Mid-West University
Examinations Management Office
End Semester Examination 2081

Bachelor level/ B. Sc. / 1st Semester   Full Marks: 60

Time: 3 hours   Pass Marks: 30

Subject: Mechanics (PHY411/311)

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

Long answer questions (attempt *all*)   [4x6 = 24]

1. State and derive an experiment of Bernoulli's Theorem. How does venturimeter work on Bernoulli's Theorem.

2. What is conservative force? Show that conservative force as negative gradient of potential energy.

3. A small hollow sphere which has a small hole in it is immersed in water to a depth of 0.4 m before any water penetrates in to it. If the surface tension of water is 73×10^{-3} Nm^{-1}, find the radius of hole. [Take density of water 1000 kg/m^3, g = 9.8 m/s^2].

4. Define an orbit. Find differential equation of the orbit of a particle moving under central force per unit mass.

OR

Derive an expression of moment of inertia of a solid sphere about its diameter and tangent.

Group B

Short answer questions (attempt *all*).   [6x4 = 24]

5. The position of a moving particle is at any instant given by r = A cosθ $\hat{i}$ + A sinθ $\hat{j}$. Show that force acting on it is conservative one. Also calculate the total energy of the particle.

6. A particle follows a spiral orbit given by $r = ae^{(b\theta)}$ where *a* and *b* are constants. Obtain the force law.

7. Calculate the Coriolis force on a mass of 50 gm placed at a distance of 10 cm from the axis of a rotating system if the angular speed of the frame is 10 rad/sec.

8. A solid cylinder (a) rolls (b) slides from rest down an inclined plane. Neglect friction and compare the velocities in both cases when the cylinder reaches the bottom of the inclined plane.

9. A wire 4 meters long and 0.3 mm in diameter is stretched by a force of 80 N. If the extension in length amounts to 1.5 mm, calculate the energy stored in the wire. If we take another wire of cross section 1 sq.mm and length 2 meters, then calculate the work done in stretching a wire through 0.1 mm if young's modulus for the material of the wire is 2×10^{11} N/m^2.

10. An annular disc of mass 0.2 kg. and radii 0.2 m and 0.25 m rolls such that the centre has a velocity of 0.5 ms^{-1}. Calculate its kinetic energy.

OR

State and explain the Kepler's law of planetary motion.

Group C

Very short answer questions (attempt *any six*). [6x2 = 12]

11. Distinguish between streamline flow and turbulent flow of liquid.
12. Define surface energy. Write the relation between surface tension and surface energy.
13. Derive an expression of strain energy for longitudinal strain.
14. Explain the Theorem of Parallel Axes.
15. Define circular cylindrical coordinate system (ρ, Φ, z). Express in terms of Cartesian co-ordinates.
16. Write the Gauss' theorem in gravitational field.
17. What is gravitational potential Energy? How is it related to gravitational force?
18. Deduce torque in term of moment of inertia.

The End