B.Sc. 1st Semester (Honours) Examination, 2019-20

PHYSICS

Course ID : 12412 **Course Code : SHPHS/102/C-2**

Course Title : Mechanics

Time: 1 Hour 15 Minutes **Full Marks: 25**

The figures in the margin indicate full marks.

The questions are equal value.

Section-I

1. Answer *any five* questions: 1×5=5

(a) If *A* is the areal velocity of a planet of mass *M*, what is the angular momentum of the planet?

(b) Distinguish between inertial and non-inertial frames?

(c) What is time dialation?

(d) What is the main outcome of Michelson-Morley experiment?

(e) What is the utility of Reynold's number?

(f) What do you mean by geosynchronous orbits?

(g) What is venturimeter used for?

(h) What is meant by neutral equilibrium?

Section-II

2. (a) A reference frame rotates with respect to a fixed reference frame with an angular velocity $\vec{\omega}$. If the position, velocity and acceleration of a particle in rotating frame are represented by $\vec{r}_m$, $\vec{v}_m$ and $\vec{a}_m$, show that the acceleration of the particle in fixed frame is given by $\vec{a}_F = \vec{a}_m + 2\vec{\omega} \times \vec{v}_m + \vec{\omega} \times (\vec{\omega} \times \vec{r}_m) + \frac{d\omega}{dt} \times \vec{r}_m$.

(b) What is coriolis force? 4+1=5

3. State Kepler's law of planetory motion. If the distance of the earth from sun was suddenly reduced to half the present value, how many days will be there in one year? 3+2=5

4. (a) Prove that the rate of flow of incompressible and mobile fluid is same throughout a pipe if the flow of liquid is streamline.

(b) The velocity of water in a river is 20 km/hr near the surface. If the river is 10m deep, find the shearing stress between the horizontal layers of water. The coefficient of viscosity of water= 10^2 poise. 3+2=5

5. Derive the formula describing variation of mass with velocity. 5

Section-III

Answer *any one* question. 10×1=10

6. What is bending moment? A straight horizontal beam of rectangular cross-section is rigidly clamped at one end. The free end is loaded with a weight *W*. When the bending is small, obtain an expression for the deflection of the free end.

 The volume of a spherical ball of radius 10 cm is decreased by 0.064 cm^3 when it is subject to a pressure of 38·4 atmosphere find the bulk modulus of the material of the ball. 2+5+3=10

7. (a) A particle moves under a force field is given by $\vec{F} = -\frac{k}{r^2}\hat{r}, k > 0$

 Then derive the differential equation of motion of the particle and prove that path of the particle is conic and show that the conic is an ellipse, parabola and hyperbola according as $E < 0, E = 0$ and $E > 0$, respectively.

 (b) If *E* is the energy of the particle, show that speed of the particle is given by $v = \sqrt{\frac{2k}{mr} + \frac{2E}{m}}$

 (5+3)+2=10

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