UG" END SEMESTER CLASS TEST – DECEMBER 2023
(REGULAR-ODD SEMESTER)
1ST "YEAR (1ST SEMESTER) - MECHANICAL ENGINEERING
ENGINEERING MECHANICS
MENUGES01
For CSE students

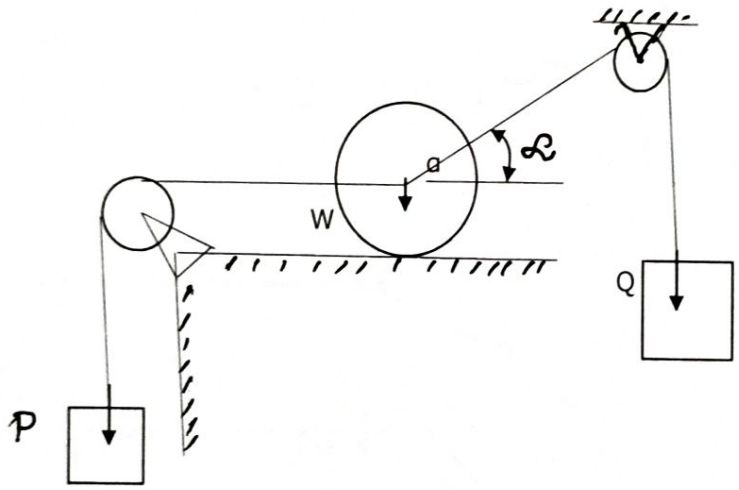
(Full Marks – 50, Time – 1&1/2 Hours)

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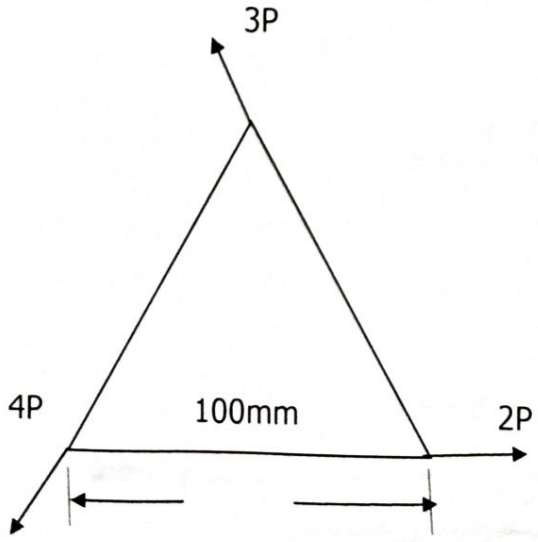
Group- A.

(Answer any three questions) [3x (10) =30]

1. (a) What is transmissibility of forces?
   (b) Define rigid body and particle.
   (c) A ball of weight 'W' rests upon a smooth horizontal plane and has attached to its center two string AB & AC which pass over a frictionless pulleys at 'B' and 'C' and carry loads P and Q respectively as shown in Figure. If the string AB is horizontal, find the angle α (alpha) that the string AC makes with horizontal when the ball is in a position of equilibrium. Also find the pressure 'R' between the ball and the plane. [2+3+5]



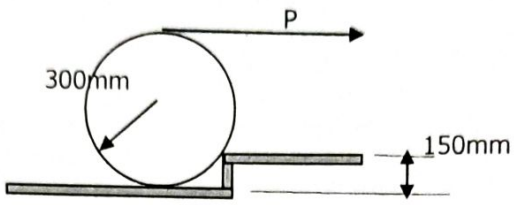
2. (a) What is free body diagram?
   (b) State Varigon's theorem.
   (c) Three forces of 2P, 3P & 4P act along the sides of an equilateral triangle of side 100mm taken in order. Find the magnitude and position of the resultant force.
   [2+2+6]



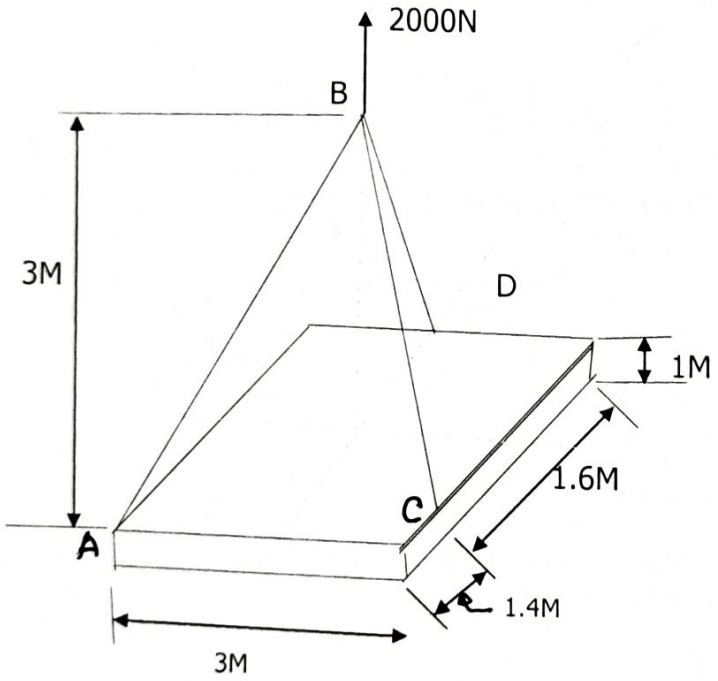
3 (a) Define friction, angle of repose and angle of friction. Establish relation between angle of repose and angle of friction.

(b) A roller of radius 300mm and weight 2000N is to be pulled over a curb of height 150mm by a horizontal force 'P' applied to end of a string wound round the circumference of the roller as shown. What will be the magnitude of force 'P' required to start the roller over the curb?

[5+5]



4. A crane (Not Shown in Fig) is supporting a 2000N crate through three cables AB, CB and DB. Note that D is at the centre of the outer edge and B is directly above the centre of the crate. What are the force s F1, F2 and F3 transmitted by the cables? [10]

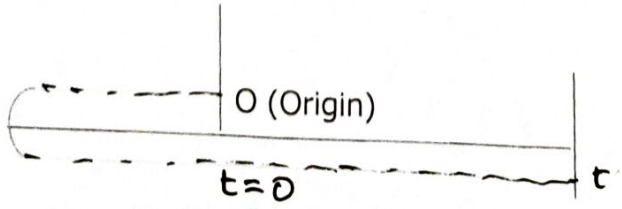


Group –B

Answer any two questions.

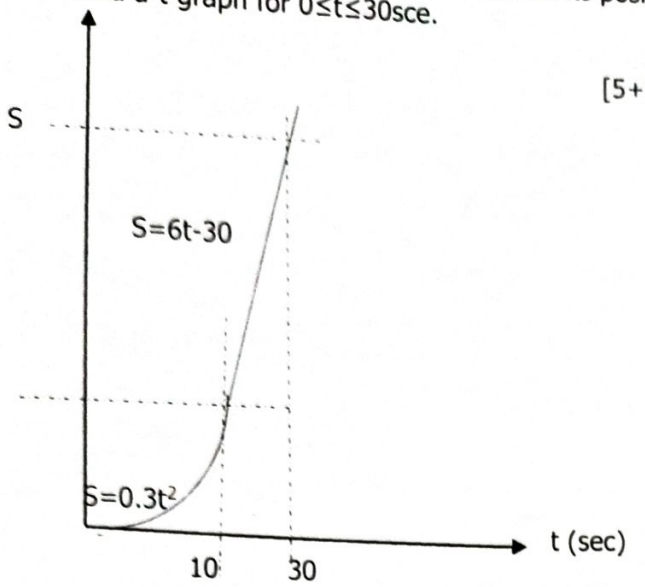
1 (a) A particle moves along a horizontal path with a velocity of $v = (3t^2-6t)$ m/s, where 't' is the time in sec. If it is initially located at the origin 'O', determine the distance travelled in 3.5 sec and the particle average velocity and average speed during the 3.5 sec.

[5+5]



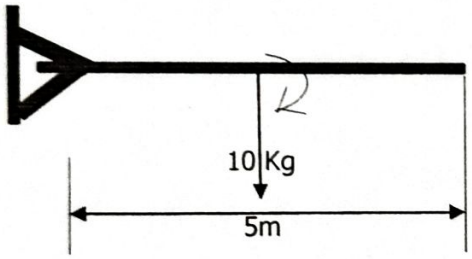
(b) A bicycle moves along a straight road such that its position described the graph shown in figure. Construct v-t and a-t graph for $0 \le t \le 30$sce.

[5+5]

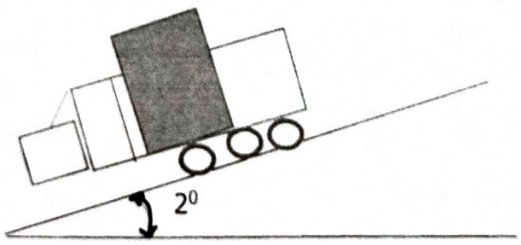


2 (a) A wheel of 1m dia rotating at an initial angular velocity of 8 rad/sec and is accelerated of 6rad/s2. Find the velocity (in m/s) and the acceleration of a point on its periphery after the wheel turns two revolutions.

(b) A slender rod of mass 10kg and length 5m is rotating with angular velocity 2 rad/sec at the instant as shown in figure. Find the angular acceleration of the rod and horizontal and vertical reaction at hinge. [5+5]



3 (a) A trailer is travelling down with 2^0 inclination with horizon (shown in figure) at a speed of 25m/s, when the brakes are applied. Knowing the static and kinetic coefficient of frictions between the loads and flatbed trailer shown are 0.4 and 0.35 respectively. Determine the shortest time in which the trailer brought to a stop if the load is not to shift. (Assume g =10m/s^2)



(b) A block weighing 200N is in contact with a plane level whose μs and μk are 0.4 and 0.2 resp. The block force horizontally, p =10t in Newton where t denotes the time in seconds. Find the velocity of the block attained after 10 sec. [5+5]