Total No. of Printed Pages: 2

SUBJECT CODE NO: - Y-2125
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. S.Y (Sem-IV)
Examination March / April - 2023
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.

Q1 A) Attempt any one: 08

a) Find the radial and transverse components of velocity.
b) Find the expressions for velocity and acceleration in terms of vector derivatives.

B) Attempt any one: 07

a) A point moves in a curve so that its tangential and normal accelerations are equal and the tangent rotates with uniform angular velocity. Show that the intrinsic equation of Path is of the forms

$$S = \mathrm{A}.e^{\psi} + \mathrm{B}$$

b) A gun of mass M fires a shell of mass m horizontally and the energy of explosion is such as would be sufficient to project the shell vertically to a height h. show that the velocity of recoil is

$$\left[\frac{2\mathrm{m}^2\,\mathrm{gh}}{\mathrm{M}(\mathrm{m}+\mathrm{M})}\right]^{1/2}$$

Q2 A) Attempt any one 08

a) prove that the kinetic energy of particle of mass m moving with velocity is $\vec{v}$ is $\frac{1}{2}$ mV^2 Also prove that change in kinetic energy of the particle is equal to the work done.
b) Find the differential equation of the Path of a particle moving under a central farce f(r). directed towards a fixed point 0.

B) Attempt any one: 07

a) A particle is thrown over a triangle from one end of the horizontal base and grazing over the vertex. It falls on the other end of the base. If A, B be the base angles of the triangle and α the angle of projection.
Prove that: tan α = tan A + tan B
b) A particle of mass 0.1 lb has the velocity $2\vec{\mathrm{i}} + 3\,\vec{\mathrm{j}}$ ft/sec. at t = 2 sec. It is Subjected to a force $3\mathrm{t}^2\vec{\mathrm{i}} + cos\,(\pi t)\vec{j}$. Find the impulse of the force over the internal $2 \leq t \leq 3$. Also find the velocity at t = 3sec.

Q3 A) Attempt any one: 05

a) Prove that in central orbits the areal velocity is uniform.

b) Find the vertex and the latus rectum of the parabola.

B) Attempt any one: 05

a) A man can throw a cricket ball up to 160 metres and no more. With what speed, in metre per Sec., must it be thrown? (Take g = 980 cm/sec^2)

b) Find the work done by the force $\vec{F} = 2x\vec{\imath} + 2y\vec{\imath}$ in moving a particle from P (1,2) to Q (3,2)

Q4 Choose the correct alternative and rewrite the sentence: 10

i) If the force is acting towards a fixed Point then it is called_____

a) central repulsive force. b) Tangential force.

c) Terminal force. d) central attractive force.

ii) The effect of couple acting on the body producess_____

a) only a motion of rotation.

b) only a motion of translation.

c) motion of rotation as well as translation

d) None of these.

iii) The time rate of change velocity is called as_____

a) A Speed b) Acceleration c) Displacement. d) Areal velocity.

iv) In central orbits the areal velocity is _____

a) unit b) zero c) Variable d) uniform.

v) The magnitude of velocity is called_____

a) Acceleration. b) Displacement. c) Speed d) Vector