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P.E.S. College of Engineering, Mandya - 571 401
 (An Autonomous Institution affiliated to VTU, Belagavi)
Second Semester, B.E. - Semester End Examination; October - 2022
Engineering Mechanics
 (Common to all Branches)

Time: 3 hrs

Max. Marks: 100

Course Outcomes

The Students will be able to:

CO1 - Apply the knowledge of basic science and mathematics to classify the force systems and Compute its resultant.

CO2 - Analyse the system of forces in equilibrium with or without frictional forces.

CO3 - Locate the centroid and composite moment of inertia of irregular and built up sections.

CO4 - Analyse the problems with respect to linear motion, curvilinear motion and energy.

Note: I) PART - A is compulsory. Two marks for each question.

II) PART - B: Answer any **Two** sub questions (from a, b, c) for a Maximum of **18 marks** from each unit.

Q. No.	Questions	Marks	BLs	COs	POs
I : PART - A		10			
1 a.	Differentiate between the resultant and equilibrant.	2	L1	CO1	PO1,2
b.	Define the terms; i) Angle of friction ii) Coefficient of friction.	2	L1	CO2	PO1,2
c.	With a neat sketch, explain axis of reference.	2	L2	CO3	PO1,2,3
d.	With a neat sketch, explain polar moment of inertia.	2	L2	CO3	PO1,2,3
e.	Define centripetal and centrifugal force.	2	L1	CO4	PO1,2,3
II : PART - B		90			

UNIT - I

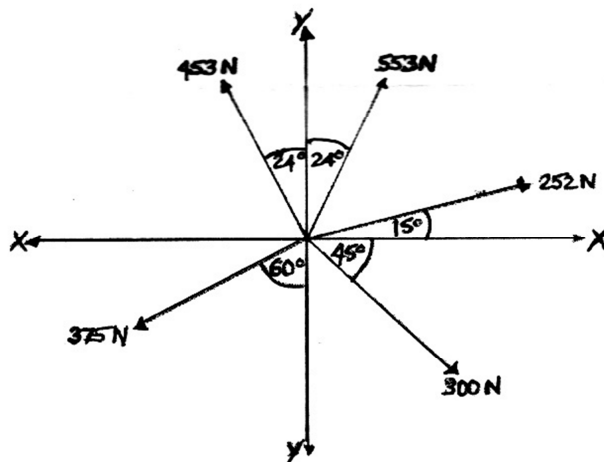
18

2 a. With the help of neat sketches, explain;

- i) Resolution of forces
- ii) Free body diagram
- iii) Lami's theorem

9 L2 CO1 PO1,2

b. Find the magnitude and direction of the resultant of the coplanar force system shown in Figure Q.2(b).



9 L3 CO1 PO1,2

- c. Calculate the reaction exerted at the contact points A, B, C and D as shown in Figure Q.2(c).

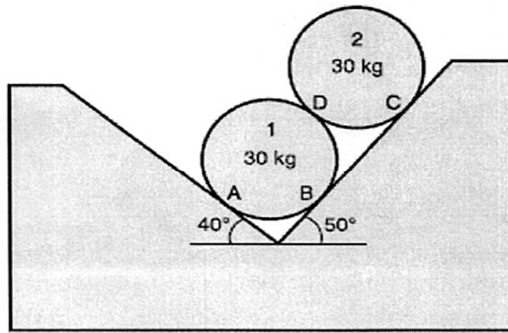


Figure Q.2(c)

9 L3 CO1 PO1,2

UNIT - II

18

- 3 a. List and explain with neat sketches, different types of supports and also mark line of action of reaction.
 b. Determine the reactions at A and E for the beam shown in Figure Q.3(b).

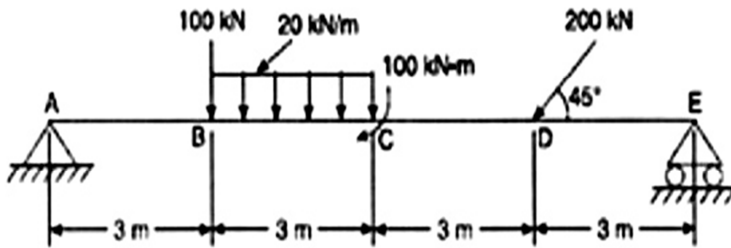


Figure Q.3(b)

9 L3 CO2 PO1,2

- c. A small block of weight 1000 N as shown in Figure Q.3(c), is placed on a 30° inclined plane with $\mu = 0.25$. Determine the horizontal force to be applied for; i) Impending motion down the plane
 ii) Impending motion up the plane

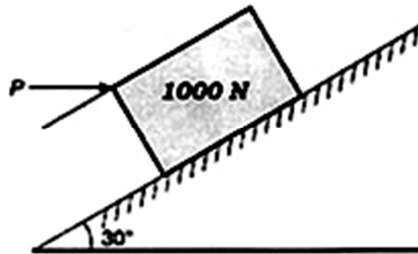


Figure Q.3(c)

9 L3 CO2 PO1,2

UNIT - III

18

- 4 a. By the method of integration, device an expression for the centroid of quarter circle.

9 L2 CO3 PO1,2,3

b. Find the centroid of the shaded area shown in Figure Q.4(b).

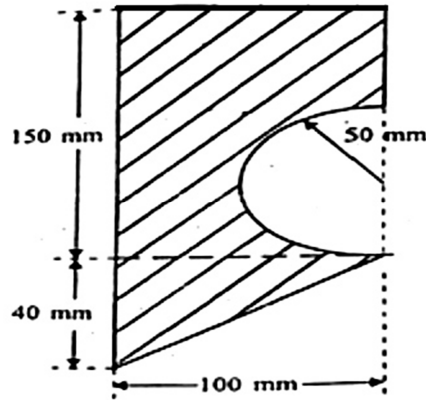


Figure Q.4(b)

9 L3 CO3 PO1,2,3

c. Locate the centroid of the shaded area shown in Figure Q.4(c).

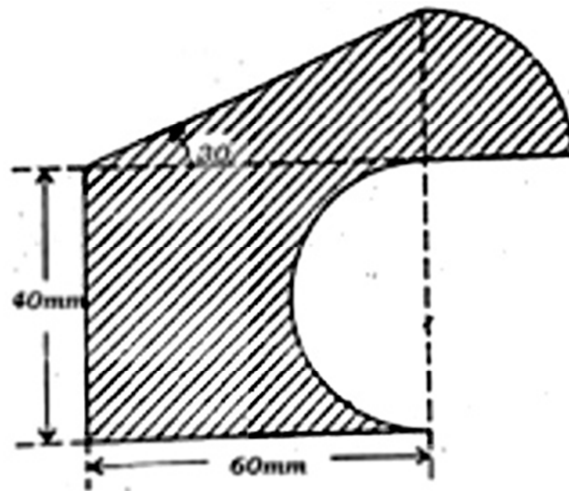


Figure Q.4(c)

9 L3 CO3 PO1,2,3

UNIT - IV

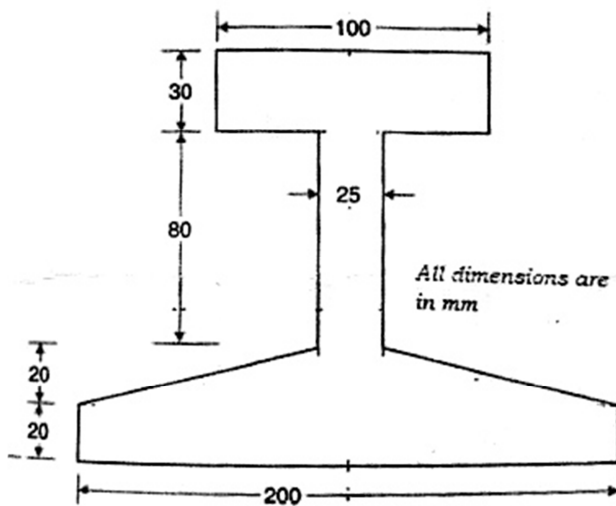
18

5 a. i) State and prove parallel axis theorem.

ii) With a neat sketch, explain radius of Gyration.

9 L2 CO3 PO1,2,3

b. Determine the moment of inertia of the built-up section shown in Figure Q.5(b) about its centroidal axes $x-x$ and $y-y$



9 L3 CO3 PO1,2,3

- c. Determine the polar moment of inertia of the section shown in Figure Q.5(c) about its centroidal axes $x-x$ and $y-y$.

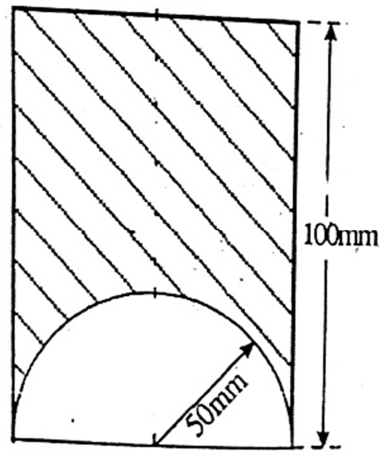


Figure Q.5(c)

9 L3 CO3 PO1,2,3

UNIT - V

18

- 6 a. i) Define work, power and energy.
 ii) What is super elevation? Why it is necessary?
- b. A stone is dropped into a well and a sound of splash is heard after 4 s. Find the depth of well if the velocity of sound is 350 m/s.
- c. The horizontal component of the velocity of a projectile is twice it's initial vertical component. Find the range on the horizontal plane, if the projectile passes through a point 18 m horizontally and 3 m vertically above the point of projection.

9 L1 CO4 PO1,2,3

9 L3 CO4 PO1,2,3

9 L3 CO4 PO1,2,3

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