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**Question Paper Code: 50735**

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2017

Third Semester

Mechanical Engineering

15UME305 - ENGINEERING MECHANICS

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. A force which combines with two or more forces to produce equilibrium is called  
(a) resultant                      (b) equilibrant                      (c) couple                      (d) moment
2. Two or more forces, whose direction lies on the same plane is  
(a) concurrent forces                      (b) coplanar forces  
(c) parallel forces                      (d) perpendicular forces
3. The free body diagram of a body shows the body  
(a) with its surroundings and external forces acting on it  
(b) isolated from all external effects  
(c) isolated from its surroundings  
(d) isolated from its surroundings and external forces acting upon it
4. A roller support has \_\_\_\_\_ degree of freedom  
(a) Single                      (b) two                      (c) three                      (d) multiple
5. For a solid cone of height  $h$  the center of gravity lies on the axis at a distance above the base  
(a)  $h/4$                       (b)  $h/3$                       (c)  $2h/3$                       (d)  $3h/8$

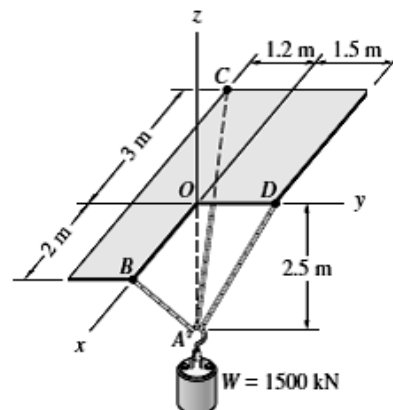
6. The centre of gravity and centroid of the body \_\_\_\_\_ each other.
- (a) Meet                      (b) coincide                      (c) intersects                      (d) does not meet
7. A stationary object of 10kg mass is acted upon by 20N force for 5 seconds. The object will attain a final velocity of
- (a) 1 m/sec                      (b) 10 m/sec                      (c) 20 m/sec                      (d) 30 m/sec
8. The maximum frictional force increase as the \_\_\_\_\_ force between the bodies increase.
- (a) Parallel                      (b) inclined                      (c) normal                      (d) gravitational
9. Which one of the following surfaces in contact has minimum coefficient of friction?
- (a) wood on wood                      (b) steel on steel  
(c) rubber tyre on dry concrete                      (d) rubber tyre on wet concrete
10. The body slide downwards in an inclined plane if
- (a)  $\alpha = \theta$                       (b)  $\alpha < \theta$                       (c)  $\alpha > \theta$                       (d)  $\alpha < \theta < \beta$

PART - B (5 x 2 = 10 Marks)

11. State parallelogram law.
12. Define the term couple.
13. Define radius of gyration.
14. Express the principle of work and energy.
15. State the Newton's law of collision of elastic bodies.

PART - C (5 x 16 = 80 Marks)

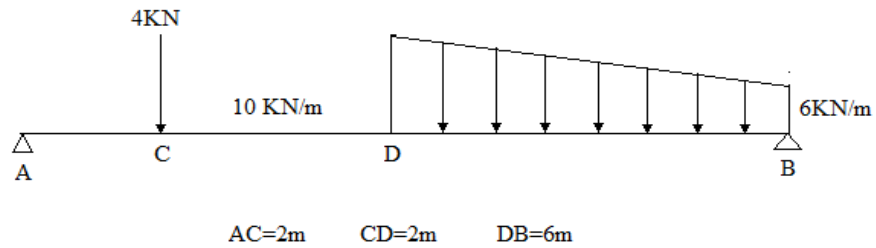
16. (a) Calculate the tension in each of the three cables [AB, AC, and AD] that support the 1500-kN weight is shown in figure. (16)



Or

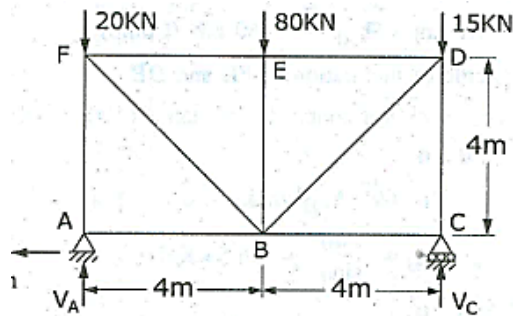
- (b) The lines of action of three forces are concurrent at the origin  $O$  passes through points  $A, B$  and  $C$  having co-ordinates  $(3, 0, -3)$   $(2, -2, -4)$  and  $(-1, 2, 4)$  respectively. If magnitude of the forces are  $10N, 30N$  and  $40N$ , find the magnitude and direction of their resultant. (16)

17. (a) Determine the support reactions of a simply supported beam subjected to the loads as shown in figure. (16)

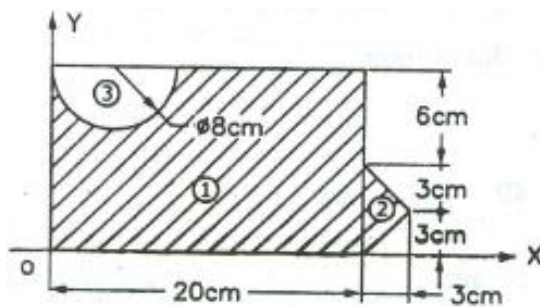


Or

- (b) Determine the forces in members of the pin-jointed frame as shown in figure. (16)

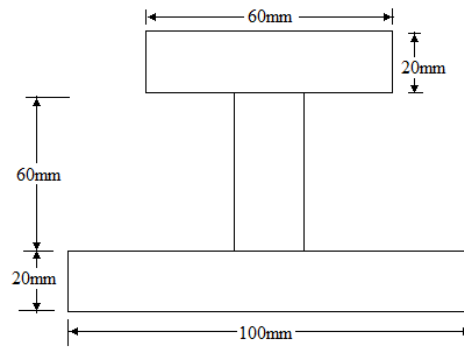


18. (a) Locate the centroid of the lamina as shown in figure. (16)



Or

- (b) Find the moment of inertia of an unsymmetrical  $I$  section shown in figure about its centroidal axis.



(16)

19. (a) The motion of a particle along a curved path is given by the equation

$$X = t^2 + 8t + 4 \quad \text{and} \quad Y = t^3 + 3t^2 + 8t + 4$$

Determine: (i) Initial velocity of the particle

(ii) Velocity of the particle at  $t = 2\text{sec}$

(iii) Acceleration of the particle at  $t = 0$

(iv) Acceleration of the particle at  $t = 2\text{sec}$ .

(16)

Or

- (b) Two weights 80N and 20N are connected by a thread and move along a rough horizontal plane under the action of force 40N, applied to the first weight of 80N. The coefficient of friction between the sliding surfaces of the weights and the plane is 0.3. Determine the acceleration of the weights and the tension in the thread using work-energy principle.

(16)

20. (a) A block overlaying a  $10^\circ$  wedge on a horizontal floor and leaning against a vertical wall and weighing 1500N is to be raised by applying a horizontal force to the wedge. The coefficient of friction for all the surface contact is 0.3, determine the minimum horizontal force to be applied to raise the block.

(16)

Or

- (b) What should be the value of the angle  $\theta$  so that motion of the 390N block impends down the plane. The coefficient of friction for all the surfaces is  $1/3$ .

(16)

