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RAN-1007

Third Year B.Sc. Semester - V Examination

March / April - 2019

Physics: Paper - VI

Mechanics and Mathematical Method

[Total Marks: 50

સૂચના : / Instructions

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
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.:

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 vecor point function?

[3] Write any one limitation of Newton's law

[4] If 'a' is a constant vector then value of $\vec{\nabla}(\vec{a}X\,\vec{r}) =$ .....

[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 Langrange'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 = 1g moves with a uniform velocity $v = (3\hat{i} + 4\hat{j})$ m/s. At time t, the particle passes through the point (1, 2, 0)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 div $(\vec{A} \times \vec{B}) = \vec{B}.(\text{curl}\vec{A}) - \vec{A}.(\text{curl}\vec{B})$

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.
