C. U. SHAH UNIVERSITY
Winter Examination-2021

Subject Name : Electricity and Magnetism

Subject Code : 4SC03ELM1   **Branch: B.Sc. (Chemistry, Physics)**

Semester: 3   **Date: 20/12/2021**   **Time: 02:30 To 05:30**   **Marks: 70**

Instructions:
(1) Use of Programmable calculator & any other electronic instrument is prohibited.
(2) Instructions written on main answer book are strictly to be obeyed.
(3) Draw neat diagrams and figures (if necessary) at right places.
(4) Assume suitable data if needed.

Q-1   **Attempt the following MCQs:**   (14)

a) The absolute permittivity (ε_0) = _____
   (A) 8.854×10^{-12} F/m   (B) 8.854×10^{12} Fm
   (C) 8.458×10^{-12} F/m²   (D) 8.458×10^{12} Fm²

b) The absolute permeability (μ_0)= _____
   (A) $4\pi \times 10^7$ H/m   (B) $4\pi \times 10^{-7}$ Hm
   (C) $4\pi^2 \times 10^{-7}$ H/m   (D) $(\pi/4) \times 10^{-7}$ Hm²

c) Unit of Electric field $(\vec{E})$= _____ & Unit of Electric flux (ϕ_E)=_____
   (A) $N/m \ \& Nm^2/C$ (B) $Vm \& Nm^2$
   (C) $N/C \ \& Nm^2/C$ (D) $NC \& Nm^2 . C$

d) The unit of inductance is
   (A)   Henry   (B)   Vs/A
   (C)   None of these   (D)   Both (A) and (B)

e) The relation amongst Capacitance (C), Potential (V) and Charge (Q) =
   (A)   C = Q/2V   (B)   V = QC
   (C)   Q= C/V   (D)   C = Q/V

f) The work of a capacitor is to store_____.
   (A)   Electric charge   (B)   Potential energy
   (C)   Both (A) and (B)   (D)   None of these

g) The unit of capacitance is _____, which is the ratio of _____to_____.
   (A)   Coulomb, Volt, Farad,   (B)   Farad, Coulomb, Volt
   (C)   Farad, Volt, Coulomb   (D)   Farad, Resistance, Volt

h) What is the unit of magnetic susceptibility?
   (A)   Unitless   (B)   Tesla
   (C)   Weber/meter²   (D)   A/m

i) Which of the following material is not the ferromagnetic?
    (A)   Aluminium (Al)   (B)   Nickle (Ni)
    (C)   Cobalt (Co)   (D)   Iron (Fe)

j) What happens when a ferromagnetic material is heated above its Curie temperature?
    (A)   It becomes diamagnetic   (B)   It becomes paramagnetic.
    (C)   It turns antiferromagnetic.   (D)   It becomes ferromagnetic.

k) In a bar magnet, the magnetic field lines
    (A)   go from S- to N- pole   (B)   are not present.
    (C)   go from N- to S- pole   (D)   depend on its dimensions.

l) Tesla (T) and Weber/meter^2 (Wb/m^2) are the two different units of _____magnetic quantity.
    (A)   Magnetic field   (B)   Magnetic induction
    (C)   Magnetic flux density   (D)   All

m) Which of the following is ferromagnetic?
    (A)   All metals and alloys   (B)   Glass and Polymers
    (C)   Quartz and Ceramics   (D)   Cobalt and Nickel

n) The electromagnetic waves are
    (A)   Acoustical waves   (B)   Mechanical waves
    (C)   Transverse waves   (D)   Longitudinal waves

Attempt any four questions from Q-2 to Q-8

Q-2	Attempt all questions	(14)
(A)	Explain electric field strength and derive $\overrightarrow{E} = \frac{1}{4\pi\,\varepsilon_0}\int\frac{1}{r^2}\,dq\,\hat{r}$	07
(B)	Discuss electric flux (ϕ) and Electric flux density (D)	07
Q-3	Attempt all questions	(14)
(A)	State Gauss theorem and explain any one of its applications.	06
(B)	What do you mean by a capacitor and its capacitance? Give the equations of potential and electric field of dipole (1) on the axial line and (2) on the bisector of the dipole.	08
Q-4	Attempt all questions	(14)
(A)	Write a brief account of diamagnetism and diamagnetic materials.	07
(B)	Write a brief account of paramagnetism and paramagnetic materials.	07
Q-5	Attempt all questions	(14)
(A)	Write a brief account of ferromagnetism and ferromagnetic materials	07
(B)	Derive the relationship between:	07

Relative magnetic permeability (μ_r) and Magnetic susceptibility (χ)

Q-6   Attempt all questions   (14)

(A) Define Hall effect with necessary figure.   10
Derive necessary expressions for the Hall voltage, Hall coefficient and Mobility of charge carriers.

(B) Discuss in short magnetic field due to a solenoid carrying current.   04

Q-7   Attempt all questions   (14)

(A) Draw and narrate each phase of a hysteresis curve for a ferromagnetic material.   07

(B) Write a short note on "Self-Induction and Self-Inductance of a solenoid".   07

Q-8   Attempt all questions   (14)

(A) Define the following terms with figure and giving unit of each: 08
(01) Magnetic Field (Induction) $\left(\vec{B}\right)$ (02) Magnetic line of forces
(03) Magnetic Flux (ϕ) (04) Magnetic Susceptibility (χ)

(B) Write a short note on the transverse nature of the EM waves.   06