UNIVERSITY COLLEGE TATI

UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET	
COURSE CODE	: BME 2013
COURSE TITLE	: STATICS AND DYNAMICS
SEMESTER/SESSION	: 1-2022/2023
DURATION	: 3 HOURS

Instructions:

1. This booklet contains **FOUR (4)** questions, answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise up your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 10 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 2

a) 60 kg load at D is supported by two cables AC and AB as shown in Figure 2. If AB is always keep horizontal and the load is in equilibrium: -

i. **Draw** free body diagram representing all the forces involved. (4 marks)

ii. **Draw** the closed polygon from the forces applied. (5 marks)

iii. **Determine** the tension in cables AB and AC (6 marks)

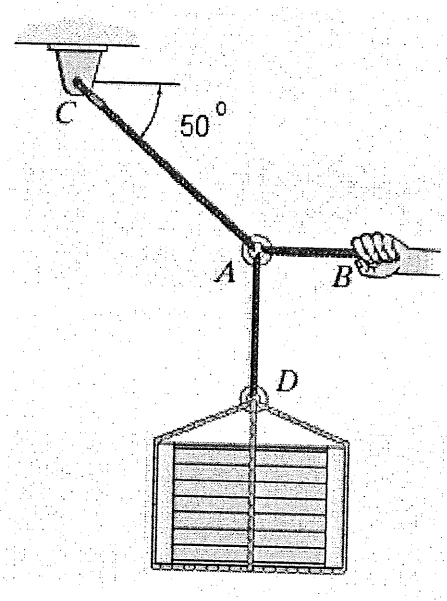


Figure 2

QUESTION 3

a) A uniform ladder in Figure 4 weighs 30 N. The vertical wall is smooth (no friction). The floor is rough and $\mu_s = 0.8$.:-

i. Briefly **explain** static friction force and kinetic friction force. (3 marks)

ii. **Determine** the force P needed to move (tip or slide) the ladder. (4 marks)

iii. **Analyse** whether the ladder will tip or slide. (3 marks)

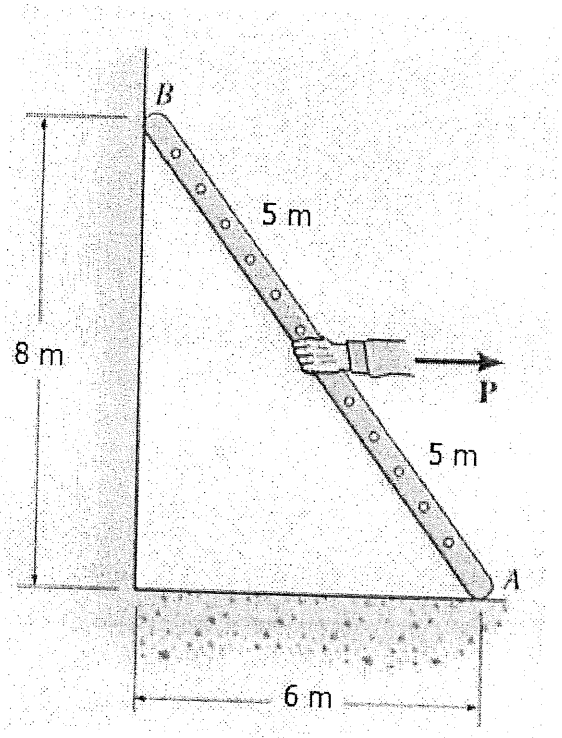


Figure 4

QUESTION 4

a) Briefly explain kinematics and kinetics, and the difference between both terms (5 marks)

b) The 100 kg crate shown in Figure 6 rests on a horizontal surface for which the coefficient of kinetic friction is $\mu_k = 0.3$. If the crate is subjected to 500 N force

i) Sketch the free body diagram for the forces involved (3 marks)
ii) Compute the acceleration and the normal force of the crate (4 marks)
iii) Compute the velocity of the crate in 3 s (3 marks)

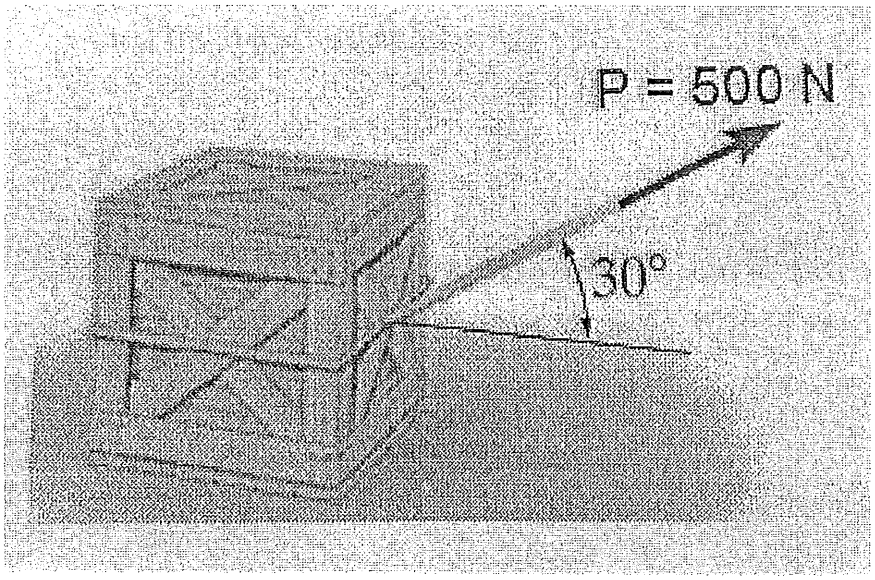
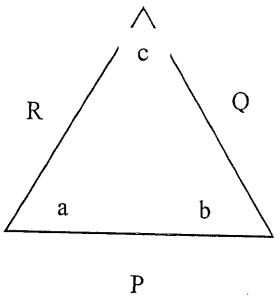


Figure 6

Formulae

Cosine Rule

$$R^2 = P^2 + Q^2 - 2PQ\cos b°$$



Sin Rule

$$\frac{\sin a}{Q} = \frac{\sin b}{R} = \frac{\sin c}{P}$$

Rectangular component

x- component = R cos θ

y- component = R sin θ

$$R = \sqrt{R_x^2 + R_y^2} \qquad \text{Tan}\,\alpha = \frac{R_y}{R_x}$$

Centroid

$$\bar{Y} = \frac{\overline{\sum \bar{y}A}}{\sum A} \qquad \bar{x} = \frac{\overline{\sum \bar{x}A}}{\sum A}$$

Friction force

$$F_{\max} = \mu_S \times F_N$$

Acceleration

$$a = \frac{dv}{dt}$$

Velocity

$$v = \frac{dy}{dt}$$

Angular speed

$$v = \omega \times r$$

Equation of uniformly accelerated motion

$$v = (v)_o + at$$

$$y = (v_y)_o t + \frac{1}{2}at^2$$

$$v_y^2 = (v_y)_o^2 + 2ay$$

$$x = (v_x)_o t$$

$$F = ma$$

$$v_B = v_A + \omega_{AB} \times r_{B/A}$$