



# RAN-1007

## Third Year B.Sc. Semester - V Examination

March / April - 2019

Physics: Paper - VI

Mechanics and Mathematical Method

[ Total Marks: 50

### सूचना : / Instructions

नीचे दृशविले निशानीवाणी विगतो उत्तरवही पर अवश्य लभवी.  
Fill up strictly the details of signs on your answer book

Name of the Examination:

Third Year B.Sc. Semester - V

Name of the Subject :

Physics: Paper - VI

Subject Code No.: 1 0 0 7

Seat No.:

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Student's Signature

- 1) Draw neat diagrams wherever necessary.
- 2) Symbols used in the paper have their usual meaning.
- 3) Figures to the right indicate full marks of the question.
- 4) Scientific calculator may be used.

### 1. Answer the following questions in brief:

( 08 )

- [1] What do you mean by constrain motion?
- [2] Give physical significance of a curl of a vector point function?
- [3] Write any one limitation of Newton's law
- [4] If 'a' is a constant vector then value of  $\vec{\nabla}(\vec{a} \times \vec{r}) = \dots\dots\dots$
- [5] What is an isolated system?
- [6] Define line integral of a vector field.
- [7] When the vector is said to be solenoidal vector?
- [8] Define scleronomic constrain.

- 2 (a) Attempt any one of the following in details: (10)
- (i) Derive Lagrange's equation of motion for conservative system from D'Alembert's principle.
  - (ii) Explain the conservation of momentum and angular momentum of the system of particle.
- (b) Attempt any one of the following in details: (4)
- (i) show that angular momentum is conserved in motion under a central force.
  - (ii) A particle of mass  $m = 1\text{g}$  moves with a uniform velocity  $\vec{v} = (3\hat{i} + 4\hat{j}) \text{ m/s}$ . At time  $t$ , the particle passes through the point  $(1, 2, 0)\text{m}$ . Find the direction and the magnitude of the angular momentum about the origin at time  $t$ .
- 3 (a) Attempt any one of the following in details: (10)
- (i) Derive expression for Grad, Divergence and curl in term of Cylindrical co-ordinate system.
  - (ii) State and prove Stoke's theorem.
- 3 (b) Attempt any one of the following: (04)
- (i) Prove that  $\text{div}(\vec{A} \times \vec{B}) = \vec{B} \cdot (\text{curl}\vec{A}) - \vec{A} \cdot (\text{curl}\vec{B})$
  - ii) If  $\vec{v} = (x + 2y + 4z)\hat{i} + (2ax + by - z)\hat{j} + (4x - y + 2z)\hat{k}$  is the irrotational field where  $a$  and  $b$  are constants. Find constant  $b$ .
- 4 Attempt any two of the following in details: (14)
- (i) Verify green's theorem in plane for  $\oint_C [(xy + y^2) dx + x^2 dy]$  where  $C$  is the close curve of the region bounded by  $y = x$  and  $y = x^2$ ,  $y = x$  and  $y = x^2$  intersect  $(0,0)$  and  $(1,1)$
  - (ii) Find the total work done in moving a particle in a force field given by  $F = 3xy\hat{i} - 5z\hat{j} + 10x\hat{k}$  along the curve  $C$  given by  $x = t^2 + 1$ ,  $y = 2t^2$   $z = t^3$  from  $t = 1$  to  $t = 2$ .
  - (iii) Derive Newton's second law of motion from Hamilton's Principle.
  - (iv) Derive Gauss' formula of electrostatic from Gauss Divergence theorem.