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SUBJECT CODE NO:- 2125
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. S.Y Sem-IV
Examination March/April-2022 (To be held in June/July-2022)
Mathematics MAT - 403
Mechanics-II

[Time: 1:53 Hours]

[Max. Marks:50]

Please check whether you have got the right question paper.

N.B.

- (i) Attempt all questions.
- (ii) Figure to right indicates full marks.
- (iii) Draw well labeled diagram wherever necessary.

Q.1 A) Attempt any one :

08

- a) Find radial and transverse components of acceleration.
- b) If the sum of external forces acting on a system of Particles be zero in any direction. Prove that the total momentum of the system in that direction remains same during the motion.

B) Attempt any one :

07

- c) A particle moves along a curve $r = a(1 + \cos \theta)$ with uniform speed v , show that
$$\frac{d\theta}{dt} = \frac{v \sec(\theta/2)}{2a} = \frac{v}{\sqrt{2ar}}$$
- d) A particle of mass m moving with velocity \vec{v} picks up a mass M at rest. Find the velocity of the combined mass, the kinetic energy of the combined mass and the loss in Kinetic energy.

Q.2 A) Attempt any one :

08

- a) Find the equation of Parabola of Safety.
- b) Find the velocity of a Particle in terms of its height at that instant.

B) Attempt any one :

07

- c) Prove that if the time of flight of a Projectile over a given horizontal range R , is t and T Seconds for two angles of projection α and β , Prove that $t^2 \cot \alpha = T^2 \cot \beta$.
- d) A Particle is Projected at an angle α to the horizontal with speed u , If R is the horizontal range, Prove that its path can be put in the form $y = x \tan \alpha (1 - x/R)$

Q.3 A) Attempt any one :

- Find the velocity of a Particle in terms of its height at that instant.
- Find the Pedal (P, γ) equation of a circle whose center is c and radius is a.

05

B) Attempt any one :

- An aero plane flying 360 miles per hour horizontally, drops a bomb from a height of 1600 ft. find the location of the point where the bomb hits the ground.
- A boy sitting on the top of a tower 96 ft. high throws a stone with the speed 80 ft. per sec. at an elevation of 30° to the horizontal. Find the time the stone takes to reach the horizontal Plane through the foot of the tower.

05

Q.4 Choose the Correct alternative and rewrite the Sentence.

10

i) In M.K.S. System the unit of force is _____.

- Newton
- Joules
- Watts
- Radians.

ii) Actions and reactions are _____.

- equal and opposite
- Not equal
- equal
- Not equal but opposite

iii) The equation of Parabola of Safety is _____.

- $x^2 = \frac{-2u^2}{g} \left(y - \frac{u^2}{2g} \right)$
- $x^2 = \frac{-2u^2}{g} \left(y - \frac{u^2}{g^2} \right)$
- $x^2 = \frac{-2u^2}{g^2} \left(y - \frac{u^2}{2g} \right)$
- $x^2 = \frac{-2u^2}{g} \left(y - \frac{u^2}{2g^2} \right)$

iv) The line joining the Centre of force and apse Point is called _____.

- A straight line
- A Skew line
- An apse line
- A dotted line

v) The Centre of gravity is _____.

- Not unique

- b) Independent
- c) Unique
- d) None of the above.