MPH-003

ASSIGNMENT BOOKLET

M.Sc. (Physics) Programme
(MSCPH)

ELECTROMAGNETIC THEORY

Valid from 1st January, 2025 to 31th December, 2025

School of Sciences
Indira Gandhi National Open University
Maidan Garhi, New Delhi-110068
(2025)

Dear Student,

Please read the section on assignments in the Programme Guide for M.Sc. (Physics). A weightage of 30 per cent, as you are aware, has been earmarked for continuous evaluation, **which would consist of one tutor-marked assignment** for this course. The assignment is in this booklet. The total marks for this assignment is 50, of which 20 marks are needed to pass it.

Instructions for Formatting Your Assignments

Before attempting the assignment please read the following instructions carefully:

1) On top of the first page of your answer sheet, please write the details exactly in the following format:

ENROLMENT NO.: …..……

NAME: ……

ADDRESS: ……

COURSE CODE:……..

COURSE TITLE: ……..……

ASSIGNMENT CODE: ……..

STUDY CENTRE: …….. **DATE:** ……

PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION AND TO AVOID DELAY.

2) Use only foolscap size writing paper (but not of very thin variety) for writing your answers.

3) Leave 4 cm margin on the left, top and bottom of your answer sheet.

4) Your answers should be precise.

5) **Submit the complete assignment answer sheet within the due date.**

6) The assignment answer sheets are to be submitted to your Study Centre as per the schedule. **Answer sheets received after the due date shall not be accepted. We strongly suggest that you retain a copy of your answer sheets.**

7) This assignment is **valid from 1st January, 2025 to 31th December, 2025**. If you have failed in this assignment or fail to submit it by December 31, 2025, then you need to get the assignment for the year 2026, and submit it as per the instructions given in the Programme Guide.

8) **You cannot fill the examination form for this course** until you have submitted this assignment. For any queries, please contact: srjha@ignou.ac.in

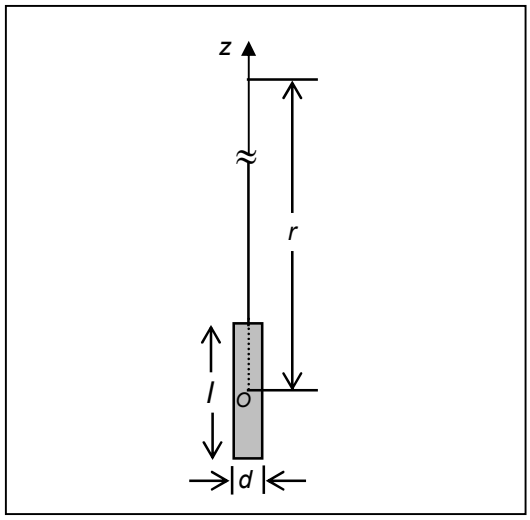
We wish you good luck.

Tutor Marked Assignment
ELECTROMAGNETIC THEORY

Course Code: MPH-003
Assignment Code: MPH-003/TMA/2025
Max. Marks: 50

Note: Attempt all questions. The marks for each question are indicated against it.

1. A cylindrical conducting rod of diameter d and length $l\,(l >> d)$ is uniformly charged such that the electric field near its surface and far from its ends is $\vec{E}_0$ as shown in the Figure below. The total charge on the rod is Q and the charge per unit length is λ. Calculate the electric field at a distance r $(r >> l)$ from the centre of the rod along its axis.



(5)

2. Show that Poisson's equation follows from Gauss's law for electrostatics. Write the general form of Poisson's equation and its solution and apply it for electrostatic potential due to a charge distribution. (3+7)

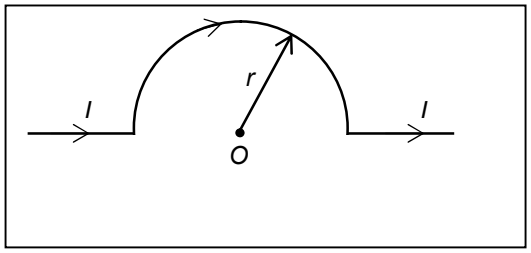
3. A charged infinite straight wire having uniform linear charge density λ is placed at a distance b above a grounded conducting plane. Determine the electric potential in the region above the plane using the method of images. (5)

4. Define displacement vector $\vec{D}$ and deduce Gauss's law in a dielectric medium. (5)

5. Calculate the magnetic vector potential due to an infinite straight current carrying wire at a point located at distance r along a direction perpendicular to the wire. The current I in the wire is flowing in the x-direction. (5)

6. Obtain an expression for the dipole moment of magnetic dipole arising due to atomic current in terms of the angular momentum of electron in the atom. Also explain the terms gyro-magnetic ratio and Lande g-factor. (6+4)

7. An infinite long wire carries a current 1 A. The wire is bent so as to have a semi-circular shape around the origin with radius 1 cm as shown in the Figure below. Calculate the magnetic field at the origin *O* and determine the direction of the field with respect to the plane of the paper.



(5)

8. What do you understand by the term reluctance? Obtain an expression for reluctance in a magnetic circuit made of an iron ring magnetised by a current flowing through a coil wound closely over it. (5)

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