Dronacharya Group of Institutions, Greater Noida

Electrical & Electronics Engineering Department

Question Bank

Subject: FEMT **Branch:EEE 5th Semester**

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1. Describe what are the source of electric field and magnetic fields?
2. State Vector & scaler Quantity.
3. Prove the following identity
   A(B×C) = B.(C×A)= C.(A×B)
   A×(B×C) = B(A.C) - C(A.B)
4. Find the dot product of the vectors A and B if A =2ax-3ay+4az, B= -ax+2ay+2az.
5. Write down expression for x,y,z in terms of spherical co-ordinates r,Θ and ϕ.
6. Discuss the cartesian coordinate system.
7. Describe the electric flux density and dielectric constant.
8. Differentiate between a scalar quantity and a scalar field and vector quantity and vector field?
9. Explain curl of a vector field and Stokes Theorem.
10. Write short notes on equation of continuity.
11. State and derive Ohm's law in point form.
12. State and Explain Coulomb's law.
13. Establish the following vector identities:
    (i) $\nabla.\nabla\times\vec{A}=0$ (ii) $\nabla\times\nabla V=0$
14. Explain the procedure of obtaining E due to line charge, surface charge and volume charge.
15. For the given points A (2, 3, -1) and B (4, -50°, 2), find the distance A to B.
16. Is Gauss's law useful in finding the Electric field vector of a finite line charge? Explain.
17. Explain the procedure of obtaining D due to line charge, surface charge and volume charge using gauss law.
18. Find out the gradient of a scalar $\emptyset = x^2 + y^2 + 2xz$.
19. State and explain the divergence theorem of any vector$\vec{A}$.
20. Find the Laplacian of the following scalar fields:
    (i) $V = e^{-z}sin2x.coshy$ (ii) $W = 10rsin^2\theta cos\emptyset$
21. For the given vector $\vec{A} = 3a_x + 4a_y + a_z$ and$\vec{B} = 2a_y - 5a_z$, find the angle between $\vec{A}$ and$\vec{B}$.
22. Determine dot product, cross product and angle between $\vec{P} = 2a_x - 6a_y + 5a_z$ and$\vec{Q} = 3a_y + a_z$
23. If $\vec{A} = (\alpha\hat{a}_x + 2\hat{a}_y + 10\hat{a}_z)$ and$\vec{B} = (4\alpha\hat{a}_x + 8\hat{a}_y - 2\alpha\hat{a}_z)$, find out the value of α for which the two vectors become perpendicular.
24. For the given points A (2, 3, -1) and B (4, -50°, 2), find the distance A to B.
25. State and prove Gauss's law of electric field.
26. Check validity of the divergence theorem considering the field D=2xy ax+x2ay c/m2 and the
27. rectangular parallelepiped formed by the planes x=0,x=1,y=0,y=2 &z=0,z=3.
28. How the Gauss's law can be used to find $\overline{D}$ in all regions of coaxial cable.
29. Show that potential difference $V_{AB} = W/Q = -\int_A^B E.dl$ to move a charge from A to B.
30. Find $\overline{D}$ due to a uniform line charge by using Gauss's law.
31. How the Gauss's law can be used to find $\overline{D}$ due to a point charge Q at origin.
32. (a) Write down gradient of any scalar and divergence and curl of any vector $\vec{A}$ in different coordinate system.
    (b) Write down the expressions of differential length, area and volume for different coordinate systems with their suitable diagrams.
33. (a) Using the differential length dl, find the length of the curve represented by $\boldsymbol{r = 1, \theta = 30^0, 0 < \emptyset < 60^0}$.
    (b) Find the Laplacian of the scalar fields: (i) $V = e^{-z}sin2x.coshy$ (ii) $W = 10rsin^2\theta cos\emptyset$

34. (a) Two particles having charges $3 \times 10^{-9}C$ and $6 \times 10^{-9}C$ are spaced by 1.1 meter apart. Determine the electric field at the point A situated at a distance of 0.5 meter from each of the particles.

(b) A charge distribution with spherical symmetry has density$\rho_v = \rho_0 r/R$, $0 \leq r \leq R$ and for $r > R$. Determine E everywhere.

35. (a) A charge of 10^{-3}C is located at P (30, -10, 15) in vacuum. What force is exerted on this charge by a second charge 6×10^{-4}C at Q(20, 10, 25)?

(b) Find the divergence of a vector $\vec{A} = 3x^2a_x + 5x^2y^2a_y + xyz^3a_z$ and Del of a scalar functionx^2yz.

36. Find a mathematical expression for electrostatic energy in terms of field quantities.

37. 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.

38. Derive the relation b/w I and J.

39. Derive the expression for displacement and conduction current densities.

40. State Ampere's circuital law and explain any two applications of Ampere's Circuital law.

41. State and explain continuity equation of current in integral form and point form.

42. Derive the expression for capacitance of parallel plate capacitor.

43. Derive the expression for capacitance of Coaxial cable.

44. Derive the expression for capacitance of spherical capacitor.

45. The electric field intensity at a point on the surface of a conductor is given by$\vec{E} = (0.2\hat{a}_x - 0.3\hat{a}_y - 0.2\hat{a}_z)V/m$. Find the surface charge density at that point.

46. (a) A parallel plate capacitor consists of two square metal plates with 500 mm side and separated by 10 mm. A slab of sulphur ($\in = 4$) 6 mm thick is placed on the lower plate. This leaves an air gap 4 mm thick between the sulphur slab and the upper plate. Find the capacitance of the capacitor.

(b) Two uniform line charges of density $\rho_l = 4nc/m$ lie in the $x = 0$ plane aty $= 4m$. Find $\vec{E}$ at$(4, 0, 10)m$.

47. (a) What is the boundary condition for dielectric-dielectric boundary? An electric field in medium 1, whose relative permittivity is 7, passes into a medium of relative permittivity 2. If Electric field E makes an angle of60° with the normal in the first dielectric medium, what angle does the field makes with normal in the second dielectric medium?

(b) Explain convection current and conduction current. Also derive the expression for convection and conduction current densities.

48. Derive the expression for the capacitance of a cylindrical capacitor of length L formed by two coaxial cylinder of radii a & b by

a) Using Gauss law
b) Without using gauss law.

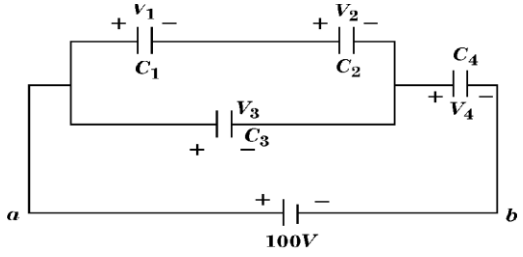
49. (a) Derive an expression for the potential difference at any point between spherical shells in terms of applied potential using Laplace equation.

(b) Describe the spherical and cylindrical coordinate system. How it is converted in other coordinate system.

50. (a) Given $\vec{A} = (2\hat{a}_x - 3\hat{a}_y + \hat{a}_z)$, $\vec{B} = (2\hat{a}_x - \hat{a}_y + 3\hat{a}_z)$, and $\vec{C} = (4\hat{a}_x + 2\hat{a}_y - 2\hat{a}_z)$. Find that $\vec{C}$ is perpendicular to both $\vec{A}$ and $\vec{B}$.

(b) Given $\vec{A} = (2x + 3y)\hat{a}_x - (2y + 3z)\hat{a}_y + (3x - y)\hat{a}_z$, determine the unit vector parallel to $\vec{A}$ at P(1, -1, 2).

51. (a) Four capacitors $C1 = 1\mu f, C2 = 2\ \mu f, C3 = 3\mu f$ & $C4 = 4\mu f$ are connected as in fig below. A D.C Voltage of 100 V is applied to the external terminal a-b. Determine: (i) Total equivalent capacitance between a-b (ii) Charge on each capicitor and (iii) Potential difference across each capicitor.



(b) The electric field intensity in polystyrene ($\epsilon_r = 2.55$) filling the space between the plates of a parallel plate capacitor is 10kV/m. the distance between the plates is 1.5mm. Calculate: (i) The surface charge density of free charge on the plates (ii) The potential difference between the plates.

52. (a) Determine $\vec{E}$ in spherical co-ordinates from Poisson's equation, assuming the uniform charge densityρ.

(b) The electric field intensity at a point on the surface of a conductor is given by$\vec{E} = (0.2\hat{a}_x - 0.3\hat{a}_y - 0.2\hat{a}_z)$V/ m. Find the surface charge density at that point.

53. (a) State coulomb's law of forces. A charge of 10^{-3}C is located at P (30, -10, 15) in vacuum. What force is exerted on this charge by a second charge 6×10^{-4}C at Q(20, 10, 25)?

(b) Find the divergence of a vector $\vec{A} = 3x^2a_x + 5x^2y^2a_y + xyz^3a_z$ and Del of a scalar functionx^2yz.

54. Find out the magnetic vector potential in the vicinity of a very large straight wire carrying a current I. Hence find magnetic field density and magnetic field strength.

55. Explain the ampere Circuital law in integral form.

56. Using Ampere's circuital law, find H due to infinitely long straight conductor.

57. Using Ampere's circuital law, find H due to coaxial cable carrying current I.

58. Discuss the energy stored in electric and magnetic fields.

59. Discuss the boundary condition for magnetic field.

60. State and explain Faraday's Law for induced e.m.f.

61. Explain following: Motion e.m.f. and transformer e.m.f.

62. State the boundary conditions at the interface between two perfect dielectrics

63. A flat perfectly conducting surface in xy plane is situated in a magnetic field,H = 3 cos x ax + z cos x ay A/m for $z \geq 0$& for $z < 0$

64. Find the current density on the conductor surface.

65. Derive the equation of continuity for the time varying fields and point out the inconsistency of amperes Law for time varying field.

66. State and prove Maxwell's equation and give their physical interpretation.

67. A wire of diameter 2mm and the conductivity 5 × 107 Ʊ/m has 1029 free electrons per m3. It is subjected to an electric field of 10 mV/m. Determine a) the free electron charge density b) Current density c) the current in the wire d) the drift velocity of the elect.

68. Determine the relaxation time for silver, having σ = 6.17 × 107 mho/m. If charge of density ϱ is placed within a silver block, find the charge density after one time constant and five times constant.

69. Derive the boundary conditions of the normal and tangential components of electric field at the interface of two media with different dielectrics.

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

71. Derive an expression for capacitance of co-axial cable.

72. Give time harmonic Maxwell's equation in point form. Assume time factor e-jwt.

73. State Poynting Theorem.

74. Write Maxwell's equation in point and integral form for good conductors.

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

76. Write down the wave equation for E and H in free space.

77. Write down the wave equation for E and H in a conducting medium.

78. Define propagation constant and skin depth .

79. Define Elliptical , Linear polarization.

80. Derive a wave equation for non dissipative medium making use of Maxwell equations and field vectors E and H.

81. Discuss about the plane waves in lossy dielectrics.

82. Discuss about the plane waves in lossless dielectrics.

83. Define wave. Derive the free space electromagnetic wave equation.

84. Give the input impedance of a open and short circuit line?

85. Write the equation for the input impedance of a TL?

86. Obtain the general solution of Transmission line

87. What do you mean by VSWR ? Derive the expression for VSWR.

88. Find out magnetic vector potential in the vicinity of a very long straight wire carrying a current I. Hence find magnetic field density and magnetic field strength.

89. Express vector $\vec{B} = \frac{10}{r}\vec{a}_r + r\text{Cos}\,\vec{a} + \vec{a}$ in Cartesian coordinates & Cylindrical Coordinates

90. If a potential $V = x^2yz - \frac{1}{3}y3z$. Determine the value of Electric field at point (2,-1, and 1).

91. What do you mean by uniform plane wave? Derive an expression for intrinsic impedance of free space.

92. State and explain faradays and Lenz law of induction & Derive Maxwell's equations.

93. Verify the vector field $A = yza_x + zxa_y + xya_z$ is irrotational and solenoidal.

94. Derive the relation between VSWR and reflection cooficient.

95. What is a smith chart and why it is useful in making transmission line calculation?

96. Explain the term standing wave ratio related to transmission line. What will be the value of input impedance when output impedances are: (i) short ckted (ii) open ckted (iii) Characteristics impedance?

97. Find the vector potential due to long straight wire of length L and carrying a current I. Also determine the self inductance per unit length of the long solenoid.

98. A cable pair has the following primary coefficient at an angular velocity of $5000\,\frac{rad}{sec}$.

$R = 30\,\Omega/km, \qquad G = 1\mu\mho/km, \qquad L = 1.1\,mH/km, \qquad C = 0.2\,\mu F/km$

Calculate-: (i) The characteristics impedance (ii) The attenuation coefficient (iii) The phase shift Co-efficient (iv) the attenuation in decibels over a length of 15 Km.

99. Using the general current and voltage equations for a transmission line, obtain an expression for the input impedance of a lossless transmission line when the line is terminated by load impedance Z_L.

100. An airline has a characteristic impedance of 70Ω and a phase constant of 3 rad/m at 100 MHz. Calculate the inductance per meter and the capacitance per meter of the line.