Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: Mid Sem Exam (Oct 2022)

Branch	**: ECE (B.Tech)**	**Semester**	**: III**
Title of the Course	**: Electromagnetic Theory**	**Course Code**	**: ECL 203**

Time: 1 Hour 30 Minutes **Maximum Marks: 25**

Note : All questions are compulsory. Figure in right hand margin indicates full marks for the question.

Q1. Write the unit vector in the direction from the origin towards the point P(4 , -3, -2). **[1 Marks]**

Q2. Convert point (1,2,3) in spherical coordinate system. **[1 Marks]**

Q3. Write the vector $\mathbf{A}= 10\hat{a}_x - 8\hat{a}_y + 6\hat{a}_z$ in cylindrical coordinate system at point P(10, -8, 6) **[2 Marks]**

Q4. Write the gradient of $L = (40 \cos\theta) / r^2$ at point P(3, $\pi/3$, $\pi/6$). **[2 Marks]**

Q5. Given a vector $\mathbf{A}= (3x + C_1 z)\,\hat{a}_x + (C_2 x - 5z)\,\hat{a}_y + (4x - C_3 y + C_4 z)\,\hat{a}_z$ **[2 Marks]**
What will be the values of C_1, C_2, C_3, and C_4, if the vector A is irrotational and solenoidal?

Q6. A volume charge density is expressed as $\rho_v = 10z^2 x \sin(\pi y)$. Find the total charge inside the volume $(-1 \le x \le 2)$, $(0 \le y \le 1)$, $(3 \le z \le 3.6)$. **[2 Marks]**

Q7. Find **E** at P(1,5,2) m in free space if a point charge of 6μC is located at (1,1,1), the uniform line charge with density ρ_L = 180 nC/m along x axis.. **[2 Marks]**

Q8. The flux density $\mathbf{D} = (r/3)\,\hat{a}_r$ nC/m^2 is in free space. How much total electric flux leaving the sphere of r = 0.3 m ? **[2 Marks]**

Q_1 = -20 uC and Q_2 = 50 uC are the points charges located at P(-6,4, 6) and R(5, 8, -2) in free space. Find the force exerted on Q_1 by Q_2 in vector form. **[3 Marks]**

Q9. The charge lies on the circular disc $r \le 4$m, z = 0, with density $\rho_S = (10^{-4}/r)$ C/m^2. Determine **E** at r = 0, z = 3m. **[3 Marks]**

Q10. Derive the expressions for electric field intensity and electric flux density due charged circular ring carrying a uniform charge density ρ_L C/m along its circumference of radious **R** placed in xz plane with center at origin. **[5 Marks]**