Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2015/2016

COURSE NAME	:	MECHANICS OF MACHINES
COURSE CODE	:	BDA 20303
PROGRAMME	:	2 BDD
DATE	:	JUNE 2016 / JULY 2016
DURATION	:	3 HOURS
INSTRUCTIONS	:	ANSWER **FIVE (5)** QUESTIONS ONLY OUT OF **SIX (6)** QUESTIONS.

THIS QUESTION PAPER CONSIST OF **SEVEN (7)** PAGES

Q1 (a) Gears are toothed cylindrical wheels used for transmitting mechanical power from one rotating shaft to another. Thus, explain the meaning of gear ratio, gear train and gear efficiency.

(6 marks)

(b) **Figure Q1(b)** shows a motor used to accelerate a hoist through two sets of gear reducing system. Moment of inertia for the motor shaft (I_M), middle shaft (I_T) and hoist shaft (I_G) are 5 kgm^2, 20 kgm^2 and 100 kgm^2 respectively. Gear ratio for gear set A and B is 0.4 while for gear set C and D is 0.5. Gear efficiency for both gear sets is 90%. The rope that carries a 300 kg load are encircle on hoist with diameter 1.2 m. By neglecting the friction, find

(i) equivalent moment inertia for a gear system (2 marks)

(ii) the total torque of the motor needed to bring up the load of 300 kg with acceleration of 1.2 m/s^2

(12 marks)

Q2 An open belt drive connects two pulleys 1.4 m and 0.6 m in diameter, on parallel shafts at 4.0 m apart. The belt has a mass of 0.9 kg/m length, and the maximum tension in it is not exceed 2.5 kN. The 1.4 m pulley, which is the driver, runs at 230 rpm. Due to the belt slip of one the pulleys, the velocity of the driven shaft is only 500 rpm. If the coefficient of friction is 0.3, determine;

(a) the length of the belt (5 marks)

(b) the torque on each of the two shafts (7 marks)

(c) the power transmitted (3 marks)

(d) the power lost in friction (5 marks)

Q3 (a) Discuss briefly statics balance and dynamics balance in mass rotation balancing system. What are the criteria to meet each balance requirement?

(6 marks)

(b) **Figure Q3** shows a shaft attached with four solid iron balls A, B, C and D. Balls C and D make angles of 90° and 195° respectively with that of ball B in the counterclockwise direction. Distance between planes B and C are 250 mm apart. The rotating balls have following properties:

Balls	Mass (kg)	Radius (mm)	Angle (°)
A	**M**	150	θ
B	25	200	0
C	40	100	90
D	35	180	195

If the shaft rotating system is completely balanced, determine

(i) the mass of ball A (3 marks)

(ii) the angular position of ball A with refer to ball B (3 marks)

(iii) the distance of all the planes relative to plane of ball A (8 marks)

Q4 (a) Clutch is a mechanical device that use friction surfaces as the means of transmitting torque to start or stop the mechanism. The activation of the device is depending on the actuation systems installed. Explain **FOUR (4)** types of actuation systems that are available commercially.

(6 marks)

(b) A square threaded screw jack *A* with 50 mm mean diameter is used to raise 2.5 tonnes of steel block B as shown in **Figure Q4**. Given the threaded screw pitch, l = 12.5 mm and coeficient of friction, μ = 0.13 between screw and nut. Assuming the steel block to rotate together with the screw, determine;

i) the angle of threaded screw, θ (1 marks)

ii) the angle of static friction, $\varnothing$ (1 marks)

iii) torque on the screw to raise the load (4 marks)

iv) the torque on the screw to lower down the same load (4 marks)

v) work done to lift-up load 125 mm vertically (4 marks)

Q5 (a) What do you understand about mechanism and what is the function of mechanism? (3 marks)

(b) List types of mechanism and explain your classification. (4 marks)

(c) **Figure Q5 (c)** shows a mechanism in which OA = QC = 100 mm, AB = QB = 300 mm and CD = 250 mm. The crank OA rotates at 150 rpm in the clockwise direction. Determine,

(i) the velocity of the slider at D

(ii) angular velocities of links QB and AB

(iii) rubbing velocity at the pin B which is 40 mm in diameter

(13 marks)

Q6 (a) State **THREE (3)** advantages and disadvantages of belt drive system. (6 marks)

(b) The essential features of a transmission dynamometer are shown in **Figure Q6**. A is the driving pulley which runs at 500 rpm. B and C are jockey pulleys mounted on a horizontal beam pivoted at D, about which point the complete beam is balanced when at rest. E is the driven pulley, and all portions of the belt between the pulleys are vertical. A, B and C are each 300 mm diameter and the thickness and mass of the belt are to be neglected. DF is 750 mm. Determine;

(i) The value of the mass m to maintain the beam in a horizontal position when 4 kW is being transmitted.

(ii) The value of m when the belt just begins to slip on A, μ being 0.2 and the maximum tension in the belt is 1100 N.

(14 marks)

- END OF QUESTION -

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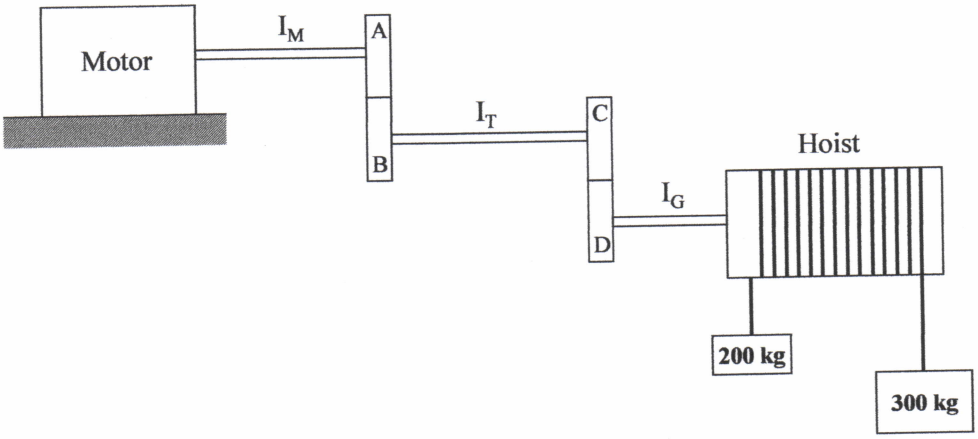

Figure Q1 (b)

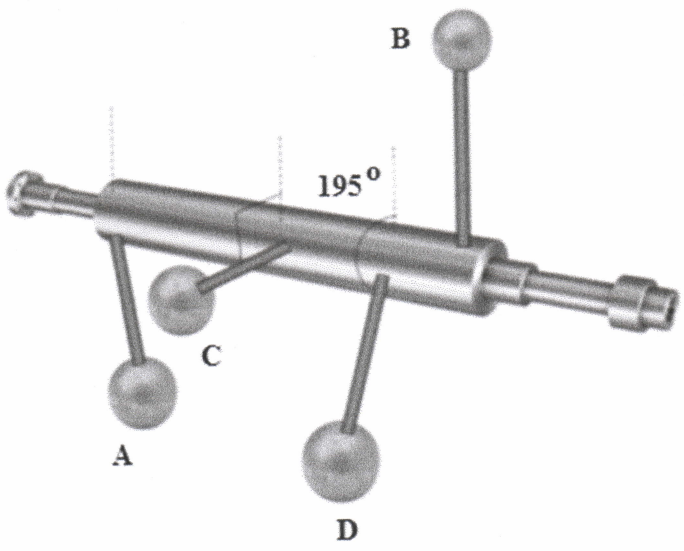

Figure Q3

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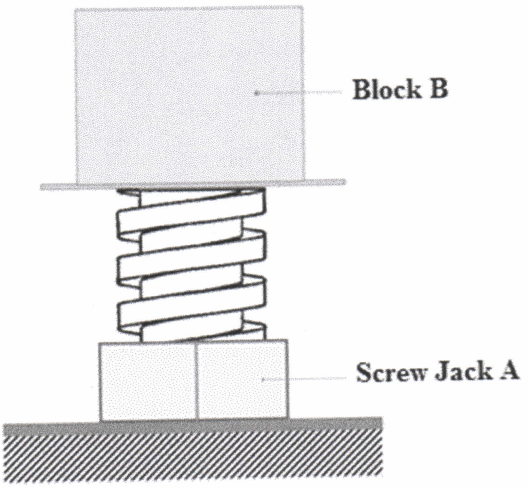

Figure Q4

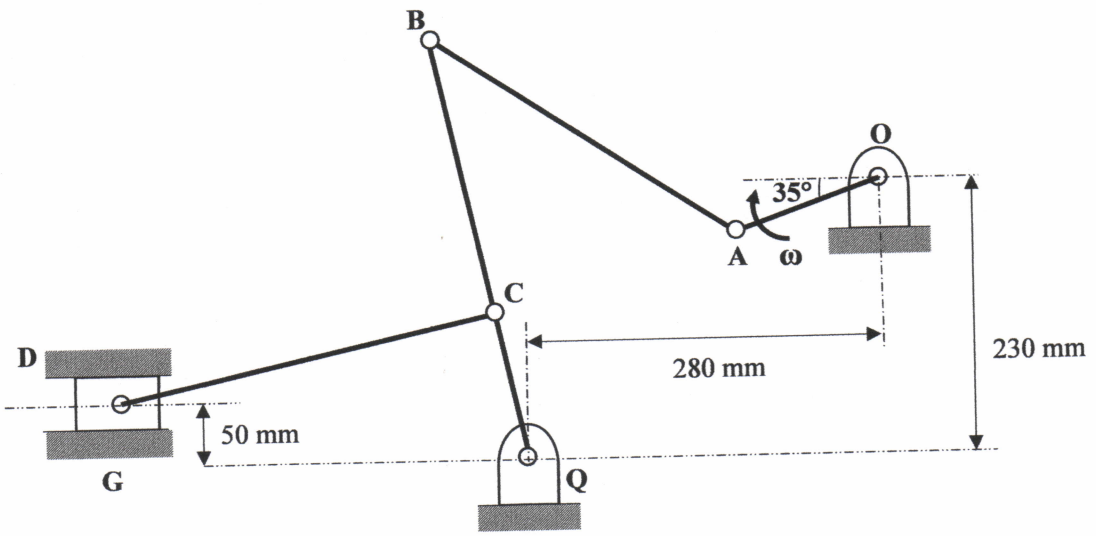

Figure Q5 (c)

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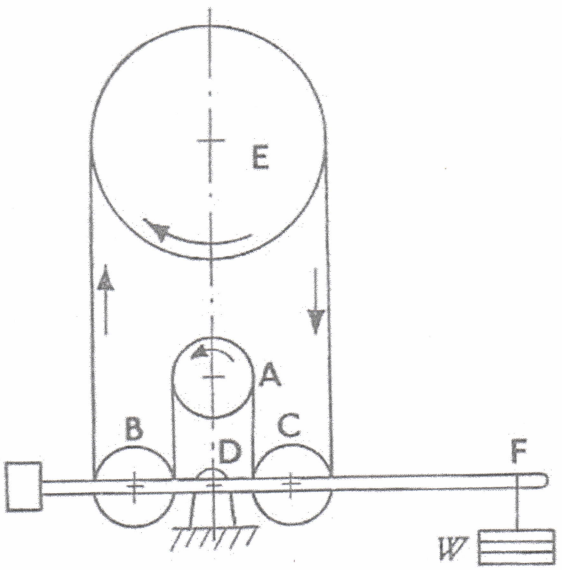

Figure Q6