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SET A

UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2014 SESSION

SUBJECT CODE	:	FMB 20202
SUBJECT TITLE	:	MECHANICS OF MACHINES
LEVEL	:	BACHELOR
TIME / DURATION	:	2.5 HOURS 9.00 am - 11.30 am
DATE	:	28 MAY 2014

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answers should be written in blue or black ink except for sketching, graphic and illustration.
5. This question paper consists of ONE (1) section. Answer FOUR (4) questions only.
6. Answer all questions in English.
7. Formula sheet is appended

THERE ARE 4 PAGES OF QUESTIONS AND 1 PAGE OF APPENDIX, EXCLUDING THIS PAGE.

INSTRUCTION: Answer only FOUR (4) questions.
Please use the answer booklet provided.

Question 1

(a) Describe the MATHEMATICAL MODELS.

(5 marks)

(b) Derive the velocity and acceleration.

(10marks)

(c) Derive the WORK and ENERGY.

(10marks)

Question 2

Part of compound epicyclic gear is shows in Figure 1. Input shaft (I) rotate with rotation speed 1000 rpm and annulus gear A1 rotate with rotation speed of 1000 rpm. The number of teeth gear as below.

S1 = 50 S2 = 40 A1 = 100 A2 = 120

(a) Find the speed of shaft O.

(12 marks)

(b) Find the rotation direction of shaft O.

(13 marks)

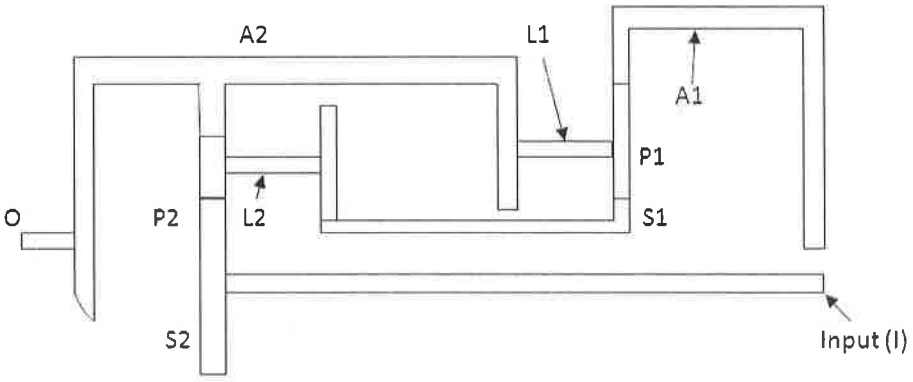


Figure 1

Question 3

A belt drive system as shown in Figure 2 shows a pulley of 200 mm diameter rotating at 500 rpm drives a 400 mm diameter follower with a belt, with two parallel shafts 1000 mm apart. The belt has a mass of 0.3 kg/m and maximum tension of 12 N. The cross sectional area of the belt is 300 mm^2 and the value of E is 300 MN/m^2. If $\mu = 0.5$, and the angle of lap is 168.52°, calculate:

i. The maximum tension difference allowing for the inertia in the belt

(12 marks)

ii. The speed of the follower in RPM at maximum condition

(13 marks)

The free part of the belt is considered straight.

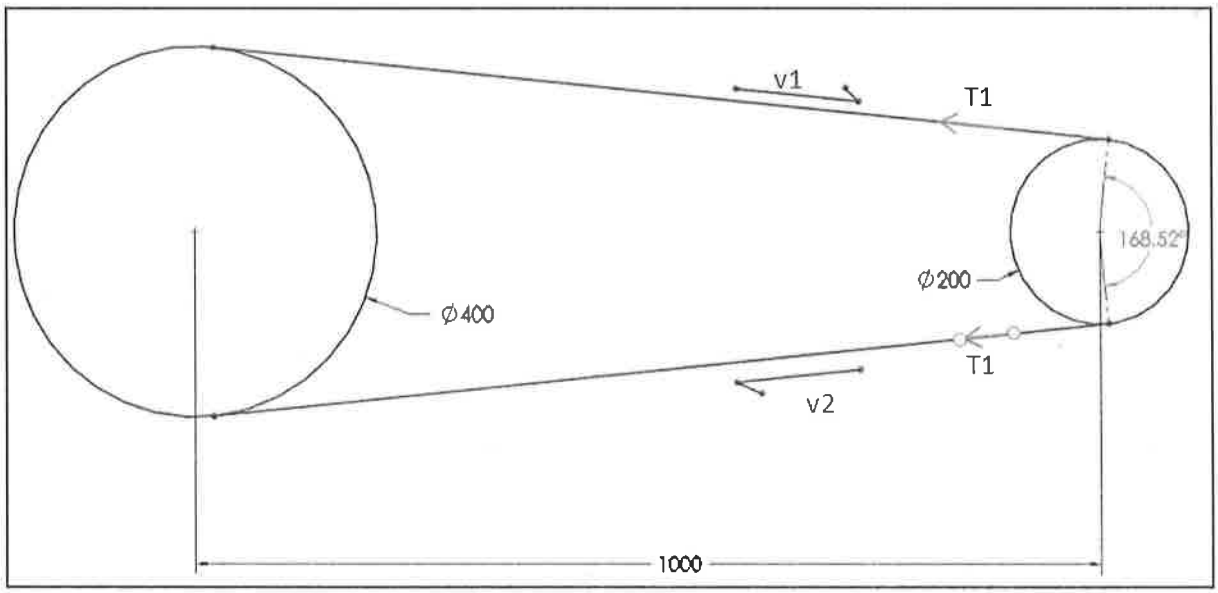


Figure 2

Question 4

A shaft has 4 masses ABCD attached to a motor as shown in Figure 3. The distance of center masses from rotor axial is 30, 36, 39, and 33 mm. The mass of A, C and D is 7.5, 5 and 4 kg. Distance between A and B is 400 mm between B and C is 500 mm. The angle between A and C is 90°. For fully balancing find;

(a) Angle between A, B and D.

(9 marks)

(b) Distance between mass C and D.

(8 marks)

(c) Mass B.

(8 marks)

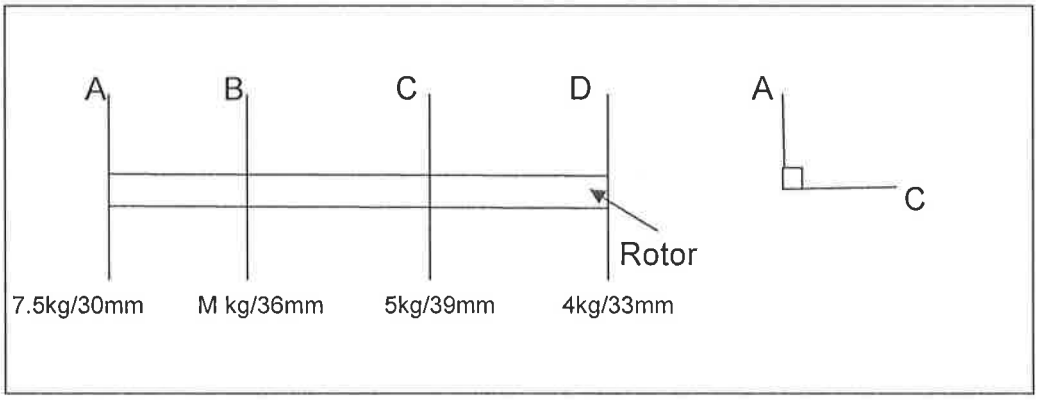


Figure 3

Question 5

Figure 4 shows a motor to accelerating a hoist with the diameter of 0.9 m through a meshing reduction gear $\frac{1}{3.5}$ and $\frac{1}{4.5}$, a mass moment of inertia for a shaft motor, for an intermediate shaft and for the hoist are 50, 20 and 100 kg m^2. An effect of torque load on bearing is 0 NM, on intermediate shaft is 150 NM and on the hoist shaft is 800 NM. A circumscribed rope at the hoist is needed to pull a load with the mass of 5 ton at an angle of an inclination 1 in 50. If a friction at the angle of the inclination is 1000N and the Torque of motor is 1500NM,. Take the efficiency of the meshing gears as 90%.

$T_m =$ 1500 Nm, $I_m =$ 5 kg m^2, $I_A =$ 20 kg m^2, $I_G =$ 100 Kg m^2, $T_x =$ 0, $T_y =$ 150 Nm and

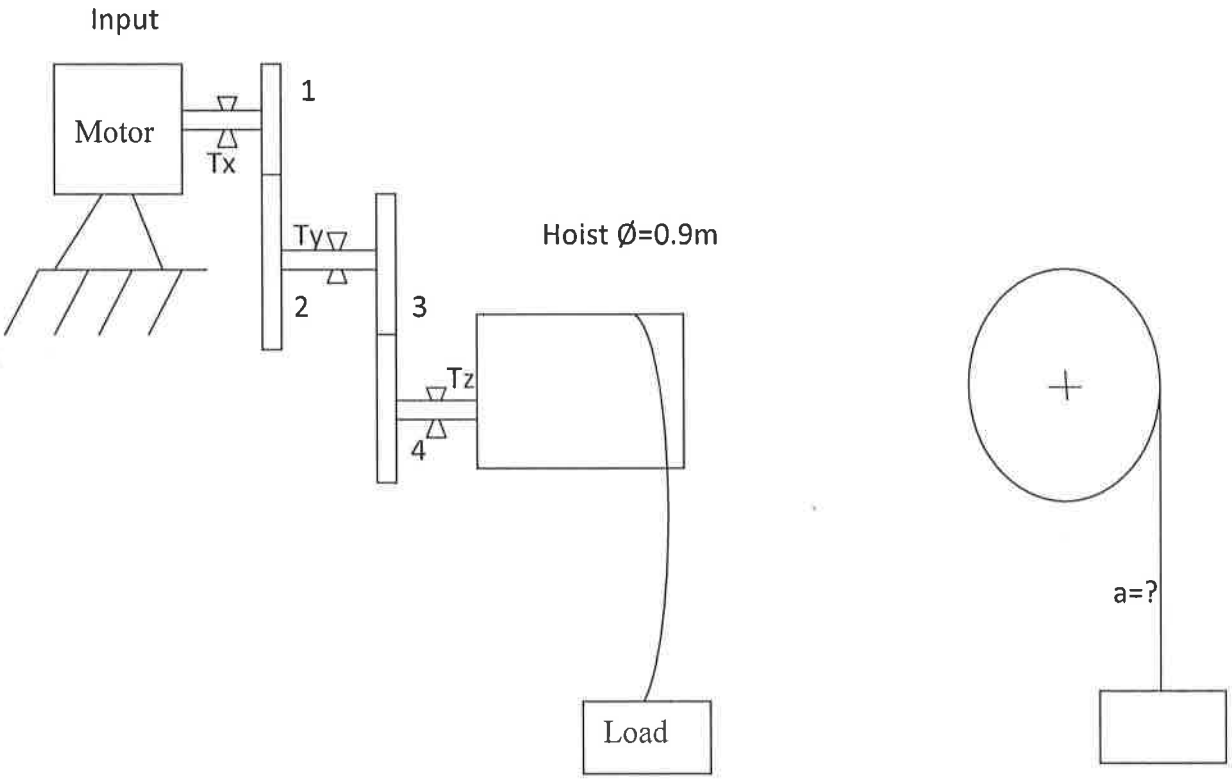
$T_z =$ 800 Nm

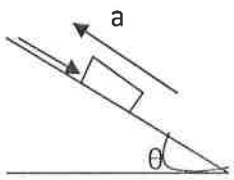
(a) Compute all torque.

(12 marks)

(b) Find the acceleration of load.

(13 marks)





Sin θ = 1/50

Figure 4

END OF QUESTION

APPENDIX

List of formula

$v = u + at = \omega r$

$P = Fv$

$P = (T_1 - T_2)v$

$F = m\omega^2 r$

$T = mv^2 = P/\omega$

$(T_1 - T_C) / (T_2 - T_C) = e^{\mu\theta}$

$v_2/v_1 = 1 - [(T_1 - T_2) / aE]$

$G.R. = N_A / N_B = T_B / T_A$

Max Tension in the belt, T=f.b.t

mass of the belt per metre length, m= Area x Length x density

centrifugal tension, $T_1 = m.v^2$

$$(I_{eq})_m = I_m + \frac{(n\ 1/2)^2\ I_l}{\eta_{1/2}} + \frac{(n\ 1/2.\ n\ 3/4)^2 I_h}{\eta_{1/2}.\eta_{3/4}}$$

$T_m = T_{m1} + T_{m2} + T_f$

$P_m = T\omega$

$T_m = (I_e)_m \times \alpha_m$