UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(TAKE HOME)
SEMESTER I
SESSION 2020/2021

COURSE NAME	:	STRUCTURAL ANALYSIS AND DESIGN
COURSE CODE	:	BNP 20803
PROGRAMME CODE	:	BNA / BNB / BNC
EXAMINATION DATE	:	JANUARY/FEBRUARY 2021
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS **OPEN BOOK EXAMINATION**

TERBUKA

THIS QUESTION PAPER CONSISTS OF **FIVE (5)** PAGES

Q1 (a) A rectangular reinforced concrete beam is provided with 4H18 bars as tension reinforcement. Calculate depth of the beam to allow it to have ultimate moment of resistance of at least 2xx kNm, if the width of beam is set at 250 mm. Assume $f_{ck} = 30$ N/mm² and $f_{yk} = 500$ N/mm².

(Note: xx is the last two digits of your student ID, e.g AN20999 will have an ultimate moment of resistance of 299 kNm)

(15 marks)

(b) A 4 m reinforced concrete beam with rectangular cross section carries an ultimate action (self weight included) of 1x kN/m. This beam is provided with reinforcement to resist bending moment only. If size of the beam, $b = 250$ mm, $d = 475$ mm, and strength of material $f_{ck} = 30$ N/mm² and $f_{yk} = 500$ N/mm², analyze the adequacy of this beam to resist shear force.

(Note: x is the last digit of your student ID, e.g AN20999 will have an ultimate action of 19 kN/m)

(10 marks)

Q2 A concrete jetty was constructed near the shore of a distric in west coast of Malaysia (refer to **Figure Q2(a)**). If layout of the pile is as described in **Figure Q2(b)** additional span outside of pile is neglected (only the area within centerline is considered), and assume transverse steel in flange and additional longitudinal reinforcement are not required, answer the question using the following assumption:

Slab thickness = 100 mm

Characteristic Action:
Finishes etc.= 1.x kN/m² (excluding selfweight)
Variable, q_k = 2.x kN/m²

Material:
Unit weight of Concrete = 2500 kg/m³
Characteristic strength of concrete, $f_{ck} = 30$ N/mm²
Characteristic Strength of steel, $f_{yk} = 500$ N/mm²
Characteristic Strength of link, $f_{yk} = 500$ N/mm²
Use nominal cover = 30 mm

Diameter of bar:
Main bar   – 20 mm
Link   6 mm

(a) Plan the layout of beam and slab on the provided pile layout.

(2 marks)

(b) Determine (with reasoning) the suitable exposure class and design life for this structure

(5 marks)

(c) Calculate the appropriate dimension for beam that correspond to the grid 2/A-B

(3 marks)

(d) Analyze the nominal cover of that beam in **Question Q2(c)**

(4 marks)

(e) Calculate the effective flange width of that beam in **Question Q2(d)**

(4 marks)

(f) Design the main reinforcement of that beam in **Question Q2(e)**

(12 marks)

(g) Design the shear reinforcement of that beam in **Question Q2(f)**

(12 marks)

(h) Analyze the designed beam in **Question Q2(g)** for deflection and cracking requirement and propose a solution if the results do not satisfy the requirement.

(4 marks)

(i) Generate a drawing of reinforcement detailing for the designed beam 2/A-B

(4 marks)

Q3 (a) With reference to **Figure Q3**, calculate reaction at support

(10 marks)

(b) Generate internal forces diagram for the structure in **Figure Q3**
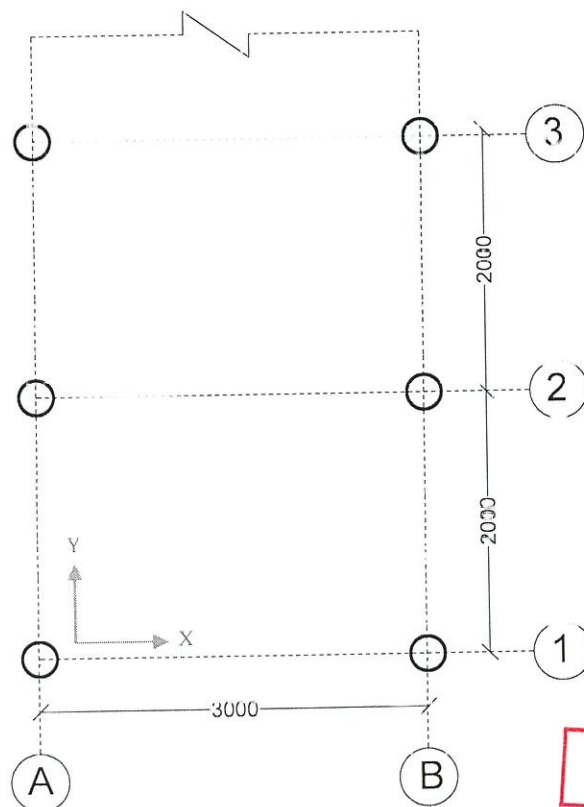
(15 marks)

-END OF QUESTIONS-

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Figure Q2(a): Jetty structure

Figure Q2(b): Layout of pile (in mm)

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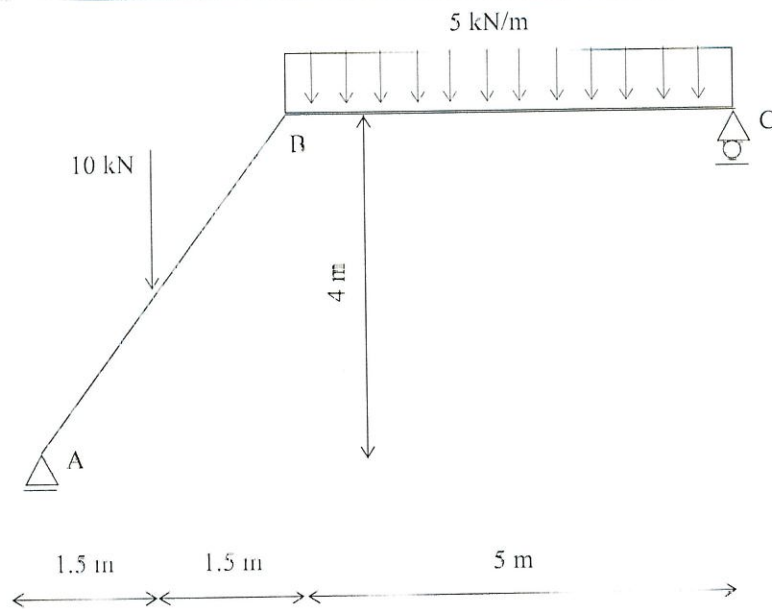COURSE NAME   : STRUCTURE ANALYSIS AND DESIGN   COURSE CODE   : BNP 20803

Figure Q3: Frame structure with incline member