



Department of Electrical and Electronic Engineering

Level-3, Term-I

Mid-Term Examination, Spring-2023

Course Code: EEE 305

Course Title: Engineering Electromagnetics

Notes:

Time: 1 Hour

a. Each question carries 30 marks.

Full Marks: 60

b. Figure on the right of each question indicate marks for respective question.

Answer any two questions including Question-1

1. a. Two parallel plates are charged equally but oppositely. Explain why the gradient can be found by directly going through the perpendicular distance between the plates. (5)
- b. Consider the vector $\mathbf{P}=50e^{-5z}(\mathbf{r}_a+\mathbf{a}_z)$. Determine the flux of \mathbf{G} out of the entire surface of the cylinder shown in **Figure 1(b)**. The radius of the cylinder is 1 and the height is in the range of $0 \leq z \leq 2$. (25)

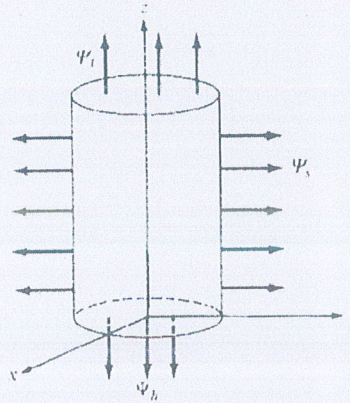


Figure 1(b). Cylinder for question number 1.b

2. a. An experimental water tub is to be filled with water from a tap. Water is to be filled to a certain volume and drained slowly. Using the concept of divergence of a vector, analyze the divergence at the regions: (20)
- At the surface of the water tap
 - The region where the water just falls on the tub.
 - The middle of the tub
 - The drain

You may use diagrams to help your discussion.

- b. Explain the differences between an open surface and a closed surface. (10)

3. a. Explain the differences in properties between a flow source and a vortex source with appropriate examples. Hence, clarify why the work done is non-zero when a hypothetical magnetic monopole is traversed around the flux but is zero in the case of an electric field. (15)
- b. Given that a $W=x^3y^2+xyz$, compute ∇W and the directional derivative dW/dl in the direction $3\mathbf{a}_x+4\mathbf{a}_y+12\mathbf{a}_z$ at $(2, -1, 0)$. (15)