A

Question Paper Code: 53705

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

Third Semester

Mechanical Engineering

15UME305 - ENGINEERING MECHANICS

(Regulation 2015)

Duration: Three hours   Maximum: 100 Marks

PART A - (10 x 1 = 10 Marks)

1. The force is created by the _____ between two bodies.   CO1 -R

    (a) Interaction   (b) collision   (c) repulsion   (d) attraction

2. According to Lami's theorem, a body is in equilibrium condition if   CO1 -R
    each force among three _____ are proportional to sine angle
    between other two.

    (a) coplanar, collinear forces   (b) collinear, non-concurrent forces

    (c) coplanar, non-concurrent forces   (d) coplanar, concurrent forces

3. Varingon's theorem of moments states that if a number of coplanar   CO2 -R
    forces acting on a particle are in equilibrium, then

    (a) their algebraic sum is zero

    (b) their lines of action are at equal distances

    (c) the algebraic sum of their moments about any point in their plane is zero

    (d) the algebraic sum of their moments about any point is equal to the moment of their

   resultant force about the same point

4. A couple produces   CO2 -R

   (a) translatory motion

   (b) rotational motion

   (c) combined translatory and rotational motion

   (d) none of the above

5. The term 'centroid' is   CO3 -R

   (a) the same as centre of gravity

   (b) the point of suspension

   (c) the point of application of the resultant of all the forces tending to cause a body to rotate about a certain axis

   (d) none of the above

6. Moment of inertia of a circular section about its diameter (d) is   CO3- R

   (a) $\pi d^3/16$ (b) $\pi d^3/32$ (c) $\pi d^4/32$ (d) $\pi d^4/64$

7. A rubber ball is dropped from a height of 2 m. If there is no loss of   CO4- R
   velocity after rebounding, the ball will rise to a height of

   (a) 1m   (b) 2m   (c) 3m   (d) 4m

8. When the spring of a watch is wound, it will possess   CO4 -R

   (a) strain energy   (b) kinetic energy   (c) heat energy   (d)electrical energy

9. A ladder is resting on a rough ground and leaning against a smooth   CO5- R
   vertical wall. The force of friction will act

   (a) downward at its upper end   (b) upward at its upper end

   (c) zero at its upper end   (d) perpendicular to the wall at its upper end

10. The body slide downwards in an inclined plane if   CO5- R

   (a) $\alpha = \emptyset$ (b) $\alpha < \emptyset$ (c) $\alpha > \emptyset$ (d) $\alpha < \emptyset < \beta$

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11. State parallelogram law.   CO1- U

12. Write the equations of equilibrium in two dimensions.   CO2- U

13. State the parallel axis theorem.   CO3-U

14. State D'Alembert's principle.   CO4- U

15. State the law's of dry friction.   CO5- U

PART – C (5 x 16= 80Marks)

16. (a) Calculate the tension in each of the three cables [AB, AC, and   CO1 -App   (16)
         AD] that support the   1500-kN weight is shown in figure.
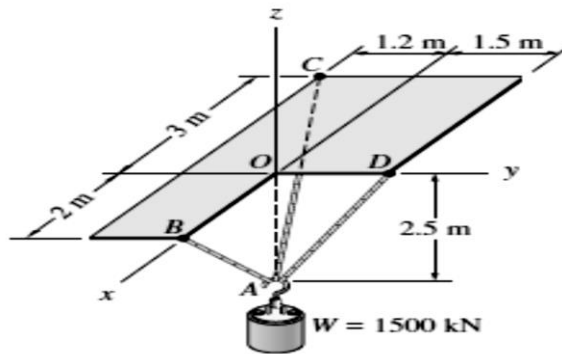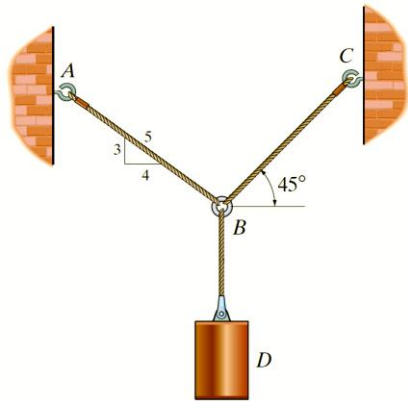

Or

(b) The antenna tower is supported by three cables. If the forces of   CO1- App   (16)
     these cables acting on the antenna are FB= 520 N, FC =680 N,
     and FD=560 N, determine the magnitude and coordinate direction
     angles of the resultant force acting at A.

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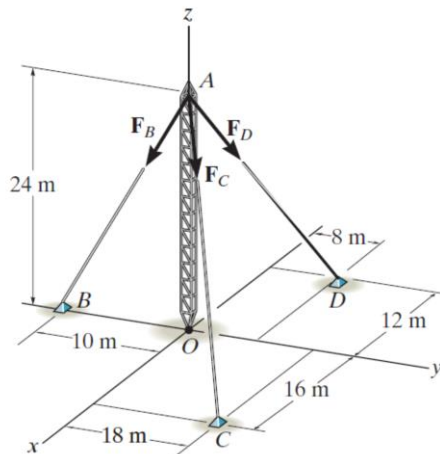
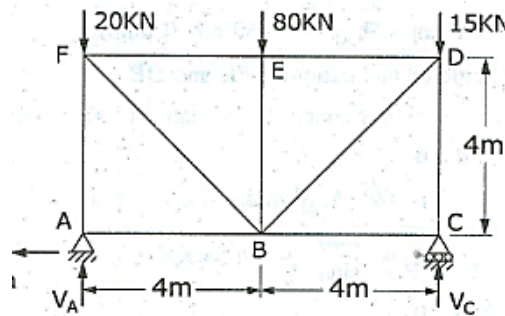17. (a) Determine the tension in cables BA and BC necessary to support   CO2 -App   (16)
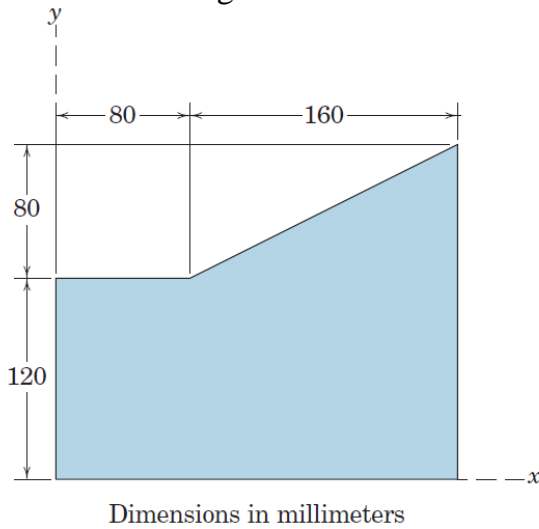the 60-kg cylinder in Fig.

Or

(b)   Determine the forces in members of the pin-jointed frame as   CO2 -Ana   (16)
shown in figure.

18. (a) Determine the x- and y-coordinates of the centroid of the shaded   CO3- Ana   (16)
area shown in Fig.

Dimensions in millimeters

Or

(b)   Determine the moment of inertia of the area shown in Fig. about   CO3- Ana   (16)
the x axis.

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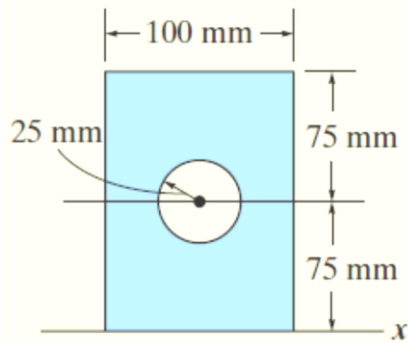
19. (a) The motion of a particle moving along a straight line is expresses as $S = t^3 - 8t^2 - 3t + 15$. Find (i) the time at which the velocity of the particle will be zero. (ii) the distance travelled by the particle at that time (iii) the acceleration of the particle at that time (iv) The net displacement of the particle from $t = 2$ seconds to $t = 4$ seconds.   CO4- U   (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.   CO4- Ana   (16)

20. (a) A 7m long ladder rests against a vertical wall, with which it makes an angle of 45° and on a floor. If a man weight is one half that of the ladder climbs it, at what   distance along the floor will he be, when the ladder is about to slip? Coefficient of friction between the ladder and the wall is 1/3 and between the ladder and floor is ½.   CO5- U   (16)

Or

(b) A screw jack has mean diameter of 50 mm and pitch 10 mm. If the coefficient of friction between its screw and nut is 0.15, find the effort required at the end of 700 mm long handle to raise a load of 10 kN.   CO5 -U   (16)

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