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 C1

(a) State TWO (2) basic measurement quantities and the SI units:

Nyatakan DUA (2) kuantiti asas pengukuran dan unit SI tersebut:

[4 marks]
[*4 markah*]

CLO 1 C3

(b) Referring to Figure 1(b), calculate;
Merujuk kepada Rajah 1(b), kirakan;

i. Force in component x and y axis and resultant force in terms of cartesian vector.
Komponen daya paksi x dan y dan daya paduan dalam bentuk vektor cartesian.

[6 marks]
[*6 markah*]

ii. Magnitude of the resultant force, F_r.
Magnitud daya paduan, F_r.

[2 marks]
[*2 markah*]

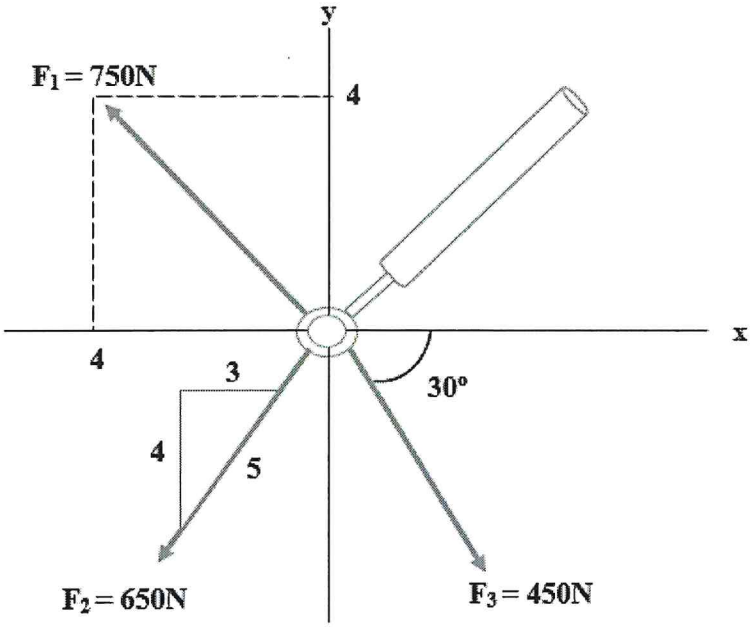


Figure 1(b) / *Rajah 1(b)*

CLO1
C2

(c) If an object is in equilibrium, then the forces are balanced. Explain the condition for the equilibrium of a particle.

Jika objek berada dalam keseimbangan, maka daya-daya tersebut adalah dalam keadaan seimbang. Terangkan keadaan keseimbangan bagi sesuatu zarah.

[3 marks]

[*3 markah*]

CLO1
C3

(d) Two cables AB and BC are tied together at B and a load of 25 kg is hung at B as shown in Figure 2(b). Calculate the tension developed in cable AB and BC.

Dua kabel AB dan BC diikat bersama di B dan muatan seberat 25 kg digantung di B seperti yang ditunjukkan dalam Rajah 2(b). Kirakan daya tegangan terhasil pada kabel AB dan BC.

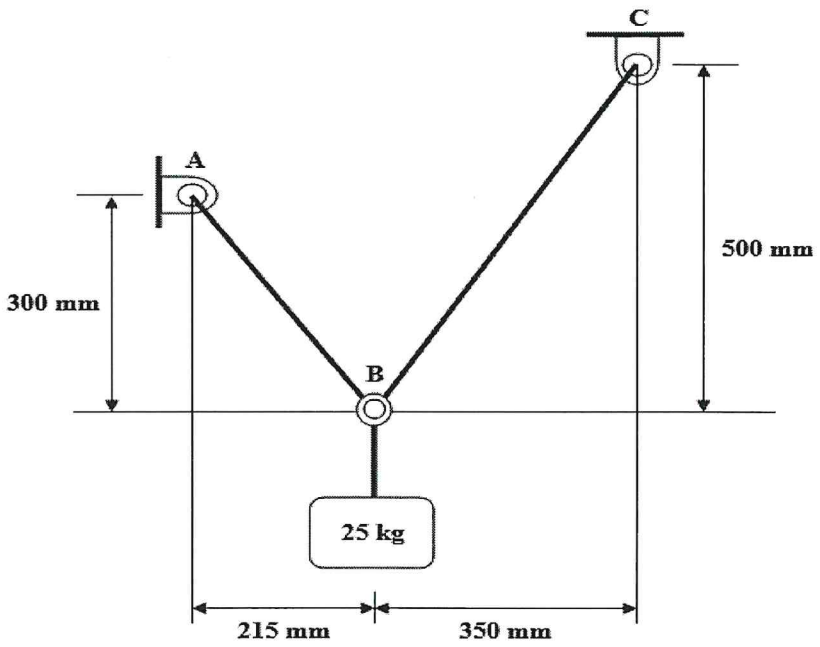


Figure 1(d) / *Rajah 1(d)*

[10 marks]

[*10 markah*]

QUESTION 2

SOALAN 2

CLO 2
C4

(a) The truss is subjected to the loading as shown in Figure 2(a);
Struktur berikut dikenakan daya seperti yang ditunjukkan dalam Rajah 2(a);

i. Illustrate free body diagram for the truss as shown in Figure 2(a).
Gambarkan rajah badan bebas untuk struktur seperti yang ditunjukkan dalam Rajah 2(a).

[2 marks]

[*2 markah*]

ii. Find the reaction force for each supporter.
Cari daya tindak balas bagi setiap penyokong.

[3 marks]

[*3 markah*]

iii. Determine the force in each member of the truss and state the members are in tension or compression.

Tentukan daya dalam setiap anggota struktur dan nyatakan anggota berada dalam keadaan tegangan atau mampatan.

[6 marks]

[*6 markah*]

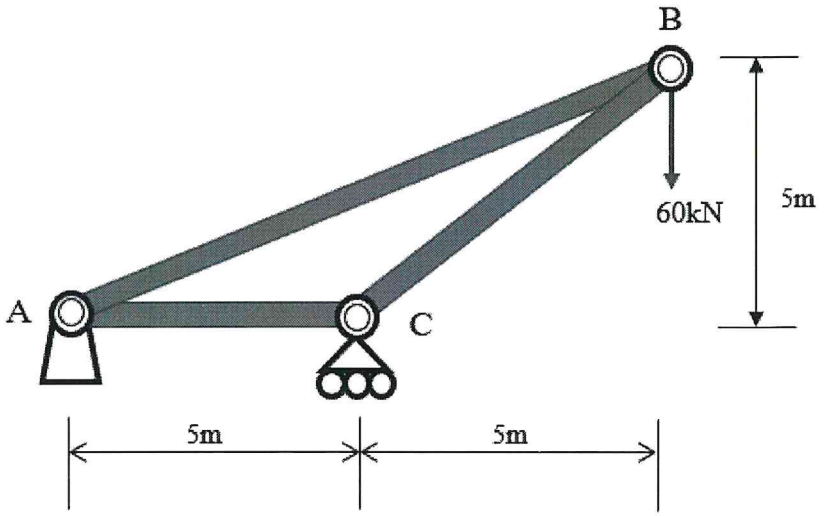


Figure 2(a) / *Rajah 2(a)*

CLO 2
C4

(b) The bridge in Figure 2(b) is subjected to the loading as shown below. By using Method of Section;

Jambatan pada Rajah 2(b) dikenakan daya seperti yang ditunjukkan. Dengan menggunakan kaedah keratan;

i. Illustrate the free body diagram.

Gambarkan rajah badan bebas berikut.

[1 mark]

[*1 markah*]

ii. Find the reaction force at supporter A and E.

Cari daya tindak balas pada penyokong A dan E.

[5 marks]

[*5 markah*]

iii. Determine force in the part of frame HI, HB and BC of the truss.

Tentukan daya pada bahagian bingkai struktur HI, HB dan BC.

[8 marks]

[*8 markah*]

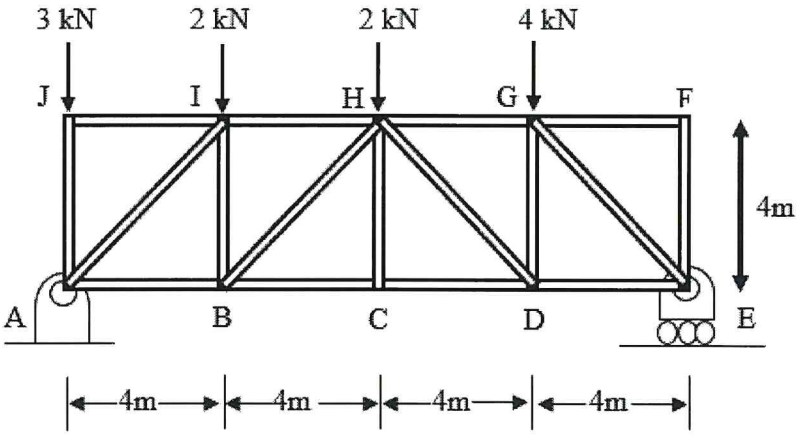


Figure 2(b) / *Rajah 2(b)*

QUESTION 3

SOALAN 3

CLO 1
C1

(a) Define the following terms:

Takrifkan maksud bagi terma berikut:

i. Constant velocity

Halaju seragam

[2 marks]

[*2 markah*]

ii. Constant acceleration

Pecutan seragam

[2 marks]

[*2 markah*]

CLO 1
C2

(b) The movement of a particle is expressed in relation of $s = t^3 - 6t^2 + 15t + 40$ where s and t are in meters and second respectively. When $t = 2$, express the answer in mathematical method;

Pergerakan suatu zarah dinyatakan dalam hubungan $s = t^3 - 6t^2 + 15t + 40$ *di mana* s *dan* t *adalah masing - masing dalam meter dan saat. Apabila* $t = 2$, *nyatakan jawapan dalam kaedah matematik;*

i. Displacement

Kedudukan

[2 marks]

[*2 markah*]

ii. Velocity

Halaju

[6 marks]

[*6 markah*]

CLO 1
C3

(c) A man starts his exercise buy running from rest and accelerates uniformly for 40 seconds and reaches a velocity of 15 m/s at the end of the acceleration. Its velocity is maintained for a while and then it stops within 60 seconds with a constant deceleration. The total distance travelled by that man is 1.3 km.
Seorang lelaki memulakan senamannya dengan berlari daripada kedudukan pegun dan memecut secara seragam selama 40 saat dan mencapai halaju 15 m/s pada penghujung pecutan tersebut. Halajun itu dikekalkan untuk seketika dan kemudian dia berhenti dalam masa 60 saat dengan nyahpecutan secara seragam. Jumlah jarak yang dilalui oleh lelaki tersebut ialah 1.3 km.

i. Sketch a graph of velocity (v) against time (t).
Lakarkan graf halaju (v) melawan masa (t).

[3 marks]
[*3 markah*]

ii. Calculate the acceleration of that running man.
Kirakan pecutan bagi larian lelaki tersebut.

[3 marks]
[*3 markah*]

iii. Calculate the total time taken for the whole exercise sessions.
Kirakan masa yang diambil bagi keseluruhan sesi senaman itu.

[4 marks]
[*4 markah*]

iv. Calculate the deceleration of that running man.
Tentukan nyahpecutan bagi larian lelaki tersebut.

[3 marks]
[*3 markah*]

QUESTION 4

SOALAN 4

CLO 1
C1

(a) Define the following terms:
Takrifkan maksud bagi terma berikut:

i. Potential Energy
Tenaga Keupayaan

[2 marks]
[*2 markah*]

ii. Kinetic Energy
Tenaga Kinetik

[2 marks]
[*2 markah*]

CLO 1
C2

(b) A 1000 kg container rest on a horizontal surface which the coefficient of kinetic friction is $\mu = 0.3$. The container is subjected to 4000N towing force acting at angle of 45° as shown.
Sebuah kontena dengan berat 1000 kg dalam kedaan pegun terletak pada permukaan mendatar di mana nilai pekali geseran kinetik adalah $\mu = 0.3$. *Kontena tersebut dikenakan daya tarikan sebanyak 4000N yang bertindak pada sudut 45° seperti yang ditunjukkan.*

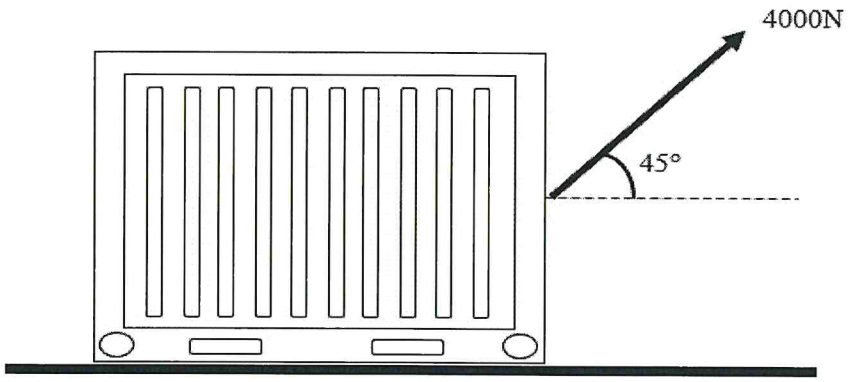


Figure 4(b) / *Rajah 4(b)*

i. Express the system with the aid of free body diagram.
Nyatakan sistem dengan bantuan gambarajah badan bebas.

[2 marks]
[*2 markah*]

ii. Express the value of the acceleration for the container in a mathematical method.
Nyatakan nilai pecutan bagi kontena tersebut dalam kaedah matematik.

[6 marks]
[*6 markah*]

CLO 1
C3

(c) A particle of 2 kg mass is being pulled across a smooth horizontal surface by a horizontal force. The force does 24 Joule of work in increasing the particle's velocity from $5ms^{-1}$ to vms^{-1}. Calculate;
Satu zarah berjisim 2 kg ditarik pada permukaan mendatar dengan daya mendatar. Daya tersebut menghasilkan 24 Joule dan menyebabkan peningkatan halaju zarah dari $5ms^{-1}$ kepada vms^{-1}. *Kirakan;*

i. The value of v.
Nilai bagi v.

[7 marks]
[*7 markah*]

ii. The value of an acceleration for the particle.
Nilai bagi pecutan zarah tersebut.

[3 marks]
[*3 markah*]

iii. The position of the particle after 15 seconds.
Kedudukan zarah selepas 15 saat.

[3 marks]
[*3 markah*]

SOALAN TAMAT

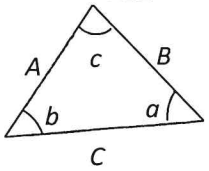
POLITEKNIK MALAYSIA
SULTAN AZLAN SHAH

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

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

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

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

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

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

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

$$F = ks$$

DYNAMICS

1. RECTILINEAR MOTION OF PARTICLES

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

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

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

2. UNIFORM RECTILINEAR MOTION

- *a constant*:

$$v = u + at$$

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

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

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

$$v = r\omega$$

$$a = r\alpha$$

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

$$PE = mgh$$