



MACHAKOS UNIVERSITY

University Examination 2018/2019

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

SECOND YEAR SPECIAL/SUPPLEMENTARY EXAMINATION FOR

BACHELOR IN CIVIL ENGINEERING

ECV 203: STRENGTH OF MATERIALS

DATE: 31/7/2019

TIME: 8.30-10.30 AM

INSTRUCTIONS: Answer questions **ONE** and any other **TWO** questions.

1. a) Define the following terminologies
- i. permissible stress
 - ii. proof stress
 - iii. modulus of rigidity
 - iv. bulk modulus
 - v. elastic modulus
 - vi. Poisson's ratio
 - vii. Ultimate stress
 - viii. Plasticity (16 marks)
- b) Given:
- $E = 209 \text{ GPa}$
- $\nu = 0.3$
- $\tau = 30 \text{ N/mm}^2$
- (i) Determine the modulus of rigidity (6 marks)
 - (ii) Shear strain (6 marks)
2. Given:
- $\epsilon_1 = 300 \times 10^{-6}$
- $\epsilon_2 = 120 \times 10^{-6}$
- $\frac{\gamma_{max}}{2} = 150 \times 10^{-6}$

Examination Irregularity is punishable by expulsion

$$\Theta = 20^\circ$$

Plot the Mohr's circle for plane strain and determine

- (a) ϵ_{aver}
- (b) ϵ_x
- (c) ϵ_{x1}
- (d) r_{max}
- (e) 2Θ , $2\Theta_{p1}$ and $2\Theta_{p2}$ (20 marks)

3. Discuss the middle third rule and middle quarter kern for structural sections (20 marks)

4. a) Explain briefly the behaviour of mild steel under tension. (9 marks)

b) Sketch a well labelled diagram of Mohr's circle for plane stress

Given $\sigma_1 = 100 \text{ N/mm}^2$, $\sigma_2 = 50 \text{ N/mm}^2$, $\tau = 40 \text{ N/mm}^2$ and $\theta = 30^\circ$ (11 marks)

5. a) A timber beam 100x50mm is subjected to an axial thrust of 20kN and a bending moment of 10kNm. Determine

i. direct stress (3 marks)

ii. bending stress (4 marks)

iii. combined stress (5 marks)

b) Plot the combined stress distribution diagram (8 marks)