Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2017/2018

COURSE NAME	:	MECHANICS OF MACHINES
COURSE CODE	:	BDA20303
PROGRAMME	:	BDD
EXAMINATION DATE	:	DECEMBER 2017/JANUARY 2018
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5) ONLY** 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 sketches 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) In a typical belt drive system, determine what is velocity ratio and slip of belt Drive. Discuss also the effect of belt thickness and slip.

(6 marks)

(b) State 2 advantageous and 2 disadvantageous of belt drive system over gear drive system.

(4 marks)

(c) A flat type pulley with diameter of 200 mm rotating at speed of 1750 rpm drives another pulley with diameter of 800 mm using open belt type arrangement. Distance between the shafts center is 1 meter and mass of belt material is 0.5 kg/m. The coefficient of friction between belt and pulley's contact surface is 0.3. When in operation, the belt tension at the slack side is 300 N, find,

i. Angle of lap, θ
ii. Belt tension of the tight side, T_{tight}
iii. If the belt maximum permissible tension is 350 N, discuss what will happen to the belt.

(10 marks)

Q3 (a) Reciprocating parts of an engine rotates and generate inertia forces which tends to induce shacking forces. Illustrate with sketches your understading to partially balance the unbalance primary inertia forces.

(4 marks)

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(b) A Disolver Tank is equipped with shaft carries blade of A, B, C and D, placed in parallel planes perpendicular to the shaft rotating axis as shown in **Figure Q3**, and in this order along the shaft the masses of B and C are 36 kg and 25 kg, respectively, and both are concentrated at a radius of 150 mm, while the masses in planes A and D are both at a radius of 200 mm. The angle between blade B and C is 100° and that between B and A is 190°. Both angle measured in the same sence. The planes containing A and B are 250 mm apart and those containing B and C are 500 mm apart. If the shaft is to be in complete dynamic balance, examine.

i. The mass of A and D. (10 marks)
ii. The distance between the planes, containing C and D. (3 marks)
iii. The angular position of blade D from B anticlockwise. (3 marks)

Q4 (a) Sketch and explain the advantage of cone clutch compare to plate or disc clutches. Also give two examples of cone clutches application. (4 marks)

(b) Clutches are design to transmit torque from the engine to the drivetrain. A scenario of multiple clutch plate having three discs on the driving shaft and two discs on the driven shaft which providing four pairs of contact surfaces is concern. The dimensions for both internal and external diameter of the clutches are 120 mm and 240 mm respectively and connected with six springs each of stiffness is 13 kN/m. This brand new system are capable to transmit 25 kW of power at 1575 RPM. Given the coefficient of friction for clutch is $\mu = 0.3$.

i. Find the total torque transmitted. (2 marks)

ii. Assuming uniform pressure, calculate the total thrust force of the spring pressing the plates together. (6 marks)

iii. Later after several years of operations, each of the clutches contact surfaces plate has worn off by 1.25 mm. Evaluate the new maximum power that can be transmitted within the same rotational speed, assuming uniform wear and having the same coefficient of friction. (8 marks)

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Q5 (a) In a particular mechanism system, explain the below terms:

i. Kinematics link
ii. Kinematic chain.
iii. Lower pair.
iv. Higher pair.

(4 marks)

(b) **Figure Q5** shows a space diagram of mechanism in a typical kinematics systems. Crank AB rotates at 200 RPM. Dimensions of the links are AB = 120 mm, BC = 480 mm, CD = 180 mm, DE = 360 mm, EF = 120 mm and FP = 360 mm,

i. Examine the velocities at point C and P. (10 marks)
ii. Calculate rubbing velocity at F if the pin diameter is 12 mm (3 marks)
iii. Determine the torque produced at A if force 500 N is applied at slider P and system efficiency is 100%. (3 marks)

Q6 (a) 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. (3 marks)
ii. Determine the ratio of the torque required to raise the load, to the torque required to lower the load (4 marks)
iii. Find the efficiency to raise and to lower the load. (3 marks)

(b) Describe the two forms of friction and explain. (2 marks)

(c) An effort of 3 kN is required just to move a certain body up an inclined plane of angle 20 degree. The effort of 1 kN is required to just move the same body down the same plane. Both forces acting parallel to the plan

i. Draw the free body diagrams for both conditions. (4 marks)
ii. Determine the weight of the body and the coefficient of friction. (4 marks)

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- END OF QUESTION –

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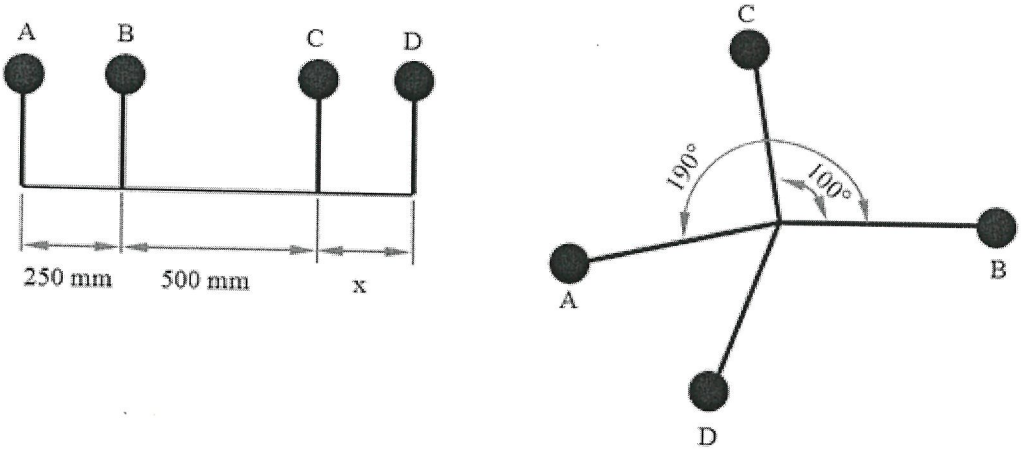

Figure Q3

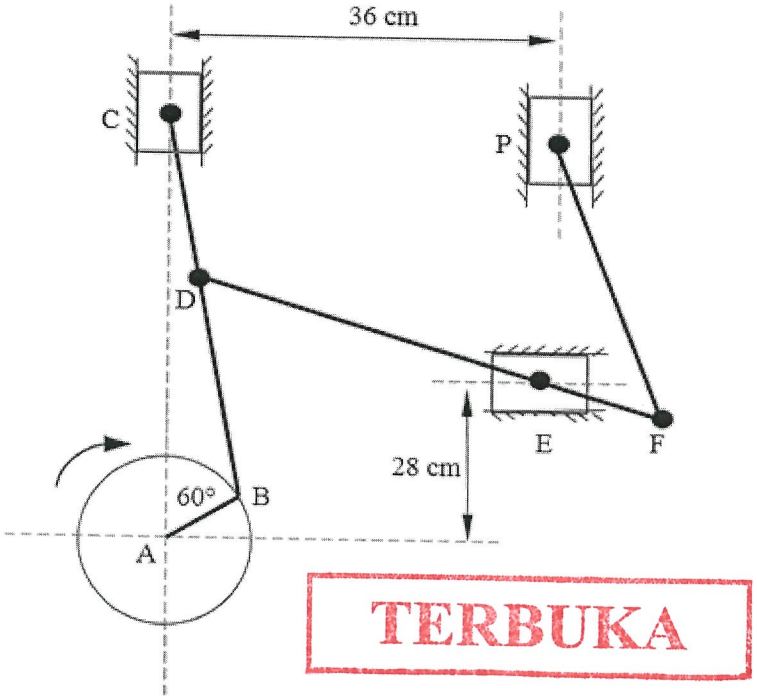

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Figure Q5