



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Engineering & Technology

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

DIPLOMA IN BUILDING & CIVIL ENGINEERING

EBC 2202: THEORY OF STRUCTURES I

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: OCTOBER 2012

TIME: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*
- *Calculator*

This paper consists of **FIVE** questions. Answer any **THREE** questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

Question One (20 marks)

- a) Figure 1 shows a universal beam section strengthened by the addition of a steel plate at the top. Determine the actual stresses at points A, B, C and D if a force of 400KN acts on the section as shown. The properties of the U.B are:

$$D = 310.4\text{mm}$$

$$A = 60.8\text{cm}^2$$

$$I_{xx} = 9485 \text{ cm}^4$$

$$I_{yy} = 438\text{cm}^4$$

$$B = 125.2 \text{ mm}$$

The indicated axes xx and y-y are for the universal beams

(20 marks)

B

Question Two (20 marks)

Determine deflection under each point load of the beam in figure 2. Using Macaulay's method. Take $E = 2.0 \times 10^5 \text{N/mm}^2$. $I = 10^9 \text{mm}^4$

(20 marks)

Question Three (20 marks)

- a) State **FOUR** assumptions upon which Euler's formula is based:
- b) A Tubular pin-jointed strut 3m long has an outer and inner diameter of 37.5mm and 32.5mm respectively. Compare the crippling loads given by Eucers and Rankines formula for the strut given the following:
- | | | | |
|-------------------|---|----------------------|-------------------|
| Yield stress | = | 330N/mm ² | |
| Rankines Constant | = | 1/7500 | (20 marks) |

Question Four (20 marks)

A masonry pier of 3m x 4m supports a vertical load of 80KN as in figure 3.

3m

- a) Find the stresses developed at each corner of the pier.
- b) What additional load should be placed at the centre of the pier, so that there is no tension anywhere in the pier section?
- c) What are the stresses at the corners with additional load in the centre? **(20 marks)**

Question Five (20 marks)

- a) A hollow alloy tube 5m long with diameter 40mm and 25mm respectively was found to extend 6.4m under a tensile load 60KN. Find the buckling load for the tube when used as a strut with both ends pinned. Also find the safe load on the tube, taking factor of safety as 4.
- b) Obtain expressions for the slope and deflection at the free end of a cantilever carrying a uniformly distributed load as shown in figure 4. **(20 marks)**

A