

B.TECH
(SEM III) THEORY EXAMINATION 2022-23
ENGINEERING MECHANICS

Time: 3 Hours

Total Marks: 100

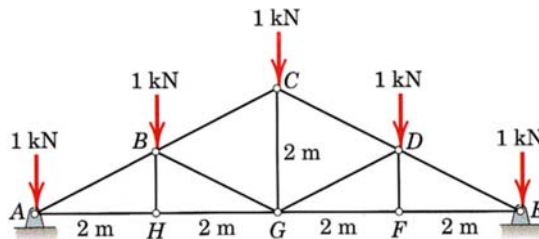
Note: 1. Attempt all Sections. If require any missing data; then choose suitably.
 2. Any special paper specific instruction.

SECTION A

1. Attempt *all* questions in brief.

2 x 10 = 20

- (a) What are the equation of equilibrium for a body in 2D space for concurrent and non-concurrent force system?
- (b) What is meant by coefficient of static and kinetic friction? Comment on the value of static and kinetic friction
- (c) Explain the term radius of gyration
- (d) Define center of percussion
- (e) Define Perfect frame and Redundant frame.
- (f) Find out the zero force member in the given figure



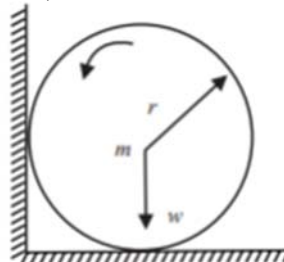
- (g) Differentiate between impulse and force
- (h) Write a short note on Kinematics and Kinetics
- (i) Write down D'Alembert's Principle
- (j) Differentiate between stable and unstable equilibrium

SECTION B

2. Attempt any *three* of the following:

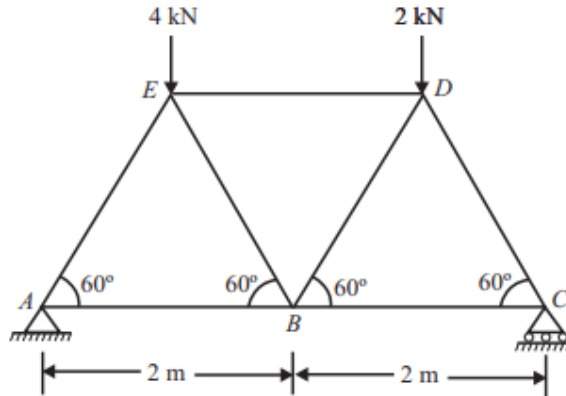
10 x 3 = 30

- (a) Homogeneous cylinder of weight W rests on a horizontal floor in contact with a wall. If the coefficient of friction for all contact surfaces be μ , determine the couple M acting on the cylinder, which will start counter clockwise rotation.

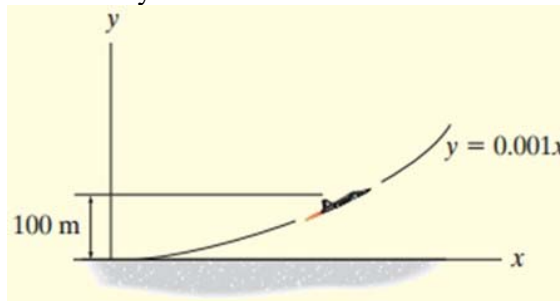


- (b) Derive an equation for moment of inertia of Right circular cone about its Z axis

- (c) Determine the reaction and the forces in member AB, AE & CD of a simple triangle truss supporting two loads as shown in fig



- (d) For a short time, the path of the plane in Fig. is described by $y = (0.001x^2)$ m. If the plane is rising with a constant upward velocity of 10 m/s, determine the magnitudes of the velocity and acceleration of the plane when it reaches an altitude of $y = 100$ m.

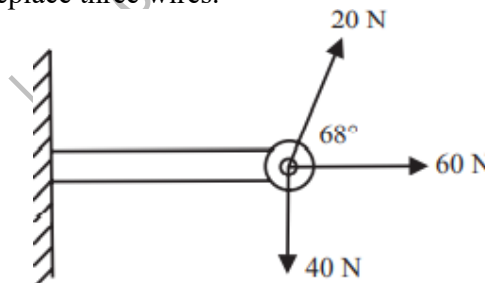


- (e) State and prove work energy principle.
A beam AB of span 8 metres is carrying a point load of 4 kN at a distance 3 metres from A and 10 kN at distance of 5 metres from A. Determine the beam reactions, by using the principle of the virtual work.

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

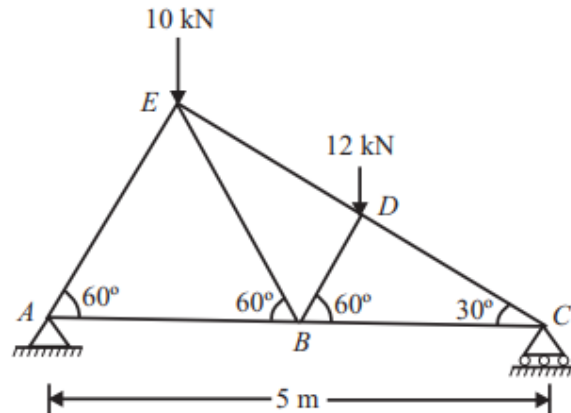
- (a) A ladder 5m long rests on a horizontal ground and leans against a smooth vertical wall at an angle 70° with the horizontal. The weight of the ladder is 900N and acts at its middle. The ladder is at the point of sliding, when a man weighing 750N stands 1.5m from the bottom of the ladder. Calculate coefficient of friction between the ladder and the floor.
- (b) How do you classify the force system? Three wires exert the tensions indicated on the ring in fig. Assuming a concurrent system, determine the force in a single wire will replace three wires.



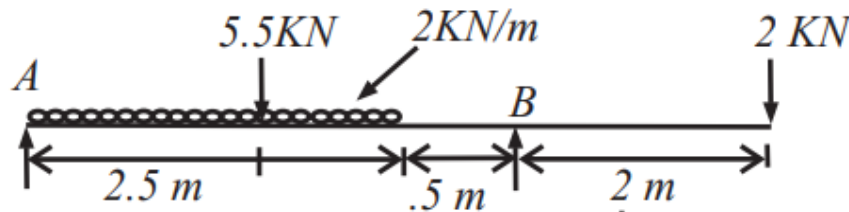
4. Attempt any *one* part of the following:

10 x 1 = 10

- (a) A truss is shown in fig. Find forces in the members AE, AB, BC & CD of the truss and indicate whether it is tension or compression



- (b) Determine the reactions at A and B of the overhanging beam as shown in fig



5. Attempt any *one* part of the following:

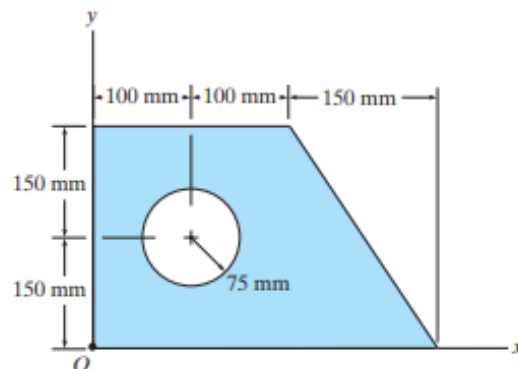
10 x 1 = 10

- (a) In a reciprocating pump, the lengths of connecting rod and crank is 1125 mm and 250 mm respectively. The crank is rotating at 420 r.p.m. Find the velocity with which the piston will move, when the crank has turned through an angle of 40° from the inner dead centre
- (b) An army truck of mass 5 tonnes has tractive resistance of 150 N/t. Find the power required to propel the truck at a uniform speed of 36 km.p.h. (a) up an incline of 1 in 100 ; (b) on a level track ; and (c) down an incline of 1 in 100.

6. Attempt any *one* part of the following:

10 x 1 = 10

- (a) Determine the moment of inertia I_x of the shaded area about the x axis.



- (b) Determine the moment of inertia of a circular section of radius R about centroidal x, y and z axis

7. Attempt any *one* part of the following:

10 x 1 = 10

- (a) In a pile driving equipment a ram of 800 kg mass is released from rest 2.5m above the top of a pile 2000 kg mass. The ram rebounds to a height of 0.15 m after hitting the pile. Calculate
1. the velocity of pile after the impact
 2. the coefficient of restitution
 3. the percentage of energy loss due to impact
- (b) A particle starts with velocity u and the acceleration-velocity relationship is prescribed as $a = -kv$ where k is a constant. Set up an expression that prescribes the displacement time relation for the particle.

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