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) Define Newton First law of Motion.
Berikan definasi kepada Hukum Newton yang Pertama.

[4 marks]
[*4 markah*]

CLO1
C2

(b) Compare between Scalar and Vector. Give **ONE** example of each quantity.
*Bandingkan antara Skala dan Vektor. Berikan **SATU** contoh untuk setiap kuantiti.*

[5 marks]
[*5 markah*]

CLO1
C3

(c) Referring to force diagram in Figure 1(c), calculate:
Merujuk kepada diagram Rajah 1(c), kirakan :

i. resultant force of each component.
daya paduan untuk setiap komponen.

[6 marks]
[*6 markah*]

ii. magnitude of the resultant force.
magnitud daya paduan.

[4 marks]
[*4 markah*]

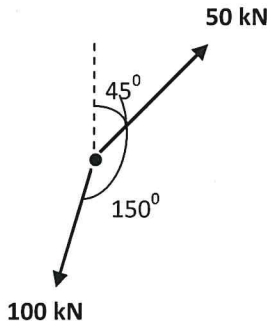


Figure 1(c) / *Rajah 1(c)*

CLO1
C4

(d) By referring to Figure 1(c):
Merujuk kepada Rajah 1(c):

i. Determine the direction of the resultant force.
Tentukan arah daya paduan.

[4 marks]
[*4 markah*]

ii. Illustrate that direction using force diagram for resultant force.
Gambarkan arah tersebut menggunakan gambarajah daya untuk daya paduan.

[2 marks]
[*2 markah*]

QUESTION 2
SOALAN 2

CLO1 C1

(a) State the equilibrium of a particle.

Nyatakan keadaan keseimbangan bagi suatu partikel.

[4 marks]

[*4 markah*]

CLO1 C2

(b) Figure 2(b) shows the system in equilibrium. Represent the system in the form of Free Body Diagram at :

Rajah 2(b) menunjukkan sisten yang berada dalam keadaan keseimbangan. Wakilkan sistem tersebut dalam bentuk Gambarajah Badan Bebas pada:

i. Point B

Titik B

[4 marks]
[*4 markah*]

ii. Point D

Titik D

[5 marks]
[5 *markah*]

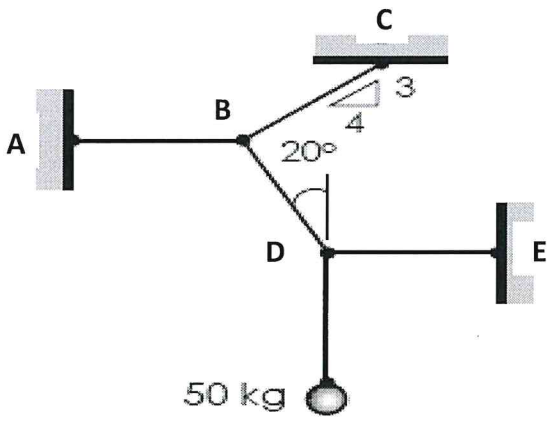


Figure 2(b) /Rajah 2(b)

CLO1 C3

(c) Calculate the force in each member of the truss in Figure 2(c). State whether it is in tension or compression.

Kirakan daya bagi setiap ahli pada rasuk dalam Rajah 2(c). Nyatakan sama ada ia berada dalam keadaan tegangan atau mampatan.

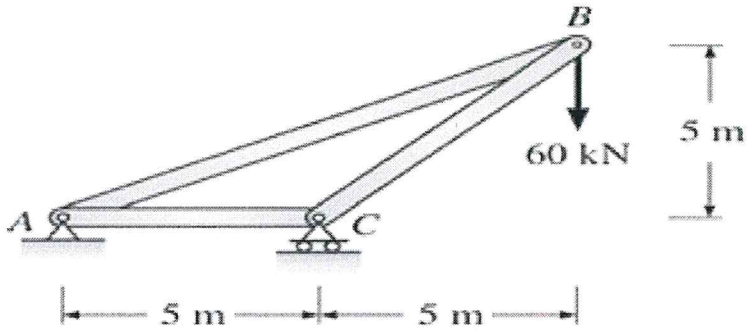


Figure 2(c) /*Rajah 2(c)*

[12 marks]
[*12 markah*]

QUESTION 3

SOALAN 3

CLO1 C1 (a) Define velocity and acceleration.
Takrifkan istilah halaju dan pecutan.

[4 marks]
[*4 markah*]

CLO1 C2 (b) Figure 3(b) shows the sketch of a circular motion, interpret v, α, ω, θ and r.

Rajah 3(b) menunjukkan lakaran satu pergerakan membulat , tafsirkan v, α, ω, θ dan r.

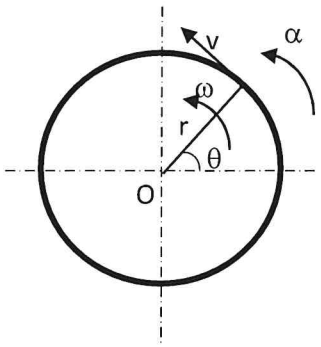


Figure 3(b) / *Rajah 3(b)*

[5 marks]

[*5 markah*]

CLO1 C3 (c) A car with a velocity of 15 ms^{-1} accelerates to reach velocity of 80 ms^{-1} with an acceleration of 3.5 ms^{-2}. This velocity is maintained for 25 seconds before deceleration until it stops within 15 seconds.

Sebuah kereta dengan halaju 15 ms^{-1} memecut sehingga mencapai halaju 80 ms^{-1} dengan pecutan 3.5 ms^{-2}. Halaju ini dikekal untuk tempoh 25 saat sebelum ianya mengalami nyahpecutan sehingga berhenti dalam masa 15 saat.

i. Draw a velocity-time diagram for the trip.
Lukiskan gambarajah halaju-masa bagi perjalanan tersebut.

[2 marks]

[*2 markah*]

ii. Calculate the time taken during the acceleration.
Kirakan masa yang diambil semasa pecutan.

[2 marks]

[*2 markah*]

iii. Calculate the car deceleration.
Kirakan nyahpecutan kereta.

[2 marks]

[*2 markah*]

iv. Calculate total distance for the trip.

Kirakan jumlah jarak perjalanan tersebut.

[4 marks]

[*4 markah*]

CLO1 C4 (d) The movement of a particle is expressed in relation of ($x = 5t^3 - 4t^2 + 3t + 12$) m, where x and t are respectively in meters and seconds. If t = 6 seconds, determine:

Pergerakan suatu zarah dinyatakan dalam hubungan ($x = 5t^3 - 4t^2 + 3t + 12$) m, di mana x dan t adalah masing-masing dalam meter dan saat. Apabila t = 6 saat, tentukan:

i. Position.

Kedudukan.

[2 marks]

[*2 markah*]

ii. Velocity.

Halaju.

[2 marks]

[*2 markah*]

iii. Acceleration.

Pecutan.

[2 marks]

[*2 markah*]

QUESTION 4

SOALAN 4

CLO1
C1

a) State the Newton's Second Law and give **TWO (2)** examples of its application.
*Nyatakan Hukum Newton Kedua dan beri **DUA (2)** contoh aplikasinya.*

[4 marks]
[*4 markah*]

b) A compact car moving at 100 km/hr with kinetic energy of 290 000 Joules and then it moves at 50 km/hr speed.

CLO1
C2

Sebuah kereta kompak bergerak pada 100 km/j dan mempunyai 290000 joule tenaga kinetik, kemudian ia bergerak pada kelajuan 50 km/j.

i. Convert 50 km/hr to m/s
Tukarkan 50 km/j ke m/s

[3 marks]
[*3 markah*]

ii. Convert 100 km/hr to m/s.
Tukarkan 100 km/j ke m/s

[3 marks]
[*3 markah*]

iii. Relate the kinetic energy and the potential energy according to Law of Conservation of Energy
Kaitkan tenaga kinetik dan tenaga keupayaan mengikut Hukum Keabadian Tenaga

[3 marks]
[*3 markah*]

CLO1
C3

c) A vehicle with a weight of 450kg is driven downhill which is 5^{o} incline and at a speed of 60 km/h as shown in Figure 4(c). When the brakes are applied, it will cause a constant total braking force of 200 N. Based on this information:

Sebuah kenderaan dengan berat 450 kg dipandu menuruni satu cerun bersudut 5^0 pada kelajuan 60km/j seperti dalam Rajah 4(c). Apabila brek dikenakan ia menghasilkan daya membrek sebanyak 200N. Berdasarkan maklumat ini:

Figure 4(c) / *Rajah 4(c)*

i. Draw a free body diagram for this vehicle.
Lukiskan rajah badan bebas bagi kenderaan tersebut.

[3 marks]
[*3 markah*]

ii. Calculate the kinetic energy for this vehicle.
Kirakan tenaga kinetik bagi kenderaan tersebut.

[6 marks]
[*6 markah*]

iii. Calculate the work done by the vehicle.
Kirakan kerja yang dilakukan oleh kenderaan tersebut.

[3 marks]
[*3 markah*]

SOALAN TAMAT

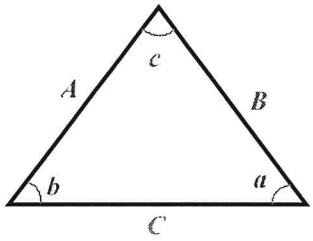
POLITEKNIK MALAYSIA

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

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

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

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

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

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

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

4. EQUILIBRIUM OF PARTICLE

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

$$F = ks$$

DYNAMICS

1. RECTILINEAR MOTION OF PARTICLES

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

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

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

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

4. KINETIC ENERGY OF PARTICLE

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

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

5. POTENTIAL ENERGY

$$PE = mgh$$