Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2016/2017

COURSE NAME	:	MECHANICS OF MACHINE
COURSE CODE	:	DAM 31703
PROGRAMME CODE	:	DAM
EXAMINATION DATE	:	JUNE 2017
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS ONLY

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

BAHASA MELAYU

S1 (a) Senaraikan **empat (4)** klasifikasi gear berdasarkan sambungan gear dan kedudukan aci bagi tujuan penghantaran kuasa.

(4 markah)

(b) **Rajah S1(b) menunjukkan** sebuah set gear mempunyai 6 gigi pada gear pemacu dan 30 gigi pada gear dipacu. Diberi tork dan kelajuan masukan masing-masing adalah 300 Nm dan 250 ppm pada arah jam dengan. Kecekapan gear adalah 70%. Momen inersia bagi aci pada gear pemacu dan dipacu adalah masing-masing 20 kgm^2 dan 81kgm^2. Kemudian;

(i) Kirakan kuasa keluaran tanpa mengambil kira kesan momen inersia pada gear.
(ii) Keluarkan tork keluaran tanpa mengambil kira kesan momen inersia pada gear.
(iii) Kirakan momen inersia sepadan sekiranya momen inersia pada set gear diambil kira.
(iv) Tentukan jumlah tork yang diperlukan oleh gear pemacu untuk mengatasi kesan momen inersia pada kedua-dua gear tersebut jika diberi pecutan sudut pada gear pemacu adalah 40 rad/s^2.

(16 markah)

S2 (a) Nyatakan **empat (4)** faktor yang perlu dipertimbangkan dalam pemilihan tali sawat yang sesuai.

(4 markah)

(b) Sebuah sistem pemacuan tali sawat terbuka beroperasi dengan dua takal berdiameter 1.5 m dan 1.0 m pada jarak 4.8 m. Tegangan awal tali sawat adalah 3000 N. Diberi jisim tali sawat ialah 0.6703 kg/m. Jika takal yang lebih kecil berputar pada 600 ppm dan pekali geseran antara tali sawat dan takal adalah 0.3:

(i) Kirakan tegangan empar,
(ii) Kirakan tegangan tali sawat pada bahagian tegang dan bahagian kendur,
(iii) Tentukan kuasa yang dipindahkan.

(16 markah)

S3 **Rajah S3** menunjukkan aci yang berputar dengan kelajuan malar membawa empat unit jisim A, B, C, D dengan jejari masing-masing dari paksi aci adalah 60 sm, 75 sm, 50 sm dan 60 sm. Jarak setiap jisim dari jisim A adalah seperti di rajah. Diberi jisim B= 5 kg dan C = 2 kg dan sudut di antara jisim B dan C ialah 60°.

(a) Tentukan nilai jisim D dan sudut di antara jisim B dan D menggunakan kaedah pengiraan momen.
(b) Tentukan nilai jisim D dan sudut di antara jisim B dan D menggunakan kaedah vektor.
(c) Terangkan dengan jelas kaedah yang boleh digunakan pada aplikasi sebenar bagi menentukan sesuatu imbangan.

(20 markah)

S4 (a) Senaraikan **dua (2)** contoh bagi geseran statik dan geseran dinamik.

(4 markah)

(b) Bebenang skru persegi memerlukan satu daya untuk menaikkan beban berjisim 200 kg. Diameter purata dan jarak antara ulir skru adalah 50 mm dan 15 mm masing-masing. Diberi pekali geseran antara nat dan skru ialah 0.12. Jika dianggap pecutan graviti adalah 9.81 m/s^2;

(i) Keluarkan daya yang diperlukan untuk menaikan beban pada skru.
(ii) Terbitkan formula daya untuk menaikkan beban pada screw jika ulir screw persegi ditukar kepada ulir jenis "Vee".
(iii) Tentukan peratusan kecekapan screw jenis "Vee" jika diberi sudut β pada ulir adalah 10°.

(16 markah)

S5 **Rajah S5** menunjukkan satu mekanisma tuil berayun di mana putaran stabil roda menghasilkan gerakan berayun OA tuil. Kedua-dua roda dan tuil dipasang di pusat-pusat tetap. roda berputar mengikut arah jam pada halaju sudut seragam (ω) sebanyak 100 rad/s. Diberi BC = 35 mm, AB = 110 mm, OA = 60 mm and OC = 100 mm.

(a) Lukis gamba rajah halaju dan pecutan untuk mekanisme dalam **Rajah S5**

(7 markah)

(b) Tentukan;

(i) Halaju mutlak pada titik A dan halaju sudut pautan AB.
(ii) Pecutan empar pada titik A dan pecutan sudut pautan OA.

(13 markah)

S6 (a) Takrifkan *'free vibration'*. Bincangkan persamaan diantara getaran tak teredam dan teredam.

(4 markah)

(b) **Rajah S6 (b)** menunjukkan *platform* nipis seragam yang mempunyai panjang 5 m, lebar 1 m dan berjisim 100 kg. Platform ini berengsel di titik O dan membawa muatan 20 kg diletakkan tengah tengahnya. Ia disokong dalam kedudukan mendatar oleh 2 spring yang simetri di titik P dan Q yang masing masing mempunyai pemalar kekukuhan 10 kN / m dan 5 kN / m.

(i) Kirakan momen inersia pada titik O.
(ii) Kirakan mampatan pada setiap spring.
(ii) Tentukan frekuensi tabii platform pada engselnya.

(16 markah)

- SOALAN TAMAT –

ENGLISH

Q1 (a) *List **four (4)** classification of gear according to gear mating and shaft position for power transmission.*

(4 marks)

(b) **Figure Q1 (b)** shows a *gear set has 6 teeth on the driver gear and 30 teeth on a driven gear. Given the input torque and speed is 300 Nm and 250 rpm clockwise respectively. Gear efficiency is 70%. Moment inertia of shaft on the driver and driven gear is 20 kgm2 and 81 kgm2 respectively. Then;*

(i) *Calculate the output power without the effect of moment inertia on gears.*
(ii) *Carry out the output torque without the effect of moment inertia on gears.*
(iii) *Calculate the equivalent moment of inertia if the moment inertia effects on gears.*
(iv) *Determine 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 40 rad/s2.*

(16 marks)

Q2 (a) *State **four (4)** factors that need to be considered in selecting a suitable belt type.*

(4 marks)

(b) *An open belt running over two pulleys 1.5 m and 1.0 m diameters connects two parallel shafts 4.8 m apart. The initial tension in the belt when stationery is 3000 N. The mass of belt is given as 0.6703 kg/m length. If the smaller pulley is rotating at 600 rpm. and coefficient of friction between the belt and pulley is 0.3;*

(i) *Calculate the centrifugal tension.*
(ii) *Calculate the tension on the tight side and slack side.*
(iii) *Determine the power transmitted.*

(16 marks)

Q3 ***Figure Q3** shows a shaft is rotating with constant speed carries four masses A,B,C,D with radius of each masses from shaft axes are 60 cm, 75 cm, 50 cm and 60 cm respectively. The distance of each mass from point A is shown the figure. Given mass B=5 kg and C=2 kg. Angle between mass B and C is 60°.*

(a) *Carry out the value of mass D and the angle between B and D using moment calculation method.*
(b) *Carry out the value of mass D and the angle between B and D using vector method.*
(c) *Explain the methods that can be used in the real application for determination of a balancing.*

(14 marks)

Q4 (a) *List **two (2)** examples of static friction and dynamic friction.*

(4 marks)

(b) *Square threaded screws require a force to raising the load of 200 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 0.12. If assume acceleration of gravity is 9.81 m/s2;*

(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 10 °.

(16 marks)

Q5 ***Figure 5** shows a rocking lever mechanism in which steady rotation of the wheel produces an oscillating motion of the lever OA. Both the wheel and the lever are mounted in fixed centers. The wheel rotates clockwise at a uniform angular velocity (ω) of 100 rad/s. Given BC = 35 mm, AB = 110 mm, OA = 60 mm and OA = 100 mm.*

*(a) Draw the velocity diagram and acceleration diagram for mechanism in **Figure Q5**.*

(7 marks)

(b) Determine:

(i) Absolute velocity at point A and angular velocity of link AB.
(ii) Centrifugal acceleration of point A and angular acceleration of link OA.

(13 marks)

Q6 *(a) Define free vibration. Discuss the similarities between undamped and damped vibration*

(4 marks)

*(b) **Figure Q6 (b)** shows a uniform thin platform 5 m long, 1 m wide and mass 100 kg carries a central load of 20 kg and is hinged at point O. It is supported in the horizontal position by two springs symmetrically placed at P and Q, whose stiffness are 10 kN/m and 5 kN/m respectively.*

(i) Calculate the moment of inertia of the system at point.
(ii) Calculate the compression of each of the spring.
(iii) Determine the natural frequency of the platform about its hinge.

(16 marks)

- END OF QUESTIONS -

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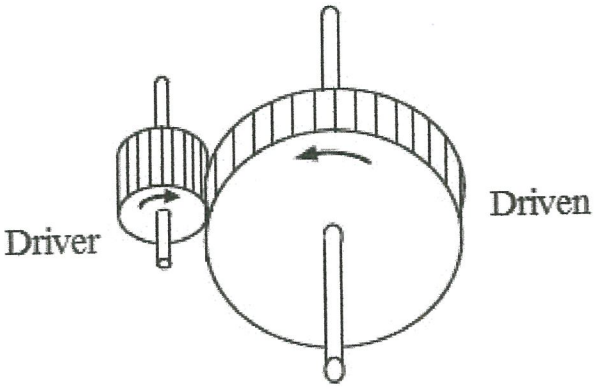
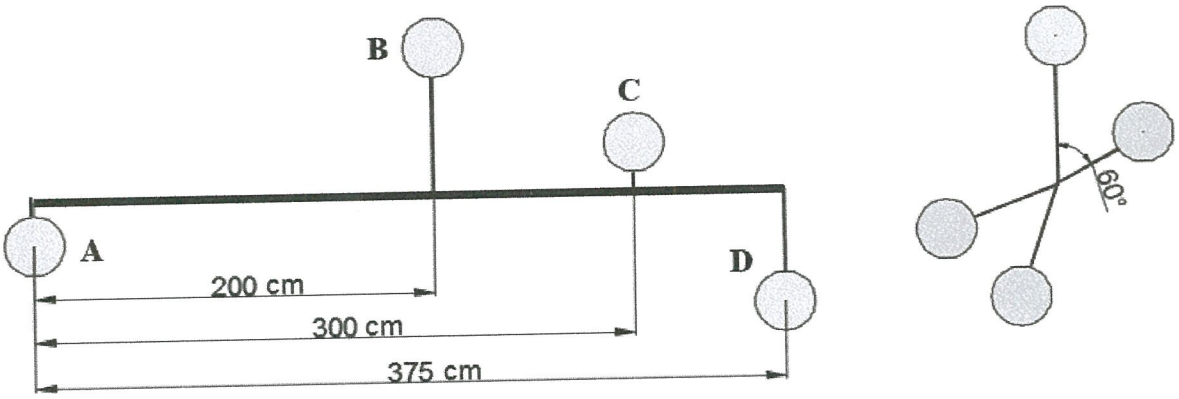


Rajah S1 (b) / *Figure Q1 (b)*



Rajah S3 / *Figure Q3*

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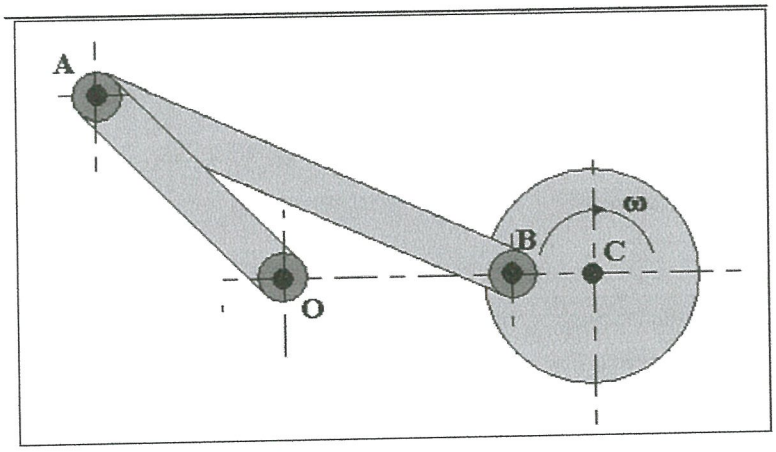
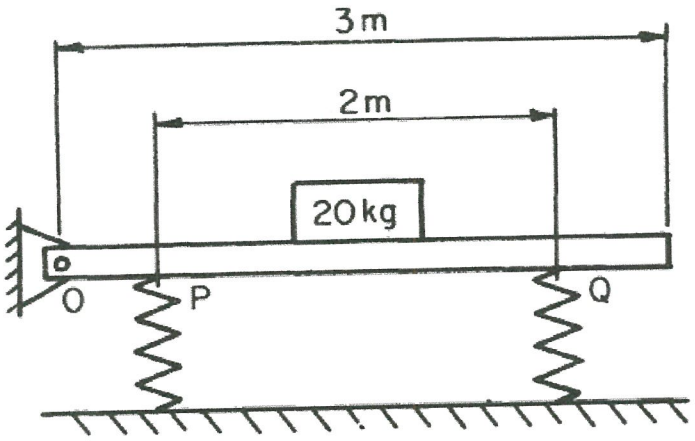


Rajah S5 / *Figure Q5*



Rajah S6 (b) / *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. Equivalent Moment of Inertia, $I_{equiv} = \left(I_A + \frac{I_B n^2}{\eta_G} \right)$
3. Velocity Ratio for belt drives, $n = \frac{N_2}{N_1} = \frac{d_1}{d_2} = \frac{t_1}{t_2}$
4. Belt tension ratio for flat belt, $\frac{T_1}{T_2} = e^{\mu\theta}$
5. Belt tension ratio for V-Belt, $\frac{T_1}{T_2} = e^{\left(\frac{\mu\theta}{\sin\beta}\right)} = e^{(\mu\theta)(\mathrm{cosec}\beta)}$
6. V-Belt type force balance, $R_N = \frac{R}{2\sin\beta}$
7. Power for Belt Drives, $P = (T_1 - T_2)v$
8. Centrifugal force term, $T_c = \rho A v^2$
9. Limiting Angle of Friction, $\tan\phi = \frac{F}{R_N} = \mu$
10. Inclination of Square Threaded Screw, $\tan\alpha = \frac{p}{\pi d}$
11. Force to moving up or lowering down , $P = W\tan(\phi \pm \alpha)$
12. Efficiency for Square Threaded Screw jack , $\eta = \frac{p}{\pi D \tan(\phi + \alpha)}$

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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, $\sum M_O = I_O \ddot{\theta}$

16. Principle of conversion of energy, $\frac{d}{dt}[T.K + T.U]$