

**PARUL UNIVERSITY**  
**FACULTY OF ENGINEERING & TECHNOLOGY**  
**B.Tech. Summer 2022 - 23 Examination**

**Semester: 4****Subject Code: 203106257****Subject Name: Electromagnetics****Date: 27/03/2023****Time: 02:00 pm to 04:30 pm****Total Marks: 60****Instructions:**

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

**Q.1 Objective Type Questions - (All are compulsory) (Each of one mark) (15)**

01. Force is a vector quantity, whereas distance is scalar. Work is defined as the product of force and distance, which is given by \_\_\_\_\_.
  - a) Cross product
  - b) Dot product
  - c) Addition of two vectors
  - d) Cannot be calculated
02. Divergence can be computed only for a vector. Since it is the measure of outward flow of flux from a small closed surface as the volume shrinks to zero, the result will be directionless.
  - a) True
  - b) False
03. From a point charge  $+Q$ , the electric field spreads in all 360 degrees. The calculation of electric field in this case will be spherical system. Thus it is \_\_\_\_\_.
  - a) Charge in space
  - b) Charge in box
  - c) Charge in dielectric
  - d) Uncharged system
04.  $\text{Div}(\text{Grad } V) = (\text{Del})^2V$ , which is the \_\_\_\_\_. A function is said to be harmonic in nature, when its Laplacian tends to zero.
  - a) Laplacian operation
  - b) Curl operation
  - c) Double gradient operation
  - d) Null vector
05. If  $V_{ab} = -\int E \cdot dl$  is the relation between potential and field then it is given by \_\_\_\_\_ integral.
  - a) Line
  - b) Curl
  - c) Surface
  - d) Volume
06. Three charged cylindrical sheets are present in three spaces with  $\sigma = 5$  at  $R = 2m$ ,  $\sigma = -2$  at  $R = 4m$  and  $\sigma = -3$  at  $R = 5m$ . Value of the flux density at  $R = 3m$  is \_\_\_\_\_.
07. Curl is always defined for vectors only. The curl of a vector is a vector only. The curl of the resultant vector is also a \_\_\_\_\_ only.
08. Six equal point charges  $Q = 10nC$  are located at 2, 3, 4, 5, 6 and 7m. The potential at origin is \_\_\_\_\_.
09. The range of Cartesian system is one to infinity. Thus the minimum scalar value of the system is \_\_\_\_\_.
10. If a point charge is single dimensional. The three dimensional imaginary enclosed surface of a point charge will be \_\_\_\_\_.
11. Give expression of the vector potential and field in terms of E.
12. Calculate the dipole moment of a dipole with equal charges  $2C$  and  $-2C$  separated by a distance of 2cm.
13. Find the potential of the function  $V = 60\cos \theta/r$  at the point P(3, 60, 25).
14. What will be the potential due the dipole when the angle subtended by the two charges at the point P is perpendicular?
15. The Maxwell second equation that is valid in any conductor is given by \_\_\_\_\_.

**Q.2 Answer the following questions. (Attempt any three) (15)**

- A) Discuss rectangular co-ordinate system.
- B) If  $A = 2a^x - 3a^y + a^z$  and  $B = -4a^x - 2a^y + 5a^z$ . Find (1)  $A \cdot B$  & (2)  $A \times B$ .
- C) Define electric field and electric flux density.
- D) Explain Gauss's law.

**Q.3 A) Explain cylindrical co-ordinate systems. (07)**

- B) Describe boundary conditions for perfect dielectric materials. (08)

**OR**

- B) Explain potential gradient with necessary mathematical expression. (08)

**Q.4 A) Describe electric potential from a point charge with electric field. (07)****OR**

- A) Transform  $F = 10a^x - 8a^y + 6a^z$  into F in spherical co-ordinates. (07)
- B) Describe Continuity of current. Derive the differential form of the continuity equation of the current  $\nabla \cdot J$ . (08)