



JARAMOGI OGINGA ODONGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF ENGINEERING AND TECHNOLOGY

**UNIVERSITY EXAMINATIONS FOR THE DEGREE IN SCIENCE IN CONSTRUCTION
MANAGEMENT**

3RD YEAR 1ST SEMESTER 2018/2019 ACADEMIC YEAR

CENTRE: MAIN CAMPUS

COURSE CODE: TCM 3311

COURSE TITLE: STRUCTURES II

EXAM VENUE: STREAM: BSc CONSTRUCTION MGT

DATE: ../12/2018 EXAM SESSION:

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 1

- a) Briefly describe the following design philosophies
- Permissible stress design
 - Load Factor Method
 - Limit state design (6mks)
- b) Outline the processes involved in structural design of a typical column element giving the expected output of each stage (4Mks)
- c) The purpose of structural design is to achieve acceptable probabilities that a structure will not become unfit for its intended use – that is, that it will not reach a limit state.
- Outline the three most commonly observed serviceability limit states (3Mks)
 - State the possible causes of errors and inaccuracies in structural design that warrants the use of partial factors of safety for actions. (4Mks)
- d) Calculate the self weight of a reinforced concrete beam of breadth 250mm, depth 450mm and length 5000mm. Assume Unit mass of reinforced concrete is 2400kg m^{-3} and that the gravitational constant is 10m s^{-2} . (3Mks)
- e) A composite floor consisting of a 175mm thick reinforced concrete slab supported on steel beams spanning 6m and spaced at 3m centres is to be designed to carry an imposed load of 5kN m^{-2} . Assuming that the unit mass of the steel beam is 50Kg m^{-1} run and that of reinforced concrete is 2400kg m^{-3} , calculate the design loads on a typical internal beam. (10Mks)

QUESTION 2

A reinforced concrete beam which is 300mm wide and 600mm deep is required to span 6.0m between the centres of supporting piers 300mm wide. The beam carries dead and imposed loads of 25 and 19 kN m^{-1} respectively. Assuming $f_{cu} = 30\text{N mm}^{-2}$, $f_y = 460\text{N mm}^{-2}$, $f_{yv} = 250\text{ N mm}^{-2}$ and the exposure condition is mild, design the beam. (20mks)

QUESTION 3

A 400mm square column carries a dead load (Gk) of 900kN and imposed load (Qk) of 280kN. The safe bearing capacity of the soil is 150kNm^{-2} . Design a square pad footing to resist the loads assuming the following material strengths: $f_{cu} = 35\text{ N mm}^{-2}$, $f_y = 460\text{ N mm}^{-2}$. (20Mks)

QUESTION 4

- a) An internal column in a multi-storey building supporting an approximately symmetrical arrangement of beams carries an ultimate load of 2,000 kN. The storey height is 5.2 m and the effective height factor is 0.85, $f_{cu} = 35 \text{ N/mm}^2$ and $f_y = 500 \text{ N/mm}^2$. Assuming that the column is square, short and braced, calculate:
- A suitable cross-section for the column;
 - The area of the longitudinal reinforcement;
 - The size and spacing of the links.
 - Sketch the reinforcement detail in cross-section.
- a) A short braced column in which $f_{cu} = 30 \text{ N/mm}^2$ and $f_y = 460 \text{ N/mm}^2$ is required to support an ultimate axial load of 2200kN. Determine a suitable section for the column assuming that the area of longitudinal steel, A_{sc} is of the order of 3% of the gross cross-sectional area of column, A_{col} . (8Mks)
- b) Using detailed illustrations, outline the basic steps that should be followed in order to design a reinforced concrete beam. (12mks)

QUESTION 5

- a) Discuss the following concepts in relation to prestressed concrete
- Pre-tensioning
 - Post-tensioning (9mks)
- b) Outline the basic assumptions made in the analysis of prestressed concrete assuming an elastic behavior. (6mks)
- c) List the main stages involved in the design of prestressed concrete. (5Mks)

END