JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

UNIVERSITY EXAMINATIONS 2012/13 ACADEMIC YEAR

SECOND YEAR FIRST SEMESTER EXAMINATION FOR THE DIPLOMA IN BUILDING AND CIVIL ENGINEERING

KISUMU LC

COURSE CODE: TBC 2211

TITLE: MECHANICS OF STRUCTURES I

DATE: 15/4/2013 11.00-12.30PM

DURATION: 2 HOURS

INSTRUCTIONS

This paper consists of 5 questions

Answer question ONE and any other two questions

QUESTION ONE

i. Define the following (**MARKS 12**)
   a) Mechanics
   b) Engineering Mechanics
   c) Statics
   d) Dynamics
   e) Kinematics
   f) Kinetics

ii. Briefly describe the following properties of structural materials (**MARKS 8**)
   a) Strength
   b) Hardness
   c) Stiffness
   d) Toughness

iii. Differentiate amongst the following (**MARKS 6**)
   a) Load
   b) Stress
   c) Strain

iv. State Hooke's law (**MARKS 2**)

v. Explain what you understand by Poisson's ratio (**MARKS 2**)

QUESTION 2

i. Briefly explain the following (**MARKS 6**)
   a) Temperature stress
   b) Composite bar
   c) Factor of safety

ii. Draw the Stress-Strain curve for a ductile material and briefly explain the key points on the curve (ie LP, EL, YP, US and BS) (**MARKS 8**)

iii. A steel rod, 25mm diameter and 5m long, is subjected to an axial pull 65KN. If E= 2 x 10^5 MN/m^2, determine: (**MARKS 6**)
   a) Stress
   b) Strain
   c) Elongation

QUESTION 3

i. List the three types of stresses which you know (**MARKS 3**)

ii. Briefly describe how each of the three types of stresses mentioned in i above arise. Make use, also of illustrative diagrams where applicable (**MARKS 9**)

iii. A short hollow cast iron cylinder of wall thickness of 10 mm is to carry a compressive load of 600 kN. Assuming the ultimate strength of the material as 500 MN/m^2 and a factor of safety of 4, determine the size of the cross-section (**MARKS 8**).

QUESTION 4

i. A tensile test was conducted on a mild steel bar. The following data was obtained from the test
   a) Diameter of the bar = 30mm
   b) Gauge length =200mm
   c) Load at elastic limit = 240kN
   d) Maximum load =360kN
   e) Extension at a load of 150kN = 0.20mm
   f) Total extension = 60mm
   g) Diameter of the rod at failure = 22.5mm

ii. Determine (**MARKS 16**)
   a) The Young's modulus
   b) The stress at elastic limit
   c) Percentage elongation
   d) Percent reduction in area`

iii. A rod 1m long and of 20mm square cross-section is subjected to a pull of 12kN. if the modulus of elasticity is 2 x 10^5 MPA, determine the elongation of the rod (**MARKS 4**)

QUESTION 5

i. Briefly describe the following properties of structural materials (**MARKS 4**)
   a) Elasticity
   b) Ductility

ii. A railway line is laid so that there is no stress at 10^{o}C. Compute
   a) The stress in the rails at 50 ^{o}C if there is no allowance for expansion (**MARKS 4**)
   b) The stress in the rails at 50 ^{o}C if the expansion allowance is 10mm (**MARKS 4**)
   c) The expansion allowance required if the stress is to be zero at 50 ^{o}C (**MARKS 4**)
   d) The maximum temperature if there should be no stress in the rails for an expansion allowance of 15mm (**MARKS 4**)

The rails are 25m long. The modulus of elasticity is 2 x 10^5 MPa and the coefficient of linear expansion of rail steel is 12.5 x 10 $^{-6}$/^{o}C