SULIT

POLITEKNIK MALAYSIA

BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI

JABATAN KEJURUTERAAN MEKANIKAL

PEPERIKSAAN AKHIR

SESI DISEMBER 2016

DJJ3053 : ENGINEERING MECHANICS

TARIKH : 12 APRIL 2017
MASA : 8.30 AM - 10.30 AM (2 JAM)

Kertas ini mengandungi **SEBELAS (11)** 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) Name **FOUR (4)** basic quantities in the field of mechanics

*Namakan **EMPAT (4)** kuantiti asas dalam bidang mechanics.*

[4 marks]

[*4 markah*]

CLO1
C2

b) Figure 1(b) shows a force F=38 kN acting on the particle O. Describe the components of the x and y axis.

Rajah 1(b) menunjukkan satu daya F=38 kN bertindak ke atas zarah O. Huraikan daya tersebut kepada komponen paksi-x dan paksi-y.

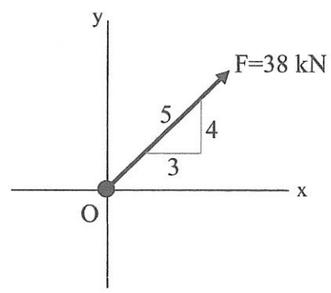


Figure 1(b)

Rajah 1(b)

[5 marks]

[5 markah]

CLO1
C3

c) Figure 1 (c) shows the three forces acting on the particle O. Calculate;
Rajah 1(c) menunjukkan tiga daya bertindak ke atas zarah O. Kirakan;

i. Magnitude Resultant Force for these forces.
Magnitud Daya Paduan bagi daya-daya tersebut.

[7 marks]
[*7 markah*]

ii. The direction of the Resultant Force in counterclockwise from the positive x-axis.
Arah Daya Paduan mengikut arah lawan pusingan jam dari paksi-x positif.

[3 marks]
[*3 markah*]

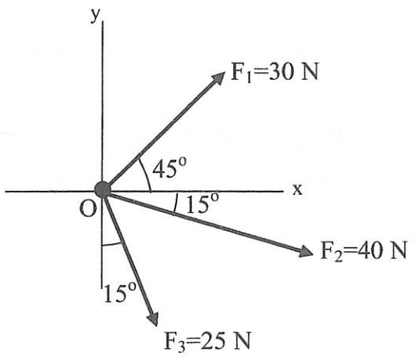


Figure 1(c)
Rajah 1(c)

CLO1
C4

d) Two forces F_1=60 kN and F_2=40 kN acting on the particle O as shown in Figure 1(d);
Dua daya F_1=60 kN dan F_2=40 kN bertindak ke atas zarah O seperti rajah 1(d);

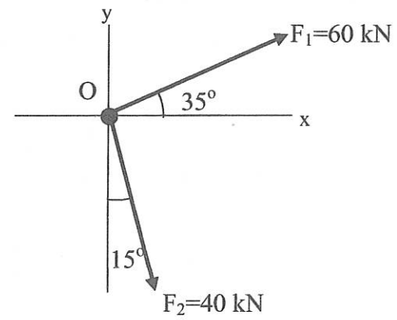


Figure 1(d)
Rajah 1(d)

i. Calculate magnitude of the Resultant Force of the forces as Cartesian vector form.
Kirakan magnitud Daya Paduan bagi daya-daya tersebut dalam Bentuk Vektor Kartesian

[3 marks]
[*3 markah*]

ii. Predict what will happen to the resultant force if the angle of F_2 is increased to 30°.
Jangkakan apakah yang akan berlaku kepada daya paduan sekiranya nilai sudut bagi F_2 dinaikkan kepada 30°.

[3 marks]
[*3 markah*]

QUESTION 2
SOALAN 2

CLO1 C1

(a) If an object is in equilibrium, then the forces are balanced.
Jika objek berada dalam keseimbangan, maka daya-daya adalah seimbang.

i. State the condition for the equilibrium of a particle.
Nyatakan keadaan keseimbangan bagi sesuatu zarah.

[3 marks]
[*3 markah*]

ii. Give the law of motion which satisfies the above condition.
Beri hukum gerakan yang memuaskan keadaan di atas.

[1 mark]
[*1 markah*]

CLO1 C2

(b) If the mass of bucket in Figure 2(b) is 10 kg, determine the tension developed in EB and ED cable used to support the bucket.
Sekiranya berat bakul Rajah 2(b) ialah 10 kg, tentukan daya tegangan kabel EB dan ED untuk menahan bakul tersebut.

[9 marks]
[*9 markah*]

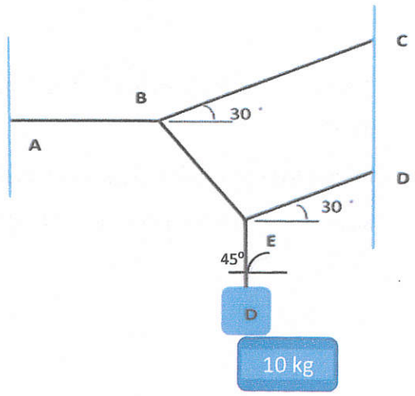


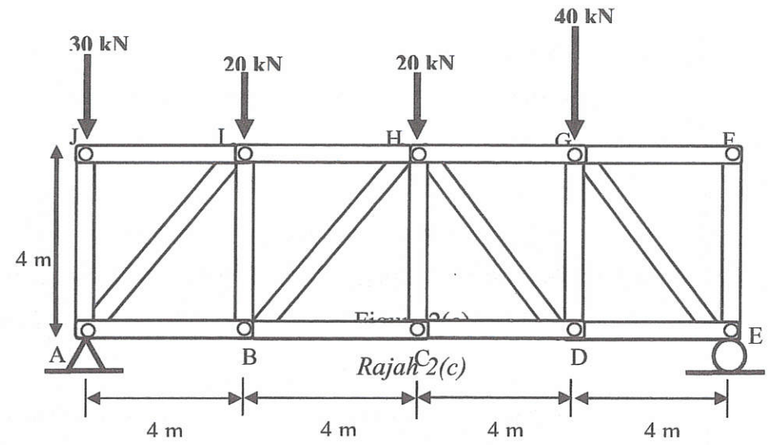
Figure 2(b)
Rajah 2(b)

CLO1 C3

(c) The bridge in Figure 2(c) is subjected to the loading shown. Identify whether the members IH, BH dan BC of the truss are in tension or compression form.

Jambatan pada Rajah 2(c) dikenakan daya seperti yang ditunjukkan. Kenalpasti sama ada bahagian kerangka IH, BH dan BC kekuda tersebut berada dalam keadaan regangan atau mampatan.

[12 marks]
[*12 markah*]



Rajah 2(c)

QUESTION 3

SOALAN 3

CLO1
C1

a) Define the following terms:
Takrifkan isitilah berikut:

i. Velocity
Halaju

[2 marks]
[*2 markah*]

ii. Displacement
Anjakan

[2 marks]
[*2 markah*]

CLO1
C2

b) A vehicle moves in a straight line such that for a short time its velocity is defined by $v = (0.9t^2 + 0.6t)$ m/s where t is in second. When t = 3s, determine :

Kenderaan A bergerak lurus dalam masa yang singkat dengan halaju bersamaan $v = (0.9t^2 + 0.6t)$ *m/s dimana nilai t ialah dalam unit second. Apabila t = 3s, tentukan ;*

i. Displacement (s)
Anjakan (s)

[3 marks]
[*3 markah*]

ii. Acceleration (a)
Pecutan (a)

[2 marks]
[*2 markah*]

CLO1
C3

c) A car starts from rest and accelerates uniformly for 70 seconds and reaches a velocity of 80 m/s at the end of the acceleration. Its velocity is maintained for a while and then it stops within 65 seconds with constant deceleration. The total distance travelled by the car is 12.2 km.

Sebuah kereta bermula dari pegun dan memecut dengan seragam selama 70 saat dan mencapai halaju 80 m/s pada akhir pecutan itu. Halaju itu dikekalkan seketika dan kemudian ia berhenti dalam masa 65 saat dengan nyahpecutan seragam. Jumlah jarak dilalui oleh kereta tersebut ialah 12.2 km.

i. Draw a Velocity-Time graph
Lukiskan gambarajah halaju-masa

[4 marks]
[*4 markah*]

ii. Determine the acceleration of the car
Tentukan pecutan kereta tersebut

[1 marks]
[*1 markah*]

iii. Calculate the time taken for the journey
Kirakan masa yang diambil untuk perjalanan itu

[3 marks]
[*3 markah*]

iv. Determine the deceleration of the car.
Tentukan nyahpecutan bagi kereta itu

[2 marks]
[*2 markah*]

CLO1
C4

d) A train starts from rest at a station with constant acceleration of 2.5 m/s^2 until it achieves velocity of 70 km/h. Then, the train decelerate until it stop in 10 s. Determine:

Sebuah keretapi mula bergerak dari keadaan rehat di sebuah stesen dengan pecutan malar sebanyak 2.5 m/s^2 sehingga mencapai halaju70 km/h. Keretapi kemudiannya nyahpecutan sehingga ia berhenti dalam masa 10 s. Tentukan:

i. Distance travelled by the train
Jarak keseluruhan yang dilalui oleh keretapi

[3 marks]
[*3 markah*]

ii. Deceleration of the train
Nyahpecutan keretapi

[3 marks]
[*3 markah*]

QUESTION 4
SOALAN 4

CLO1
C1

a) Draw the free body diagram.
Lukis gambarajah badan bebas.

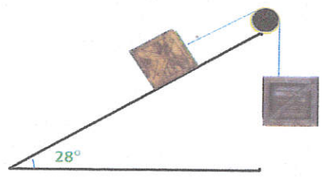


Figure 4(a)
Rajah 4(a)

[4 marks]
[*4 markah*]

CLO1
C2

b) A 50 kg crate rests on a horizontal plane for which the coefficient of kinetic friction (μ_k) is 0.30. If the crate is subjected to a 400N towing force as shown in Figure 4(b), determine the velocity of the crate in 5 sec starting from rest.

Sebuah peti 50 kg berkeadaan pegun terletak pada satah mengufuk dimana pekali geseran kinetik (μ_k) adalah 0.30. Jika peti itu dikenakan daya tarikan sebanyak 400N seperti yang ditunjukkan dalam Rajah 4(b), tentukan halaju peti dalam masa 5 saat bermula dari keadaan pegun.

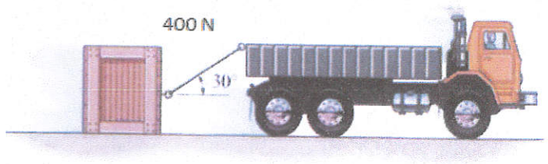


Figure 4(b)
Rajah 4(b)

[9 marks]
[*9 markah*]

CLO1
C3

c) A particle of 2 kg mass is being pulled across a smooth horizontal surface by a horizontal force. The force does 24 Joule of work in increasing the particle's velocity from $5ms^{-1}$ to $v\ ms^{-1}$. Calculate the value of v and the position of particle after 15s.

Satu zarah berjisim 2 kg sedang ditarik pada permukaan mendatar dengan daya mendatar. Daya itu menghasilkan kerja sebanyak 24 Joule dan menyebabkan peningkatan halaju zarah dari $5ms^{-1}$ to $v\ ms^{-1}$. Kira nilai v dan kedudukan zarah selepas 15s.

[12 marks]
[*12 markah*]

SOALAN TAMAT

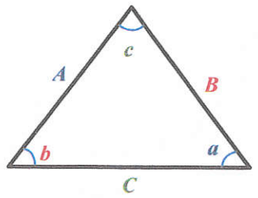
POLITEKNIK MALAYSIA

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

$$KE = \tfrac{1}{2}mv^2$$
$$U_{1\rightarrow 2} = T_2 - T_1$$

5. POTENTIAL ENERGY

$$PE = mgh$$