

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 : 2025/2026

DJJ30093: ENGINEERING MECHANICS

TARIKH : 04 DISEMBER 2025

MASA : 2.30 PETANG - 4.30 PETANG (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)

SULIT

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) Give **TWO (2)** examples of Newton's Third Law of Motion.
 Berikan **DUA (2)** contoh Hukum Pergerakan Newton Ketiga.

[4 marks]

[4 markah]

- CLO1 (b) An elastic rubber band is attached to points *A* and *B* as shown in Figure 1(b) below. Calculate:
 Seutas gelang getah elastik disambungkan pada titik *A* dan *B* seperti yang ditunjukkan dalam rajah Rajah 1(b) di bawah. Kirakan:

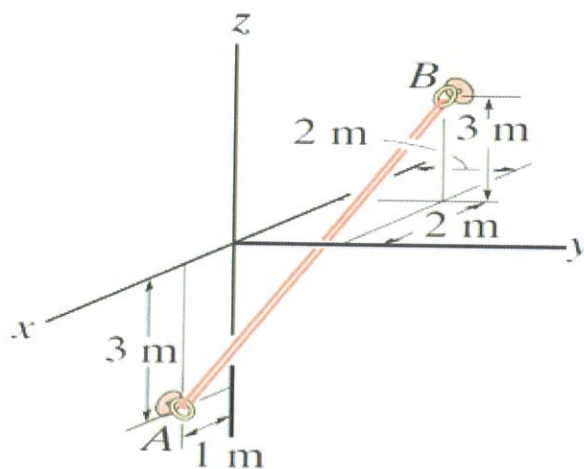


Figure 1(b) / Rajah 1 (b)

- i. Magnitude of the resultant vector *A* towards *B*.
 Magnitud bagi vektor paduan *A* ke arah *B*.

[4 marks]

[4 markah]

- ii. The direction angle of the resultant vector from A towards B .

Sudut arah bagi vektor paduan dari A ke arah B .

[4 marks]

[4 markah]

- CLO1 (c) If the cable length AB 1.5 m to withstand a maximum force of 3500 N as shown in Figure 1(c).

Jika panjang kabel AB 1.5 m untuk menampung daya maksimum sebanyak 3500 N seperti ditunjukkan dalam Rajah 1(c).

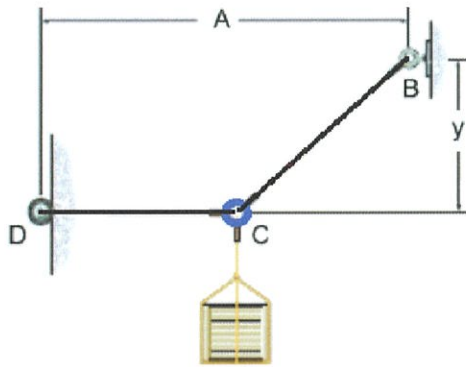


Figure 1(c) / Rajah 1(c)

- i. Visualize the Free Body Diagram (FBD) for equilibrium.

Gambarkan Gambarajah Badan Bebas untuk keseimbangan.

[3 marks]

[3 markah]

- ii. Express in value of the force on the BC cord and the y distance if a 200kg load is applied.

Nayatakn dalam nilai daya pada kabel BC dan jarak y sekiranya beban 200 kg dikenakan.

[10 marks]

[10 markah]

QUESTION 2

SOALAN 2

- CLO2 (a) A simple truss structure has force applied at point B with 500 N as shown in Figure 2(a). By using method of joints:
- Struktur kekuda ringkas mempunyai daya yang dikenakan pada titik B dengan 500 N seperti ditunjukkan dalam Rajah 2(a). Dengan menggunakan kaedah sambungan:*

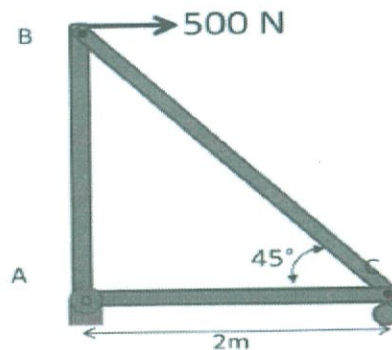


Figure 2(a) / Rajah 2(a)

- i. Write **TWO (2)** of the forces developed in each member when the truss is subjected to a given load.

*Tuliskan **DUA (2)** jenis daya yang ada dalam setiap anggota apabila kekuda dikenakan beban yang tertentu.*

[2 marks]

[2 markah]

- ii. Draw a Free Body Diagram (FBD) on the whole truss system.

Lukiskan Gambarajah Badan Bebas pada keseluruhan sistem kekuda.

[3 marks]

[3 markah]

- iii. Calculate the force reaction in each member and expose each member of the truss system whether in tension or compression.

Kirakan tindak balas daya dan dedahkan setiap anggota sistem kekuda sama ada dalam keadaan tegangan atau mampatan.

[6 marks]

[6 markah]

CLO2

- (b) The Howe bridge truss is subjected to the load as shown in Figure 2(b).

Kekuda jambatan Howe tertakluk kepada beban seperti yang ditunjukkan dalam Rajah 2(b).

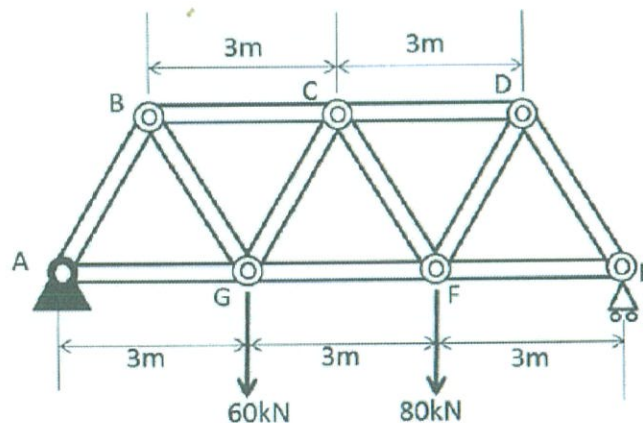


Figure 2(b) / Rajah 2(b)

- i. Determine the suitable method of analyzing truss in Figure 2(b).

Tentukan kaedah menganalisis kekuda yang sesuai untuk strutur kekuda dalam Rajah 2(b).

[1 mark]

[1 markah]

- ii. Determine the external reactions for unknown forces acting on the bridge truss structure.

Tentukan tindak balas luar bagi daya yang tidak diketahui yang bertindak pada struktur kekuda jambatan.

[5 marks]

[5 markah]

- iii. Analyze the force acting in CD, CF, and GF members whether in tension or compression condition.

Analisis daya yang bertindak dalam anggota CD, CF dan GF sama ada dalam keadaan tegangan atau mampatan.

[8 marks]

[8 markah]

QUESTION 3

SOALAN 3

CLO1

- (a) List **FOUR (4)** physical quantities commonly studied in kinematics.

Senaraikan EMPAT (4) kuantiti fizik yang biasa dikaji dalam kinematik.

[4 marks]

[4 markah]

CLO1

- (b) A particle moves along a straight line such that its position is defined by $s = (t^2 - 6t + 5)$ m. Interpret the position expressions into the following function of time at $t = 2$ s:

Sebuah zarah bergerak sepanjang satu garis lurus di mana kedudukannya ditakrifkan oleh persamaan $s = (t^2 - 6t + 5)$ m. Nyatakan ungkapan kedudukan tersebut kepada fungsi berikut pada masa, $t = 2$ s.

- i. Velocity

Halaju

[4 marks]

[4 markah]

- ii. Acceleration.

Pecutan

[4 marks]

[4 markah]

CLO1

- (c) A train starts from rest at station *A* and accelerates uniformly at 1.2 m/s^2 for 25 seconds. It then travels at a constant speed for some time before decelerating uniformly at 0.8 m/s^2 and comes to a stop at station *B*, which is 1.5 km away from station *A*.

Kereta api bermula dari keadaan rehat di stesen A dan memecut secara seragam pada kadar 1.2 m/s^2 selama 25 saat. Ia kemudian bergerak pada halaju malar pada 0.8 m/s^2 untuk suatu tempoh masa sebelum sehingga berhenti di stesen B, yang terletak 1.5 km dari stesen A.

- i. Sketch the Velocity-Time, $v-t$ graph

Lukiskan graf Halaju-Masa, $v-t$

[5 marks]

[5 markah]

- ii. Calculate time when it travels at a constant speed

Kirakan masa apabila ia bergerak pada halaju malar

[8 marks]

[8 markah]

QUESTION 4

SOALAN 4

- CLO1 (a) Describe the definition of work and energy.

Huraikan definisi kerja dan tenaga.

[4 marks]

[4 markah]

- CLO1 (b) The 50 kg crate shown in Figure 4(b) rests on a horizontal surface for which the coefficient of kinetic friction is $\mu_k=0.3$. If the crate is subjected to a 400 N towing force as shown.

Kotak seberat 50 kg yang ditunjukkan dalam Rajah 4(b) terletak di atas permukaan mendatar dengan pekali geseran kinetik $\mu_k=0.3$. Jika kotak itu dikenakan daya tarikan 400 N seperti yang ditunjukkan.

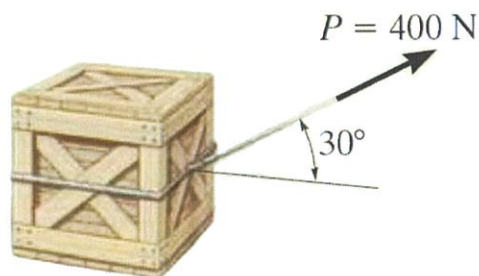


Figure 4(b) / Rajah 4 (b)

- i. Visualize the Free-Body Diagram (FBD)

Gambarkan Gambarajah Badan Bebas

[4 marks]

[4 markah]

- ii. Express the Equation of Motions of the towing movement.

Nyatakan Persamaan Gerakan bagi pergerakan menunda tersebut.

[4 marks]

[4 markah]

CLO1

- (c) A 50 kg block shown in Figure 4(c) rests on a horizontal plane for which the coefficient of kinetic friction is 0.30.

Sebuah bongkah 50 kg yang ditunjukkan dalam Rajah 4(c) terletak pada satah mengufuk dengan pekali geseran kinetik ialah 0.30.

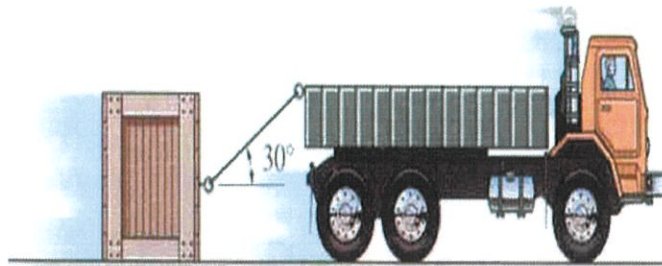


Figure 4(c) / Rajah 4 (c)

- i. Draw the Free Body Diagram (FBD)

Lukiskan Gambarajah Badan Bebas

[2 marks]

[2 markah]

- ii. If the crate is subjected to a 400 N towing force as shown, solve the velocity of the crate in 5 seconds starting from rest.

Jika bongkah dikenakan daya tarikan 400 N seperti yang ditunjukkan, selesaikan halaju bongkah dalam 5 saat bermula dari pegun.

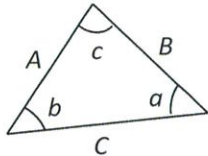
[11 marks]

[11 markah]

SOALAN TAMAT

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

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

$$\left(\begin{smallmatrix} + \\ \uparrow \end{smallmatrix} \right) \Sigma F_y = F_{1y} - F_{2y} + F_{3y}$$

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

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

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:*

$$v = u + at$$

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

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

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

$$v = r\omega$$

$$a = r\alpha$$

$$\omega = \frac{2\pi N}{60}$$

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. POTENTIAL ENERGY

$$PE = mgh$$

6. ANGULAR MOTION

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

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