TECHNICAL UNVERSITY OF MOMBASA

Faculty of Engineering & Technology in Conjunction with Kenya Institute of Highways and Building & Technology (KIHBT)

DEPARTMENT OF BUILDING & CIVIL ENGINEERING

HIGHER DIPLOMA IN BUILDING ECONOMICS

EBE 3115: THEORY OF STRUCTURES I

SPECIAL/SUPPLEMENTARY EXAMINATION
SERIES: AUGUST 2013
TIME: 2 HOURS

Instructions to Candidates:
You should have the following for this examination
- *Answer Booklet*

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) Derive the equation of theory of simple bending. **(9 marks)**

b) Determine the maximum moment which can be resisted by the section in figure 1. If the maximum permissible stresses are 105N/mm^2 and 125N/mm^2 for the top and bottom fibres respectively. **(11 marks)**

120mm

Question Two (20 marks)

A non-ferrous metal test piece, gauge length 50mm, original cross-section 80mm2 gave the following results in a tensile test.

Load (KN)	20	30	40	45	50	55	57.5	60
Extension (mm)	0.053	0.080	0.107	0.120	0.140	0.172	0.195	0.23

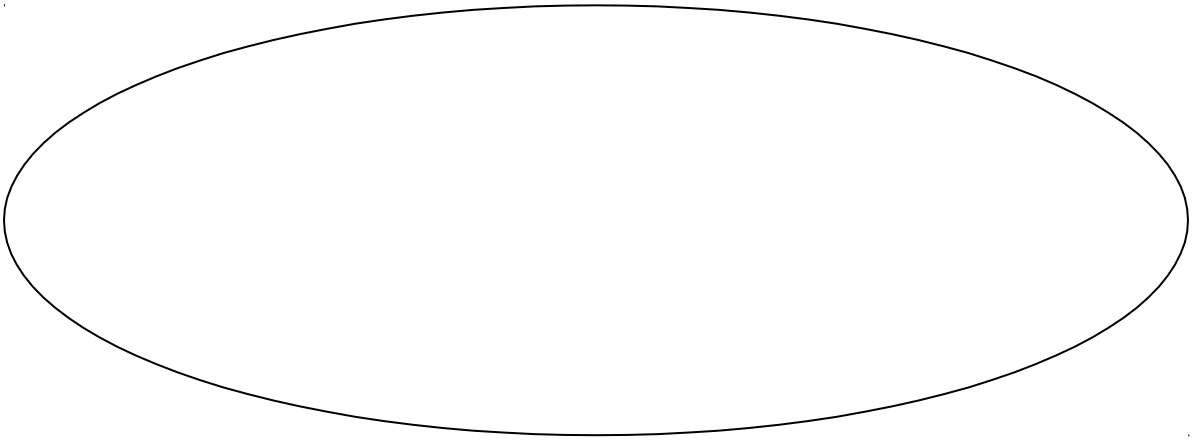
The test specimen failed at 65KN, with an extension of 6.86mm and a minimum diameter of fracture of 7.0mm. Plot a load extension graph **(6 marks)**

Determine:

a) The elastic modulus **(4 marks)**
b) The 0.1 percent proof stress **(4 marks)**
c) The percentage elongation **(2 marks)**
d) The percentage area reduction **(4 marks)**

Question Three (20 marks)

Calculate the reactions of the frame shown in figure 2 and hence determine graphically the magnitude and nature of the forces in all the members **(20 marks)**



Question Four

a) Show that the total strain energy stored in a member under flexural loading is given by:

$$U = \int_0^1 \frac{M^2 dx}{2EI}$$

(5 marks)

b) Using 'castiglianos 1st theorem' and by taking EI as constant determine the rotation and deflection at the free end of the beam shown in figure 3. **(15 marks)**

Figure 3

Question Five

A symmetrical three hinged circular arch has a span of 16m and a rise of 4m to the central hinge and carries a vertical point load of 160KN at 4m from the left hand end.

Determine:

(i) Horizontal thrusts at the supports
(ii) Reactions at the supports
(iii) The bending moments at 6m from the left hand hinge
(iv) Maximum positions and negative bending moments **(18 marks)**

c) Sketch the bending moment diagram indicating the critical values **(2 marks)**