POLITEKNIK
Jabatan Pengajian Politeknik

EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION

(MINISTRY OF HIGHER EDUCATION)

MECHANICAL ENGINEERING DEPARTMENT

FINAL EXAMINATION

JUNE 2012 SESSION

JJ311: MECHANIC OF MACHINES

DATE: 22 NOVEMBER 2012 (THURSDAY)
DURATION: 2 HOURS (2.30 PM - 4.30 PM)

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

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(The CLO stated is for reference only)

INSTRUCTION:

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

QUESTION 1

A rope is wound on a drum of a lift machine which has a diameter of 1.2 m, a mass of 25 kg and 0.19 m radius of gyration. Tied at both ends of the rope are two masses 65 kg and 30 kg respectively. Calculate:

(CLO 1 : C3)

i) Driving torque needed to raise the mass of 65 kg with 2.5 m/s^2 acceleration. (10 marks)

ii) Linear velocity as the load is rising at 2.5 m/s^2 acceleration where the power produced by the drum is 1.4 kW. (5 marks)

iii) The acceleration of the system when the drum is allowed to move freely. (10 marks)

QUESTION 2

A mass of 64 kg is suspended vertically from 2 parallel springs with the same coefficient. Static deflection caused by the mass is 52 mm. The mass is pulled downward 65 mm and then released. Calculate:

(CLO1 : C3)

i) The spring constant for each spring. (5 marks)

ii) The initial acceleration for the body. (5 marks)

iii) The periodic time of oscillation. (5 marks)

iv) The maximum force of the spring. (5 marks)

v) The velocity where the body is at 25 mm from the stability. (5 marks)

QUESTION 3

A piston, connecting rod and crank mechanism is shown in the **Figure Q3**. The crank rotates at a constant velocity of 300 rad/s. Find the acceleration of the piston and the angular acceleration of the link BC. The figure is not drawn to scale.

(CLO 1 : C3)

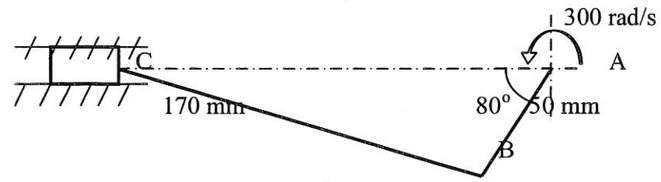


Figure Q3

i) Draw the velocity diagram and determine the velocity of C relative to B.

(10 marks)

ii) Calculate the acceleration of the piston and the angular acceleration of the link BC.

(15 marks)

QUESTION 4

a) Calculate the magnitude of push, P that will move the wooden crate to the point of sliding as shown in Figure Q4(a) below. Coefficient of friction between the crate and the floor is 0.55. Wooden crate = 20.41 kg.

(CLO 2 : C3)
(8 marks)

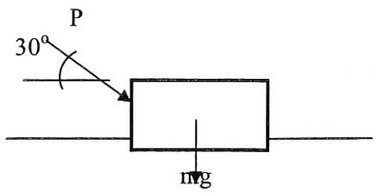


Figure Q4(a)

b) A block is positioned on a 30° incline surface. The block is pulled by a force 10° from the incline surface. The coefficient of static friction is 0.25.

(CLO2 : C3)

i) Sketch a free body diagram of balance forces in both x and y directions. (3 marks)

ii) Calculate the value of forces to initiate the inclined motion. (9 marks)

iii) Calculate the operational efficiency. (5 marks)

QUESTION 5

Calculate the mass and the angle at which it should be positioned in plane X and Y at a radius of 200 mm in order to produce a complete dynamic balance of the system shown in **Figure Q5** below.

(CLO 2 : C3)
(25 marks)

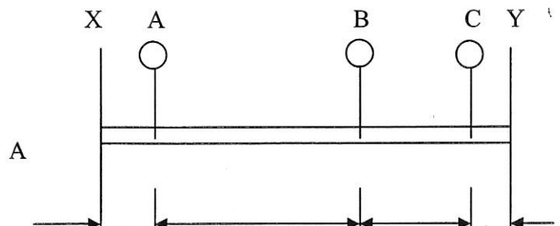
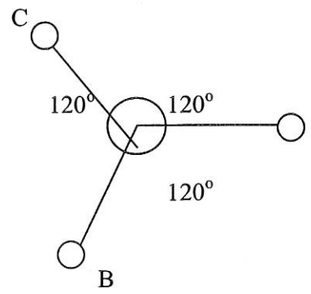


Figure Q5



QUESTION 6

a) State **TWO** (2) types of belts used in a belt drive. (CLO 2 : C1)
(2 marks)

b) Two pulleys with a diameter of 0.5 m and 1.4 m respectively are connected by a flat belt. If the distance between the center of the pulleys is 1.7 m, calculate the length of the belt needed.

(CLO 2 : C3)
(8 marks)

c) A pulley of 750 mm effective diameter is driven by a flat belt running at 420 rpm. The coefficient of friction between the pulley and the belt is 0.29 and the angle of contact is 120°. The maximum permissible tension in the belt is 530 N. Calculate the power transmitted by the belt. (CLO 2 : C3)
(15 marks)