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 II : 2025/2026

DJJ30313: ENGINEERING MECHANICS

TARIKH : 11 MEI 2026
MASA : 02.30 PETANG – 04.30 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)

INSTRUCTIONS:

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

ARAHAN:

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

QUESTION 1

SOALAN 1

CLO1 (a) State **TWO (2)** differences between scalar quantities and vector quantities.
*Nyatakan **DUA (2)** perbezaan di antara kuantiti skalar dan kuantiti vektor.*

[4 marks]
[*4 markah*]

CLO1 (b) The eyebolt is subjected to the forces F_1, F_2 and F_3 as shown in Figure 1(b). The magnitudes of F_1, F_2 and F_3 are 600 N, 500 N and 450 N respectively. Calculate:
Satu penyambung dikenakan daya F_1, F_2 dan F_3 seperti yang ditunjukkan pada Rajah 1(b). Nilai daya F_1, F_2 dan F_3 adalah 600 N, 500 N dan 450 N. Kirakan:

i. Magnitude of the resultant of these three forces.
Nilai paduan daya bagi ketiga-tiga daya tersebut.

[7 marks]
[*7 markah*]

ii. Direction angle of the resultant force.
Arah bagi daya paduan tersebut.

[2 marks]
[*2 markah*]

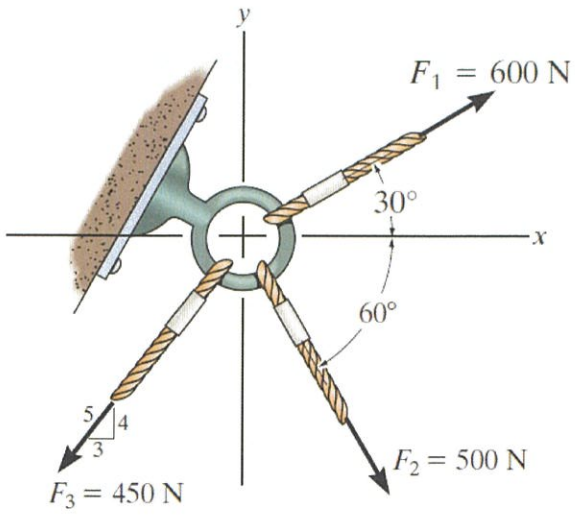


Figure 1(b) / *Rajah 1(b)*

CLO1

(c) The particle P is in equilibrium as shown in Figure 1(c).
Zarah P berada dalam keadaan keseimbangan seperti pada Rajah 1(c).

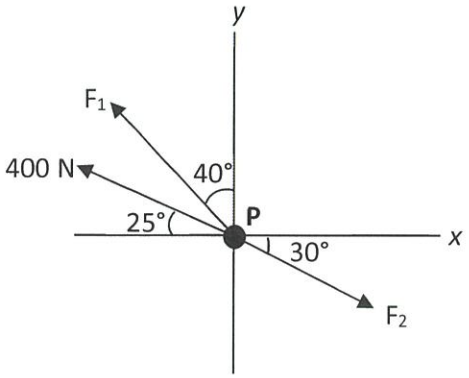


Figure 1(c) / *Rajah 1(c)*

i. Explain the condition of the equilibrium of the particle P.
Terangkan keadaan keseimbangan bagi zarah P.

[3 marks]
[*3 markah*]

ii. Express the magnitude of forces F_1 and F_2.
Nyatakan magnitud daya F_1 dan F_2.

[9 marks]
[*9 markah*]

QUESTION 2

CLO2 ***SOALAN 2***

(a) A pin-jointed plane truss structure is shown in Figure 2(a) and is subjected to a 5 kN vertical load at joint D. The truss is supported by a roller support at joint A and a pin support at joint E, which is attached to a vertical wall.

Struktur kekuda satah bersendi pin ditunjukkan dalam Rajah 2(a) dan dikenakan beban menegak 5 kN di sendi D. Struktur kekuda tersebut disokong oleh sokongan jenis penggelek di sendi A dan sokongan jenis pin di sendi E, yang dipasang pada dinding menegak.

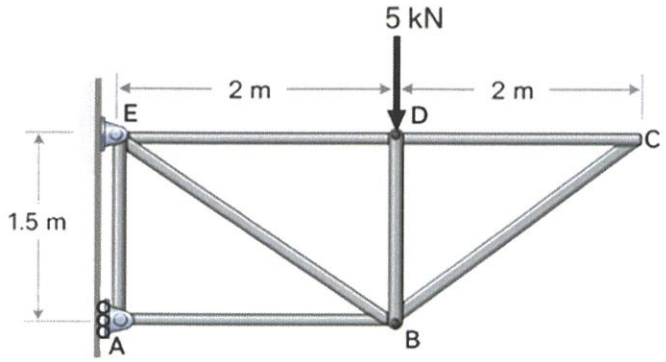


Figure 2(a) / *Rajah 2(a)*

i. Identify the members that carry zero force in the truss by applying the conditions of zero-force members.

Kenal pasti anggota-anggota yang mengalami daya sifar dalam kekuda tersebut dengan menggunakan syarat-syarat anggota daya-sifar .

[4 marks]

[*4 markah*]

ii. Calculate the magnitude of the support reaction force on the roller at A and the pin support at E.

Kira magnitud daya tindak balas sokongan pada penggelek di A dan sokongan pin di E.

[4 marks]

[*4 markah*]

iii. Calculate the force in member BD.
Tentukan daya pada anggota kekuda BD.

[3 marks]
[*3 markah*]

CLO2 (b) A bridge truss, as illustrated in Figure 2(b) consists of bars that are connected at their ends by joint connections. These joints can be connected by pinning, bolting, riveting or welding. Based on Figure 2(b):
Kekuda jambatan seperti pada Rajah 2(b) terdiri daripada bar yang disambung pada hujungnya melalui sambungan sendi. Sendi-sendi tersebut boleh disambungkan dengan cara menyemat, membaut, memaku atau mengimpal. Berdasarkan pada Rajah 2(b):

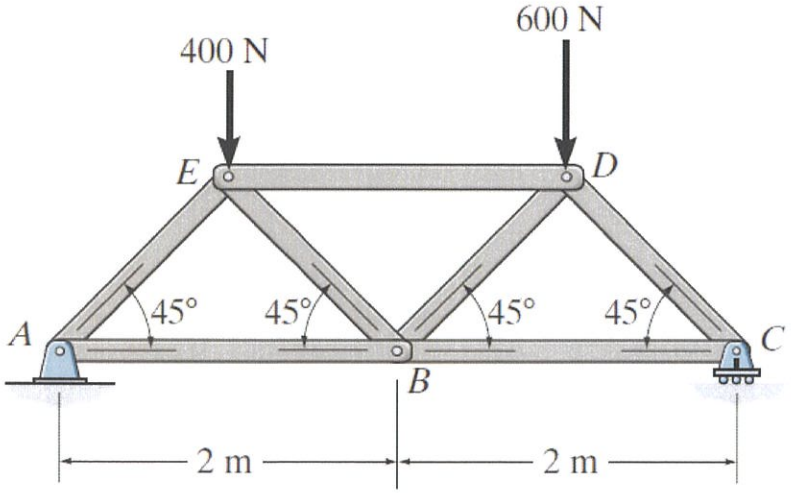


Figure 2(b)
Rajah 2(b)

i. Calculate the magnitude of the support reaction force at roller support C based on free body diagram.
Kira magnitud daya tindakbalas sokongan pada sokongan jenis penggelek C berdasarkan Rajah Badan Bebas.

[3 marks]
[3 *marks*]

ii. Calculate the force in members BC, BD and DE of the truss using the Method of Section.

Kira daya kekuatan anggota kekuda BC, BD dan DE dengan menggunakan kaedah pembahagian.

[8 marks]

[8 *markah*]

CLO2 (c) Based on the answer to Question 2(b)(ii), determine whether the members BC, BD and DE are in tension or compression.

Berdasarkan pada jawapan Soalan 2(b)(ii), tentukan samada anggota BC, BD dan DE berada dalam keadaan tegangan atau mampatan.

[3 marks]

[3 *markah*]

QUESTION 3

SOALAN 3

CLO1 (a) Explain the speed and velocity of a particle.

Terangkan kelajuan dan halaju bagi sesuatu zarah.

[4 marks]

[*4 markah*]

CLO1 (b) A motorcycle is moving with a uniform velocity of 20 m/s for 25 seconds. Then, it gradually accelerates at 3 m/s^2. After that, it continues at uniform velocity of 40 m/s before decelerating and finally stopping in 15 seconds. The total time it takes for the motorcycle to stop is 60 seconds.

Sebuah motosikal bergerak dengan halaju seragam 20 m/s selama 25 saat. Kemudian, ia memecut seragam pada 3 m/s^2. Selepas itu, ia meneruskan perjalanan dengan halaju seragam 40 m/s sebelum menyahpecut dan akhirnya berhenti dalam masa 15 saat. Jumlah masa keseluruhan yang diambil oleh motosikal tersebut untuk berhenti ialah 60 saat.

i. Draw a velocity - time graph.

Lukis graf halaju - masa.

[6 marks]

[6 *markah*]

ii. Calculate the deceleration of the motorcycle.

Kirakan nyahpecutan motosikal tersebut.

[3 marks]

[3 *markah*]

CLO1

(c) The angular velocity of a solid shaft is constantly decreased from 800 rpm to 300 rpm in 10 seconds. Calculate:
Halaju sudut satu aci berkurang secara seragam dari 800 ppm kepada 300 ppm dalam 10 saat. Kira:

i. Angular acceleration.
Pecutan sudut.

[6 marks]
[*6 markah*]

ii. Number of rotations in 10 seconds.
Bilangan pusingan dalam 10 saat.

[4 marks]
[*4 marks*]

iii. Additional time required for the shaft to stop.
Masa tambahan yang diperlukan untuk aci berhenti.

[2 marks]
[2 *markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Define kinetics and energy.

Takrifkan maksud kinetik dan tenaga.

[4 marks]

[4 markah]

CLO2 (b) The position of a car along a straight line is given by $s = (-0.5t^3 + 1.5t^2 + 150t - 4.5)$ m, where t is in seconds. Calculate:

Kedudukan sebuah kereta yang melalui garis lurus ditakrifkan sebagai $s = (-0.5t^3 + 1.5t^2 + 150t - 4.5)$ *m, di mana t diukur dalam saat. Kirakan:*

i. Velocity of the car when t = 10 seconds.

Halaju basikal apabila t = 10 saat.

[4 marks]

[4 *markah*]

ii. Acceleration of the car when t = 10 seconds.

Pecutan basikal apabila t = 10 saat.

[4 marks]

[4 *markah*]

CLO1

(c) The crate, which has a mass of 100 kg, is subjected to the action of two forces as shown in Figure 4(c). The coefficient of kinetic friction between the crate and the surface is $\mu_k = 0.2$.

Sebuah peti berjisim 100 kg, dikenakan tindakan dua daya seperti yang ditunjukkan pada Rajah 4(c). Pekali geseran kinetik antara peti dan satah permukaan ialah $\mu_k = 0.2$.

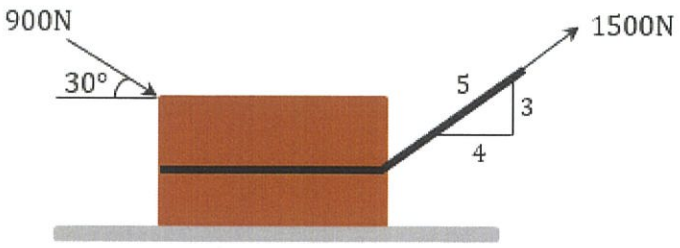


Figure 4(c)

Rajah 4(c)

i. Sketch a free-body diagram of the crate.

Lakarkan gambar rajah badan bebas peti tersebut.

[4 marks]

[*4 markah*]

ii. Calculate the distance the crate must travel to attain a speed of 10 m/s if it is originally at rest.

Kira jarak yang perlu ditempuh oleh peti untuk mencapai kelajuan 10 m/s, jika ia bermula dari keadaan rehat.

[9 marks]

[*9 markah*]

SOALAN TAMAT

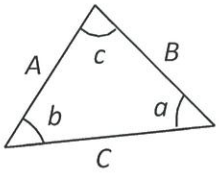
POLITEKNIK MALAYSIA

LIST OF FOMULA

DJJ30313 ENGINEERING MECHANICS

STATICS

1. TRIANGLE RULE



Sine law:

$$\frac{A}{\sin a} = \frac{B}{\sin b} = \frac{C}{\sin c}$$

Cosine law:

$$C = \sqrt{A^2 + B^2 - 2AB\cos\theta}$$

2. ADDITION OF SYSTEM OF COPLANAR FORCE

$$(\overset{+}{\rightarrow})\ \Sigma F_x = F_{1x} + F_{2x} + F_{3x} + ... + F_n$$

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

$$F_R = \sqrt{\sum F_x{}^2 + \sum F_y{}^2}$$

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

3. CARTESIAN VECTOR

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

4. EQUILIBRIUM OF PARTICLE

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

$$F = ks$$

DYNAMICS

1. RECTILINEAR MOTION OF PARTICLES

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

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

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

DYNAMICS

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. UNIFORM ANGULAR MOTION

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

- *α constant*:

$$\omega_2 = \omega_1 + \alpha t$$

$$\omega_2{}^2 = \omega_1{}^2 + 2\alpha\,\theta$$

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

$$\theta = \frac{1}{2}(\omega_2 + \omega_1)\,t$$

4. WORK OF FORCE

$$U_{1-2} = (F\cos\alpha)\,\Delta s$$

$$U_W = -W\,\Delta y$$

$$U_S = -(\tfrac{1}{2}\,ks_2{}^2 - \tfrac{1}{2}\,ks_1{}^2)$$

5. KINETIC ENERGY OF PARTICLE

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

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

6. POTENTAL ENERGY

$$PE = mgh$$