POLITEKNIK
Jabatan Pengajian Politeknik

EXAMINATION AND EVALUATION DIVISION
DEPARTMENT OF POLYTECHNIC EDUCATION
(MINISTRY OF HIGHER EDUCATION)

MECHANICAL ENGINEERING DEPARTMENT

FINAL EXAMINATION

DECEMBER 2011 SESSION

J3010 : MACHINE MECHANICS I

DATE : 26 APRIL 2012 (THURSDAY)
DURATION : 2 HOURS (8.30 AM - 10.30 AM)

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

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STRUCTURED / ESSAY (100 marks)

Instruction: This section consists of **SIX(6)** structured / essay questions.

Answer **FOUR(4)** questions only.

QUESTION 1

(a) A static lift starts to move upward with a constant acceleration. After 4 seconds, the velocity of a lift is 8 m/s and moving with this velocity in 2 seconds. Then, it slow down constantly and stop after 9 seconds.

i. Sketch a velocity versus time graph.

(4 marks)

ii. Calculate the total distance of the lift.

(2 marks)

iii. Determine the lift acceleration.

(2 marks)

iv. Calculate the lift deceleration.

(2 marks)

(b) The angular velocity of a body is constantly decreased from 600 rpm to 300 rpm in 6 seconds. Determine:

i. Angular acceleration.

(5 marks)

ii. The numbers of rotation in 6 seconds.

(5 marks)

iii. The time required for the body to stop from 300 rpm.

(5 marks)

QUESTION 2

A steel disc with 300 mm diameter and 30 mm thickness is drilled hollow with 80 mm diameter at disc center. Then 80 mm diameter of brass bar with 100 mm length is installed inside the disc hollow. Given steel density is 7820 kg/m^3 and brass density is 8480 kg/m^3. Compute the following:

(a) The inertia moment for the hollow steel disc at the central axis.

(8 marks)

(b) The inertia moment for the assembled at the central axis.

(6 marks)

(c) The gyration radius for the assembled at the central axis.

(5 marks)

(d) The torque to accelerate the assembled from 70 rpm to 200 rpm in 10 seconds.

(6 marks)

QUESTION 3

A rope is tied on a steel drum of lifting machine with a diameter of 1.2 m, a mass of 25 kg and 0.18 radial of gyration. A mass of 65 kg is tied to one end of the rope and the other end is tied with a mass of 30 kg. Determine:

(a) The torque of driver needed to lift the 65 kg of mass with 2.5 m/s^2 acceleration.

(13 marks)

(b) The linear velocity of mass with 2.5 m/s^2 acceleration where the power produced by the drum is 1.4 kW.

(3 marks)

(c) The linear acceleration when the drum is freely released.

(9 marks)

QUESTION 4

(a) A force P acting on a block of mass M is positioned α^{o} incline to the horizontal surface moving with a constant velocity. Based on the statement above,

i. Draw free body diagram showing the forces acted on the block.

(3 marks)

ii. Derive the equation for coefficient of friction, μ in terms of P and M.

(4 marks)

(b) A block of 100 kg is positioned on the 30^{o} incline surface. The block is pulled by a force acting 10^{o} parallel to the incline. The coefficient of friction is 0.25.

i. Draw free body diagram showing the forces acted on the block.

(5 marks)

ii. Determine the value of force needed to pull the block sliding up the incline surface.

(7 marks)

iii. Calculate the operational efficiency

(6 mark)

QUESTION 5

A jet screw V threading is used to lift weighing 750kg through a handle. Horizontal force 112N applied to the end of handle and the distance is 300 mm from screw axial. The mean diameter is 50 mm and 200 mm V thread per meter. The included of the thread V is 60^0. Calculate:

(a) The helix angle of the screw.

(4 marks)

(b) Tangential force at mean radius to turn the screw.

(4 marks)

(c) Forward efficiency.

(7 marks)

(d) Horizontal force received to the end of the handle to raise down the load.

(7 marks)

(e) Maximum efficiency.

(3 marks)

QUESTION 6

An open belt drive connects two pulley 0.88 m and 0.46 m diameter. Distances between the pulleys are 2.5 m. The belt has mass 0.6 kg/m length and the maximum tension is not exceeding 1.7kN. The coefficient of friction between the belt and pulley is 0.25. The 1.5 m pulley, which is the driver, runs at 310 rev/min. The velocity of the driven shaft only rotated at 500 rev/min because the belt on one of the pulley slips. Calculate:

(a) The tension in the slack side.

(10 marks)

(b) The torque on each of the two shafts.

(6 marks)

(c) The power transmitted on each of two shafts .

(6 marks)

(d) The efficiency of the drive.

(3 marks)