Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	MECHANICS OF MACHINES
COURSE CODE	:	BDA20303
PROGRAMME	:	BDD
EXAMINATION DATE	:	DECEMBER 2018/JANUARY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER ANY **FIVE (5)** OUT OF **SIX (6)** QUESTIONS

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THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) Describe three key differences between spur gear and helical gear then illustrate the geometry of these two gears.

(5 marks)

(b) The axes of two parallel shafts are to be approximately 600 mm apart and have to be connected by spur gears, having a circular pitch of 30 mm. If rpm of A is 200 and that of B is 600, find

(i) The number of teeth on each wheel

(ii) Pitch diameter of each wheel

(iii) Circular pitch of each wheel

(iv) Exact centre to centre distance apart, of the two shafts

(v) If the tangential pressure between the teeth of gears, acting at the point of contact of the two pitch circle is 18 kN, find the power transmitted by A.

(15 Marks)

Q2 (a) One of the type of belt drives is cross type belt drive.

(i) Explain what is the function of cross type belt drive? (2 marks)

(ii) Sketch the cross type belt drive diagram (2 marks)

(b) An open belt drive connects two pulleys 1.2 m and 0.5 m diameter on parallel shafts 3.6 m apart. The mass of belt per unit length is 0.9 kg and the maximum tension in it is not exceeding 2 kN. The 1.2 m pulley, which is the driver, runs at 250 rpm. Due to the belt slip on one of the pulleys, the velocity of the driven shaft is only 500 rpm. If the coefficient of friction between the belt and the pulley is 0.25, calculate

(i) Torque on each of the two shafts (10 marks)

(ii) Power transmitted (2 marks)

(iii) Power lost in friction (2 marks)

(iv) Efficiency of the drive (2 marks)

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Q3 (a) Define single plane balance and two plane balance in balancing mechanisms. What are the criteria to meet each balance requirement? (4 marks)

(b) A, B, C and D are four masses carried by a rotating shaft at radial 100 mm, 125 mm, 200 mm and 150 mm, respectively as shown in **Figure Q3**. The planes in which the masses revolve are spaced 600 mm apart and the mass of B, C and D are 10 kg, 5 kg, and 4 kg respectively.

(i) Draw the illustration of the planes if the 1st mass is used as the reference plane. Tabulate all the given data in a table. (4 marks)

(ii) By considering the illustration and table in (i), calculate the angular setting of masses *C* and *D*. (4 marks)

(iii) Find the required mass A and its angular position settings of the four masses so that the shaft shall be in complete balance. (4 marks)

(iv) Illustrate the final angular position of all masses. (4 marks)

Q4 (a) Describe the two forms of friction and explain. (4 marks)

(b) The pitch of 50 mm mean diameter threaded screw of a screw jack is 12.5 mm The coefficient of friction between the screw and the nut is 0.13. Assuming the load to rotate with the screw

(i) Calculate the torque required on the screw to raise a load of 25 kN (4 marks)

(ii) Determine the ratio of the torque required to raise the load, to the torque required to lower the load. (8 marks)

(iii) Find the efficiency of the system to raise and to lower the 25 kN load. (4 marks)

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Q5 (a) What is inversion of mechanism in engineering words? List out **THREE (3)** examples of inversion mechanism. (4 marks)

(b) In a slider crank mechanism shown in **Figure Q5**, the crank OA rotates clockwise about '**O**' at 120 rpm.

(i) Find the linear velocity of slider B. (6 marks)

(ii) Find the linear velocity of point P located at a distance of 8 cm on the connecting rod extended. (3 marks)

(iii) Determine the velocity of rubbing at the pin of the crank shaft OA , if the diameter of it pins is 5 mm. (3 marks)

(iv) What would happen to the system if the rpm of crank OA is increased to 200rpm? Please briefly explain and verify your answer with calculation. (4 marks)

Q6 (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 Q6** shows a toggle clamp used for securing a work piece during a machining operation. Pin holes distance for handle arm is 20 mm, clamp arm is 12 mm, support base is 25 mm and connecting linkage is 15 mm. Determine the angle that handle must be displaced in order to lift the clamp arm 30° clockwise direction. (13 marks)

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- END OF QUESTION -

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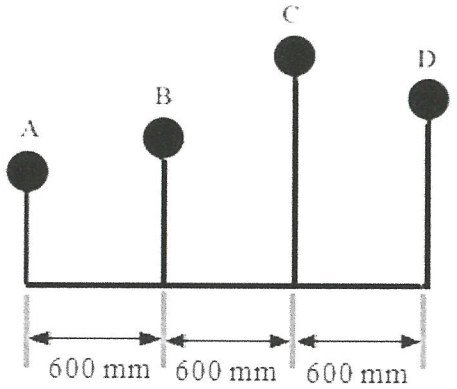

Figure Q3

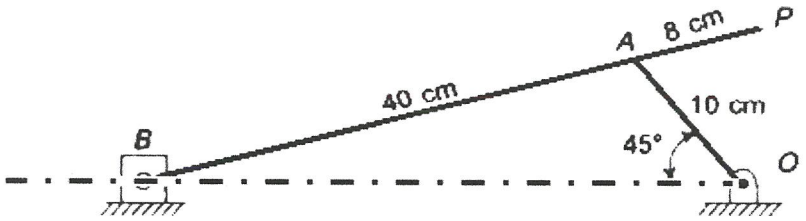

Figure Q5

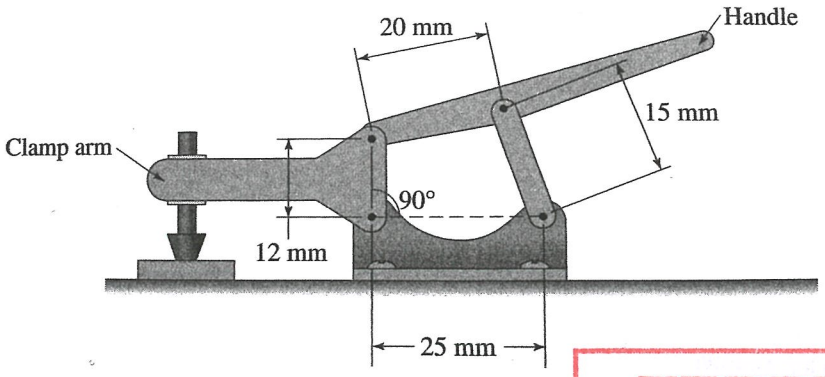

Figure Q6

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