DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
QUESTION BANK (www.EasyEngineering.net)
SUBJECT CODE & NAME : EE8391 - ELECTROMAGNETIC THEORY
YEAR / SEM : II / III

UNIT I
ELECTROSTATICS-I
PART –A

1. How the unit vectors are defined in cylindrical co- ordinate system? (2)
2. State stoke's theorem. (2)
3. State divergence theorem. (2)
4. Under what condition will the electric field be both solenoidal & irrotational? (2)
5. Convert the point P(3,4,5)from cartesian to spherical co-ordinates (2)
6. Express the divergence of a vector in the three system of orthogonal co-Ordination (2)
7. Transform a vector $A=Y_IX-X_IY+Z_IZ$ in to cylindrical co-ordinates. (2)
8. Write down the expression for differential length, volume&area in three co-Ordinate system (2)
9. Find the distance from a(1,2,3)to(2,0,-1)in rectangular co-ordinates (2)
10. Explain the physical significance of ▼v. (2)
11.Define electric potential and potential difference.
12.Name few applications of gauss law in electrostatics.
13.State the conditions for a vector to be solenoidal and irrotational.
14.Mention the sources of electromagnetic fields.
15.Give the physical significance of curl and divergence.
16. What are the practical applications of electromagnetic fields.
17.Give the differential displacement and volume in spherical co-ordinate system.
18.Given $A=4a_x+6a_y-2a_z$ and $B= -2a_x+4a_y+8a_z$.Show that the vectors are orthogonal.
19.Express in matrix form the unit vector transaformation from the rectangular to cylindrical coordinate system.
20.Point P and Q are located at (0,2,4) and (-3,1,5). Calculate the distance vector from P to Q.
21. Determine the electric flux density at a distance of 20 cm due to an infinite sheet of uniform charge $20\mu C/m^2$ lying on the z=0 plane.
Determine The angle between A= 2ax+4ay and B=6ay-4az.

PART-B

1. The electric field in a spherical co-ordinate is given by E=rρr/5ε. Show that closed ∫E.dS=∫(▼.E)Dv. (16)
2. State and prove divergence theorem (16)
3. 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. (16)
4. 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. (16)
5. Given A= 2r cosΦ+Riφ in cylindrical co-ordinates .for the contour x=0to1 y=0to1 , verify stoke's theorem (16)
6. Explain three co-ordinate system. (16)
7. What are the major source of electromagnetic fields (16)
8.Write short notes on gradient ,divergence and curl.
9.Transform the vecto $rA=4a_x-2a_y-4a_z$ at p(x=2,y=3,z=4) to spherical coordinates.
10.Derive the Laplace equation.Obtain the Laplacian operator in the cylindrical coordinate system.

11.Verify the divergence theorem considering the field $D=3x^2\, a_x +(3y +z)a_y+(3z-x)\, a_z c/m^2$ and the cylinder formed by the planes x=0,y=0, &z=0,z=2.
12. A novel printing technique is based upon electrostatic deflection principle.Justify
13. State and prove the Coulombs law. 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 $+\rho\ c/m$ at a point which lies along the perpendicular bisector of wire.
14. Show that over a closed surface of a sphere of radius b,ds=0. Show that the vector $E=(6xy+z^3)a_x+ (3x^2-z)a_y+(3xz^2-y)a_z$ is irrotational and find its scalar potential.
15. If B=yax+(x-z)ay and a point Q is located at (-2,6,3), express 1.the point Q in cylindrical and sphetical coordinates.2.B in spherical coordinates.
16. Transform the vector $A=4a_x-2a_y-4a_z$ at p(x=2,y=3,z=5) to cylindrical coordinates.
17. Given that $A=30e^{-r}a_r-2za_z$ in cylindrical coordinates, evaluate bth sides of divergence theorem for the volume enclosed by r=2,z=0 and z=5

UNIT II
ELECTROSTATICS-II
PART –A

1. State coulombs lawof electric force. (2)
2. Write down the expression and give the significance for laplace's &poisson's *equations. (*2)
3. Find the force in Newton between two charges ,30μc and -30μcsituated at (0,1,2)m & (2,0.0)m, respectively in free space. (2)
4. State two applications of the dipole. (2)
5. Define electric field intensity. (2)
6. State gauss law. (2)
7. Determine the potential difference between the points a and b which are at a distance of 0.5m and 0.1m respectively from a negative charge of 20x10- 10coulomb, ε0=8.854picoF/m (2)
8. What is polarization? (2)
9. Sketch the electric field lines due to an isolated point charge Q. (2)
10. Define potential difference& absolute potential. (2)
11. Determine the capacitance of the parallel plate capacitor composed of tin foil sheets,25cm square for plates separated through a glass dielectric0.5cm thick with relative permittivity 6 (2)
12. Define dielectric strengh. (2)
13. State the conditions of gauss law. (2)
14. Write the expression for electric field intensity at any point due to infinite plane sheet having charge density σs c/m2 (2)
15. What are the equipotential surfaces?give two example. (2)
16. Write the expression for capacitance of an isolated sphere. (2)
17. Why electric field inside a conductor is zero. (2)
18. Write the expression for energy density in electric field. (2)
19. Show by using gauss law:D= ε0 E. (2)
20. Write the expression for capacitance of co-axial cable. (2)
21. Show that E=-▼V (2)
22.Name few applications of gauss law in electrostatics.
23. Define electric potential and potential difference.
24.Define electric dipole and dipole moment.
25.State the properties of electrical flux lines.
26.What is meant by conservative property of electric field.
27. Define dielectric strength.
28.Define polarization.
29. Calculate the capacitance per Km between a pair of parallel wires each of diameter 1 cm at a spacing of 50 cms.
30.Find E in free space if $D=30a_xC/m^2$
31. State the properties of electric flux lines.

32.Define capacitor and capacitance.
33.Write poissons equation in cylindrical coordinates.
34.Find the magnitude of D for a dielectric material in which E=0.15MV/m and εr=5,25.

PART-B

1. State and proof gauss law .and explain applications of gauss law. (16)
2. 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)
3. Explain poissons and lapace's equations. (16)
4. 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 (2,3,15)m. (16)
5. A circular disc of radius'a' m is charged uniformly with a charge density of σc/ m2.find the electric field at a point 'h' m from the disc along its axis. (16)
6. 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.(16)
7. Derive the boundary conditions of the normal and tangential components of electric field at the inter face of two media with different dielectrics. (16)
8. Derive an expression for the capacitance of a parallel plate capacitor having two dielectric media. (16)
9. Obtain the expression for the energy stored in a capacitor. (16)
10. Drive an expression for energy stored and energy density in an electrostatic field. (16)
11. Derive an expression for the capacitance of two wire transmission line. (16)
12 Derive an expression for capacitance of concentric spheres. (16)
13. Derive an expression for capacitance of co-axial cable. (16)
14 .Explain and derive the polarization of a dielectric materials. (16)
15. List out the properties of dielectric materials. (16)
16. The capacitance of the conductor formed by the two parallel metal sheets, each 100cm2,in area separated by a dielectric 2mm thick is ,2x10-10 micro farad .a potential of 20kv is applied to it .find
(i) Electric flux (4)
(ii) Potential gradient in kV/m (4)
(iii) The relative permittivity of materials (4)
(iv) Electric flux density. (4)
17. Derive an expression for series and parallel plate capacitor. (16)
18. Define the potential difference and absolute potential. Give the relation between potential and field intensity. (16)
19. Given that potential V=10sinθcosΦ/r2 find the electric flux density D at (2,π/2,0) (16)
20.Determine the electric field intensity and potential at P(-0.2,0,-2.3) due to a point charge of +5nC at Q(0.2,0.1,-2.5) in air.All dimensions are in metres.
21. linear homogeneous isotropic dielectric material has ζ_r=3.6 and is covering the space between z-0 and z=1.If V=-6000z volts in the material,find1.E 2.P 3.ρ_s
22.Explain polarization of a dielectric material.
23. A positive point charge 100*10-12C is located in air at x=0, 0.01m and another charge at x=0, y=-0.1m. What is the magnitude and direction of E.
24. A dielectric slab of flat surface with $\mathcal{E}_r$=1 is disposed with its surface normal to a uniform field with flux density 1.5 C/m^2.The slab occupies a volume of 0.08m^3 and is uniformly polarized.Determine1. Polarization in the slab2. Total dipole moment of slab.
25. three point charges in free space are located as follows: 50 nC at (0,0)m;40 n at (3,0)m; 60 nC at (0,4)m.Find the electric field intensity at (3,4)m.
26. A charge Q1= 100nC is located in vacuum at P1 (-0.03,.01,.04)m.Find the force on Q1 due to (i)Q2=120µC at P2(.03,.08,-.02)m (ii)Q3=120 µC at P3(-.09,-0.06,0.10)m(iii)Q2 and Q3.

27. Write the lapace's equation in Cartesian coordinates and obtain the solution when V is function of X only for the boundary conditions V=V1 at x=x1 and V=V2 at x=x2.
28. Calculate the potential at a point P(0,0) m due to a point charges Q1 and Q2. Q1=10^{-12} C is located at (0.5,0)m and Q2=-10^{-11} C is locaed at (-0.5,0)m.
29. Find the force on charge Q1 of 20 µC at (0,1,2)m due to Q2 of 300 µC at (2,0,0)m
30. Find the potential at r_A=5m with respect to rB=15m due to point charge Q=500 pC at the origin and zero reference at infinity.
31. Find the capacitance of a parallel plate capacitor with dielectric εr1=1.5 and εr2=3.5 each occupy one half of the space inbetween the plates of area $2m^2$ and d=10^{-3}m
32. In spherical coordinates V=-25 V on a conductor at r=2cm and V=150 V at r=35cm. The space between the conductor is a dielectric of ε_r=3.12.Find the surface charge densities on the conductor.

UNIT III
MAGNETOSTATICS
PART-A

1. Define and give the practical significance of Lorenz force. (2)
2. Define Magnetic Field Intensity. (2)
3. State Biot-savart Law. (2)
4. Satae Ampere's scircuital law. (2)
5. Define Scalar Magnetic potential and vector magnetic potential. (2)
6. Define Magnetic Moment. (2)
7. Define Magnetisation (2)
8. Write the expressions for inductance of solenoid. (2)
9. What is energy density in magnetic field and Energy stored in Magnetic field.(2)
10. Define self iductance. (2)
11. Define Mutual inductance. (2)
12. What is the Magnetic field B infinite long wire carrying a current I. (2)
13. What is the magnetic boundary conditions. (2)
14. Calculate the inductance of a ring shaped coil having a mean diameter of 20 cm wound on a wooden core of 2 cm diameter .The winding is uniformly distributed and contains 200 turns. (2)
15. Define coefficient of coupling (2)
16.Define magnetic permeability.
17. Write the expressions for inductance of toroid.
18.A conductor of 1 m length is moved with a velocity of 100m/sec.perpendicular to a field of 1 tesla.What is the value of emf induced?
19.Define magnetostatic energy density.
20.State the law of conservation of magnetic flux.
21.What is the mutual inductance of two inductively coupled coils with self inductances of 25 mH and 100mH.
22.Find the maximum torque on a 100 turns rectangular coil of 0.2m by 0.3m, carrying current of 2A in the field of flux density 5Wb/m^2
23.Determine the value of H at the centre of circular loop carrying a current of 10 A. The radius of the loop is 2m.
24. A conductor 4m long lies along the Y axis with the current of 10 A in ay direction, if the field is B=0.05ax tesla.Calculate the force on the conductor.

PART-B

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

2. Derive the expressions for magnetic flux intensity due to solenoid of the coil.(16)
3. Derive the expressions for magnetic field intensity due to toroidal coil and circular coil. (16)
4. Derive an expressions for energy stored and energy density in magnetic field. (16)
5. Derive an expressions for self inductance of two wire transmission line. (16)
6. Derive an expressions for force between two current carrying conductors. (16)
7. 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 500.calculate the flux established in the ring. (16)
8. Explain Magnetic materials,BH curve and scalar and vector magnetic potentials. (16)
9. Derive the expressions for boundary conditions in magnetic fields. (16)
10. Derive the expression for torque developed in a rectangular closed circuit carrying current I a uniform field. (16)
11. A solenoid 25cm long ,1cm mean diameter of the coil turns a uniformly Distributed windings of 2000turns .the solenoid is placed in uniform field of 2tesla flux density. a current of 5a is passed through the winding.Determine the
(i) Maximum torque on the solenoid& (8)
(ii) Maximum force on the solenoid (4)
(iii) Compute the magnetic moment on the solenoid. (4)
12. Derive an expression for co-efficient of coupling. (16)
13.Derive coefficient of coupling in terms of mutual and self inductance of a coil
14.Explain the classifications of magnetic materials.
15.Derive an expression for the magnetic field intensity inside and outside the coaxial conductor carrying current I amperes in the inner and outer conductors.
16. Derive an expression for the magnetic field intensity inside and outside the coaxial conduca solid cylinder carrying current I amperes and sketch the variation of H and distance from the conductor axis.
17.Develop an expression for the magnetic field intetnsity at any point on the line through the centre at a distance ‘h’ m from the centre and perpendicular to the plane of the circular loop of radius ‘a’ m and carrying a current I in the anticlockwise direction.
18. Find the magnetic field intensity at a point P/(1.5,2,3) caused by a current filament of 24 A in the a_z dirction on the Z axis and extending from Z=0 to Z=6.
19. Deduce the point form of Ampere’s scircuital law
20. Derive an expression for the magnetic field intensity inside and outside the solid cylinder conductor carrying current I amperes.
21.Calculate the inductance of a ringshaped coil of mean diameter 20cm wound on a wooden coreof 2 cm diameter containing 200 turns.

UNIT IV

ELECTRODYNAMIC FIELDS

PART-A

1. State faradays law of electromagnetic induction. (2)
2. What are the different types of EMFS (2)
3. Differentiate field theory &circuit theory. (2)
4. What is displacement current .differentiate conduction current and displacement current. (2)
5. Compare field theory with circuit theory. (2)
6. Define motional emf. (2)
7. Define lenz’s law. (2)
8. Write the point form and integral form of maxwell’s equation using faradays law(2)
9. Write the point form and integral form of maxwell’s equation using ampere circuital law (2)
10. Write the point form and integral form of maxwell’s equation using electric and magnetic gauss law (2)

11. Write down the expression for the emf induced in the moving loop in static magnetic field. (2)
12.distinguish between transformer and motional emf.
13.State faradays law of electromagnetic induction.
14. In a material for which $\sigma = 5.0\ s/m$, and ε_r =1, the electric field intensity is $E = 250 \sin 10^{10} t\ V/m.$ Find the conduction and displacement current densities, and the frequency at which both have equal magnitudes.
15.What is the practical significance of skin depth?
16.Compare the equipotential plots of uniform and non uniform fields.
17.State ohms law for magnetic circuits.
Give two equations that provide a connection between field and circuit theory.
18. Moist soil has conductivity of 10-3S/m and ε_r=2.5.Determine the Displacement current density if E=6*10^{-6} Sin 9*10^{9}t(V/m)

PART-B

1. Explain the relation between field theory and circuit theory. (16)
2. What are the different ways of EMF generation? Explain with the governing equations and suitable practical examples. (16)
3. With necessary explanation, starting from the basic principles derive the maxwell's equation in differential and integral forms for conducting medium and freespace(16)
4. Write short notes on faradays law of electromagnetic induction. (16)
5. What do you mean by displacement and conduction current? write down the expression for the total current density (16)
6.In a material for which σ=5 s/m and εr=1 and E=250 sin 1010t (V/m).find the conduction and displacement current densities. (16)
7.Find the total current in a circular conductor of radius 4mm if the current density Varies according toJ=104/R A/m2 . (16)
8. 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. (16)
9. Show that the ratio of the amplitudes of the conduction current density and displacement current density is σ/ωε,for the applied field amplitude ratio if the applied field is E=Em e-t/λ where λ is real. (16)
10. Derive the wave equation starting from Maxwell' s equation for free space.
11.the magnetic circuit of a toroid has a uniform cross sectionof 10-3 m2.if the circuit is energized by a current of 3 sin 100Πt in a coil of N1=200 turns,find the emf induced in the coil of N2=100 turns.Assume μ=500μ0.the mean radius of the toroid is 10 cm.
12.Derive the differential form of time harmonic maxwell's equation.
13.By means of a simple RLC circuit explain the relationship between field theory and circuit theory
14.A circular loop of wire is placed in a uniform magnetic field of flux density 0.5 Wb/m2. The wire has 200 turns and frequency of rotation of 1000 revolutions/minute.If the radius of coil is 0.2m determine1.induced emf when the plane of the coil is 60 deg to flux lines 2. Induced emf when the plane of coil is perpendicular to the field.
15.An iron ring with a cross sectional area of 3 cm 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.
16. Derive the circuit equation for a series RLC circuit.
17. Explain the concept of EMF induction in static and time varying magnetic field.

UNIT V

ELECTROMAGNETIC WAVES
PART-A

1 State poynting theorem.
2. What is transmission –LINE parameters?
3. What is loss tangent?
4. Define wave?
5. What are the conditions to be satisfied for plane waves?
6. What is the significance of intrinsic impedance?
7. Write the expression for plane electromagnetic waves propagating in a dielectric media
8. Find the velocity of a wave in a lossless medium having a relative permeability of 5 and relative permeability of 2.
9. Define the desired boundary conditions for the conductor free space boundary in electrostatics.
10. What are the boundary conditions of electromagnetic wave at the interface between two losses less dielectric media?
11. What are boundary conditions?
12. Define skin depth.
13. What do you mean by the uniform plane wave?
14. What is meaning of wave?
15. Define propagation constant.
16. Define attenuation constant and phase constant.
17. What is perfect dielectric medium?
18. What is lossy dielectric?
19. Explain skin effect.
20. Define depth of penetration.
21. What is poynting vector?
22. Calculate intrinsic impedance of medium whose relative permittivity is 3 and relative permeability is 1
23.a plane wave travelling in air is normally incident on a block of paraffins with E_r=3
24.What is skin depth?
25. Define standing wave ratio
26. State the properties of uniform plane wave.
PART-B
1. Derive poynting' s theorem**.**
2 Explain propagation of uniform plane in perfect dielectric .what is lossless dielectric?
3. Derive the expressions describing propagation of uniform plane wave in good conductor?
4. What is skin effect? What is skin depth? What is its relation with attenuation constant, conductivity and frequency?
5. Calculate the attenuation constant and phase constant for the uniform plane wave with the frequency of 10GHz in a medium for which μ=μ0, εr=2.3 and σ=2.54x10^-4Ω/m (16)
6. Derive the expression for the attenuation constant ,phase constant and intrinsic impedance for a uniform plane wave in a good conductor. (16)
7. Derive the one dimensional general wave equation and find the solution for wave equation.(16)
8. Discuss about the plane waves in lossy dielectrics. (16)
9. Discuss about the plane waves in lossless dielectrics. (16)
10. Briefly explain about the wave incident
(i) Normally on perfect conductor (8)
(ii) Obliquely to the surface of perfect conductor. (8)
11. Briefly explain about the wave incident
(i) Normally on perfect dielectrics (8)
(ii) Obliquely to the surface of perfect dielectrics. (8)

12. Assume that Eland H waves, traveeling in free space, are normally Incident on the interface with a perfect dielectric with εr=3 .calculate the magnitudes of incident, reflected and transmitted E and H waves at the interface. (16)
13. A uniform plane wave of 200 MHz, traveling in free space Impinges normally on a large block of material having εr =4 , μr =9 and σ =0. Calculate transmission and reflection co efficient of interface. (16)
14.Derive the wave equation for an electric and magnetic field.
15.Define Brewster angle and derive its expression.
16.Describe about the reflection coefficient and transmission coefficient.
17.Derive the wave equations in frequency domainand obtain the expression for intrinsic impedence.
18. Derive the wave equation for conducting medium andperfect dielectric medium.
19, Discuss group velocity, phase velocity and propagaton constant of electromagnetic waves.
20. Deduce the expression for fields of a plane electromagnetic was which are normally Incident on the surface of a perfect dielectric medium.
21. Write short notes on standing waves.

22.A 6580 MHz uniform plane wave is propagation in a material medium of εr=2.25 if the amplitude of the electric field intensity of lossless medium is 500 V/m.Calculate the phase constant,propagation constant,velocity,wavelength and intrinsic impedence.

23. A plane wave travelling in +zdirection in freespace (Z<0) IS normally incident at z=0 on a conductor z>0 for which σ=61.7MS/m, μr=1 . The free space E wave has a frequency F=1.5Mhz and an amplitude of 1V/m at the interface is given by E(0,t)=1 sin 2ΠftayV/m.Analyse the wave and predict magnetic waveH(z,t) at z>0

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