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NMAM INSTITUTE OF TECHNOLOGY, NITTE

(An Autonomous Institution affiliated to VTU, Belagavi)

First Semester B.E. (Credit System) Degree Examinations

Make up Examinations - July - August 2021

20CV103 – ENGINEERING MECHANICS

Duration: 3 Hour

Max. Marks: 10

Note: Answer any Five full questions choosing Two full question from Unit – I & Unit – II each and One full question from Unit – III.

Unit – I

		Marks	BT*	CO*	PO*
1. a)	Explain the following fields of civil engineering i) Structural Engineering ii) Geotechnical Engineering	05	L*1	1	1
b)	Define and explain the characteristics of force.	05	L1	1	1
c)	Determine the tension in different parts of string as shown in Fig. Q1 (c). also find w_1 and w_2 if portion BC is horizontal.	10	L3	2	2

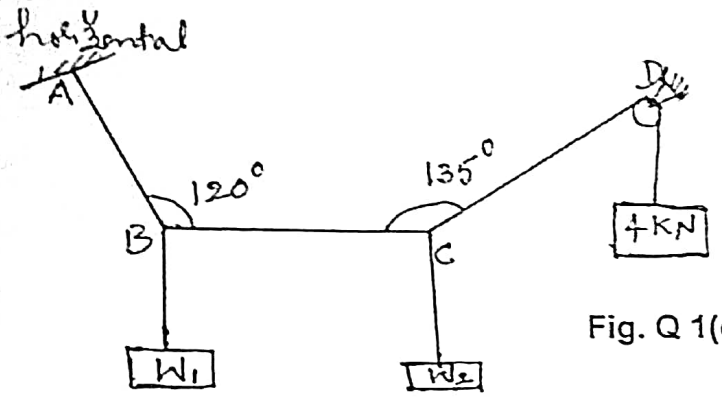

Fig. Q 1(c)

2. a)	Explain basic idealizations in Engineering Mechanics.	05	L1	1	1
b)	Explain the principle of transmissibility and mention its limitations.	05	L2	2	2
c)	Determine the magnitude, direction and position of resultant w.r.t point '0' shown in Fig. Q2(c).	10	L3	2	2

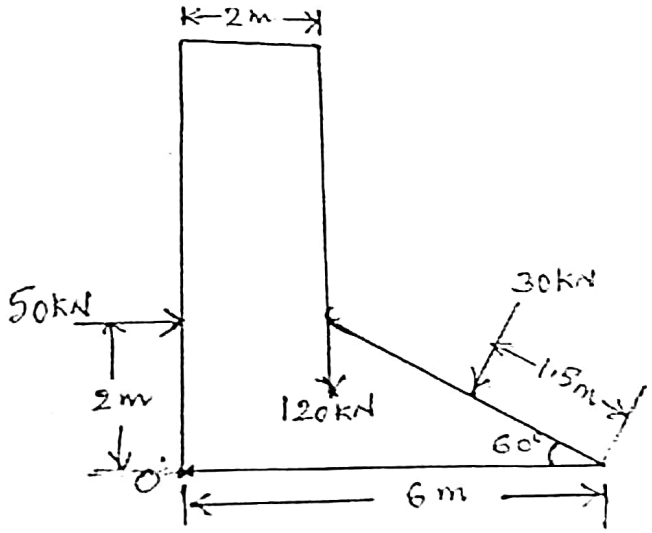

Fig Q 2(c)

3. a)	State and prove the principle applied to find the position of resultant in concurrent force system.	05	L2	2	2
b)	Explain equivalent force couple system with neat sketches.	05	L1	2	1

c) Determine the resultant force acting on the structure at point 'O' both in magnitude and direction for the system of forces shown in Fig. Q3 (c).

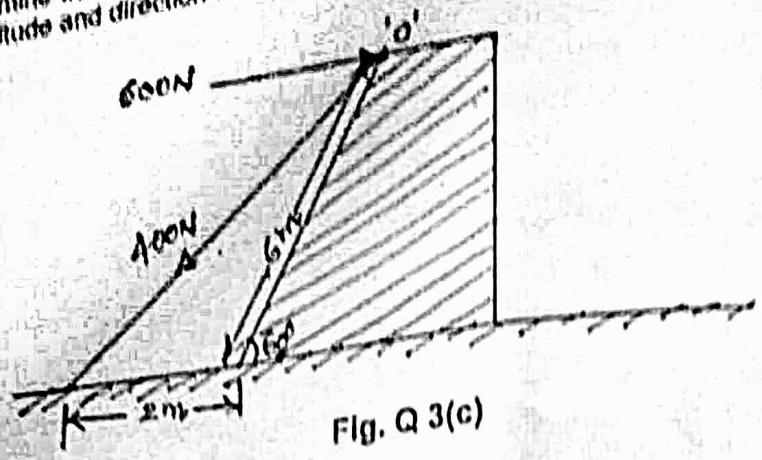

Fig. Q 3(c)

10 L3

Unit – II

4. a) Derive an expression for moment of inertia of a rectangle with respect to its centroidal axes. 05 L1
   b) Differentiate between centroid and centre of gravity. 05 L1
   c) Determine the supports reactions developed in the double overhanging beam shown in Fig. Q4 (c).

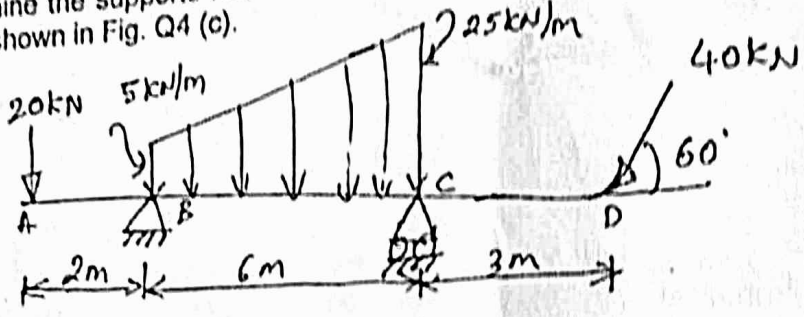

Fig Q. 4(c)

10 L3

5. a) Explain different types of loads acting on the beam. 05 L1
   b) Differentiate between determinate beam and Indeterminate beam with examples. 05 L2
   c) Locate the centroid of the shaded area shown in Fig. Q 5(c)

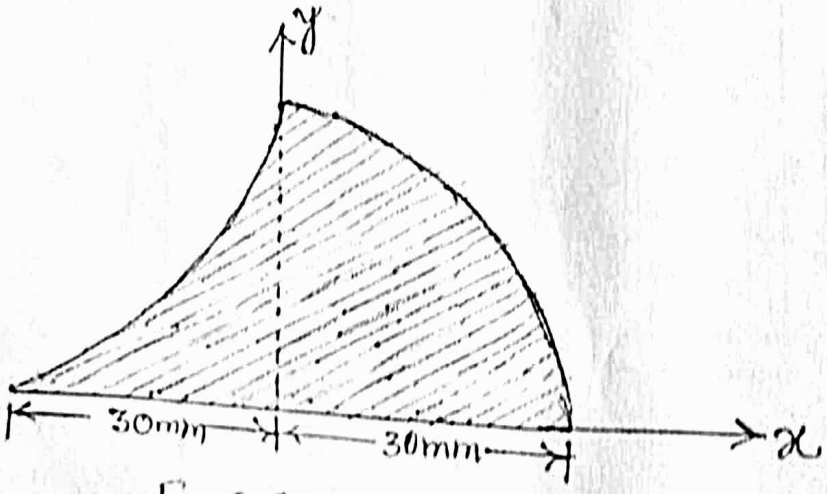

Fig Q 5(c)

10 L3

) Distinguish between hinged and roller support with heat sketch. 05 L1 3 1

) Determine the reactions developed in the cantilever beam shown in Fig. Q 6 (b).

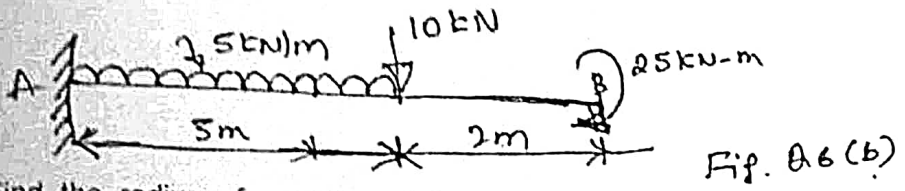

Fig. Q6 (b)

) Find the radius of gyration of the area shown in Fig. Q 6(c) about horizontal axis. 05 L3 3 2

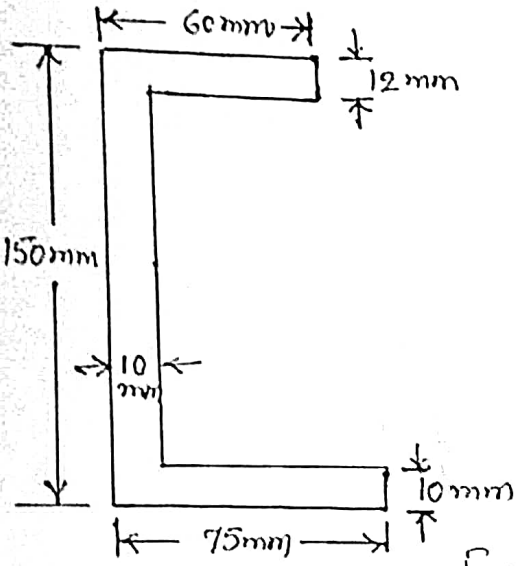

Fig Q6(c)

10 L3 4 2

Unit – III

a) State and explain work-energy principle. 06 L2 5 1

b) State and explain Impulse momentum principle. 06 L1 5 1

c) A body of weight 450 N is pulled up along an inclined plane having inclination 30° to the horizontal at a steady speed. Find the force required if the coefficient of friction between the body and the plane is 0.25 and force is applied parallel to the inclined plane (Fig. Q7 (c)).

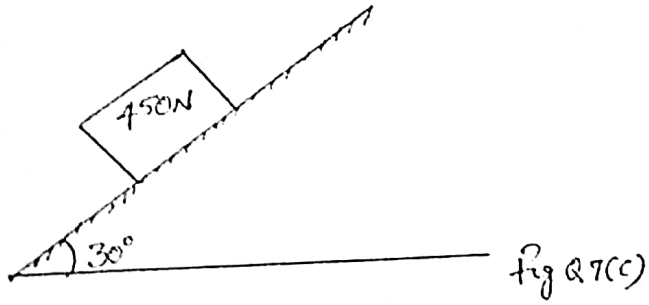

Fig Q7(c)

08 L3 5 2

a) Define i) Coefficient of friction 06 L1 5 1
ii) Angle of friction 06 L1 5 1
iii) Cone of friction

b) Mention Coulomb's laws of friction.

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c) A train of weight 1500 kN is ascending a slope of 1 in 100 with a uniform speed of 36 kMPh as shown in Fig. Q 8(c). Find the power exerted by the engine, if the road resistance is 5N per kN weight of the train.

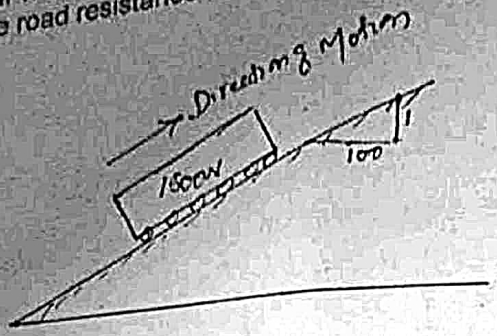

Fig Q 8(c)

BT* Bloom's Taxonomy, L* Level; CO* Course Outcome; PO* Program Outcome

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First / Second Semester B.E. (Credit System) Degree Examinations

Make up/Supplementary Examinations – September 2021

20CV103 – ENGINEERING MECHANICS

17CV103 – ELEMENTS OF CIVIL ENGINEERING AND ENGINEERING MECHANICS

on: 3 Hours Max. Marks: 100

*Note: 1) Answer any **Five full** questions.*
2) Assume any missing data suitably and indicate the same.

	Marks	BT*	CO*	PO*
(i) Explain the scope of following fields of Civil Engineering (a) Transportation Engineering (b) Geotechnical Engineering. (ii) With a neat sketch, explain the characteristics of a force.	10	L*1	1	1
(i) Define "Equilibrant", state how it is different from "resultant"? (ii) A bracket is subjected to a coplanar force system as shown in Fig. 1(b). Determine the magnitude and line of action of single resultant of the system. If the resultant is to pass through B, what should be the magnitude and direction of a couple?	10	L3	2	2

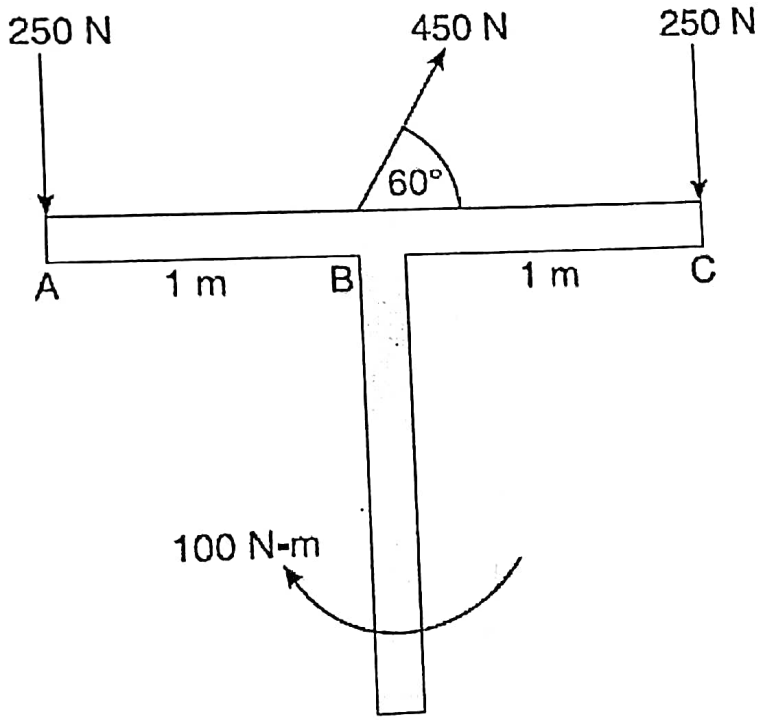

Fig. 1(b)

(i) With a neat sketch explain the concept of free-body diagram. (ii) With sketches, explain "Non-coplanar concurrent force system" and "Collinear force system".	10	L1	1	1

b) (i) Reduce the force acting at A into a system of equivalent force and couple at point O (Fig. 2(b1)).

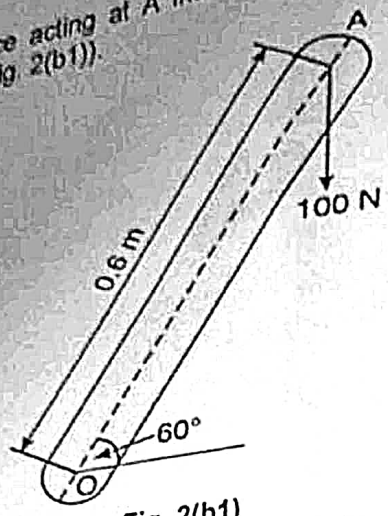

Fig. 2(b1)

(ii) Find the value of W, which is required to maintain equilibrium configuration as shown in Fig. 2(b2).

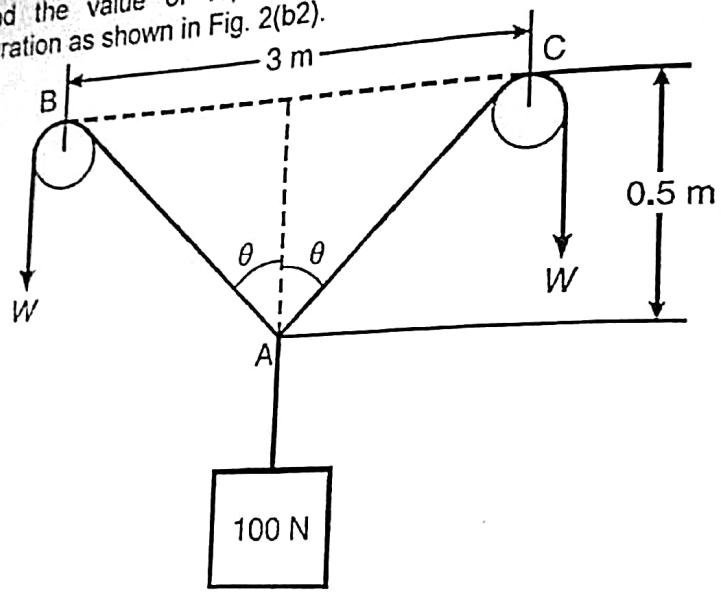

Fig. 2(b2)

3. a) (i) Determine the resultant force acting on the structure at point O as shown in Fig. 3(a1).

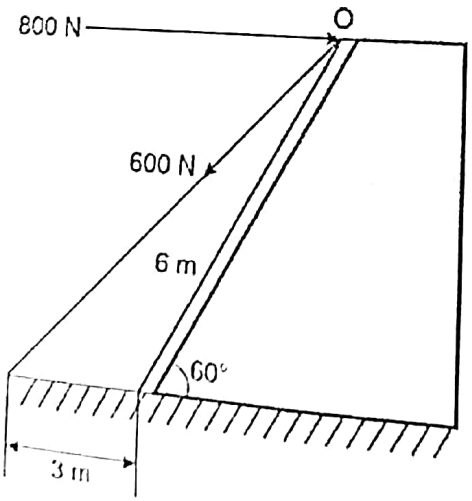

Fig. 3(a)

(ii) With relevant neat sketches explain the Principle of Transmissibility of Forces.

(i) State and prove Varignon's theorem.
(ii) Determine the magnitude and direction of force P, which keeps the concurrent system of Fig 3(b) in equilibrium.

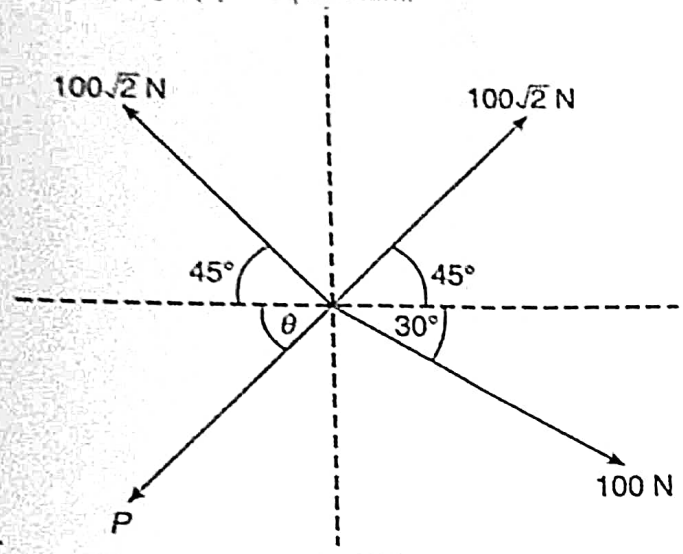

Fig 3(b)

10 L3 2 2

(i) With examples, explain statically indeterminate beam.
(ii) Calculate the support reactions for the cantilever beam shown in Fig 4.(a).

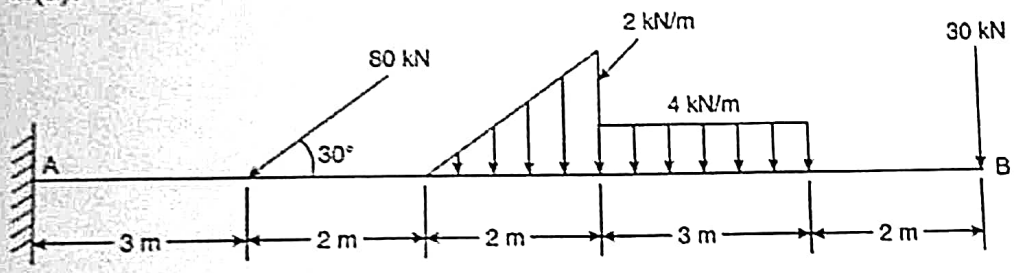

Fig 4.(a)

10 L3 3 2

Locate the centroid of the shaded area shown in Fig 4(b).

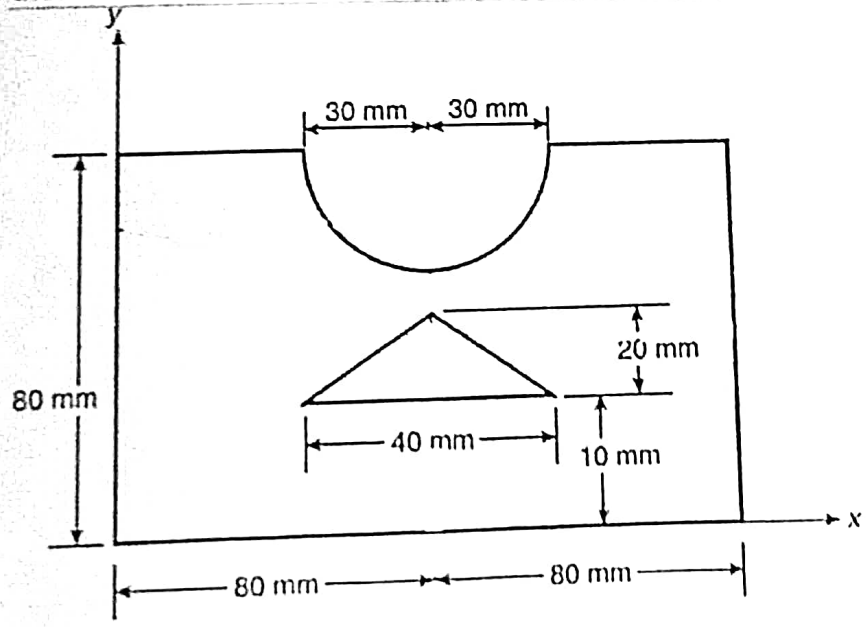

Fig 4(b)

10 L3 4

5. a) Find the support reactions at A and B for the simply supported beam loaded as shown in Fig 5(a).

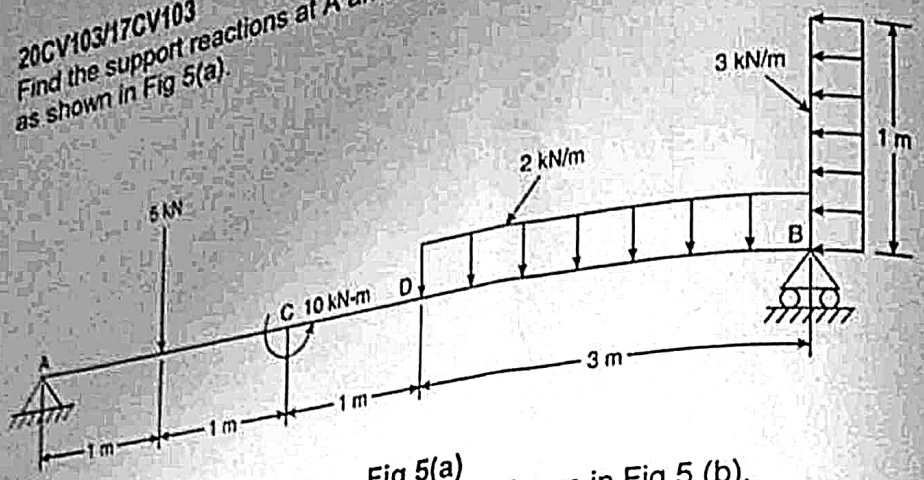

Fig 5(a)

b) Find the polar radius of gyration for the area shown in Fig 5 (b).

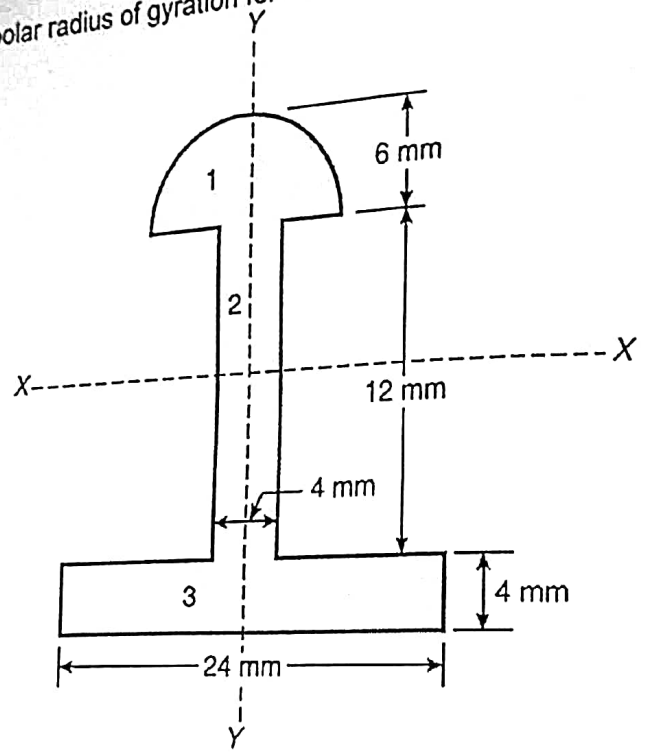

Fig 5 (b)

6. a) (i) List any four types of loads which act on any structural member, describe any two in detail.
(ii) With relevant sketches, explain any two types of structural supports.

b) (i) With usual notations, obtain an expression for the centroid of a triangular lamina with respect to its base by the method of integration.
(ii) Obtain the expression for the determination of moment of inertia of a circular lamina about its diametrical axis from first principles.

7. a) Define "limiting friction" and "angle of repose". State any four Coulomb's laws of dry-friction.

Determine the tension in the strings and the velocity of 1500 N block shown in Fig 7(b) five seconds after starting with a downward velocity of 3 m/s. Assume the pulleys are weightless and frictionless. Use **impulse momentum** principle.

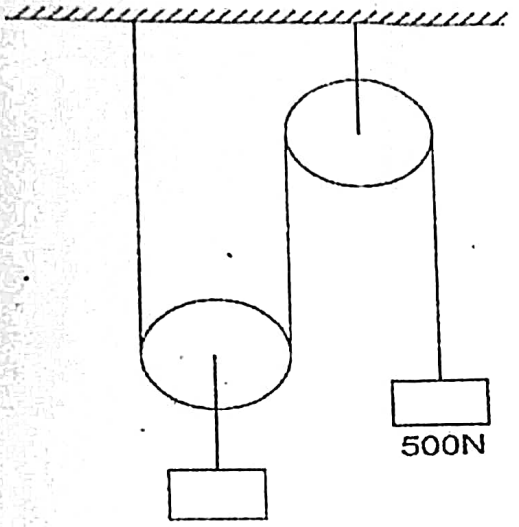

Fig 7(b)

	6	L3	5	2

b) A body weighing 600 N just starts moving down a rough inclined plane supported by a force of 200 N acting parallel to the plane and is on the verge of moving up the plane when pulled by a force of 320N parallel to the plane. Find the inclination of the plane and coefficient of friction between the inclined plane and the weight.

8	L3	5	2

a) State and prove work-energy principle.

6	L2	5	1

b) Find the power of locomotive driving a train up in inclination 1 in 120 whose weight including that of engine is 450 kN at the steady speed of 50kmph against tractive resistance of 5N/kN. While the train is ascending steam shutoff, find how far will it move before coming to rest assuming tractive resistance remain the same.

8	L3	5	2

c) A 500N block is placed on a horizontal floor and subjected to pull of 150N at an angle 20 with horizontal. Determine the coefficient of static friction between the block and the floor.

6	L3	5	2

BT* Bloom's Taxonomy, L* Level; CO* Course Outcome; PO* Program Outcome

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