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Question Paper Code: 53705

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

Third Semester

Mechanical Engineering

15UME305 - ENGINEERING MECHANICS


(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

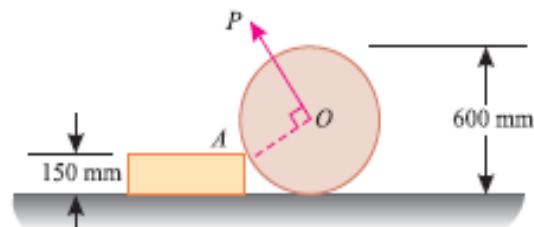
PART A - (10 x 1 = 10 Marks)

- Which of the following is a vector quantity CO1-R
(a) Energy (b) Mass (c) Momentum (d) Angle
- The algebraic sum of the resolved parts of a number of forces in a given direction is equal to the resolved part of their resultant in the same direction. This is known as CO1- R
(a) principle of independence of forces (b) principle of resolution of forces
(c) principle of transmissibility of forces (d) none of these
- 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) $\Sigma H=ma, \Sigma V=ma,$
-  CO2-U
Indicate which type of support it belongs to
(a) Pinned (b) Roller (c) Simple frictionless (d) Fixed
- The point, through which the whole weight of the body acts, irrespective of its position, is known as CO3- R
(a) Moment of inertia (b) Centre of gravity
(c) Centre of percussion (d) Centre of mass

6. The centre of gravity of a hemisphere lies at a distance of _____ from its base measured along the vertical radius. CO3- R
- (a) $2r/8$ (b) $8r/3$ (c) $8r/2$ (d) $3r/8$
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 equation of motion of a body is given by $s = 2t^3 + 3t^2 + 7$ (where s is in metre and t is in seconds). Starting from rest, it will travel in 2 seconds, a distance of CO4-App
- (a) 35m (b) 28m (c) 27m (d) 20m
9. A box rests in the rear of a truck moving with a deceleration of 2 m/s^2 . To prevent the box from sliding, the approximate value of static coefficient of friction between the box and the bed of the truck should be CO5- App
- (a) 0.1 (b) 0.2 (c) 0.3 (d) 0.4
10. The force required to move the body up the plane will be minimum if it makes an angle with the inclined plane _____ the angle of friction. CO5- R
- (a) Equal to (b) Less than (c) Greater than (d) No relation

PART – B (5 x 2= 10Marks)

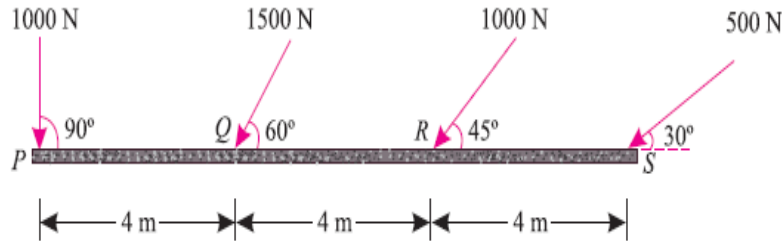
11. Two forces act at an angle of 120° . The bigger force is of 40 N and the resultant is perpendicular to the smaller one. Find the smaller force. CO1- App
12. A uniform wheel of 600 mm diameter, weighing 5 kN rests against a rigid rectangular block of 150 mm height as shown in Fig. Determine P. CO2- App



13. Differentiate centroid with center of gravity. CO3- R
14. Define work-energy principle. CO4- R
15. State the laws of friction. CO5- R

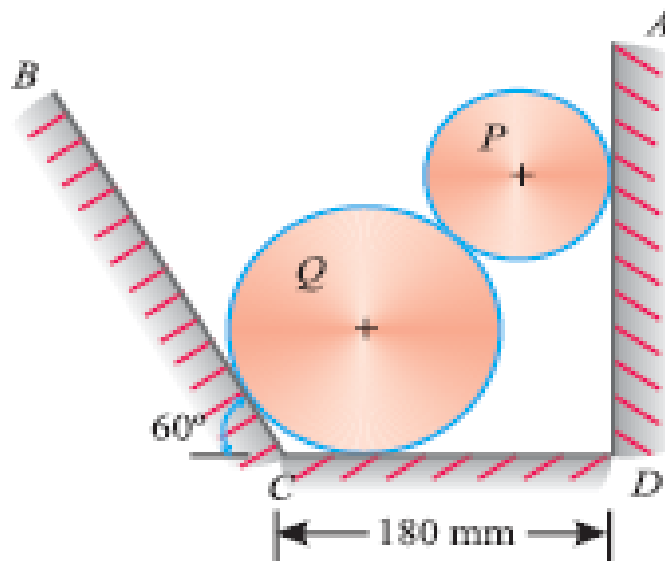
PART – C (5 x 16= 80Marks)

16. (a) A horizontal line PQRS is 12 m long, where $PQ = QR = RS = 4$ m. CO1- App (16)
 Forces of 1000 N, 1500 N, 1000 N and 500 N act at P, Q, R and S respectively with downward direction. The lines of action of these forces make angles of 90° , 60° , 45° and 30° respectively with PS. Find the magnitude, direction and position of the resultant force.

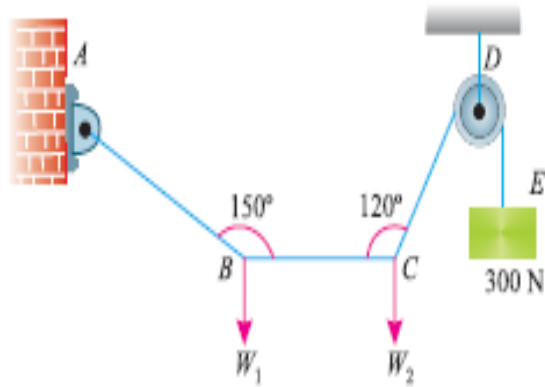


Or

- (b) Two cylinders P and Q rest in a channel as shown in Fig. The CO1- App (16)
 cylinder P has diameter of 100 mm and weighs 200 N, whereas the cylinder Q has diameter of 180 mm and weighs 500 N. If the bottom width of the box is 180 mm, with one side vertical and the other inclined at 60° , determine the pressures at all the four points of contact.

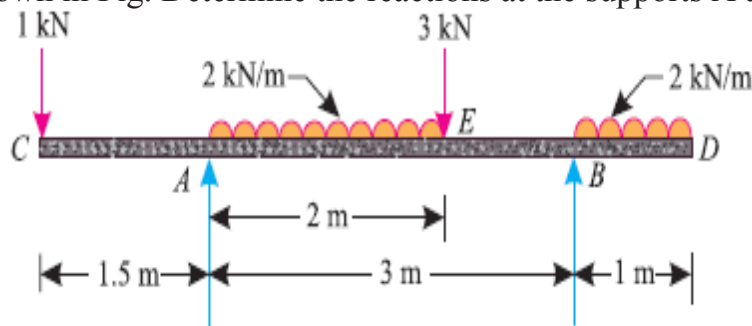


17. (a) A light string ABCDE whose extremity A is fixed, has weights W_1 and W_2 attached to it at B and C. It passes round a small smooth peg at D carrying a weight of 300 N at the free end E as shown in Fig. If in the equilibrium position, BC is horizontal and AB and CD make 150° and 120° with BC, find (i) Tensions in the portion AB, BC and CD of the string and (ii) Magnitudes of W_1 and W_2 . CO2- App (16)

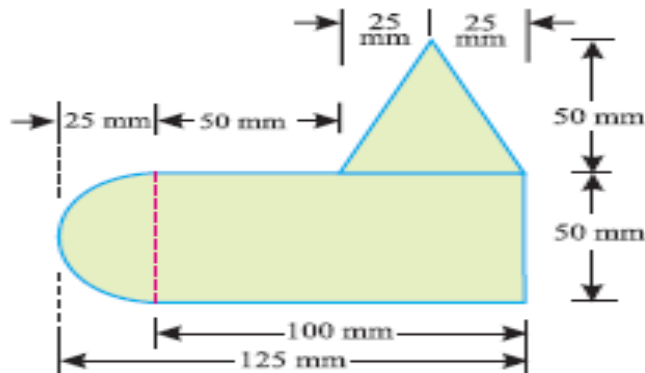


Or

- (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)

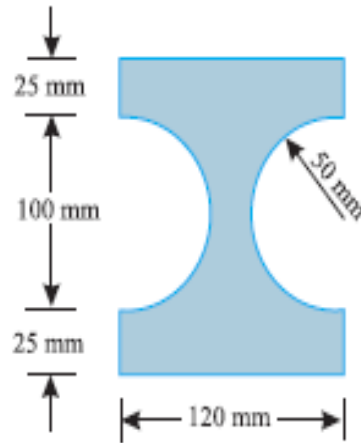


18. (a) A uniform lamina shown in Fig. consists of a rectangle, a circle and a triangle. Determine the centroid of the lamina. All dimensions are in mm. CO3- App (16)

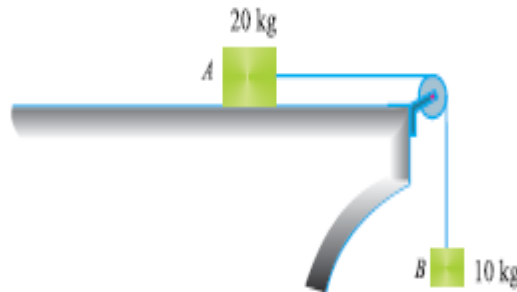


Or

- (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)

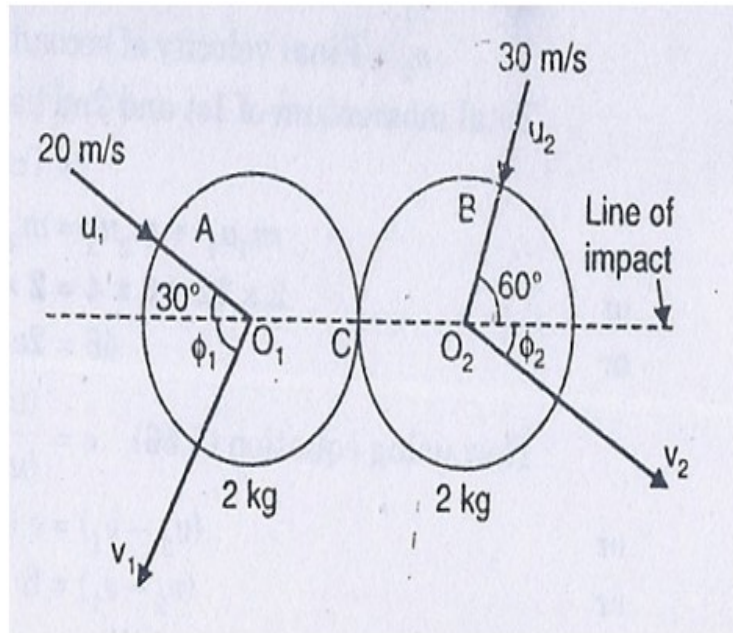


19. (a) Two blocks shown in Fig, have masses $A = 20 \text{ kg}$ and $B = 10 \text{ kg}$ and the coefficient of friction between the block A and the horizontal plane, $\mu = 0.25$. If the system is released, from rest, and the block B falls through a vertical distance of 1 m , what is the velocity acquired by it? Neglect the friction in the pulley and the extension of the string. CO4-Ana (16)

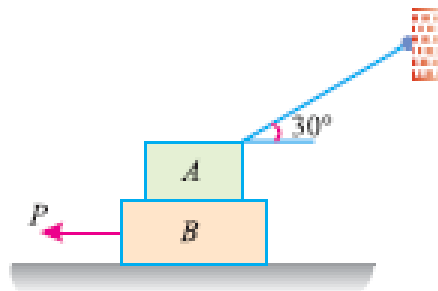


Or

- (b) A ball of mass 2 kg , moving with a velocity of 20 m/s , strikes on a ball of mass 2 kg moving with a velocity of 30 m/s . At the instant of impact, the velocities of the balls are inclined at an angle of 30° and 60° to the line joining their centres, as shown in Fig. . If co-efficient of restitution is 0.9 , then find:
 (i) the magnitude and direction of first ball after impact
 (ii) the magnitude and direction of second ball after impact. CO4-Ana (16)



20. (a) Two blocks A and B of weights 1 kN and 2 kN respectively are in equilibrium position as shown in Fig. If the coefficient of friction between the two blocks as well as the block B and the floor is 0.3, find the force (P) required to move the block B. 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.

