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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 $\boldsymbol{A} = 4\boldsymbol{ax} + 8\boldsymbol{ay}$ and $\boldsymbol{B} = 12\boldsymbol{ay} - 8\boldsymbol{az}$ 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 $\boldsymbol{H}$ 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

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 **P** = 20Cm 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 +4nC and -4nC 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 $\boldsymbol{E_1} = 5a_x - 2a_y + 4a_z$ incidents at the boundary between two dielectrics of permittivity $\epsilon_1 = 2$ and $\epsilon_2 = 4$ respectively. Find the Vector $\boldsymbol{E_2}$. 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 magentic 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 η, the propagation constant γ, and the wave velocity u at a frequency f = 50 Hz for a good conducting medium in which σ = 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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