

**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 I : 2023/2024**

**DJJ30093: ENGINEERING MECHANICS**

**TARIKH : 17 DISEMBER 2023**

**MASA : 8.30 AM – 10.30 AM (2 JAM)**

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

Struktur (4 soalan)

Dokumen sokongan yang disertakan : Formula

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**JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN**

(CLO yang tertera hanya sebagai rujukan)

**SULIT**

**INSTRUCTION:**

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

**ARAHAN:**

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

**QUESTION 1****SOALAN 1**

- CLO1 (a) Define the Newton's first law of motion and give **TWO (2)** examples of the Newton's first law of motion.

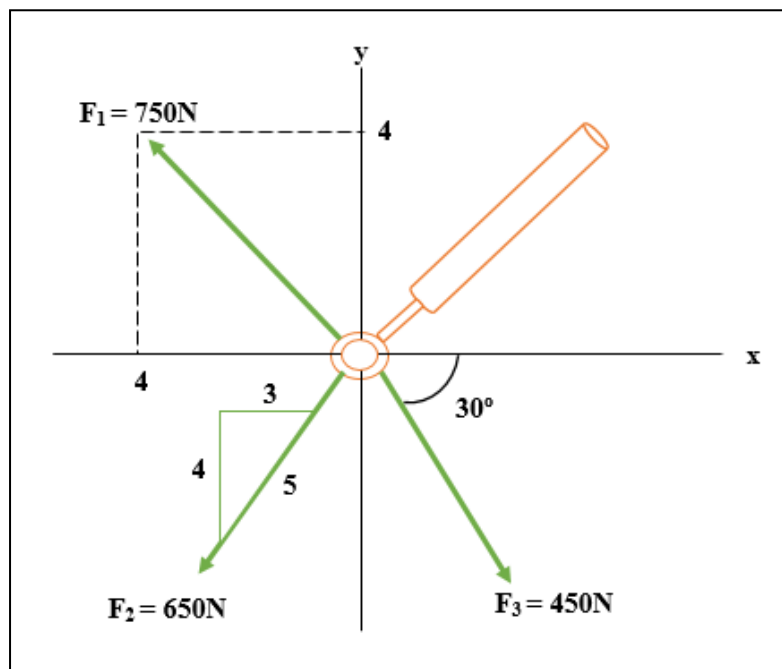
*Berikan definisi hukum pergerakan pertama Newton dan berikan **DUA (2)** contoh bagi hukum pergerakan pertama Newton tersebut.*

[4 marks]

[4 markah]

- CLO1 (b) Refer to Figure 1(b), calculate;

*Merujuk kepada Rajah 1(b), kirakan;*



**Figure 1b / Rajah 1b**

- 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]

[6markah]

- ii. Magnitude of the resultant force,  $F_r$ .

*Magnitud daya paduan,  $F_r$ .*

[2 marks]

[2markah]

CLO1

- (c) i. Explain the equilibrium equation using the Newton's Second law of motion.

*Terangkan persamaan keseimbangan menggunakan Hukum Pergerakan Newton Kedua.*

[3 marks]

[3 markah]

CLO1

- ii. Express the value of the internal forces in cable CB, CE and spring CD in Figure 1(c), if the mass of the ball is 73kg.

*Nyatakan nilai bagi daya dalaman bagi kabel CB, CE dan pegas CD dalam Rajah 1(c), jika jisim bola 73kg.*

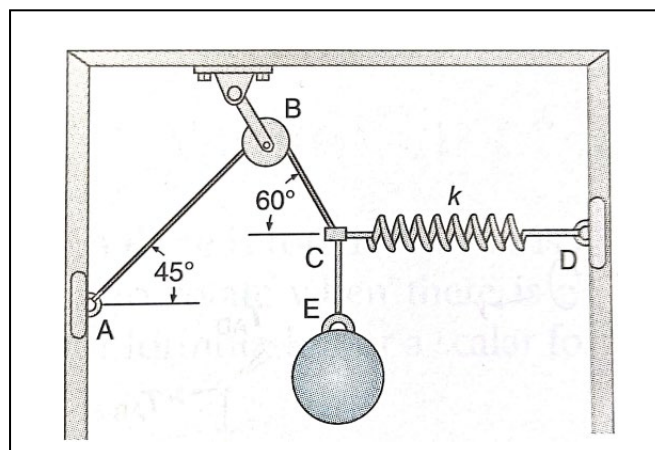


Figure 1c / Rajah 1c

[10 marks]

[10 markah]

**QUESTION 2****SOALAN 2**

CLO2

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

- i. Draw the free body diagram for the truss as shown in **Figure 2a**.  
*Lukiskan gambarajah badan bebas untuk struktur seperti yang ditunjukkan dalam Rajah 2a.*

[2 marks]

[2 markah]

- ii. Calculate the reaction force for each supporter.  
*Kirakan daya tindak balas bagi setiap penyokong.*

[3 marks]

[3 markah]

- iii. Calculate the force in each member by using the method of joint and state the members are in tension or compression.  
*Kirakan daya dalam setiap anggota struktur dengan menggunakan kaedah sambungan dan nyatakan anggota berada dalam keadaan tegangan atau mampatan.*

[6 marks]

[6 markah]

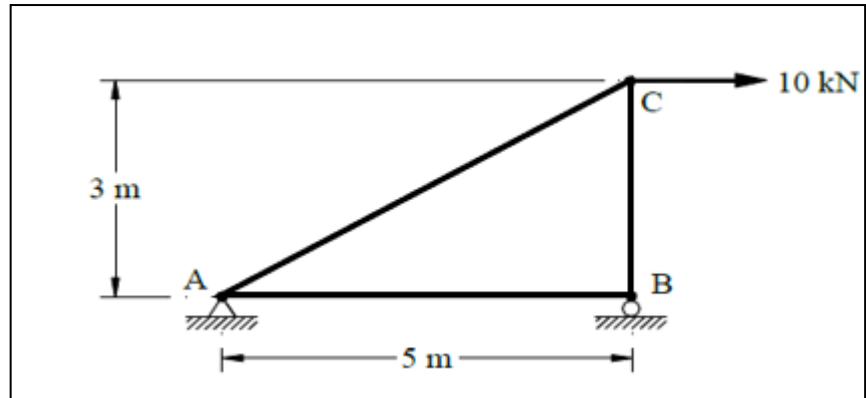


Figure 2a / Rajah 2a

CLO2

- (b) **Figure 2b** shows a truss on the floor with a supporter pin at A and supporter a roller at D. By using the method of section;

*Rajah 2b* menunjukkan struktur berada di atas lantai dengan penyokong pin pada A dan penyokong penggelek pada D. Dengan menggunakan kaedah keratan;

- i. Illustrate the free body diagram.

*Lakarkan gambarajah badan bebas berikut.*

[1 mark]

[1 markah]

- ii. Find the reaction force at supporter A and D.

*Cari daya tindak balas pada penyokong A dan E.*

[5 marks]

[5 markah]

- iii. Determine force in member BC, GF and GC of the truss and state whether the members are in tension or compression.

*Tentukan daya pada anggota BC, GF dan GC dan nyatakan samada anggota struktur berada dalam keadaan tegangan atau mampatan.*

[8 marks]

[8 markah]

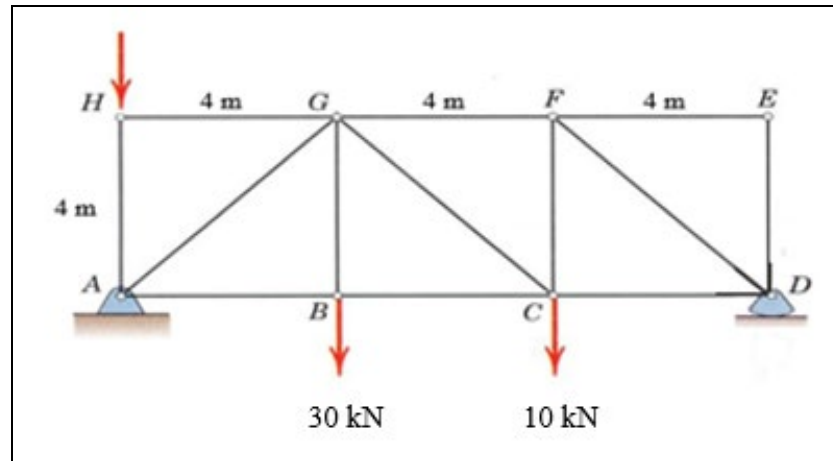


Figure 2b / Rajah 2b

### QUESTION 3

#### SOALAN 3

CLO1

- (a) State the following terms;  
*Nyatakan istilah berikut;*
- i. Displacement of particle  
*Anjakan sesuatu zarah*

[2 marks]

[2 markah]

- ii. Acceleration  
*Pecutan.*

[2 marks]

[2 markah]

- CLO1 (b) A motorcycle moves with a wheel speed of 250 rpm. If the diameter of motorcycle wheel is 60.5 cm ;  
*Sebuah motosikal bergerak dengan kelajuan roda 250 ppm. Jika diameter roda motosikal ialah 60.5 cm ;*
- i. Convert the velocity of motorcycle in km/h unit.  
*Tukarkan halaju motosikal dalam unit km/j.*
- [6 marks]  
[6 markah]
- ii. If the motorcycle moves for 8 minutes from rest, express the value of acceleration for the motorcycle in  $\text{m/s}^2$   
*Jika motosikal tersebut bergerak selama 8 minit dari keadaan rehat, nyatakan nilai pecutan motosikal teresbut dalam  $\text{m/s}^2$ .*
- [2 marks]  
[2 markah]
- CLO1 (c) The distance between building A and building B is 5.8 km. A car starts from rest at building A with a constant acceleration for 32 seconds, then a car travels with a constant velocity before it decelerates constantly and stops at building B in the last 15 seconds of the journey. If the total time taken is 7 minutes:  
*Jarak antara bangunan A dan bangunan B adalah 5.8 km. Sebuah kereta bermula dari pegun dari bangunan A dengan pecutan seragam selama 32 saat, kemudian kereta tersebut bergerak dengan halaju seragam sebelum mengawapecut dengan seragam dan berhenti di bangunan B dalam masa 15 saat terakhir perjalanan tersebut. Jika jumlah masa yang diambil adalah 7 minit*
- i. Draw a velocity-time graph.  
*Lukiskan gambarajah graf halaju- masa*
- [3 marks]  
[3 markah]

- ii. Calculate the constant velocity of the car in m/s.  
*Kirakan halaju seragam kereta tersebut dalam m/s.*
- [5 marks]  
[5 markah]
- iii. Calculate the acceleration of the car in  $\text{m/s}^2$ .  
*Kirakan pecutan kereta tersebut dalam  $\text{m/s}^2$ .*
- [2 marks]  
[2 markah]
- iv. Calculate the distance traveled in the first 3 minutes of the journey.  
*Kirakan jarak dilalui dalam 3 minit pertama perjalanan itu.*
- [3 marks]  
[3 markah]

**QUESTION 4****SOALAN 4**

CLO1

- (a) State the following terms;  
*Nyatakan istilah berikut;*
- i. Kinetic  
*Kinetik*
- [2 marks]  
[2 markah]
- ii. Work  
*Kerja*
- [2 marks]  
[2 markah]



CLO1

- (b) An object of mass 5 kg is dropped from a height of 25 m from a building. Based on the situation below, express the value of :

*Satu objek yang berjisim 5 kg telah jatuh dari ketinggian 25 m dari sebuah bangunan. Berdasarkan situasi di bawah, nyatakan nilai bagi :*

- i. The potential energy possessed by the object before it fell  
*Tenaga keupayaan yang dimiliki oleh objek sebelum ia jatuh*  
[2 marks]  
[2 markah]
- ii. The kinetic energy possessed by the object before it fell  
*Tenaga kinetik yang dimiliki oleh objek sebelum ia jatuh*  
[2 marks]  
[2 markah]
- iii. The potential energy possessed by the object after it fell and touched the ground  
*Tenaga keupayaan yang dimiliki oleh objek selepas ia jatuh dan menyentuh lantai*  
[2 marks]  
[2 markah]
- iv. The kinetic energy possessed by the object after it fell and touched the ground  
*Tenaga kinetik yang dimiliki oleh objek selepas ia jatuh dan menyentuh lantai*  
[2 marks]  
[2 markah]

CLO1

- (c) The 75kg crate shown in Figure 4(c) rests on a horizontal surface for which the coefficient of kinetic friction is  $\mu_k = 0.3$ . If the crate is subjected to a 500N towing force as below;

*Sebuah bongkah kayu 75 kg seperti Rajah 4(c) dalam keadaan rehat pada permukaan mendatar yang mempunyai koefisien pekali geseran iaitu  $\mu_k = 0.3$ . Jika bongkah kayu seberat 500 N itu ditarik seperti rajah di bawah;*

- i) Draw a Free Body Diagram (FBD)

*Lukiskan gambarajah badan bebas*

[4 marks]

[ 4 markah]

- ii) Calculate the velocity of the crate after 5 second starting from rest.

*Kirakan halaju bongkah kayu selepas 5 saat bermula dalam keadaan rehat.*

[9 marks]

[ 9 markah]

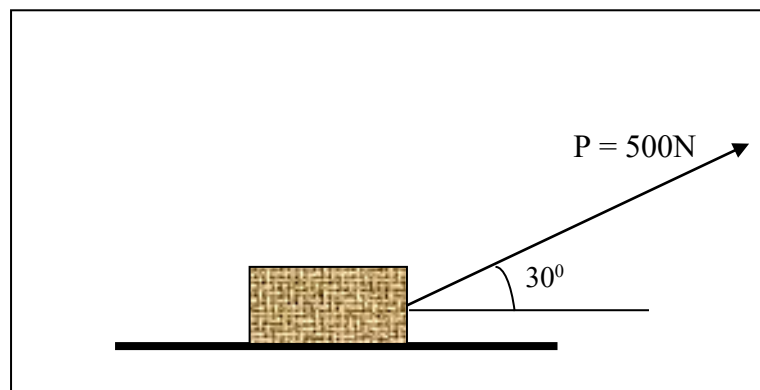
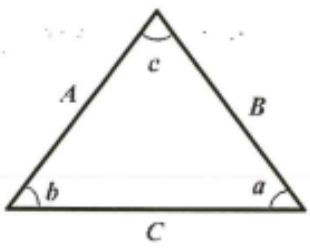


Figure 4c / Rajah 4c

**SOALAN TAMAT**

LIST OF FORMULA  
DJJ 30093 – ENGINEERING MECHANICS

<u>STATICS</u>	<u>DYNAMICS</u>
<p>1. TRIANGLE RULE</p> <div style="text-align: center; margin: 10px 0;">  </div> <p>Sine law:</p> $\frac{A}{\sin a} = \frac{B}{\sin b} = \frac{C}{\sin c}$ <p>Cosine law:</p> $C = \sqrt{A^2 + B^2 - 2AB \cos c}$ <p>2. ADDITION OF SYSTEM OF COPLANAR FORCE</p> $(\rightarrow) \Sigma F_x = F_{1x} + F_{2x} - F_{3x}$ $(+\uparrow) \Sigma F_y = F_{1y} - F_{2y} + F_{3y}$ $F_R = \sqrt{(\Sigma F_x)^2 + (\Sigma F_y)^2}$ $\theta = \tan^{-1} \left  \frac{\Sigma F_y}{\Sigma F_x} \right $ <p>3. CARTESIAN VECTOR</p> $\mathbf{F} = F_x \mathbf{i} + F_y \mathbf{j} + F_z \mathbf{k}$ $\mathbf{u}_A = \frac{\mathbf{F}}{F} = \frac{F_x}{F} \mathbf{i} + \frac{F_y}{F} \mathbf{j} + \frac{F_z}{F} \mathbf{k}$ $\cos^2 \alpha + \cos^2 \beta + \cos^2 \gamma = 1$ $\mathbf{F}_R = \Sigma \mathbf{F} = \Sigma F_x \mathbf{i} + \Sigma F_y \mathbf{j} + \Sigma F_z \mathbf{k}$ $\mathbf{r} = (x_B - x_A) \mathbf{i} + (y_B - y_A) \mathbf{j} + (z_B - z_A) \mathbf{k}$ $\mathbf{F} = F \mathbf{u} = F \frac{\mathbf{r}}{r}$ <p>4. EQUILIBRIUM OF PARTICLE</p> $\Sigma \mathbf{F} = 0$ $F = ks$	<p>1. RECTILINEAR MOTION OF PARTICLES</p> $v = \frac{ds}{dt}$ $a = \frac{dv}{dt}$ <p>2. UNIFORM RECTILINEAR MOTION</p> <p style="margin-left: 20px;">- <math>a</math> constant</p> $v = u + at$ $v^2 = u^2 + 2as$ $s = ut + \frac{1}{2}at^2$ $s = \frac{1}{2}(v + u)t$ $v = r\omega$ $a = r\alpha$ <p>3. WORK OF FORCE</p> $U_{1 \rightarrow 2} = (F \cos \alpha) \Delta x$ <p>4. KINETIC ENERGY OF PARTICLE</p> $KE = \frac{1}{2}mv^2$ $U_{1 \rightarrow 2} = T_2 - T_1$ <p>5. POTENTIAL ENERGY</p> $PE = mgh$