MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

SECOND YEAR SECOND SEMESTER EXAMINATION FOR BACHELOR OF SCIENCE IN CIVIL ENGINEERING

ECV 208: STRENGTH OF MATERIALS II

DATE: 15/6/2017 **TIME: 8:30 – 10:30 AM**

INSTRUCTIONS

1. ***Non-programmable calculators may be used.***
2. ***Clearly state the assumptions used if any.***
3. ***Diagrams MUST be clearly labeled and symbols used MUST be defined.***
4. ***Answer question 1 and any other 2 questions.***

QUESTION ONE (COMPULSORY)

a) Discuss the tensile test. (5 marks)

b) Describe a typical stress strain curve from tensile test in a). (15 marks)

c) Distinguish between isotropic and anisotropic materials. (5 marks)

d) The poisons ration of a material μ must be between 0 to 0.5 ie. $0 \leq \mu < 0.5$ discuss. (5 marks)

QUESTION TWO (20 MARKS)

a) State and explain the five limit states that have to be checked during the design of a retaining wall. (5 marks)

b) Describe any two theories that may be used to estimate the lateral earth pressure. (4 marks)

c) The following diagram in Fig. 1 is masonry dam, it retains water against the vertical face. Examine the stability condition of the dam with respect to tension in the joints, ground bearing pressure and sliding. The density of masonry is 2100kg/m^3. (11 marks)

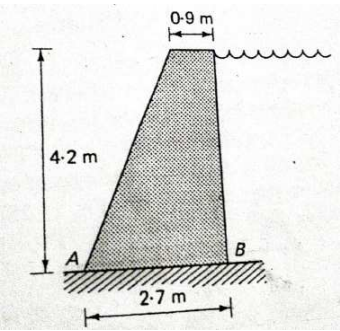

Figure 1

QUESTION THREE (20 MARKS)

a) Differentiate between ductile and brittle materials. (4 marks)

b) The table below, table1 is results from tensile test. The rod was 20mm in diameter and 100mm in length.

Table 1

Force (kN)	Elongation (mm)
0	**0**
11.94	**2**
24.82	**4**
38.01	**6**
49.95	**8**
53.40	**10**
59.70	**12**
59.10	**14**
58.12	**16**
58.11	**18**
52.88	**20**

i Assuming the diameter remains constant through the entire experiment. Derive the stresses and strain and draw the stress strain curve. (10 marks)

ii From the stress strain curve above; find the yield stress, ultimate stress and the Young's modulus. (3 marks)

iii In the derivation of the stress strain curve above, the diameter of the rod is assumed constant in order to simplify the calculations. However in reality the diameter of the rod changes with each elongation. Assuming a correction for the diameter is applied so that the actual instantaneous areas are used to derive the stresses above, comment on the answers in II above. (3 marks)

QUESTION FOUR (20 MARKS)

a) State the assumptions used in deriving the pure shear formulae. (4 marks)

b) Prove that for a rectangular section $\tau = \frac{6V}{bh^3}(\frac{h^2}{4} - y^2)$ symbols carry usual meaning.

(8 marks)

c) Fig. 2 below shows a beam loaded as shown. The cross section is as shown. At interval of 25 mm along the depth plot the shear stress distribution along the depth of the cross section at support A.

(8 marks)

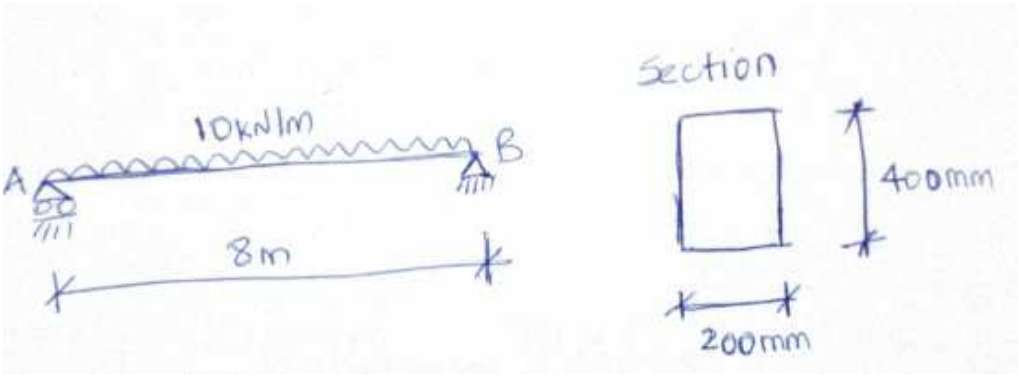

Figure 2

QUESTION FIVE (20 MARKS)

a) Discuss the poisson's ratio (4 marks)

b) Show that $\Delta V = V_0(1 + \varepsilon_x + \varepsilon_y + \varepsilon_z)$ Symbols have usual meaning. (4 marks)

c) Given $\sigma_x = -40N/mm^2\ \sigma_y = 10N/mm^2\ \sigma_z = 20N/mm^2\ \tau_y = -20N/mm^2$

Plane p inclined from plane yz about angle $\alpha = 25^0$, Determine the principal stresses $\sigma_{1,2,3}$, maximum shear stress τ_{max} and the stresses in the given inclined plane $p(\sigma_p, \tau_p)$ (12 marks)