



Seat No. _____

HAL-003-2013002
B. Sc. (Sem.-III) (CBCS)
(W.E.F. 2019) Examination
June - 2023
Physics : 301

(Magnetism & Semiconductor) (New Course)

Faculty Code : 003

Subject Code : 2013002

Time : $2\frac{1}{2}$ Hours / Total Marks : 70

- Instructions :** (1) All questions are compulsory.
(2) Symbols have their usual meaning.
(3) Figures on right side indicate marks.

- 1 (A) Give answer in short: 4
(1) Define vector quantity.
(2) Name any two vector physical quantities.
(3) Define scalar product of two vectors.
(4) Define divergence.
- (B) Answer any one question: 2
(1) If $\vec{A} = 2i + 3j + k$ and $\vec{B} = 3i + 4j + 2k$ then find $A \cdot B$
(2) Find the gradient of $f = X^2 + Y^3 + Z^4$.
- (C) Answer any one question: 3
(1) Write properties of scalar product.
(2) Calculate the curl of $\vec{V} = Y^2i + (2XY + Z^2)j + 2YZk$.
- (D) Answer any one question: 5
(1) State and explain fundamental theorem of Divergence.
(2) Explain fundamental theorem of curl.

- 2 (A) Give answer in short: 4
- (1) What is the unit of charge?
 - (2) Electric field is vector quantity, true or false ?
 - (3) Gauss law is true for any closed surface, true or false ?
 - (4) Which law is useful to calculate electric field at any point ?
- (B) Answer any one question: 2
- (1) If $\vec{E} = 2i + 3j + k$ N/C and area $\vec{A} = i + j + 3k$ m^2 then calculate the flux passing through the area.
 - (2) Calculate the electric intensity required to just support an ion of mass 10^{-4} g and having a charge of 1.44 coulomb in air.
- (C) Answer any one question: 3
- (1) Explain Coulomb's law in details.
 - (2) Explain electric potential.
- (D) Answer any one question: 5
- (1) Explain electric flux and Gauss law.
 - (2) Explain electric field around uniformly charged spherical shell.
- 3 (A) Give answer in short: 4
- (1) The current carrying wire attract each other what will be the direction of current through the wire ?
 - (2) Write the expression of Lorentz force.
 - (3) Which relation is known as cyclotron formula ?
 - (4) Write the formula of Bio Savart law.
- (B) Answer any one question: 2
- (1) A solenoid of length 0.5m has a radius of 1 cm and its made up of 500 turns it carry current of 5 A .Calculate the magnetic field inside the solenoid.
 - (2) Calculate the magnitude of the magnetic field due to long thin wire carrying current of 15 Amp at a distance of 1 cm from the wire.

- (C) Answer any one question : 3
- (1) To find the magnetic field inside the solenoid using Ampere's circuital law.
 - (2) A long wire carries a current of 2 A. An electron travel with a velocity of 40000 m/s parallel to the wire 0.1 m from it in a direction opposite to the current. What force does the magnetic field of current exert on the moving electron? $\mu_0 = 4\pi \times 10^{-7}$
- (D) Answer any one question: 5
- (1) State Bio Savart law and derive the magnetic field at a distance R from a long straight wire carrying a steady current I.
 - (2) State Bio Savart law and derive a magnetic field at a distance x from the centre of a circular loop of radius which carries a steady current I.
- 4 (A) Give answer in short: 4
- (1) Which kind of biasing is required for operation of photo diode?
 - (2) Draw the symbol of varactor diode.
 - (3) Name the diode which act as variable capacitor.
 - (4) What is the principle of photo diode?
- (B) Answer any one question: 2
- (1) A coil of induction $0.4/\pi$ Henry is joined in series with a resistance of 30Ω . Calculate the current flowing in the circuit, when connected to a.c. mains of 200 volt and frequency 50Hz.
 - (2) A series LCR circuit has $L=1\text{mH}$, $C=0.1 \mu\text{F}$ and $R=10\Omega$ calculate the resonance frequency of the circuit.
- (C) Answer any one question: 3
- (1) Discuss the working and construction of LED.
 - (2) Explain any one application of photodiode.

- (D) Answer any one question: 5
- (1) Explain construction, working and application of Solar cell.
 - (2) Explain construction, working and uses of phototransistor.
- 5 (A) Give answer in short: 4
- (1) Why transistor biasing is necessary ?
 - (2) The operating point of the circuit changes when temperature increases due to _____.
 - (3) The operating point is also known as _____.
 - (4) What is the Ideal value of stability factor?
- (B) Answer any one question: 2
- (1) If in transistor configuration the value of $\alpha = 0.98$, what would be the value of β ?
 - (2) For the transistor amplifier having
 $R_C = 2\text{ k}\Omega$, $R_L = 1\text{ k}\Omega$, $R_{in} = 1\text{ k}\Omega$, $\beta = 80$
find the voltage gain.
- (C) Answer any one question: 3
- (1) Explain operating point of transistor.
 - (2) Write short note an d.c. and a.c. load line
- (D) Answer any one question: 5
- (1) Explain voltage divider bias method.
 - (2) Explain cut-off and saturation region of C-E transistor.
-