S.D. College, Alappuzha

Outcome Based Internal Evaluation Blue Print – 2022-23

Programme Name and Code: B.Sc Physics (230)   Semester 1

Course Name and Code: PY1141:Basic Mechanics & Properties of Matter

Assignment/Seminar

Distinguish the dynamics of rigid bodies of different shapes	Obtain the expression for moment of inertia of i.　　a solid sphere about its diameter ii.　　a solid cylinder about transverse axis.

Internal Question Paper – Mapping of Test Items

Course Outcome	Test item with Mark
Correlate the knowledge gathered to the immediate experimental curriculum	What is center of mass of a body -1 Mark Define bending moment- 1 Mark Small drops are spherical, while large ones are elliptical. Why?-2 Marks Explain the term surface tension. Give its unit.-2 Marks
Distinguish the dynamics of rigid bodies of different shapes	What do you mean by cantilever?-2 Marks Explain the terms angle of shear and angle of twist.-2Marks Define Poisson's ratio.-1 Mark What is surface energy – 1 Mark. For a uniform solid sphere of mass M and radius R with an axis which touches the surface of the sphere, calculate the radius of gyration-2Marks What is a flywheel? Describe the experimental determination of moment of inertia of a flywheel.- 15 Marks Obtain an expression for twisting couple per unit twist of a uniform solid cylinder – 15 Marks For a collection of point particles, write down the expressions for center of mass and center of gravity-2 Marks
Explain the implications of conservation laws	Show that the two bodies connected by a linear spring is equivalent to a one body problem.
Interpret the flavor of classical fields from oscillations and waves	Write down the expression for time period of a simple pendulum-1 Mark With proper schematic diagram, explain the four colinear points of same time period of a compound pendulum - 2Marks What is the equivalent length of a compound pendulum? Explain with proper expression.- 2 Marks Write down the differential equation of SHM. Find the solution-4Marks

Handle the known problems in elasticity, surface tension and viscosity in a more mathematically rigorous way.	Calculate the work done against surface tension force in blowing a soap bubble of 5cm radius, If the surface tension of soap solution is 0.025 N/m.- 4 Marks Force F is on the X-Y plane, with 5N in the positive direction of x and 2N in the negative direction of y. At the position (3,6,1) meters, what will be the torque?- 4Marks Obtain the expression for depression at the loaded end of the cantilever – 4 Marks A cylindrical road of diameter 14 mm rests on two-knife edges 0.8 m apart and a load of Kg is suspended from its mid-point. Calculate the depression of the mid-point if Youngs modulus of the material is 2.04×10^{11} N/m^2. - 4 Marks

SANATANA DHARMA COLLEGE, ALAPPUZHA

B. Sc Physics- Sl Internal Examination January 2024

PY1141:Basic Mechanics and Properties of Matter

Duration: 1.5 Hrs   Max. Marks :40

Part A (Answer all)

1. Define bending moment.
2. What is surface energy
3. Define Poisson's ratio.
4. What is center of mass of a body.
5. Write down the expression for time period of a simple pendulum.

(5 X 1=5)

Part B (Answer any 4)

6. Explain the terms angle of shear and angle of twist.
7. What do you mean by cantilever?
8. Explain the term surface tension. Give its unit.
9. Small drops are spherical, while large ones are elliptical. Why?
10. For a collection of point particles, write down the expressions for center of mass and center of gravity.
11. For a uniform solid sphere of mass M and radius R with an axis which touches the surface of the sphere, calculate the radius of gyration.
12. With proper schematic diagram, explain the four colinear points of same time period of a compound pendulum.
13. What is the equivalent length of a compound pendulum? Explain with proper expression.

(4 x 2 = 8)

Part C (Answer any 3)

14. Obtain the expression for depression at the loaded end of the cantilever.
15. Calculate the work done against surface tension force in blowing a soap bubble of Scm radius, If the surface tension of soap solution is 0.025 N/m.

16. A cylindrical road of diameter 14 mm rests on two-knife edges 0.8 m apart and a load of Kg is suspended from its mid-point. Calculate the depression of the mid-point if Youngs modulus of the material 1 is 2.04×10^{11} N/m^2.

17. Write down the differential equation of SHM. Find the solution.

18. A force F is on the X-Y plane, with SN in the positive direction of x and 2N in the negative direction of y. At the position (3,6,1) meters, what will be the torque?

19. Show that the two bodies connected by a linear spring is equivalent to a one body problem.

(3 x 4 = 12)

Part D (Answer any one)

20. Obtain an expression for twisting couple per unit twist of a uniform solid cylinder.

21. What ls a flywheel? Describe the experimental determination of moment of inertia of a flywheel.

(1X 15 = 15)

Maximum marks-**40**   **Duration 1.5 Hrs**

Assignment/Seminar

Distinguish inertial and non- inertial frames of references	Explain the concept of twin Paradox

Internal Question Paper – Mapping of Test Items

Course Outcome	Test item with Mark
Recognize the mechanics of a single and a system of particles under different force fields.	How fast can a signal travel? - 1Marks What do you mean by central force?-1 Mark What does the term 'rotational invariance' imply?-2 Marks Deduce law of conservation of linear momentum, assuming linear uniformity of space.-2 Marks Deduce law of conservation of energy, assuming homogeneity of flow of time.-2 Marks A space ship moving away from earth with velocity0.5c fires a rocket whose velocity relative to space is 0.5c (a) away from earth and (b) towards earth. Calculate the velocity of the rocket as observed from the earth in two cases.-4 Marks Potential energy of interaction between two particles at x1 and x2on the x-axis is given by $U = A(x_2 - x_1)^2 + \dfrac{B}{(x_2 - x_1)^2}$. Show that this potential is in accordance with the requirements for linear uniformity of space and the Newton's third law is valid-4 Marks Determine the length and orientation of a rod of length 110 m in a frame of reference which is moving with 0.6c velocity in a direction making an angle 30° angle with the rod.-4 Marks Deduce two body problem into equivalent one body problem and hence, explain the concept of reduced mass.-15 Marks
Solve different mechanical problems in classical mechanics	State and explain the principle of virtual work – 2 Marks. What are generalized co-ordinates?-2 Marks

using Lagrangian and Hamiltonian formalism.	What do you mean by degrees of freedom?- 1 Mark
	What are the advantages of Lagrangian mechanics over Newtonian mechanics – 2 Marks
	Obtain the equation of motion of simple pendulum using Lagrangian method and deduce its time period for small amplitude oscillations-4 Marks
	Obtain the equation of Atwood's machine using Lagrangian method-4 Marks
	Describe the Hamiltonian and Hamiltonian's equation of an ideal spring-mass arrangement
	What is D'Alembert's Principle? Derive Lagrange's equation from D'Alembert's Principle.-15 Marks
Distinguish inertial and non-inertial frames of references	Write a note on holonomic constraints.- 1 Mark
	What are inertial frames of reference?-1 Mark
	Derive Einstein's mass energy relation-2 Marks
	Describe Michelson Morley Experiment. Discuss its consequences-15 Marks
Understand the concept of Galilean and Lorentz Transformations and their applications.	Write down Galilean transformation-2 Marks

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SANATANA DHARMA COLLEGE ALAPPUHA

BSc.-Physics -Internal Examination July-2023

Classical & Relativistic Mechanics

Maximum marks-**40**   **Duration 1.5 Hrs**

Part A (Answer all, each carries *one* marks: 5x1=5)

1. What are inertial frames of reference?
2. How fast can a signal travel?
3. Write a note on holonomic constraints.
4. What do you mean by degrees of freedom?
5. What do you mean by central force?

Part B (Answer 4 questions, each carries *two* marks: 4x2=8)

6. Write down Galilean transformation.
7. State and explain the principle of virtual work.
8. What are generalized co-ordinates?
9. What does the term 'rotational invariance' imply?
10. Deduce law of conservation of linear momentum, assuming linear uniformity of space.
11. Deduce law of conservation of energy, assuming homogeneity of flow of time.
12. Derive Einstein's mass energy relation.
13. What are the advantages of Lagrangian mechanics over Newtonian mechanics

Part C (Answer 3 questions, each carries *four* marks; 3x4=12)

14. Obtain the equation of motion of simple pendulum using Lagrangian method and deduce its time period for small amplitude oscillations.
15. Obtain the equation of Atwood's machine using Lagrangian method.
16. A space ship moving away from earth with velocity0.5c fires a rocket whose velocity relative to space is 0.5c (a) away from earth and (b) towards earth. Calculate the velocity of the rocket as observed from the earth in two cases.
17. Potential energy of interaction between two particles at x1 and x2on the x-axis is given by $U = A(x_2 - x_1)^2 + \dfrac{B}{(x_2 - x_1)^2}$. Show that this potential is in accordance with the requirements for linear uniformity of space and the Newton's third law is valid.
18. Determine the length and orientation of a rod of length 110 m in a frame of reference which is moving with 0.6c velocity in a direction making an angle 30° angle with the rod.
19. Describe the Hamiltonian and Hamiltonian's equation of an ideal spring-mass arrangement

Part D (Answer any *one* questions, each carries **15** marks; 1x15=15)

20. Describe Michelson Morley Experiment. Discuss its consequences.

21. What is D'Alembert's Principle? Derive Lagrange's equation from D'Alembert's Principle.
22. Deduce two body problem into equivalent one body problem and hence, explain the concept of reduced mass.