



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

UNIVERSITY EXAMINATION FOR THE DIPLOMA IN BUILDING AND CIVIL ENGINEERING

3RD YEAR 2ND SEMESTER 2022/2023 ACADEMIC YEAR

SPECIAL EXAMS

CENTRE: MAIN CAMPUS

COURSE CODE: TBC 2321

COURSE TITLE: STRUCTURAL DESIGN II

EXAM VENUE: **STREAM: Dip. BUILD & CIV ENG**

DURATION: 2 HOURS

Instructions

- 1. Answer question 1 (Compulsory) and ANY other two questions**
- 2. Candidates are advised not to write on question paper**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

QUESTION ONE (COMPLUSORY) (30 MARKS)

- Discuss the advantages and disadvantages of using steel as a structural material over timber and concrete. (8 marks)
- Explain three important properties of steel that are important in structural design. (6 marks)
- Make neat sketches of three of each of the following connections (12 Marks)
 - Simple Beam to column cleat connections
 - Rigid Beam to Column connections
- Explain what is meant by a laterally supported beam. (4 marks)

QUESTION TWO (15 Marks)

- In structural Steel Design and Construction, list any four types of tension members (2 Marks)
- What are the advantages of bolted connections (4 Marks)
- Determine the bolt capacity of a bolt with the below properties. (9 marks)

M20 black bolt, grade 4.6, to BS4190

| | |
|---------------------------|-----------------------|
| nominal diameter d | 20 mm |
| shank area | 314 mm ² |
| tensile stress area A_t | 245 mm ² |
| tension strength f_t | 195 N/mm ² |
| shear strength f_s | 160 N/mm ² |
| bearing strength f_{bb} | 435 N/mm ² |

QUESTION THREE (15 Marks)

- With aid of neat sketches, explain the different types of end supports for calculation of effective lengths in column design. (8 marks)
- With the aid of neat sketches, describe the two main types of welds used in steel work connections. (6 marks)
- Explain what is meant by limit state design (1 marks)

QUESTION FOUR (15 Marks)

- Neatly sketch the five main hot rolled steel sections that are mostly used for structural members. (5 marks)
- Explain the criteria for a structural beam design. (2 marks)
- Determine the buckling resistance moment of a universal beam (UB) 457 x 152 x 52mm (8 marks)

QUESTION FIVE (15 Marks)

Check the ability of a 203 x 203 x 52 in grade 43, shown below, to withstand an axial compressive load of 1100KN over unsupported height of 3.5m assuming that both ends are held in position but are provided with no restraint in direction. Design to BS 5950 Part 1 (15 marks)

