

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth Semester B.Tech Degree Regular and Supplementary Examination July 2021

Course Code: EE302**Course Name: ELECTROMAGNETICS**

Max. Marks: 100

Duration: 3 Hours

PART A*Answer all questions, each carries 5 marks.*

Marks

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| 1 | State Stoke's theorem and explain its significance. | (5) |
| 2 | The region between two concentric right circular cylinders contains a uniform volume charge density ρ . Solve the Poisson's equation for the potential in the region. | (5) |
| 3 | State Ampere's circuital law and using it derive the expression for magnetic field intensity around an infinitely long straight current carrying conductor | (5) |
| 4 | What is electric polarization? How dielectrics are classified based on polarization? | (5) |
| 5 | Using Poynting Theorem derive an expression for power flow in a co-axial cable | (5) |
| 6 | What are uniform plane waves? Explain. | (5) |
| 7 | Explain phase velocity and group velocity. | (5) |
| 8 | What is skin depth? Explain. | (5) |

PART B*Answer any two full questions, each carries 10 marks.*

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| 9 | Verify divergence theorem for the vector field $\mathbf{D}=2\rho z^2\mathbf{a}_\rho + \rho\cos^2\Phi\mathbf{a}_z$ over the region defined by $0 \leq \rho \leq 5$, $-1 \leq z \leq 1$ and $0 \leq \Phi \leq 2\pi$. | (10) |
| 10 | a) State and prove Gauss's Law. | (4) |
| | b) A circular ring of radius a carries a uniform charge ρ_L C/m and is placed on the xy -plane and centered at origin. Derive an expression for electric field intensity at a point $(0, 0, h)$ on the axis of the ring. | (6) |
| 11 | a) Explain the physical significance of gradient of a scalar quantity and curl of a vector quantity. | (5) |
| | b) What is an equipotential surface? What are its properties? | (5) |

PART C

Answer any two full questions, each carries 10 marks.

- 12 State and explain Biot-Savart Law. Apply Biot-Savart's Law to derive an expression for magnetic field intensity due to a straight current carrying conductor of finite length. (10)
- 13 a) Apply amperes circuital law to find magnetic field intensity due to an infinitely long straight conductor. (5)
- b) From Faraday's Law, derive Maxwell's Equations in Differential and integral form. (5)
- 14 Derive an expression for electrostatic energy in terms of electric field intensity. (10)

PART D

Answer any two full questions, each carries 10 marks.

- 15 From Maxwell's equations, derive wave equations for free space. Also write wave equations in phasor form. (10)
- 16 a) Explain about electromagnetic interference and electromagnetic compatibility. (5)
- b) A uniform plane wave in free space is given by $\mathbf{E} = 10.4 \times 10^{-6} e^{j(2\pi \times 10^9 t - \beta x)} \mathbf{a}_y$ V/m. Find (i) Direction of propagation (ii) wave velocity (iii) Phase constant β (5)
- 17 For a lossy dielectric material having $\mu_r = 1, \epsilon_r = 48, \sigma = 20 \Omega^{-1} m^{-1}$. At a frequency of 16 GHz, calculate the (i) propagation constant (ii) attenuation constant (iii) phase constant and (iv) wavelength (10)
