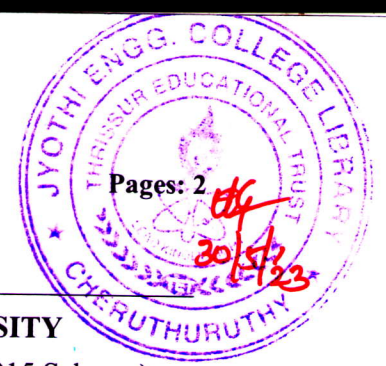


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Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth Semester B.Tech Degree (S,FE) Examination May 2023 (2015 Scheme)

Course Code: EE302

Course Name: ELECTROMAGNETICS

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks.

- | | | Marks |
|---|--|-------|
| 1 | Given $A = (y \cos ax) \mathbf{a}_x + (y + e^x) \mathbf{a}_z$, find curl of A at the origin. | (5) |
| 2 | A point charge of 9 nC is located at (3,4,0). Calculate the electric field intensity vector in free space at (3,4,9) due to this point charge. | (5) |
| 3 | Derive an expression for magnetic field intensity at a point due to a line charge using Ampere's Circuital Law. | (5) |
| 4 | Differentiate between conduction current density and displacement current density. | (5) |
| 5 | Verify Poynting's theorem for power flow through a coaxial cable | (5) |
| 6 | What is the advantage of using phasor form of representation? Write down all the four Maxwell's equations in phasor form. | (5) |
| 7 | Define skin depth. What will be the effect on skin depth of a medium, if its conductivity increases to 4 times its original value? | (5) |
| 8 | Explain impedance matching and Voltage Standing Wave Ratio (VSWR). | (5) |

PART B

Answer any two full questions, each carries 10 marks.

- | | | |
|----|---|-----|
| 9 | a) Express vector $B = \frac{10}{r} \mathbf{a}_r + r \cos \theta \mathbf{a}_\theta + \mathbf{a}_\phi$ in cylindrical coordinates. Also find \mathbf{B} (5)
(5, $\pi/2$, -2). | (5) |
| | b) Apply Gauss's law to find the expression for Electric field Intensity and Electric flux density at a point due an infinite sheet of charge. | (5) |
| 10 | a) Determine the divergence of these vector fields: (5)
(i) $P = x^2 y z \mathbf{a}_x + x z \mathbf{a}_z$
(ii) $Q = \rho \sin \phi \mathbf{a}_\rho + \rho^2 z \mathbf{a}_\phi + z \cos \phi \mathbf{a}_z$ | (5) |
| | b) Derive the expression of capacitance between two parallel conductors of a transmission line. | (5) |

- 11 a) Using Gauss theorem derive an expression for electric field intensity due to a uniformly charged sphere of radius R with volume charge density $\rho_v \text{ C/m}^3$. (6)
- b) If the electric potential in a region is given by $V = x^2 + y^2 - 2z$, then calculate the electric field intensity at $(3, 2, 1)$. (4)

PART C

Answer any two full questions, each carries 10 marks.

- 12 a) State and explain Biot-Savart Law. (3)
- b) Apply Biot-Savart's Law to derive an expression for magnetic field intensity due to a circular loop of current carrying conductor. (7)
- 13 a) Define (i) Scalar magnetic potential and (ii) Vector magnetic potential (5)
- b) State Faraday's Law. Derive the integral form and point form of Faraday's Law. (5)
- 14 a) Derive an expression for energy stored in an electrostatic field in terms of electric flux density. (6)
- b) Explain the continuity equation. (4)

PART D

Answer any two full questions, each carries 10 marks.

- 15 a) Derive wave equation in free space from Maxwell's equations. (5)
- b) Define intrinsic impedance of a medium. Calculate the intrinsic impedance of free space. (5)
- 16 State and explain Poynting theorem. Also derive an expression for complex average pointing vector. (10)
- 17 a) In a lossless medium for which $\eta = 60\pi$, $\mu_r = 1$ and $H = -0.1\cos(\omega t - z)a_x + 0.5\sin(\omega t - z)a_y \text{ A/m}$. Calculate ϵ_r , ω , and E . (7)
- b) Explain Electromagnetic Interference (3)
