| PRN: | | Course Code : | UEV302 |
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Second Year **B. Tech** End Semester Examination Winter 2024

# Electromagnet and Power Transfer

Day and Date: Mon 25 NOV 2024 Max Marks: **100** 000229

Time : 10:30AM To 01.30PM Duration: **03** hrs

Instructions: All questions are compulsory.

| | | | Marks | Bloom's Level | CO |
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| Q.1 | | **Attempt the following** | | | |
| | a) | Derive the matrix to convert Cylindrical to cartesian coordinate system and vice versa? | 08 | $L_2$ | CO1 |
| | b) | With suitable diagram explain the cylindrical coordinate system? | 08 | $L_2$ | CO1 |
| | | OR | | | |
| | b) | With suitable diagram explain the Spherical coordinate system? | 08 | $L_2$ | CO1 |
| Q.2 | | **Attempt the following** | | | |
| | a) | Derive the Maxwells' equation in Differential and Integral form? | 08 | $L_2$ | CO2 |
| | b) | Consider, a uniformly charged wire length of L m and the it is uniformly distributed at the rate of line charge density. Determine the Electric Field intensity due to the Line charge? | 08 | $L_2$ | CO2 |
| | | OR | | | |
| | b) | Derive the Electric Field Intensity due to Surface charge? | 08 | $L_2$ | CO2 |
| Q.3 | | **Attempt any two from the following** | | | |
| | a) | Derive the energy stored in the electric field when three charges are distributed in the free space by bringing the charge to the space and taking it back? | 08 | $L_3$ | CO3 |
| | b) | Assume $\vec{A} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$. Find the magnitude of the $\vec{A}$ at the point (1,1,1). Find the divergence, gradient and curl operation and explain the importance and difference when those operation carried out in $\vec{A}$. | 08 | $L_3$ | CO3 |
| | c) | By applying Gauss's law find the Electric Field Intensity due to line charge? | 08 | $L_3$ | CO3 |
| Q.4 | | **Attempt any two from the following** | | | |
| | a) | Consider the straight solenoid which has N number of turns and the windings carry the current of I. Apply Ampere's Circuital law and derive the magnetic field intensity in the path which has the length of 'a' along the direction of the solenoid length? | 08 | $L_3$ | CO3 |
| | b) | A circular loop of radius b in XY plane and carries a current I. Obtain an expression for a magnetic flux density at a point on the positive Z axis. What is the approximate expression for magnetic flux density at a point far away from the loop? | 08 | $L_3$ | CO3 |
| | c) | Using Biot Savart's law find the magnetic field intensity due to the straight current carrying conductor at the outside of the conductor of point P which is at the distance 'a' from an end of the conductor. Assume total length of the wire is 'l' | 08 | $L_3$ | CO3 |
| Q.5 | | **Attempt any Two of the following** | | | |
| | a) | Derive the plane wave equation in terms of Electric Fild Intensity and Magnetic Field Intensity? | 09 | $L_4$ | CO3 |
| | b) | Derive the conduction current density and displacement current density with suitable diagram and explanation? | 09 | $L_4$ | CO3 |



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| | c) | Derive the wave equation when the Wave passes through dielectric? Consider there is no conductor. | 09 | $L_4$ | CO3 |
| Q.6 | | **Attempt any Two of the following** | | | |
| | a) | Detail the types of wireless power transfer with merits and demerits? | 09 | $L_4$ | CO4 |
| | b) | Draw the schematic of Inductive Power Transfer and explain the principle? | 09 | $L_4$ | CO4 |
| | c) | Explain the principle of Inductive Power Transfer and with suitable derivation detail the impact of coupling coefficient? | 09 | $L_4$ | CO4 |

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