UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2010/2011

COURSE NAME	:	SOLID MECHANICS II
COURSE CODE	:	BDA 3033
PROGRAMME	:	3 BDD
EXAMINATION DATE	:	NOVEMBER / DECEMBER 2010
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FIVE (5)** OUT OF SIX (6) QUESTIONS

THIS PAPER CONTAINS EIGHT (8) PAGES

S1 Satu daya paksi **P** dan daya mendatar **Q** dikenakan pada titik C seperti yang ditunjukkan pada **Rajah S1.** Roset terikan 45° yang diletakkan pada titik A pada blok tersebut menghasilkan bacaan terikan seperti berikut:

$$\varepsilon_1 = -75 \times 10^{-6}$$

$$\varepsilon_2 = +300 \times 10^{-6}$$

$$\varepsilon_3 = +250 \times 10^{-6}$$

Di beri nilai $E = 200$ GPa dan $\upsilon = 0.30$, tentukan:-

(a) Terikan-terikan normal dan terikan ricih dan satah-satah utama (4 Markah)

(b) Tegasan-tegasan normal dan tegasan ricih dan satah-satah utama (7 Markah)

(c) Nilai daya P dan Q (9 Markah)

S2 **Rajah S2** menunjukkan satu rasuk kayu dikenakan beban.

(a) Lukiskan gambarajah badan bebas bagi rasuk tersebut

(b) Tentukan tindakbalas sokongan pada rasuk

(c) Tentukan persamaan lengkungan elastik rasuk

(d) Tentukan pesongan rasuk pada hujung C. Diberi EI adalah malar.

(e) Dapatkan lokasi dan nilai pesongan maksimum

(20 Markah)

S3 Hitungkan keamatan daya teragih seragam maksimum yang dibenarkan, w yang boleh dikenakan terhadap anggota BC tanpa menyebabkan anggota AB meleding. Anggapkan bahawa AB diperbuat daripada keluli dan ianya bercemat dikedua-dua hujung bagi paksi x-x, dan kedua-dua berhujung tetap pada paksi y-y. Guna faktor keselamatan 3 untuk kes ledingan ini. $E_{steel} = 200$ GPa, $\sigma_Y = 360$ MPa. Sila rujuk gambar dalam **Rajah S3**.

(20 Markah)

S4 Bar aluminium mempunyai dua bahagian iaitu berdiameter 5 mm dan 10 mm seperti yang ditunjukkan dalam **Rajah S4**. Kirakan tinggi maksimum,h dari mana relang berjisim 5 kg harus dijatuhkan supaya ianya tidak mengakibatkan kacacatan kekal pada bar selepas ianya menghentam bebibir A. E_{al} = 70 GPa, σ_Y = 410 MPa. Juga, hitung tegasan minimum dalam bar jika relang:-

(a) dijatuhkan dari ketinggian, h = 250 mm

(b) dilepaskan dari ketinggian, h = 0

(c) diletakkan secara perlahan-lahan pada bebibir A

(20 Markah)

S5 (a) Nyatakan mana-mana dua anggapan yang dibuat dalam teori Lame' bagi silinder tebal. (4 Markah)

(b) Satu silinder tebal yang berdiameter dalam 150 mm dan diameter luar 200 mm dikenakan tekanan dalaman 150 bar. Kirakan nilai tegasan lilitan maksimum yang terhasil didalam dinding silinder. Silinder ini kemudiannya dikenakan tekanan luaran 100 bar, selain dari tekanan dalaman 150 bar. Berapakah nilai tegasan ricih yang bakal terhasil didalam dinding silinder. (16 Markah)

S6 Satu aci AB mempunyai diameter 38 mm diperbuat daripada keluli yang mana tegasan alah adalah σ_Y = 250 MPa seperti ditunjukkan dalam **Rajah S6**. Dengan mengunakan teori kegagalan dibawah, tentukan kilasan T jika P = 240 kN.

(a) Kriteria tegasan ricih-maksimum; Tresca (10 Markah)

(b) Kriteria tenaga-herotan-maksimum; Von Mises (10 Markah)

Q1 An axial force **P** and a horizontal force **Q** are both applied at point C of the rectangular bar as shown in **Rajah S1**. A 45° strain rosette on the surface of the bar at point A indicates the following strains:

$$\varepsilon_1 = -75 \times 10^{-6}$$

$$\varepsilon_2 = +300 \times 10^{-6}$$

$$\varepsilon_3 = +250 \times 10^{-6}$$

Given that E = 200 GPa and $\upsilon = 0.30$, determine :-

(a) the values of normal strains, shear strain and their principal planes (4 Marks)

(b) the values of normal stresses, shear stress and their principal planes(7 Marks)

(c) the magnitude of P and Q. (9 Marks)

Q2 **Rajah S2** shows the wooden beam is subjected to the load.

(a) Draw free body diagram of the beam.

(b) Determine the support reactions of the beam

(c) Determine the equation of the elastic curve.

(d) Specify the deflection at the end C. Given EI is constant..

(e) Find the location and magnitude of maximum deflection.

(20 Marks)

Q3 Determine the maximum allowable intensity of distributed load, w that can be applied to member BC without causing member AB to buckle. Assume that AB is made of steel and is pinned at its ends for x-x axis buckling and fixed at its ends for y-y axis buckling. Use a factor of safety with respect to bucking of 3. E_{steel} = 200 GPa, σ_Y = 360 MPa. Please refer image in **Rajah S3**.

(20 Marks)

Q4 The aluminium bar is made from two segments having diameters of 5 mm and 10 mm as shown in **Rajah S4**. Determine the maximum height, h from which the 5-kg collar should be dropped so that it not permanently damage the bar after striking the flange at A. E_{al} = 70 GPa, $\sigma_Y = 410$ MPa. Also, determine the minimum stress in the bar if the weight:-

a) dropped from height of $h = 250$ mm

b) released from a height, $h = 0$

c) placed slowly on the flange at A

(20 Marks)

Q5 (a) Mention any two assumptions made in Lame's theory for thick cylinders. (4 Marks)

(b) A thick cylinder of 150 mm inner diameter and 200 mm outer diameter is subjected to an internal pressure of 150 bar. Determine the value of the maximum hoop stress set up in the cylinder wall. This cylinder later on subjected to external pressure of 100 bar, apart of 150 bar internal pressure. What will be the shear stress developed in cylinder wall. (16 Marks)

Q6 The 38 mm diameter shaft AB is made of a grade of steel for which type yield strength is $\sigma_Y = 250$ MPa as shown in **Rajah S6**. Using the theories of failure as below, determine the torque T if P = 240 kN.

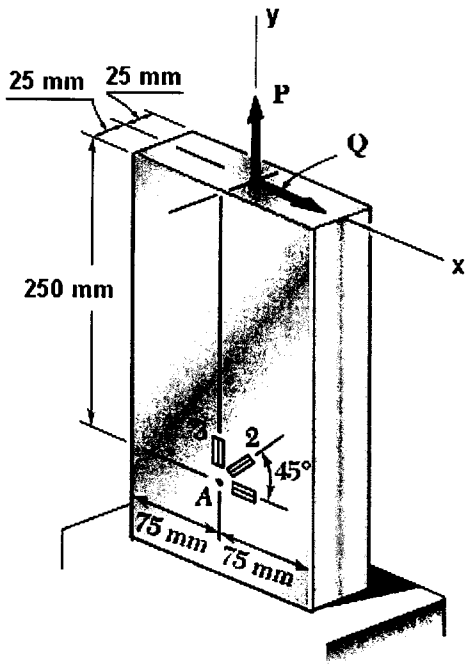
(a) The maximum-shearing stress criterion; Tresca (10 Marks)

(b) The maximum-distortion-energy criterion; Von Mises (10 Marks)

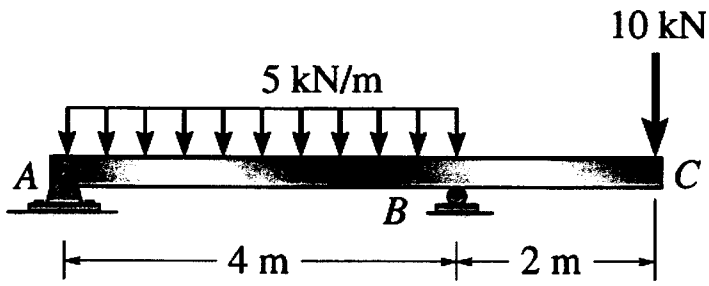
PEPERIKSAAN AKHIR

SEMESTER / SESI : SEMESTER 1/2010/2011 PROGRAM : 3 BDD

NAMA KURSUS : MEKANIK PEPEJAL II KOD KURSUS :BDA 3033



Rajah S1



Rajah S2

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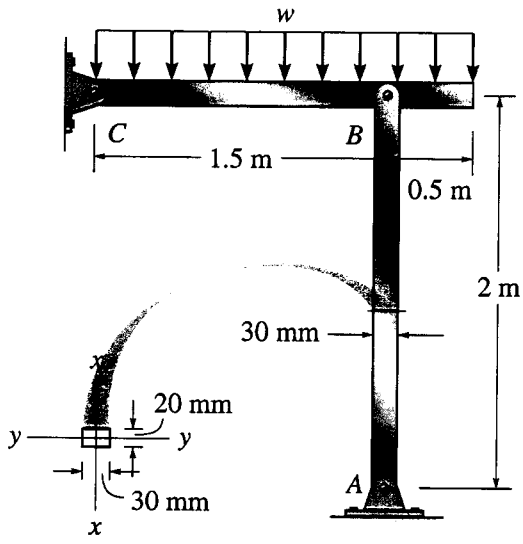
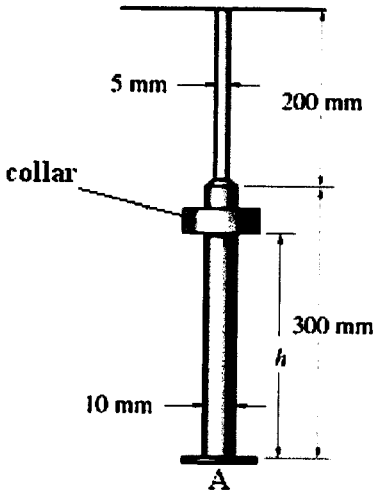


Rajah S3



Rajah S4

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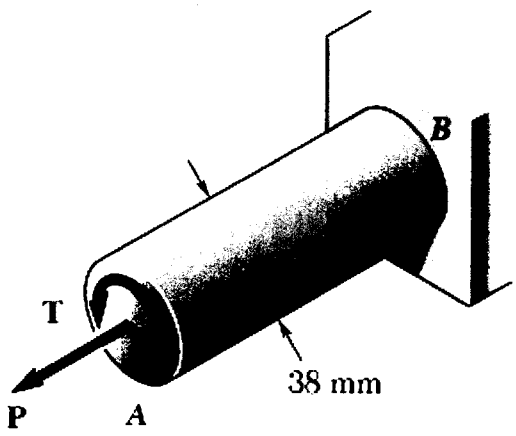

Rajah S6