



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF BUILDING & CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:
DIPLOMA IN BUILDING AND CIVIL ENGINEERING
INSTITUTION BASED EXAMINATION

EBC 2202: THEORY OF STRUCTURES I

SERIES: MARCH 2017

TIME: 2 HOURS

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

-Pocket calculator

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

Do not write on the question paper

Mobile Phones are NOT allowed inside the examination room

QUESTION ONE

- a) State three assumptions in the Euler's column theory. **(3 marks)**
- 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. **(7 marks)**
- c) A hollow rectangular masonry pier is 1.2m long x 0.8m 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. **(10 marks)**

QUESTION TWO

- a) Define an eccentric load. **(2 marks)**
- b) 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. **(8 marks)**
- c) 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. **(10 marks)**

QUESTION THREE

- a) A hollow alloy tube 4m long with external and internal diameter of 50 and 25 mm respectively was found to extend 2.5 mm under a tensile load of 75 KN. Find the buckling load for the tube with both ends pinned. Also find the safe load on the tube, taking a factor of safety as 3. **(10 marks)**
- b) 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. **(10marks)**

QUESTION FOUR

- a) Describe the following terms as used in structural analysis of columns:
- (i) Braced columns
 - (ii) Short columns
- (4 marks)**
- 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. **(16 marks)**

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)