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PBC-003-1013002

Seat No. _____

B. Sc. (Sem. III) (CBCS) Examination

November / December - 2018

Physics : Paper - P - 301

Faculty Code : 003

Subject Code : 1013002

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

Instructions : (1) Attempt all the questions.
(2) Figures on right side indicate marks.
(3) Notations have their usual meanings.

1 (a) Objective type questions : **4**

(1) $\hat{j} \cdot \hat{j}$ = _____.

(2) $\nabla \cdot A$ is the scalar or vector ?

(3) $\nabla \times \left(f\vec{A} \right)$ = _____.

(4) Div (Curl f) = _____.

(b) Answer in brief : (any **one** out of two) **2**

(1) Find the gradient of $f(x, y, z) = x^2 + y^3 + z^4$.

(2) What is ∇ ? Represent it into component form.

(c) Answer in detail : (any **one** out of two) **3**

(1) Explain the vector triple product.

(2) Prove that $\nabla \cdot \left(f\vec{A} \right) = f\left(\nabla \cdot \vec{A} \right) + \vec{A} \cdot (\nabla f)$.

(d) Write a note : (any **one** out of two) **5**

(1) Explain in detail how vector transform from one system to another system.

(2) Explain the fundamental theorems of curls.

2 (a) Objective type questions : **4**

(1) State the Coulomb's law.

(2) What is the unit of electric field intensity ?

(3) Define the potential and give its unit.

(4) $\nabla \cdot E$ = _____.

(b) Answer in brief : (any **one** out of two) **2**

(1) A uniformly charged sphere has a total charge of $400\,\mu$ C and radius of 8 cm. Find the electric field intensity at a point on the surface of the sphere.

(Hint : $E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{R^2}$)

(2) At a point of electric field a charge of 5×10^{-4}C experiences a force of 2.25 N. Calculate the intensity of electric field at that point.

(c) Answer in detail : (any **one** out of two) **3**

(1) Explain continuous charge distribution of various types.

(2) Derive the Poisson's and Laplace's equations.

(d) Write a note : (any **one** out of two) **5**

(1) Derive the Gauss's law in differential and integral form.

(2) Find the value of $\nabla \cdot \vec{E}$ and $\nabla \times \vec{E}$.

3 (a) Objective type questions : **4**

(1) How much work done by a static magnetic field on a moving charge ?

(2) Which relation is known as cyclotron formula ?

(3) Write equation of continuity in magneto statics.

(4) What is differential form of Ampere's law ?

(b) Answer in brief : (any **one** out of two) **2**

(1) Calculate the magnitude of magnetic field due to a long thin wire carrying current of 15 A at distance of 1 cm from the wire.

$\left[\mu_o = 4\pi \times 10^{-7} N/A^2\right]$

(2) A long wire carries a current of 5 mA. Find the line integral of $\vec{B}$ around the path of radius 10 cm, enclosing the wire. $\left[\mu_o = 4\pi \times 10^{-7} N/A^2\right]$

(c) Answer in detail : (any **one** out of two) **3**

(1) Derive equation of continuity.

(2) A long wire carries a current of 2 A. An electron travels with a velocity of 4×10^{-4} m/s parallel to the wire 0.1 from it in direction opposite to the current. What force does the magnetic field of current exert on moving electron ?

$\left[\mu_o = 4\pi\times10^{-7} N/A^2 \text{ and } Q = 1.6\times10^{-19} C\right]$

(d) Write a note : (any **one** out of two) **5**

(1) Give the quantitative explanation of cycloid motion.

(2) Describe magnetic field above a straight wire.

4 (a) Objective type questions : **4**

(1) Define dielectrics.

(2) The induced electric dipole moment $\vec{p}$ = _____.

(3) What is magnetization ?

(4) Give the equation of torque acting on a magnetic dipole.

(b) Answer in brief : (any **one** out of two) **2**

(1) What do you mean by induce dipoles ?

(2) Give the mechanism responsible for peramagnetism.

(c) Answer in detail : (any **one** out of two) **3**

(1) Explain the polarization of matter.

(2) Obtain the expression for force acting on a magnetic dipole in a magnetic field.

(d) Write a note : (any **one** out of two) **5**

(1) Give the physical of bound charges.

(2) Explain the magnetic field on atomic orbits with necessary equations.

5 (a) Objective type questions : **4**

(1) What is operating point or quiescent point of transistor ?

(2) What is faithful amplifications ?

(3) What is stability factor ?

(4) Define frequency response curve of an amplifier.

(b) Answer in brief : (any **one** out of two) **2**

(1) Define voltage gain in single stage transistor amplifier.

(2) In transistor circuit, collector load is $4K\Omega$ where as zero signal collector current is 1 mA.

(i) What is the operating point is V_{cc} = 12 V ?

(ii) What will be the operating point if $R_c = 5K\Omega$?

(c) Answer in detail : (any **one** out of two) **3**

(1) A silicon transistor biased by collector feedback resistor method. Determine the operating point. [Given that $\beta = 100, V_{cc} = 20\,V, R_B = 100K\Omega$ and $R_C = 1K\Omega$]

(2) Derive the equation of stability factor for transistor biasing.

(d) Write a note : (any **one** out of two) **5**

(1) Explain the voltage divider method of transistor biasing.

(2) Discuss phase reversal in detail.
