SULIT

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

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI II : 2021/2022

DJJ3053: 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)** structured questions. Answer **ALL** questions.

ARAHAN:
*Bahagian ini mengandungi **EMPAT (4)** soalan berstruktur. Jawab semua soalan.*

QUESTION 1

SOALAN 1

CLO1 C1

(a) Newton's First Law states that an object at rest will remain at rest unless acted upon by an external force. Using this law, indicate what will happen when a bus at rest suddenly moves forward?

Hukum Pertama Newton menyatakan sesuatu objek yang berada dalam keadaan rehat akan tetap berada dalam keadaan rehat sehinggalah ada daya luar yang dikenakan. Dengan menggunakan hukum ini nyatakan apa yang akan berlaku jika sebuah bas yang sedang berhenti tiba-tiba bergerak ke hadapan?

[4 marks]
[*4 markah*]

CLO1 C2

(b) The screw eye in figure 1(a) is subjected to two forces FA and FB. Match the magnitude acting on each rope in order to develop a resultant force of 950 N directed along the positive x axis.

Sebuah pencangkuk dalam rajah 1(a) telah dikenakan dua daya FA dan FB. Padankan magnitud setiap tali supaya dapat menghasilkan daya paduan sebanyak 950N disepanjang paksi-x arah positif.

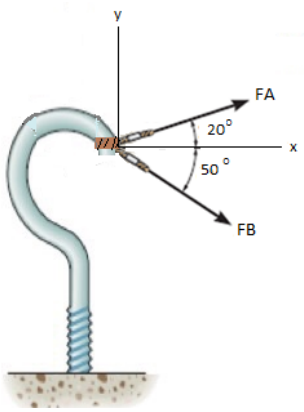


Figure 1(a)
Rajah 1(a)

[5 marks]
[5 *markah*]

CLO1
C3

(c) If cylinder E is 30kg and cylinder F is 60kg for equilibrium as figure 1(b) below; calculate the tensions developed in wires CD, CB and BA and the angle θ required for equilibrium.

Jika silinder E ialah 30kg dan silinder F ialah 60kg untuk keseimbangan seperti rajah 1(b), kirakan jumlah tegangan yang terhasil di dalam wayar CD, CB dan BA dan sudut θ yang diperlukan untuk semua berada didalam keseimbangan.

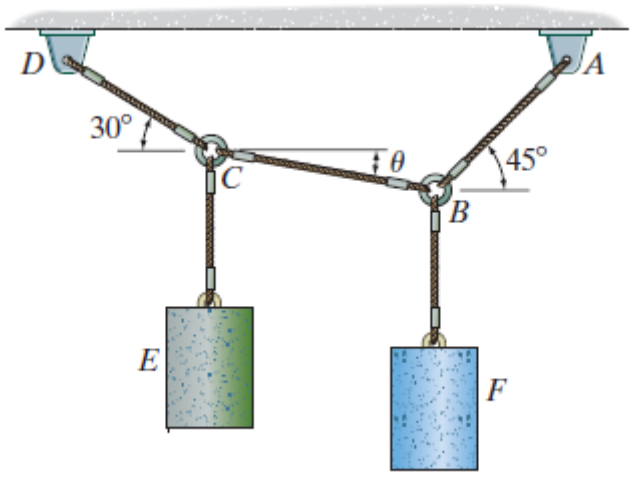


Figure 1(b)
Rajah 1(b)

[10 marks]
[10 *markah*]

(d) Figure 1(c) shows a block of a mass of 10kg resting on the smooth plane. Determine the unstretched length of the spring.
Rajah 1(c) menunjukkan blok dengan jisim 10kg dan berehat di atas permukaan licin, Tentukan panjang asal spring.

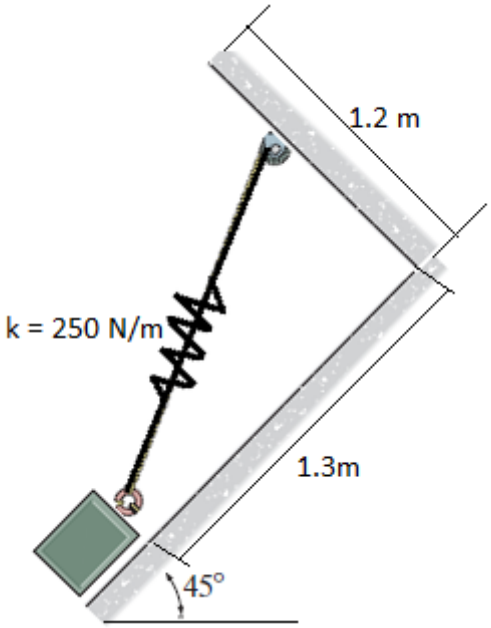


Figure 1(c)
Rajah 1(c)

[6 marks]
[6 markah]

CLO1
C4

QUESTION 2

SOALAN 2

CLO1
C2

(a) Figure 2(a) shows the system of the truss. Represent the system in the form of Free Body Diagram.
Rajah 2(a) menunjukkan sistem rasuk. Wakilkan sistem tersebut dalam bentuk Gambarajah Badan Bebas.

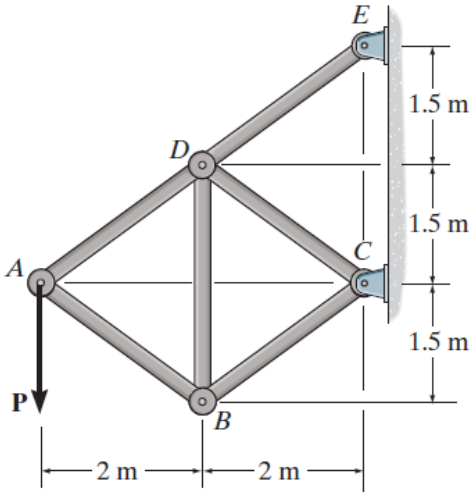


Figure 2(a)
Rajah 2(a)

[4 marks]
[*4 markah*]

CLO1
C2

(b) The truss is shown in figure 2(a) with P_1=800 kN and P_2=400 kN. Express each members of truss, whether in tension or compression.
Kekuda seperti rajah 2(a) dengan P_1 = 800 kN dan P_2 = 400 kN. Nyatakan daya di dalam setiap badan sama ada tengangan atau mampatan.

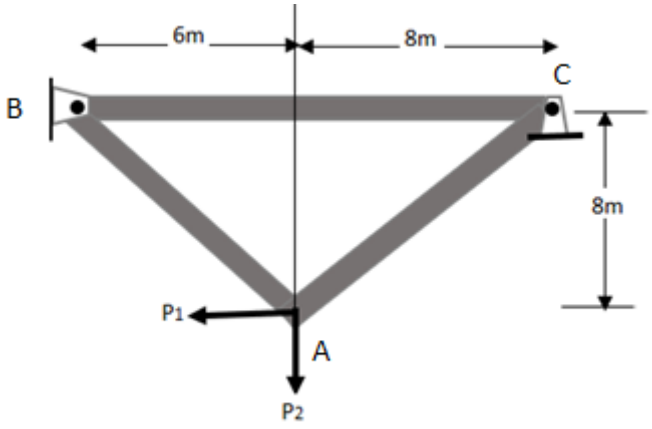


Figure 2 (b)
Rajah 2 (b)

[9 marks]
[9 markah]

CLO1
C3

(c) The Howe bridge truss is subjected to the loading shown figure 2(c). Calculate the force in members JK, CJ, and CD.

Sebuah jambatan kerangka Howe telah dikenakan beban sepeti ditunjukkan dalam rajah 2 (c). Kirakan daya dalam anggota JK, CJ, dan CD.

[12marks]

[12 markah]

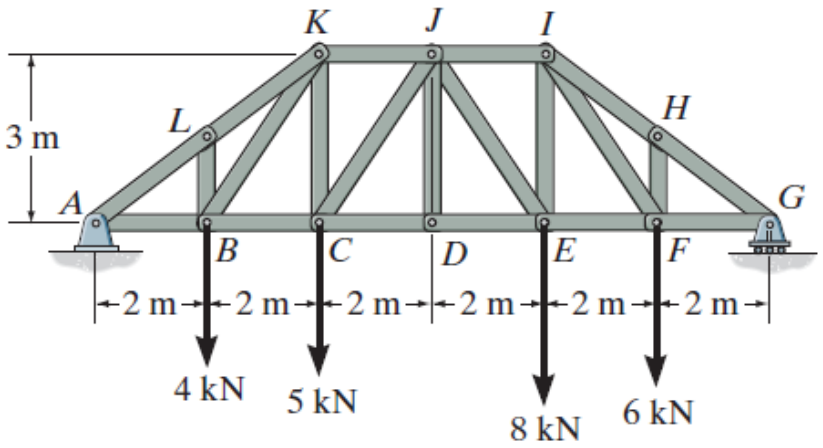


Figure 2(c)
Rajah 2(c)

QUESTION 3

SOALAN 3

CLO1
C1

(a) Define the following terms: -

Takrifkan terminologi berikut:-

i. Velocity

Halaju

ii. Acceleration

Pecutan

[4 marks]
[*4 markah*]

CLO1
C2

(b) A particle moves with acceleration $5 m/s^2$. Fill in the velocity and displacement formula given when t=4s;

$$v = v_0 + at$$
$$\Delta s = v_0 t + \tfrac{1}{2} at^2$$

Sebuah jasad bergerak dengan pecutan 5m/s^2. *Isikan formula halaju dan sesaran yang telah diberikan jika t=4s;*

$$v = v_0 + at$$
$$\Delta s = v_0 t + \tfrac{1}{2} at^2$$

i. The particles start from rest
Jasad bergerak dari keadaan diam

[2 marks]
[*2 markah*]

ii. The particles move with initial velocity 12m/s
Jasad bergerak dengan halaju awal 12m/s

[3 marks]
[*3 markah*]

CLO1
C3

(c) The coordinate of a car which is confined to move along straight line is given by equation $s = 2t^3-24t + 6$, where s is expressed in meters and t in seconds.
Calculate:
Koordinat sebuah kereta yang bergerak sepanjang garis lurus di beri persamaan $s = 2t^3-24t + 6$, *dimana s dalam unit meter dan t dalam saat. Kirakan:*

i. The time required for the car to reach a velocity of 72m/s from its initial condition at t = 0
Masa yang diperlukan untuk kereta mencapai halaju 72m/s daripada koordinat awal di t=0

[3 marks]
[3 *markah*]

ii. The acceleration of the car when the velocity is 30m/s
Pecutan kereta apabila halaju 30m/s

[3 marks]
[3 *markah*]

iii. The net displacement of the car during the interval from t=1s to t=4s.
Jarak sebenar yang dilalui kereta diantara t=1s kepada t=4s.
[4 marks]
[4 *markah*]

CLO1
C4

(d) A fan from rest moves with the blades accelerating steadily to 120rad/s in 1.5s. Determine its angular acceleration and the angle through which it turns.
Kipas berputar dari keadaan rehat, pecutan bilah seragam kepada 120 *rad/s dalam* 1.5*s. Tentukan pecutan sudut dan sudut apabila ia berputar.*
[6 marks]
[6 *markah*]

QUESTION 4

SOALAN 4

CLO1
C1

a) Define the following terms: -
Takrifkan terminologi berikut:-

i. Kinetics
Kinetik

ii. Work
Kerja

[4 marks]
[*4 markah*]

CLO1
C2

b) A 20kg box has a pulling force of 150N which is acting 30° from the horizontal plane as shown in figure 4(b). The box is moving with constant acceleration of 2 m/s^2. Express the friction force and the coefficient of friction between the box and the floor from the equation below;

F= ma

Sebuah kotak 20kg ditarik oleh daya sebanyak 150N yang bertindak 30° dari keadaan mengufuk seperti yang ditunjukkan dalam rajah 4(b). Kotak tersebut bergerak dengan pecutan seragam sebanyak 2 m/s^2. Nyatakan daya geseran dan pekali geseran antara kotak dan lantai daripada persamaan di bawah;

$F = ma$

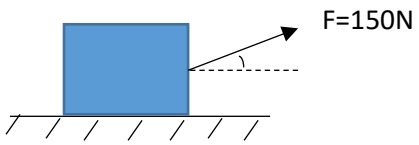


Figure 4(b)
Rajah 4(b)

[9 marks]
[9 *markah*]

CLO1
C3

c) The 50kg crate as shown in figure 4(c) has an initial velocity of 1m/s on the inclined plane. If a towing force F = 5t (N), where t is in seconds has been applied to the crate for 6 seconds, calculate the acceleration and the velocity of the crate. The coefficient of kinetic friction is 0.2.
Sebuah bongkah 50kg seperti rajah 4(c) mempunyai halaju awal 1m/s di atas permukaan condong. Jika bongkah ditunda dengan daya F = 5t (N), iaitu t bersamaan saat dan pergerakkan bongkah ialah 6 saat , kirakan pecutan dan halaju bongkah tersebut. Diberi pekali geseran kinetic ialah 0.2.

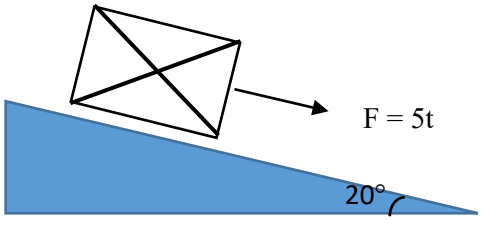


Figure 4(c)
Rajah 4(c)

[12 marks]
[12 *markah*]

SOALAN TAMAT

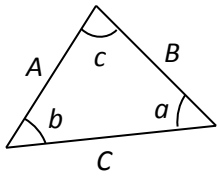
POLITEKNIK MALAYSIA
SULTAN AZLAN SHAH

LIST OF FOMULA

DJJ3053: ENGINEERING MECHANICS

STATICS

1. TRIANGLE RULE



Sine law:

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

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

$$PE = mgh$$