Reg. No. :

Question Paper Code: 53075

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

Third Semester

Mechanical Engineering

15UME305 - ENGINEERING MECHANICS
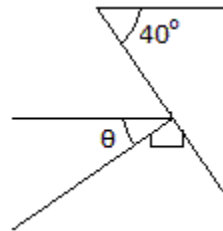
(Regulation 2015)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Determine the angle θ

    (a) θ = 30°   (b) θ = 40°   (c) θ = 60°   (d) θ = 50°

2. According to Lami's theorem, a body is in equilibrium condition if 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. Which of the following conditions do not change the effect of couple?

    (a) Shifting of couple to a new position in its plane
    (b) Shifting of couple to a parallel plane
    (c) Rotation of couple in its plane
    (d) All of the above

4. If a spanner is 15 cm long, and a force of 10 N is applied using this spanner, what is the turning effect of the force in Nm?

    (a) 150 Nm   (b) 15 Nm   (c) 1.5 Nm   (d) 0.15 Nm

5. What is the centroidal distance of an equilateral triangle of side 2 m?

   (a) 0.866 m   (b) 0.577 m   (c) 1.000 m   (d) 0.769 m

6. The unit of moment of inertia of the area is

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

7. Which of the following is not the unit of energy?

   (a) K-cal   (b) Kg-m   (c) Watt hour   (d) Watt

8. What is the distance travelled by an electron in first 4 seconds from its initial position, if velocity time relation is given as $v = 3t$?

   (a) 12 m   (b) 15 m   (c) 20 m   (d) 24 m

9. Frictional force depends on

   (a) surface area in contact   (b) roughness of Surface
   (c) both a and b   (d) none of these

10. The ratio of limiting and normal friction is known as

    (a) Coefficient of friction   (b) Angle of friction
    (c) Sliding friction   (d) Frictional resistance

PART - B (5 x 2 = 10 Marks)

11. Define concurrent force system.

12. Define free body diagram.

13. State perpendicular axis theorem.

14. State D'Alembert's principle.

15. Define angle of repose.

PART - C (5 x 16 = 80 Marks)

16. (a) The screw eye is subjected to two forces F1 and F2 as shown in figure. Determine the magnitude and direction of the resultant force by using analytical method. (16)


Or

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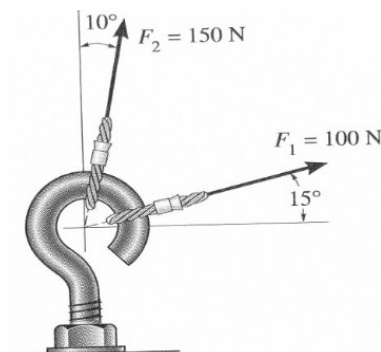
(b) A push of 40 N acting on a point and its line of action are inclined at an angle of 30° with the horizontal. Resolve it along horizontal axis and another axis which is inclined at an angle of 65° with the horizontal. (16)

17. (a) A beam is simply supported at both the ends carries load system as shown in figure. Find the reactions at the two ends. (16)
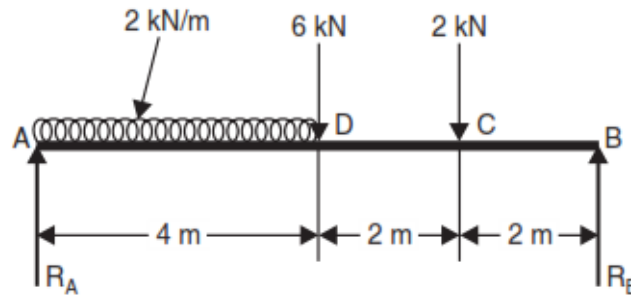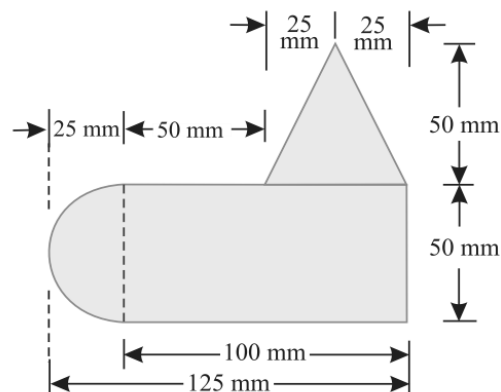

Or

(b) LMNS is a square, each side being 0.4 m and Q is the middle point of LM. Forces of 14, 16, 24, 10,18 and 12 N act in the line of directions LM, QN, MN, MS, NL and SQ respectively. Find the magnitude, direction and position of the resultant force. (16)
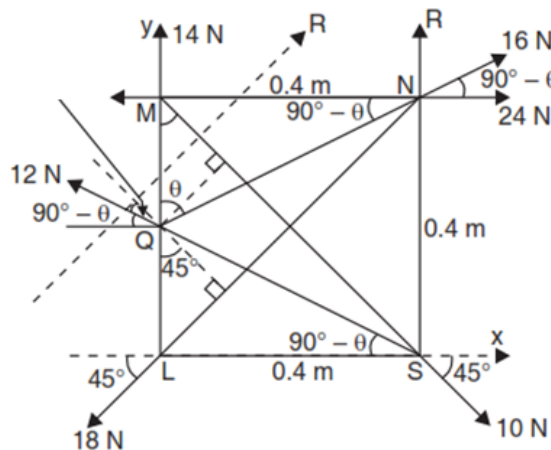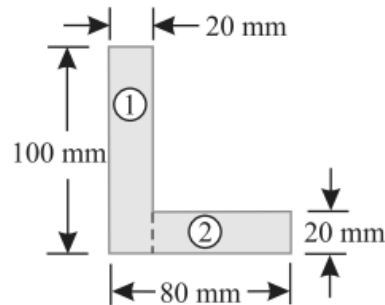

18. (a) Determine the centroid of the given lamina. (16)

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Or

(b) Find the moment of inertia about the centroidal X-X and Y-Y axes of the given angle section. (16)

19. (a) A car starts from rest and accelerates uniformly to a speed of 80 km/hour over a distance of 500 metres. Calculate the acceleration and time taken. If a further acceleration raises the speed to 96 km/hour in 10 seconds, find the acceleration and further distance moved. The brakes are now applied and the car comes to rest under uniform retardation in 5 seconds. Find the distance travelled during the braking. (16)

Or

(b) A pile of mass 500 kg is driven into ground by dropping freely a hammer of mass 318 kg through a height of 2.7 m. If the pile is driven into the ground by 0.15 m, calculate the average resistance of the soil. (16)

20. (a) 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. (16)

Or

(b) The cylinder shown in figure rolls without slipping on the surface of a conveyor belt which is moving at 2 ft/s. Determine the velocity of point A. the cylinder has a clockwise angular velocity ω =15 rad/s at the instant shown. (16)

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