Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2013/2014

COURSE NAME	:	MECHANIC OF MATERIALS
COURSE CODE	:	BNP 20203
PROGRAMME	:	2 BNB
EXAMINATION DATE	:	DECEMBER 2013/ JANUARY 2014
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS FROM **FIVE (5)** QUESTIONS.

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

Q1 (a) Figure **Q1(a)** show a diagram normal stress and strain curve of structural steel. Briefly explain what will happen to the steel at point A, B, C, D and E.

(10 marks)

(b) A prismatic bar with a circular cross section is subjected to an axial tensile force of 85 kN as in **Figure Q1(b)**. The bar having length of 3.0 m with diameter 30 mm. By using modulus elasticity of 70 kN/mm^2 and Poisson ratio 1/3:

(i) Calculate the elongation, δ and

(ii) Change in diameter, ΔD.

Assume that stress on proportionality limit is 180 kN/mm^2.

(10 marks)

Q2 (a) Sketches and list down types of force

(6 marks)

(b) A block size 200 mm x 100 mm x 80 mm was shown in **Figure Q2**. This block loaded with force of 250 kN in the x-direction. If Poisson's ratio is 1/3 and the modulus of elasticity is 2 x 10^4 N/mm^2, determine the percent of change in volume of the block.

(14 marks)

Q3 A simply supported beam in **Figure Q3** are loaded with a uniform distributed load of 2 kN/m at its free end, an anticlockwise couple load of 16 kNm and a point load of 5 kN applied at point C and D respectively.

(a) Calculate the reactions at support B and D (4 marks)

(b) By applying an equilibrium analysis on the beam portions:

(i). calculate the shear force and bending moment acting on the beam, and

(ii). draw the Shear Force Diagram (SFD) and Bending Moment Diagram (BMD) acting on the beams.

(16 marks)

Q4 The simply supported beam has the cross sectional area as shown in **Figure Q4**. Determine:

(a) The maximum bending stress in the beam, and

(4 marks)

(b) The bending stress at point A and B, and draw the stress distribution over the cross section at this location.

(16 marks)

Q5 (a) A column has a length of 8 m, modulus elasticity of 200 kN/mm^2 and moment of inertia 7519 x 10^4 mm^4. Given the factor of safety is 2, determine the allowable load if,

(i) pin-connected at the both ends, and

(ii) fix-connected at both ends.

(8 marks)

(b) The pinned ended column is shown in **Figure Q5**. Determine:

(i) Whether the column is slender or not by using the slenderness ratio of slender column > 100.

(ii) The allowable load for the column if given E = 200 kN/mm^2 and factor of safety is 2.

(12 marks)

- END OF QUESTION -

TERJEMAHAN BAHASA MELAYU

S1 (a) Rajah **S1(a)** menunjukkan lengkung tegasan normal dan terikan bagi keluli.. Terangkan dengan ringkas apakah yang berlaku kepada keluli tersebut pada titik A, B, C, D dan E.

(10 markah)

(b) Sebatang bar prismatik dengan keratan rentas bulat dikenakan daya tegangan 85 kN seperti dalam **Rajah S1(a)**. Bar ini mempunyai panjang 3.0 m dan diameter 30 mm. Dengan menganggap modulus keanjalan 70 kN/mm^2 dan nisbah Poisson 1/3:

(i) Kira pemanjangan, δ dan

(ii) perubahan diameter, ΔD.

Anggap tegasan pada had kadaran ialah 180 kN/mm^2.

(10 markah)

S2 (a) Senaraikan serta lakarkan jenis-jenis daya

(6 markah)

(b) Satu blok berukuran 200 mm x 100 mm x 80 mm seperti dalam **Rajah S1**. Blok ini dibebani daya sebesar 250 kN pada arah x. Jika nisbah Poisson ialah 1/3 dan modulus keanjalan ialah 2 x 10^4 N/mm^2, tentukan peratus perubahan isi padu blok.

(14 markah)

S3 Rasuk dalam **Rajah S3** ditindaki beban teragih seragam 2 kN/m pada bahagian yang tergantung, satu ganding lawan jam 16 kNm yang bertindak di C dan beban titik 5 kN bertindak di D.

(a) Kira tindak balas yang bertindak pada sokong B dan D

(4 markah)

(b) Dengan menggunakan kaedah analisis keseimbangan:

(i). kira daya ricih dan momen lentur yang bertindak pada rasuk, dan

(ii). lukiskan Gambarajah Daya Ricih (GDR) dan Gambarajah Momen Lentur (GML) bagi rasuk tersebut.

(16 markah)

S4 Sebatang rasuk terletak mudah mempunyai keratan rentas seperti dalam **Rajah S4**. Tentukan:

(a) Tegasan lentur maksimum pada rasuk tersebut, dan

(4 markah)

(b) Tegasan lentur pada titik A dan B, seterusnya lukiskan taburan tegasan di sepanjang keratan rentas rasuk tersebut.

(16 markah)

S5 (a) Sebatang tiang mempunyai panjang 8 m, mempunyai modulus keanjalan 200 kN/mm^2 dan momen sifatekun 7519 x 10^4 mm^4. Jika factor keselamatan yang harus diberikan ialah 2, tentukan beban selamat bagi tiang tersebut jika,

(iii) kedua-dua hujung tiang dipin, dan

(iv) kedua-dua hujung tiang diikat tegar.

(8 markah)

(b) Sebatang tiang yang dipin pada kedua-dua hujungnya ditunjukkan dalam **Rajah S6(b)**. Tentukan:

(i) Sama ada tiang tersebut langsing atau tidak dengan menganggap bahawa tiang langsing mempunyai nisbah kelangsingan > 100.

(ii) Beban selamat tiang tersebut jika nilai $E = 200$ kN/mm^2 dan factor keselamatan ialah 2.

(12 markah)

-SOALAN TAMAT-

FINAL EXAMINATION

SEMESTER / SESSION : SEM 1/2013/2014 PROGRAMME : 2 BNB
COURSE : MECHANICS OF MATERIALS COURSE CODE : BNP 20203

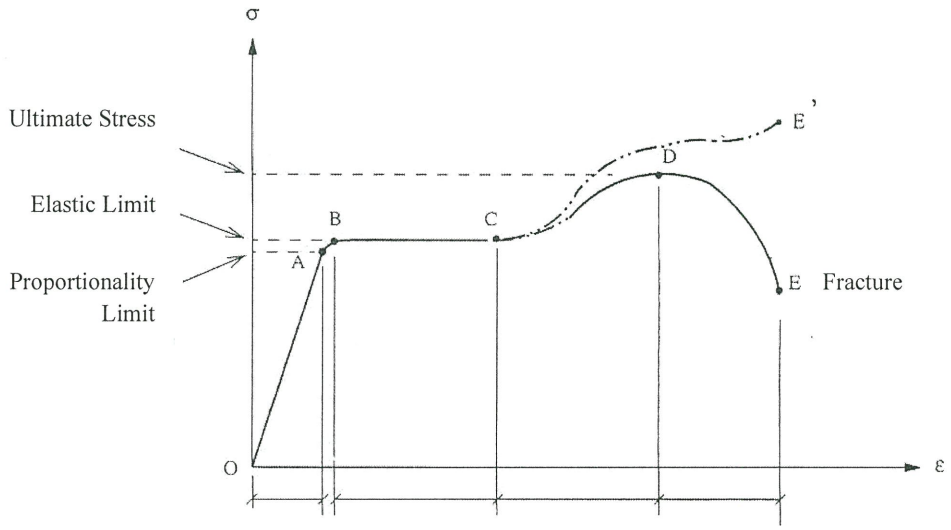

FIGURE Q1(a)/ RAJAH S1(a)

FIGURE Q1(b)/ RAJAH S1(b)

FINAL EXAMINATION

SEMESTER / SESSION : SEM 1/2013/2014 PROGRAMME : 2 BNB
COURSE : MECHANICS OF MATERIALS COURSE CODE : BNP 20203

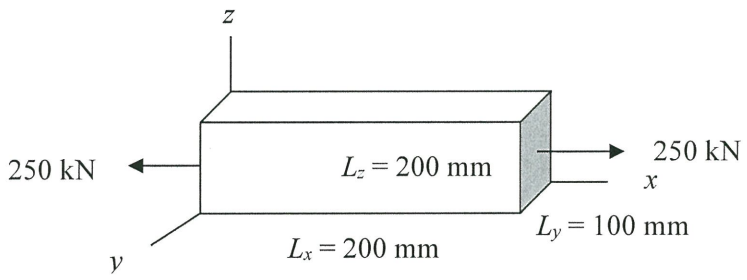

FIGURE Q2/ RAJAH S2

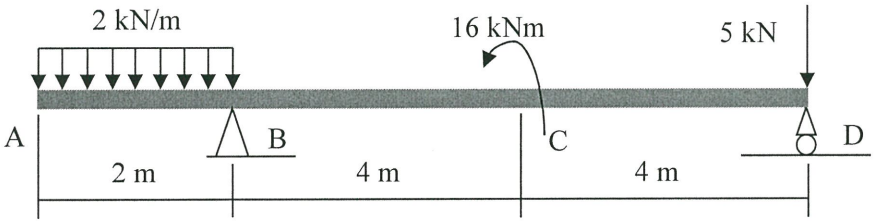

FIGURE Q3/ RAJAH S3

FINAL EXAMINATION

SEMESTER / SESSION : SEM 1/2012/2013 PROGRAMME : 2 BNB
COURSE : MECHANICS OF MATERIALS COURSE CODE : BNP 20203

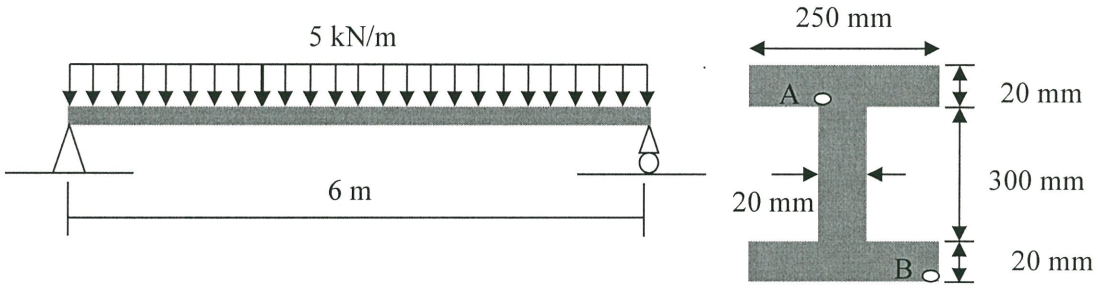

FIGURE Q4/ RAJAH Q4

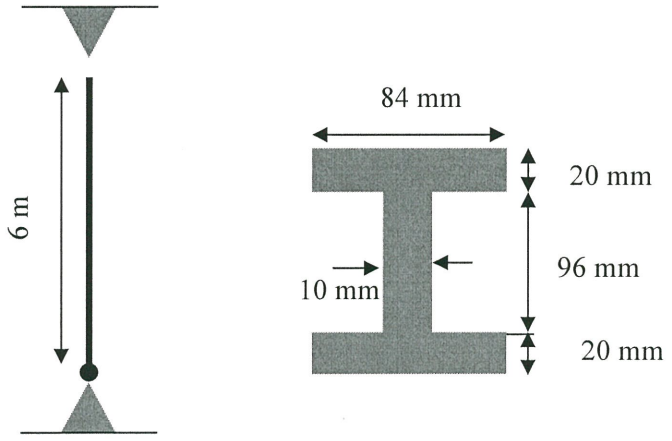

FIGURE Q5/ RAJAH S5

FINAL EXAMINATION

SEMESTER / SESSION : SEM 1/2012/2013 PROGRAMME : 2 BNB
COURSE : MECHANICS OF MATERIALS COURSE CODE : BNP 20203

LISTS OF EQUATION

1. $\sigma = \quad =$
2. $\tau =$
3. $\varepsilon =$
4. $\sigma = E\varepsilon$
5. $v = \quad =$
6. $\quad = [\sigma_x - v(\sigma_y + \sigma_z)]$; $\quad = [\sigma_y - v(\sigma_x + \sigma_z)]$; $\quad = [\sigma_z - v(\sigma_x + \sigma_y)]$
7. $\sigma_{maks} =$
8. $I_x =$; $I_y =$; $I_{circle} =$
9. Pin-connected at the both ends:

   $P_{cr} =$; $L_e = L$
10. Fix-connected at the both ends:

    $P_{cr} = \quad =$; $L_e =$