5. (a) A engine of horse power H, draws a train of mass M tons up as incline of 1 in n against a resistence of m lbs wt. per ton. Show that maximum speed of train is $\frac{550\ Hn}{M\ (2240 + mn)}$ ft/sec. **4**

(b) Prove that in any displacement of a particles the hange in the K.E. is equal to the work done by the impressed force acting on the particle. **4**

Section C

6. (a) A heavy particle slides down a smooth cycloid starting from rest at the cusp, the axis being verticle and vertex downwords. Prove that magnitude of acceleration is equal to g. **4**

(b) Two particles are let drop from the cusp of cycloid down the curve at interval of time *t*. Prove that they will meet in time $2\pi\sqrt{\frac{a}{g}} + \frac{t}{2}$. **4**

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B. Sc. EXAMINATION, 2026

(Sixth Semester)

(Re-appear Only)

MATH

Paper–BM-363

Dynamics

Time : 3 *Hours*] [*Maximum Marks :* 40

Before answering the question-paper, candidates must ensure that they have been supplied with correct and complete question-paper. No complaint, in this regard will be entertained after the examination.

Note : Candidates are required to attempt *five* questions in all, selecting *one* question from each Section and the compulsory question. Q. No. **1** is compulsory.

1. (a) Write differential equation of central orbit in pedal form. **1**

(b) Define Areal Velocity 2

(c) Define kinetic energy and potential energy. **2**

(d) Define periodic motion. Show that S.H.M. is periodic. **2**

(e) Define modulus of Elasticity. **1**

Section A

2. (a) An insects crawl at constant rate is along the spoke of cart wheel of radius a and the cost is moving with velocity v. Find the accelerations along and perpendicular to the spoke. **4**

(b) To an passanger in an open car travelling at 20 km/hr the wind appears to come from a direction 60^{o} to the right and from ahead at 4 km/hr. What is the true direction and velocity of wind ? **4**

3. (a) A particle moves with S.H.M. in a straight line. In the first second after starting from rest, it travels distance a and in the next second it travels distance b in the same direction. Prove that amplitude of the motion is $\frac{2a^2}{3ab}$. **4**

(b) Prove that the work done against the tension in streching a light elastic string is equal to the product of its extension and the mean of the initial and final tension. **4**

Section B

4. (a) A mass of 10 kg falls freely a distance of 10 m. from rest after pentrating through 1 m. in sand. Find the average force exerted by sand on it. **4**

(b) Two particles of masses M_1 and M_2 are connected by a light inextensible string, M_2 is placed on the smooth horizontal table. The string passes over a light pulley at the edge of the table and M_1 is langing freely. Find the motion, tension in the string and pressure on the pulley. **4**

7. (a) Let v_1 and v_2 be the velocities at the ends of the focal chord projectiles path an 'u' the horizontal component of the velocity show that $\frac{1}{v_1^2}+\frac{1}{v_2^2}=\frac{1}{u^2}$. **4**

(b) A particle is thrown over an isosceles right angled triangle ABC, right angle at B, from one end A of the horizontal base AC and grazing the vertex B falls at C. Show that the angle of projection is $\tan^{-1}(2)$. **4**

Section D

8. (a) Derive differential equation of central orbit in pedal form. **4**

(b) If the law of force is $5\mu u^2+8\mu c^2u^2$ and the particle is projected from an apse at a distance c with velocity $\frac{3\sqrt{\mu}}{c}$, prove that the orbit $r=c\cos\theta\left(\frac{2\theta}{3}\right)$. **4**

9. (a) A particle describes an ellipse about a center of force at the focus. Show that any point of its path, the angular velocity about the other focus varies inversly as the square of the normal at a point. **4**

(b) Find the acceleration of particle in terms of spherical polar coordinates. **4**

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