Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	MECHANIC OF MACHINE
COURSE CODE	:	DAJ 32103
PROGRAMME CODE	:	DAJ
EXAMINATION DATE	:	DECEMBER 2018 / JANUARY 2019
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY

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

Q1 (a) Explain the equivalent moment of inertia of gear in power transmission system

(4 marks)

(b) A gear set has 8 teeth on the drive gear and 27 teeth on a gear-driven. Given the input torque and speed is 320 Nm and 270 rpm clockwise respectively. Gear efficiency is 55%. Moment inertia of the driver and driven gear is 20 kgm^2 and 81 kgm^2 respectively. Determine;

(i) the output power without the effect of moment inertia on gears.
(ii) the output torque without the effect of moment inertia on gears.
(iii) the equivalent moment of inertia if the moment inertia effects on gears.
(iv) the required torque of driver gear to overcome the effects of the moment of inertia on gears if given the angular acceleration of the driver gear is 25 rad/s^2.

(16 marks)

Q2 (a) List **four (4)** factors of belt drive selection.

(4 marks)

(b) A crossed-belt drive system is used as a power transmission system to the shaft of a conveyor. Belt of 'V' type with groove angle of 60^o is installed at two pulleys of the belt drive system with the centre distance is 1.95 m. If the diameter of the driver and driven pulleys is 450 cm and 200 cm respectively. Calculate;

(i) the required length of the belt.
(ii) the angle of contact between the belt and each pulley.
(iii) the power can be transmitted by the belt when the driver pulley rotates at 200 rev/min and the maximum allowable tension in the belt is 1 kN. Given the coefficient of friction between the belt and pulley is 0.25.

(16 marks)

Q3 (a) Explain the difference between static balance and dynamic balance.

(4 marks)

(b) **Figure Q3(b)** shows a shaft is rotating with constant speed carries four masses P, Q, R, S with radius of each masses from shaft axes is 8 cm, 12 cm, 15cm and 12 cm. Each mass is arranged with the same ratio of distance on the shaft. Given mass P = 12 kg and S = 5 kg. Angle between mass P and S is 90°. Determine the value of masses Q and R and its direction relative to mass P for system to be completely balance.

(16 marks)

Q4 (a) List **four (4)** types of friction.

(4 marks)

(b) Square threaded screws require a force to raising the load of 250 kg. The mean diameter and the distance between screw thread are 50 mm and 15 mm respectively. Given the coefficient of friction between the nut and the screw is 0.14. If assume acceleration of gravity is 9.81 m/s^2;

(i) carry out the force required to raising the load on the screw.
(ii) derive the formula of required force to raising load on the screw if square threaded changed to "Vee" thread screw.
(iii) determine the percentage efficiency of "Vee" type screw if given the angle β is 15 °.

(16 marks)

Q5 (a) Explain the 2nd Inversion of Slider Crank mechanism with example and diagram.

(4 marks)

(b) **Figure Q5(b)** shows in a Slider Crank mechanism, the link OA rotates clockwise about 'O' at 200 rpm. Given the angle AOB = 45°, the length of link OA = 14 cm and link AB = 40 cm. By drawing the velocity diagram, calculate;

(i) the linear velocity of point B and angular velocity of link AB.
(ii) the linear velocity of point P that located at distance of 12 cm from pin A and point Q that located with distance 10 cm on the connecting rod extended from pin A.

(16 marks)

Q6 (a) Damping is a mechanism by which vibration energy is gradually converted into heat or sound. Explain **three (3)** models of damping system.

(6 marks)

(b) **Figure Q6(b)** shows lever BOC has a mass of 5 kg and gyration radius is 200 mm on center of gravity at the pivot point O. The lever brings 2 kg mass at C. K_1 and K_2 have a spring constant of the same strength of 5 kN/m. Calculate the natural frequency of the system. (Neglect the pendulum effect)

(14 marks)

END OF QUESTION

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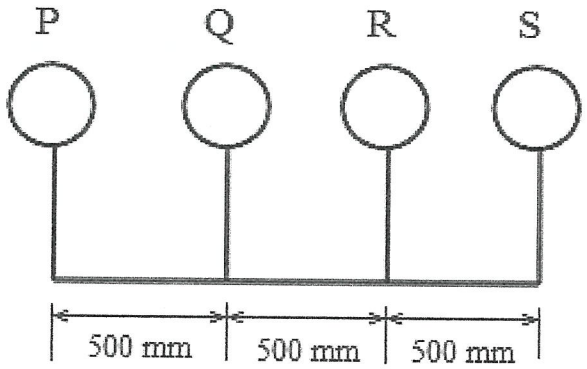

Figure Q3(b)

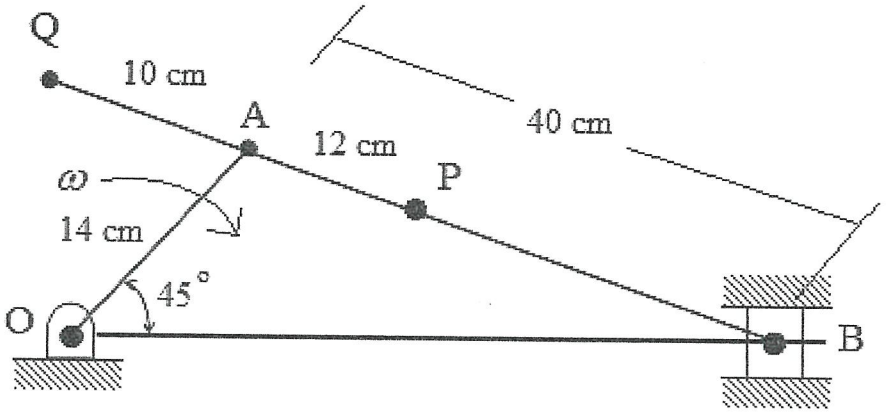

Figure Q5(b)

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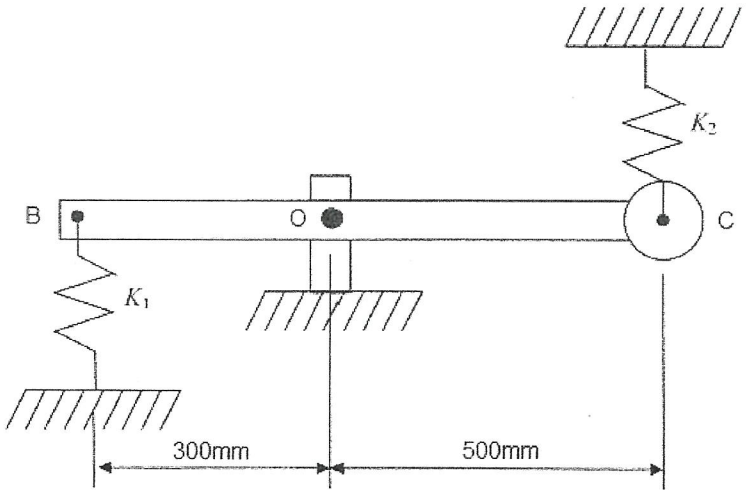

Figure Q6(b)

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List of Formula

1. Linear velocity at the contact surface of gear, $\pi D_1 N_1 = \pi D_2 N_2$
2. Belt tension ratio for flat belt, $\frac{T_1}{T_2} = e^{\mu\theta}$
3. Belt tension ratio for V-Belt, $\frac{T_1}{T_2} = e^{\left(\frac{\mu\theta}{\sin\beta}\right)} = e^{(\mu\theta)(\mathrm{cosec}\beta)}$
4. V-Belt type force balance, $R_N = \frac{R}{2\sin\beta}$
5. Power for Belt Drives, $P = (T_1 - T_2)v$
6. Centrifugal force term, $T_c = \rho A v^2$
7. Limiting Angle of Friction, $\tan\phi = \frac{F}{R_N} = \mu$
8. Inclination of Square Threaded Screw, $\tan\alpha = \frac{p}{\pi d}$
9. Force to moving up or lowering down , $P = W\tan(\phi \pm \alpha)$
10. Efficiency for Square Threaded Screw jack , $\eta = \frac{p}{\pi D\tan(\phi + \alpha)}$
13. Radial component of acceleration, $a_{BA}^n = \omega^2(BA) = \frac{(V_{BA})^2}{BA}$
14. Tangential component of acceleration, $a_{BA}^t = \alpha(BA)$
15. Newton's Second Law of Motion, $\sum Mo = Io\,\ddot{\theta}$
16. Principle of conversion of energy, $\frac{d}{dt}[T.K + T.U]$