Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Online End Semester Examination, December 2021

Course: Mechanics **Semester: I**
Program: BSc. (H) Physics **Time 03 hrs.**
Course Code: PHYS 1012 **Max. Marks: 100**

Instructions:

- All questions are compulsory (**Q9** and **Q11** have an internal choice)
- Use blank paper as rough work to solve the questions in section-A and write only the correct options (type answers, no upload)
- Scientific calculators can be used for calculations.

All bold representations are vector quantities.

SECTION A

Each Question will carry 4 Marks

S. No.	**Question**	**CO**
Q 1	Which of the following are not true about impulse? a. Impulse is a vector quantity b. The direction of impulse is parallel to force c. Impulse is zero when initial and final momenta are same d. Short interaction time means small damage e. Impulse is area under the momentum-time curve	**CO1**
Q2	The ratio of gravitational potential of a solid sphere at centre and circumference is a. 0.5 : 1 b. 1 : 1 c. 1.5 : 1 d. 2 : 1	**CO3**
Q3	The moment of inertia of a thin rod of mass M and length L, about an axis passing through a point L/4 from one end and perpendicular to length is a. $\frac{7}{48}ML^2$ b. $\frac{1}{3}ML^2$ c. $\frac{1}{4}ML^2$ d. ML^2	**CO1**
Q4	The coefficient of viscosity of liquid is equal to the external force that acts between two successive layers of unit cross-sectional area of fluid to a. balance internal frictional force between layers b. maintain unit velocity gradient between layers c. maintain the motion of liquid between layers	**CO2**
Q5	What is a satellite? State the difference between geostationary and geosynchronous satellites in not more than 100 words.	**CO1**

SECTION B (Question No: 9 has an internal choice)

Each question will carry 10 marks

Q 6	Derive mass-energy equivalence expression based on special theory of relativity	**CO4**
Q 7	Define angular momentum and explain with the help of examples the principle of conservation of angular momentum. Prove that the torque acting on a rotating body is equal to the rate of change of angular momentum.	**CO2**
Q 8	Write short notes on any two of the following: (a) Length Contraction (b) Time Dilation (c) Global positioning system (d) Physiological effects on astronauts	**CO2**
Q 9	(a) A wire 3 m long and 0.625 cm^2 in cross-section is found to stretch 3 mm under a tension of 1200 kg. What is the Young's modulus of the material of the wire? (b) A simple harmonic motion is represented by the equation $y = 10\sin(10t - \frac{\pi}{6})$, Calculate (i) maximum velocity and (ii) maximum acceleration OR State the postulates of special theory of relativity and derive the expressions for Lorentz transformations.	**CO3**

Section C (Question No: 11 has an internal choice)

Each Question carries 20 Marks.

Q 10	Derive and expression for gravitational potential and field due to solid sphere at a point a. Outside the sphere b. On the sphere c. Inside the sphere Graphically explain how the gravitational potential and field vary with distance.	**CO2**
Q11	With the help of appropriate diagram, deduce an expression for the distribution of velocity of a liquid flowing through a uniform capillary of circular cross section. Show that it represents a parabola. Also derive Poiseuille's formula. OR Explain damped vibrations and forced vibrations citing an example of each. Qualitatively Derive and solve the differential equation of a damped harmonic oscillator discussing the three cases along with amplitude versus time graphs.	**CO4**

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