MACHAKOS UNIVERSITY COLLEGE

(A Constituent College of Kenyatta University)
University Examinations 2015/2016

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

FIRST SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 208: STRENGTH OF MATERIALS II

Date: 25/4/2016   **Time: 8.30-10.30AM**

INSTRUCTIONS
    This paper consists of FIVE questions
    Answer question one and other two questions in this paper

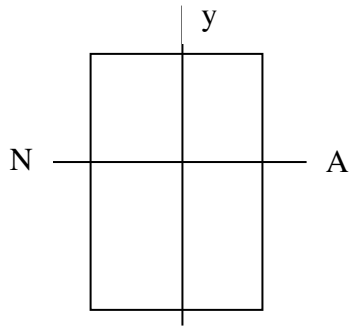**QUESTION ONE**

a) Define the following terminologies as used in strength of materials
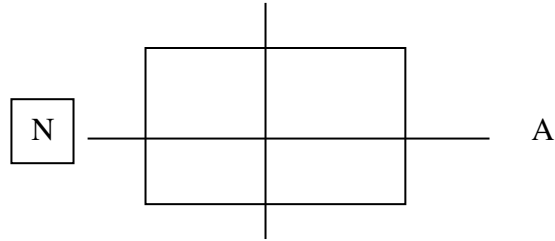
    i.   Tensile strength

    ii.   Compressive strength

    iii.   Modulus of elasticity

    iv.   Section modulus

    v.   Stress

    vi.   Strain

    vii.   Moment of inertia

    viii.   Section Modulus

    ix.   Composite beam

    x.   Pure bending   (10 marks)

b) The figure below shows Beams A and B. Calculate the elastic section modulus for each beam section about the N-A axis.
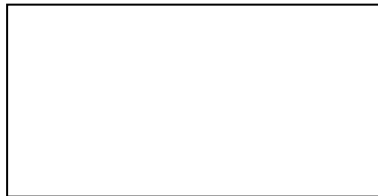
b=50mm   d=200mm   b=200mm d=50mm

(10 marks)

c) Determine the second moment of the section below   (10 marks)

b=150mm
h=100mm

N ———————————————————— A

QUESTION TWO

Discuss the theory of simple bending and derive the General Bending equation for simple bending.

(20 marks)

QUESTION THREE (20 marks)

a)   A cantilever of length 5m fails when a load of 3KN is applied at the free end. If the section of the beam is 40mm x 50 mm, find the stress at the failure.   (6 marks)

b)   A reinforced concrete beam has a rectangular section of breadth 350mm and a depth of 500mm to the steel reinforcement, which consists of three 30mm bars. If the maximum allowable stresses in the concrete and steel are 7 N square millimeter and 140 N square millimeter respectively, determine the moment of resistance of the beam. The modular ratio m=15.   (14 marks)

QUESTION FOUR

a)   A concrete foundation slab 2.4m x 1.8m is subject to a central concentrated load of 2.4 MN and a moment of 160kNm which is applied parallel to the longer side as shown in the figure below. Determine the maximum and minimum bearing pressures acting on the soil beneath the slab.

(8 marks)

b)   Briefly explain FOUR theories of failure   (8 marks)

c)   A beam is formed by connecting two timber joists each 150mm x 450mm with a steel plate 14mm x 30mm placed symmetrically between them. If the beam is subjected to a bending moment of 60kNm, determine the maximum stress in the steel and the timber. The ratio of Young's modulus for steel to that of timber is 14:1   (4 marks)

QUESTION FIVE

a)   A shaft of 50mm diameter and a length of 0.7m is subjected to a torque of 1000Nm. Determine the shear stress and the angle of twist given the modulus of rigidity G=90 GPa.   (10 marks)

b)   Another steel shaft is 40mm in diameter with a maximum allowable shear stress of 50Mpa. Calculate the maximum torque that can be safely transmitted when G=90GPa.   (10 marks)