SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI DISEMBER 2017

DJJ3053 : ENGINEERING MECHANICS

TARIKH : 03 APRIL 2018
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. Answers **ALL** questions

ARAHAN :

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

QUESTION 1

SOALAN 1

CLO1
C1

(a) List **FOUR (4)** basic measurement quantities.

*Senaraikan **EMPAT (4)** kuantiti asas pengukuran.*

[4 marks]

[*4 markah*]

CLO1
C2

(b) Explain Newton's Laws of Motion.

Terangkan Hukum Pergerakan Newton.

i. First Law / *Hukum Pertama*

ii. Second Law / *Hukum Kedua*

[5 marks]

[*5 markah*]

CLO1
C3

(c) Based on **Figure 1(a),** if F_1=150N and Φ=30°, calculate the magnitude of the resultant force acting on the bracket and its direction measured clockwise from the positive x-axis.

*Berdasarkan **Rajah 1(a),** jika F_1=150N dan Φ=30°, kirakan magnitud daya paduan yang bertindak ke atas braket dan arah yang diukur mengikut arah jam dari paksi x positif.*

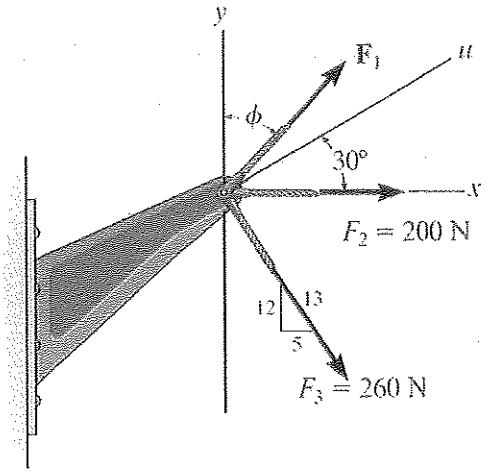


Figure 1(a) / *Rajah 1(a)*

[10 marks]
[*10 markah*]

CLO1
C4

(d) i. Calculate the magnitude of the resultant force of F_1 and F_2 as shown in **Figure 1(b)** in terms of Cartesian vector.

*Kirakan magnitud daya paduan bagi daya-daya F_1dan F_2 yang ditunjukkan pada **Rajah 1(b)** dalam bentuk Cartesian vector.*

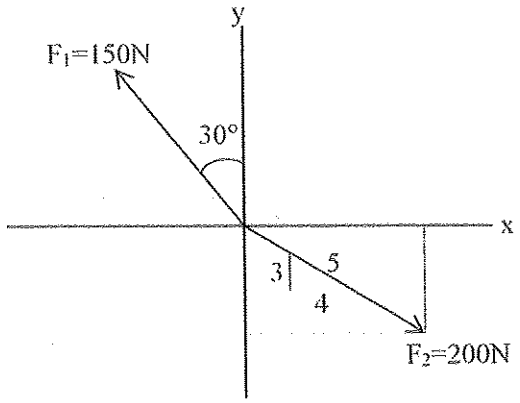


Figure 1(b) / *Rajah 1(b)*

[4 marks]
[*4 markah*]

ii. Predict what will happen to the resultant force if the angle of F_1 is increased to 60°

Jangkakan apa yang akan terjadi kepada daya paduan jika sudut F_1 dinaikkan menjadi 60°

[2 marks]
[*2 markah*]

QUESTION 2

SOALAN 2

CLO1
C1

(a) Define Equilibrium of particle and give the law of motion which satisfies the equilibrium condition.

Takrifkan definisi keseimbangan zarah dan berikan hukum pergerakan yang mematuhi keadaan keseimbangan tersebut.

[4 marks]

[*4 markah*]

CLO1
C2

(b) If the mass of chandelier in **Figure 2(a)** is 50kg, determine the tension developed in BD and CD cable used to support the chandelier.

*Sekiranya berat candelier pada **Rajah 2(a)** ialah 50kg, tentukan daya tegangan kabel BD dan CD untuk menyokong candelier tersebut.*

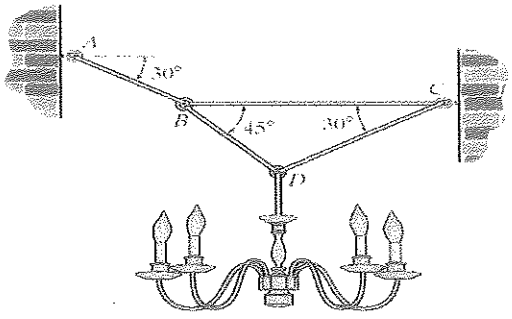


Figure 2(a) / *Rajah 2(a)*

[9 marks]

[*9 markah*]

CLO1
C3

(c) The bridge in **Figure 2(b)** is subjected to the loading shown. Calculate the force in the part of frame HI, HB and BC of the truss. Identify whether the parts of frame are in tension or compression.

*Jambatan pada **Rajah 2(b)** dikenakan daya seperti yang ditunjukkan. Kirakan daya dalam bahagian kerangka HI, HB dan BC kekuda tersebut. Kenalpasti samada bahagian kerangka tersebut berada dalam keadaan regangan atau mampatan.*

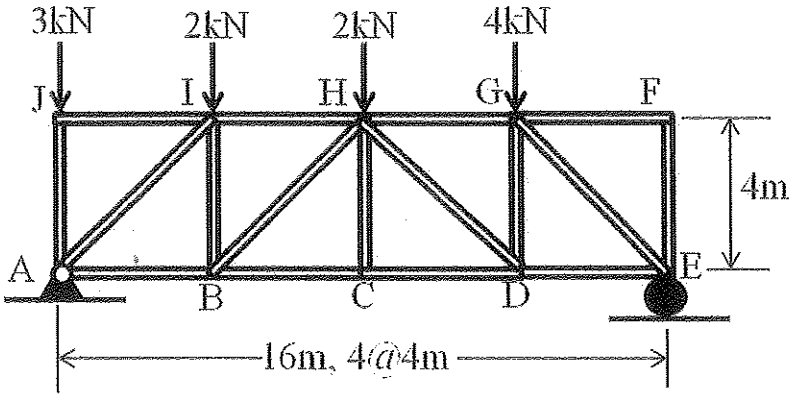


Figure 2(b) / *Rajah 2(b)*

[12 marks]

[*12 markah*]

QUESTION 3

SOALAN 3

CLO1
C1

(a) Define the following terms:

Takrifkan maksud istilah tersebut:

i. Velocity / *Halaju*

[2 marks]

[*2 markah*]

ii. Acceleration / *Pecutan*

[2 marks]

[*2 markah*]

CLO1
C2

(b) A car is travelling along a straight road at 30km/h and the speed increases to 100km/h in 20s. Determine the distance travelled. The answer must be in SI unit.

Sebuah kereta bergerak sepanjang jalan lurus pada 30km/j dan kelajuannya meningkat kepada 100km/j dalam masa 20s. Tentukan jarak yang dilalui. Jawapan mestilah dalam unit SI.

[5 marks]

[*5 markah*]

CLO1
C3

(c) A car starts from rest and accelerates uniformly for 50 seconds and reaches a velocity of 70m/s at the end of the acceleration. Its velocity is maintained for a while and then it stops within 60 seconds with constant deceleration. The total distance travelled by the car is 11.5km.

Sebuah kereta dari keadaan pegun memecut seragam selama 50 saat dan mencapai halaju 70m/s pada akhir pecutan tersebut. Halaju dikekalkan untuk seketika dan ia berhenti dalam masa 60 saat dengan nyahpecutan seragam. Jumlah jarak yang dilalui oleh kereta tersebut ialah 11.5km.

i. Sketch a velocity-time graph

Lakarkan graf halaju melawan masa

[4 marks]
[*4 markah*]

ii. Calculate the acceleration of the car

Kirakan pecutan kereta tersebut

[2 marks]
[*2 markah*]

iii. Calculate the time taken for the journey

Kirakan jumlah masa yang diambil untuk perjalanan tersebut.

[4 marks]
[*4 markah*]

CLO1
C4

(d) A vehicle moves in a straight road with a displacement defined by $s = (0.6t^3+0.3t^2)$m where t is in second and s is in meter. When t = 6s, identify:

Sebuah kenderaan bergerak pada jalan lurus dengan sesaran bersamaan dengan $s = (0.6t^3+0.3t^2)$*m di mana nilai t dalam unit saat dan s dalam unit meter . Apabila t = 6s, kenalpasti:*

i. Velocity / *Halaju*

[2 marks]
[*2 markah*]

ii. Acceleration / *Pecutan*

[2 marks]
[*2 markah*]

iii. Predict whether the vehicle is in the motion of accelerating or decelerating within the duration time of $\{1 \leq t \leq 6\}$ s.

Jangkakan samada pergerakan kenderaan mengalami pecutan atau nyahpecutan pada selang masa $\{1 \leq t \leq 6\}$ s.

[2 marks]
[*2 markah*]

QUESTION 4

SOALAN 4

CLO1
C1

(a) Define the following terms:

Takrifkan maksud istilah tersebut:

i. Kinetics / *Kinetik*

[2 marks]

[*2 markah*]

ii. Work / *Kerja*

[2 marks]

[*2 markah*]

CLO1
C2

(b) An 80kg block as shown in **Figure 4(a)** rests on a horizontal plane. Determine the magnitude of the force P required to give the block an acceleration of 2.5 m/s^2 to the right. The coefficient of kinetic friction between the block and the plane is $\mu_k = 0.25$.

*Sebuah blok 80kg pada **Rajah 4(a)** berada di atas lantai mendatar. Tentukan magnitud daya P yang diperlukan untuk blok tersebut bergerak ke kanan dengan pecutan 2.5m/s^2. Pekali geseran kinetik antara blok dan lantai ialah $\mu_k = 0.25$.*

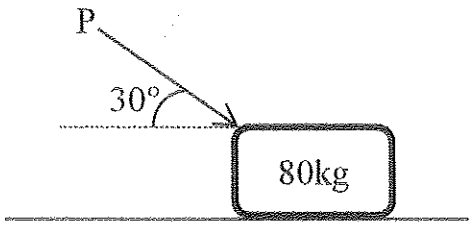


Figure 4(a) / *Rajah 4(a)*

[9 marks]

[*9 markah*]

CLO1
C3

(c) The 100kg crate shown in **Figure 4(b)** is originally at rest on a smooth horizontal surface. If a force of 200N is applied to the crate for 6s, calculate the final velocity using:

*Sebuah bongkah kayu 100kg seperti pada **Rajah 4(b)** berada dalam keadaan pegun di atas permukaan mengufuk yang licin. Jika satu daya 200N dikenakan ke atasnya untuk 6s, kirakan halaju akhir dengan menggunakan:*

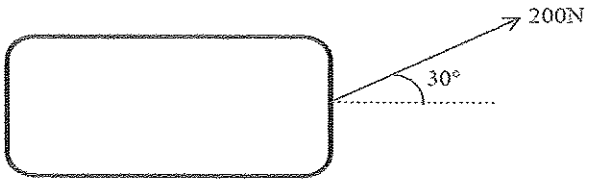


Figure 4(b) / *Rajah 4(b)*

i. Equation of motion

Persamaan gerakan

[7 marks]

[*7 markah*]

ii. Principle of work and energy

Prinsip kerja dan tenaga

[5 marks]

[*5 markah]*

SOALAN TAMAT

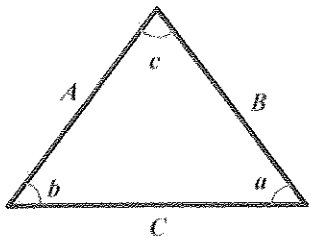
POLITEKNIK MALAYSIA

LIST OF FORMULA

DJJ3053 – 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

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

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

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

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

3. CARTESIAN VECTOR

$$\mathbf{A} = A_x\mathbf{i} + A_y\mathbf{j} + A_z\mathbf{k}$$

$$\mathbf{u}_A = \frac{\mathbf{A}}{A} = \frac{A_x}{A}\mathbf{i} + \frac{A_y}{A}\mathbf{j} + \frac{A_z}{A}\mathbf{k}$$

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

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

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

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

4. EQUILIBRIUM OF PARTICLE

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

$$F = ks$$

DYNAMICS

1. RECTILINEAR MOTION OF PARTICLES

$$v = {ds}/{dt}$$

$$a = {dv}/{dt}$$

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

$$U_{1\rightarrow 2} = (F\cos\alpha)\Delta x$$

4. KINETIC ENERGY OF PARTICLE

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

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

5. POTENTIAL ENERGY

$$PE = mgh$$