SULIT

KEMENTERIAN PENDIDIKAN TINGGI
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI II : 2024/2025

DJJ30093 : ENGINEERING MECHANICS

TARIKH : 20 MEI 2025
MASA : 8.30 PAGI - 10.30 PAGI (2 JAM)

Kertas ini mengandungi **SEPULUH (10)** halaman bercetak.

Struktur (4 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

CLO1

(a) Figure 1(a) shows a rocket launched into space. Based on the figure:
Rajah 1(a) menunjukkan sebuah roket dilancarkan ke angkasa. Berdasarkan pada rajah tersebut:

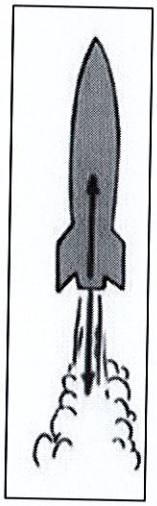


Figure 1(a) / *Rajah 1(a)*

i. Name the best Newton's Law to describe the situation.
Namakan Hukum Newton yang sesuai untuk menggambarkan situasi tersebut.

[1 mark]
[1 *markah*]

ii. Define the Newton's Law in Question 1(a)(i).
Takrifkan Hukum Newton pada Soalan 1(a)(i).

[3 marks]
[3 *markah*]

CLO1

(b) A plate is subjected to the forces F1, F2 and F3 as shown in Figure 1(b). The magnitude of F1, F2 and F3 are 4 kN, 6 kN and 5 kN respectively. Calculate:
Satu kepingan plat dikenakan daya F_1, F_2 dan F_3 seperti yang ditunjukkan pada ***Rajah 1(b)****. Nilai daya F_1, F_2 dan F_3 adalah 4 kN, 6 kN dan 5 kN. Kirakan:*

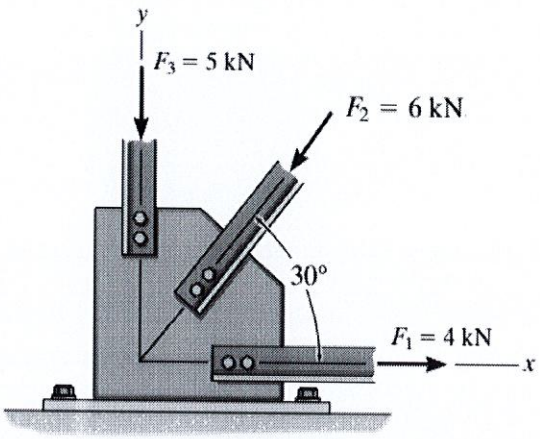


Figure 1(b) / Rajah 1(b)

i. The magnitude of the resultant of these three forces.
Nilai paduan bagi ketiga-tiga daya tersebut.

[5 marks]
[*5 markah*]

ii. The direction of the resultant force is measured clockwise from the positive x-axis.
Arah paduan daya yang diukur arah jam dari paksi positif x.

[3 marks]
[*3 markah*]

CLO1

(c) i. Based on Figure 1(c)(i) below, express the condition of equilibrium for the particle at the center in terms of forces equations.
Berdasarkan Rajah 1(c)(i) di bawah, nyatakan keadaan keseimbangan bagi zarah tersebut dalam bentuk persamaan daya.

[3 marks]
[*3 markah*]

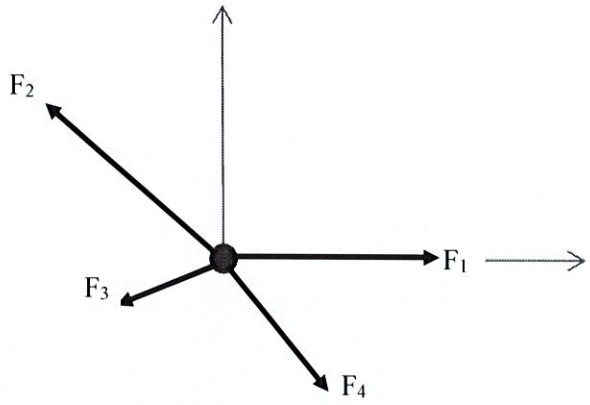


Figure 1(c)(i) / *Rajah 1(c)(i)*

CLO1

ii Express the value of the tension developed in each cable based on Figure 1(c)(ii) if **F** = 500 N. The system is in equilibrium

Nyatakan nilai ketegangan pada setiap kabel berdasarkan Rajah 1(c)(ii) jika F = 500 N. Sistem berada dalam keseimbangan

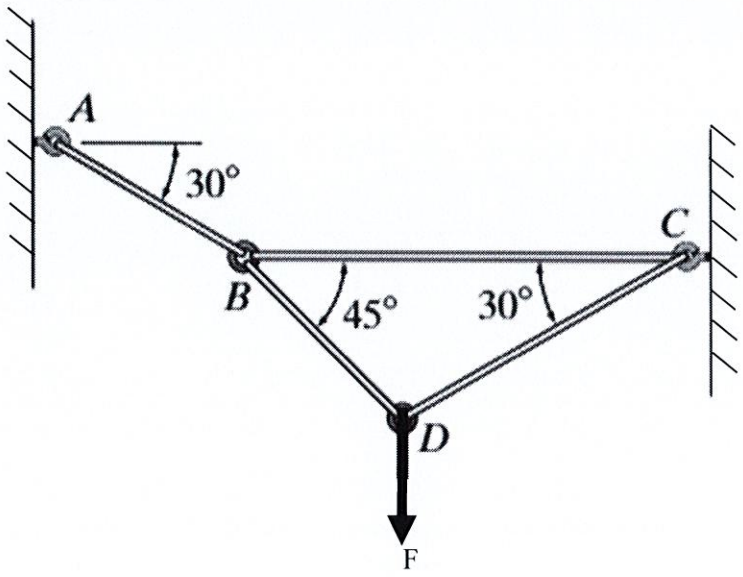


Figure 1(c)(ii) / *Rajah 1(c)(ii)*

[10 marks]

[*10 markah*]

QUESTION 2
SOALAN 2

CLO2

(a) Referring to the truss at Figure 2(a),
Merujuk kepada kekuda pada Rajah 2 (a),

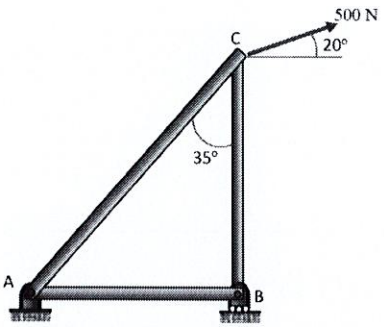


Figure 2(a) / *Rajah 2(a)*

i. Draw the truss in the form of a Free Body Diagram. Assume each joint is a pin.
Lakarkan kekuda dalam bentuk gambarajah badan bebas. Anggapkan setiap sendi adalah pin.

[2 marks]
[*2 markah*]

ii. Calculate the magnitude of the external reactions at A and B.
Tentukan daya tindak balas luaran di A dan B.

[4 marks]
[*4 markah*]

iii. Calculate the force in each member of the truss
Tentukan daya dalam setiap anggota kekuda

[5 marks]
[5 *markah*]

CLO2

(b) The Howe bridge truss is subjected to the loading as shown in Figure 2(b).
Kekuda jambatan Howe dikenakan beban seperti yang ditunjukkan pada Rajah 2 (b).

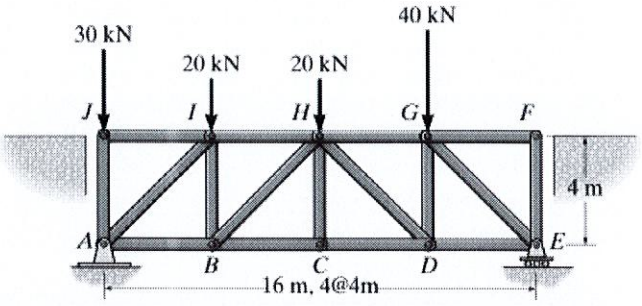


Figure 2(b) / *Rajah 2 (b)*

i. Illustrate the free-body diagram for the truss.
Lakarkan gambarajah badan bebas bagi kekuda tersebut.

[2 marks]
[*2 markah*]

ii. By using your answer from 2 (b)(i), determine the reaction force A_x and A_y at support A.
Dengan berpandukan jawapan anda pada 2 (b)(i), tentukan daya tindak balas A_x dan A_y pada penyokong A.

[3 marks]
[*3 markah*]

iii. By using the method of section, determine the force in members HI, HB, and BC. Analyse if the members are in tension or compression.
Dengan menggunakan kaedah keratan, tentukan daya pada anggota HI, HB, dan BC. Analisiskan samada anggota-anggota tersebut berada dalam keadaan tegangan atau mampatan.

[9 marks]
[*9 markah*]

QUESTION 3

SOALAN 3

CLO1 (a) Define the following terms:

Takrifkan istilah berikut:

i. Acceleration

Pecutan

[2 marks]

[*2 markah*]

ii. Velocity

Halaju

[2 marks]

[2 *markah*]

CLO1 (b) A vehicle starts from rest at $t_0=0$ and accelerates according to the equation: $a(t)=10t$ m/s^2. Express:

Sebuah kenderaan bermula dari keadaan pegun pada $t_0=0$ dan mengalami pecutan mengikut persamaan : $a(t)=10t\ m/s^2$. Nyatakan :

i. The velocity after 4 seconds

Halaju selepas 4 saat.

[4 marks]

[*4 markah*]

ii. The displacement after 4 seconds

Sesaran selepas 4 saat.

[4 marks]

[*4 markah*]

CLO1

(c) A motorcycle starts from rest and travels on a straight road with a constant acceleration of 6 m/s^2 for 10 s, then maintains a constant speed for 5 s. Later, it decelerates at 9 m/s^2 until it stops.

Sebuah motosikal bermula dari rehat dan bergerak di sepanjang jalan lurus dengan pecutan yang seragam pada 6 m/s^2 selama 10 s, kemudian bergerak pada halaju seragam selama 5 s. Selepas itu ia akan nyah pecutan pada 9 m/s^2 sehingga berhenti.

i. Draw the v-t graph for the movement with all the values.
Lukiskan graf v-t untuk pergerakan tersebut dengan semua nilai.

[3 marks]
[3 *markah*]

ii. Calculate the total distance travelled.
Kirakan jumlah jarak yang dilalui.

[8 marks]
[8 *markah*]

iii. Calculate the average speed.
Kirakan purata halaju.

[2 marks]
[*2 markah*]

QUESTION 4
SOALAN 4

CLO1 (a) Define Newton Second Law of Motion.
Takrifkan Hukum Gerakan Newton Kedua.

[4 marks]
[*4 markah*]

CLO1 (b) A particle of 2 kg mass is released from a height of 10 m above the ground. Assume that there is no air resistance, and the acceleration due to gravity is 9.81 m/s^2.
Sebuah zarah dengan jisim 2 kg dilepaskan dari ketinggian 10 m di atas tanah. Anggapkan tiada rintangan udara, dan pecutan akibat graviti adalah 9.81 m/s^2.

i. Express the total energy of the particle at the point of release.
Nyatakan jumlah tenaga bagi zarah tersebut pada titik pelepasan.

[4 marks]
[4 *markah*]

ii. Express the velocity of the particle just before it hits the ground using the principle of conservation of energy.
Nyatakan halaju zarah tepat sebelum ia mencecah tanah menggunakan prinsip keabadian tenaga

[4 marks]
[*4 markah*]

CLO1 (c) A 10 kg block is placed on a frictionless horizontal surface and connected to another 5 kg block by a light, inextensible rope that passes over a frictionless pulley. The 5 kg block hangs vertically. Assume the acceleration due to gravity is g = 9.81 m/s^2.
Sebuah blok seberat 10 kg diletakkan di atas permukaan mendatar licin dan dihubungkan dengan satu blok lain seberat 5 kg melalui tali ringan dan tidak regang yang melalui takal tanpa geseran. Blok 5 kg tergantung secara menegak. Anggapkan pecutan graviti adalah g = 9.81 m/s^2.

i. Draw a free-body diagram for both blocks, clearly labelling all forces acting on them.

Lukiskan gambar rajah badan bebas untuk kedua-dua blok dan labelkan dengan jelas semua daya yang bertindak ke atasnya.

[3 marks]

[*3 markah*]

ii. Derive the equations of motion for the two blocks using Newton's Second Law.

Huraikan persamaan gerakan untuk kedua-dua blok dengan menggunakan Hukum Kedua Newton.

[4 marks]

[*4 markah*]

iii. Calculate the acceleration of the system and the tension in the rope.

Hitungkan pecutan sistem dan ketegangan dalam tali.

[6 marks]

[6 *markah*]

SOALAN TAMAT

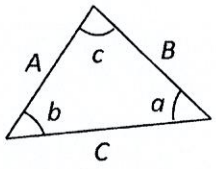
POLITEKNIK MALAYSIA

LIST OF FOMULA

DJJ30093 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

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

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

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

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

3. CARTESIAN VECTOR

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

$$\mathbf{u}_A = \frac{\mathbf{F}}{F} = \frac{F_x}{F}\mathbf{i} + \frac{F_y}{F}\mathbf{j} + \frac{F_z}{F}\mathbf{k}$$

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

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

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

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

4. EQUILIBRIUM OF PARTICLE

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

$$F = ks$$

DYNAMICS

1. RECTILINEAR MOTION OF PARTICLES

$$v = \frac{ds}{dt}$$

$$a = \frac{dv}{dt}$$

$$a\,ds = v\,dv$$

2. UNIFORM RECTILINEAR MOTION

- *a constant*:

$$v = u + at$$

$$v^2 = u^2 + 2as$$

$$s = ut + \frac{1}{2}at^2$$

$$s = \frac{1}{2}(v + u)t$$

$$v = r\omega \qquad \omega = \frac{2\pi N}{60}$$

$$a = r\alpha$$

3. WORK OF FORCE

$$U_{1-2} = (F\cos\alpha)\Delta s$$

4. KINETIC ENERGY OF PARTICLE

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

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

5. POTENTAL ENERGY

$$PE = mgh$$

6. ANGULAR MOTION

$$\omega_2 = \omega_1 + \alpha t \qquad \theta = \omega_1 t + \frac{1}{2}\alpha t^2$$

$$\omega_2{}^2 = \omega_1{}^2 + 2\alpha\theta \qquad \theta = \frac{1}{2}(\omega_2 + \omega_1)t$$