POLITEKNIK
Jabatan Pengajian Politeknik

EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION

(MINISTRY OF HIGHER EDUCATION)

MECHANICAL ENGINEERING DEPARTMENT

FINAL EXAMINATION

JUNE 2012 SESSION

JJ205: ENGINEERING MECHANICS

DATE: 22 NOVEMBER 2012(THURSDAY)

DURATION: 2 HOURS (8.30 AM - 10.30 AM)

This paper consists of **SEVEN (7)** pages including the front page.
Structured (6 questions – answer 4)

CONFIDENTIAL

DO NOT OPEN THIS QUESTION PAPER UNTIL INSTRUCTED BY THE CHIEF INVIGILATOR

(The CLO stated is for reference only)

ESSAY (100 marks)

INSTRUCTION:

This section consists of **SIX (6)** essay questions. Answer **FOUR (4)** questions only.

QUESTION 1

(a) By referring to Figure 1(a), determine the angle of θ for connecting member A to the plate so that the resultant force of F_A and F_B are directed horizontally to the right. Also, what is the magnitude of the resultant force? [CLO 1:C3]

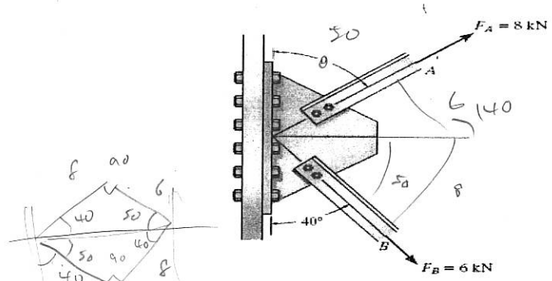

Figure 1(a) (10 marks)

(b) Based on Figure 1(b), if θ = 30° and T = 6 kN, calculate the force in the Cartesian form and determine the magnitude of resultant force acting on the eyebolt and its direction from the positive x-axis. [CLO 1:C3]

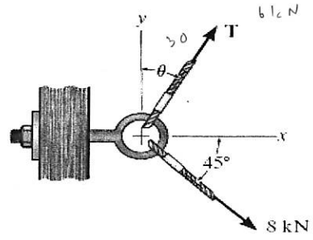

Figure 1(b) (15 marks)

QUESTION 2

(a)

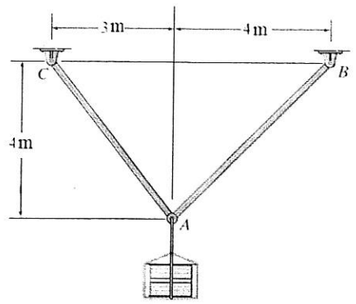

Figure 2(a)

With reference to Figure 2(a) above, members AB and AC support the 300kg crate. [CLO 2:C3]

i. Sketch the free body diagram. (2 marks)

ii. Calculate the force in each member AB and AC to hold the system in the equilibrium position. (8 marks)

(b) If the bucket weights 50 kg, determine the tension developed in each of the wires in Figure 2(b) if the bucket weight 50kg. [CLO 1:C3]

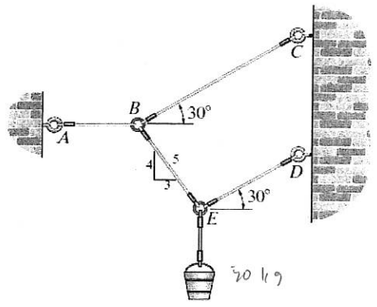

Figure 2(b) (15 marks)

QUESTION 3

(a) Define the following terms: [CLO 1:C1]

i. Truss. (2 marks)

ii. Simple Truss. (2 marks)

(b)

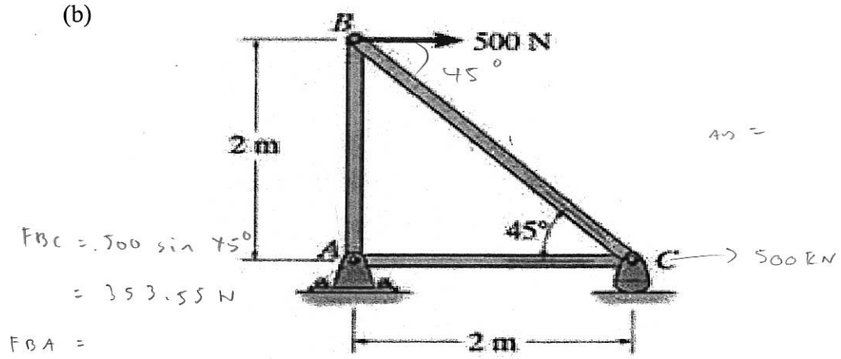

Figure 3(b)

With reference of figure 3(b), determine the force in each of the following members: [CLO 1:C3]

i. F_{BC}

ii. F_{BA}

iii. F_{CA} (10 marks)

(c)

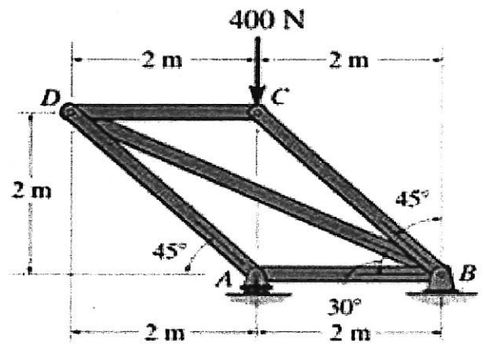

Figure 3(c)

following members: [CLO 1:C3]

i. F_{BC}
ii. F_{CD}
iii. F_{AD}
iv. F_{BD} (11 marks)

QUESTION 4

(a) Define the following terms: [CLO 1:C1]
i. Kinematics (2 marks)
ii. Kinetics (2 marks)

(b) Write the following equations: [CLO 1:C1]
i. Linear velocity (2 marks)
ii. Angular velocity (2 marks)

(c) Determine the peripheral speed of the tread on a tire of a motor car if the wheel spins about the axle with an angular velocity of 10 rad/s. Diameter of the tires is 0.6 m. [CLO 1:C3] (5 marks)

(d) A grinding wheel is accelerating uniformly from rest to 4500 rpm in 5 second. If the wheel diameter is 200mm, determine: [CLO 1:C3]
i. Angular acceleration. (6 marks)
ii. Linear acceleration. (3 marks)
iii. The final linear speed of a point on its rim. (3 marks)

QUESTION 5

(a) Define the following terms : [CLO 1:C1]
i Displacement (2marks)
ii Velocity (2marks)
iii Acceleration (2marks)

(b) A car has an initial speed of 25 m/s and a constant deceleration of $3m/s^2$. [CLO 1:C3]
i Calculate the velocity of the car when t = 4 s. (3marks)
ii Calculate the displacement of the car during the 4 s time interval. (4 marks)
iii Calculate the time needed to stop the car. (4marks)

(c) A train starts from rest at a station with constant acceleration of 1.5 m/s^2 until it achieves velocity of 54 km/h. The train decelerate until it stop in 12 s. Determine : [CLO 1:C3]
i. Distance travelled by the train. (4marks)
ii. Deceleration of the train. (4marks)

QUESTION 6

(a) State Newton's Second Law of Motion and its formula. [CLO 1:C1] (4 marks)

(b) A particle moves with acceleration of 5 m/s^2. Determine the velocity and displacement when t = 4 s if: [CLO 1:C3]

i. The particle starts from rest. (4 marks)

ii. The particle move with the v_0 = 12 m/s. (4 marks)

(c) With reference of Figure 6(c), the 50kg crate rests on a horizontal surface for which the coefficient of kinetic friction is μ_k = 0.3. If the crate is subjected to a 400N towing force as shown, determine the velocity of the crate in 3s starting from rest. [CLO 1:C3]

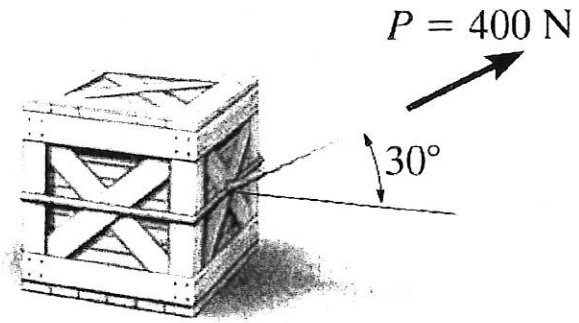

Figure 6(c) (13 marks)