UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER 1
SESSION 2011/2012

NAME OF COURSE	:	STATICS
COURSE CODE	:	BDA 10203/BDA1023
PROGRAM	:	1 BDD
DATE OF EXAMINATION	:	JANUARY 2012
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** QUESTIONS OUT OF **SIX (6)** QUESTIONS

THIS PAPER CONSISTS OF ELEVEN (11) PAGES

Q1. The force F_1 and F_2 acts at point B and point A respectively as shown in **Figure Q1**. Take $F_1 = \{-10i + 20j - 40k\}N$ and $F_2 = \{15i + 10j - 30k\}N$

   a) Find the unit vectors u_a which defines the direction of the a axis.   (5 marks)

   b) What is the position coordinates of point A and point B?   (4 marks)

   c) Represent the position vectors r_A acting from origin point to point A   (2 marks)

   d) Represent the position vectors r_B acting from origin point to point B   (2 marks)

   e) Determine the moment of force F_1 and F_2 acting on the handle of the wrench about the a axis.   (7 marks)

Q2. a) Define a system of forces and couple moments acting on a body with an equivalent single resultant force and couple moment acting at a specified point O? What are the relevant equations?

(5 marks)

   b) A sack has a weight of 150N and is supported by six cables tied together as shown in **Figure Q2**. Determine the tension in each cable and the angle θ for equilibrium. Cable BC is horizontal.

(15 marks)

Q3. The pipe in **Figure Q3** is subjected to the force of $F = 100N$.

   a) Determine the angle θ between pipe segments BA and BC.   (7 marks)

   b) Formulate the unit vector along BC.   (2 marks)

   c) Formulate force F as a Cartesian vectors.   (4 marks)

   d) Determine the magnitude of the components of the force parallel to member CB

(3 marks)

   e) Determine the magnitude of the components of the force perpendicular to member CB.

(4 marks)

Q4. (a) (i) Determine the force in each member of the truss as shown in **Figure Q4(a).**

(ii) State if the members are in tension and compression and explain why.

(6 marks)

(b) **Figure Q4(b)** shows the truss acted upon by the horizontal and vertical external force.

(i)   Find the forces in member ED

(ii) Calculate the force in member EH

(iii) Determine the force in member GH.

(iv) State if the members above are in tension and compression and explain why.

(14 marks)

Q5. (a) (i) Give the definition of Centroid of an Area.

(ii) Referring to **Figure Q5 (a)**, calculate the centroid ($\bar{x}, \bar{y}$) of the composite area.

(10 marks)

(b) (i) Give the definition of second theorem of Pappus and Guldinus.

(ii) **Figure Q5 (b)** shows the thin-wall tank is fabricated from a hemisphere and cylindrical shell. Determine the vertical reactions that each of the four symmetrically placed legs exerts on the floor if the tank contains water which is 3.6 m deep in the tank. The specific gravity of water is 10 kN/m^3. Neglect the weight of the tank.

(10 marks)

Q6   A support block is acted upon by the two forces as shown in Figure Q6. The coefficients of friction between the block and the incline plane are μ_s= 0.35 and μ_k= 0.25. The effectiveness of the support can be determined by three conditions, first to start the block moving up the inclined plane, second to keep it moving up and third to prevent it from sliding down. According to this three conditions, find the following;

(a) Draw the free body diagram for all three cases.   (4 marks)

(b) Determine the force P required to accomplish each condition

(10 marks)

(c) What will happen if this support is applied with 800N of force P and calculate the new coefficients of friction between the block and the incline plane.

(6 marks)

S1. Daya F_1 dan F_2 bertindak di titik B dan A seperti ditunjukkan dalam **Rajah S1**. Diberi nilai $F_1 = \{-10i + 20j - 40k\}N$ dan $F_2 = \{15i + 10j - 30k\}N$

    a) Cari vektor unit u_a dimana menunjukkan arah paksi a. (5 marks)

    b) Apakah koordinat kedudukan titik A dan titik B. (4 marks)

    c) Berikan vektor kedudukan r_A yang bertindak dari titik asalan ke titik A. (2 marks)

    d) Berikan vektor kedudukan r_B yang bertindak dari titik asalan ke titik B. (2 marks)

    e) Tentukan momen daya F_1 dan F_2 yang bertindak ke atas pemulas spanar pada paksi a. (7 marks)

S2. a) Tentukan sistem daya dan momen gandingan yang bertindak pada satu badan yang mana bersamaan dengan daya paduan tunggal dan momen gandingan yang bertindak pada satu titik O? Sila nyatakan persamaan yang berkaitan dengannya?

(5 markah)

    b) Guni mempunyai berat 150N dan ditanggung oleh enam kabel diikat bersama seperti ditunjukkan dalam **Rajah S2**. Tentukan tegangan di dalam setiap kabel dan sudut θ untuk keseimbangan. Kabel BC adalah mendatar.

(15 markah)

S3. Paip didalam **Rajah S3** dikenakan daya, $F = 100N$.

    a) Nyatakan sudut θ diantara segmen paip BA dan BC. (7 marks)

    b) Formulakan vektor unit sepanjang CB. (2 marks)

    c) Formulakan daya F sebagai vektor Cartesian. (4 marks)

    d) Nyatakan magnitud komponen daya yang selari dengan anggota CB. (3 marks)

    e) Nyatakan magnitud komponen daya yang berserenjang dengan anggota CB. (4 marks)

S4. (a) (i) Tentukan daya pada setiap anggota bagi *truss* seperti dalam **Rajah S4 (a).**

      (ii) Nyatakan jika anggota tersebut dalam keadaan tegang atau mampat. Mengapa?

                        (6 markah)

    (b)**Rajah S4(b)** menunjukkan *truss* yang dikenakan daya secara mendatar dan menegak.

      (i)   Cari daya dalam anggota ED

      (ii) Kira daya dalam anggota EH

      (iii) Tentukan daya dalam anggota GH.

      (iv) Nyatakan jika anggota tersebut dalam keadaan tegang atau mampat. Mengapa?

                        (14 markah)

S5   (a) (i) Berikan definasi sentroid kawasan.

        (ii) Merujuk kepada **Rajah S5(a)**, kirakan sentroid ($\bar{x}, \bar{y}$) kawasan komposit.

                        (10 markah)

    (b) (i) Berikan definasi Teorem kedua Pappus dan Guldinus.

        (ii) **Rajah S5(b)** menunjukkan tangki dinding-nipis yang di fabrikasi dari kelumpang hemisphere dan selinder. Tentukan reaksi menegak terhadap empat kaki simetri terletak di atas lantai jika tangki mengandungi air ke dalaman 3.6 m di dalam tangki. Graviti tentu air ialah 10 kN/m^3. Abaikan berat tangki.

                        (10 markah)

S6   Satu blok sokongan dikenakan tindakan 2 daya seperti dalam **Rajah S6**. Diketahui
      bahawa pekali geseran antara blok dan permukaan condong adalah $\mu_s = 0.35$ dan
      $\mu_k = 0.25$. Keberkesanan sokongan boleh ditentukan dengan tiga keadaan, pertama untuk
      memulakan pergerakkan blok keatas satah condong, kedua menentukan ia terus bergerak
      dan ketiga untuk menghalang dari mengelongsor kebawah. Menurut ketiga-tiga keadaan
      diatas , cari yang berikut;

      (a)   Bina gambarajah badan bebas untuk setiap kes.   (4 marks)

      (b)   Tentukan daya *P* yang diperlukan untuk memenuhi ketiga-tiga keadaan diatas.

                                                                                (10 markah)

      (c)   Apakah yang akan terjadi jika sokongan ini dikenakan daya P sebanyak 800N. Kira
             pekali geseran yang baru antara blok dan satah condong

                                                                                 (6 markah)
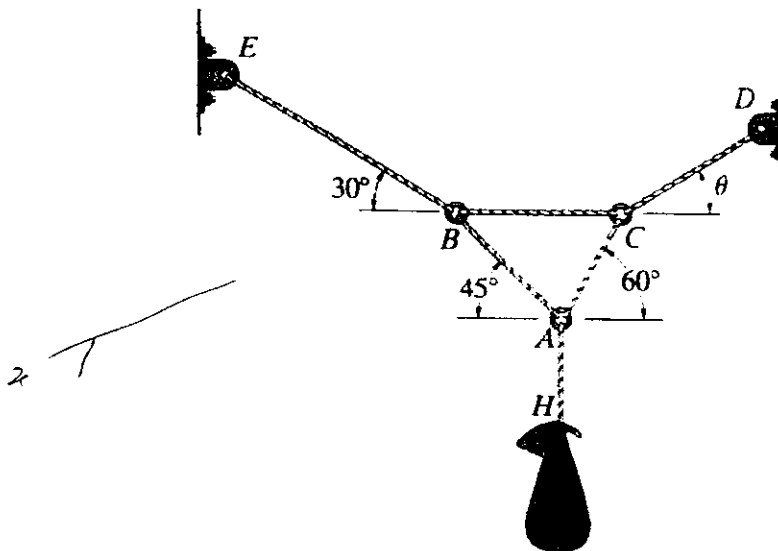
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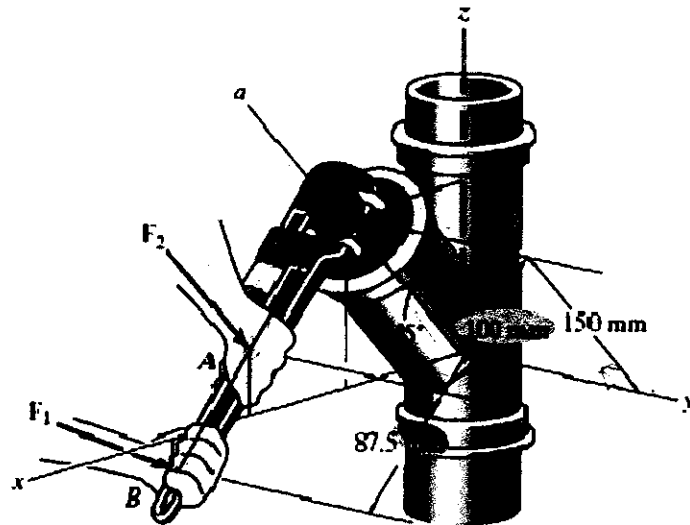
Figure Q1

Figure Q2

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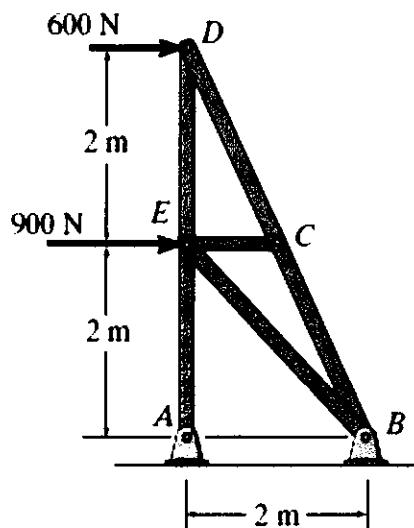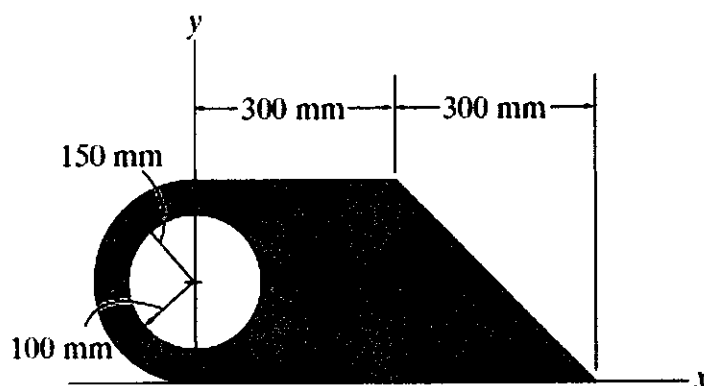| SEMESTER / SESSION	: SEMESTER 1 - 2011/12	PROGRAM	: 1 BDD
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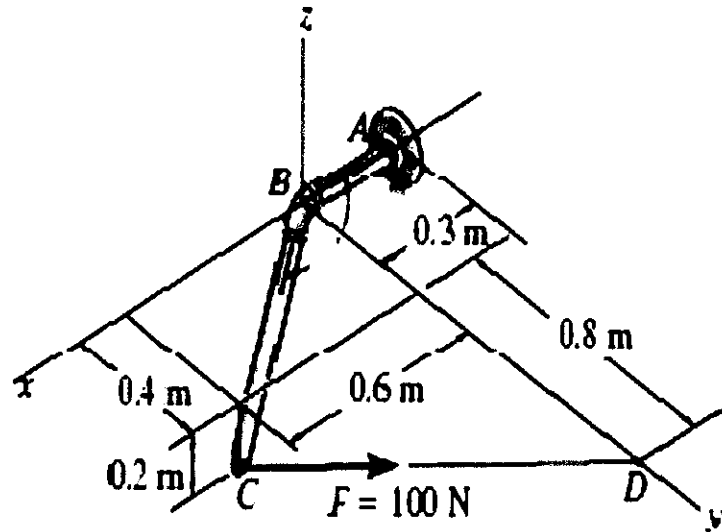
Figure Q3

Figure Q4(a)

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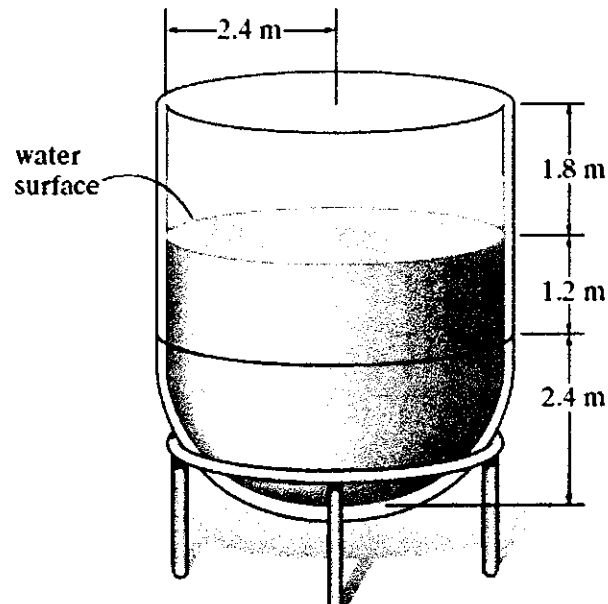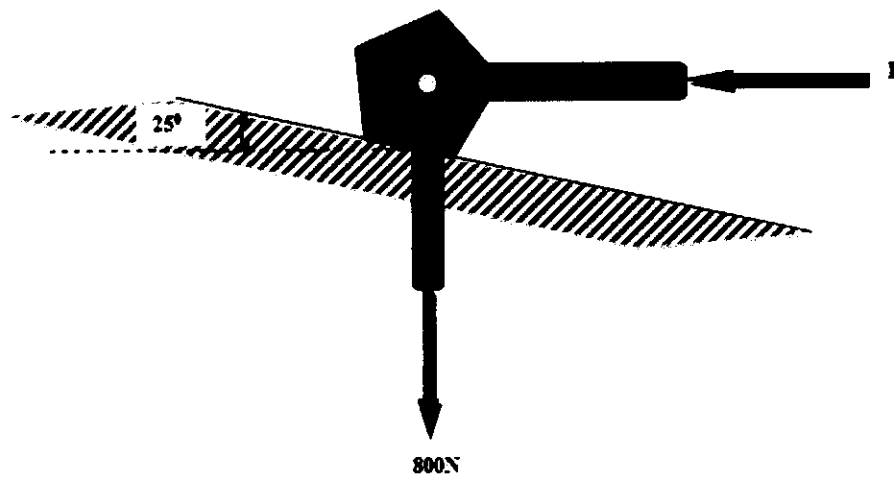|			
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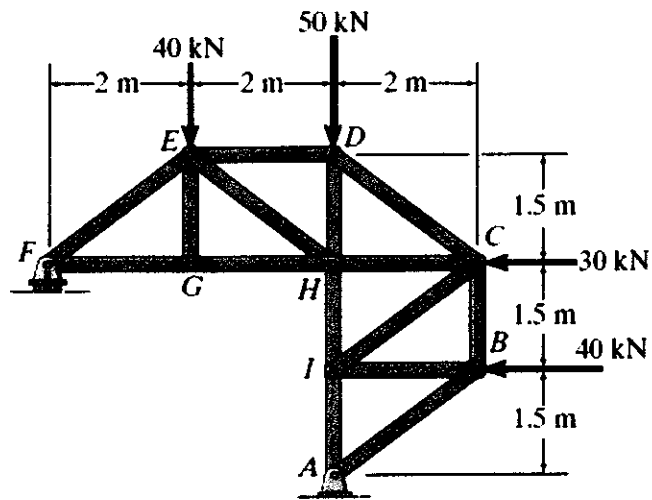
Figure Q4(b)

Figure Q5 (a)

FINAL EXAMINATION

SEMESTER / SESSION	: SEMESTER 1 - 2011/12	PROGRAM	: 1 BDD
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Figure Q5(b)

Figure Q6