SULIT

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK DAN KOLEJ KOMUNITI
KEMENTERIAN PENGAJIAN TINGGI

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI II : 2021/2022

DJJ30093: ENGINEERING MECHANICS

TARIKH : 05 JULAI 2022
MASA : 8.30 PAGI – 10.30 PAGI (2 JAM)

Kertas ini mengandungi **SEMBILAN (9)** halaman bercetak.
Struktur : 4 soalan
Dokumen sokongan yang disertakan : Formula

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

INSTRUCTION:

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

ARAHAN:

*Bahagian ini mengandungi **EMPAT (4)** soalan. Jawap **SEMUA** soalan.*

QUESTION 1

SOALAN 1

CLO1
C1

(a) State the Newton's first law of motion and give ONE (1) example of the Newton's first law of motion.

Nyatakan hukum pergerakan pertama Newton dan berikan SATU (1) contoh bagi hukum pergerakan pertama Newton tersebut.

[4 marks]

[4 *markah*]

CLO1
C3

(b) By referring Figure 1(b), calculate :

Merujuk Rajah 1(b), kirakan :

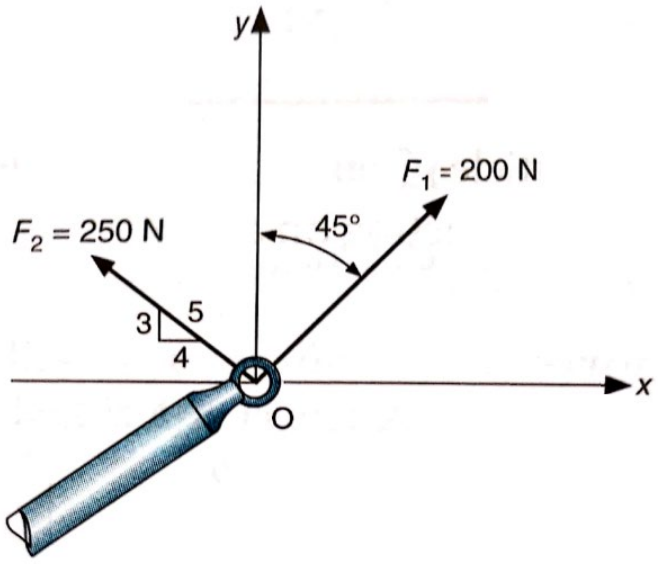


Figure 1(b) / *Rajah 1(b)*

i. Forces in component x and y axis.
Komponen-komponen daya paksi x dan y.

[4 marks]
[4 *markah*]

ii. The resultant force acting on point O and its direction counter clockwise along the x-axis.
Paduan daya terhasil yang bertindak pada titik O dan arahnya lawan arah pusingan jam dari paksi-x.

[4 marks]
[4 *markah*]

CLO1 C2

(c) 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 C3

(d) Calculate the internal forces in cable CB, CE and spring CD in Figure 1(d), if the ball weight 50kg.
Kirakan daya dalaman dalam kabel CB, CE dan pegas CD dalam Rajah 1(d), jika jisim bola 50kg.

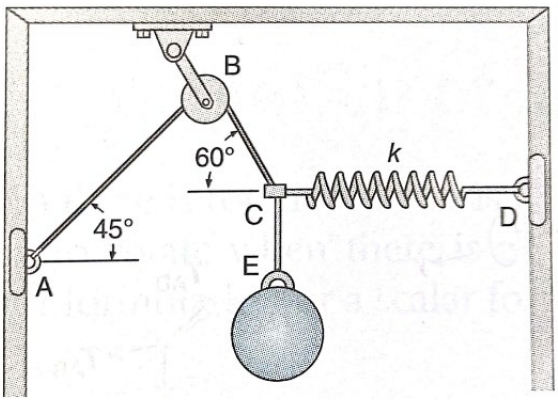


Figure 1(d) / *Rajah 1(d)*

[10 marks]
[10 *markah*]

QUESTION 2

SOALAN 2

CLO2
C4

(a) Determine the internal forces in each member of the truss, as shown in Figure 2(a). Indicate whether the member is in tension or compression.

Tentukan daya-daya dalaman dalam setiap ahli kerangka, seperti ditunjukkan dalam Rajah 2(a). Tunjukkan sama ada kerangka tersebut mengalami tegangan atau mampatan.

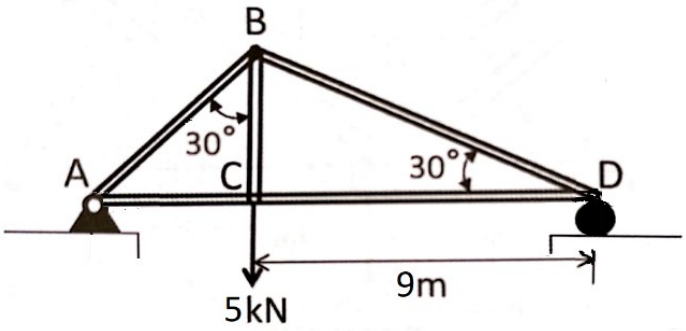


Figure 2(a) / *Rajah 2(a)*

[11 marks]

[11 *markah*]

CLO2
C4

(b) Figure 2(b) shows the Warren truss supported by a pin at A and a roller at E. By using the method of section:

Rajah 2(b) menunjukkan kerangka Warren dengan penyokong jenis pin pada A dan penggelek pada E. Dengan menggunakan kaedah keratan :

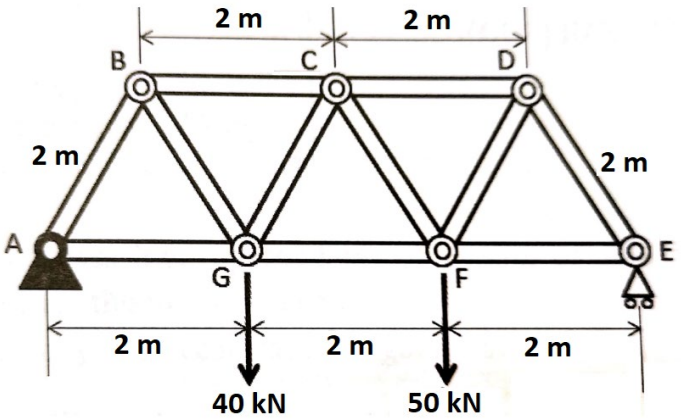


Figure 2(b) / *Rajah 2(b)*

i. Illustrate the free body diagram.
Gambarkan gambarajah badan bebas.

[1.5 marks]
[1.5 *markah*]

ii. Find the reaction force at the support A and E.
Cari daya tindakbalas bagi penyokong A dan E.

[5 marks]
[5 *markah*]

iii. Determine the force in member BC, CG and FG of the Warren truss, as shown in Figure 2(b). Indicate whether the members are in tension or compression.
Tentukan daya dalam anggota BC, CG dan FG bagi kerangka Warren, seperti ditunjukkan dalam Rajah 2(b). Tentukan sama ada kerangka-kerangka tersebut dalam tegangan atau mampatan.

[7.5 marks]
[7.5 *markah*]

QUESTION 3
SOALAN 3

CLO1
C1

(a) Define the following :
Takrifkan :

i. Linear velocity
Halaju lurus

[2 marks]
[*2 markah*]

ii. Linear acceleration
Pecutan lurus

[2 marks]
[*2 markah*]

CLO1 C2

(b) Explain the concepts of kinematics of particles.
Terangkan konsep kinematik zarah

[8 marks]
[*8 markah*]

CLO1 C3

(c) A train travels between two stations A and D. It starts with an acceleration of 1.2 m/s² for 18 seconds until it reaches point B. The velocity remains constant over a distance of 2000 m from point B to C, and then it decelerates uniformly at 2.4 m/s² until it stops at D.
Sebuah keretapi bergerak diantara dua stesen A dan D. Ia bermula dengan pecutan 1.2 m/s² selama 18 s sehingga tiba di stesen B. Halaju itu kekal sepanjang jarak 2000 m dari stesen B ke stesen C. Kemudian ianya nyahpecutan seragam 2.4 m/s² sehingga berhenti di stesen D.

i. Draw a Velocity – Time graph.
Lukiskan graf halaju –masa.

[5 marks]
[*5 markah*]

ii. Calculate the velocity at point B.
Kirakan halaju di stesen B.

[2 marks]
[*2 markah*]

iii. Calculate the distance from A to B.
Kirakan jarak dari stesen A ke B.

[2 marks]
[*2 markah*]

iv. Calculate the distance C to D.
Kirakan jarak dari stesen C ke D.

[2 marks]
[*2 markah*]

v. Calculate the total distance travelled by the train.
Kirakan jumlah jarak keseluruhan yang dilalui oleh keretapi.

[2 marks]
[*2 markah*]

QUESTION 4
SOALAN 4

CLO1
C1

(a) Describe Newton's second law. [4 marks]
Terangkan hukum Newton kedua. [*4 markah*]

CLO1
C2

(b) A compact car moving at 100 km/hr with kinetic energy of 290 000 Joules and then it moves at 50 km/hr speed.
Sebuah kereta kompak bergerak pada 100 km/j dan mempunyai 290,000 joule tenaga kinetik, kemudian ia bergerak kepada kelajuan 50 km/j.

i. Convert 50 km/hr to m/s.
Tukarkan 50 km/j ke m/s.

[3 marks]
[*3 markah*]

ii. Convert 100 km/hr to m/s.
Tukarkan 100 km/j ke m/s.

[3 marks]
[*3 markah*]

iii. Relate the kinetic energy and the potential energy according to Law of Conservation of Energy.

Kaitkan tenaga kinetik dan tenaga keupayaan mengikut Hukum Keabadian Tenaga.

[2 marks]

[*2 markah*]

CLO2
C3

(c) A man pushes a 80 N crate with a force **F**. The force is always directed down at 30^0 from the horizontal as shown in **Figure 4(c)**, and the magnitude increases until the crate begins to slide. If the coefficient of static friction is $\mu_s = 0.7$ and the coefficient of kinetic friction is $\mu_k = 0.4$;

*Seorang lelaki sedang menolak kotak seberat 80 N dengan daya **F**. Daya sentiasa dikenakan pada sudut 30^0 pada garisan mengufuk seperti **Rajah 4(c)** dan magnitude daya meningkat sehingga kotak bergelongsor. Jika pekali geseran statik adalah $\mu_s = 0.7$ dan pekali geseran kinetik adalah $\mu_k = 0.4$;*

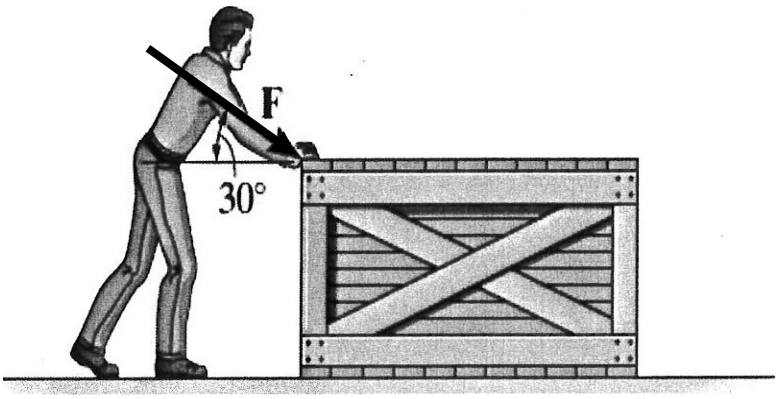


Figure 4(c) / *Rajah 4(c)*

i. Draw a free body diagram before the crate begin to slide.

Lukiskan gambarajah badan bebas sebelum kotak mula menggelongsor

[1.5 marks]

[*1.5 markah*]

ii. Calculate the force, **F** that directed down at 30° from the horizontal as shown in Figure 4(c).
*Kirakan daya, **F** yang dikenakan pada sudut 30° pada garisan mengufuk seperti Rajah 4(c).*

[6 marks]
[*6 markah*]

iii. Draw a free body diagram after the crate slide on the surface.
Lukiskan gambarajah badan bebas selepas kotak menggelongsor di permukaan.

[1.5 marks]
[*1.5 markah*]

iv. Calculate the initial acceleration of the crate.
Kirakan pecutan awal kotak.

[4 marks]
[*4 markah*]

SOALAN TAMAT

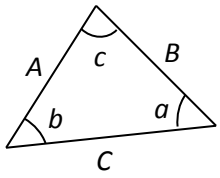
POLITEKNIK MALAYSIA
SULTAN AZLAN SHAH

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

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

$$\mathbf{u_A} = \frac{\mathbf{F}}{F} = \frac{F_x}{F}\mathbf{i} + \frac{F_y}{F}\mathbf{j} + \frac{F_z}{F}\mathbf{k}$$

$$cos^2\alpha + cos^2\beta + cos^2\gamma = 1$$

$$\mathbf{F_R} = \mathbf{\Sigma F} = \Sigma F_x\mathbf{i} + \Sigma F_y\mathbf{j} + \Sigma F_z\mathbf{k}$$

$$\mathbf{r} = (x_B - x_A)\,\mathbf{i} + (y_B - y_A)\mathbf{j} + (z_B - z_A)\mathbf{k}$$

$$\mathbf{F} = F\mathbf{u} = F\frac{\mathbf{r}}{r}$$

4. EQUILIBRIUM OF PARTICLE

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

$$F = ks$$

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

$$PE = mgh$$