

(i) Printed Pages : 3

Roll No.

(ii) Questions : 7

Sub. Code :

1	1	7	5	6
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Exam. Code :

5	0	1	2
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**Bachelor of Science (FYUP) 2nd Semester
(2056)**

PHYSICS

Paper : Electricity and Magnetism

Time Allowed : Three Hours] [Maximum Marks : 60

Note :— Attempt 2 questions each from Unit I and Unit II, Unit III is compulsory.

UNIT - I

(Attempt any two questions. Each question carries 12 marks.)

1. (a) Define gradient, divergence and curl of a vector field. Explain their physical significance. 6
(b) State and prove Gauss's divergence theorem. 6
2. (a) Using Coulomb's law, derive the expression for electric field due to an electric dipole at a point on its axial line. 6
(b) Prove that $\nabla \cdot \left(\frac{\vec{r}}{r^3} \right) = 0$ 6
3. (a) Show that the electric field is the negative gradient of scalar potential. 4

(b) Prove that the function $V = \frac{A}{\sqrt{x^2 + y^2 + z^2}} + B$, where A and B are constants, satisfies Laplace's equation. 4

(c) What is polarization of dielectric? Establish relation between electric susceptibility and dielectric constant. 4

UNIT - II

(Attempt any two questions. Each question carries 12 marks.)

4. (a) Define current density and derive the equation of continuity. 6

(b) An electric field, measured in the laboratory frame of reference is given by:

$\vec{E} = (3\hat{i} + 4\hat{j}) \text{NC}^{-1}$. Calculate the electric field $\vec{E}'$ as measured in a frame of reference moving with a velocity of $\vec{v} = (2\hat{i} + 1.5\hat{j}) \text{ms}^{-1}$ with respect to the laboratory frame. 6

5. (a) State and explain Biot-Savart's law. Use it to derive magnetic field at the centre of a circular current loop. 6

(b) Show that divergence of $\vec{B}$ is zero and curl of $\vec{B}$ is $\mu_0 \vec{J}$. 6

6. (a) State Ampere's circuital law and apply it to find magnetic field inside a long solenoid. 6

(b) Explain Faraday's law of electromagnetic induction. Define self-inductance and mutual inductance. 6

UNIT - III (Compulsory)

(Attempt any six. Each carry 2 marks.)

7. (1) Define Laplacian operator.
- (2) Write the differential form of Gauss's law.
- (3) What is electric dipole moment?
- (4) Define electric potential.
- (5) What is polarizability?
- (6) Define magnetic susceptibility.
- (7) State Lorentz force law.
- (8) What is self-inductance?

$2 \times 6 = 12$