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**Reg. No. :**

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**Question Paper Code: 53705**

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2022

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. The unit of weight is CO1-R  
(a) Nm. (b) kg. (c)  $N\ m^2$ . (d) N.
2. Sine law also called CO1- R  
(a) Triangle law. (b) Polygon law. (c) Lami's law. (d) Pappus law.
3. Condition of equilibrium for coplanar concurrent force system will be CO2- R  
(a)  $\Sigma H=0, \Sigma V=0$  (b)  $\Sigma H=0, \Sigma V=0, \Sigma M=0$   
(c)  $\Sigma H= ma, \Sigma V=ma, \Sigma M=ma$  (d)  $\Sigma H=ma, \Sigma V=ma,$
4. One end fixed and also other end fixed this type of beam is called CO2-U  
(a) Cantilever beam. (b) Simply supported beam.  
(c) Over hanging beam. (d) Fixed beam.
5. The point, through which the whole weight of the body acts, irrespective CO3- R  
of its position, is known as  
(a) Moment of inertia (b) Centre of gravity  
(c) Centre of percussion (d) Centre of mass
6. The unite of radius of gyration for rectangle is CO3- R  
(a) m. (b)  $m^2$ . (c)  $m^3$ . (d)  $m^4$ .

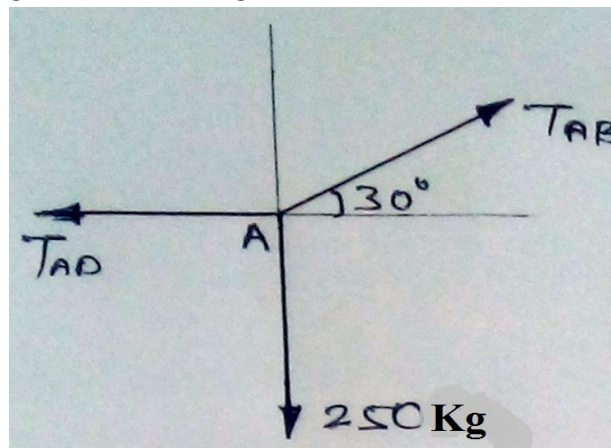
7. Which one of the following statements is correct? CO4- U
- (a) Energy and work are scalars  
 (b) Force and work are vectors  
 (c) Energy, momentum and velocity are vectors  
 (d) Force, momentum and velocity are scalar
8. The horizontal range will be maximum when the angle of projection is CO4-App
- (a)  $0^\circ$ .                      (b)  $45^\circ$ .                      (c)  $90^\circ$ .                      (d)  $180^\circ$ .
9. Frictional force is a CO5- App
- (a) Scalar quantity.                      (b) Vector quantity.  
 (c) Applied quantity.                      (d) Fluid quantity.
10. The ratio of frictional force and normal reaction is CO5- R
- (a) Coefficient of friction.                      (b) Angle of friction.  
 (c) Cone of friction.                      (d) Angle of repose.

PART – B (5 x 2= 10Marks)

11. Write the conditions of equilibrium of rigid body. CO1- App
12. Differentiate moment and couple. CO2- App
13. State pappus and Guldinus theorems. CO3- R
14. Define uniform motion. CO4- R
15. What is cone of friction? CO5- R

PART – C (5 x 16= 80Marks)

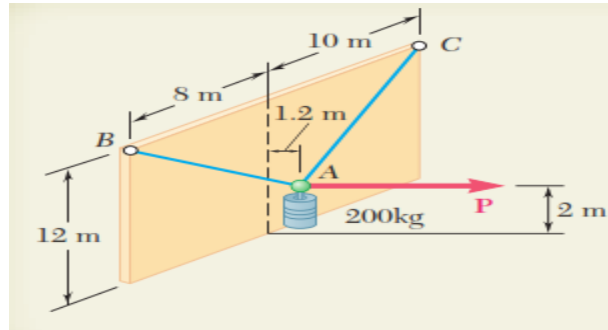
16. (a) Determine the tension in the cables AB and AD for equilibrium of CO1- App (16)  
 the 250 kg engine shown in figure



Or

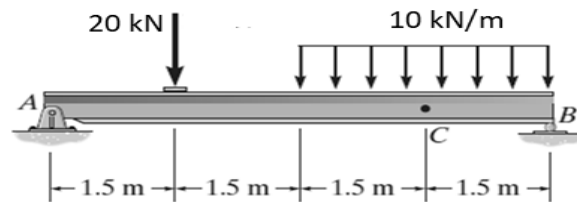
- (b) A 200kg cylinder is hung by means of two cables AB and AC, which are attached to the top of a vertical wall. A horizontal force P perpendicular to the wall holds the cylinder in the position shown. Determine the magnitude of P and the tension in each cable.

CO1- App (16)



17. (a) Determine the reactions at the supports A and B for the simply supported beam shown.

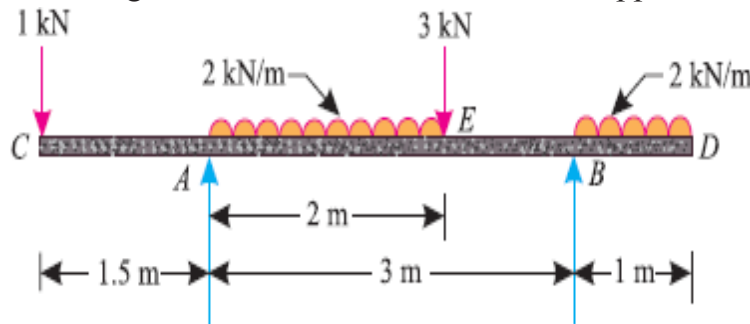
CO2- App (16)



Or

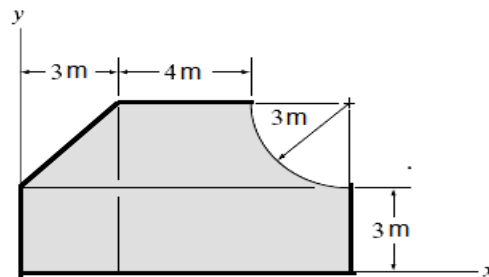
- (b) A beam AB of span 3 m, overhanging on both sides is loaded as shown in Fig. Determine the reactions at the supports A and B.

CO2 App (16)



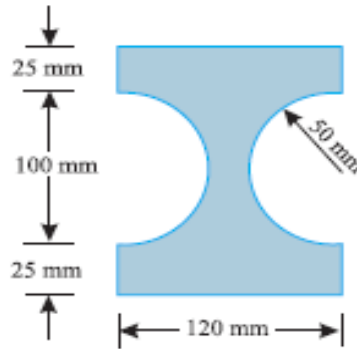
18. (a) Locate the centroid of the given cross sectional area

CO3- App (16)



Or

- (b) Figure shows the cross-section of a cast iron beam. Determine the moments of inertia of the section about horizontal and vertical axes passing through the centroid of the section. CO3- App (16)



19. (a) A small metal particle travels downward through a fluid medium while being subjected to the attraction of a magnetic field such that its position is  $s = (5t^3 - 3t)$  mm where  $t$  is in seconds. Determine the particle's displacement from  $t = 2$  s to  $t = 4$  s and the velocity and acceleration of the particle when  $t = 5$  s. CO4-Ana (16)

Or

- (b) A mass of 12Kg travelling to the right with a speed of 8m/sec collides with another mass of 20kg travelling to the left with a speed of 25 m/sec. if the coefficient of restitution is 0.60, find the velocities of the particles after the collision and loss of kinetic energy. What is the impulse acting on each particles during impac CO4-Ana (16)

20. (a) A weight of 40kN is on the point of motion down a rough inclined plane when supported by a force of 15kN acting parallel to the plane and is on the point of motion up the inclined plane under the influence of the force 20kN applied parallel to the inclined plane. Determine the coefficient of friction and angle of the plane CO5- App (16)

Or

- (b) A screw jack has a square thread of 75 mm mean diameter and 15 mm pitch. The load on the jack revolves with the screws. The coefficient of friction at the screw thread is 0.05. CO5-Ana (16)
- (i) Find the tangential force to be applied to the jack at 360 mm radius, so as to lift a load of 6 kN weight.
- (ii) State whether the jack is self locking. If it is, find the torque necessary to lower the load. If not, find the torque which must be applied to keep the load from descending.