UNIVERSITI TUN HUSSEIN ONN MALAYSIA

PEPERIKSAAN AKHIR
SEMESTER II
SESI 2011/2012

NAMA KURSUS	:	MEKANIK MESIN
KOD KURSUS	:	DDA 3043 / DAM 31703
PROGRAM	:	3 DDM / DAM / DAI
TARIKH PEPERIKSAAN	:	MAC 2012
JANGKA MASA	:	3 JAM
ARAHAN	:	JAWAB **LIMA (5)** SOALAN DARIPADA **ENAM (6)** SOALAN

KERTAS SOALAN INI MENGANDUNGI SEBELAS (11) MUKA SURAT

SOALAN DI DALAM BAHASA MELAYU

S1 (a) Merujuk kepada **Rajah S1 (b)**, kirakan Darjah Kebebasan (DOF). **Rajah S1 (a)** adalah aplikasi kepada mekanisme.

(3 markah)

(b) Gear boleh diklasifikasikan mengikut kedudukan relatif paksi pertemuan gear. Terangkan **Tiga (3)** klasifikasi gear berserta contoh.

(6 markah)

(c) Kotak gear mempunyai kelajuan masukan *2500 p.p.m* mengikut arah jam dan kelajuan keluaran *600 p.p.m* arah lawan jam. Kuasa masukan ialah *70 kW* dan kecekapan *45%*. Tentukan yang berikut:

(i) Daya kilas masukan.
(ii) Kuasa keluaran.
(iii) Daya kilas keluaran dan daya kilas memegang

(12 markah)

S2 (a) Senaraikan **Tiga (3)** jenis pemacu tali sawat.

(3 markah)

(b) Beri **Lima (5)** kelebihan sistem pemacu tali sawat berbanding dengan sistem penghantaran kuasa lain.

(5 markah)

(c) Satu tali sawat rata digunakan untuk sistem pemacu tali sawat yang menyambungkan dua takal pada jarak *1.5 m*. Takal pemandu dengan *50 sm* diameter berputar pada kelajuan *400 p.p.m*, manakala diameter takal yang dipacu ialah *120 sm*. Pekali geseran permukaan sentuhan antara tali sawat dan takal adalah *0.4*. Ketegangan maksima yang dibenarkan ialah *700 N*. Tentukan:

(i) Kuasa yang dihantar oleh tali sawat.
(ii) Ketegangan awal tali sawat.
(iii) Kuasa yang dihantar jika tali sawat rata digantikan oleh tali sawat V dengan sudut alur *25°*.

(12 markah)

S3 (a) Huraikan **Dua (2)** jenis pengimbangan.

(4 markah)

(b) Merujuk pada **Rajah S3**, cari jisim dan sudut di mana ia perlu diletakkan dalam satah *A* dan *D* pada jejari *60 mm* untuk menghasilkan pengimbangan lengkap kepada sistem yang ditunjukkan.

(16 markah)

S4 (a) Terangkan dengan ringkas **Dua (2)** jenis geseran.

(4 markah)

(b) Diameter min bebenang persegi skru jek seperti ditunjukkan pada **Rajah S4** ialah *55 mm*. Pic benang ialah *15 mm*. Pekali geseran adalah *0.16*. Kira kecekapan dan daya yang perlu dikenakan pada hujung tuil *0.7 m* panjang, yang berserenjang dengan paksi membujur skru untuk menaikkan beban sebanyak *25 kN* dan untuk menurunkannya.

(16 markah)

S5 (a) Huraikan **Empat (4)** jenis penterbalikan di dalam mekanisme engkol gelangsar dan contoh bagi setiap penterbalikan ini.

(4 markah)

(b) Dalam mekanisme engkol gelongsor, panjang engkol *OA* dan rod penyambung *AB* adalah masing-masing *0.125 m* dan *0.5 m*. Pusat graviti *G* rod penyambung adalah *0.275 m* dari gelongsor B. Kelajuan engkol *600 p.p.m* mengikut arah jam. Apabila engkol telah berpusing *45°* dari kedudukan tengah mati dalam, tentukan:

(i) Halaju gelongsor *B*.
(ii) Halaju sudut rod penyambung.
(iii) Halaju titik *G*.
(iv) Halaju gosokan di semua pin aci engkol, engkol dan kepala-rentas, apabila diameter pin masing-masing adalah *0.05 m*, *0.06 m* dan *0.03 m*.

(16 markah)

S6 (a) Terangkan dengan jelas mengenai getaran bebas.

(6 markah)

(b) Nyatakan **Dua (2)** contoh untuk setiap getaran yang dikehendaki dan getaran yang tidak dikehendaki.

(4 markah)

(c) Rod seragam nipis, *AB* yang ditunjukkan dalam **Rajah S6** mempunyai jisim *1 kg* dan membawa jisim tertumpu sebanyak *3.5 kg* di *B*. Rod digantung pada A dan dikekalkan dalam kedudukan melintang oleh pegas berketegangan *2 kN/m* pada *C*. Dapatkan frekuensi ayunan. (Abaikan kesan jisim spring)

(10 markah)

SOALAN DI DALAM BAHASA INGGERIS

Q1 (a) Referring on **Figure Q1 (b)**, calculate Degrees of Freedom (DOF). **Figure Q1 (a)** is an application of the mechanism.

(3 marks)

(b) Gears can be classified according to the relative position of the axes of mating gears. Describe **Three (3)** gear classifications with example.

(6 marks)

(c) A gear box has an input speed of *2500 rpm* clockwise and an output speed of *600 rpm* anticlockwise. The input power is *70 kW* and the efficiency is *45%*. Determine the following.

(i) The input torque.
(ii) The output power.
(iii) The output torque and holding torque

(12 marks)

Q2 (a) List **Three (3)** types of belt drive.

(3 marks)

(b) Give **Five (5)** advantages of belt drive system compared to other power transmission system.

(5 marks)

(c) A flat belt type is used for a belt drive system connecting two pulleys *1.5 m* apart. The driver pulley with diameter *50 cm* is rotating with speed *400 rpm*, while diameter of driven pulley is *120 cm*. Coefficient of friction of the contact surface between belt and pulley is *0.4*. Maximum allowable tension is *700 N*. Find:

(i) Power transmitted by the belt
(ii) Initial tension of the belt
(iii) The power transmitted if the flat belt is replaced by the V-belt with groove angle of *25°*.

(12 marks)

Q3 (a) Describe **Two (2)** types of balancing.

(4 marks)

(b) Referring on **Figure Q3**, find the mass and the angle at which it should be positioned in planes A and D at a radius of *60 mm* in order to produce complete balance of the system shown.

(16 marks)

Q4 (a) Briefly describe **Two (2)** types of friction.

(4 marks)

(b) The mean diameter of a square threaded screw jack as shown in **Figure Q4** is *55 mm*. The pitch of the thread is *15 mm*. The coefficient of friction is *0.16*. Calculate the efficiency and force that must be applied at the end of a *0.7 m* long lever, which is perpendicular to the longitudinal axis of screw to raise a load of *25 kN* and to lower it.

(16 marks)

Q5 (a) Describe **Four (4)** types of inversion in slider crank mechanism and example for each inversion.

(4 marks)

(b) In slider crank mechanism, the length of crank *OA* and connecting rod *AB* are *0.125 m* and *0.5 m* respectively. The centre of gravity *G* of the connecting rod is *0.275 m* from slider *B*. The crank speed is *600 r.p.m* clockwise. When the crank has turned *45°* from the inner dead centre position, determine:

(i) Velocity of slider *B*.
(ii) Angular velocity of connecting rod.
(iii) Velocity of point *G*.
(iv) Rubbing velocity at all pins of the crankshaft, crank and cross-head, when the diameter of their pins are *0.05 m*, *0.06 m* and *0.03 m* respectively.

(16 marks)

Q6 (a) Explain clearly on free vibration.

(6 marks)

(b) State **Two (2)** examples each for desirable vibration and undesirable vibration.

(4 marks)

(c) A uniform thin rod, *AB* shown in **Figure Q6** has a mass of *1 kg* and carries a concentrated mass of *3.5 kg* at B. The rod is hinged at *A* and is maintained in the horizontal position by a spring of stiffness *2 kN/m* at *C*. Find the frequency of oscillation. (Neglect the effects of the spring mass)

(10 marks)

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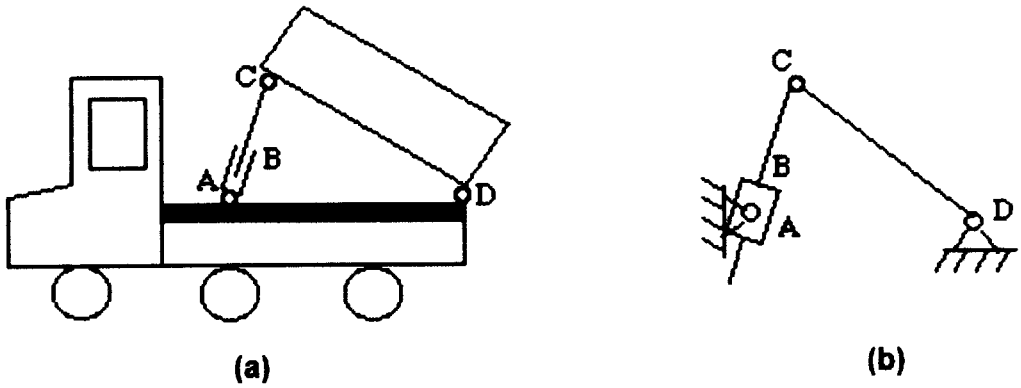
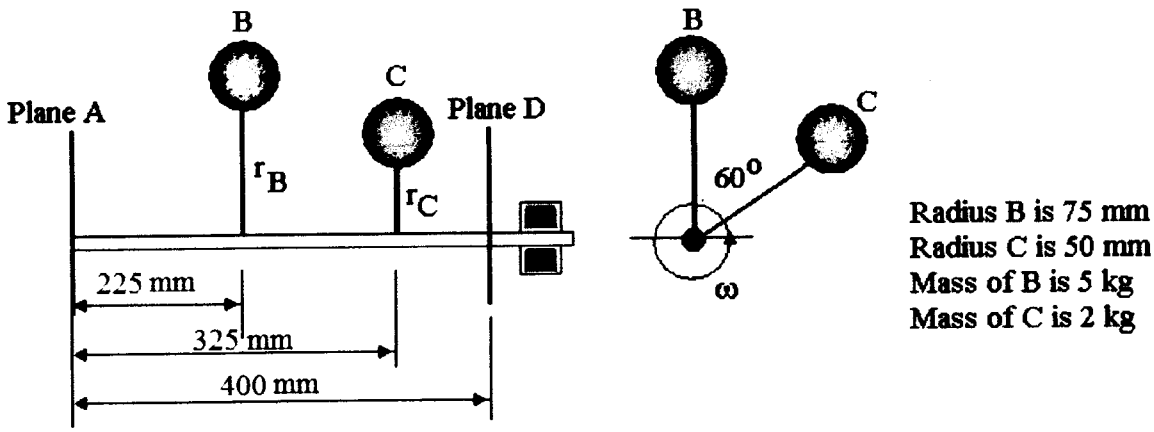
KURSUS *COURSE*	:	**MEKANIK MESIN**	**KOD KURSUS** *COURSE CODE*	:	**DDA 3043/DAM 31703**



Rajah S1 / Figure Q1



Rajah S3 / Figure Q3

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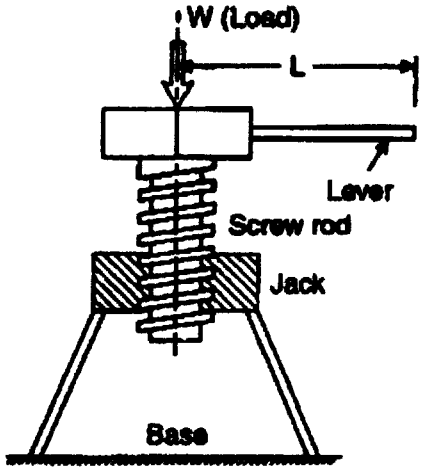
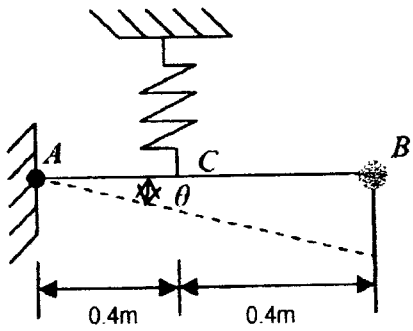


Rajah S4 / Figure Q4



Rajah S6 / Figure Q6

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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, $n = \frac{N_2}{N_1} = \frac{d_1}{d_2}$
4. Belt tension ratio for flat belt, $\frac{T_1}{T_2} = e^{\mu\theta}$
5. Belt tension ratio for V-Belt, $\frac{T_1}{T_2} = e^{\left(\frac{\mu\theta}{\sin\beta}\right)} = e^{(\mu\theta)(\operatorname{cosec}\beta)}$
6. V-Belt type force balance, $R_N = \frac{R}{2\sin\beta}$
7. Maximum Power for Belt Drives, $P = (T_1 - T_2)v$
8. Centrifugal force term, $\rho A v^2 = T_C$
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. Efficiency for Square Threaded Screw, $\eta = \frac{p}{\pi D \tan(\beta + \alpha)}$
12. Radial component of acceleration, $f_{BA}^r = \omega^2 (BA) = \frac{(V_{BA})^2}{BA}$

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13. Tangential component of acceleration, $f'_{BA} = \alpha(BA)$

14. Newton's Second Law of Motion, $\sum M_O = I_O\ddot{\theta}$

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