



**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  $E = 2 \times 10^5 \text{ MN/m}^2$ , 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  $500 \text{ MN/m}^2$  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  $2 \times 10^5$  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°C. Compute
  - a) The stress in the rails at 50 °C if there is no allowance for expansion **(MARKS 4)**
  - b) The stress in the rails at 50 °C if the expansion allowance is 10mm **(MARKS 4)**
  - c) The expansion allowance required if the stress is to be zero at 50 °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  $2 \times 10^5$  MPa and the coefficient of linear expansion of rail steel is  $12.5 \times 10^{-6}/^{\circ}\text{C}$