A   Reg. No. :

| Question Paper Code: 53705 |

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2023

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) 0^0.   (b) 45^0.   (c) 90^0.   (d) 180^0.

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

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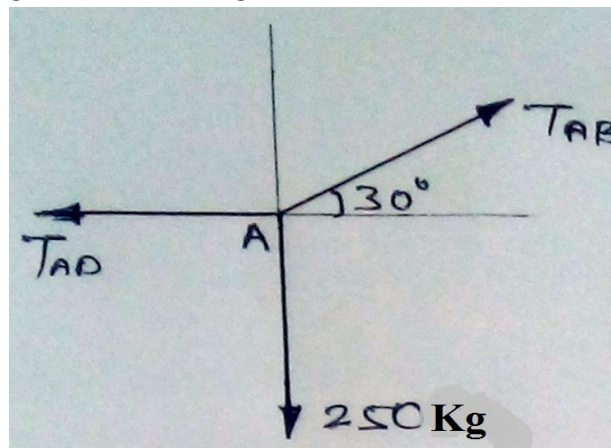
(b) A 200kg cylinder is hung by means of two cables AB and AC, which are attached to the top of a vertical wall. A horizontal force P perpendicular to the wall holds the cylinder in the position shown. Determine the magnitude of P and the tension in each cable.

CO1- App   (16)
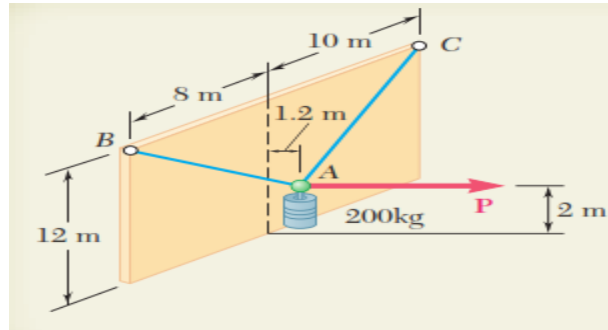
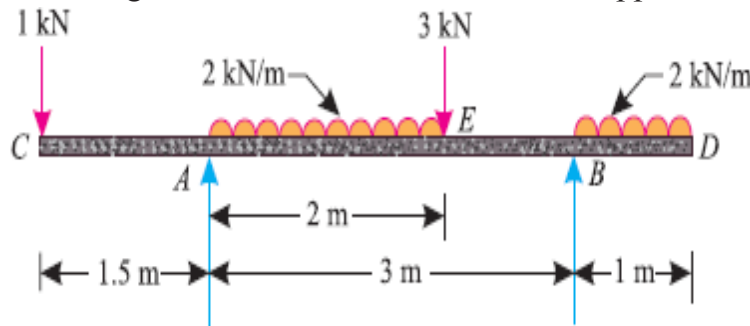17. (a) Determine the reactions at the supports A and B for the simply supported beam shown.
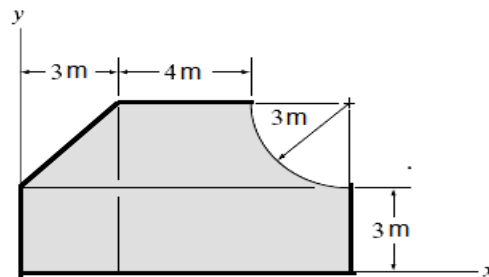
CO2- App   (16)
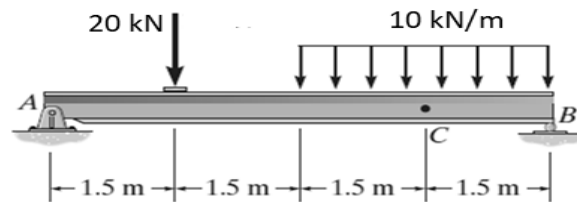
Or

(b) A beam AB of span 3m, overhanging on both sides is loaded as shown in Fig. Determine the reactions at the supports A and B.
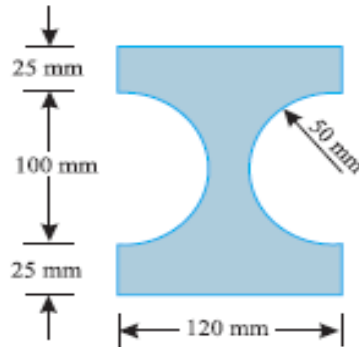
CO2 App   (16)

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

CO3- App   (16)

Or

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

19. (a) A small metal particle travels downward through a fluid medium   CO4-Ana   (16)
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.

<div align="center">Or</div>

(b) A mass of 12Kg travelling to the right with a speed of 8m/sec   CO4-Ana   (16)
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

20. (a) A weight of 40kN is on the point of motion down a rough inclined   CO5- App   (16)
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

<div align="center">Or</div>

(b) A screw jack has a square thread of 75 mm mean diameter and 15   CO5-Ana   (16)
mm pitch. The load on the jack revolves with the screws. The
coefficient of friction at the screw thread is 0.05.
(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.

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