TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT BUILDING AND CIVIL ENGINEERING

UNIVERSITY EXAMINATION FOR:

BSC IN CIVIL ENGINEERING

ECE 2214: STRENGTH OF MATERIALS II

END OF SEMESTER EXAMINATION

SERIES:APRIL2016

TIME:2HOURS

DATE:18May2016

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, Drawing Instruments, Scientific calculator, examination pass and student ID

This paper consists of five questions.

Attemptquestion ONE (Compulsory) and any other TWO questions.

QUESTION ONE (COMPULSORY)

a) A rectangular masonry pier of sectional size 4.5m x 3.0m is subjected to a direct load of 450KN placed at an eccentricity of 250mm from both axes.

i) Determine the stress intensities at the four corners of the pier section (16 marks)

ii) Calculate the maximum and minimum stresses in the pier section if an additional load of 135KN is placed at the centroidal axis of the pier (4 marks)

b) Find the Euler crushing load for a hollow cylindrical cast iron column 20cm external diameter and 25mm thick if it is 6m long and is hinged at both ends. Take $E = 1.2 \times 10^6$ N/mm^2.

Compare the load with the crushing load as given by the Rankine's formula, taking f_c=550 N/mm^2 and $\alpha = \frac{1}{1600}$; for what length of the column would these two formulae give the same crushing load? (10 marks)

QUESTION TWO

a) State the assumptions in the Euler's column theory (3 marks)

b) Derive the formula for the Euler critical load for a long column with one end built-in and the other pinned. (8 marks)

c) A T-section 150mm x 140mm x20mm thick is used as a strut of length 4.0m hinged at its ends. Determine the Euler buckling load if young's modulus for the material is 200KN per m^2.

(9 marks)

QUESTION THREE

a) Define a composite section and explain briefly the circumstances that necessitate its use giving **TWO** examples. (6 marks)

b) Derive: Total Moment of Resistance (MR) equation:

$$M = (mI_2 + I_1)\frac{ft}{y}$$ (11 marks)

c) A solid shaft of 150mm diameter is used to transmit torque. Find the maximum torque transmitted by the shaft if the maximum shear stress induced to the shaft is 45N/mm^2. (3 marks)

QUESTION FOUR

a) State the assumptions for finding out shear stresses in a circular shaft subjected to torsion

(3 marks)

b) Derive the equation for determining torsional stresses and strains induced in a circular shaft

(7 marks)

c) Describe the **FOUR** main theories of elastic failure (10 marks)

QUESTION FIVE

a) State the assumptions on which Rankine's theory for active earth pressure is based

(2 marks)

b) A masonry retaining wall of trapezoidal cross section with a vertical face on the earth side is 1.0m wide at the top, 3.0m wide at the bottom and 6.0m high. It retains non-cohesive soil over its entire height. The densities of the retained soil and masonry wall are $16KN/m^3$ and $24KN/m^3$ respectively.

The soil backfill has an angle of repose of 30^o and the coefficient of friction at the base of wall is 0.6. Determine the stability of the retaining wall against:

i) Tension at the base

ii) Overturning

iii) Sliding (12 marks)

iv) Calculate the extreme stresses induced in the base of wall (6 marks)