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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S4 (R,S) (FT/WP) / (S2 PT) Exam April 2025 (2019 Scheme)

Course Code: EET 204

Course Name: ELECTROMAGNETIC THEORY

Max. Marks: 100 Duration: 3 Hours

PART A

(Answer all questions; each question carries 3 marks) Marks

1	State and explain Stokes's theorem.	(3)
2	Convert point P (1, 3, 5) from Cartesian to Spherical coordinates.	(3)
3	Define Coulomb's law and give the expression for force experienced between two point charges in vector form.	(3)
4	Given the potential $V = \frac{10}{r^2} sin\theta\ cos\varphi$, find Electric flux density at $(2, \frac{\pi}{2}, 0)$.	(3)
5	State and explain Ampere's circuital law.	(3)
6	What is the difference between conduction current density and displacement current density? Write down the expressions for each.	(3)
7	Derive the relation between phase velocity and group velocity.	(3)
8	Explain three characteristics of uniform plane waves.	(3)
9	Explain characteristic impedance of a transmission line.	(3)
10	What is standing wave ratio?	(3)

PART B

(Answer one full question from each module, each question carries 14 marks)

Module -1

11 a) Convert the vector $\boldsymbol{A} = 6\boldsymbol{a_x} + \boldsymbol{a_y}$ into cylindrical and spherical coordinate system at the point P (- 2, 6, 3). (10)

b) What do you mean by del (∇) operator? Write down the expression for ∇ in Cartesian, cylindrical and spherical coordinate system. (4)

12 a) What do you mean by divergence of a vector field? State and explain Gauss divergence theorem. (7)

b) Determine the divergence of the following vector field and evaluate the same at the specified point $\boldsymbol{B} = \rho z \sin\varphi\, \boldsymbol{a_\rho} + 3\rho z^2 \cos\varphi\, \boldsymbol{a_\varphi}$ at $(5, \frac{\pi}{2}, 1)$ (7)

Module -2

13 a) Define Gauss's law and derive Maxwell's first equation from Gauss's law. (6)

b) Using Gauss's law, obtain the expression for electric field intensity due to infinite line charge distribution. (8)

14 a) Define electric potential and obtain the relation between electric field intensity and potential. (6)

b) Two point charges $-4\ \mu C$ and $5\ \mu C$ are located at (2, -1, 3) and (0, 4, -2) respectively. Find the potential at (1, 0, 1) assuming zero potential at infinity. (8)

Module -3

15 a) Define Biot-Savart's Law and derive the expression for magnetic field intensity due to a finite and infinite wire carrying current. (8)

b) With neat sketches, derive the boundary conditions of electric field for conductor dielectric interface. (6)

16 a) Derive Maxwell's Equation in Differential and Integral form for time varying field and explain the significance of each Maxwells equation. (14)

Module -4

17 a) Derive wave equation from Maxwells equation. (10)

b) Define skin depth and skin effect. (4)

18 a) Obtain the expression for attenuation constant and phase constant for plane wave propagating in a lossy medium. (8)

b) State and explain Poynting theorem. (6)

Module -5

19 a) What are the different parameters of a transmission line? Explain each parameter. (4)

b) Derive wave equation in a transmission line. (10)

20 a) A distortionless transmission line has $Z_0 = 60\ \Omega,\ \alpha = 20mNp/m, u = 0.6c$, where c is the speed of light in a vacuum ($3 \times 10^8 m/s$). Find R, L, G, C and λ at 100 MHz. (14)

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