Reg. No. : | | | | | | | | | | | |

L 1703

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2008.

First Semester

Civil Engineering

GE 131 — ENGINEERING MECHANICS

(Common to all branches except Marine Engineering)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. State the condition for a body to be in equilibrium under coplanar non concurrent forces.

2. How are the multi-force members analysed in free body diagrams?

3. What is resolution of a force into a force and couple?

4. A force of 15 kN forms an angle of 60°, 30° and 120° with x, y and z axes respectively. Find the components and express it as a vector.

5. Define the term : radius of gyration.

6. For a hollow circular section, the external diameter if D and internal diameter is d, find the polar moment of inertia.

7. What is limiting friction?

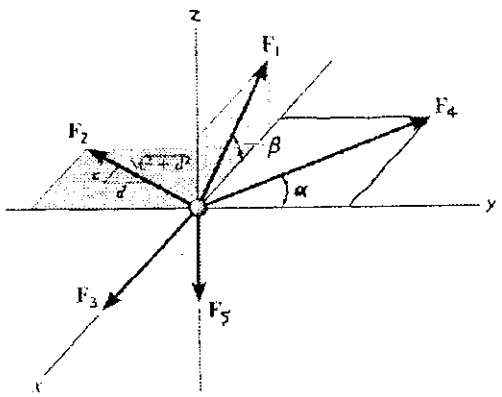
8. A body of weight 100 N is placed on a rough horizontal plane. Determine the coefficient of friction if a horizontal force of 60 N just causes the body to slide over a horizontal plane.

9. What is the period of restitution?

10. State the work energy principle.

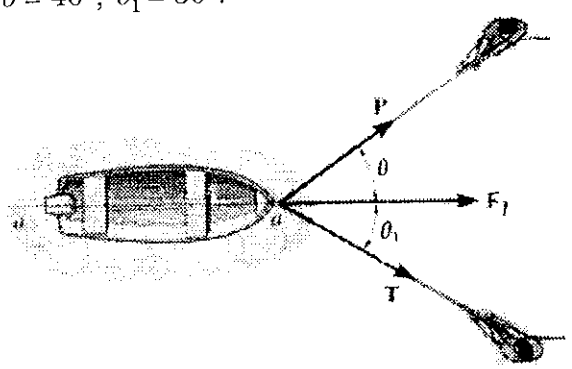
PART B — ($5 \times 16 = 80$ marks)

11. (a) Determine the magnitudes F_1, F_2 and F_3 of for the equilibrium of the particle. Given $F_4 = 10\,\text{kN}$; $F_5 = 2.5\,\text{kN}$; $\alpha = 15°$; $\beta = 30°$; $c = 8$ and $d = 25$.

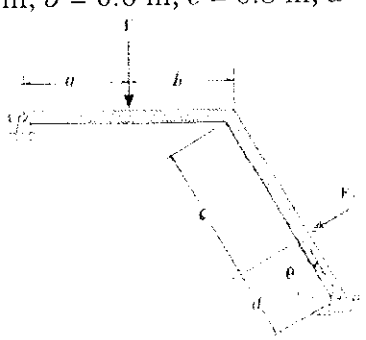


Or

(b) The boat is to be pulled onto the shore using two ropes. Determine the magnitudes of forces T and P acting in each rope in order to develop a resultant force $F_1 = 100$ kN directed along the keel axis a - a as shown. The angle $\theta = 40°$; $\theta_1 = 30°$.



12. (a) Determine the normal reaction at the roller A and horizontal and vertical components at pin B for equilibrium of the member. Take $F_1 = 10$ kN, $F_2 = 6$ kN, $a = 0.6$ m, $b = 0.6$ m, $c = 0.8$ m, $d = 0.4$ m and $\theta = 60°$.



Or

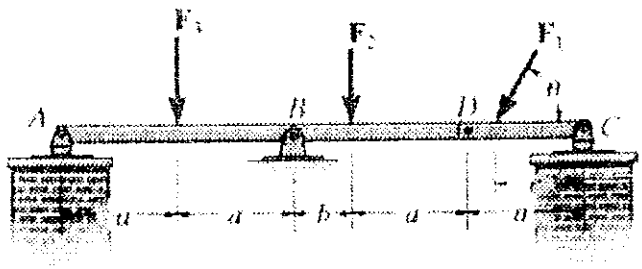
(b) The compound beam is pin supported at B and supported by rockers at A and C. There is a hinge (pin) at D. Determine the reactions at the supports. Given :

$F_1 = 7$ kN $\qquad F_2 = 6$ kN

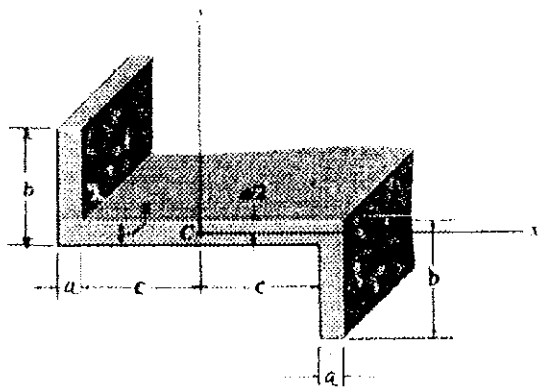
$F_3 = 15$ kN $\qquad \theta = 60°$

$a = 4$ m $\qquad b = 2$ m

$c = 3$ m $\qquad d = 4$ m

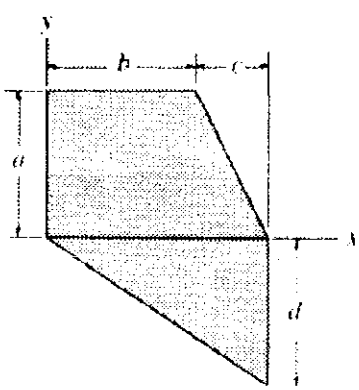


13. (a) Determine the product of inertia for the beam's cross-sectional area with respect to the x and y axes that have their origin located at the centroid C. The length of $a = 25$ mm, and $c = b = 125$ mm.



Or

(b) Determine the moment for inertia of the area about the x and y axis. The dimensions of $a = b = d = 15$ cm and $c = 7.5$ cm.



14. (a) A ladder of weight 400 N and 6 m long is placed against a vertical wall. The angle of ladder makes 30° with respect to the wall. The coefficient of friction between the wall and the ladder is 0.25 and that between ladder and floor is 0.3. How high a man of weight 1200 N can climb, before the ladder begins to slip.

Or

(b) A belt is running over a pulley of diameter 1.2 m at 300 rpm. The angle of contact is 150° and coefficient of friction is 0.35. If the maximum tension in the belt is 500 N, determine the power transmitted by it.

15. (a) A smooth spherical ball '*A*' of mass 15 kg is moving from left to right with a velocity of 5 m/s in a horizontal plane. Another identical ball '*B*' traveling in a perpendicular direction with a velocity of 15 m/s collides with '*A*' in such a way that the line of impact is in the direction of motion of ball '*B*'. Assuming the coefficient of restitution is 0.6. Determine the velocity of balls of *A* and *B* after impact.

Or

(b) A stone '*A*' is dropped from rest down a well of depth 25 m and after 2 sec another stone *B* is dropped from rest. Determine the time interval between the instant A strikes the water and the instant *B* strikes the water. Also, at what speed do they strike the water?