SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI JUN 2017

DJJ3053 : ENGINEERING MECHANICS

TARIKH : 01 NOVEMBER 2017
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

CLO 1
C1

(a) Define the terms below:
Takrifkan istilah dibawah:

i. Mass
Jisim [2 marks]
[*2 markah*]

ii. Space
Ruang [2 marks]
[*2 markah*]

CLO 1
C2

(b) Differentiate between the quantity of scalar and vector quantities and give **TWO (2)** examples for each quantity.
*Bezakan antara kuantiti skalar dan kuantiti vektor serta berikan **DUA (2)** contoh bagi setiap kuantiti.* [5 marks]
[*5 markah*]

CLO 1 C3 (c) Calculate the magnitude of force T acting on the eyebolt and its angle θ, if the magnitude of the **resultant force** is 9 kN to be directed along the positive x axis.

*Kira magnitud daya yang bertindak ke atas T 'eyebolt' dan sudut θ jika magnitud **daya paduan** adalah 9 kN yang bertindak sepanjang paksi x positif.*

[10 marks]

[*10 markah*]

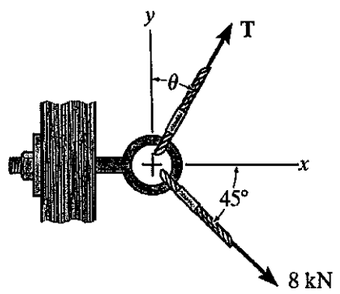


Figure 1(c)

Rajah 1(c)

CLO1 C4 (d) Solve each force acting into x and y components. Express the force as a Cartesian vector.

Selesaikan setiap daya yang bertindak ke pada komponen x dan y. Tunjukkan daya dalam bentuk vektor Cartesian.

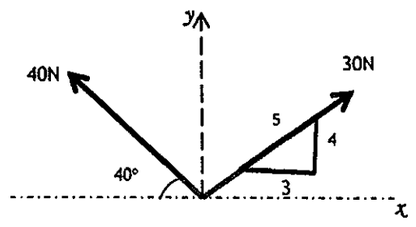


Figure 1(d)

Rajah 1(d)

[6 marks]

[*6 markah*]

QUESTION 2

SOALAN 2

CLO 1 C1 (a) Describe the following terms

Terangkan istilah berikut

i. the conditions for equilibrium

keadaan untuk keseimbangan

ii. plane truss

kekuda satah

[4marks]

[*4 markah*]

CLO 1 C2 (b) Based on Figure 2(b), determine the tension developed in cable CA and CB

Berdasarkan kepada Rajah 2(b), tentukan tegangan yang terhasil pada kabel CA dan CB

[9 marks]

[*9 markah*]

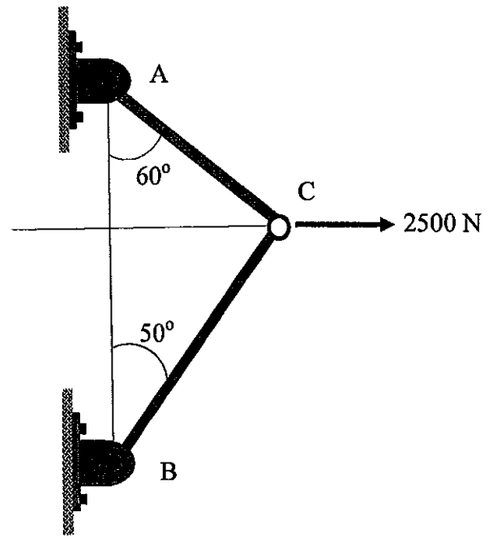


Figure 2(b)

Rajah 2(b)

CLO 1
C3

(c) Using the method of joints, determine:

Dengan menggunakan kaedah sambungan, tentukan

i. the force in each member of the truss and state whether the members are in tension or compression.

daya dalam setiap anggota kekuda dan nyatakan samada anggota dalam tegangan atau mampatan

[5 marks]
[*5 markah*]

ii. the magnitude of the external reactions at A and B and show the direction of the reaction.

daya tindak balas di A dan B dan tunjukkan arah tindak balasnya.

[7 marks]
[*7 markah*]

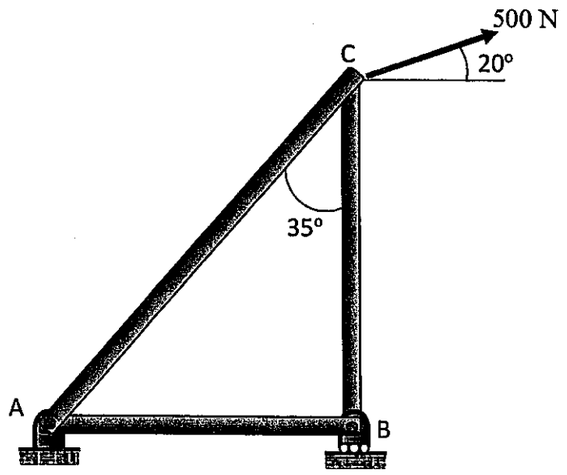


Figure 2(c)

Rajah 2(c)

QUESTION 3

SOALAN 3

CLO 1
C1

(a) Define the following terms:-

Takrifkan maksud yang berikut:-

i. Constant velocity [2 marks]
Halaju seragam [*2 markah*]

ii. Constant acceleration [2 marks]
Pecutan seragam [*2 markah*]

CLO 1
C2

(b) A shaft starts from rest and reaches velocity 250 rpm in 10 seconds. Calculate the angular acceleration of the shaft and the number of rotation within the time.

Sebatang aci bermula dari pegun dan mencapai halaju 250 rpm dalam masa 10 saat. Kirakan halaju sudut acidan bilangan pusingan dalam masa tersebut.

[5 marks]
[*5 markah*]

CLO 1
C3

(c) An object being thrown up from the top of 100 meters building from the ground with a velocity 20 m/s. Determine:-

Satu objek dilontar dari atas puncak bangunan yang tingginya 100 meter dari permukaan bumi dengan halaju 20 m/s. Kirakan:-

i. The velocity of an object exactly when it hits the ground
Halaju objek apabila ia mencecah permukaan bumi

[5marks]
[*5 markah*]

ii. Time taken from it starts until it reaches the ground

Masa yang diambil sejak dilontarkan hingga ia mencecah permukaan bumi

[5marks]
[*5 markah*]

CLO 1
C4

(d) A car starts from rest with a constant acceleration of 1.25 m/s^2 until it achieves 50 km/h. The velocity maintained as far as 1.2 km. When the brake is applied it stops with 10 second with constant deceleration.

Sebuah kereta bermula dari pegun dengan pecutan seragam 1.25 m/s^2 sehingga mencapai halaju 50 km/j. halaju tersebut dikekalkan sejauh 1.2 km. Apabila brek dikenakan ia berhenti dengan lambatan seragam selama 10 saat.

i. Calculate the total time taken during the journey
Kirakan jumlah masa yang diambil untuk keseluruhan perjalanan

[3 marks]
[*3 markah*]

ii. Determine the total distance during the journey
Hitungkan jumlah jarak yang dilalui untuk keseluruhan perjalanan

[3 marks]
[*3 markah*]

QUESTION 4
SOALAN 4

CLO 1
C1

(a) Define kinematics and kinetics.
Takrifkan kinematik dan kinetik.

[4 marks]
[*4 markah*]

CLO 1
C2

(b) Based on **Figure 4(b)**, determine the tension developed in the cable when the motor, M winds in the cable with a constant acceleration. Then, the 25 kg crate moves a distance s = 6 m in 4 s, starting from rest. The coefficient of kinetic friction between the crate and the plane is $\mu_k = 0.25$.

*Berdasarkan pada **Rajah 4(b)**, tentukan daya tegangan pada kabel apabila motor M melilit kabel dengan pecutan seragam. Seterusnya, peti 25 kg bergerak sejauh s=6m dalam masa 4 saat, bermula dari keadaan pegun. Pekali geseran kinetik di antara peti dan satah permukaan ialah $\mu_k = 0.25$.*

[9 marks]
[*9 markah*]

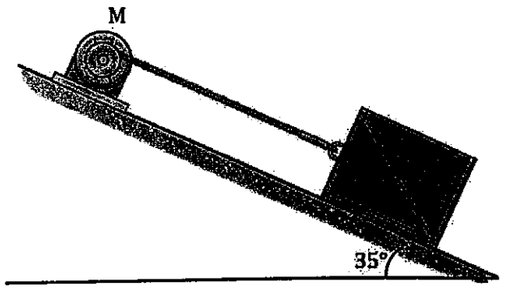


Figure 4(b)
Rajah 4(b)

CLO 1
C3

(c) The 150 kg box as shown in **Figure 4(c)** is originally at rest on the smooth horizontal surface. If a towing force of 300N acting at an angle of 45° is applied to the box for 8 s, determine the final velocity using:

*Sebuah kotak 150kg seperti pada **Rajah 4(c)** berada dalam keadaan pegun di atas permukaan mengufuk yang licin. Jika daya tegangan 300 N bertindak ke atas kotak pada sudut 45° selama 8 saat, tentukan halaju akhir dengan menggunakan:*

i. Equation of motion
Persamaan gerakan

[7 marks]
[*7 markah*]

ii. Principle of work and energy
Prinsip kerja dan tenaga

[5 marks]
[*5 markah*]

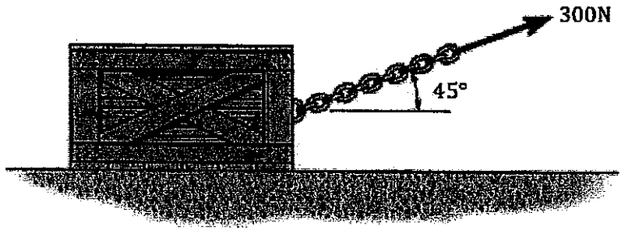


Figure 4(c)
Rajah 4 (c)

SOALAN TAMAT

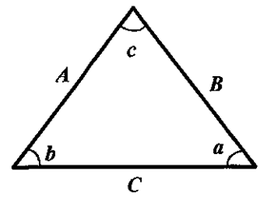
POLITEKNIK MALAYSIA

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

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

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

5. POTENTIAL ENERGY

$$PE = mgh$$