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Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
Fourth Semester B.Tech Degree Examination July 2021 (2019 Scheme)

**Course Code: EET204****Course Name: ELECTROMAGNETIC THEORY**

Max. Marks: 100

Duration: 3 Hours

**PART A***(Answer all questions; each question carries 3 marks)*

|    |  | Marks |
|----|--|-------|
| 1  | Explain divergence of a vector field with its physical significance  | 3     |
| 2  | Evaluate the gradient of the scalar field $\frac{3z}{\rho} \cos\phi$   | 3     |
| 3  | Sketch equipotential surfaces for a positive test charge   | 3     |
| 4  | Illustrate the conservative nature of electrostatic field  | 3     |
| 5  | Using Ampere's circuital law, obtain the expression for magnetic field intensity due an infinite wire carrying current | 3     |
| 6  | What do you mean by magnetic vector potential  | 3     |
| 7  | Explain the significance of Poynting vector  | 3     |
| 8  | What is skin effect and explain its significance   | 3     |
| 9  | List the reasons for Electromagnetic Interference  | 3     |
| 10 | Explain impedance matching in transmission lines   | 3     |

**PART B***(Answer one full question from each module, each question carries 14 marks)***Module -1**

- |    |   |   |
|----|---|---|
| 11 | a) State and prove Stokes' theorem  | 7 |
|    | b) Evaluate the curl of the following vector fields a) $\mathbf{P} = xy \mathbf{a}_x + y^2 \mathbf{a}_y + xz \mathbf{a}_z$                      | 7 |
|    | b) $\mathbf{Q} = \rho z^2 \mathbf{a}_\rho + \rho \sin^2\phi \mathbf{a}_\phi + 2\rho z \sin^2\phi \mathbf{a}_z$                                  |   |
| 12 | a) Explain spherical to rectangular coordinate system transformation  | 7 |
|    | b) Express the vector $\mathbf{A} = \rho \sin\phi \mathbf{a}_\rho + \rho \cos\phi \mathbf{a}_\phi - 2z \mathbf{a}_z$ in rectangular coordinates | 7 |

**Module -2**

- |    |   |   |
|----|---|---|
| 13 | a) State and explain Gauss's law  | 7 |
|    | b) Using Gauss's law, determine the electric field intensity due to an infinite sheet charge of uniform surface charge density. | 7 |

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- 14 a) Derive the expression for capacitance of a coaxial cable 7  
b) Obtain Poisson's and Laplace's equations for a homogeneous material 7

**Module -3**

- 15 a) State and explain Biot Savart's law 7  
b) Obtain the expression for magnetic field intensity on the axis of a rectangular loop carrying current 7
- 16 a) Explain the boundary conditions for electric field in a dielectric-dielectric interface 7  
b) State and explain the continuity equation for current 7

**Module -4**

- 17 a) Derive wave equations from Maxwell's equations 7  
b) Explain propagation of uniform plane waves in a lossy dielectric medium 7
- 18 a) Define the following terms: phase velocity, group velocity, Attenuation constant and Propagation Constant 6  
b) State and explain Poynting theorem 8

**Module -5**

- 19 a) Obtain the transmission line equations and its solution 10  
b) State the transmission line parameters 4
- 20 a) Obtain the expression for propagation constant and characteristic impedance in the case of a lossless transmission line 7  
b) A low loss coaxial cable of characteristic impedance  $50 \Omega$  is terminated by a resistive load of  $150 \Omega$ . Calculate Voltage standing wave ratio. If the maximum voltage in SWR is 30V, find the minimum voltage 7

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