Universiti Tun Hussein Onn Malaysia

# UNIVERSITI TUN HUSSEIN ONN MALAYSIA

## FINAL EXAMINATION
## (ONLINE)
## SEMESTER II
## SESSION 2020/2021

| | | |
|---|---|---|
| COURSE NAME | : | PRESTRESSED CONCRETE DESIGN |
| COURSE CODE | : | BFS40303 |
| PROGRAMME CODE | : | BFF |
| EXAMINATION DATE | : | JULY 2021 |
| DURATION | : | 3 HOURS |
| INSTRUCTION | : | ANSWER **ALL** QUESTIONS |

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

**Q1** **Figure Q1(a)** shows a tapered rectangular post-tensioned cantilever beam subjected to a concentrated load at the end of the beam. The initial effective prestressing force is F. Ignore self-weight of the beam.

(a) Based on stress concept, prove the stress on the top of the beam section is,

$$\sigma_t = \frac{F}{bh^2}\left(4h - \frac{6PL}{F} - 450\right)$$

(20 marks)

(b) The dimension of the cross section at both ends of the beam is given in **Figure Q1(b)**. The length (L) of the beam is 6 m, concentrated load (P) = 1000 kN, cross sectional area of the tendon (Aps) = 1000 mm$^2$ and the effective initial prestress is 1150 N/mm$^2$. Determine the stress on top of the beam section at a distance of 3 m from point A.

(10 marks)

(c) If the concentrated load was estimated wrongly which is lower than the actual value. Propose a new solution without changing the pre-designed prestressing tendon. Justify the proposed solution.

(10 marks)

**Q2** **Figure Q2(a)** shows part of the first floor plan of a double storey building. The floor of the building is using precast prestressed hollow core slabs. The hollow core slabs are sitting on the simply supported precast pre-tensioned beam (PCB1) as shown in **Figure Q2(b)**. Given the following data:

| | | |
|---|---|---|
| Floor: | | |
| Weight of hollow core slab | = | 4.0 kN/m$^2$ |
| Unit weight of concrete | = | 24 kN/m$^3$ |
| Strength of concrete | = | 40 N/mm$^2$ |
| Concrete topping | = | 75 mm |
| Finishes & Services | = | 2.0 kN/m$^2$ |
| Imposed load | = | 5.0 kN/m$^2$ |
| | | |
| Prestressing: | | |
| Short term losses ($\alpha$) | = | 10% |
| long term losses ($\beta$) | = | 20% |
| $f'_{max}$ | = | 20 N/mm$^2$ |
| $f_{max}$ | = | 16.5 N/mm$^2$ |
| $f'_{min}$ | = | -1.0 N/mm$^2$ |
| $f_{min}$ | = | 0 N/mm$^2$ |

(a) Prove the proposed precast beam section is adequate.

(18 marks)

(b) Evaluate the range of the prestressing force if the maximum eccentricity of the tendons at mid-span is 50 mm above the soffit.

(12 marks)

**Q3** **Figure Q3** shows the solid end-block of a post-tensioned prestressed box girder beam of 15 m span containing two cables. The top cable is consists of 7-12.9 mm super strands and tensioned up to 900 kN. The bottom cable is consists of 7-15.7 mm super strands and tensioned up to 1300 kN. The anchorage plates are 150 mm x 150 mm and 180 mm x 180 mm for top and bottom anchorages, respectively. The end block is required for resisting the bursting forces. Use steel reinforcement of 10 mm diameter for the individual prism and 16 mm for the overall prism. The stress of the steel cables is limited to 175 MPa.

(a) Design the end block for the individual prism. (20 marks)

(b) Design the end block based on overall prism. (10 marks)

**- END OF QUESTIONS-**

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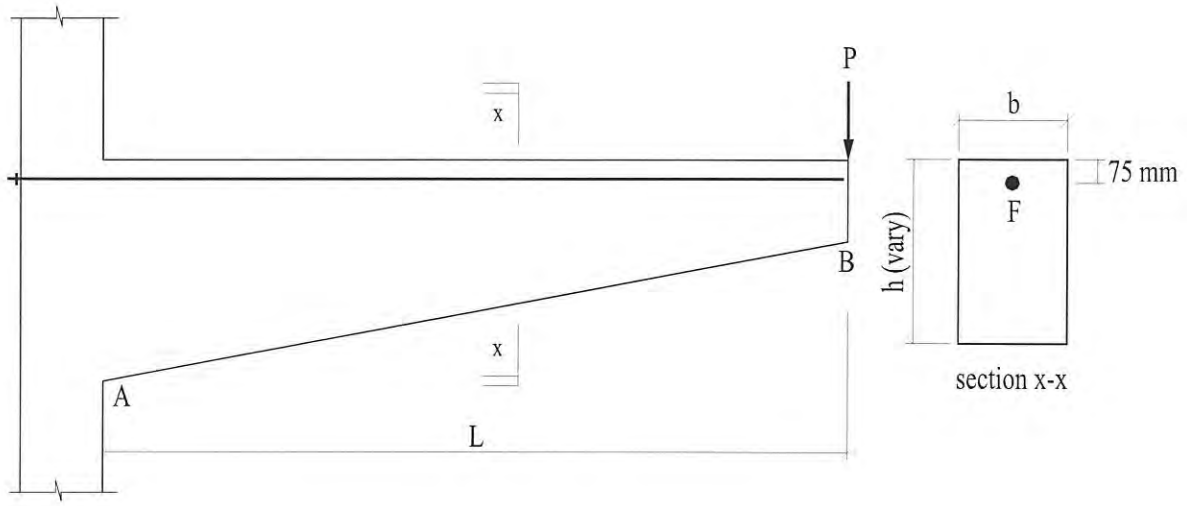


**FIGURE Q1(a)**

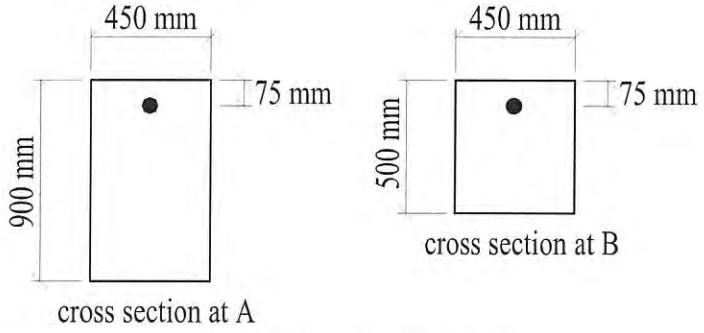


**FIGURE Q1(b)**

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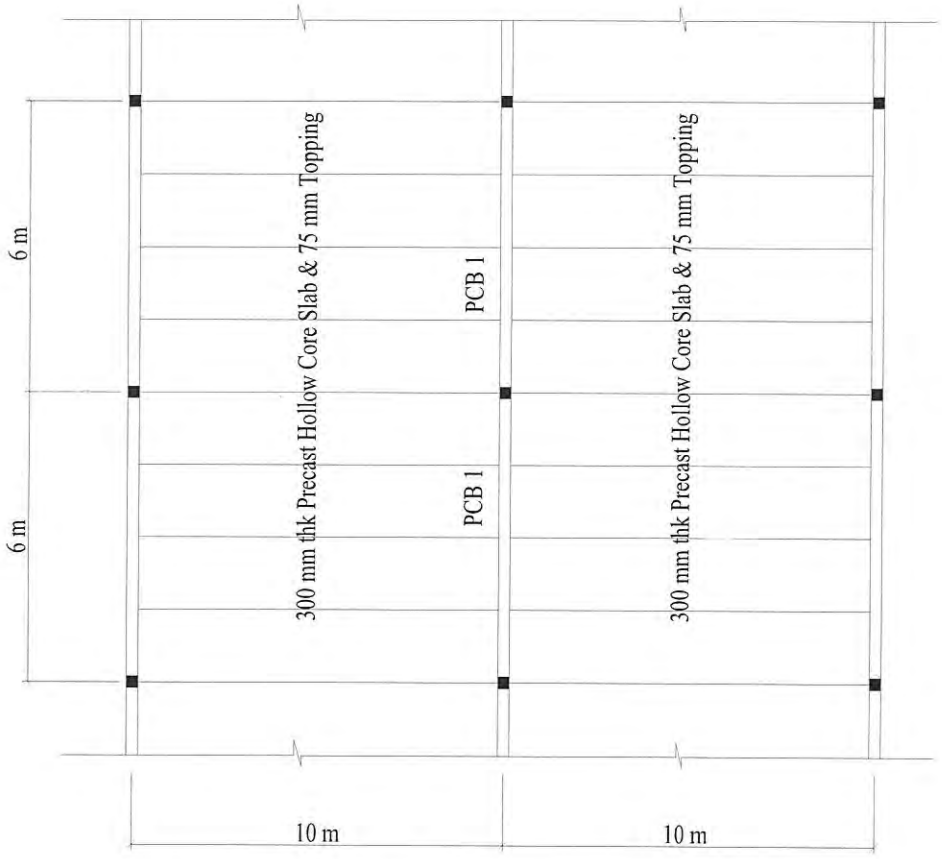


**FIGURE Q2(a)**

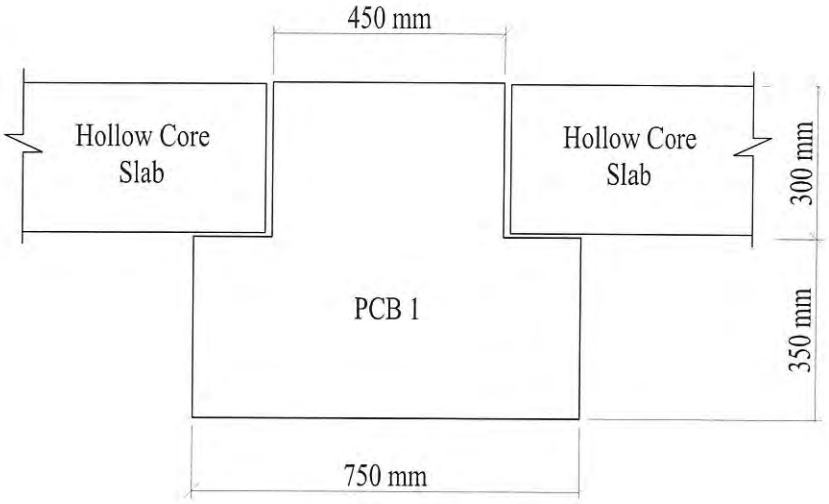


**FIGURE Q2(b)**

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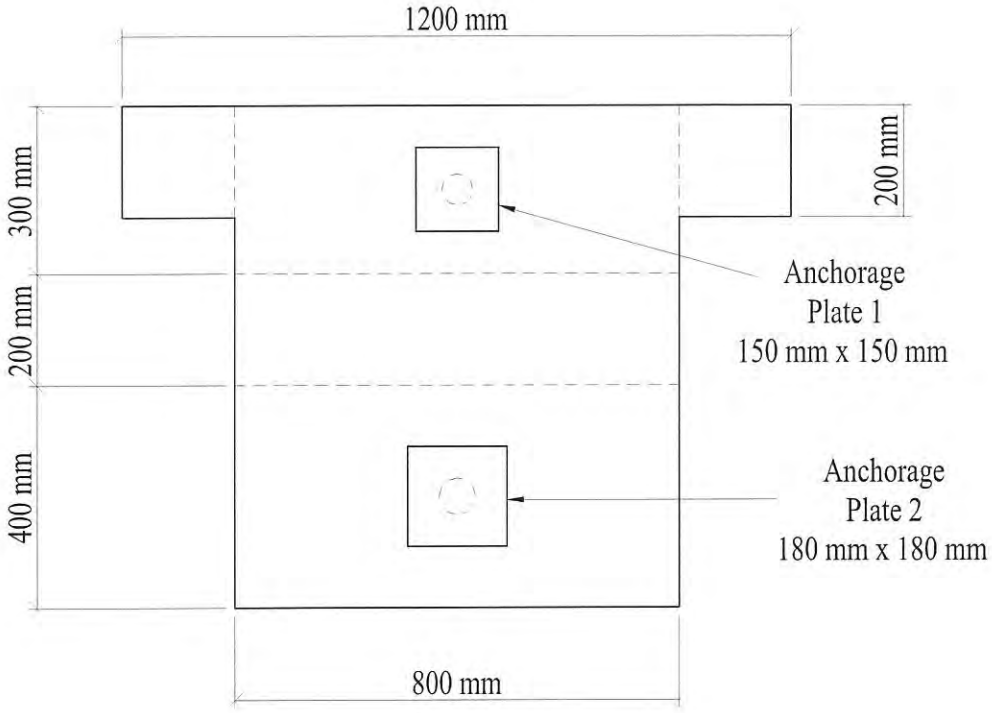


**FIGURE Q3**