JAH-003-1013002 Seat No. _____

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

November - 2019

Physics : Paper - 301

(Electricity Magnetism) (Electricity Magnetism & Semiconductor Electronics)

(New Course)

Faculty Code : 003

Subject Code : 1013002

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 hand sides indicates full marks.

1 (a) Give the correct answer of the following questions : **4**

(1) $\nabla \times A$ is the vector or scalar?

(2) $\hat{j} \cdot \hat{k} =$_____

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

(4) State the fundamental theorem for curl.

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

(1) Prove that curl of gradient is zero.

(2) Calculate the divergence of

$$\vec{V} = 2xy\,\hat{i} + 3yz\,\hat{j} + 4zx\,\hat{k}$$

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

(1) Explain the scalar triple product.

(2) Discuss : Operator ∇.

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

(1) Explain the vector transform for two and three dimensional case.

(2) Explain the fundamental theorem of divergences.

2 (a) Give the correct answer of the following questions : **4**

(1) Write the unit of permittivity of free space ε_0.

(2) Write the value of electric charge on electron.

(3) The potential of point charge at distance r is _____.

(4) Write the Laplace's equation.

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

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

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

(2) The potential due to an isolated point charge at a point 30cm from the charge is 300 volts. Calculate the magnitude of the charge.

$$\left(\text{Hint} : V = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r_i}\right)$$

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

(1) Explain continuous charge distribution of various types.

(2) Explain Poisson's equation.

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

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

(2) Describe the electric potential with its comments.

3 (a) Give the correct answer of the following questions : **4**

(1) What is the relation of horentz force?

(2) When a charged particle moves in a magnetic field its potential energy _____.

(3) Write the equation of continuity in magnetostatics.

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

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

(1) A long wire carries a current of 5mA. Find the line integral of $\vec{B}$ around the path of radius 10cm, enclosing the wire. $\left[\mu_0 = 4\pi \times 10^{-7}\ N/A^2\right]$

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

$\left[\mu_0 = 4\pi \times 10^{-7}\ N/A^2\right]$

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

(1) Derive the equation of continuity.

(2) Prove that the divergence of magnetic field is zero.

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

(1) Describe magnetic field above a straight wire.

(2) Discuss Biot-Savart's law.

4 (a) Give the correct answer of the following questions : **4**

(1) Write relation between induced dipole moment and electric field when the electric field is not strong.

(2) Is H_2O polar molecules or non-polar molecules?

(3) Write the equation of torque acting on a magnetic dipole.

(4) What is the differential form of Ampere's law for magnetized material?

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

(1) Define : Polarizability of material.

(2) Define: Linear media

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

(1) Explain the polarization of matter.

(2) Explain the magnetization of material.

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

(1) Discuss the physical interpretation of bound charges.

(2) Derive the expression of torque and force acting on a magnetic dipole when placed in a magnetic field.

5 (a) Give the correct answer of the following questions : **4**

(1) The slope of dc load line is always _____ than ac load line.

(2) The point at which the dc and ac load lines intersect is called _____

(3) An ideal value of the stability factor _____

(4) The phase difference between input voltage and output voltage of a CE amplifier is _____

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

(1) In a common base connection, the emitter current is 1 mA. If the emitter circuit is open, the collector current is $50\,\mu A$ Find the total collector current. $\alpha = 0.92$.

(2) For the transistor amplifier having R_C = 12 KΩ, R_E = 2 KΩ, V_{CC} = 20V, $\beta = 200$ and R_{in} = 2 KΩ. Find the voltage gain.

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

(1) Discuss why stabilization of operating point is necessary.

(2) Explain frequency response for CE transistor amplifier.

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

(1) Explain various regions of C-E connection with the help of output characteristics and a.c. load line.

(2) Describe phase reversal.