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 : 2026/2027

DJJ30313: ENGINEERING MECHANICS

TARIKH : 02 NOVEMBER 2026
MASA : 11.30 PAGI – 01.30 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)

TERBUKA

INSTRUCTION:

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) List **FOUR (4)** basic quantities in mechanics.

*Senaraikan **EMPAT (4)** kuantiti asas dalam mekanik.*

[4 marks]

[*4 markah*]

CLO1 (b) Express the horizontal (F_x) and vertical (F_y) components of the force shown in the Figure 1(b) as a Cartesian vector.

Nyatakan komponen mendatar (F_x) dan menegak (F_y) bagi daya yang ditunjukkan dalam Rajah 1(b) sebagai vektor Cartesian.

[6 marks]

[6 *markah*]

i.

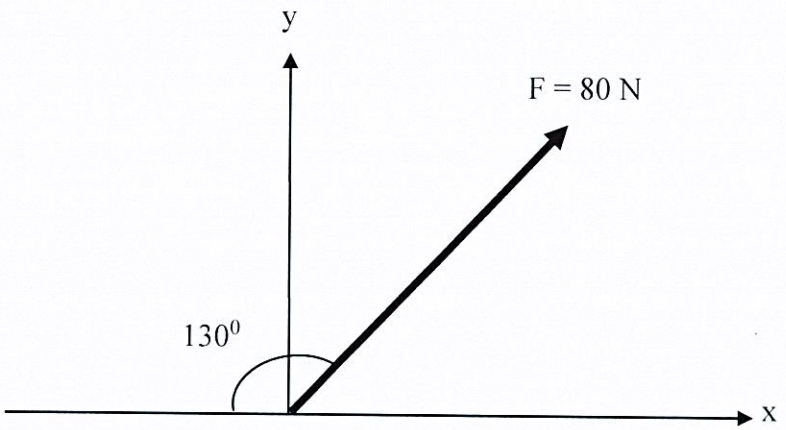


Figure 1(b) i / *Rajah 1(b) i*

TERBUKA

ii.

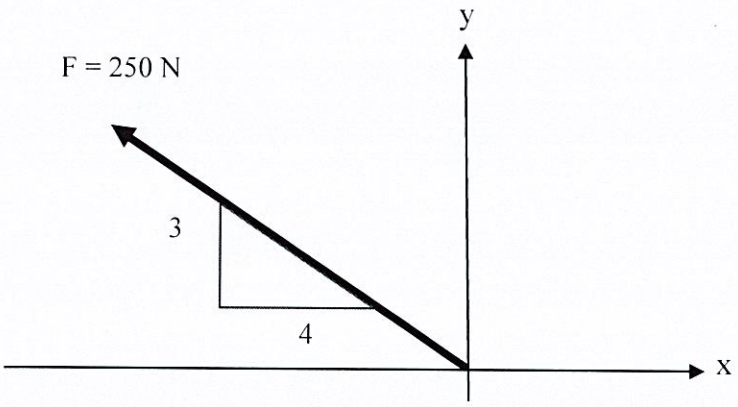


Figure 1(b) ii / *Rajah 1(b) ii*

CLO1 (c) i. With the aid of diagram explain for a particle to be in equilibrium.
Jelaskan sesuatu zarah berada dalam keadaan keseimbangan dengan bantuan gambarajah.

[4 marks]
[*4 markah*]

ii. Calculate the spring extension needed to maintain the 15 kg lamp in the position as illustrated in Figure 1(c), given that spring has a stiffness of K_{BC}= 600N/m.
Hitungkan pemanjangan spring yang diperlukan supaya lampu berjisim 15 kg berada pada kedudukan seperti yang ditunjukkan dalam Rajah 1(c). Diberi bahawa pemalar spring, K_{BC}, ialah 600 N/m.

TERBUKA

[11 marks]
[*11 markah*]

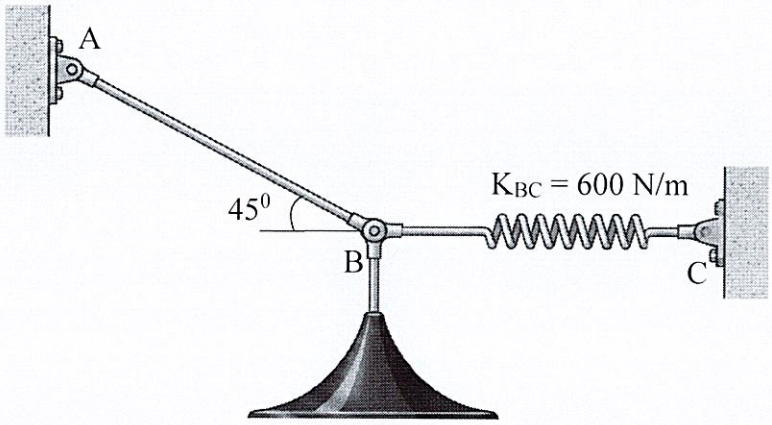


Figure 1(c) / *Rajah 1(c)*

TERBUKA

QUESTION 2

SOALAN 2

CLO2 (a) Answer the following questions based on Figure 2(a).

Jawab soalan berikut berdasarkan Rajah 2(a).

i. Calculate the support reactions at supports A and C of the entire truss using the equations of equilibrium.

Kirakan daya tindakbalas pada penyokong A dan C bagi keseluruhan kekuda dengan menggunakan persamaan keseimbangan.

[6 marks]

[*6 markah*]

ii. Calculate the forces in members AB and AD using the method of joints.

Kirakan daya pada anggota AB dan AD dengan menggunakan kaedah sendi.

[5 marks]

[*5 markah*]

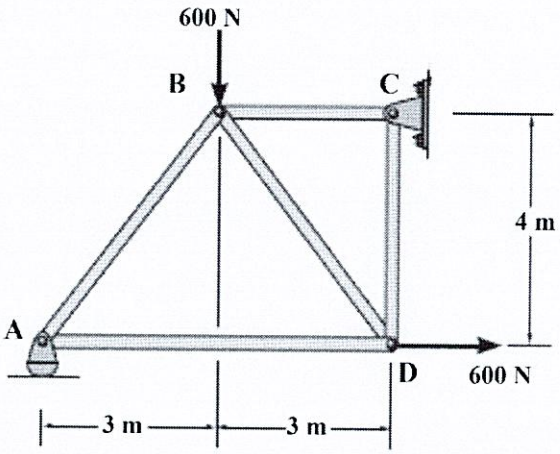


Figure 2(a) / *Rajah 2(a)*

TERBUKA

CLO 2

(b) Figure 2(b) illustrates the loading applied to the structure. Based on the figure, answer the following questions:
Rajah 2(b) menggambarkan beban yang dikenakan pada struktur . Berdasarkan rajah tersebut, jawab soalan-soalan berikut:

i. Determine the forces in members BC, CF, and FE in Figure 2(b).
Tentukan daya pada anggota BC, CF dan FE pada Rajah 2(b).

[11 marks]
[*11 markah*]

ii. Classify each member of BC, CF and FE as being in tension or compression.
Kelaskan setiap anggota BC, CF and FE *tersebut sama ada dalam keadaan tegangan atau mampatan.*

[3 marks]
[*3 markah*]

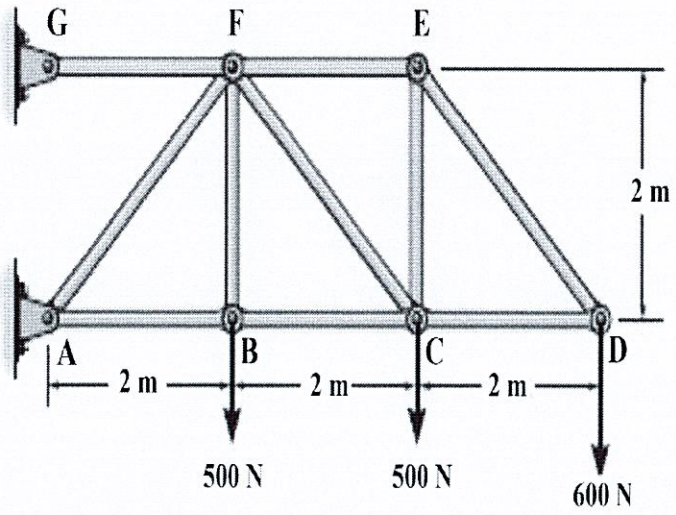


Figure 2(b) / *Rajah 2(b)*

TERBUKA

QUESTION 3

SOALAN 3

CLO1 (a) Explain the definition of velocity and angular velocity.
Terangkan definisi bagi halaju dan halaju putaran.

[4 marks]
[*4 markah*]

CLO1 (b) The position of high-speed train confined to move along a straight track is given by $s = 2t^3 - 6t + 4$, where s is measured in meters from a convenient origin and t is in seconds. Calculate:
Kedudukan sebuah keretapi berkelajuan tinggi yang bergerak di sepanjang trek lurus diberikan oleh $s = 2t^3 - 6t + 4$, dengan s diukur dalam unit meter daripada satu asalan yang sesuai dan t dalam saat. Hitungkan:

i. Velocity of the train when t = 5 seconds.
Halaju keretapi tersebut apabila t = 5 saat.

[3 marks]
[*3 markah*]

ii. Acceleration of the train when t = 5 seconds.
Pecutan keretapi tersebut apabila t = 5 saat.

[3 marks]
[*3 markah*]

iii. The time required to reach a velocity of 18 m/s from its initial condition t = 0.
Masa yang diperlukan untuk mencapai halaju 18 m/s daripada keadaan awalnya pada t = 0.

TERBUKA

[3 marks]
[*3 markah*]

CLO1 (c) A bus starts from rest and accelerates to reach a velocity of 20 m/s with an acceleration of 1 m/s^2. The velocity is maintained for 40 s before the bus decelerates uniformly until it stops within 8 s.

Sebuah bas bermula daripada rehat dan memecut untuk mencapai halaju 20 m/s dengan pecutan 1 m/s^2. Halaju tersebut dikekalkan selama 40 s sebelum bas itu mengalami nyahpecutan seragam sehingga berhenti sepenuhnya dalam masa 8 s.

i. Draw a velocity – time graph.
Lukis graf halaju – masa.

[4 marks]
[*4 markah*]

ii. Calculate the time taken during the acceleration phase.
Hitungkan masa yang diambil semasa fasa pecutan.

[2 marks]
[*2 markah*]

iii. Calculate the deceleration of the bus.
Hitungkan nyahpecutan bas tersebut.

[2 marks]
[*2 markah*]

iv. Calculate the total distance travelled for the whole journey.
Hitungkan jumlah jarak yang dilalui bagi keseluruhan perjalan tersebut.

TERBUKA

[4 marks]
[*4 markah*]

QUESTION 4

SOALAN 4

CLO1 (a) Define work and kinetic energy with the SI unit for each.

Takrifkan kerja dan tenaga kinetic beserta dengan unit SI bagi kedua-duanya.

[4 marks]

[*4 markah*]

CLO1 (b) A wind turbine blade assembly with a diameter of 2.4 m is rotating at 300 rev/min. When the wind speed drops, the blade assembly decelerates uniformly to 180 rev/min in 15 s. Calculate:

Struktur bilah turbin angin berdiameter 2.4 m berputar pada 300 pusingan seminit. Apabila kelajuan angin berkurang, struktur bilah itu mengalami nyahpecutan seragam kepada 180 pusingan seminit dalam masa 15 s. Hitungkan:

i. Angular deceleration of the blade.

Nyahpecutan sudut bilah tersebut.

[6 marks]

[*6 markah*]

ii. Initial and final linear speed of a point at the tip of the blade.

Laju linear awal dan akhir bagi suatu titik di hujung bilah.

[4 marks]

[*4 markah*]

iii. The number of revolutions made by the blade assembly when its angular displacement is 377 rad.

Bilangan putaran yang dibuat oleh struktur bilah itu apabila sesaran sudutnya ialah 377 rad.

TERBUKA

[3 marks]

[*3 markah*]

CLO1 (c) Figure 3 (c) shows a damaged sedan being towed by a tow truck on a straight horizontal road. The car has a mass of 1000 kg where the coefficient of kinetic friction between the tires of the car and the surface of the road is $\mu_k = 0.2$.

Rajah 3 (c) menunjukkan sebuah kereta sedan yang rosak sedang ditunda oleh sebuah lori tunda di atas jalan mendatar yang lurus. Kereta tersebut mempunyai jisim 1000kg yang mana pekali geseran kinetik antara tayar kereta dengan permukaan jalan ialah $\mu_k = 0.2$.

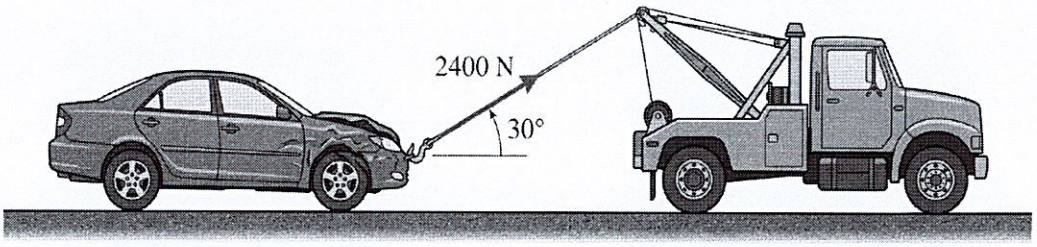


Figure 3(c) / *Rajah 3(c)*

i. Sketch a free-body diagram of the car.
Lakarkan gambar rajah badan bebas kereta tersebut.

[4 marks]
[*4 markah*]

ii. Calculate the value of the friction force acting on the car.
Hitungkan nilai daya geseran yang bertindak ke atas kereta tersebut.

[4 marks]
[*4 markah*]

TERBUKA

SOALAN TAMAT

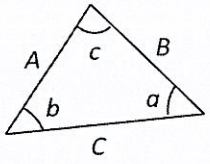
POLITEKNIK MALAYSIA

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:

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

2. ADDITION OF SYSTEM OF COPLANAR FORCE

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

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

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

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

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*:

$$v = u + at$$

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

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

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

$$v = r\omega \qquad \omega = \frac{2\pi N}{60}$$

$$a = r\alpha$$

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 MOTION

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

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

TERBUKA