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 **PRESIDENCY UNIVERSITY**

  **Bengaluru**

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| **End - Term Examinations – JANUARY 2025** |
| **Date:** 11 - 01- 2025 **Time:** 01:00 pm – 04:00 pm |

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| **School:** SOE | **Program:** Electronics and Communication |
| **Course Code :** ECE3004 | **Course Name :** ELECTROMAGNETIC THEORY |
| **Semester**: III | **Max Marks**:100 | **Weightage**:50% |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** | **16** | **29** | **31** | **24** | **NA** |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*

**Part A**

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| **Answer ALL the Questions. Each question carries 2marks. 10Q x 2M=20M** |
| **1** | Four Points are A(2,3,-1)B(1,5,2)C(3,1,-5) and D(1,2,3).Find (i)AB+CD (ii)AB-CD | **2 Marks** | **L1** | **CO1** |
| **2** | State Gauss Divergence Theorem with relevant equation | **2 Marks** | **L1** | **CO2** |
| **3** | List different coordinate systems with relevant equations | **2 Marks** | **L1** | **CO1** |
| **4** | State Guass Law for Electric field intensity | **2 Marks** | **L1** | **CO2** |
| **5** | State Faraday’s first Law | **2 Marks** | **L1** | **CO3** |
| **6** | Determine the relationship between Magnetic field intensity and Magnetic flux density | **2 Marks** | **L1** | **CO3** |
| **7** | Pictorially represent Electro-magnetic Waves in free space as explained by Maxwell | **2 Marks** | **L1** | **CO4** |
| **8** | Determine the two conditions Maxwells equation for free space(Vaccum) | **2 Marks** | **L1** | **CO4** |
| **9** | Define Lorentz force | **2 Marks** | **L1** | **CO3** |
| **10** | Determine the magnetic field in the figure | **2 Marks** | **L1** | **CO3** |

**Part B**

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| **Answer the Questions Total 80 Marks** |
| **11.** | **a.** | State Green’s Theorem. Evaluate $∮\_{c}^{}\left(2x^{2}-y^{2}\right)dx+(x^{2}+y^{2})dy$ where C is the boundary enclosed by line x=0,y=0,x=2,y=3 using green’s theorem (both LHS and RHS) | **(2+8)****Marks** | **L2** | **CO1** |
| **Or** |
| **12.** | **a.** | 1. Find the divergence of the following vector fields $ $

$A=x^{2}z a\_{x}-y^{2}z^{2}a\_{y}+xy^{2}za\_{z}$.1. Find the gradient of the following scalar fields V=$e^{-z }Sin\left(2x\right)Coshy$
2. Find the curl of the following vector fields

$$A=x^{2}yz a\_{x}+xza\_{z}$$ | **(3+3+4)****Marks** | **L2** | **CO1** |
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| **13.** | **a.** | 1. A point charge of Q1=2µC is located in free space at P1(-3,7,-4) while Q2=5 µC is at P2 (2,4,-1) find $\rightharpoonaccent{F\_{12}}$ and $\rightharpoonaccent{F\_{21}}$
2. Two point charges 2mc and -3mc are located at (-1,3,2) and (1,1,-4) respectively. If the force acting on 5nc charge located at (1,3,-1) is $\vec{F}$ Determine $\vec{E}$ at that point
 | **(5+5)****Marks** | **L2** | **CO2** |
| **Or** |
| **14.** | **a.** | 1. Find the charge in the volume defined by

 $ρ\_{v}=\frac{1}{x^{3}y^{3}z^{3}}$c/m3 -0.2<x,y,z<0.21. Find the electric field intensity at a distance 25cm from the center of an infinite bar that has line charge density 60nc/m
 | **(5+5)****Marks** | **L2** | **CO2** |

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| **15.** | **a.** | Derive the expression for total Magnetic field for current carrying wire of infinite and finite length using Bio Savarts Law | **10****Marks** | **L2** | **CO3** |
| **Or** |
| **16.** | **a.** | 1. If a current of 5A is flowing through a wire determine the magnetic field at a distance 0.5m perpendicular from the wire using Ampere Circuital law
2. If a current of 10A is passed through a solenoid of length 0.5m and number of windings 1500. Determine the magnetic field within the solenoid using Ampere Circuital Law
 | **(5+5)****Marks** | **L3** | **CO3** |

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| **17.** | **a.** | 1. Derive the expression for Poisson and Laplace Equation
2. If an electric dipole moment $\rightharpoonaccent{P}=6a\_{z}$ n-cm is located at the origin in free space. Determine electric field intensity at P(r=4. Ɵ=20, ø=0)
 | **15****Marks** | **L3** | **CO2** |
| **Or** |
| **18.** | **a.** | 1. There are two primary boundary conditions associated with electric fields that need to be considered when studying an electromagnetic problem. These conditions are concerned with the normal and tangential components of the electric field vectors at the boundary between two different media.Determine the Boundary conditions for Electric field with respective to dielectric
2. A parallel plate capacitor filled with air separated by distance 0.5mm. If the capacitor is connected across a 9V battery determine (i) Electric field between the two plates (ii) Energy density
 | **10+5****Marks** | **L3** | **CO2** |

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| **19.** | **a.** | 1. List Maxwell equation in Integral and Differential form
2. The magnetic field at a point in space is $H=4xa\_{x}-2Kya\_{y}+8a\_{z}$ find the value of K using Gauss law for Magnetic field
 | **10+5****Marks** | **L3** | **CO3** |
| **Or** |
| **20.** | **a.** | The point charge Q=18nc has a velocity of 5x106 m/s in the direction $a\_{v}=0.04a\_{x}-0.05a\_{y}+0.2a\_{z}$ calculate the magnitude of force exerted on the charge by the field1. $E=(-3a\_{x}-4a\_{y}+6a\_{z})$ Kv/m
2. $B=(-3a\_{x}-4a\_{y}+6a\_{z})$mT
3. $B and E acting together$
 | **15****Marks** | **L3** | **CO3** |

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| **21.** | **a.** | Differentiate between Magnetic Scalar Potential and Magnetic vector Potential with relevant Equations. | **20****Marks** | **L2** | **CO4** |
| **Or** |
| **22.** | **a.** | The Poynting Theorem which was named after the British Physicist John Henry Poynting is a concept in electromagnetism that describes the energy inflow in an electromagnetic field. It Establishes a connection between the electromagnetic fields and the rate of energy transfer in a given region of space. Define Poynting Theorem. Derive the Expression for the average Power Poynting Theorem | **20****Marks** | **L2** | **CO4** |

**\*\*\*\*\* BEST WISHES \*\*\*\*\***