SECTION A

Answer all questions in this Section in the spaces provided ONLY.

1. Determine the dimensions of the constants A and B in the dimensionally homogeneous equation;

$$v^2 = Axt + Bvt$$

where x, v and t are displacement, velocity and time, respectively.

A = _____ B = _____

2. Determine the magnitude of the resultant of the three concurrent forces acting on the hook in Figure A1. Also determine the direction the makes with the positive x-axis.

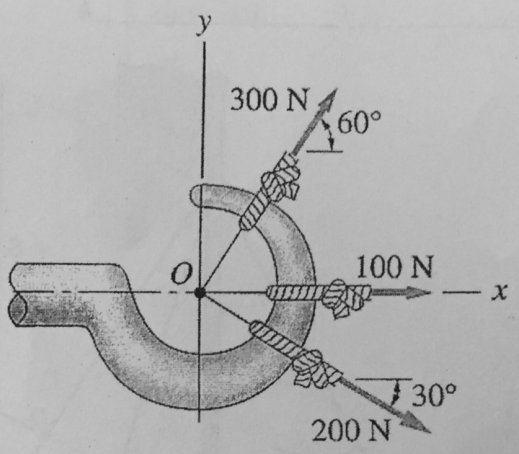

Figure A1

Magnitude of Resultant = _____ Angle resultant makes with the x-axis = _____

3. A flagpole is held by three guy wires anchored by bolts at B, C and D as shown in Figure A2. The tension in the wires are given by T_1, T_2 and T_3. If $T_1 = 315$ N, the components of T_1 are;

$T_1 =$ _____ i _____ j _____ k

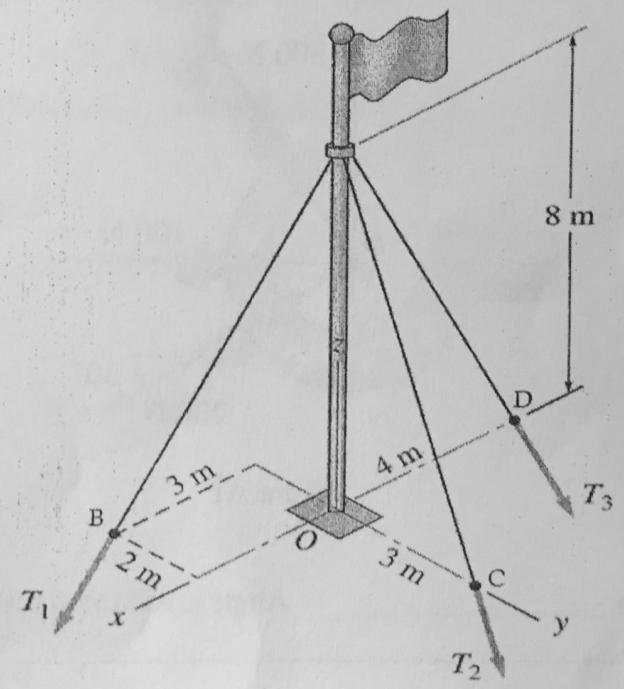

Figure A2

4. A man holds a ball of mass 3 kg as shown in Figure A4. Take $\theta = 30^0$
The moment of the weight of the ball about the elbow joint B is _____.

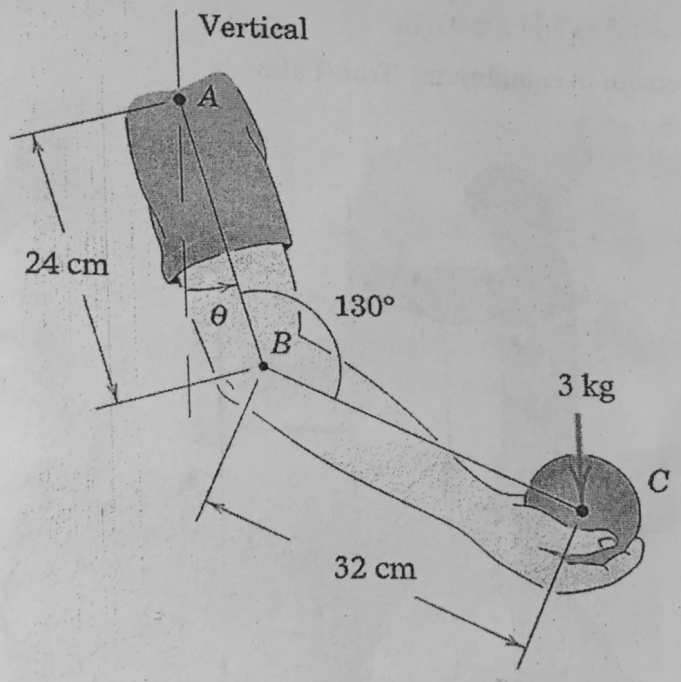

Figure QA4

5. The refrigerator shown in Figure A5 weighs 250 kg and is supported at A and B. The man exerts force F of 100 N on the fridge as shown. The coefficient of static friction between all contact surfaces as 0.25 and let $h = 1.0$ m and $b = 0.6$ m.

The fridge will remain in equilibrium. True/False

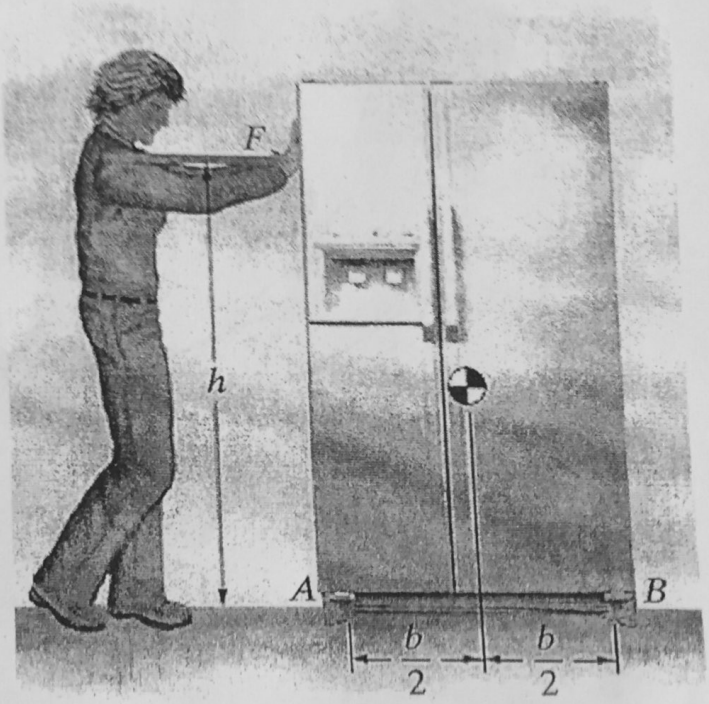

Figure A5

Question 2

The square-threaded screw of the C-clamp shown in Figure B2 has a mean diameter of 9 mm and a pitch of 1.5 mm. The coefficient of static friction between the threads is 0.2. A minimum torque, C = 1.25 Nm is required to tighten the self-locking clamp. If the weight of work piece being clamped is negligible;

(a) Determine the friction angle and the helix (thread) angles of the clamp's screw. [6 marks]

(b) Determine the magnitude of the clamping force exerted on the workpiece. [3 marks]

(c) Determine the magnitude of the minimum torque required to loosen the clamp. [7 marks]

(d) Determine the Mechanical Advantage of the clamp if the handle is 30 cm in length. [4 marks]

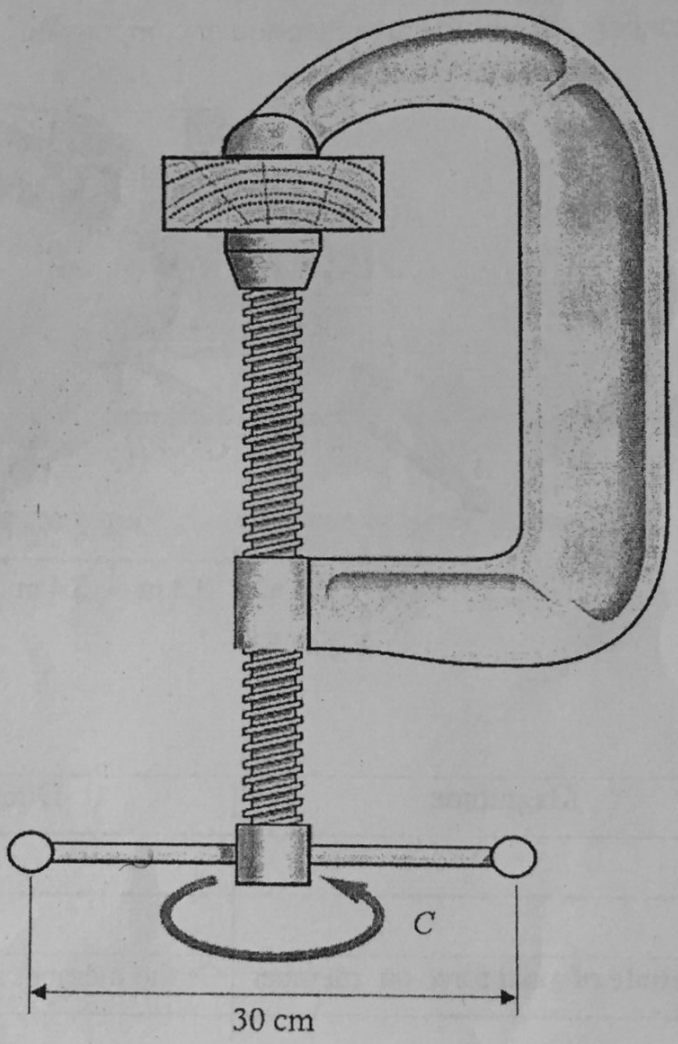

Figure B2

Friction angle	=
Helix angle	=
Clamping force	=
Maechanical advantage of the clamp	=

Question 3

In Figure B3, the masses of the blocks A and B which rest against the wall the floor respectively, are 30 kg and 70 kg respectively. The coefficient of static friction between all of the contacting surfaces is 0.1.

(a) Sketch the free body diagram for both blocks. [8 marks]

(b) Obtain the equilibrium equations for both blocks. [8 marks]

(c) What is the magnitude of the reaction between the two blocks. [2 marks]

(d) Determine the mximum magnitude of F that will not cause the blocks to slip. [2 marks]

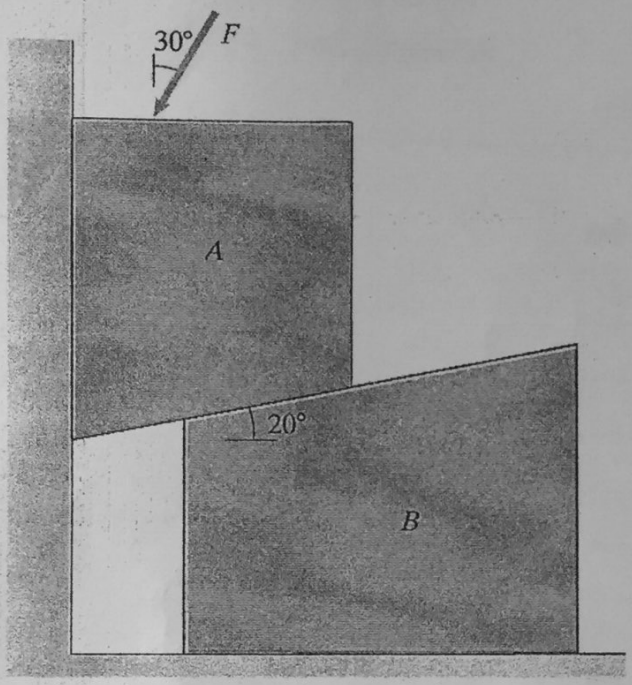

Figure B3

Reaction between;	**Magnitude**
Block B and the floor	
Block A and the wall	
Block A and block B	

The maximum F for the blocks to remain in equilibrium is _____

J. Ampofo

SECTION B

Answer only **two** questions from this section in the answer booklet.

Question 1

In Figure B1, the plane truss ABCDEHGFA forms part of the supports of a crane on an offshore oil platform. The crane exerts two forces, each of magnitude 122.5-kN, and acting vertically downwards on truss joints B and D.

(a) Considering the supports at A as a roller and E as fixed, sketch the free body diagram for the truss. [7 marks]

(b) Determine the support reactions at A and E. [4 marks]

(c) Determine the magnitudes of the axial forces in members AB, EH, and CG. [7 marks]

(d) State whether members AB and EH are in tension or compression. [2 marks]

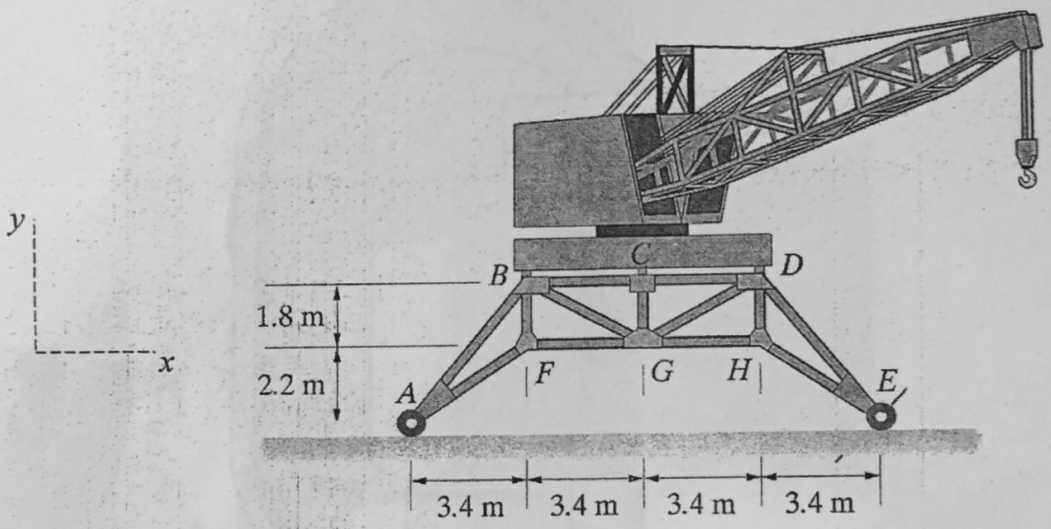

Figure B1

Reaction @	Magnitude	Direction(up/down)
A		
E		
Member	Magnitude of axial force on member	Is the member in Tension or compression?
AB		
EH		
CG		