Code: 15A03302

R15

ENGINEERING MECHANICS
(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

PART - A
(Compulsory Question)
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1   Answer the following: (10 X 02 = 20 Marks)
  (a)   What is a free body diagram? Explain with a suitable example.
  (b)   State Lami's theorem.
  (c)   Distinguish between static friction and dynamic friction.
  (d)   What is relation for the efficiency of a screw jack, taking friction into account?
  (e)   Distinguish between center of gravity and centroid.
  (f)   How radius of gyration of a body is expressed in terms of its mass moment of inertia?
  (g)   Explain the term 'instantaneous centre'.
  (h)   Explain the dynamic equilibrium of a rigid body in plane motion.
  (i)   State clearly the difference between a perfect frame and an imperfect frame.
  (j)   Give the expression for frequency of compound pendulum.

PART - B
(Answer all five units, 5 X 10 = 50 Marks)

UNIT - I

2   Two cylinders P and Q rest in a channel as shown in figure below. The cylinder P has diameter of 100 mm and weight 200 N, whereas the cylinder Q has diameter of 180 mm and weight 500 N. Determine the pressure at all the four points of contact.
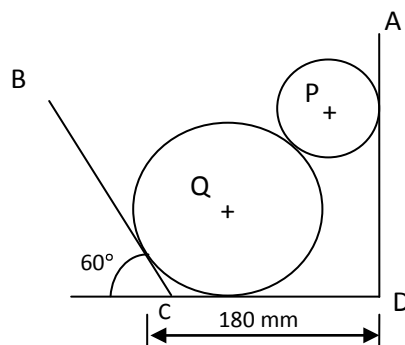
OR

3   (a)   A horizontal line PQRS is 12 m long is acted upon by the system of forces at P, Q, R and S as shown in the figure below. Find the magnitude, direction and position of the resultant force.
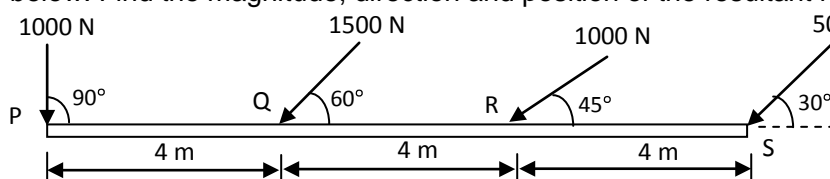

 (b)   State and prove parallelogram law of forces.

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UNIT - II

4   A uniform ladder 3 m long weights 200 N and placed against a wall as shown in figure below. The coefficient of friction between wall and the ladder is 0.25 and that between the floor and ladder is 0.35. The ladder in addition to its own weight, has to support a man of 1000 N at its top at P. Calculate:
(i) The horizontal force P to be applied to ladder at the floor level to prevent slipping.
(ii) If the force P is not applied, what should be the minimum inclination of the ladder with the horizontal, so that there is no slipping of it with the man at its top?
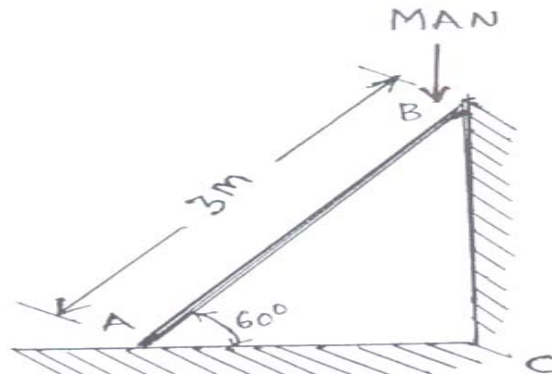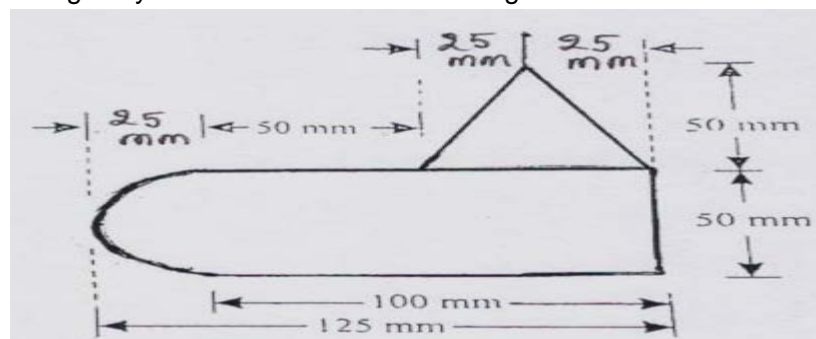

OR

5   A 15° wedge 'A' has to be driven for tightening a body 'B' loaded with 1000 N weight as shown in figure below. If the angle of friction for all the surface is 14°, find the force 'P' which should be applied to the wedge.
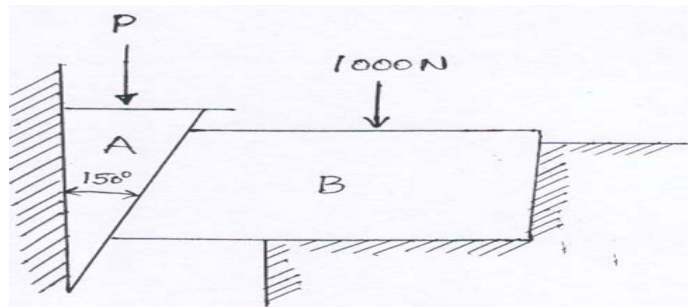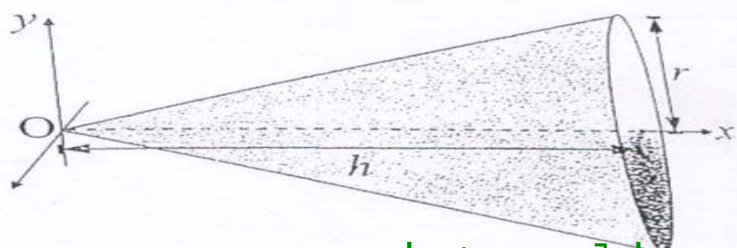

UNIT - III

6   Determine the centre of gravity of the lamina shown in the figure below.

OR

7   Find the moment of inertia of a solid cone about its Z axis as shown in figure below.

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UNIT - IV

8   A girl throws a ball in the air with a speed 'u' at an angle θ_1. If another girl at the same time and same place throws another ball at the same speed 'u' at an angle of θ_2 as shown in the figure below. Determine the time between the throws so the balls collide in the midair at P.
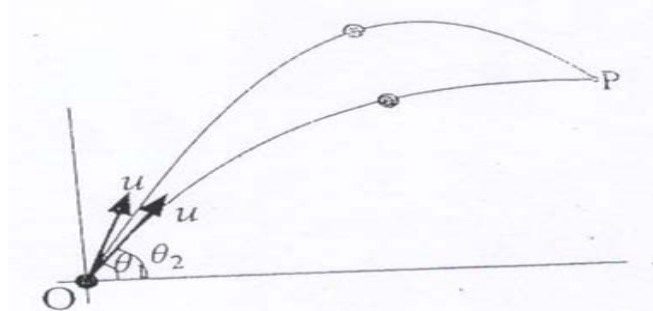

OR

9   Two bodies A and B rest on two smooth inclined planes and are supported by a string of negligible mass and pass over a composite pulley as shown in figure below. If the pulley has a mass of 75 kg and radius of gyration of 100 mm, find the accelarations of the masses A and B and pulls in the string. Neglect friction in the bearings.
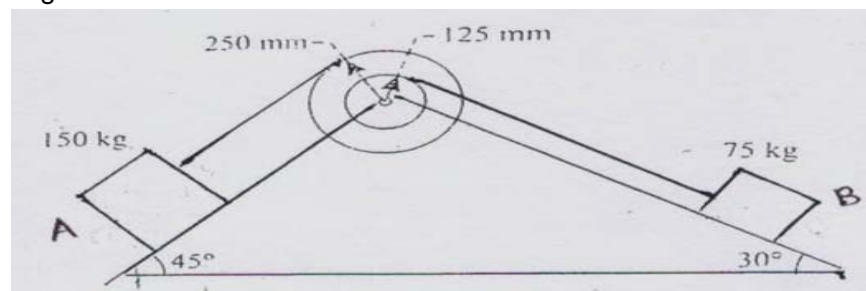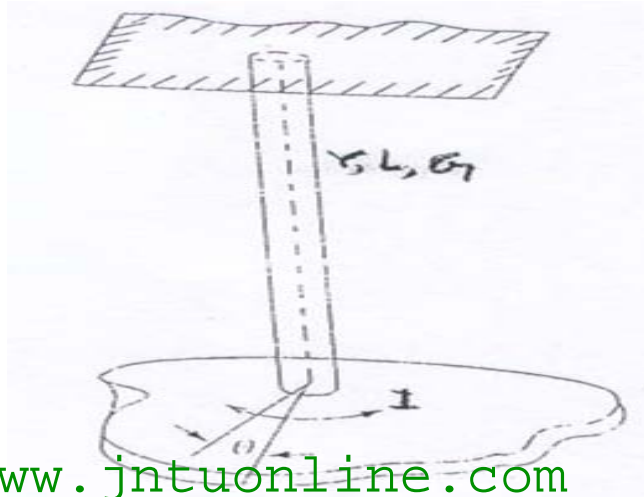

UNIT - V

10   A cantilever truss having a span of 4.5 m is hinged at two joints to a wall and is loaded as shown in figure below. Find the forces in all the members of the truss.
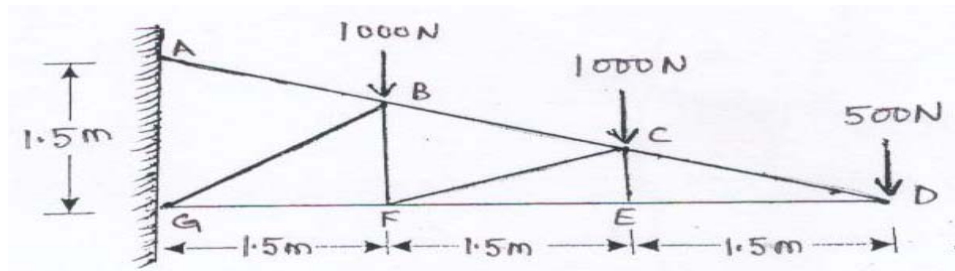
OR

11   Obtain an expression for frequency and time period for a torsional pendulum shown in figure below.

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