SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI JUN 2015

DJJ 3053: ENGINEERING MECHANICS

TARIKH : 04 NOVEMBER 2015
TEMPOH : 8.30 AM – 10.30 AM (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** halaman bercetak.
Soalan Struktur (4 Soalan). Jawab **SEMUA** soalan.
Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

INSTRUCTION:

This section consists of **FOUR (4)** structured questions. Answer **ALL** questions.

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO 1, C1

a) Define the terms below;

Takrifkan istila-istilah di bawah.

i. Static [2 marks]

Statik [*2 markah*]

ii. Dynamic [2 marks]

Dinamik [*2 markah*]

iii. Third Newton's Law [2 marks]

Hukum Newton Ketiga [*2 markah*]

CLO 1, C2

b) Resolve the 30 N forces into components along the *u* and *v* axes as shown in **Figure 1(b)**.

*Leraikan daya 30 N kepada komponen sepanjang paksi u dan paksi v seperti yang ditunjukkan dalam **Rajah 1(b)**.*

[6 marks]

[*6 markah*]

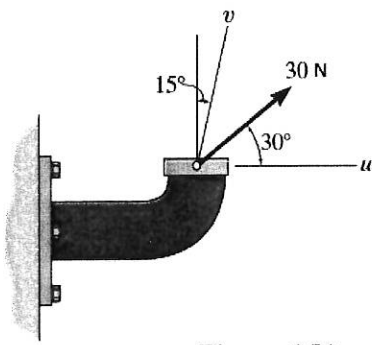


Figure 1(b)

Rajah 1(b)

CLO 1, C3

c) The link in **Figure 1(c)** is subjected to three forces F_1, F_2 and F_3. Determine the magnitude (F_R) and direction (θ) of the resultant force. Direction is measured as counterclockwise from the positive x axis. Apply the resultant force as a Cartesian vector.

Sambungan pada ***Rajah 1(c)*** *dikenakan tiga daya F_1, F_2 dan F_3. Tentukan magnitud (F_R) dan arah (θ) daya paduan. Arah daya paduan diukur lawan putaran jam daripada paksi positif x. Ungkapkan daya paduan dalam bentuk vektor Cartesian.*

[13 marks]

[*13 markah*]

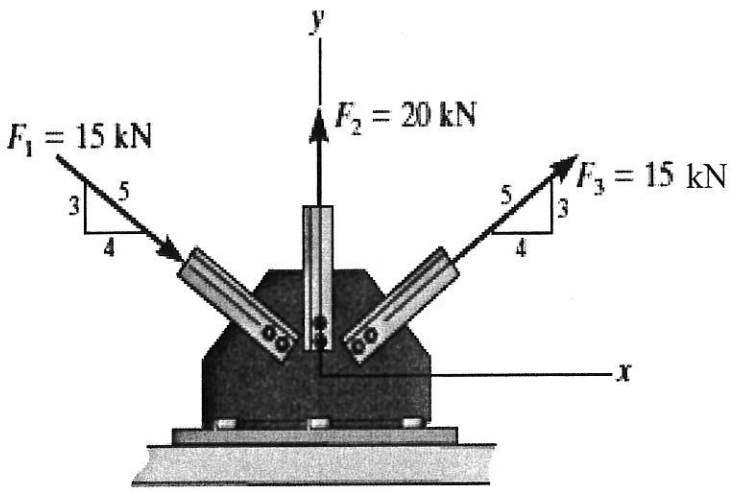


Figure 1(c)

Rajah 1(c)

QUESTION 2

SOALAN 2

CLO 1, C1

a) State the condition for the equilibrium of a particle.

Nyatakan keadaan keseimbangan bagi sesuatu zarah.

[2 marks]

[*2 markah*]

CLO 1, C2

b) Describe a plane truss.

Huraikan kekuda sesatah.

[3 marks]

[*3 markah*]

c) **Figure 2(c)** shows a truss is subjected to a horizontal force of 500N.

Rajah 2(c) *menunjukkan satu kekuda dikenakan daya mengufuk 500N.*

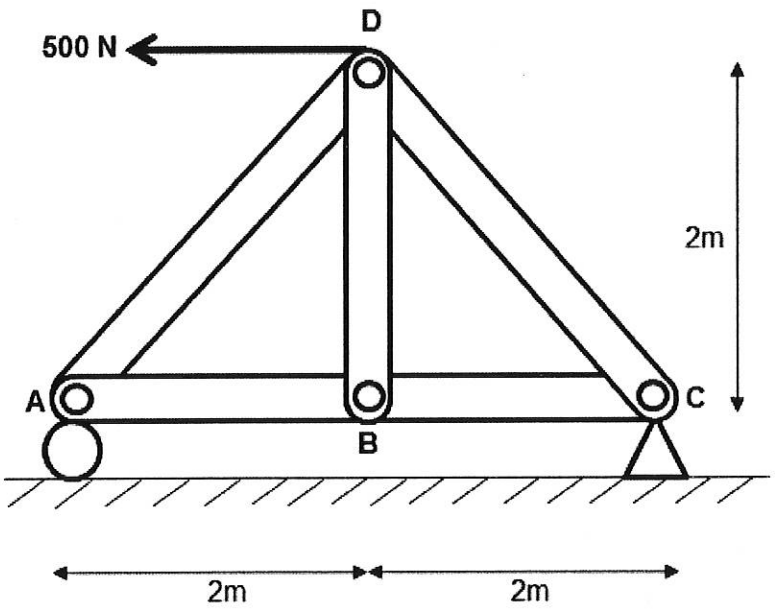


Figure 2(c)

Rajah 2(c)

CLO 1, C3

i. Calculate the force in each member of the truss.
Hitung daya pada setiap anggota kekuda.

[16 marks]
[16 markah]

CLO 1, C4

ii. Identify whether the members are in tension or compression form.
Kenalpasti sama ada bahagian kerangka tersebut berada dalam keadaan regangan atau mampatan.

[4 marks]
[4 markah]

QUESTION 3

SOALAN 3

CLO 1, C1

a) Define:

i. Kinematics

ii. Velocity

iii. Acceleration

Takrifkan:

i. Kinematics

ii. Velocity

iii. Acceleration

[6 marks]

[*6 markah*]

CLO 1, C2

b) A ball in **Figure 3(b)** is thrown vertically upward with a speed of 15 m/s. Determine the time of flight when it returns to its original position.

*Sebiji bola seperti pada **Rajah 3(b)** dibaling secara menegak ke atas dengan halaju 15 m/s. Tentukan masa penerbangan apabila ia kembali ke kedudukan asalnya.*

[3 marks]

[*3 markah*]

Figure 3(b)

Rajah 3(b)

CLO 1, C3

c) The motion of a particle is defined by the relation $x = 1.5t^4 - 30t^2 + 5t + 10$, where x and t are expressed in meters and seconds, respectively. When t = 4s, determine:

i. the position,

ii. the velocity,

iii. the acceleration of the particle.

Pergerakan suatu zarah ditakrifkan oleh hubungan $x = 1.5t^4 - 30t^2 + 5t + 10$, *di mana x dan t dinyatakan dalam meter dan saat masing-masing. Apabila t = 4s, tentukan:*

i. kedudukan,

ii. halaju,

iii. pecutan zarah tersebut

[8 marks]

[*8 markah*]

CLO 1, C3

d) A car starts from rest and has an acceleration described by the graph in **Figure 3(d)**. Sketch the v-t graph for the time interval $0 \leq t \leq t'$, where t' is the time for the car to come to rest.

Sebuah kereta mula bergerak dari keadaan rehat dan mengalami pecutan digambarkan melalui graf dalam ***Rajah 3(d)****. Bentukkan graf v-t bagi sela masa* $0 \leq t \leq t'$, *di mana t' merupakan masa bagi kereta tersebut berhenti.*

[8 marks]

[*8 markah*]

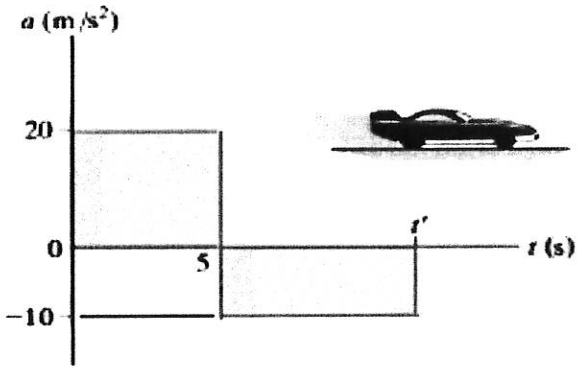


Figure 3(d)

Rajah 3(d)

QUESTION 4

SOALAN 4

CLO 1, C1

a) Describe Newton's second law. [4 marks]

Terangkan hukum Newton kedua. [*4 markah*]

CLO 1, C2

b) A 1500 kg crate is pulled along the ground with a constant speed of a distance for 25m, using a cable that makes a horizontal angle of 15°. Determine the tension in the cable and the work done by this force. The coefficient of kinetic friction between the ground and the crate is μ_k=0.55.

Sebuah kotak 1500 kg ditarik di atas lantai dengan halaju sekata berjarak 25m, menggunakan kabel yang bersudut 15^0 mengufuk. Kira daya tegangan kabel tersebut dan kerja yang dilakukan. Pekali geseran kinetik di antara lantai dan kotak ialah μ_k=0.55. [8 marks]

[8 *markah*]

CLO 1, C3

c) A man pushes a 60 N crate with a force **F**. The force is always directed down at 30° from the horizontal as shown in **Figure 4(c),** and the magnitude increases until the crate begins to slide. Determine the crate's initial acceleration if the coefficient of static friction is μ_s=0.6 and the coefficient of kinetic friction is μ_k=0.3.

*Seorang lelaki sedang menolak kotak dengan daya **F** 60N. Daya yang dikenakan pada sudut 30^0 pada garisan menufuk seperti **Rajah 4(c)** dan magnitud meningkat sehingga kotak bergelongsor. Tentukan pecutan awal peti itu jika pekali geseran statik adalah μ_s = 0.6 dan pekali geseran kinetik adalah μ_k = 0.3.*

[13 marks]

[13 *markah*]

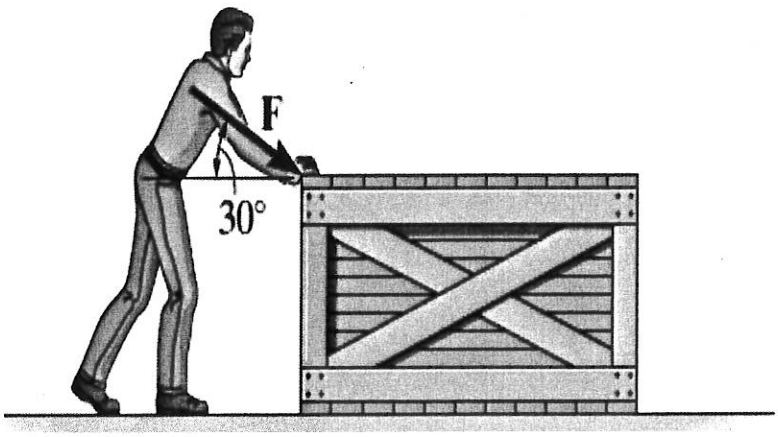


Figure 4(c)

Rajah 4(c)

SOALAN TAMAT

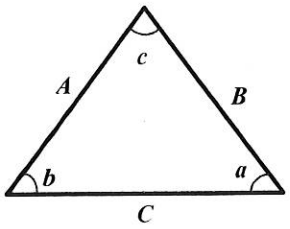
POLITEKNIK MALAYSIA

LIST OF FORMULA

DJJ3053 – ENGINEERING MECHANICS

STATICS

1. TRIANGLE RULE



Sine law:

$$\frac{A}{\sin a} = \frac{B}{\sin b} = \frac{C}{\sin c}$$

Cosine law:

$$C = \sqrt{A^2 + B^2 - 2AB\cos c}$$

2. ADDITION OF SYSTEM OF COPLANAR FORCE

$$(\overset{+}{\rightarrow})\ \Sigma F_x = F_{1x} + F_{2x} - F_{3x}$$

$$(+\uparrow)\ \Sigma F_y = F_{1y} - F_{2y} + F_{3y}$$

$$F_R = \sqrt{(\Sigma F_x)^2 + (\Sigma F_y)^2}$$

$$\theta = \tan^{-1}\left|\frac{\Sigma F_y}{\Sigma F_x}\right|$$

3. CARTESIAN VECTOR

$$\mathbf{A} = A_x\mathbf{i} + A_y\mathbf{j} + A_z\mathbf{k}$$

$$\mathbf{u}_A = \frac{\mathbf{A}}{A} = \frac{A_x}{A}\mathbf{i} + \frac{A_y}{A}\mathbf{j} + \frac{A_z}{A}\mathbf{k}$$

$$cos^2\alpha + cos^2\beta + cos^2\gamma = 1$$

$$\mathbf{F}_R = \Sigma\mathbf{F} = \Sigma F_x\mathbf{i} + \Sigma F_y\mathbf{j} + \Sigma F_z\mathbf{k}$$

$$\mathbf{r} = (x_B - x_A)\mathbf{i} + (y_B - y_A)\mathbf{j} + (z_B - z_A)\mathbf{k}$$

$$\mathbf{F} = F\mathbf{u} = F\frac{\mathbf{r}}{r}$$

4. EQUILIBRIUM OF PARTICLE

$$\Sigma\mathbf{F} = 0$$

$$F = ks$$

DYNAMICS

1. RECTILINEAR MOTION OF PARTICLES

$$v = {}^{dx}/_{dt}$$

$$a = {}^{dv}/_{dt}$$

2. UNIFORM RECTILINEAR MOTION

- v constant

$$x = x_o + vt$$

- a constant

$$v = v_o + at$$

$$x = x_o + v_o t + \frac{1}{2}at^2$$

$$v^2 = v_o^2 + 2a(x - x_o)$$

3. WORK OF FORCE

$$U_{1\rightarrow 2} = (F\cos\alpha)\Delta x$$

4. KINETIC ENERGY OF PARTICLE

$$T = \frac{1}{2}mv^2$$

$$U_{1\rightarrow 2} = T_2 - T_1$$