



# MACHAKOS UNIVERSITY

University Examinations for 2019/2020 Academic Year

SCHOOL OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF BUILDING AND CIVIL ENGINEERING

THIRD YEAR SPECIAL/ SUPPLEMENTARY EXAMINATION FOR

DIPLOMA IN CIVIL ENGINEERING

BCECD 313: STEEL AND TIMBER DESIGN

DATE: 20/01/2021

TIME: 8.30-10.30 AM

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## INSTRUCTIONS

- This paper consists of **Five** questions.
- Answer question **ONE** and any other **TWO** questions
- Maximum marks for each part of the question are as shown.

## QUESTION ONE (30 MARKS) (COMPULSORY)

- a) Distinguish between the following methods of grading the strength of timber, giving two examples of timber grades in each case:
- Visual grading
  - Machine grading (4 marks)
- b) State six conditions that cased sections should meet in accordance with BS 5950. (6 marks)
- c) A suspended concrete floor slab 150mm thick is supported on simply supported universal beams of effective length 8m spaced at 3m centres. Select a suitable UB section for the internal beams in grade S275 steel and hence check for bending, shear and deflection.  
Imposed load  $3\text{kN/m}^2$ , finishes  $0.8\text{kN/m}^2$ ,  $E=210\text{kN/mm}^2$  (20 marks)

## QUESTION TWO (20 MARKS)

A simply supported universal beam supports uniformly distributed characteristic dead and imposed loads of 2kN/m each as well as characteristic imposed and dead point loads which are equidistant over an effective span of 9m as shown in figure 1. Assuming that the beam is fully laterally restrained and normal loading conditions, select a suitable universal beam in grade S275 steel to satisfy bending, shear and deflection.  $E=205\text{kN/mm}^2$

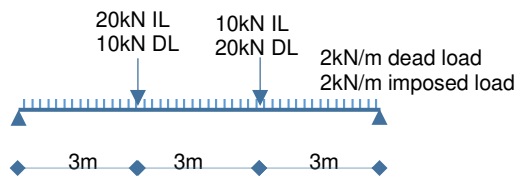


Fig. 1

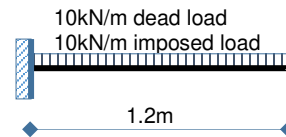


Fig. 2

## QUESTION THREE (20 MARKS)

A cantilever beam of effective length 1.2m is built into a concrete wall as shown in figure 2. It supports characteristic dead and imposed loads of 10kN/m and 10kN/m respectively. Select a suitable universal beam section in grade S275 steel to satisfy bending, shear, shear buckling and deflection.  $E=205\text{kN/mm}^2$

## QUESTION FOUR (20 MARKS)

A timber section 150 X 50mm of strength class C16 and effective span 3.0m is used as a simply supported beam. Assuming the beam is fully laterally restrained, check the adequacy of the timber beam in bending, bearing, shear and deflection given the following data:

Dead load = 0.5kN/m

Imposed load = 1.5kN/m

Bearing length = 100mm

Assume long term loading

Take all K factors as 1.0

### QUESTION FIVE (20 MARKS)

A universal column supports a factored axial load of 1000kN and factored eccentric loads of 70kN, 80kN and 100kN as shown in figure 3. The column is 5m long and it is effectively held in position and partially restrained at both ends.

Design the uncased column in grade S275(grade 43) steel. Ignore the self weight of the column

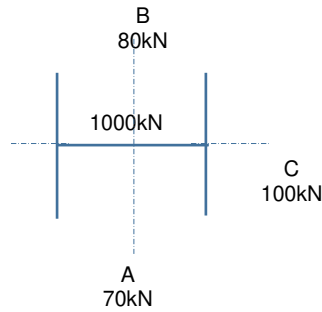


Fig. 3