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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2011/2012**

COURSE NAME : STATICS
COURSE CODE : BDA 10203 / BDA 1023
PROGRAMME : BACHELOR OF MECHANICAL
ENGINEERING WITH HONOURS
EXAMINATION DATE : JUNE 2012
DURATION : 3 HOURS
INSTRUCTION : ANSWER FIVE (5) QUESTIONS
OUT OF SIX (6) QUESTIONS

THIS QUESTION PAPER CONSISTS OF NINE (9) PAGES

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- Q1.** Two forces F_A and F_B act at the points A and B as shown in **Figure Q1**. The forces are given in Cartesian vector.
- (a) Represent the unit vector \mathbf{u}_{OA} (4 marks)
 - (b) Represent the unit vector \mathbf{u}_{OB} (4 marks)
 - (c) Determine the addition vector of forces F_A and F_B (2 marks)
 - (d) Determine the moment produced by F_A and F_B about point O. Express the result as Cartesian vector. (10 marks)
- Q2.** Two cables with their forces F_1 and F_2 act at one hook as shown in **Figure Q2**.
- (a) Resolve F_1 into components along u and v axes and determine the magnitudes of these components. (5 marks)
 - (b) Resolve F_2 into components along u and v axes and determine the magnitudes of these components. (5 marks)
 - (c) Determine the resultant of the forces and the reaction angle measured counterclockwise about the positive u-axis. (10 marks)
- Q3.** (a) (i) Determine the forces in the members 1, 2 and 3 of the truss shown in **Figure Q3 (a)**.
(ii) State if the members are in tension or compression. (10 marks)
- (b) The vertical forces are acted upon the truss members as shown in **Figure Q3 (b)**.
- (i) State all the zero-forces members.
 - (ii) Determine the force in members JE and GF of the truss.
 - (iii) State if the members are in tension or compression. (10 marks)

- Q4.** (a) Determine the coordinates of the centroids (\bar{x}, \bar{y}) of the number shown in **Figure Q4 (a)**. All dimensions are given in millimeter. (10 marks)
- (b) Calculate the centroids (\bar{x}, \bar{y}) of the profiles as shown in **Figure Q4 (b)**. (10 marks)
- Q5.** Blocks A and B have a mass of 5 kg and 12 kg, respectively, and are connected to the weightless links as shown in **Figure Q5**. The coefficient of static friction between the blocks and the contacting surfaces is $\mu_s = 0.32$.
- (a) Draw the FBD of the forces acting at the points A, B and C. (5 marks)
- (b) Determine the largest vertical force P that can be applied at the pin C without causing any movement. (15 marks)
- Q6.** The pipe in **Figure S6** is subjected to the force of $F = 500$ N.
- (a) Determine the angles of the force F about the x , the y and the z axes. (5 marks)
- (b) Formulate the unit vector of BA. (3 marks)
- (c) Formulate the force F as a Cartesian vector. (5 marks)
- (d) Determine the moment of the force F about the x , the y and the z axes. (7 marks)

- S1.** Dua daya F_A dan F_B bertindak di titik-titik A dan B seperti ditunjukkan dalam **Rajah S1**. Nilai-nilai daya tersebut diberikan dalam vector Cartesian.
- (a) Berikan vektor unit u_{OA} (4 markah)
 - (b) Berikan vektor unit u_{OB} (4 markah)
 - (c) Tentukan jumlah vektor bagi daya-daya F_A dan F_B (2 markah)
 - (d) Tentukan momen daya F_A dan F_B yang bertindak terhadap titik O. Tuliskan jawapan dalam vektor Cartesian. (10 markah)
- S2.** Dua kabel dengan setiap satu mempunyai daya F_1 dan F_2 bertindak pada satu cangkuk seperti dalam **Rajah S2**.
- (a) Leraikan daya F_1 kepada komponen-komponen sepanjang u dan v dan kirakan magnitud setiap komponen tersebut. (5 markah)
 - (b) Leraikan daya F_2 kepada komponen-komponen sepanjang u dan v dan kirakan magnitud setiap komponen tersebut. (5 markah)
 - (c) Tentukan paduan daya-daya F_1 dan F_2 dan sudut tindakan yang dikira arah lawan putaran jam dari paksi- u positif. (10 markah)
- S3.** (a) (i) Tentukan daya-daya pada anggota 1, 2 dan 3 seperti dalam **Rajah S3 (a)**.
(ii) Nyatakan jika anggota tersebut dalam keadaan tegang atau mampatan. (10 markah)
- (b) **Rajah S3(b)** menunjukkan kekuda yang dikenakan daya-daya menegak di F dan G.
- (i) Nyatakan semua anggota-anggota berdaya sifar.
 - (ii) Tentukan daya-daya pada anggota JE dan GF.
 - (iii) Nyatakan jika anggota tersebut dalam keadaan tegang atau mampatan. (10 markah)

- S4.** (a) Dapatkan kordinat-kordinat bagi sentroid \bar{x} , \bar{y} untuk nombor seperti ditunjukkan dalam **Rajah S4 (a)**. Semua ukuran ialah dalam milimeter. (10 markah)
- (b) Kirakan sentroid \bar{x} , \bar{y} bagi bentuk seperti ditunjukkan dalam **Rajah S4 (b)**. (10 markah)
- S5.** Blok-blok A dan B mempunyai jisim 5 kg dan 12 kg, dan dihubungkan dengan penyambung-penyambung yang beratnya diabaikan seperti dalam **Rajah S5**. Pekali geseran statik diantara blok dan permukaan sentuhan ialah $\mu_s = 0.32$.
- (a) Lukiskan FBD daya-daya pada titik-titik A, B dan C. (5 markah)
- (b) Tentukan daya tegak maksimum yang boleh dikenakan pada pin C tanpa menyebabkan sebarang pergerakan. (15 markah)
- S6.** Paip dalam **Rajah S6** dikenakan daya $F = 500$ N.
- (a) Nyatakan sudut-sudut oleh daya F terhadap paksi x, y dan z. (5 markah)
- (b) Formulakan vektor unit bagi BA. (3 markah)
- (c) Formulakan daya F sebagai vektor Cartesian. (5 markah)
- (d) Nyatakan momen oleh daya F terhadap paksi x, y dan z. (7 markah)

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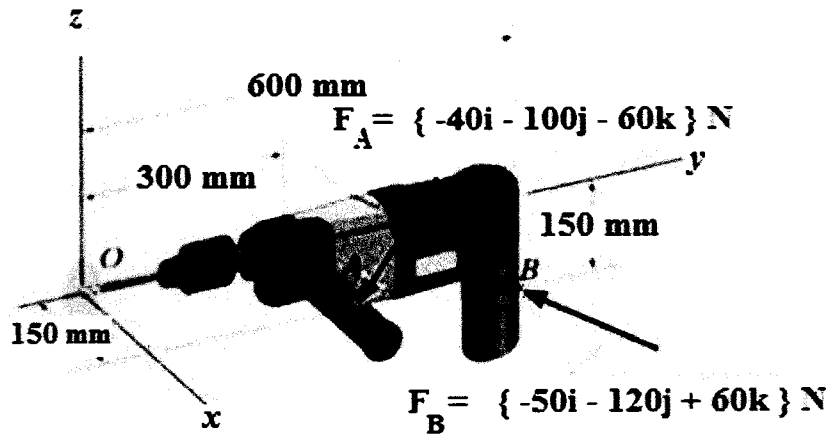


FIGURE Q1 / RAJAH S1

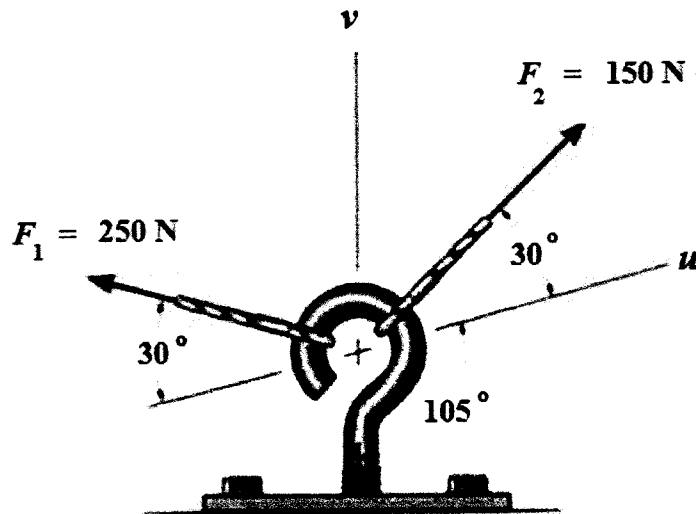


FIGURE Q2 / RAJAH S2

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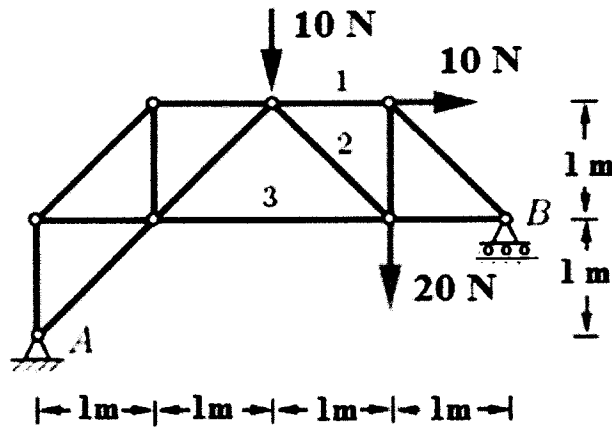


FIGURE Q3(a) / RAJAH S3(a)

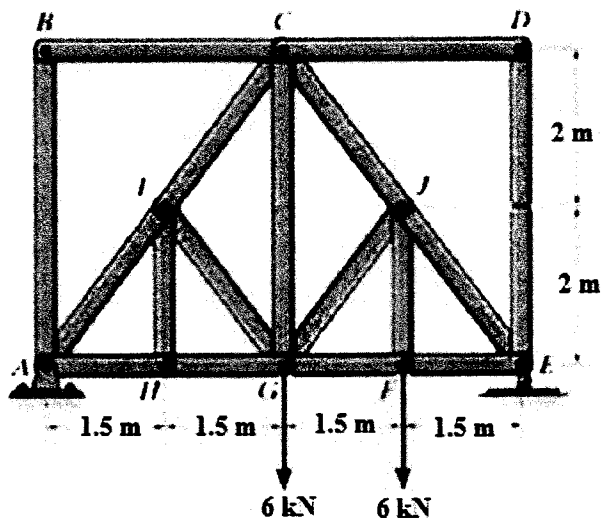


FIGURE Q3(b) / RAJAH S3(b)

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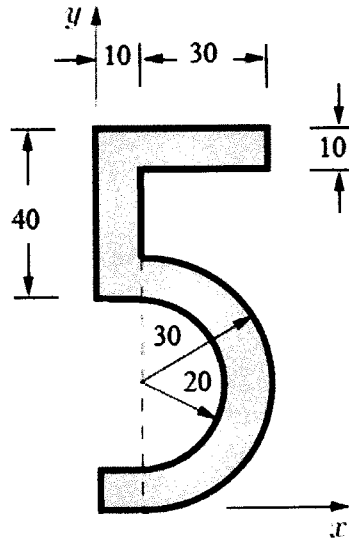


FIGURE Q4(a) / RAJAH S4 (a)

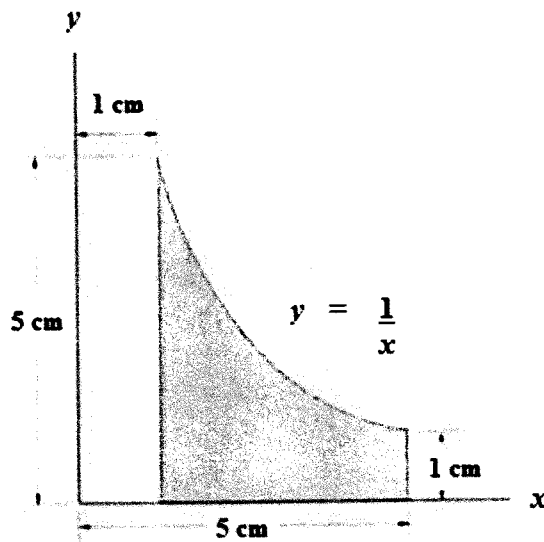


FIGURE Q4(b) / RAJAH S4 (b)

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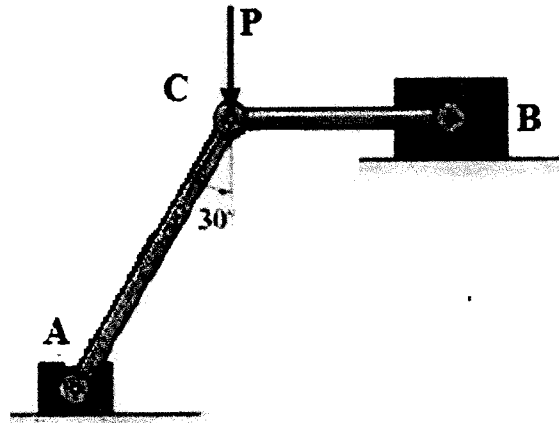


FIGURE Q5 / RAJAH S5

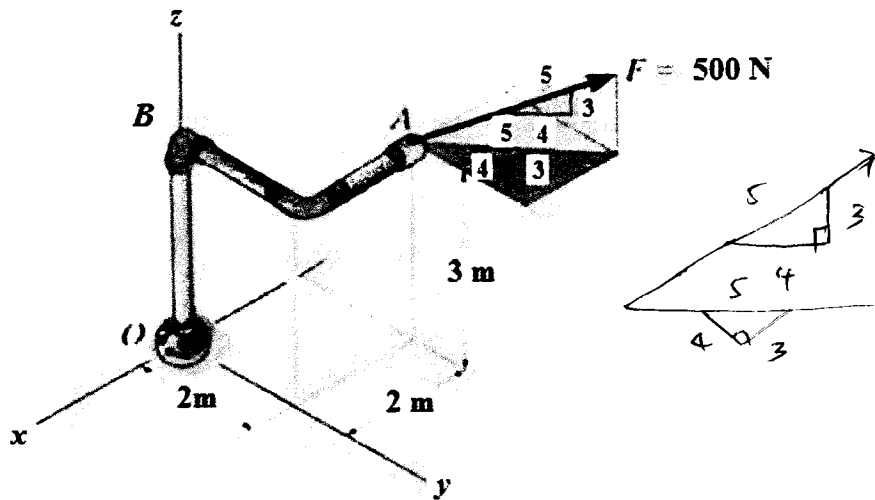


FIGURE Q6 / RAJAH S6