

(34) Seat No: \_\_\_\_\_

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Sardar Patel University  
Second Semester F. Y. B. Sc  
US02CPHY01 (Physics)(NC)  
Classical Mechanics & Relativity

Date: 18/10/2016  
Tuesday

Time: 02:00 to 04:00 p.m.  
Total Marks: [70]

Q-1 Multiple Choice Questions. [10]

- 1 For irrotational vector,  $\text{curl } V = \text{-----}$ .  
(a) 0 (b)  $\infty$  (c) -1 (d) 1
- 2 For scalar  $\phi$ ,  $\nabla \cdot \nabla \phi = \text{-----}$ .  
(a) 0 (b)  $\infty$  (c) -1 (d) 1
- 3 The maximum line integral per unit area enclosed by the path of integration is called -----.  
(a) gradient (b) divergence (c) curl (d) flux
- 4 The planet moving around the Sun is due to conservation of angular -----.  
(a) acceleration (b) velocity (c) momentum (d) none
- 5 If  $m_1 = m_2$  in Atwood's machine the acceleration of machine will be -----.  
(a) 0 (b)  $\infty$  (c) -1 (d) 1
- 6 The periodic time of a compound pendulum will be ----- when the axis of rotation passing through the c.g.  
(a) equal (b) same (c) minimum (d) maximum
- 7 If the length of simple pendulum is increased by 44% then what is change in the time period of the pendulum?  
(a) 55% (b) 44% (c) 20% (d) 33%
- 8 A set of co-ordinate axes with respect to which measurements are made is called -----.  
(a) frame of reference (b) inertial frame of reference  
(c) non-inertial frame of reference (d) none
- 9 ----- is invariant under Galilean transformations.  
(a) Velocity (b) Mass (c) Acceleration (d) Work
- 10 ----- believed in absolute time.  
(a) Maxwell (b) Galileo (c) Einstein (d) Newton

Q-2 Short Questions (Attempt Any Ten). [20]

- 1 Give the characteristics of scalar triple product.
- 2 Define divergence & curl of vector.
- 3 State Gauss's theorem & Stoke's theorem.
- 4 State & prove the conservation of angular momentum of a particle.
- 5 Prove that linear momentum of the particle is conserved if no external force acting on it.
- 6 Write the equation of motion of a particle under constant force.
- 7 What is compound Pendulum?
- 8 State the condition for minimum time period of a compound pendulum.
- 9 Define centre of suspension & centre of oscillation.
- 10 What is ether? Give main features of ether.
- 11 State the fundamental postulates of special theory of relativity.
- 12 Write: 1) Lorentz transformation equation &  
2) Inverse Lorentz transformation equation.

- Q-3 (A) Explain the vector triple product & Derive the relation  $A \cdot (B \times C) = B(A \cdot C) - C(A \cdot B)$  and find the volume of the parallelepiped for  $A = i + 2j - k$ ;  $B = j + k$ ;  $C = i - j$ . [06]
- (B) Give the physical significance of curl of a vector point function & Derive its expression in rectangular co-ordinate system. [04]
- OR
- Q-3 (A) State & prove Stoke's theorem. [06]
- (B) Derive the Green's theorem. [04]
- Q-4 (A) Prove that the sum of kinetic energy & potential energy of a particle at every point in a conservative force field is constant. [06]
- (B) Derive the equation of motion of a particle under constant force. [04]
- OR
- Q-4 (A) Discuss the motion of a charged particle in a crossed field & derive the expression of drift velocity. [06]
- (B) Discuss the motion of a charged particle in a constant magnetic field & derive the expression of cyclotron frequency. [04]
- Q-5 (A) What is simple pendulum? Derive an expression for the periodic time of a simple pendulum. Write drawbacks of simple pendulum. [05]
- (B) Prove that there are four points collinear with the centre of gravity of a compound pendulum about which its times of oscillations are equal, hence obtain the length of an equivalent simple pendulum. [05]
- OR
- Q-5 (A) Draw a diagram of a Bar Pendulum & explain how to determine 'g' using Bar Pendulum. [06]
- (B) Draw a diagram of a Kater's Pendulum & prove that the distance between the knife edges equal to the length of simple equivalent pendulum. [04]
- Q-6 Give construction & working of Michelson-Morley experiment. Derive necessary formula for the path difference & show how the negative results obtained from this experiment were interpreted? [10]
- OR
- Q-6 Discuss the case of Lorentz-Fitzgerald length contraction & obtain  $L_0$ . Discuss the phenomena of time dilation and mass energy equivalence. Obtain energy momentum relation. [10]

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