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   (a)   List **TWO (2)** basic measurement quantities and the SI units.

Senaraikan DUA (2) kuantiti asas pengukuran dan unit SI tersebut.

[4 marks]

[*4 markah*]

CLO 1   (b)   Figure 1(b) is subjected to two forces, F_1 and F_2.

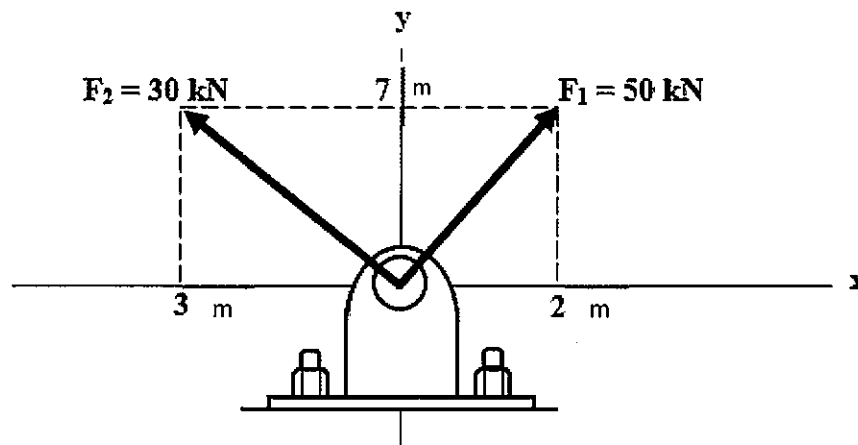*Rajah 1(b) dikenakan kepada dua daya F_1 dan F_2.*

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

i.   Calculate each force in component x and y axis and the resultant force in Cartesian Vector form.

Kirakan komponen setiap daya dalam paksi x dan y dan Daya Paduan dalam bentuk Vektor Cartesan.

[6 marks]

[*6 markah*]

ii.   Calculate magnitude of the resultant force, F_R.

Kirakan magnitud bagi Daya Paduan, F_R.

[2 marks]

[2 markah]

CLO 1   (c)   i.   Explain **THREE (3)** conditions for the equilibrium of a particle

according to Newton's First Law of motion

*Terangkan **TIGA (3)** keadaan keseimbangan bagi sesuatu zarah*

merujuk kepada Hukum Pergerakan Newton Pertama.

[3 marks]

[3 markah]

ii.   Figure 1(c) shows a hanging safety lifebuoy of 5 kg supported by two

cables, BA and BC.   If the system is in equilibrium, express the value

of tension force developed at cable BA and BC.

Rajah 1(c) menunjukkan sebuah pelampung keselamatan dalam

keadaan tergantung dengan berat 5kg disokong oleh dua kabel, BA dan

BC. Sekiranya sistem berada di dalam keseimbangan, nyatakan nilai

bagi daya tegangan terhasil pada kabel BA dan BC.
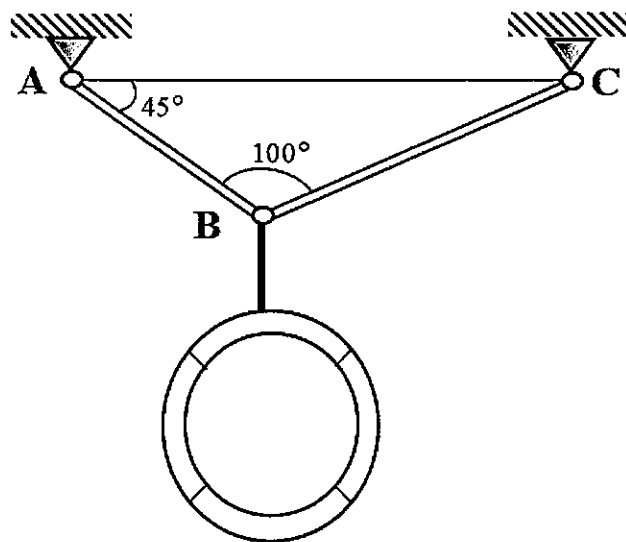
[10 marks]

[10 markah]

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

QUESTION 2
SOALAN 2

CLO 2   (a)   The truss is subjected to the loading as shown in Figure 2(a).

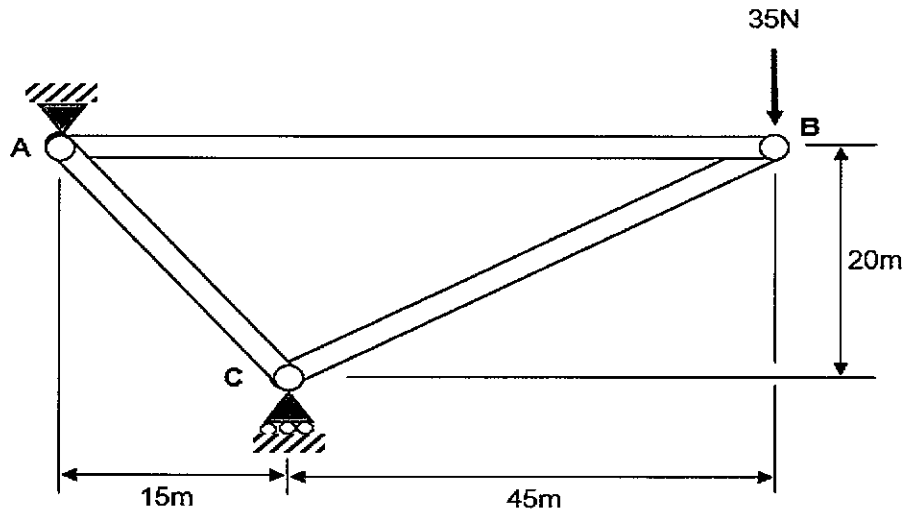*Kekuda berikut dikenakan daya seperti yang ditunjukkan dalam Rajah 2(a).*

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

i.   Write **TWO (2)** methods of analyzing a truss.

*Tuliskan **DUA (2)** kaedah untuk menganalisis sesebuah kekuda.*

[2 marks]

[2 markah]

ii.   Draw the Free Body Diagram of the truss in Figure 2(a).

Lukiskan Gambarajah Badan Bebas bagi kekuda dalam Rajah 2(a).

[3 marks]

[3 markah]

iii.   Calculate the external reaction forces at support A and C in Figure 2(a).

Kirakan daya tindak balas luaran pada sokongan A dan C dalam Rajah 2(a).

[6 marks]

[6 markah]

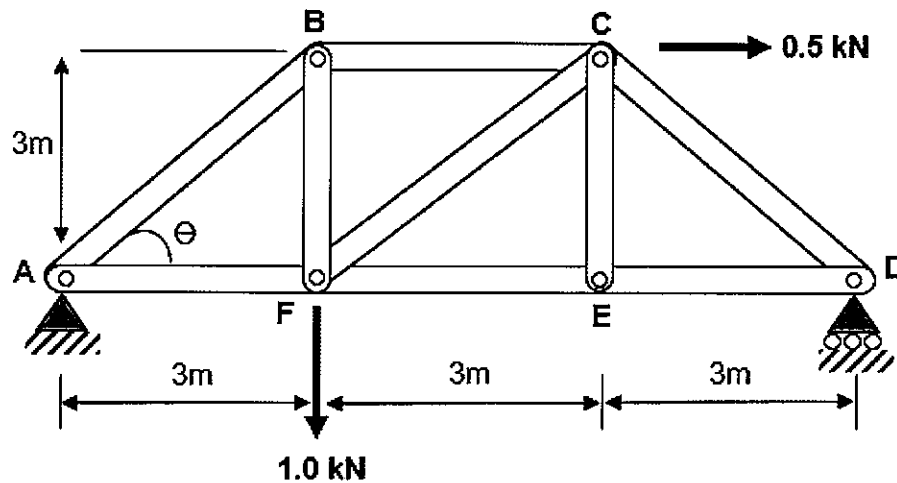CLO 2 | (b)   The bridge is subjected to a loading as shown in Figure 2(b).

Jambatan berikut dikenakan daya seperti yang ditunjukkan dalam Rajah 2(b).

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

i.   Find the value of Θ for the truss in Figure 2(b).

Dapatkan nilai Θ bagi kekuda pada Rajah 2(b).

[1 mark]

[1 markah]

ii.   Determine the external reaction forces at supporters A and D.

Tentukan daya tindak balas luaran pada sokongan A dan D.

[5 marks]

[5 markah]

iii.   Determine the force in members BC, CF and EF by using **Method of Sections**. State if the members are in tension or compression.

*Tentukan daya pada anggota BC, CF dan EF dengan menggunakan **Kaedah Keratan**. Nyatakan sama ada anggota tersebut berada dalam keadaan tegangan atau mampatan.*

[8 marks]

[8 markah]

QUESTION 3

SOALAN 3

CLO 1   (a)   State the SI units for the following parameters:

Nyatakan unit SI bagi parameter berikut:

        i.   Displacement

               Anjakan

[1 mark]

[*1 markah*]

        ii.   Velocity

               Halaju

[1 mark]

[*1 markah*]

        iii.   Angular velocity

               Halaju sudut

[1 mark]

[*1 markah*]

        iv.   Angular Acceleration

               Pecutan sudut

[1 mark]

[*1 markah*]

CLO 1   (b)   A vehicle moves on a straight road with a displacement defined by $s = (0.6t^3 + 0.3t^2 - 0.2t)$ meter where t is in second and s is in meter. When t=5s, express the value of the followings:

Sebuah kenderaan bergerak di atas satu jalan lurus dengan anjakan, $s = (0.6t^3 + 0.3t^2 - 0.2t)$ meter di mana t adalah dalam unit saat dan s adalah dalam meter. Apabila t=5s, nyatakan nilai bagi yang berikut:

i. Displacement

Anjakan

[2 mark]

[*2 markah*]

ii. Velocity

Halaju

[3 marks]

[*3 markah*]

iii. Acceleration

Pecutan

[3 marks]

[*3 markah*]

CLO 1 (c) A car travel from **point A** with initial velocity 8 m/s and it accelerates uniformly at 1.5 m/s^2 to reach **point B**. Then, it travels at a constant velocity for 20 s. Finally, it slows at a constant deceleration for 15 seconds until it stops at **point C.**

*Sebuah kenderaan bergerak daripada **titik A** dengan halaju awal 8 m/s dan ia memecut secara seragam pada 1.5 m/s^2 untuk sampai ke **titik B**. Kemudian, ia bergerak dengan halaju seragam selama 20 saat. Akhirnya, ia bergerak perlahan dengan nyahpecutan seragam selama 15 saat sehingga berhenti di **titik C.***

i. Draw a velocity-time graph of the journey.

Lukiskan graf halaju-masa bagi perjalanan tersebut.

[3 marks]

[*3 markah*]

ii. Calculate the constant velocity of the car.

Kirakan halaju seragam kereta tersebut.

[3 marks]

[*3 markah*]

iii.   Calculate the time taken by the car from point A to point B.

Kirakan masa yang diambil oleh kereta dari titik A ke titik B.

[3 marks]

[3 markah]

iv.   Calculate the total distance of the car.

Kirakan jumlah jarak yang dilalui oleh kereta tersebut.

[4 marks]

[4 markah]

QUESTION 4

SOALAN 4

CLO 1   (a)   State the principle of conservation of energy and give **ONE (1)** example.

Nyatakan prinsip pemuliharaan tenaga dan berikan SATU (1) contoh.

[4 marks]

[4 markah]

CLO 1   (b)   A car of 1000 kg is travelling along a straight road at 12 m/s^2 when the traffic lights change from green to yellow. The driver applies the brakes 25 metres from the lights and just manage to stop on the line. Express the value for:

Sebuah kereta berjisim 1000 kg bergerak di sepanjang jalan lurus dengan 12 m/s^2 apabila lampu isyarat bertukar daripada hijau ke kuning. Pemandu menekan brek 25 meter sebelum lampu isyarat dan berjaya berhenti di garisan. Nyatakan nilai bagi:

i.   The kinetic energy of the car before braking.

Tenaga kinetik kereta tersebut sebelum brek.

[3 marks]

[3 markah]

ii.   The work done in bringing the car to rest.

Kerja yang dilakukan untuk membuat kereta tersebut berhenti.

[2 marks]

[2 markah]

iii.   The force which work is done.

Daya untuk kerja yang dilakukan.

[3 marks]

[3 markah]

CLO 1 | (c) An 80 kg block is having an applied force of $F=(25t^2)$ N as shown in **Figure 4(c)**. The coefficient of kinetic friction at the surface is $\mu_k = 0.2$.

Sebuah blok 80 kg dikenakan daya $F=(25t^2)$ N seperti di dalam Rajah 4(c) Pekali geseran pada permukaan ialah $\mu_k = 0.2$.
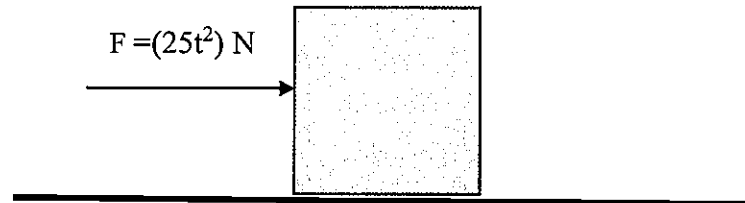
$$F =(25t^2)\ N$$

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

i. Draw the free body diagram of the block.

Lukiskan gambarajah badan bebas blok tersebut.

[4 marks]

[*4 markah*]

ii. Calculate the friction force of the block.
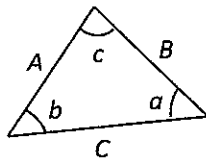
Tentukan daya geseran pada blok tersebut.

[4 marks]

[*4 markah*]

iii. Calculate the acceleration of the block when t=4 s.

Tentukan pecutan blok tersebut apabila t=4 s.

[5 marks]

[*5 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

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

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

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

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

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

$$\Sigma F = 0$$

$$F = ks$$

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

$$PE = mgh$$

6. ANGULAR VELOCITY

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

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