' equations.

UNIT- V

ELECTROMAGNETIC WAVES

PART- A (2 MARKS)

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.
9. Define Pointing vector.
10. State Poynting Theorem.
11. What is lossy dielectric medium?
12. For a loss dielectric material having μr=1 , r=48, =20s/m. calculate the Propagation constant at a frequency of 16 GHz.
13. Define Polarization.
14. Define Circular Polarization.
15. Define Elliptical polarization.
16. Define Linear Polarization.

PART- B

1. (a) Calculate the attenuation constant and phase constant for the uniform plane wave with the frequency of 10GHz in a medium for which μ=μ0, r=2.3 and =2.54×10-4/m .

1.(b) Derive the expression for the attenuation constant ,phase constant and intrinsic impedance for a uniform plane wave in a good conductor.

2. Derive the one dimensional general wave equation and find the solution for wave equation.

3. Discuss about the plane waves in lossy dielectrics.

4. Discuss about the plane waves in lossless dielectrics.

5. Briefly explain about the wave incident
(i) Normally on perfect conductor
(ii) Obliquely to the surface of perfect conductor.

6. (a). Assume that Eland H waves, traveling in free space, are normally Incident on the interface with a perfect dielectric with r=3 .calculate the magnitudes of incident, reflected and transmitted E and H waves at the interface.

(b) A uniform plane wave of 200 MHz, traveling in free space Impinges normally on a large block of material having r =4 , μr =9 and =0. Calculate transmission and reflection co efficient of interface.

7. Derive wave equation in phasor form .

8. Derive suitable relations for integral and point forms of poynting theorem.

9. A plane wave propagating through a medium with r = 8, μr = 2 has E = 0.5 sin (108 t – z) az V/m.
Determine

(i) The loss tangent
(ii) Wave impedance
(iii) Wave velocity
(iv) H field (16)