



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

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
- calculator

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) State three assumptions in the Euler's column theory **(3marks)**
- b) 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 200Gpa. **(6 marks)**
- c) 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 side and at an eccentricity of 100mm from the geometric axis of the section. Calculate the maximum and minimum stress intensities in the section. **(10marks)**
- d) A rectangular column 200mm wide and 150mm thick is carrying a vertical load of 120KN at an eccentricity of 50mm in a plane bisecting the thickness. Determine the maximum and minimum intensities of stress in the section. **(6marks)**
- e) 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 125 Mpa, find the value of Young's modulus for the rod material. **(8marks)**

QUESTION TWO

For columns with both ends fixed show that the crippling load,

$$P = \frac{4\pi^2 EI}{l^2}$$

(20marks)

QUESTION THREE

- a) 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. **(20marks)**



QUESTION FOUR

- a) 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. **(5marks)**
- b) 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 2.3m and hinged at its both ends. Take $E=205$ GPa. Also determine crippling load by Rankine's formula using constants as 335 Mpa and $1/7500$. **(15marks)**

QUESTION FIVE

A hollow cylindrical shaft of 200mm external diameter has got an eccentric bore of 140mm diameter, such that the thickness varies from 20mm at one end to 40mm at the other. Calculate the extreme stress intensities if the shaft is subjected to a load for 400KN along the axis of the bore. **(20marks)**

