

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

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

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
Fourth Semester B.Tech Degree Examination June 2022 (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  | Two vectors $\mathbf{A} = 4ax + 8ay$ and $\mathbf{B} = 12ay - 8az$ are on the same plane. Find the vector normal to the plane.     | 3 |
| 2  | Develop the equation for differential volume $dv$ in Spherical coordinate system. Draw necessary figure.                           | 3 |
| 3  | State Coulomb's law and write the equation in vector form.   | 3 |
| 4  | What are equipotential surfaces. Mention two characteristics of equipotential surfaces.  | 3 |
| 5  | Derive the expression for $\mathbf{H}$ at a point due an infinitely long conductor carrying a current $I$ . Use Biot Savart's law. | 3 |
| 6  | State Ampere's circuital law for steady magnetic fields. Write the point form of Ampere's circuital law.                           | 3 |
| 7  | Describe the characteristics of uniform plane waves.   | 3 |
| 8  | What is meant by a Poynting vector. Mention its significance.  | 3 |
| 9  | What are the primary constants of Transmission line. Draw a neat figure to represent it.   | 3 |
| 10 | Define characteristic impedance of a lossless line.  | 3 |

**PART B**

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

**Module -1**

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|----|---|---|
| 11 | a) Find the Vector directed from $(2, -5, -2)$ to $(14, -5, 4)$ in Spherical coordinate system.                               | 7 |
|    | b) Define Gradient of a Vector and Mention three characteristics of it.   | 7 |
| 12 | a) State Divergence of a vector field and Derive the expression for Divergence of a vector field in integral and point forms. | 7 |
|    | b) Derive Coordinate transformation between Cartesian to Cylindrical Coordinates with necessary figure.                       | 7 |

**Module -2**

- 13 a) State Gauss's law and obtain Electric field intensity  $E$  at any point due to an infinite sheet of charge with the help Gauss's law. Draw necessary figures. 7
- b) Obtain the Potential at a point (1,2,5) due to a dipole with centre at origin and of dipole moment  $\mathbf{P} = 20\text{Cm}$  acting along the  $Z$  axis. Also find the Potential at point (1,2,0). 7
- 14 a) Find the Voltage between two infinitely long conductors parallel to  $z$  axis with charges  $+4\text{nC}$  and  $-4\text{nC}$  are passing through points (0,-4,0) and (0,4,0) respectively. Assume free space. 7
- b) Derive the expression for Capacitance per unit length between two infinitely long conductors. 7

**Module -3**

- 15 a) List all the Maxwell's equation for static Electric and Magnetic fields in Integral and Point forms. Write the significance of each in one sentence. 7
- b) An uniform electric field  $\mathbf{E}_1 = 5ax - 2ay + 4az$  incidents at the boundary between two dielectrics of permittivity  $\epsilon_1 = 2$  and  $\epsilon_2 = 4$  respectively. Find the Vector  $\mathbf{E}_2$ . Assume the boundary is at  $Z=0$  plane. 7
- 16 a) Derive the expression for modified form of Ampere's circuital law. 7
- b) The magnetic flux density at a point which is at a perpendicular distance of 2m from an infinitely long current carrying conductor along  $Z$  axis is 0.05 mWb/sq.m. Find the value of dc current passing through the conductor. Also find the value of  $B$  at point (1, 2, 5) during the same condition as above. Assume free space. 7

**Module -4**

- 17 Derive Poynting Theorem. Describe each term in the equation with one sentence. 14
- 18 Calculate the intrinsic impedance  $\eta$ , the propagation constant  $\gamma$ , and the wave velocity  $u$  at a frequency  $f = 50$  Hz for a good conducting medium in which  $\sigma = 58$  S/m and  $\mu r = 1$ . 14

**Module -5**

- 19 Describe the terms; a) SWR. b) Impedance matching c) Propagation constants. 14
- 20 Derive the wave equations for Voltage and Current in a transmission line with neat figure. 14

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