

QP Code : 28512

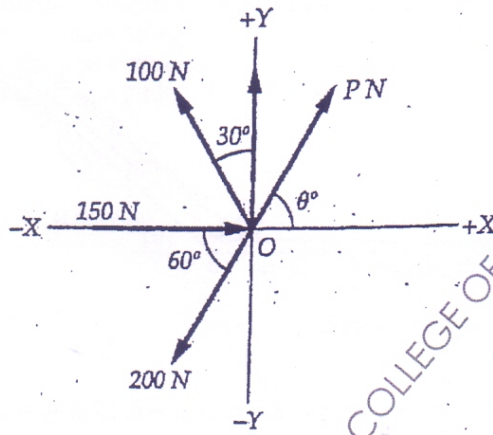
OLD COURSE

Total Marks : 100

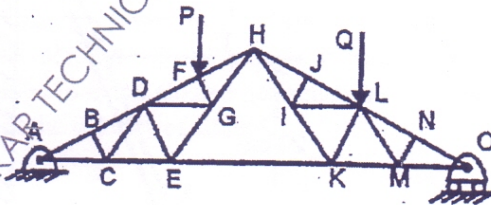
(3 Hours)

NB : Question No. 1 is compulsory. Solve any four questions from question Nos. 2 to 7.
Assume suitable data, if necessary and state it.
Take $g = 9.81 \text{ m/s}^2$

Q.1 a) A system of four forces shown in fig. has resultant of 50 N along + X axis. Determine magnitude and direction of unknown force P.



b) For the given loading determine all the zero force members in the truss shown. Justify your answers with adequate reasons.

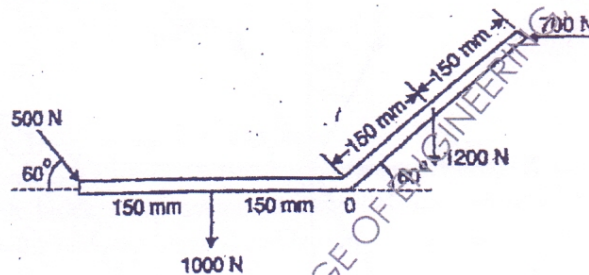


c) Calculate the force required to hold a weight of 10 KN suspended on a rope wrapped twice around a post. Take coefficient of friction $\mu = 0.2$.

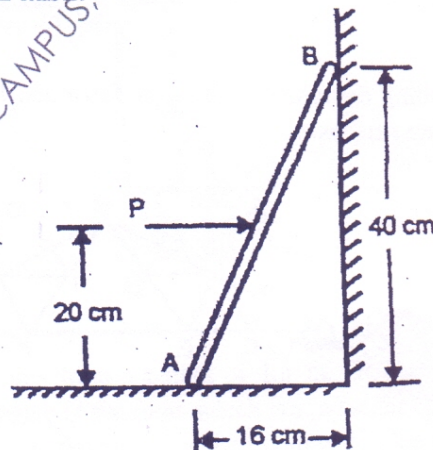
d) A ball is thrown from horizontal level, such that it clears a wall 6m high, situated at a horizontal distance of 35 m. If the angle of projection is 60° with respect to the horizontal, what would be minimum velocity of projection? 4

e) A body of 10 kg mass moving towards right with a speed of 8 m/s strikes with another body of 20 kg mass moving towards left with 25 m/s. determine final velocities of the two bodies. 4

Q.2 a) A system of forces acting on a bell crank is shown in fig. Determine the magnitude, direction and the point of application of the resultant w.r.t. 'O' 8



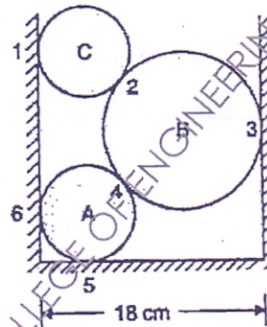
b) A 100 N uniform ladder AB is held in equilibrium as shown, If $\mu = 0.15$ at A and B, Calculate the range of values of P for which equilibrium exists. 6



c) Two trains A and B leave the same station on parallel lines. Train A starts with a uniform acceleration of 0.3 m/s^2 and attains a speed of 36 kmph after which it maintains the same velocity. Train B leaves 2 minutes later with a uniform acceleration of 0.45 m/s^2 to attain a maximum speed of 90 kmph. When and where will B overtake A. 6

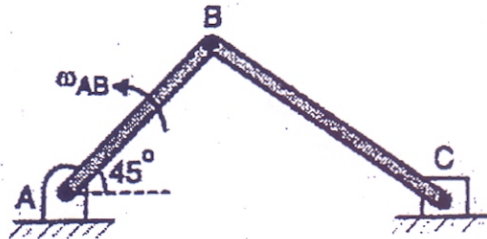
Q.3 a) Three cylinders are piled up in rectangular channel as shown. Determine the reaction at point 6 between the cylinder A and the vertical wall of the channel. 8

Cylinder A : radius = 4 cm, $m = 15 \text{ kg}$
 Cylinder B : radius = 6 cm, $m = 40 \text{ kg}$
 Cylinder C : radius = 5 cm, $m = 20 \text{ kg}$



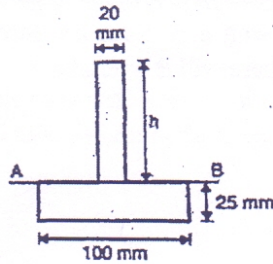
b) The acceleration of a particle performing rectilinear motion is given by $a = kt^2 \text{ m/s}^2$. It is found that $v = -24 \text{ m/s}$ when $t = 0$ and $v = 48 \text{ m/s}$ when $t = 4 \text{ sec}$. Also $x = 0$ at $t = 3 \text{ sec}$. Find the value of k and also the position, velocity and acceleration of particle at $t = 2 \text{ sec}$. 6

c) In the slider crank mechanism shown in fig., the crank AB of length 20 cm rotates anticlockwise with an angular velocity of 3 rad/sec. The connecting rod BC is 90 cm in length and the slider at C is constrained to move along a horizontal line. At the instant shown, find the angular velocity of rod BC and the velocity of slider C. 6

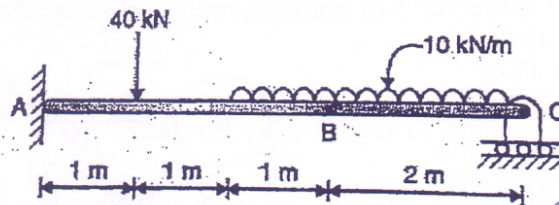


Q4 a) Determine the depth of web T-section, such that the centroid of section coincides with AB.

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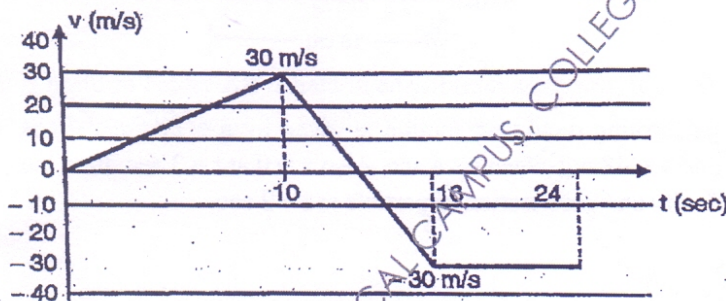


b) Find all support reaction. B is an internal hinge.



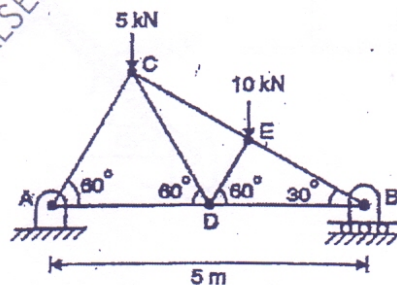
c) A particle moves along in a straight line with $v-t$ diagram as shown. If $S = -25$ m at $t = 0$, draw $a-t$ and $x-t$ diagrams for 0 to 24 seconds.

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Q.5 a) For the truss shown in fig. determine forces in members of truss. State the nature of force in each member.

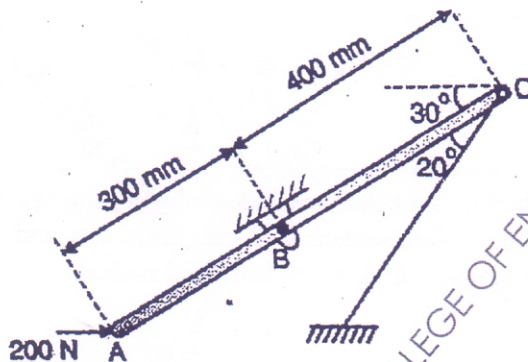
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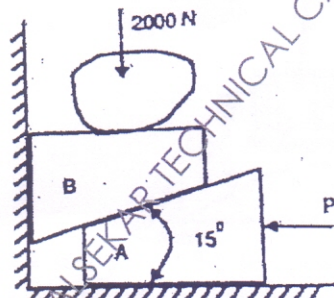
b) A 8 mm thick x 100 mm wide, belt drives a 1.0 m diameter pulley at 200 rev/min. the angle of contact is 165° and mass of belt material is 1000 kg/m^3 . If maximum permissible stress in the belt is 1.5 N/mm^2 and the coefficient of friction between the belt and pulley is 0.25, determine the power transmitted by the belt. Take centrifugal tension into account. 8

c) A motorist travelling at a speed of 90 kmph suddenly applies the brakes and comes to rest after skidding 100 m. Determine the time required for the car to stop and coefficient of kinetic friction between the tires and the road. 6

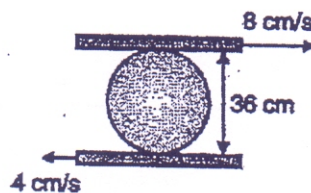
Q6 a) For the rod AB, Find the hinge reaction and tension in string using concurrency of force. 6



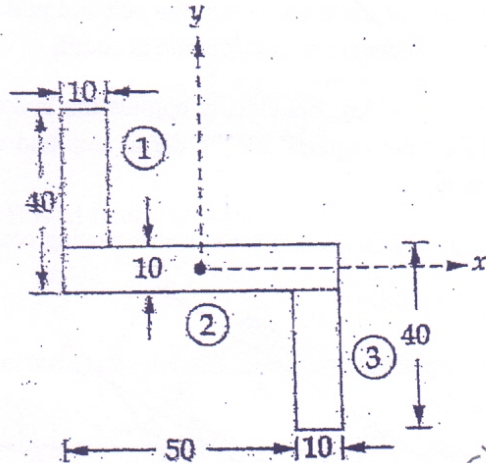
b) To raise a heavy stone block weighing 2000 N, the arrangement shown is used. What horizontal force P is necessary to be applied to the wedge in order to raise the block. $\mu = 0.25$. Neglect the weight of the wedges. 6



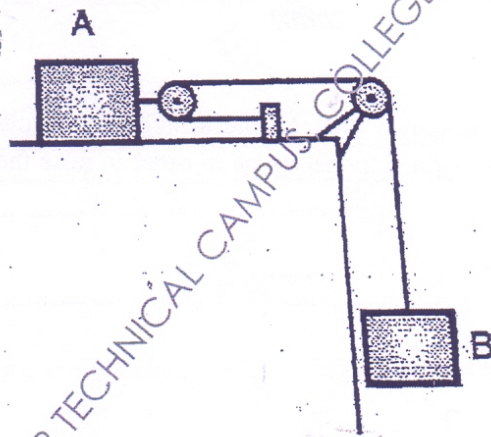
c) A cylinder with diameter 36 cm is held between two plates as shown in fig. The upper plate moves to the right with velocity 8 cm/s while the lower plate moves to the left with velocity 4 m/s. Locate ICR for the cylinder. 8



Q7 a) Determine the moments of inertia about the x and y centroidal axis of a beam whose cross sectional area is as shown in fig. All dimensions are in cm. 6



b) Two blocks $m_A = 10$ kg and $m_B = 5$ kg are connected with cord and pulley system as shown. Determine the velocity of each block when system is started from rest and block B gets displacement by 2 m. Take $\mu_K = 0.2$ between block A and horizontal surface. 8



c) A boy throws a ball vertically downwards from a height of 1.5 m. He wants the ball to rebound from the floor and just touch the ceiling of the room which is at a height of 4 m from the ground. If coefficient of restitution e is 0.8, find the initial velocity with which the ball should be thrown. 6