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**SUBJECT CODE NO:- B-2125**  
**FACULTY OF SCIENCE & TECHNOLOGY**  
**B. Sc. S. Y (Sem – IV)**  
**Examination November/December- 2022**  
**Mathematics MAT - 403**  
**Mechanics-II**

[Time: 1:30 Hours]

[Max. Marks: 50]

Please check whether you have got the right question paper.

- N.B
1. Attempt all questions.
  2. Figures to the right indicate full marks.
  3. Draw well labeled diagram whenever necessary.
- Q.1
- A. Attempt any one: 08
- a. Find the components of Velocity and acceleration along rectangular Cartesian axes.
  - b. Prove that change in kinetic energy of the particle is equal to the work done.
- B. Attempt any one: 07
- c. A particle moves along a curve  $r = 1(1 + \cos \theta)$  with uniform speed  $v$ . prove that
- $$\frac{d\theta}{dt} = \frac{v \sec(\theta/2)}{2a} = \frac{v}{\sqrt{2ar}}$$
- And the radial component of acceleration is constant.
- d. Prove that the tangential acceleration of a moving point varies as its radial velocity, if its angular velocity about the fixed origin is constant.
- Q.2
- A. Attempt any one: 08
- a. Find the vertex and the latus rectum of the parabola.
  - b. Show that the necessary and sufficient condition for a force  $\vec{F}$  to be conservative is that the line integral over a closed path C in a conservative field is zero.
- B. Attempt any one: 07
- c. A particle projected at an angle of elevation  $\sin^{-1}\left(\frac{4}{5}\right)$ , and its range on the horizontal plane is 4 miles. Find the Velocity of projection and velocity at the highest point of its path.
- d. A shell bursts on striking a ground and its piece's fly in all directions, with maximum speed to find the time for which a person at a distance a is in danger.
- Q.3
- A. Attempt any one: 10
- a. Find the differential equation of central orbit in pendal form.
  - b. Prove that the relation:  $t_1 \cdot t_2 = \frac{2R}{g}$

B. Attempt any one:

- c. When a particle is projected at an angle  $\alpha$  with the horizontal, the range is R and greatest height is H. prove that  $\alpha = \tan^{-1}\left(\frac{4H}{R}\right)$
- d. A particle describes an elliptic orbit, under a force  $\mu/r^2$  to the focus. Show that the velocity at the end of the minor axis is the geometric mean between the greatest and the least velocity.

Q.4 Choose the correct alternative and rewrite the sentence.

10

- If the velocity is uniform the acceleration is \_\_\_\_\_
  - Unit
  - Zero
  - Double the velocity
  - Equal to the speed
- The product of mass and acceleration is called \_\_\_\_\_
  - The velocity
  - Kinetic energy
  - Effective force
  - Radial acceleration
- The central orbit is \_\_\_\_\_
  - A triangle
  - A plane curve
  - Parallelogram
  - Parabola
- The kinetic energy of a particle of mass m moving with velocity  $\vec{V}$  is \_\_\_\_\_
  - $\frac{1}{2} m V^2$
  - $2 m v^2$
  - $\frac{1}{2} m^2 v^2$
  - $2 m^2 v^2$
- The unit of angular acceleration is \_\_\_\_\_
  - Rad/sec
  - Rad/sec<sup>2</sup>
  - m/sec<sup>2</sup>
  - radian