TECHNICAL UNIVERSITY OF MOMBASA

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

DIPLOMA IN BUILDING AND CIVIL ENGINEERING
DBCE/MAY 2015/FT-S Y2 S1

EBC 2202: THEORY OF STRUCTURES I

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination

- Answer booklet

This paper consists of **FIVE** questions

Answer question one (**compulsory)** and any other two questions

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed papers.

QUESTION ONE (COMPULSORY)

a)

i. Define a strut.

ii. Outline **three** assumptions in the Euler's column theory. **(4mks)**

b) A hollow alloy tube 4m long with external and internal diameters of 40mm and 25mm respectively was found to extend 4.8mm under a tensile load of 60KN.Find the buckling load for the tube with both ends pinned. Also find the safe load on the tube, taking a factor of safety of 5. **(10mks)**

c)

i. Define an eccentric load.

ii. A rectangular strut is 150mm and 120mm thick. It carries a load of 180KN at an eccentricity of 10mm in a plane bisecting the thickness. Find the maximum and minimum intensities of stress in the section. **(10mks)**

d)

i. A steel wire of 5mm diameter is bent into a circular shape of 5m radius. Determine the maximum stress induced in the wire. Take E=200Gpa.

ii. A copper wire of 2mm diameter is required to be wound around a drum. Find the minimum radius of the drum if the stress in the wire is not to exceed 80 Mpa. Take modulus of elasticity for the copper as 100Gpa. **(6mks)**

QUESTION TWO

a) For columns with both ends hinged, show that the critical load 'P' is given by the formula $\mathbf{P} = \frac{\prod^2 \mathbf{EI}}{\mathrm{L}^2}$ **(15mks)**

b) A metallic rod of 10mm diameter is bent into a circular form of radius 6m. If the maximum bending stress developed in the rod is 125Mpa, find the value of Young's modulus for the rod material. **(5mks)**

QUESTION THREE

a) A steel rod 5m long and of 40mm diameter is used as a column, with one end fixed and the other free. Determine the crippling load by Euler's formula. Take E as 200 Gpa.

(5mks)

b) An I-section joist 400mmx200mmx20mm and 6m long is used as a strut with both ends fixed. What is Euler's crippling load for the column? Take Young's modulus for the joist as 200Gpa. **(15mks)**

QUESTION FOUR

A T-section 150mmx120mmx20mm is used as a strut of 4m long with hinges at its both ends. Calculate the crippling load, if Young's modulus for the material is to be 200Gpa.

(20mks)

QUESTION FIVE

a) Find the Euler's crippling load for a hollow cylindrical steel column of 38mm external diameter and 2.5mm thick. Take length of the column as 2.3 m and hinged at its both ends. Take E=205Gpa.

Also determine crippling load by Rankine's formula using constants as 335Mpa and $\frac{1}{7500}$. **(10mks)**

b) A hollow rectangular masonry pier is 1.2mx0.8m wide and 150mm thick. A vertical load of 2MN is transmitted in the vertical plane bisecting 1.2m wide and at an eccentricity of 100mm from the geometric axis of the section. Calculate the maximum and minimum stress intensities in the section. **(15mks)**