MACHAKOS UNIVERSITY COLLEGE

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

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

SECOND SEMESTER EXAMINATION FOR DIPLOMA IN CIVIL ENGINEERING
DIPLOMA IN BUILDING TECHNOLOGY

BCECD & BCEBD 212: STRENGTH OF MATERIALS II

Date: 02/12/2015 **Time: 8:30 – 10:30 am**

INSTRUCTIONS:

- ***This paper comprises of five questions***
- ***Question one is compulsory and carry 30 marks***
- ***Answer question one and any other two questions***

1 a) i) State three assumptions made in the Rankine's theory of earth pressure. (3 marks)

ii) Prove that in the theory in (a) above the pressure intensity at the bottom of the retaining dam, P is expressed by the expression; $P = wh(\frac{1-sin\emptyset}{1+sin\emptyset})$ (7 marks)

b) A masonry dam of rectangular cross-section 10m high and 5m wide retains water fully on one side. If the density of the masonry is 21.582kN/m^3, Find;

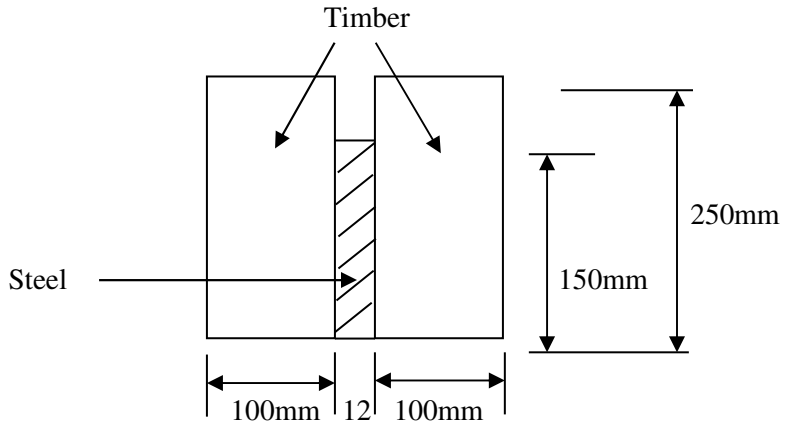
i) the pressure due to water per meter length of the dam
ii) the resultant force and the point at which it cuts the base of the dam (9 marks)

c) A simply supported beam carries a uniformly distributed load of 40kN/m over the entire span. The section of the beam is rectangular and has a depth of 500mm. if the maximum stress in the material of the beam is 120N/mm^2 and the moment of inertia of the section is 7 x 10^8 mm^4, determine the span of the beam. (11marks)

2. a) Using timber and steel as relevant examples, show that the total moment of resistance for a composite beam section is given by $M = \left[\frac{f_t}{y}(MI_s + I_t)\right]$

(8 marks)

b) A flitched beam is simply supported over a span of 5 m and carries a uniformly distributed load of 2 kN/m over the entire span. If the beam cross-section is as shown below, determine the maximum tensile and compressive stresses developed in both the materials due to the loading. (Take E_s = 210 kN/mm^2 and E_t = 10 kN/mm^2). (12 marks)



3. a) With an aid of elaborate sketches describe three causes of failures to retaining structures.

(6 marks)

b) State four assumptions made in the theory of simple bending (4 marks)

c) A 406mm x 152mm x 60kg U.B section used as a simply supported beam has an effective span of 6m and carries a total uniformly distributed load of 176.6 kN.

i) Calculate the stress in the beam at a point 102 mm beneath the top of the compression flange at a beam section 1m from the left support

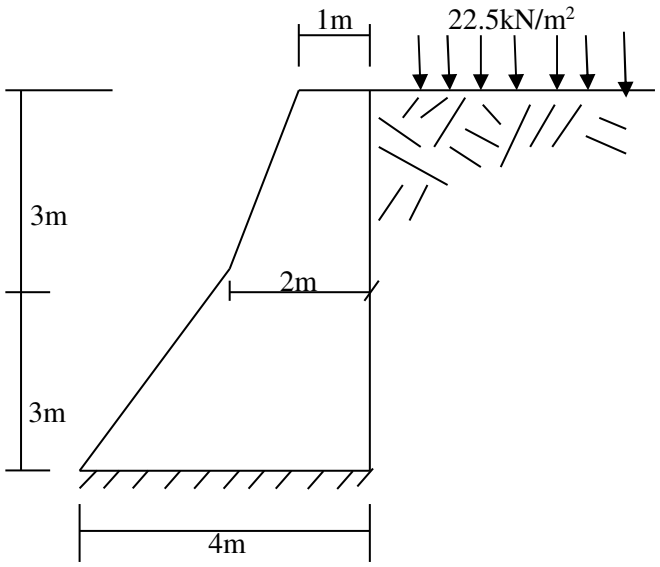
ii) Draw a stress variation diagram of the beam at the given section (take Z_{xx} for the given U.B = 1011cm^3) (10 marks)

4. The figure below shows a retaining wall which supports a cohesionless soil having a unit weight of 17.5kN/m^2 and an angle of shearing resistance of 30°. If the unit weight of the wall is 25kN/m^3 and a surcharge load of 22.5kN/m^2 is applied to the surface of the soil;

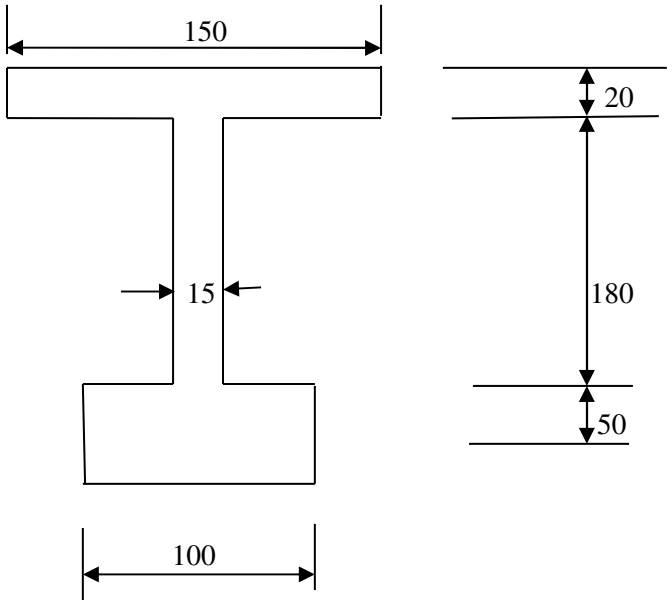
(i) Calculate the maximum and minimum ground bearing pressures occurring beneath the base of the wall

(ii) Check the stability of the wall with respect to overturning, sliding and tension in the joints

(20 marks)



5. a) Calculate the stresses, bending and shear for the beam shown below if the beam is simply supported 6m long and carries a uniformly distributed load of 40 kN/m over its entire span. Also sketch the shear stress variation diagram for the section. (14 marks)



b) Calculate the safe moment of resistance of the beam section shown in the figure in 4 (a) above if the stresses in the upper and lower flanges are limited to 30 N/mm^2 and 20 N/mm^2 respectively.

(6 marks)