



First Semester Examination  
2019/2020 Academic Session

December 2019 / January 2020

**EMM 101 – Engineering Mechanics**  
**[Mekanik Kejuruteraan]**

Duration : 3 hours  
[Masa : 3 jam]

Please check that this paper contains **EIGHT [8]** printed pages before you begin the examination.

*[Sila pastikan bahawa kertas soalan ini mengandungi **LAPAN [8]** mukasurat bercetak sebelum anda memulakan peperiksaan.]*

**INSTRUCTIONS** : Answer **ALL FOUR [4]** questions.  
**[ARAHAN** : Jawab **SEMUA EMPAT [4]** soalan.]

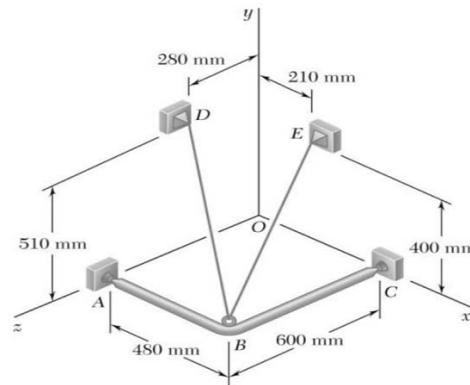
Answer Questions In **English OR Bahasa Malaysia**.  
*[Jawab soalan dalam **Bahasa Inggeris** ATAU **Bahasa Malaysia**.]*

Answer to each question must begin from a new page.  
*[Jawapan bagi setiap soalan mestilah dimulakan pada mukasurat yang baru.]*

In the event of any discrepancies, the English version shall be used.  
*[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.]*

1. [a] Figure 1 [a] shows a frame ABC that is supported by a cable DBE that passes through a frictionless ring at B. Knowing that the tension in the cable is 385 N, determine the force vector EB and force vector DB that exerted by the cable.

Rajah 1 [a] menunjukkan satu bingkai ABC yang disokong oleh kabel DBE melalui gelang tanpa geseran di B. Diketahui bahawa tegangan dalam kabel adalah 385 N, tentukan vektor daya EB dan vektor daya DB yang dikenakan oleh kabel.

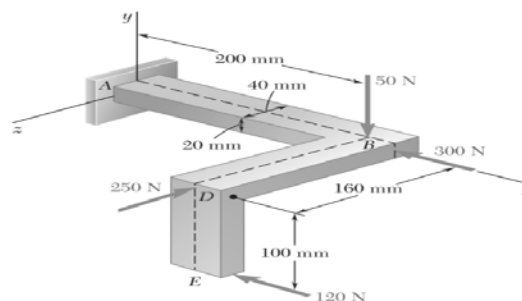


**Figure 1 [a]**  
Rajah 1 [a]

(50 marks/markah)

- [b] Figure 1 [b] shows a machine component ABDE that is acting by four forces. Replace the forces with the equivalent force and moment acting at A in vector notation.

Rajah 1 [b] menunjukkan satu komponen mesin yang ditindak oleh empat daya. Gantikan daya-daya tersebut dengan daya setara dan momen di titik A dalam perwakilan vektor.



**Figure 1 [b]**  
Rajah 1 [b]

(50 marks/markah)

2. [a] Figure 2 [a] shows a pole ACD supported by a pin at A and cable BC.

Rajah 2 [a] menunjukkan sebuah tiang ACD yang disokong oleh pin di A dan kabel BC.

- (i) Draw the free body diagram of the assembly of Figure 2 [a].  
Lukis rajah jasad bebas pepasangan Rajah 2 [a].

(10 marks/markah)

- (ii) Determine all the components of reaction at the supports if the cylinder has a mass of 40 kg.  
Tentukan kesemua komponen tindak balas pada penyokong-penyokong jika silinder tersebut berjisim 40 kg.

(50 marks/markah)

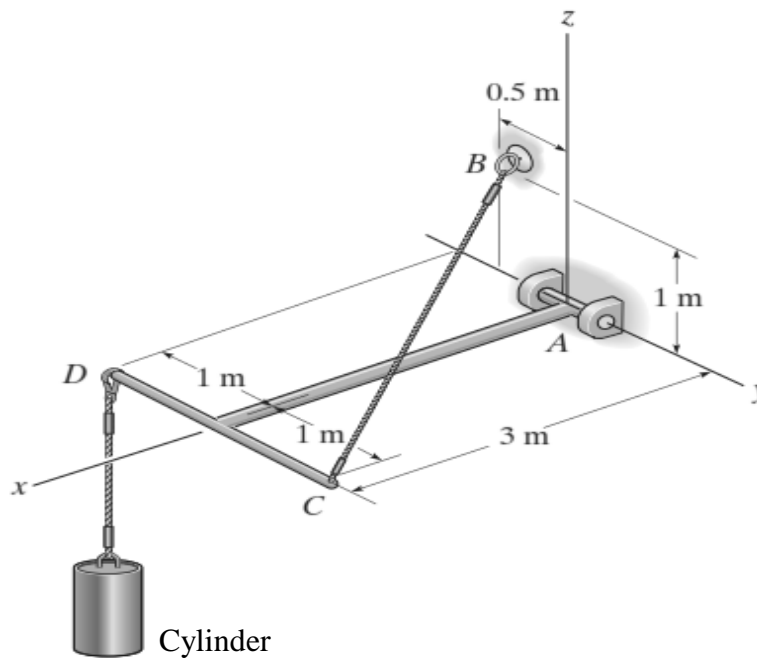


Figure 2 [a]  
Rajah 2 [a]

[b] Figure 2 [b] shows a composite area of two elementary shapes.

Rajah 2 [b] menunjukkan luas komposit bagi dua bentuk asas.

- (i) Locate the centroid  $\bar{y}$  of the composite area.  
Cari sentroid  $\bar{y}$  bagi luas komposit.

(20 marks/markah)

- (ii) Determine the moment of inertia of the composite area about the  $x'$  axis.

Tentukan momen inersia bagi luas komposit sekitar paksi  $x'$ .

(20 marks/markah)

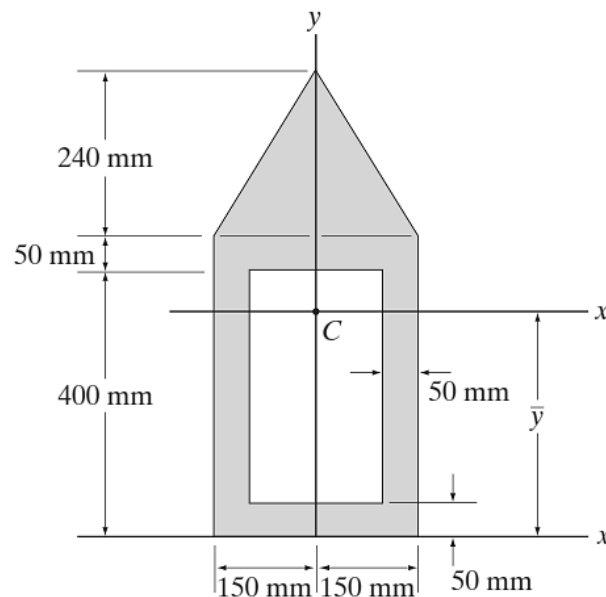


Figure 2 [b]  
Rajah 2 [b]

3. [a] The baseball player A hits the baseball with  $v_A = 12 \text{ m/s}$  and  $\theta_A = 60^\circ$  as shown in Figure 3 [a]. When the ball is directly above of player B he begins to run under it. Determine the constant speed  $v_B$  and the distance  $d$  at which the player B must run in order to make the catch at the same elevation at which the ball was hit.

Pemain besbol A memukul bola besbol dengan  $v_A = 12 \text{ m/s}$  dan  $\theta_A = 60^\circ$  seperti dalam Rajah 3 [a]. Apabila bola berada di atas pemain B, dia mula berlari di bawahnya. Tentukan kelajuan malar  $v_B$  dan jarak  $d$  di mana pemain B mesti lari untuk membuat tangkapan pada ketinggian yang sama di mana bola telah dipukul.

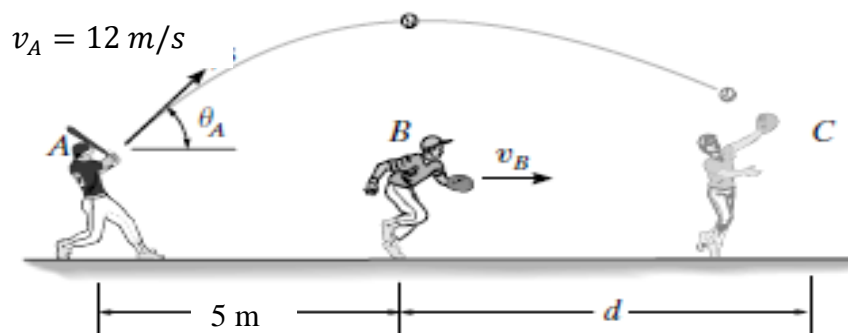
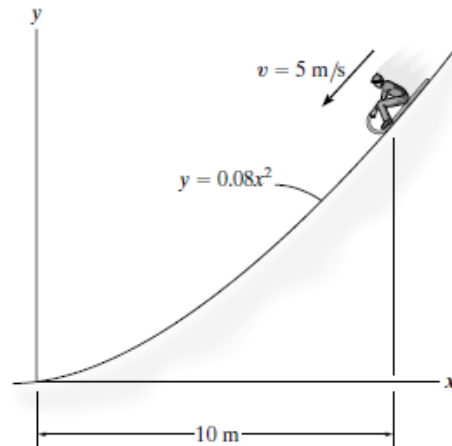


Figure 3 [a]  
Rajah 3 [a]

(50 marks/markah)

- [b] A sledge and rider of total mass  $90 \text{ kg}$  travel down along the (smooth) slope defined by the equation  $y = 0.08x^2$  as shown in Figure 3 [b]. At the instant  $x = 10 \text{ m}$ , the sledge's speed is  $5 \text{ m/s}$ . At this point, determine the rate of increase in speed and the normal force which the slope exerts on the sledge. Neglect the size of the sledge and rider for the calculation.

Sebuah andur salji dan penunggang berjisim  $90 \text{ kg}$  bergerak ke bawah di sepanjang cerun (lancar) yang ditakrifkan oleh persamaan  $y = 0.08x^2$  seperti dalam Rajah 3 [b]. Pada ketika  $x = 10 \text{ m}$ , kelajuan andur salji adalah  $5 \text{ m/s}$ . Pada titik ini, tentukan kadar kenaikan kelajuan dan daya normal daripada cerun pada andur salji. Abaikan saiz andur salji dan penunggang untuk pengiraan.



**Figure 3 [b]**  
Rajah 3 [b]

(50 marks/markah)

4. [a] A roller coaster car descends from the highest point of the track to the lowest. Neglecting friction, determine:

*Sebuah kereta 'roller coaster' turun dari tempat yang tertinggi ke tempat yang terendah. Dengan mengabaikan geseran, tentukan:*

- (i) **The speed of the car at its lowest point if the car has initial speed of 1.5 m/s at that highest point.**

*Kelajuan kereta di tempat terendah jika kereta itu mempunyai kelajuan mulaan 1.5 m/s di tempat yang tertinggi tersebut.*

(25 marks/markah)

- (ii) **The smallest radius of curvature such that the passengers will not experience a normal force that is more than 3 times their weight against the seat of the car.**

*Jejari kelengkungan terkecil supaya penumpang tidak akan mengalami daya normal yang lebih daripada 3 kali berat badan mereka terhadap kerusi kereta.*

(25 marks/markah)

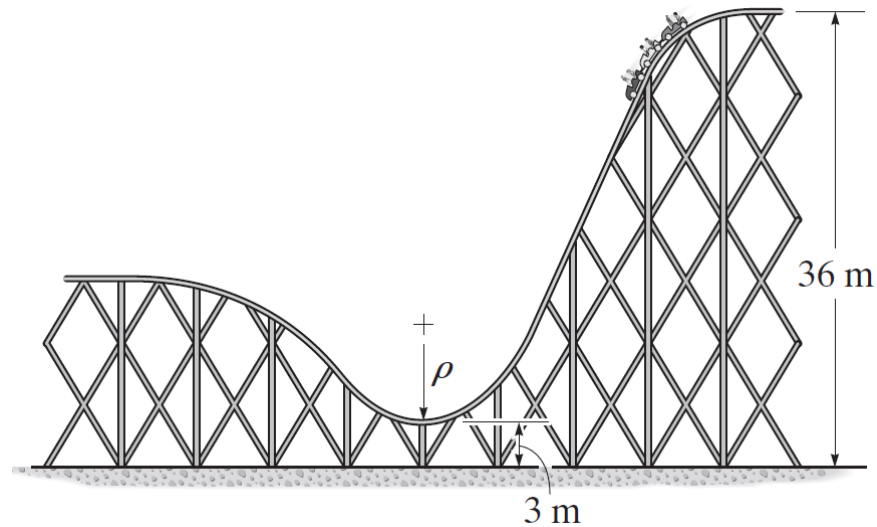


Figure 4 [a]  
Rajah 4 [a]

- [b] Figure 4 [b] shows a 40-kg crate A is released from rest onto the smooth ramp. After it slides down the ramp it strikes the 60-kg crate B that rests against the spring of stiffness coefficient  $k = 10 \text{ kN/m}$ . If the coefficient of restitution between the crates is  $e = 0.5$ , determine:

Rajah 4 [b] menunjukkan kotak A berjisim 40 kg dilepaskan dari keadaan pegun ke peluncur licin. Selepas ia meluncur, ia melanggar kotak B berjisim 60 kg yang terletak di sebelah spring dengan pekali kekakuan  $k = 10 \text{ kN/m}$ . Jika pekali pengembalian asal antara kotak ialah  $e = 0.5$ , tentukan:

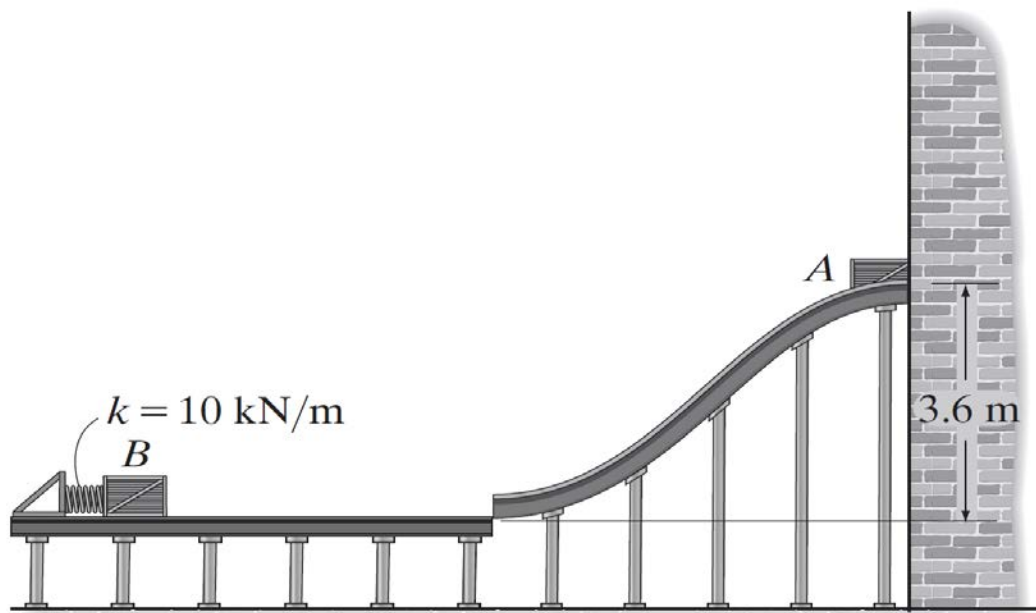
- (i) The velocities of crates just after the impact.  
*Halaju kotak-kotak selepas pelanggaran.*

(25 marks/markah)

- (ii) The spring's maximum compression. (The spring is originally unstretched).

*Mampatan maksimum spring. (spring pada awalnya tidak terulur).*

(25 marks/markah)



**Figure 4 [b]**  
*Rajah 4 [b]*

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