(6 pages) **Reg. No. :**

Code No. : 5856 Sub. Code : PPHM 11

M.Sc. (CBCS) DEGREE EXAMINATION, NOVEMBER 2020.

First Semester

Physics - Core

CLASSICAL MECHANICS

(For those who joined in July 2017 onwards)

Time : Three hours Maximum : 75 marks

PART A — $(10 \times 1 = 10 \text{ marks})$

Answer ALL questions.

Choose the correct answer.

1. D'Alembert's principle is based on the principle of

	(a) Natural work		ck (b)	(b) Virtual work	
	(c)	Virtual pow	er (d)	None of	of these
2.	Whi equa	ch of the f ation?	ollowing is	correct	Lagrangian
	(a)	L = T - V	(b)	L = T	+V
	(c)	L = 2V - T	(d)	L = 2V	T + T

3. The	e important	central	force	\mathbf{is}	that	which	varies
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_____.

	(a)	$\frac{1}{r}$	(b)	$rac{1}{r^2}$			
	(c)	$\frac{1}{r^3}$	(d)	$\frac{1}{r^4}$			
4.	Kep any	Kepler's second law of planetary motion is true for any ——— force.					
	(a)	Repulsive	(b)	attractive			
	(c)	central	(d)	non central			
5.	The most useful set of generalized coordinates for a rigid body are ———————————————————————————————————						
	(a)	Solid	(b)	Azimuthal			
	(c)	Polar	(d)	Euler			
6.	——————————————————————————————————————						
	(a)	$\vec{w}\cdot\vec{v}_1$	(b)	$\vec{w} \times \vec{v}_1$			
	(c)	$2m(\vec{w}+\vec{v}_1)$	(d)	None of these			
7.	The Poisson's bracket obey the commutative law						
	(a)	must	(b)	does not			
	(c)	partially	(d)	none of these			

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8. At stable equilibrium ———.

(a)
$$\left(\frac{\partial V}{\partial q_i}\right) = 0$$

(b)
$$\left(\frac{\partial V}{\partial q_i}\right) > 0$$

(c)
$$\left(\frac{\partial V}{\partial q_i}\right) < 0$$

- (d) Motion is unbounded
- 9. In small oscillations each oscillations with definite frequency is known as ————.
 - (a) Normal vibration
 - (b) Eigen vibration
 - (c) Longitudinal vibration
 - (d) Transverse vibration
- 10. Lagrange's bracket is invariant under canonical transformation
 - (a) True
 - (b) False
 - (c) Neither (a) nor (b)
 - (d) None of these

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PART B — $(5 \times 5 = 25 \text{ marks})$

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

- 11. (a) Derive Lagrange's equation of motion from Hamiltons principle for conservative system. Or
 - (b) Discuss the motion of simple pendulum using Lagrange's equation.
- 12. (a) State and prove virial theorem.

 \mathbf{Or}

- (b) Write and explain two main features of the motion of the particle under the action of central force.
- 13. (a) Derive an expression for moment of inertia of Rigid body.

Or

- (b) Discuss the torque free motion of a rigid body.
- 14. (a) Show that the transformations defined by equations $q = \sqrt{2p} \sin Q$ and $p = \sqrt{2p} \cos Q$ is canonical.

 \mathbf{Or}

(b) State and prove the principle of least action.

Page 4 Code No.: 5856 [P.T.O.] 15. (a) What are normal coordinates and normal modes of vibration? Explain.

Or

(b) Obtain the normal modes of oscillation of the double pendulum as a coupled oscillator.

PART C — $(5 \times 8 = 40 \text{ marks})$

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Derive Lagrange's equation of motion from D'Alemberts principle.

 \mathbf{Or}

- (b) Briefly explain conservative theorem and symmetry properties.
- 17. (a) Discuss the motion of a particle under a central attractive force inversely proportional to the square of the distance from centre of force.

Or

(b) State three Kepler's law of planetary motion and explain them properly. If the law of gravitational attraction were different from inverse square law, which of the Kepler's law would still remain valid?

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18. (a) Define Euler's angles and derive Euler's equation of motion in terms as Euler's angles.

Or

- (b) Derive an expression for rotational kinetic energy of a rigid body.
- 19. (a) Describe Hamilton-Jacobi theory and use it to solve the problem of linear harmonic oscillator.

Or

- (b) Arrive at the Hamilton's equation with the help of variational principle.
- 20. (a) Discuss in detail about the free vibrations of a linear triatomic molecule.

Or

(b) Discuss in detail the general theory of small oscillation.

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