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B.Tech. Degree I & II Semester (Combined) Examination June 2014

**IT/CS/CE/ME/SE/EE/EB/EC/EI/FT 1104 ENGINEERING MECHANICS
(2012 Scheme)**

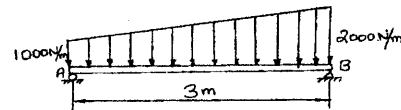
Time: 3 Hours

Maximum Marks: 100

**PART – A
(Answer ALL questions)**

(8 x 5 = 40)

- I (a) State and prove Lami's theorem.
 (b) Compute the reactions at the supports A and B of the beam loaded as shown in the figure. Neglect the weight of the beam.



- (c) Briefly explain 'Principal axes'.
 (d) Differentiate between trusses and frames.
 (e) The motion of a particle is defined by the relation $x = 3t^4 - 10t^2 + 3t + 20$, where x represents the distance traveled by the particle in meters and ' t ' represents the time in seconds. Determine the position, the velocity, and the acceleration of the particle when $t=5s$.
 (f) Explain the principle of work and energy.
 (g) Briefly explain 'moment of momentum'.
 (h) A flywheel rotating at 1500rpm comes to rest with constant angular deceleration in 100seconds owing to friction in the bearings. If the moment of inertia of the flywheel with respect to its axis of rotation $I=12.5\text{kgm}^2$ determine friction couple that produces this angular deceleration.

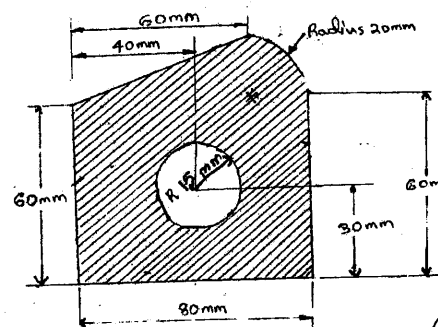
PART – B

(4 x 15 = 60)

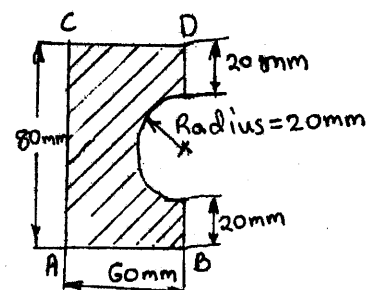
- II. A 10m long ladder of weight 400N rests against a vertical wall, with which it makes an angle of 30° , and on a floor. If a man of weight 675N climbs it, how much length of the ladder he shall climb before the ladder slips. The coefficients of friction are between the ladder and wall-0.25, between the ladder and floor – 0.3. (15)

OR

- III. Locate the centroid of the shaded area shown in figure. (15)



- IV. (a) Determine the moments of inertia of the shaded area shown in figure with respect to its centroidal axes parallel and perpendicular to the side AB. (10)

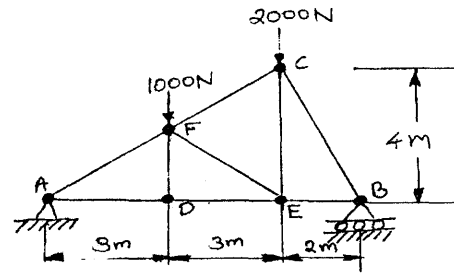


- (b) Explain the applications of the "principle of virtual work". (5)

OR

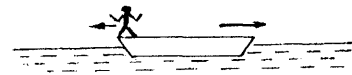
(P.T.O.)

- V. Determine the axial forces in the members of the plane truss shown in figure. (15)

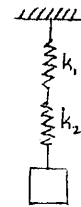


- VI. (a) An elevator of weight 5KN starts from rest and moves upward with constant acceleration, traveling a distance of 10m in 5S. Find the tensile force in the cable during this accelerated motion. Neglect friction. (7)

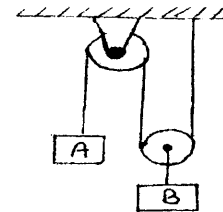
- (b) A boat of weight 1500N together with a man of weight 800N is moving to the right with a speed of 10m/s. Determine the velocity of the boat if the man dives from left with a 5m/s velocity relative to the boat. (8)



- OR**
VII. (a) A 100N block is suspended by two helical springs of constants $k_1 = 800\text{N/m}$ and $k_2 = 600\text{N/m}$ arranged in series as shown in figure. If the block is pulled 50mm down from its equilibrium position and released, determine the period of oscillation, the maximum velocity of the block and the maximum acceleration of the block. (6)

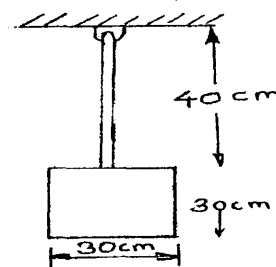


- (b) Two blocks A and B of weights 60N and 100N respectively are arranged as shown in figure. If the system is released from rest determine the velocities of each block after 2S. Neglect friction and inertia of pulleys. (9)

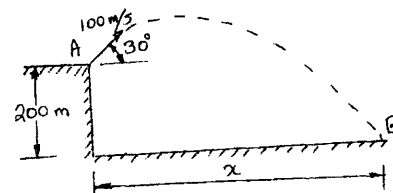


- VIII. (a) An automobile travels around a curve of radius 200m on a level road at a constant speed of 72kmph. What is the minimum value of coefficient of friction between the road and tyre of the automobile, if it travels without skidding? (7)

- (b) Determine the period of small oscillations of the compound pendulum shown in figure, which consists of square plate of weight 20N suspended by a slender rod of weight 2N. (8)



- OR**
IX. (a) A projectile is fired from point A with initial velocity of 100m/s and angle of elevation 30° as shown in figure. Determine the distance x to the target B. (10)



- (b) Derive the expression for kinetic energy of a rotating body. (5)