UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2012/2013

COURSE NAME	:	STRUCTURAL ANALYSIS
COURSE CODE	:	BFC21403/BFC3023
PROGRAMME	:	3 BFF
EXAMINATION DATE	:	DECEMBER 2012/JANUARY 2013
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY FROM **SIX (6)** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **TWELVE (12)** PAGES

Q1 Figure **Q1** shows a pin-pointed plane truss that is pinned at A and B. The truss is subjected to load with 15kN and 30kN at point D and E respectively. Given $A=1800mm^2$ and E=200GPa.

(a) Proof that this structure is statically determinate

(2 marks)

(b) Determine the axial forces for all members of truss

(10 marks)

(c) Determine the horizontal displacement at E by using the Virtual Work method.

(13 marks)

Q2 A truss with applied loading is shown in Figure **Q2**. The Modulus of Elasticity of each member is E = 200 kN/mm^2 and the cross-sectional area of the member given in Table **Q2**.

If the support at C assumed as an external redundant, determine;

(a) Reaction force at each support

(2 marks)

(b) Calculate and sketch the internal force due to external force for each members of the truss.

(8 marks)

(c) By using Method of Virtual Work, calculate the reaction C and fill in the value in table.

(15 marks)

Q3 Figure **Q3(a)** below shows a sway rigid frame which is subjected to a concentrated vertical load of 100kN acting on mid span of member BC respectively. The support at A is fixed and D is pinned. Figure **Q3(b)** shows a frame without sway and Figure **Q3(c)** a frame with sway.

Given $EI\Delta = 45$.

State your answer in two decimal places.

(a) From Figure **Q3(b)** calculate all end moments and reactions by using the moment distribution method and define the value of P.

(8 marks)

(b) From Figure **Q3(c)** calculate all end moments and reactions by using the moment distribution method and define the value of X.

(8 marks)

(c) Based on answer from **(a)** and **(b)** determine the correction factor and actual moment for every member.

(9 marks)

Q4 A truss bridge has a bottom side is the way (A-G-H-I-J-K-B), shown in Figure **Q4(a)**. Meanwhile, a car crossing the bridge where the front wheel had loads of 10 kN and back 20 kN as shown in Figure **Q4(b)**.

(a) Determine influence line of Support A.

(6 marks)

(b) Determine influence line for members 1, 2 and 3.

(6 marks)

(c) Find the maximum value of member 3 (incline member) when a car as in Figure **Q4(b)** across point J. The car move from point A to B.

(7 marks)

(d) Explain the effect of member 1 when a car passing over a bridge?

(6 marks)

Q5 (a) A beam with cross section of T-shape is shown in Figure **Q5(a)**. Given the σ_y = 250 N/mm^2. Determine;

i. Elastic Modulus, E

(5 marks)

ii. Yield Moment, My

(5 marks)

iii. Plastic Moment, Mp

(10 marks)

(b) Determine the plastic moment, Mp for the given beam at Figure **Q5(b)** by using the Method of Virtual Work.

(5 marks)

Q6 (a) State three (3) types of instability and four (4) classification of instability of a structure.

(5 marks)

(b) Figure **Q6** shows I steel beam with approximately 3 meters from the steel floor. The steel bracing systems is installed in the middle of I beam to prevent flexural buckling in I steel beam. Both ends of the steel bracing system that hold the I beam are used pin-joint, on the other end are welded on the steel floor.

If the I steel beam has critical load 3414 kN that resting on point B, calculate moment inertia cross section (I) steel bracing with assuming moment inertia of cross section both of bracing system are the same ($I_{AB} = I_{BC}$).

Data of steels bracing systems:

Length AB = 5.4 meters

BC = 3.9 meters,

Modulus of Elasticity AB = BC = 210 kN/mm^2

(20 marks)

S1 Rajah **Q1** menunjukkan satu kekuda pin tajam pesawat yang disematkan di A dan B. kekuda adalah tertakluk kepada beban dengan 15kN dan 30kN pada titik D dan E masing-masing. Diberi A = 1800mm2 dan E = 200GPa.

(a) Buktikan bahawa struktur ini boleh tentu statik.

(2 markah)

(b) Tentukan daya paksi untuk semua anggota kekuda

(10 markah)

(c) Tentukan anjakan mendatar di E dengan menggunakan Kaedah Kerja Maya.

(13 markah)

S2 Satu kekuda dengan beban pugak adalah seperti yang ditunjukkan dalam Rajah **Q2**. Modulus Keanjalan setiap anggota adalah E = 200 kN/mm^2 dan luas keratan rentas anggota diberikan dalam Jadual **Q2**.

Jika sokongan di C dianggap sebagai berlebihan luaran, tentukan;

(a) Daya tindakbalas pada setiap penyokong.

(2 markah)

(b) Kira dan lakarkan daya dalaman yang disebabkan oleh daya luaran untuk setiap anggota kekuda.

(8markah)

(c) Dengan menggunakan Kaedah Kerja Maya, kira daya tindakbalas di C dan isikan nilai-nilai dalam bentuk jadual.

(15 markah)

S3 Rajah **Q3(a)** menunjukkan kerangka huyung tegar yang ditindaki beban pugak 100kN yang bertindak di tengah rentang BC. Kerangka ini disokong tegar di A dan disokong pin di D. Rajah **Q3(b)** menunjukkan kerangka tanpa huyung dan Rajah **Q3(c)** kerangka huyung.

Diberi $EI\Delta = 45$

Nyatakan jawapan didalam dua titik perpuluhan.

(a) Berdasarkan Rajah **Q3(b)** tentukan semua nilai momen hujung dan daya tindakbalas dengan menggunakan kaedah agihan momen (empat kali agihan) dan tentukan nilai P.

(8 markah)

(b) Berdasarkan Rajah **Q3(c)** tentukan nilai momen akhir dan daya tindakbalas dengan menggunakan kaedah agihan momen (empat kali agihan) dan tentukan nilai X.

(8 markah)

(c) Berdasarkan jawapan dari **(a)** dan **(b)** tentukan faktor pembetulan dan momen sebenar untuk setiap anggota.

(9 markah)

S4 Sebuah jambatan kerangka dengan bahagian bawah sebagai jalan (A-G-H-I-J-K-B) ditunjukkan seperti dalam Rajah **Q4(a)**. Sementara sebuah kereta melintasi jambatan dimana tayar depan mempunyai beban 10 kN dan tayar belakang 20 kN seperti dalam Rajah **Q4(b)**.

(a) Tentukan garis imbas penyokong A.

(6 markah)

(b) Tentukan garis imbas anggota 1, 2 dan 3.

(6 markah)

(c) Berapakah nilai maksimum pada anggota 3 (anggota condong) ketika kereta seperti Rajah **Q4(b)** melalui titik J jika kereta bergerak dari A menuju B.

(7 markah)

(d) Jelaskan apa yang berlaku pada anggota 1 ketika kereta melalui jambatan.

(6 marks)

S5 (a) Rajah **Q(5a)** menunjukkan keratan rentas berbentuk T bagi satu rasuk.

Diberi $\sigma_y = 250\ N/mm^2$. Tentukan nilai-nilai berikut;

i. Modulus Keanjalan, Z

(5 markah)

ii. Momen alah, My

(5 markah)

iii. Momen Plastik, Mp

(10 markah)

(b) Tentukan momen plastik Mp bagi rasuk pada Rajah **Q5(b)** dengan menggunakan Kaedah Kerja Maya.

(5 markah)

S6 (a) Nyatakan 3 jenis ketidakstabilan dan 4 pengkelasan ketidakstabilan struktur.

(5 markah)

(b) Rajah **Q6** menunjukkan rasuk keluli berbentuk I yang berjarak 3m daripada lantai keluli. Sistem perembat keluli di pasang ditengah tengah rasuk untuk mengatasi masalah lenturan lengkuk pada rasuk. Rasuk ini dipin di kedua-dua hujungnya dan dikimpal ke lantai keluli.

Jika rasuk keluli mempunyai beban kritikal 3414 kN bertindak di B, tentukan momen luas kedua (I) perembat keluli dengan menganggap momen luas kedua- dua sistem perembat adalah sama ($I_{AB} = I_{BC}$).

Data bagi perembat keluli;

Panjang AB = 5.4 meters

BC = 3.9 meters,

Modulus Keanjalan AB=BC= 210 kN/mm^2

(20 markah)

FINAL EXAMINATION

SEMESTER/SESSION	: SEM I 2012/2013	PROGRAMME :	3 BFF
COURSE	: STRUCTURAL ANALYSIS	COURSE CODE :	BFC21403/BFC3023

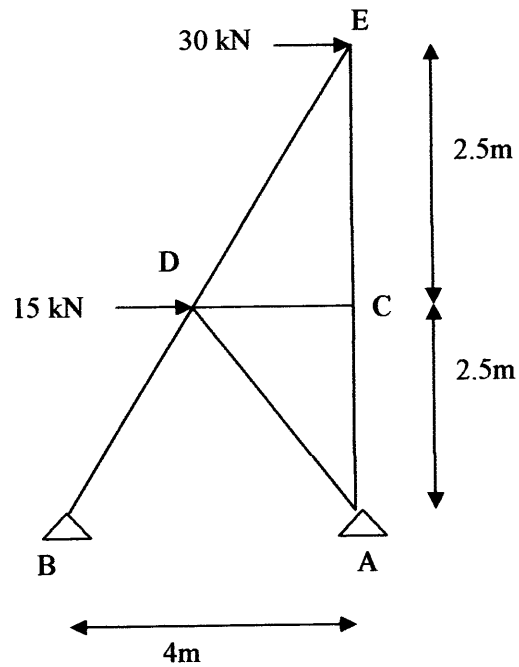

FIGURE Q1

FINAL EXAMINATION

SEMESTER/SESSION : SEM I 2012/2013 PROGRAMME : 3 BFF

COURSE : STRUCTURAL ANALYSIS COURSE CODE : BFC21403/BFC3023

Member	Area (mm^2)	Member	Area (mm^2)
AB	400	FG	300
BC	400	GH	300
CD	400	AF	250
DE	400	BG	250
BF	350	DG	250
CG	350	EH	250
DH	350		

TABLE Q2

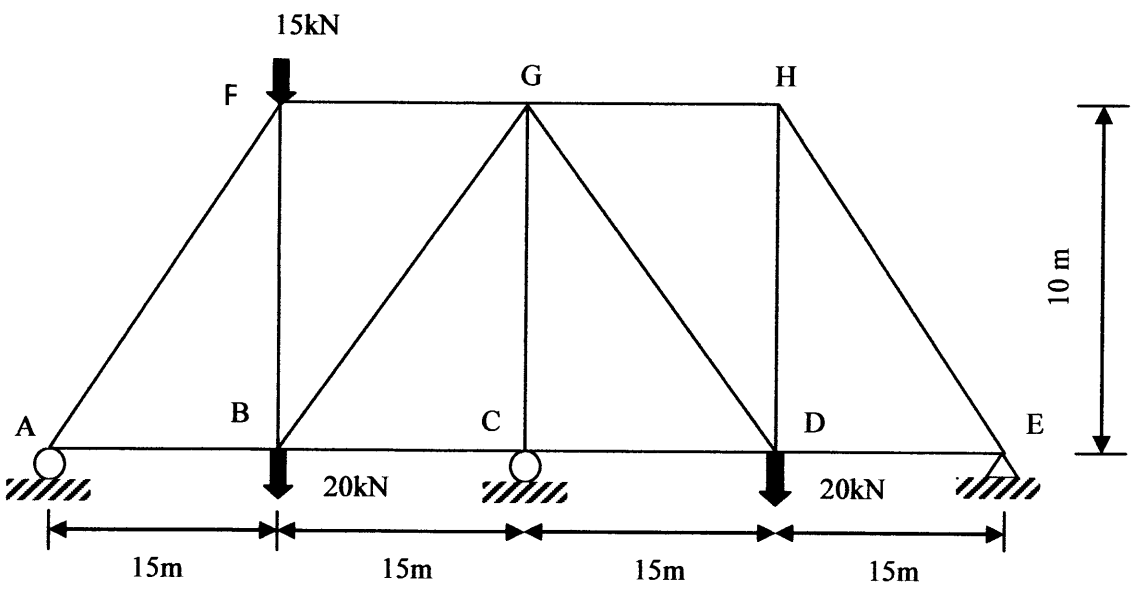

FIGURE Q2

FINAL EXAMINATION

SEMESTER/SESSION	: SEM I 2012/2013	PROGRAMME :	3 BFF
COURSE	: STRUCTURAL ANALYSIS	COURSE CODE :	BFC21403/BFC3023

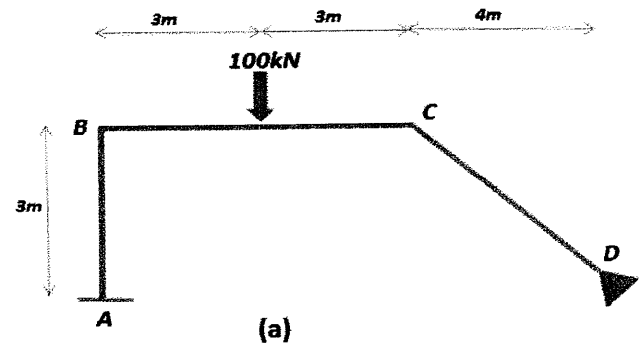

FIGURE Q3(a)

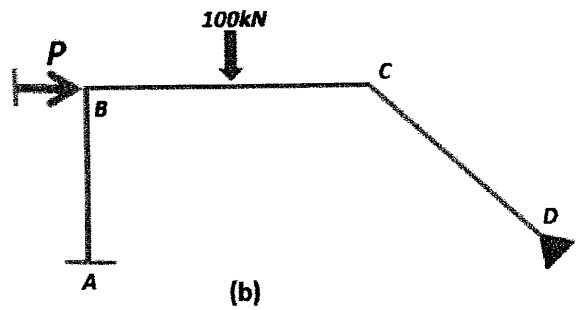

FIGURE Q3(b)

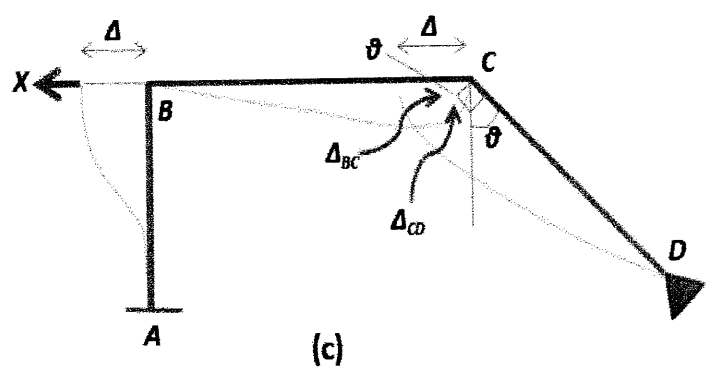

FIGURE Q3(c)

FINAL EXAMINATION

SEMESTER/SESSION	: SEM I 2012/2013	PROGRAMME :	3 BFF
COURSE	: STRUCTURAL ANALYSIS	COURSE CODE :	BFC21403/BFC3023

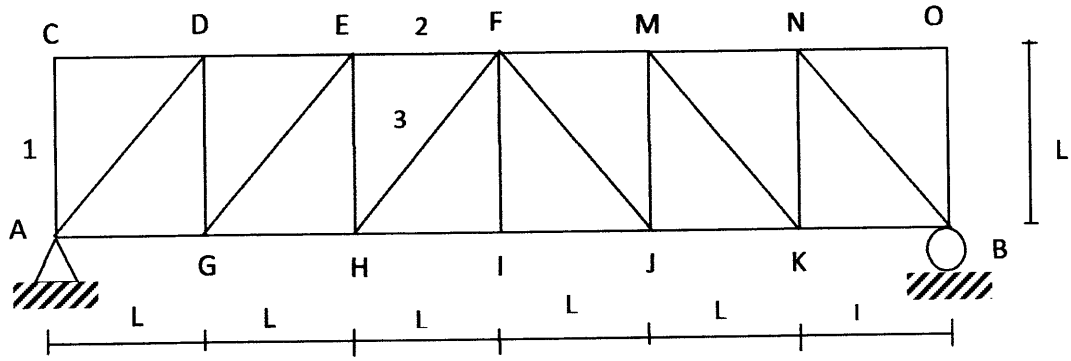

FIGURE Q4(a)

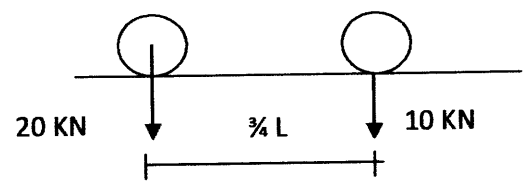

FIGURE Q4(b)

FINAL EXAMINATION

SEMESTER/SESSION	: SEM I 2012/2013	PROGRAMME :	3 BFF
COURSE	: STRUCTURAL ANALYSIS	COURSE CODE :	BFC21403/BFC3023

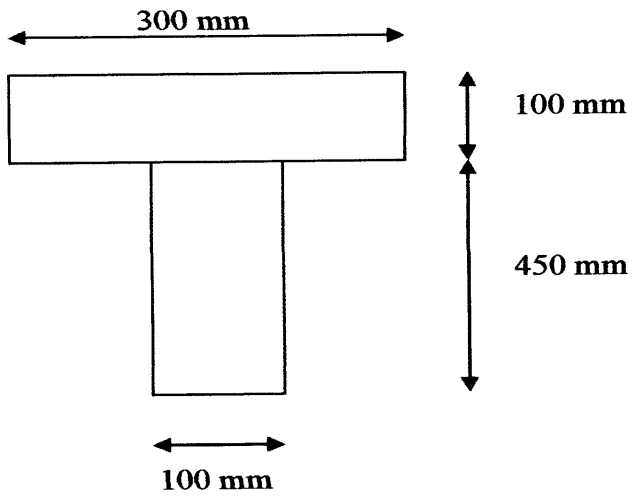

FIGURE Q5(a)

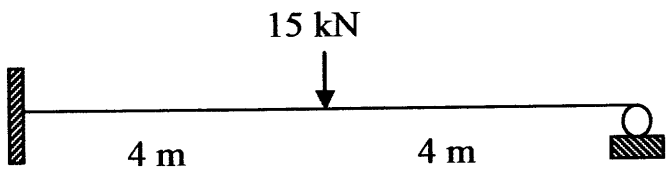

FIGURE Q5(b)

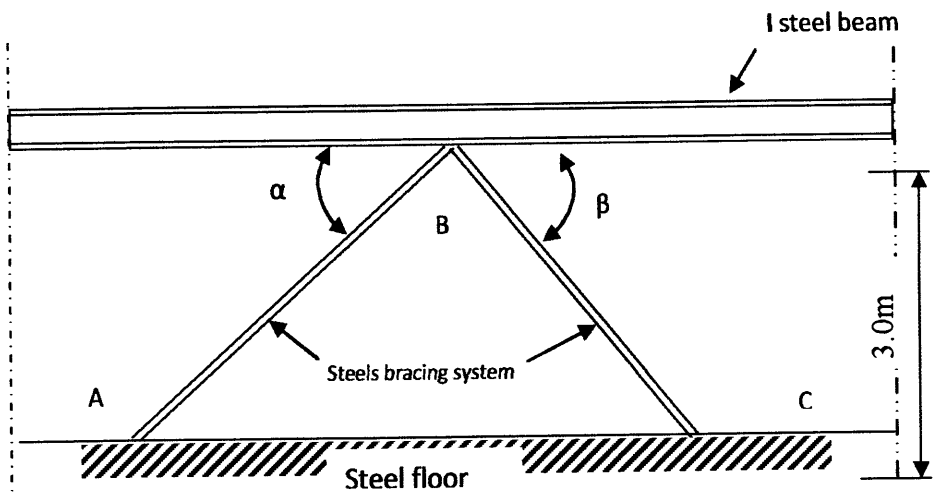

FIGURE Q6