CHANCHAL COLLEGE

ASSIGNMENT 2021

MATHEMATICS (Honours)

Paper Code: MTMH-H-DC-09

[CBCS-4TH SEM]

Full Marks: 32

The figures in the margin indicate full marks.
Notations and symbols have their usual meanings.

Group-A
(4 Marks)

1. Answer any **four** questions. $1 \times 4 = 4$

   (a) State the Principle of Virtual work for any system of coplanar forces acting on a rigid body.

   (b) A tangential and normal acceleration of a particle moving in a plane curve are equal.Find the expression of velocity.

   (c) Find the law of force towards the pole under the curve described by $au = n\theta$.

   (d) Define angle of friction and cone of friction.

   (e) If v_1 and v_2 are the linear velocities of a planet when it is respectively nearest and furthest from the sun, write down the relation between v_1 and v_2.

Group-B
(10 Marks)

Answer any **two** questions

. $5 \times 2 = 10$

2. Describe the expression for the radial and cross-radial component of acceleration of a particle which describes in a plane curve.

3. If an elastic string, whose natural length is that of a uniform rod, be attached to the rod at both ends and suspended by the middle point, show by means of the principle of Energy, that the rod will sink until the string are inclined to the horizon at an angle

θ given by the equation $cot^3\frac{\theta}{2} - cot\frac{\theta}{2}$.

4. State and prove the principle of virtual work for a system of coplanar forces acting on a rigid body.

5. Investigate the conditions of equilibrium of a particle constrained to rest on a rough surface $f(x, y, z) = 0$ under the action of any given forces.

Group-C
(18 Marks)

Answer any **two** questions

. $9 \times 2 = 18$

6. A ball of mass m is moving under gravity in a medium which deposit matter on the ball at a uniform rate μ. Show that the equation of the trajectory,referred to horizontal and vertical axes through a point on itself, may be written in the form $K^2xy = Kx(g + K\nu) + gu(1 - e^{\frac{Kx}{u}})$, where u and ν are the horizontal and vertical velocities at the origin and $mK = 2\mu$.

7. Find the co-ordinates of the c.g of a lamina in the shape of a quadrant of the curve $(\frac{x}{a})^{\frac{2}{3}} + (\frac{y}{b})^{\frac{2}{3}} = 1$, density being given by $\rho = kxy$.

8. The middle points of opposite sides of a quadrilateral formed by four freely jointed weightless bars are connected by two light rods of length a and b in a state of tension. If T_1 and T_2 be the tensions of those rods, prove that $\frac{T_1}{a} + \frac{T_2}{b} = 0$.

9. A body of mass $(m_1 + m_2)$ is split into two parts of masses m_1 and m_2 by an internal explosion which generates kinetic energy E. Show that, if after explosion the parts move in the same line as before, then their relative speed is $\sqrt{\frac{2E(m_1+m_2)}{m_1m_2}}$.
