UNIVERSITY OF RUHUNA

Faculty of Engineering

Mid-Semester 6 Examination in Engineering: November 2014

Module Number: CE 6319 **Module Name: Design of Concrete Structures II**

[Two Hours]

[Answer **all questions**, Questions (1) & (3) carries 5 marks each and Question (2) carries 10 marks]

Code of Practice BS 8110 Part 1: 1997 is provided

Q1. a) List out various applications of pre-stressed concrete (PC).

[1.0 Mark]

b) Derive the expressions for Pre-stressing forces (P_e and P_i) applied eccentrically in a concrete member based on the most critical stresses at service and transfer states. Draw all necessary stress and strain diagrams.

[4.0 Marks]

Q2. A simply supported pre-tensioned concrete beam has dimensions as shown in Figure Q2 and span 15.0 m. Pre-tensioned member is subjected to initial pre-stressing force of 1100 kN and member carries an uniformly distributed imposed load of 12 kN/m. Determine the extreme fiber stresses at the mid-span for the following both cases.

a) Calculate cross sectional area and sectional modulus of the section shown in Figure Q2.

[2.0 Marks]

b) Determine the self weight of section and calculate maximum moments at mid-span due to self weight and imposed load

[3.0 Marks]

c) Determine the extreme fiber stresses at the mid-span for the following both cases.

i) Considering only self weight of the beam, if the short term losses are 6% and the eccentricity is 325 mm below the beam centroid.

[2.5 Marks]

ii) Considering total design load, assume that the pre-stress force has been reduced by a further 14% at the point of maximum loading.

[2.5 Marks]

Q3. A newly constructed multi-story building has a 12 m spanning singly supported pre-cast pre-tensioned concrete slab. This slab is designed to carry imposed load of 3.0 kN/m^2. Assume immediate losses and long term losses to be 7% and 18%, respectively, and concrete strength at 7 days (at transfer) and at 28 days of casting are 40 N/mm^2 and 55 N/mm^2, respectively. Take unit weight of concrete as 24 kN/m^3 and f_{pu} for 5 mm Φ high tensile wire as 1670 MPa.

a) Determine the minimum depth required. Assume that the slab is designed as a Class 2 member.

[1.0 Mark]

b) Taking the slab thickness as 160 mm, select a suitable pre-stressing force for the slab. Assume that pre-stressing wires are positioned at 35 mm above the bottom face of the slab.

[2.0 Marks]

c) Determine suitable initial pre-stressing force and high tensile wires requirement for the slab geometry discussed in Q3. (b).

[2.0 Marks]

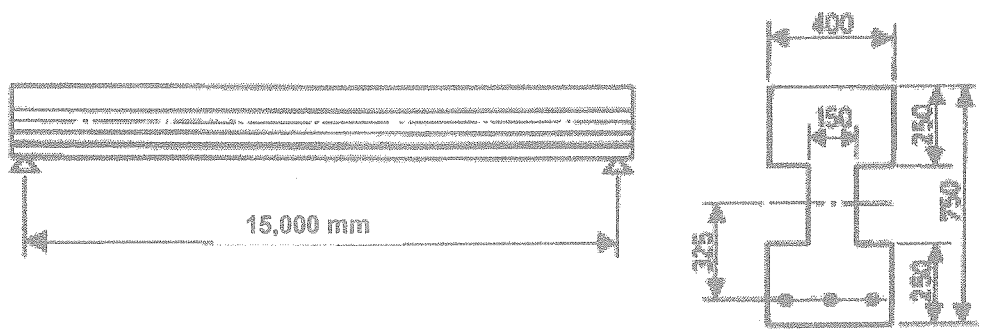

Figure Q2

All dimensions are in mm