Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2014/2015

COURSE NAME	:	STRUCTURAL ANALYSIS
COURSE CODE	:	BFC 21403
PROGRAMME	:	BACHELOR OF CIVIL ENGINEERING WITH HONOURS
EXAMINATION DATE	:	JUNE 2015/JULY 2015
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **FOUR (4)** QUESTIONS ONLY

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

Q1 The truss as shown in **FIGURE Q1** is comprised entirely of equilateral triangles. The wind loads of 6 kN at D and E act perpendicularly to the member ED. The cross section area and Modulus of Elasticity for all members are 1800 mm^2 and 200 000 N/mm^2, respectively.

(a) Prove that the truss is a statistically determinate structure.

(3 marks)

(b) Calculate the reaction forces at each supports

(2 marks)

(c) Calculate and sketch the internal force due to external force for each member of the structure

(7 marks)

(d) By using the virtual work method, calculate and sketch the internal force due to 1 unit load in vertical at joint B.

(7 marks)

(e) Determine the vertical deflection of joint B.

(6 marks)

Q2 The cross sectional area of the truss shown in **FIGURE Q2** is tabulated in **TABLE Q2**. The Modulus of Elasticity for all members is 210 kN/mm^2.

(a) Check the determinacy of the truss.

(3 marks)

(b) Calculate the reaction forces at support A and C.

(1 mark)

(c) Assume the truss is indeterminate,

i. Determine the internal redundant member

(1 mark)

ii. Calculate the internal force due to external force

(4 marks)

iii. Calculate the internal force due to unit load

(4 marks)

iv. Determine the real internal force of the truss

(12 marks)

Q3 The side of the frame shown in **FIGURE Q3** is subjected to the hydrostatic loading. Assume support A is fixed and support D is pin. By using moment distribution (modified stiffness) method, determine

(a) The moment at each joint and support for un-sway frame.

(9 marks)

(b) The moment at each joint and support for a sway frame.

(9 marks)

(c) The actual moment for each member.

(7 marks)

Q4 (a) **FIGURE Q4 (a)** shows a beam which carries a point load 50 kN at A. Construct the influence line for

(i) Reaction B

(2 marks)

(ii) Bending moment at location 5.5 m from A.

(3 marks)

(b) The maximum wheel loading for the wheel of the truck and trailer that are used in construction are shown in **FIGURE Q4 (b)**. The truck and trailer are travels along the runway girders that are simply supported on column. Determine:

(i) The absolute maximum shear in an intermediate girder AB.

(10 marks)

(ii) The absolute maximum moment in the girder AB.

(10 marks)

Q5 (a) Explain and define the correlation between Yield Moment, M_y and Plastic Moment, M_p.

(5 marks)

(b) **FIGURE Q5 (a)** shows a frame subjected to inclined force of 90 kN.

(i) Determine the maximum plastic moment for all mechanisms.

(12 marks)

(ii) Determine the yield stress, σ_y at the plastic condition if the cross section area is shown in **FIGURE Q5 (b)**.

(8 marks)

Q6 (a) Sketch the deformed shape of braced column given in **FIGURE Q6 (a)** and **FIGURE Q6 (b)**

(5 marks)

(b) **FIGURE Q6 (c)** shows a I steel beam with approximately 4 meters from the steel floor. Steel bracing systems installed in the middle of I-beam with $\alpha°$ of angle to avoid flexural buckling in I steel beam. Both ends of the steel bracing system that holds the I beam are welded. The other end is welded on to steel floor. Using the details below, calculate the critical loading that carried by each steels bracing systems.

Data of steels bracing systems:

Length , AC = BC = 5 meters,
Moment Inertia of cross section, AC =1200cm^4
Moment Inertia ocross section, BC =1400cm^4
Modulus of Elasticity AC = BC = 210 kN/mm^2

(20 marks)

- END OF QUESTION –

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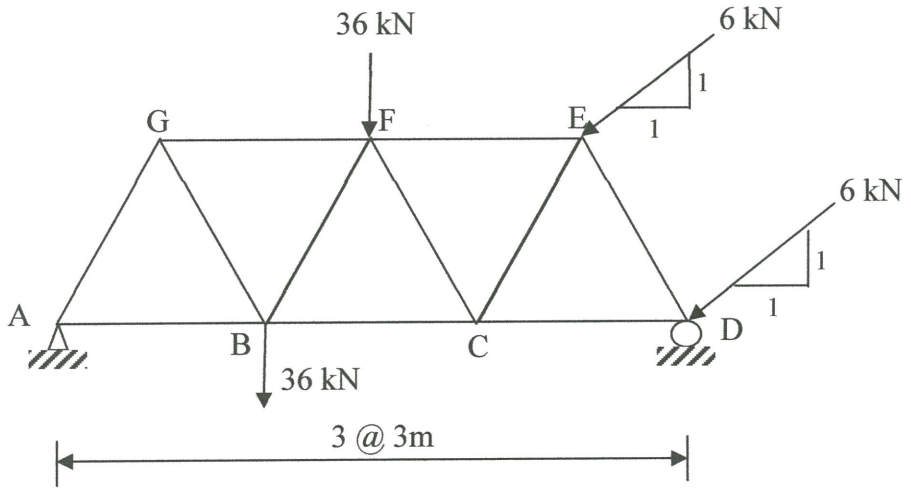

FIGURE Q1

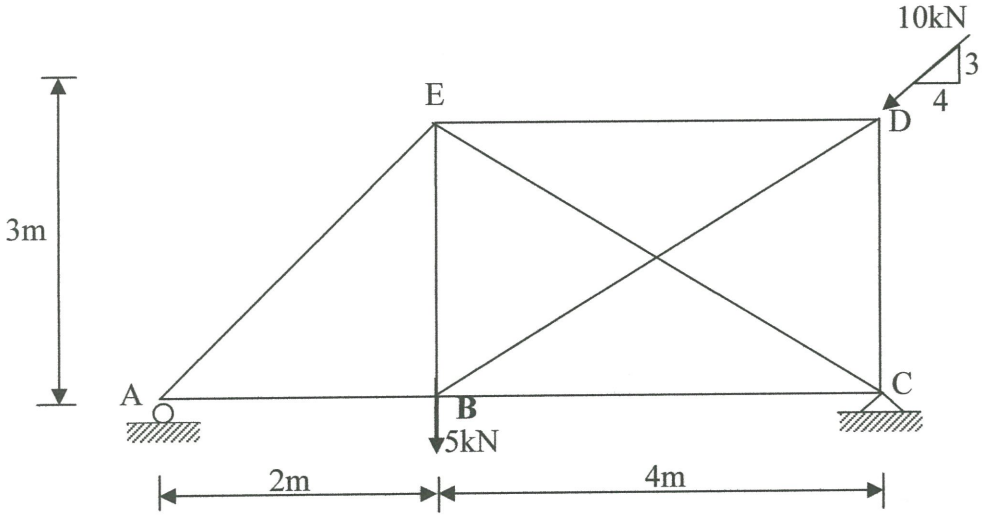

FIGURE Q2

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TABLE Q2

Member	Area (mm^2)	Modulus Elasticity (kN/mm^2)
AB	150	210
AE	150	210
BC	250	210
BD	250	210
BE	250	210
CD	250	210
DE	250	210
EC	250	210

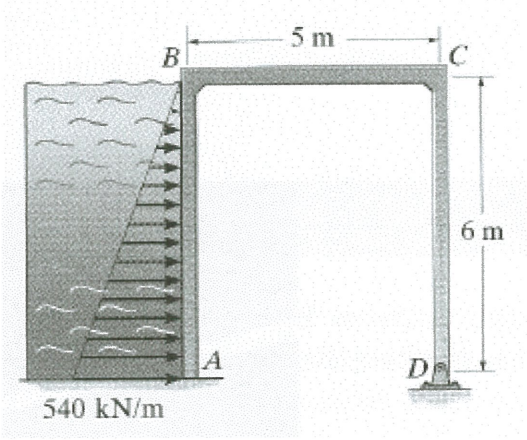

FIGURE Q3

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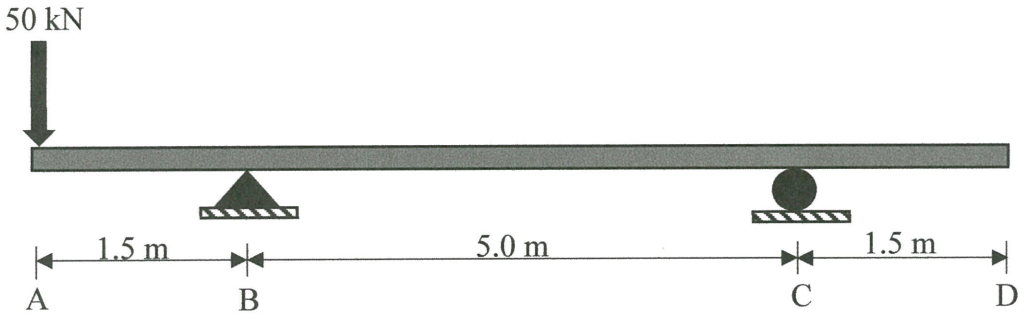

FIGURE Q4 (a)

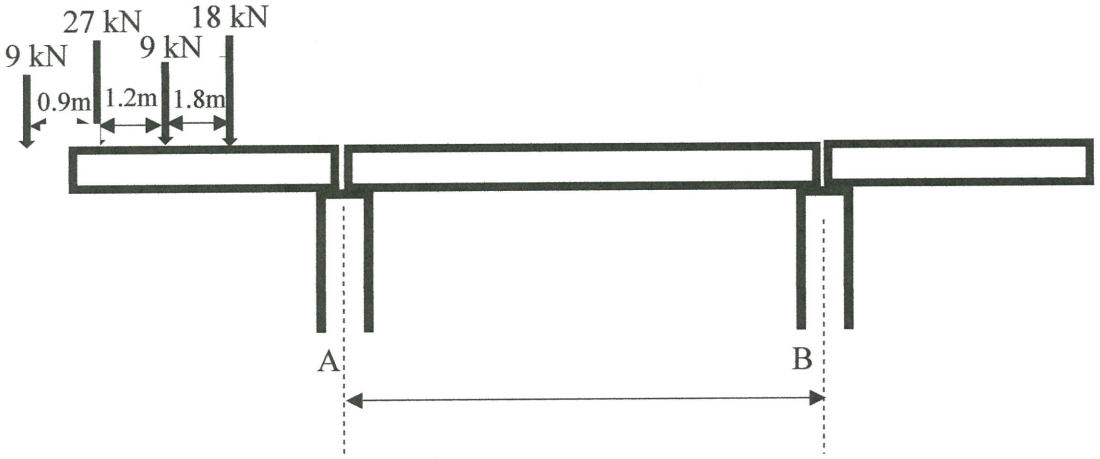

FIGURE Q4 (b)

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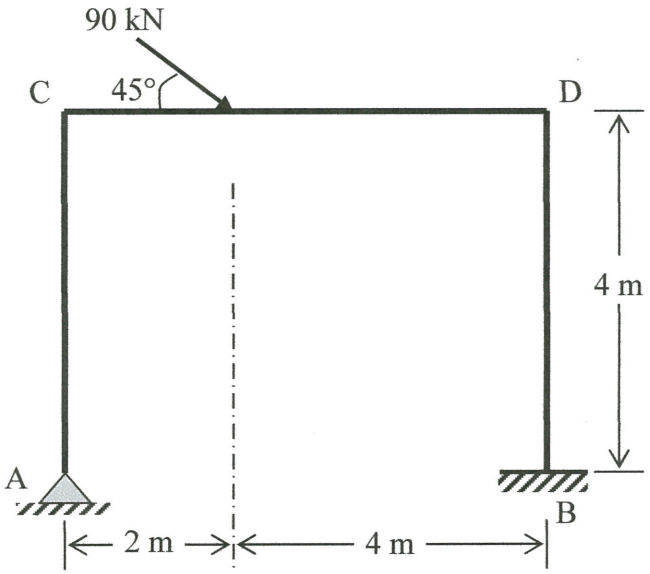

FIGURE Q5 (a)

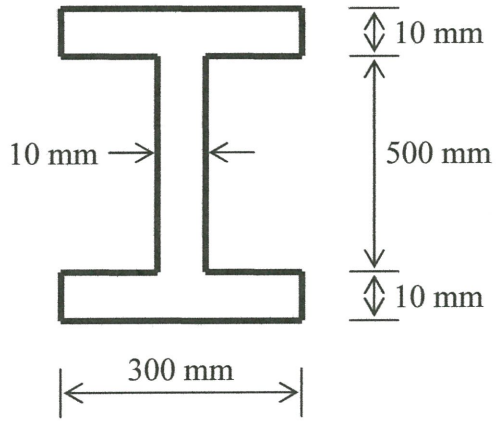

FIGURE Q5 (b)

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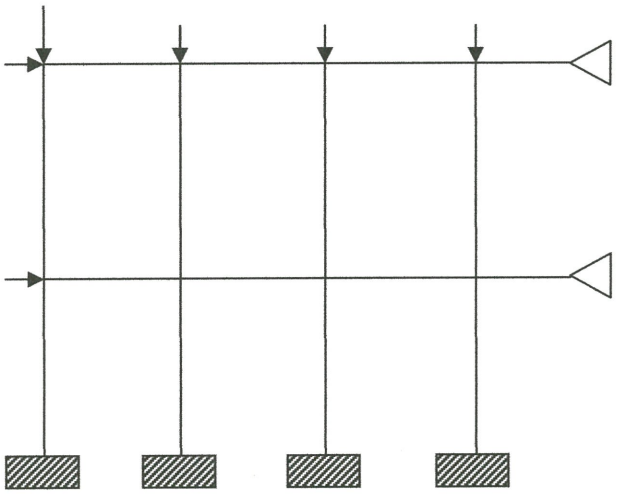

FIGURE Q6 (a)

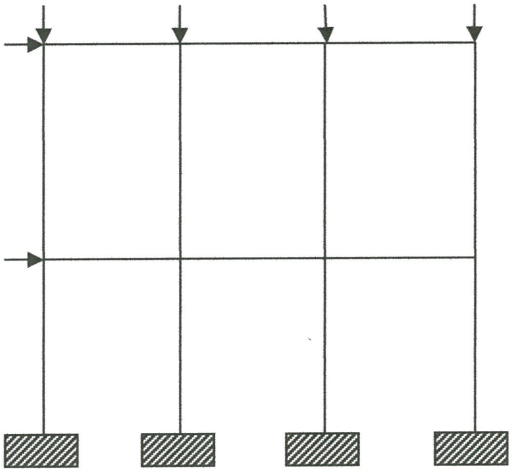

FIGURE Q6 (b)

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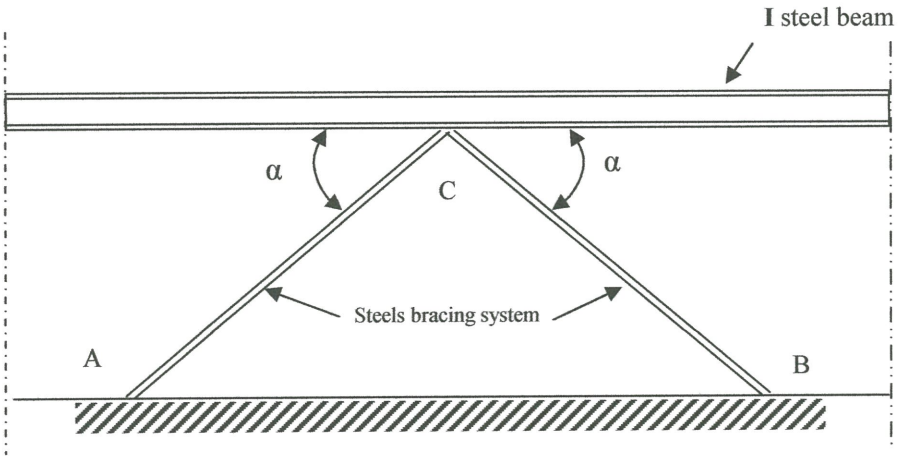

FIGURE Q6 (c)

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Table 1: Value for ρ and s for the stability function

ρ	s
0.00	4.000
0.04	3.947
0.08	3.894
0.12	3.840
0.16	3.785
0.20	3.730
0.24	3.674
0.28	3.617
0.32	3.650
0.36	3.502
0.40	3.444
0.44	3.385
0.48	3.325
0.52	3.264
0.56	3.203
0.60	3.140
0.64	3.077
0.68	3.013
0.72	2.948
0.76	2.883
0.80	2.816
0.84	2.748
0.88	2.680
0.92	2.610
0.96	2.539

ρ	s
1.00	2.467
1.04	2.394
1.08	2.320
1.12	2.245
1.16	2.168
1.20	2.090
1.24	2.011
1.28	1.930
1.32	1.848
1.36	1.764
1.40	1.678
1.44	1.591
1.48	1.502
1.52	1.411
1.56	1.319
1.60	1.224
1.64	1.127
1.68	1.028
1.72	0.927
1.76	0.823
1.80	0.717
1.84	0.608
1.88	0.496
1.92	0.382
1.96	0.264

ρ	s
2.00	0.143
2.04	0.018
2.08	-0.110
2.12	-0.242
2.16	-0.379
2.20	-0.519
2.24	-0.665
2.28	-0.815
2.32	-0.971
2.36	-1.133
2.40	-1.301
2.44	-1.475
2.48	-1.656
2.52	-1.845
2.56	-2.043
2.60	-2.249
2.64	-2.465
2.68	-2.692
2.72	-2.930
2.76	-3.180
2.80	-3.445
2.84	-3.725
2.88	-4.021
2.92	-4.337
2.96	-4.673
3.00	-5.032

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FIXED END MOMENTS: