Second Semester B.Sc., Degree Examinations

May / June 2026

(Semester Scheme NEP 2021 onwards CBCS)

PHYSICS

Paper : II: DSC 4 : NSB0210 : Electricity and Magnetism

Time: 2 hrs.] *[Max.Marks:60*

Instructions to Students :

1. ***The students should legibly write section number along with question number.***
2. ***The answer without section number and question numbers will not be valued.***
3. ***The question numbers should be legibly written within margin only.***
4. ***The question paper consists of four Sections I, II, III and IV.***
5. ***Answer all the questions (MCQ type) in Section - I, five questions in section-II Section - III and two questions in Section - IV.***
6. ***Draw the neat labelled diagrams wherever necessary.***
7. ***Take necessary data from tables.***
8. ***Symbols used have their usual meaning.***
9. ***Use of scientific calculator is allowed.***
10. ***Section - I question should be answered in first page of answer booklet.***

SECTION- I

I. ***Select the most appropriate answer from options provided :*** ***10X 1= 10 Marks***

I-1) The electric field inside a perfectly conducting material is

(a) ∞ (b) 0

(c) π (d) depends on charge

I-2) A test charge is brought from a lower to a higher potential point. The test charge's potential energy will

(a) Stay constant (b) go up

(c) go down (d) go to zero

I-3) An electric dipole placed in a non-uniform electric field experiences

(a) a force with no torque (b) a torque but no force

(c) a force as well as a torque (d) neither a force nor a torque

Contd...2

I-4) Which of the following is correct in case of capacitor

(a) $W = \frac{1Q^2}{2C}$ (b) $W = \frac{1}{2}\ CI^2$

(c) $W = \frac{1}{2}\ VC^2$ (d) $W = \frac{1}{2}\ CV^2$

I-5) The capacitance of the capacitor increases when plates are kept

(a) Closer together (b) further apart

(c) in series (d) made smaller

I-6) In a series resonance circuit impedance will be

(a) Zero (b) infinite

(c) very small and finite (d) none of these

I-7) $\sqrt{\mu/\varepsilon}$ has the dimensions of

(a) An inductance (b) a capacitance

(c) an impedance (d) an electric field

I-8) Which of the following is correct

(a) $\vec{D} = \varepsilon \vec{E}$ (b) $\nabla V = -\vec{E}$

(c) $\vec{J} = \sigma \vec{E}$ (d) all are correct

I-9) An A.C. wave is

(a) Unidirectional wave (b) bi-directional wave

(c) non directional wave (d) none of the above

I-10) Susceptibility for diamagnetic substances are

(a) Negative and small (b) positive and small

(c) positive and high (d) none of the above

SECTION- II

II. ***Answer any FIVE of the following questions.*** *5X 3= 15 Marks*

II-1) Mention the properties of electrical charges.

II-2) State Gauss's theorem and using it calculate the electric field due to a line charge distribution.

Contd...3

II-3) A parallel plate capacitor consists of two square metal plates 6.0 cm of side and separated by 1 cm. A sulphur slab 6 mm thick is placed on the lower plate. Calculate the capacitance of the capacitor; dielectric constant of sulphur is 4.

II-4) State Biot - Savart law and Mention its applications.

II-5) A coil has an inductance of 20 H and a resistance of 10 ohm. It is connected to a 50 V battery. How long will it take for the current to reach one half of the final value?

II-6) Obtain an expression for power in AC circuit with only pure resistance.

II-7) Compare diamagnetic and paramagnetic materials.

II-8) What is poynting vector? Define poynting theorem.

SECTION- III

III. ***Answer any THREE of the following questions.*** ***3X 5= 15 Marks***

III-1) State and prove Gauss's theorem in electrostatics.

III-2) Obtain an expression for growth of charge in a RC circuit and hence define time constant of the circuit.

III-3) State Ampere's law and calculate magnetic field due to a straight long conductor using Ampere's law.

III-4) Derive Maxwell's first equation $\vec{\nabla} \cdot \vec{D} = \rho$ from Gauss law.

III-5) Write a note on Displacement current and its significance.

SECTION- IV

IV. ***Answer the following:*** ***2X 10= 20 Marks***

IV-1) a) Obtain an expression for the electric potential and electric field due to a dipole.

OR

b) Deduce an expression for the energy stored in a charged conductor and show that there is a loss of energy due to sharing of charges between two conductors.

Contd...4

IV-2) a) Derive an expression for current and impedance of a series L-C-R circuit using *j* notation and discuss the phenomena of resonance.

OR

b) Arrive at electromagnetic wave equation from Maxwell's equation and show that the electromagnetic waves travel with the velocity of light.

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