

Faculty of Engineering &amp; Technology

Second Semester B.E. Examination

ENGINEERING MECHANICS

Time—Two Hours]

[Maximum Marks—40

## INSTRUCTIONS TO CANDIDATES

- (1) All questions carry marks as indicated.
- (2) Due credit will be given to neatness and adequate dimensions.  
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- (3) Assume suitable data wherever necessary.
- (4) Illustrate your answers wherever necessary with the help of neat sketches.

1. (a) Define the term "couple". What are the properties of couple ?  
4
- (b) Three forces  $F$ ,  $P$ ,  $Q$  acting at point  $D$  as shown in figure.  $F = 90$  N,  $P = 150$  N. Determine the magnitude of force  $Q$ , so that the resultant of the  
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three forces is parallel to "y" axis. Point  $D$  is in plane  $x$ - $y$ .  
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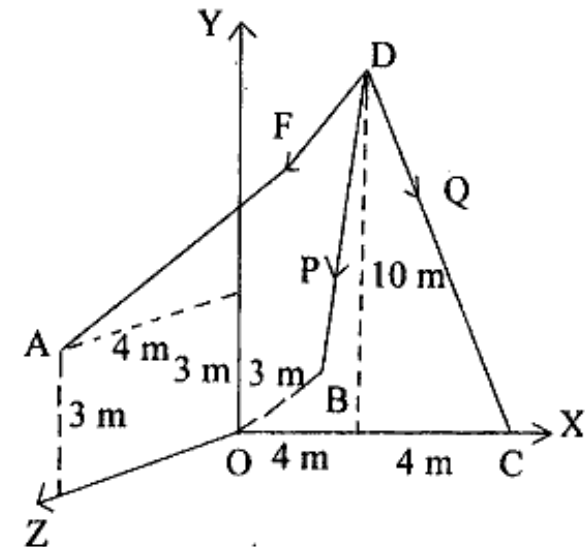


Fig. 1(b)

OR rtmnuonline.com

2. (a) Three forces are shown in figure 2(a). Determine the resultant and position where it cuts  $X$ -axis.  
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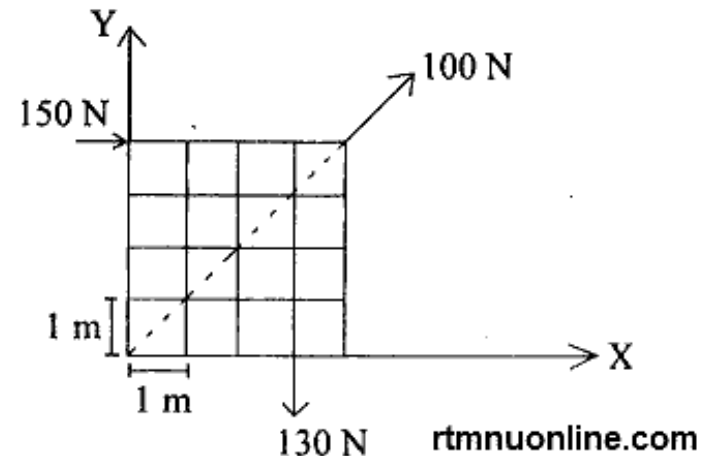


Fig. 2(a)

- (b) The three forces in a system are given below with their points of application :

$200\vec{i}$  at  $(0, 1.2, 0)$ ;  $300\vec{j}$  at  $(0, 0, 1)$ ;

$-150\vec{k}$  at  $(1.5, 0, 0)$  rtmnuonline.com

and a couple moment of  $240\vec{i} + 300\vec{j} + 225\vec{k}$ .

Replace this force system by a wrench passing through a point in Y-Z plane. 6

3. (a) A circular roller of weight 100 N and radius 10 cm hangs by a tie rod AB = 20 cm and rest against a smooth vertical wall at C. Determine the force F in the tie rod and the reaction  $R_C$  at point C. rtmnuonline.com 4

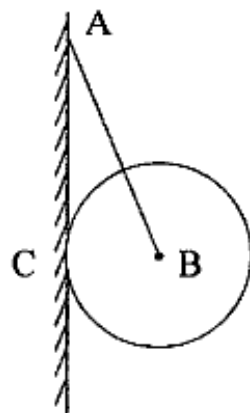


Fig. 3(a) rtmnuonline.com

- (b) Determine the forces in all the members of truss shown in figure 3(b) and indicate the magnitude and nature of the forces. 6

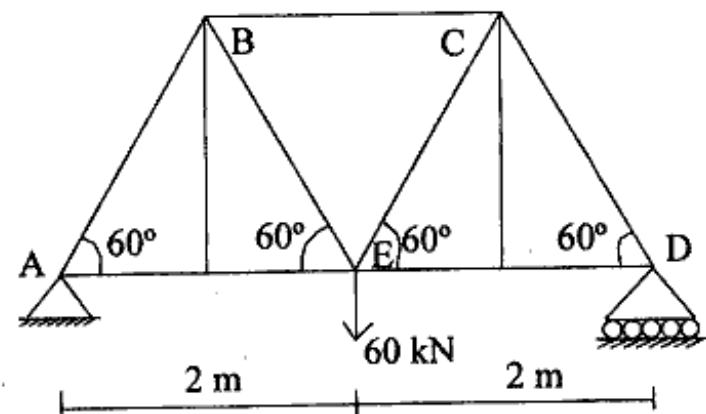


Fig. 3(b)

OR rtmnuonline.com

4. (a) Find the support reaction at A and B as shown in figure 4(a). A couple of 16 kN-m is acting at C. 7

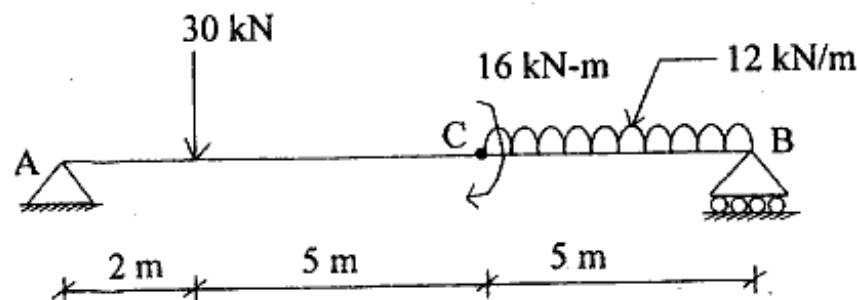


Fig. 4(a) rtmnuonline.com

- (b) Define perfect truss and imperfect truss and also assumptions made in analysis of simple truss.

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5. (a) For the composite area shown in figure determine :  
 (i) Moment of Inertia w.r.t. X axis and Y axis.  
 (ii) Product of Inertia w.r.t. X-Y axis.

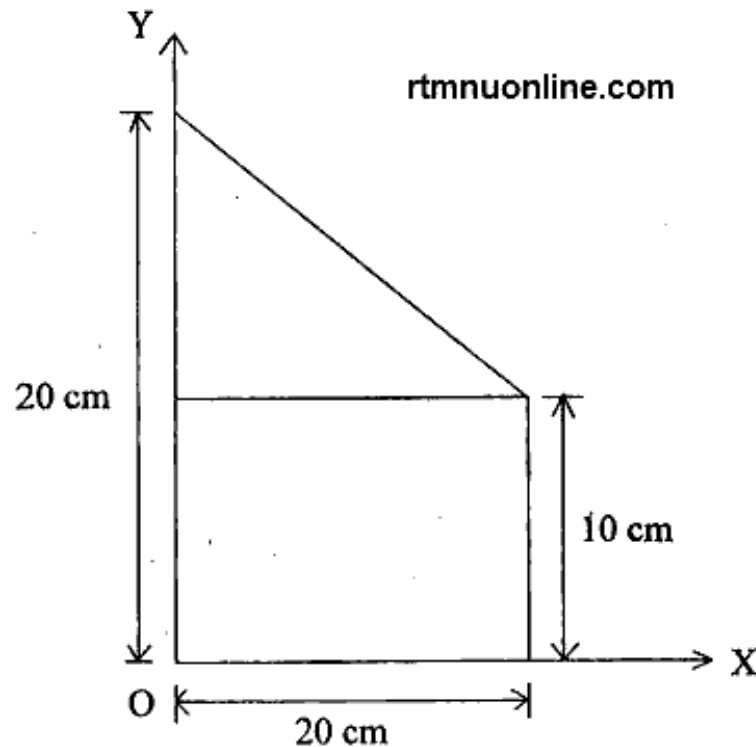


Fig. 5(a)

- (b) State and explain principle of virtual work.

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OR

6. (a) For the shaded area determine the coordinates of centroid w.r.t. X and Y axis.

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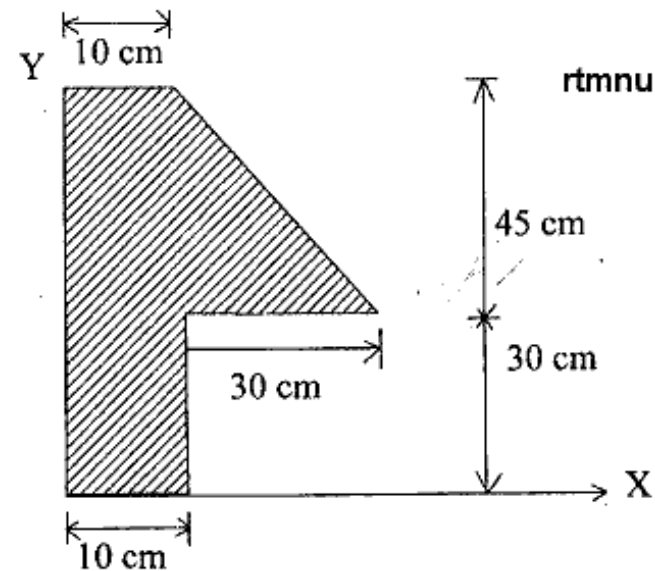


Fig. 6(a)

- (b) A beam ABCDE 10 m long is hinged at A and freely supported at B and D as shown in Figure. There is internal hinge at C midway between B and D. Evaluate the reactions at A, B and D for the loading shown in figure using virtual work method.

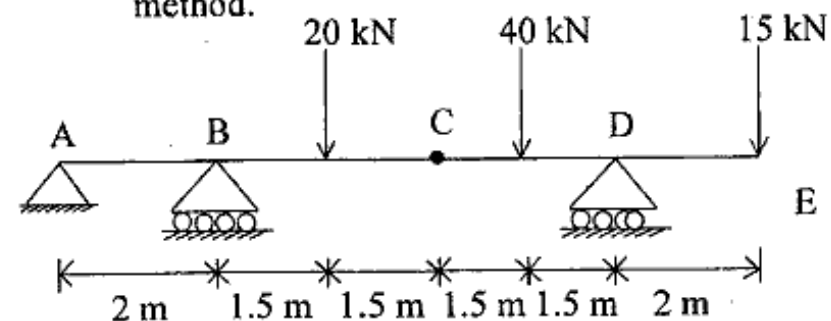


Fig. 6(b)

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7. (a) State and explain D'Alembert's principle. 2
- (b) The uniform crate shown in fig. weighs of 200 N, it is pulled up the smooth incline by a counter weight  $W$  of 400 N. Find the maximum and minimum values of ' $d$ ' so that the crate does not tip over as it slides up the incline. 8

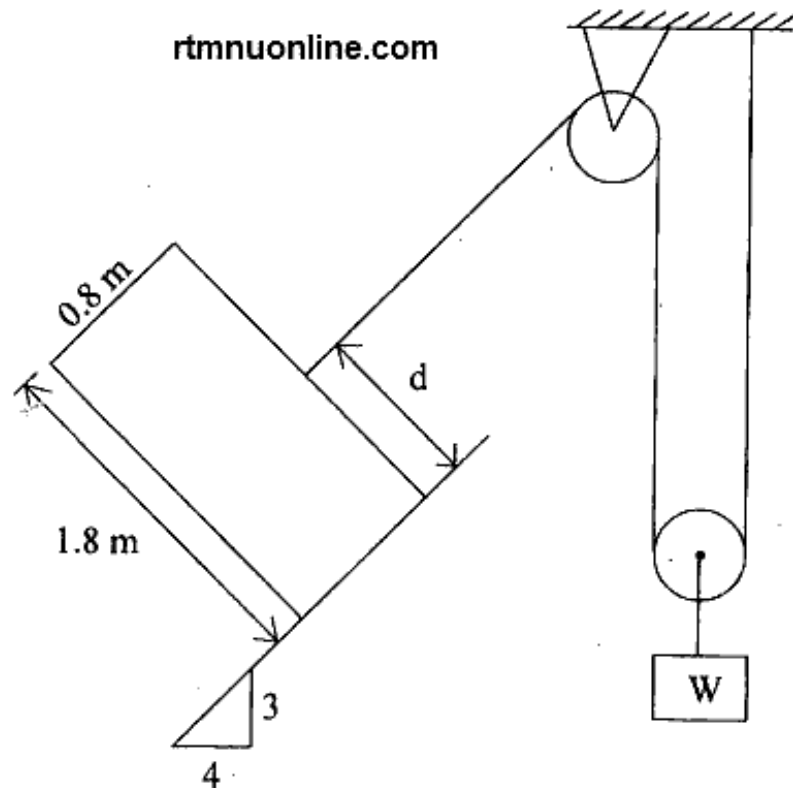


Fig. 7(b) rtmnuonline.com  
OR

8. (a) What is Coefficient of Restitution ? Explain in brief. 2

- (b) The spheres 'A' and 'B' as shown in Fig. are attached to stiff rods of negligible weight. The sphere 'A' is released from rest and allowed to strike sphere 'B', kept in vertical position, if the coefficient of restitution  $e = 0.6$ , determine the maximum angle  $\theta$  through which sphere 'B' will swing. What is minimum and maximum tension in the rod attached to sphere 'B' ? If the impact lasts for 0.01 second, find average impact force. Weight of 'A' = 45 N and 'B' = 40 N. 8

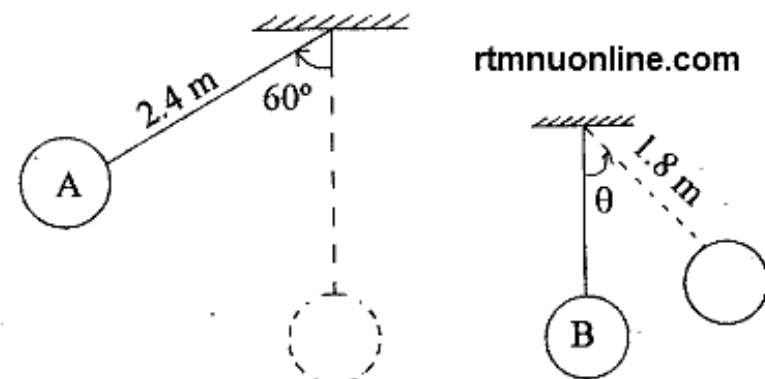


Fig. 8(b)