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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION

SEMESTER I

SESSION 2012/2013

COURSE NAME : STATICS
COURSE CODE : BNP 10102
PROGRAMME : BNB
EXAMINATION DATE : JANUARY 2013
DURATION : 2 HOURS
INSTRUCTION : ANSWER **THREE (3)**
QUESTIONS ONLY

THIS QUESTIONS PAPER CONSISTS OF TEN (10) PAGES

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Q1 Two bowling balls as shown in Figure **Q1** are resting on a shelf which touches one another. The balls have 230 mm diameter and are made from plastic with density $\rho_A = 1170 \text{ kg/m}^3$ for ball A and $\rho_B = 980 \text{ kg/m}^3$ for ball B.

- (a) Determine the weight of each ball and express in SI units. (15 marks)
- (b) Convert the answer in (a) to U.S. Customary units. (5 marks)
- (c) Determine the force of mutual attraction. Given $G = 66.74 \times 10^{-12} \text{ m}^3/\text{kg}\cdot\text{s}^2$ (5 marks)

Q2 (a) Briefly explain the following terms:

- (i) Scalar (3 marks)
- (ii) Vector (3 marks)

(b) Two forces are applied to an eye bracket as shown in Figure **Q2 (b)**. The resultant R of the two forces has a magnitude of 1500 lb and its line of action is directed along the x -axis. If the force F_1 has a magnitude of 300 lb, determine:

- (i) The magnitude of force F_2 (3 marks)
- (ii) The angle α between the x -axis and the line of action of the force F_2 . (3 marks)

(c) A force 250 kN is resisted by two pipe struts as shown in Figure **Q2 (c)**. Determine:

- (i) The component F_u of the force along the axis of strut AB. (6.5 marks)
- (ii) The component F_v of the force along the axis of strut BC. (6.5 marks)

- Q3** (a) Three forces are applied to a triangular plate as shown in Figure **Q3 (a)**. Determine:
- (i) The moment of force F_B at point C. (5 marks)
 - (ii) The moment of force F_C at point B. (5 marks)
 - (iii) The moment of force F_D at point B. (5 marks)
- (b) Determine the reactions at A and B for the beam loaded as shown in Figure **Q3 (bi)** and Figure **Q3 (bii)**. (10 marks)
- Q4** (a) State the equations for equilibrium that can be used for solving the three dimensional problems. (5 marks)
- (b) A horizontal plate is represented by grid as shown in Figure **Q4 (b)**. Each square has sides' 1 ft length. The plate is supported at A, B and C and has 30 lb applied as shown. Neglect the weight of the plate. Determine:
- (i) The reactions at A. (6 marks)
 - (ii) The reactions at B. (7 marks)
 - (iii) The reactions at C. (7 marks)
- Q5** (a) State and draw the **four (4)** conclusions of friction laws for dry surfaces. (8 marks)
- (b) Figure **Q5 (b)** shows the unsymmetrical channel section. Determine:
- (i) The centroid about x and y axis. (8 marks)
 - (ii) The moment of inertia about x and y axis. (9 marks)

- END OF QUESTION -

- S1** Dua bola boling seperti yang ditunjukkan pada Rajah **Q1** diletakkan di atas almari di mana ia bersentuhan antara satu sama lain. Bola tersebut mempunyai diameter 230 mm dan diperbuat dari plastik yang ketumpatannya adalah $\rho_A = 1170 \text{ kg/m}^3$ untuk bola A dan $\rho_B = 980 \text{ kg/m}^3$ untuk bola B.
- (a) Tentukan berat setiap bola dan tuliskan dalam unit SI. (15 markah)
- (b) Tukarkan jawapan (i) pada unit U.S. Customary. (5 markah)
- (c) Tentukan daya tarikan bersama. Diberi $G = 66.74 \times 10^{-12} \text{ m}^3/\text{kg}\cdot\text{s}^2$ (5 markah)
- S2** (a) Terangkan secara ringkas terma berikut:
- (i) Skalar (3 markah)
- (ii) Vektor (3 markah)
- (b) Dua daya dikenakan pada satu pengikat seperti ditunjukkan dalam Rajah **Q2 (b)**. Daya paduan R bagi dua daya tersebut adalah 1500 lb dan garisan tindakannya adalah di sepanjang paksi x. Jika daya F_1 mempunyai magnitud 300 lb, tentukan:
- (i) Magnitud daya F_2 . (3 markah)
- (ii) Sudut α antara paksi x dan garisan tindakan daya F_2 . (3 markah)
- (c) Satu daya 250 kN di rintang oleh dua tiang paip seperti ditunjukkan dalam Rajah **Q2 (c)**. Tentukan:
- (i) Komponen daya F_u di sepanjang paksi tiang AB. (6.5 markah)
- (ii) Komponen daya F_v di sepanjang paksi tiang BC. (6.5 markah)

- S3** (a) Tiga daya dikenakan pada plat segitiga seperti ditunjukkan dalam Rajah **Q3 (a)**. Tentukan:
- (i) Daya momen F_B pada titik C. (5 markah)
 - (ii) Daya momen F_C pada titik B. (5 markah)
 - (iii) Daya momen F_D pada titik B. (5 markah)
- (b) Tentukan tindakbalas pada A dan B bagi rasuk yang dikenakan beban seperti yang ditunjukkan dalam Rajah **Q3 (bi)** dan Rajah **Q3 (bii)**. (10 markah)
- S4** (a) Nyatakan persamaan keseimbangan yang boleh digunakan untuk menyelesaikan masalah tiga dimensi. (5 markah)
- (b) Satu plat melintang dipersembahkan oleh grid seperti ditunjukkan dalam Rajah **Q4 (b)**. Setiap segiempat mempunyai panjang 1 ft. Plat ini disokong pada A, B dan C dan mempunyai beban 30 lb yang dikenakan seperti yang ditunjukkan. Abaikan berat plat dan tentukan:
- (i) Tindakbalas pada A. (6 markah)
 - (ii) Tindakbalas pada B. (7 markah)
 - (iii) Tindakbalas pada C. (7 markah)
- S5** (a) Nyatakan dan lukiskan **empat (4)** kesimpulan bagi hukum geseran untuk permukaan kering. (8 markah)
- (b) Rajah **Q5 (b)** menunjukkan keratan saluran tidak simetri. Tentukan:
- (i) Titik tengah bagi paksi x dan y. (8 markah)
 - (ii) Momen sifatekun bagi paksi x dan y. (9 markah)

- KERTAS SOALAN TAMAT -

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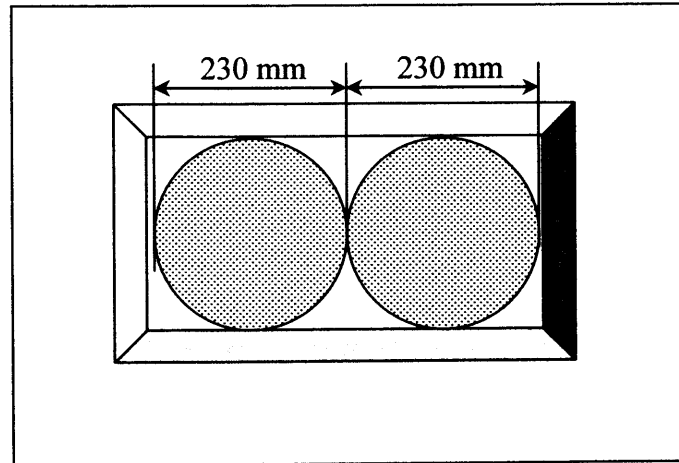


FIGURE Q1

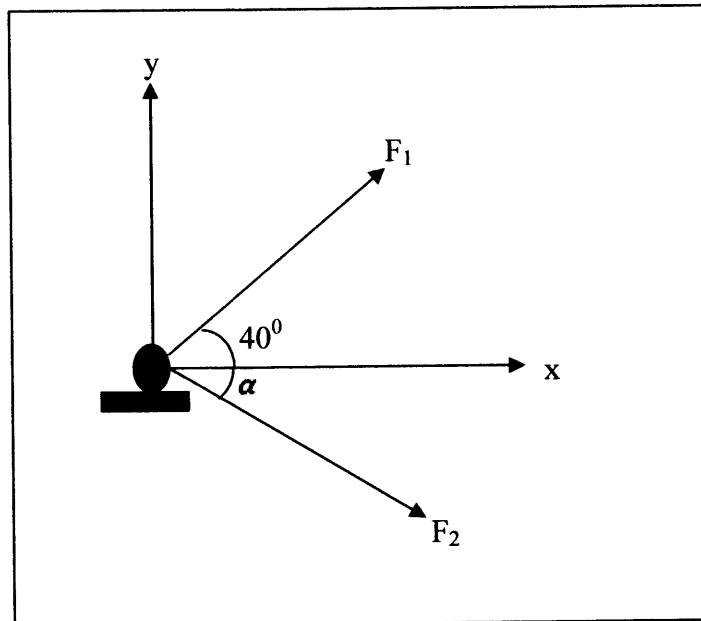
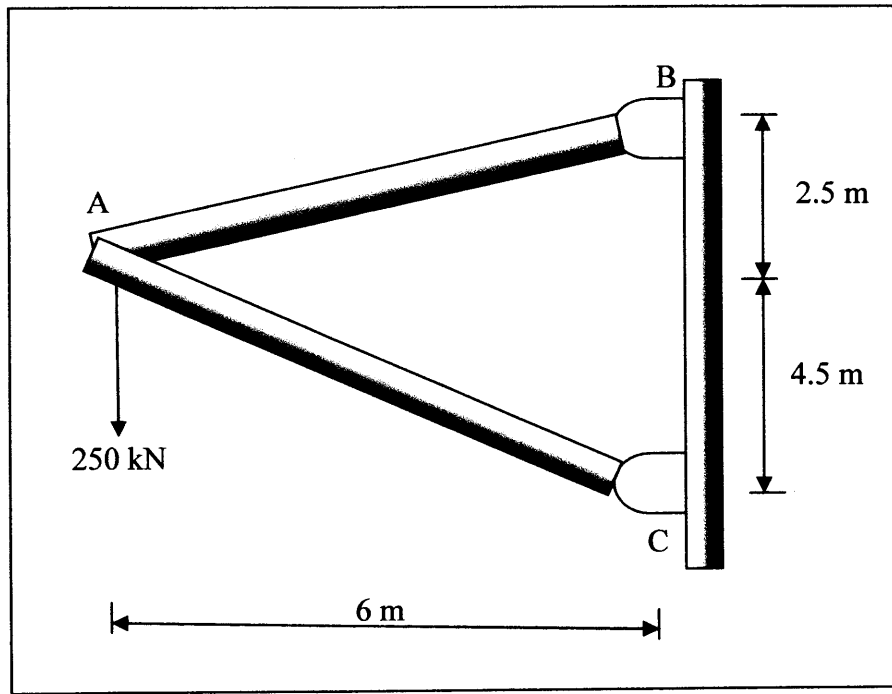
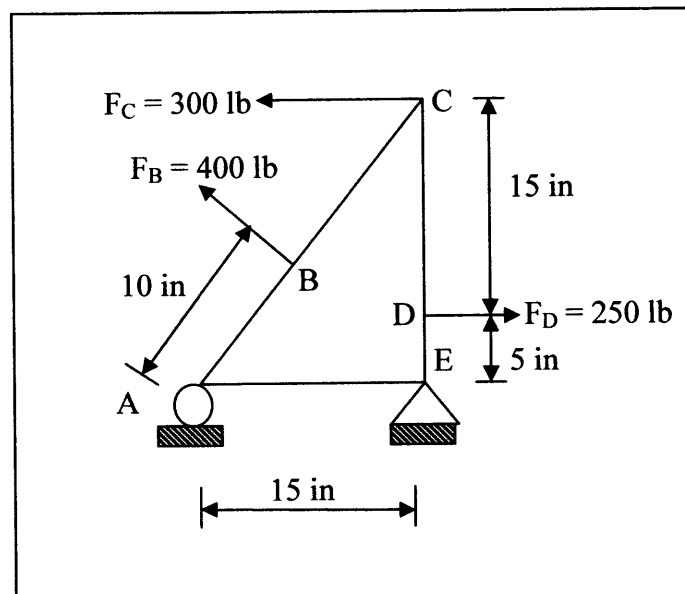


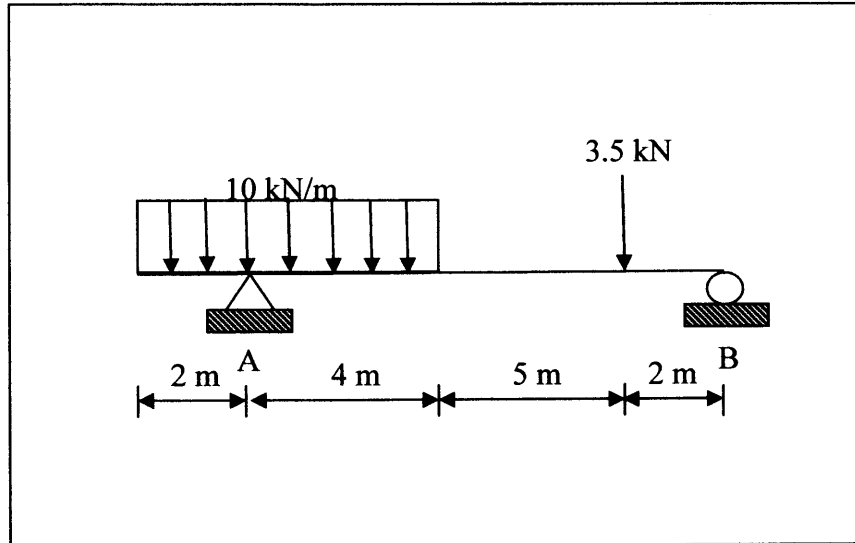
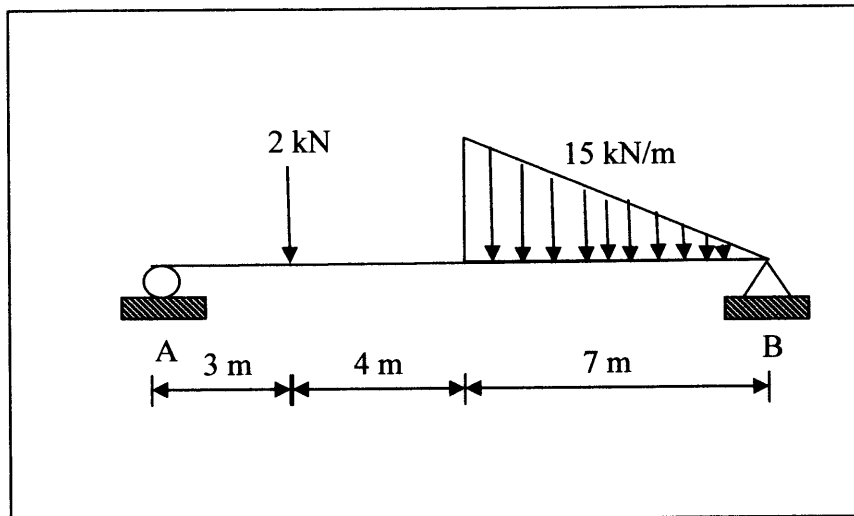
FIGURE Q2 (b)

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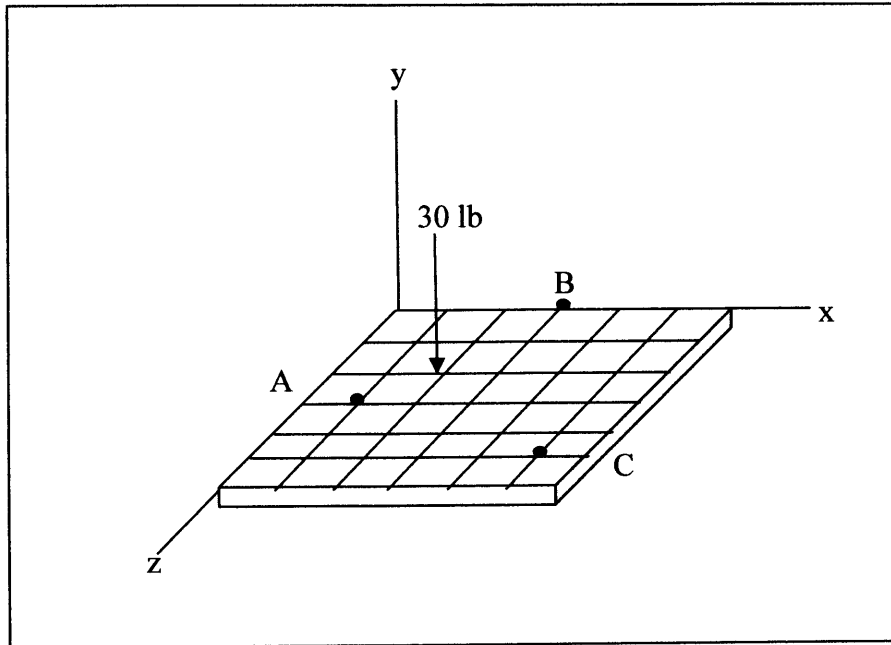
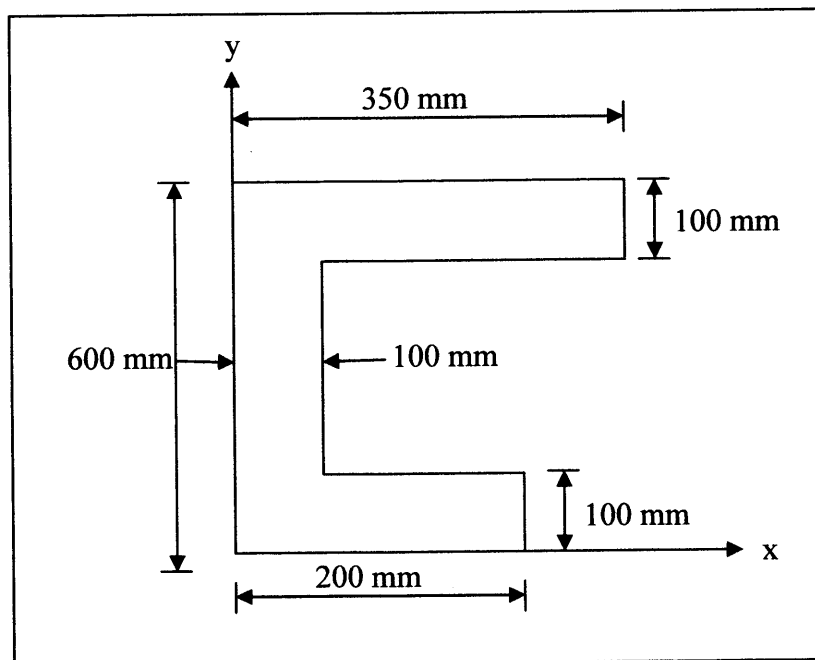
**FIGURE Q2 (c)****FIGURE Q3 (a)**

FINAL EXAMINATIONSEMESTER/SESI: SEM I/2012/2013
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**FIGURE Q4 (b)****FIGURE Q5 (b)**

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APPENDIX

$$V = \frac{4}{3} \pi r^3$$

$$F = G \left(\frac{m_A + m_B}{r} \right)$$