THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

Faculty of Engineering & Technology

DEPARTMENT OF CIVIL AND BUILDING ENGINEERING

HIGHER DIPLOMA IN BUILDING AND CIVIL ENGINEERING
(HD BC 08A)

END OF COURSE EXAMINATIONS

APRIL/MAY 2010 SERIES

STRUCTURE AND HIGHWAYS

TIME: 3 HOURS

Instructions to Candidates

This paper consists of **EIGHT** Questions.

Answer **FOUR** Questions from Section **A** and **ONE** Question from Section **B.**
All Questions Carry Equal Marks.
Answer Each Section separately.

SECTION A

Question ONE

The floor of a Lecture hall 7.5mm by 14.0m consists of FIVE beams equally spaced at 3.5m centres monolithically casted with it. Design the slab given. The following information:

- PVC floor tiles of density = $0.135kg/m^2$
- 20mm thick screed on the upper side of slab
- 15mm thick screed on the lower side of slab
- I.L on floor = $3.0KN/m^2$
- Density of screed = $18KN/m^3$
- Permissible local bond stress = $1.25N/mm^2$
- Use load factor method of design
- Pcb = $7N/mm^2$
- Pst = $210N/mm^2$
- Density of coverage = $24KN/m^3$ **(20 Marks)**

Question TWO

Design typical internal T-beam for the slab in Q1 including shear reinforcement. Check for local bond. Permissible shear stress = $0.7N/mm^2$**.(20 Marks)**

Question THREE

Fig. 1 shows a grade 43 u.b section supported on u.c. sections.

(a). Determine the safe uniformity distributed load exclusive of the self weight, the beam would carry over the entire span of 8.0m if the compression flange of the beam is fully restrained against lateral movement.

(6 Marks)

(b). Check for;

(i). Shear
(ii). Deflection
(iii). Web buckling
(iv). Web crushing

(14 Marks)

DATA
- Permissible stress in shear = $115N/mm^2$
- Permissible stress in bending = $165N/mm^2$
- Permissible stress in bearing = $190N/mm^2$
- E_{steel} = $210KN/mm^2$

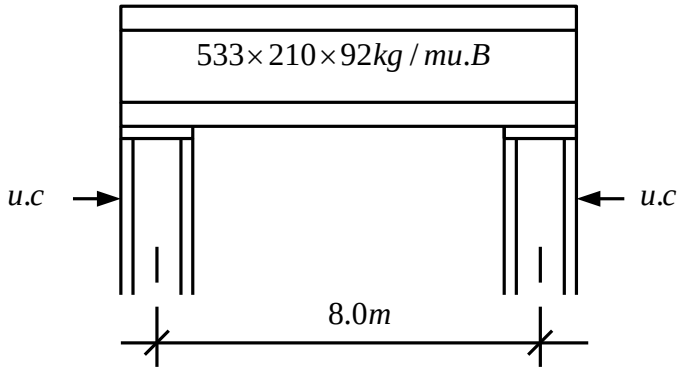

Fig. d

Question FOUR

(a). Define the following as applied to steel stanctions;

(i). Actual length of column
(ii). Effective length of column
(iii). Slenderness ratio

(3 Marks)

(b). Fig. 2 shows the plan of a loaded multi-storey stanction with loads from in-coming beams. The column has an actual length of 4.0m and is fixed in position and direction at both ends. Select a suitable grade 43 u.c. section and check its adequacy.

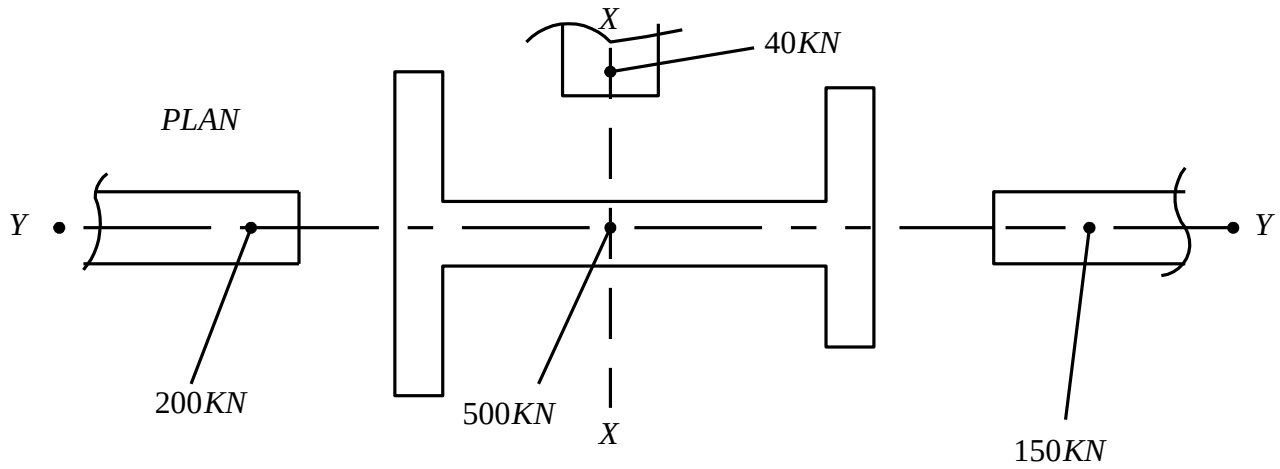

Fig. 2

Question FIVE

(a). State **FOUR** losses of pre-stress. **(4 Marks)**

(b). Figure 3 shows a pre-assessed concrete beam.

(i). Determine the pre-stressing force if the combined stresses or top and bottom is limited to -2N/m^2 and 25N/m^2 respectively.

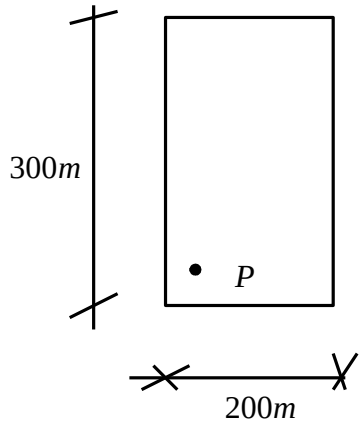

Fig. 3

(ii). Determine the safe uniformly distributed load the beam would carry over a spa of 8.0m allowing 20% loss of pre-stress.

(16 Marks)

Question SIX

Figure 4 shows a concrete retaining wall containing a non-cohesive soil. Determine the stability of the wall for:

(a). overturning
(b). Sliding
(c). Tension cracks
(d). Bearing

Data:

- Density of soil = 18KW/m^3
- Density of concrete = 24KW/m^3
- Ø = 30^o
- μ = 0.3

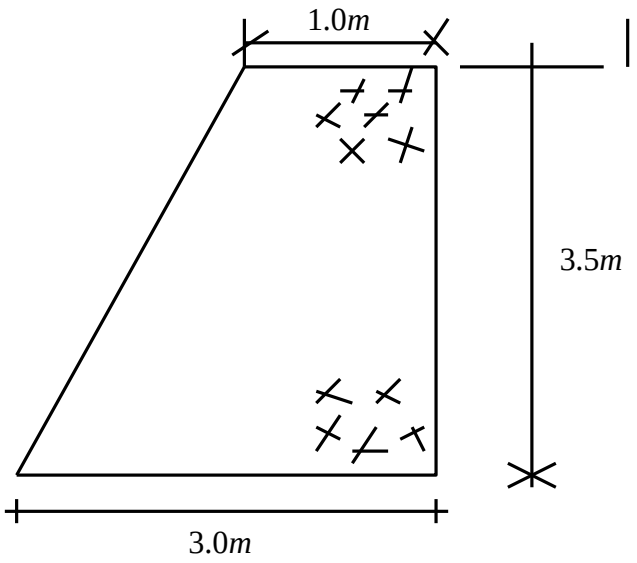

Fig. 4

SECTION B (HIGHWAY)

Question SEVEN

(a). Briefly describe the **THREE** stages in a typical highway design planning. **(6 Marks)**

(b). State **FOUR** soil tests done for a highway design. **(4 Marks)**

(c). Briefly describe each of the **FIVE** rural classification in Kenya and give **ONE** example of each in Coast Province. **(10 Marks)**

Question EIGHT

(a). Sketch, and label the label the typical cross section of a flexible pavement. **(6 Marks)**

(b). State the formula for calculating the cumulative number of standard axles for design of a flexible pavement. **(4 Marks)**

(c). Describe the standard steps for a pavement design. **(10 Marks)**