UNIVERSITI TUN HUSSEIN ONN MALAYSIA

PEPERIKSAAN AKHIR
SEMESTER II
SESI 2009/2010

SUBJECT	:	MECHANIC OF MACHINE
SUBJECT CODE	:	BDA 2033
COURSE	:	2 BDD
EXAMINATION DATE	:	APRIL/MEI 2010
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER FIVE (5) OUT OF SIX (6) QUESTIONS

THIS PAPER CONSIST OF TEN (10) PAGES

S1 (a) (i) Apakah rangkaian gear dan nyatakan jenis rangkaian gear.

(4 markah)

(ii) Lakarkan tiga jenis rangkaian gear. (3 markah)

(b) **Rajah S1** menunjukkan satu sistem lif yang dipacu oleh motor elektrik melalui dua set sistem gear pengecilan. Motor menghasilkan daya kilas maksimum 1600 Nm dan kecekapan penghantaran diantara sentuhan gear 1 dan 2 ialah 90% manakala sentuhan gear 3 dan 4 ialah 95%. Satu daya tetap 500 N merintangi pergerakan pada lif dan penimbal. Data bagi sistem lif adalah seperti di bawah,

Diameter gegendang	=	1 m
Bilangan gigi gear 1	=	50
Bilangan gigi gear 2	=	70
Bilangan gigi gear 3	=	40
Bilangan gigi gear 4	=	50
Momen inersia syaf gegendang	=	55 kgm^2
Momen inersia syaf tengah	=	30 kgm^2
Momen inersia syaf motor	=	7 kgm^2

Dapatkan jisim (M2) supaya lif dapat bergerak naik dengan pecutan 0.5 m/s^2 dengan membawa jumlah beban pada lif sebanyak 2500 kg. Ambil g = 9.81 m/s^2 (13 markah)

S2 (a) Senaraikan lima kelebihan sistem tali sawat berbanding sistem penghantaran kuasa yang lain. (5 markah)

(b) Senaraikan dan lakarkan tiga jenis susunan sistem tali sawat

(3 markah)

(c) Satu sistem tali sawat terbuka menghubungkan dua takal bergarispusat 120 cm dan 50 cm pada aci selari yang berjarak 4 meter antara satu sama lain. Jisim tali sawat per unit panjang ialah 0.9 kg/m dan tegangan maksima tidak melebihi 2000 N. Pekali geseran ialah 0.3. Takal pemacu iaitu takal yang bergarispusat 120 cm bergerak pada kelajuan 200 p.p.m. Disebabkan oleh gelinciran, halaju takal penurut hanyalah 400 p.p.m. Tentukan :-

(i) Nilai daya kilas pada kedua-dua aci

(ii) Kuasa yang dihantar

(iii) Kehilangan kuasa disebabkan oleh geseran

(iv) Kecekapan sistem tali sawat ini.

(12 markah)

S3 (a) Apa yang anda faham dengan istilah keseimbangan dalam kejuruteraan? Apakah perbezaan di antara imbangan statik dan imbangan dinamik?

(5 markah)

(b) Senaraikan dan jelaskan tiga peralatan atau mesin yang mementingkan keseimbangan dalam pengoperasiannya. (3 markah)

(c) **Rajah S3** menunjukkan satu sistem yang mempunyai tiga pemberat pada aci yang berputar. W_1= 40 N @ 90° pada jejari 101.6 mm, W_2 =40 N @ 225° pada jejari 152.4 mm, dan W_3 =26.7 N @ 315° pada jejari 254 mm. Tentukan nilai magnitud dan sudut pemberat imbang yang diperlukan untuk keseimbangan sistem itu secara dinamik. Pemberat imbang pada satah 4 dan 5 diletakkan pada jejari 76.2mm.

(12 markah)

S4 (a) Senaraikan dua bentuk geseran? Jelaskan. (6 markah)

(b) Daya 2 kN diperlukan untuk menggerakkan sebuah bongkah ke bawah pada satu satah condong dengan sudut 15°, daya adalah selari dengan satah. Jika sudut kecondongan satah adalah 20°, daya yang diperlukan menjadi 2.3 kN. Cari:

(i) Pekali geseran

(ii) Berat bongkah

(14 markah)

S5 (a) *ABCD* ialah penyambung empat bar dengan sambungan *AD* ditetapkan seperti dalam **Rajah S5**. Panjang penyambung-penyambung tersebut adalah $AB = 7$ cm, $BC = 5$ cm, $CD = 9$ cm, $AD = 16.5$ cm dan $BC = CF = BF$. Engkol *AB* membuat 100 rpm mengikut arah jam. Sudut *BAD* ialah 45°.

(i) Lukiskan gambarajah halaju untuk mekanisma dalam **Rajah S5**. (8 markah)

(ii) Halaju sudut penyambung *BC*. (2 markah)

(iii) Halaju titik *E*, di mana *BE* : *EC* ialah 2 : 1. (4 markah)

(iv) Halaju titik *F*, yang mana berada di luar *ABCD*. (6 markah)

S6 (a) Redaman adalah sebuah mekanisme di mana tenaga getaran ditukar secara berkala kepada bentuk tenaga haba atau bunyi. Terangkan 3 model bagi sistem redaman. (6 markah)

(b) Terbitkan persamaan bagi frekuensi tabii bagi sistem berikut:

(i) Sistem bandul ringkas

(ii) Sistem spring-jisim

Nota: Untuk soalan (b), anda boleh gunakan sama ada Hukum Gerakan Newton atau Prinsip Keabadian Tenaga

(14 markah)

Q1 (a) (i) What is a gear train and state the types of gear train? (4 marks)

(ii) Sketch the three types of gear train? (3 marks)

(b) **Figure Q1** shows a lift system driven by an electric motor through two sets of gear reducing system. The motor produces a maximum torque of 1600 Nm. The transmission efficiency between gear 1 and 2 is 90% while for gear 3 and 4 is 95%. A constant load of 500 N is resisting the movement of the lift system. Data for the lift system is given below,

Hoist diameter	=	1 m
No. of teeth gear 1	=	50
No. of teeth gear 2	=	70
No. of teeth gear 3	=	40
No. of teeth gear 4	=	50
Moment of inertia hoist shaft	=	55 kgm^2
Moment of inertia centre shaft	=	30 kgm^2
Moment of inertia motor shaft	=	7 kgm^2

Find the load mass (M2) so that the lift can move upward with acceleration of 0.5 m/s^2 while carrying total load of 2500 kg. Take g =9.81 m/s^2

(13 marks)

Q2 (a) Describe five advantages of belt drive system compared to other forms of power transmission. (5 marks)

(b) With the aid of sketches, list three types of belt drives system arrangement (3 marks)

(c) An open belt drive connects two pulleys 120 cm and 50 cm diameter, on parallel shafts 4 meters apart. The mass of belt per metre length is 0.9 kg/m and the maximum tension is not to exceed 2000 N. The coefficient of friction is 0.3. The 120 cm pulley, which is the driver runs at 200 r.p.m. Because of belt slip, on one of the pulleys, the velocity of the driven pulley is only 400 r.p.m. Determine :-

(i) the torque on each of the two shafts

(ii) the power transmitted

(iii) the power lost in friction

(iv) the efficiency of the drive

(12 marks)

Q3 (a) What is balancing in engineering words? What is the difference between a static balance and a dynamic balance?

(5 marks)

(b) Describe and explain three different devices or machines where balancing play an important role in its operation. (3 marks)

(c) **Figure Q3** shows a system with three weights on a rotating shaft. W_1= 40 N @ 90° at a 101.6-mm radius, W_2 =40 N @ 225° at a 152.4-mm radius, and W_3 =26.7 N @ 315° at a 254-mm radius. Determines the magnitudes and angles of the balance weights needed to dynamically balance the system. The balance weights in planes 4 and 5 are placed at a 76.2-mm radius.

(12 marks)

Q4 (a) Describe the two forms of friction and explain. (6 marks)

(b) An effort of 2 kN is required just to move a certain body down an inclined plane of angle 15°, the force acting parallel to the plane. If the angle of inclination of the plane is made 20°, the effort required again, applied parallel to the plane is found to be 2.3 kN. Find;

(i) The coefficient of friction. (7 marks)

(ii) Weight of the body (7 marks)

Q5 (a) *ABCD* is a Four Bar Chain with the link *AD* is fixed as in **Figure Q5**. The length of the links are *AB* = 7 cm, *BC* = 5 cm, *CD* = 9 cm, *AD* = 16.5 cm and *BC* = *CF* = *BF*. The crank *AB* makes 100 rpm in the clockwise direction. The angle *BAD* is 45°.

(i) Draw the velocity diagram for the mechanism in **Figure Q5** (8 marks)

(ii) Find the angular velocity of link *BC*. (2 marks)

(iii) Find the velocity of point *E*, where *BE : EC* is 2 : 1. (4 marks)

(iv) Find the velocity of point *F*, which is lying outside *ABCD* (6 marks)

Q6 (a) Damping is a mechanism by which vibration energy is gradually converted into heat or sound. Explain 3 models of damping system. (6 marks)

(b) Derive an expression for the natural frequency, ω_n for following system:

(i) Simple pendulum system

(ii) Mass spring system

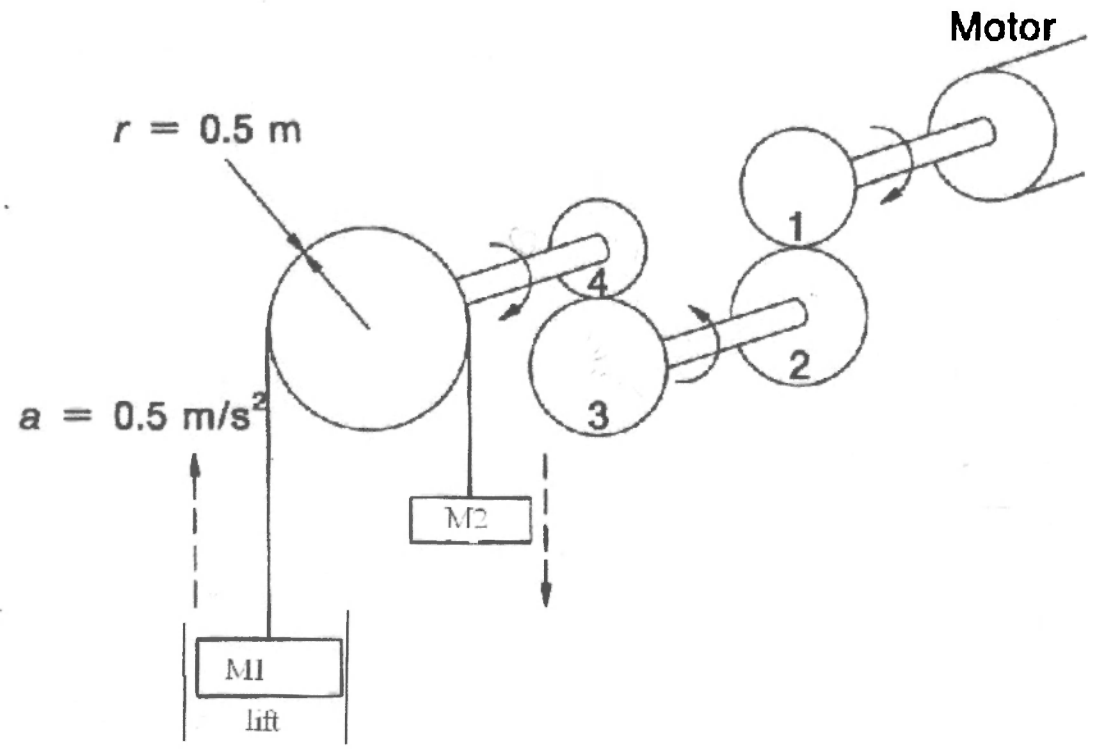
Note: For Q6(b) you might use either Newton's Law of Motion or Principle of Conservation of Energy.

(14 marks)

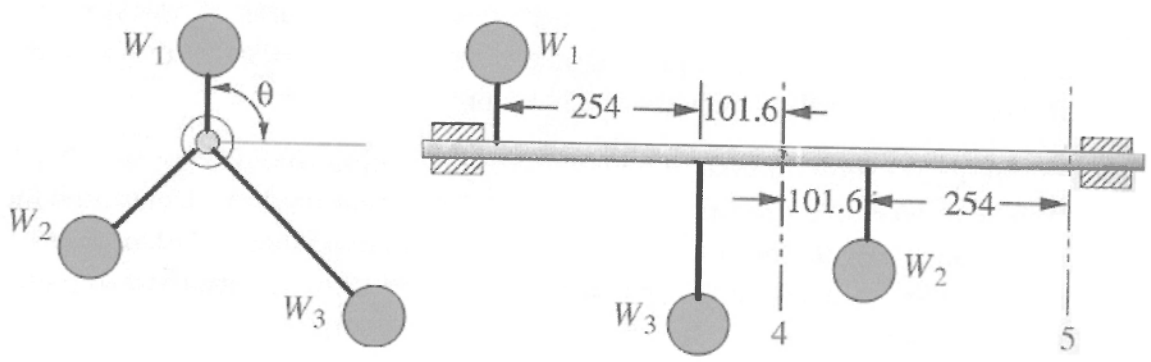
PEPERIKSAAN AKHIR

SEMESTER/SESI : 2/2009/2010 **KURSUS : 2 BDD**

MATAPELAJARAN : MEKANIK MESIN **KOD M/P : BDA 2033**



Rajah S1/Figure Q1



Rajah S3/Figure Q3

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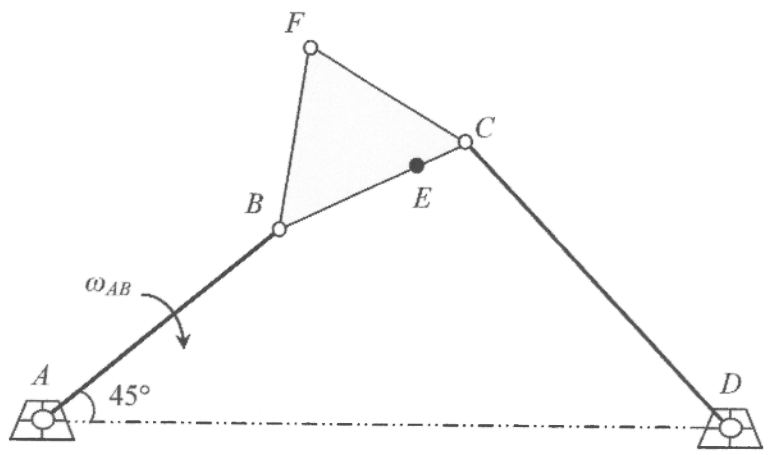

RAJAH S5/Figure Q5

PEPERIKSAAN AKHIR

LAMPIRAN 1

SEMESTER/SESI : 2/2009/2010 **KURSUS : 2 BDD**

MATAPELAJARAN : MEKANIK MESIN **KOD M/P : BDA 2033**

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. V-Belt type force balance, $R_N = \frac{R}{2\sin\beta}$
6. Maximum Power for Belt Drives, $P = (T_1 - T_2)v$
7. Centrifugal force term, $\rho A v^2 = T_C$
8. Limiting Angle of Friction, $\tan\phi = \frac{F}{R_N} = \mu$
9. Inclination of Square Threaded Screw, $\tan\alpha = \frac{p}{\pi d}$
10. Motion Up the Plane, $P = W \frac{\tan\alpha + \tan\phi}{1 - \tan\alpha \tan\phi}$
11. Clutch under Uniform Pressure condition, $\frac{T}{W} = \frac{2}{3}\mu \left[\frac{r_1^3 - r_2^3}{r_1^2 - r_2^2} \right]$
12. Clutch under Uniform Wear condition, $T = \frac{\mu W}{2} \times (r_1 + r_2)$
13. Acceleration in Harmonic Motion, $\ddot{x} = -Aw^2 \sin\omega t = -\omega^2 x$
14. Logarithmic Decayed, $\ln\left(\frac{\theta_1}{\theta_r}\right) = (r-1)2\pi\xi / \left(\sqrt{1-\xi^2}\right)$