

Mid-West University
Examinations Management Office
Final Examinations -2078

Bachelor level/ B.Sc/ 1st Semester
Time: 3hrs
Subject : Mechanics(PHY411/311)

Full Marks : 60
Pass Marks.: 30

Candidates are required to give their answer in their own words as far as practicable. The figures in the margin indicate full marks.

Group – A

1. **Answer in short any SIX questions** [6X2 = 12]
- Differentiate between cylindrical coordinate system and spherical coordinate systems.
 - Write an application of Bernoulli's theorem in the physical world.
 - Give an idea about Rutherford scattering.
 - If an external torque on body is zero, show that this condition leads to the conservation of angular momentum.
 - What are the generalized coordinates? How do they relate with constraints of the motion?
 - What do you know about bending moment?
 - Water-sprayer tubes used to wash vehicles generally have small opening for the water, why?
 - Small water drops become spherical while large modify in to an oval shaped on the waxy surface, why?

Group – B

2. **Attempt all questions** [6X4= 24]
- Calculate the excess pressure inside a soap bubble of radius $3 \times 10^{-3} m$. Surface tension of soap solution is $20 \times 10^{-3} Nm^{-1}$. Also calculate the surface potential energy.
 - Calculate the mass of water flowing in 10 minutes through a tube 0.1 cm in diameter, 40 cm long if there is a constant pressure head of 40 cm of water. The coefficient of viscosity of water is 0.0089 C.G.S. units. [Take density of water $1 \frac{gram}{cm^3}$].

- A wire 300 cm long and $0.6 cm^2$ in cross-section is found to stretch 0.3 cm under a tension of 1200 kg. What is the Young's modulus for the material of the wire.
- The position of a moving particle is at any instant given by $r = A \cos \theta \hat{i} + A \sin \theta \hat{j}$. Show that force acting on it is conservative one.
- A particle follows a spiral orbit given by $r = a \exp(b\theta)$ where a and b are constants. Obtain the force law.

OR

- Derive an expression for the Coriolis force. Explain it's significance in the long range projectile motions.
- Derive the relations between spherical polar coordinates and Cartesian Coordinates.

Group – C

- State and prove Kepler's first law in planetary motion. [1+5]
- Derive an expression for the acceleration in cylindrical coordinate system. [6]

OR

What is Poiseuille's equation? Derive the expression for the rate of flow of a liquid through a narrow tube.

- Show that for a cantilever $y = \frac{Wl^3}{3 Y I_g}$ where symbols have their usual meanings. [6]
- A wheel of radius 4 cm is mounted so as to rotate about horizontal axis through its center. A string of negligible mass, wrapped round its circumference, carries a mass of 200 gm attached to its free end. When let fall, the mass descends through 100 cm in the first 5 seconds. Calculate the angular acceleration of the wheel and its momentum of inertia. Take $g = 9.8 m/s^2$. [6]

THE END