

Solution for Design of Steel and Composite Structures (7ENT2033)

Introduction

This document presents a structured approach to the coursework for Design of Steel and Composite Structures (7ENT2033). It includes calculations, sketches, and justifications for design choices. The coursework follows the project brief, focusing on structural integrity, material optimization, and architectural support.

Project Information

Consultancy Role: Acting as a technical assistant to an architect, the goal is to design a multi-storey composite framed building with adequate strength and stability while minimizing temporary supports.

Load and Material Specifications

Load Assumptions:

- Live load: 4.0 kPa
- Partition load: 1.0 kPa

Material Specifications:

- Slabs: Lightweight concrete
- Steel grade: S275 (as per Cobb, 2014)

Design Tasks

Task 1: Hand-drawn A3 Sketch Plans

- Floor Plans: Three A3 sketches with a suitable scale.
- Beams: Two different line thicknesses for primary and secondary beams.
- Slab Details: Indicating slab edges and required openings.
- Metal Decking: Selection based on industry standards.

Task 2: Beam and Slab Design Development

Beam Design (Using Cobb, 2014):

- Consider two beam size options.
- Perform moment, shear, and deflection checks.
- Justify beam choices based on cost-effectiveness and material efficiency.

Slab Thickness Design:

- Evaluate lightweight concrete slab thickness options.
- Calculate imposed loads and reinforcement requirements.

Task 3: Column Design

- Column Splices: Determine appropriate levels for column splicing.
- Load Assessments for Internal, Perimeter, and Corner Columns.
- Cross-section Design: Based on axial load and buckling considerations.

Task 4: Vertical Bracing Design

- Bracing System Selection: X-bracing or K-bracing based on structural efficiency.
- Hand Calculations: Forces acting on braces and member sizing.

Task 5: Justification of Design Choices

- Clearly state and reference all assumptions.
- Ensure all components meet safety standards.
- Justify design choices to minimize steel weight and cost.

Submission Requirements

Document Format:

- Font: 11pt Arial
- Line Spacing: 1.5
- File Format: Single PDF
- Inclusions: Hand-drawn calculations and sketches, Justifications for all assumptions

Assessment Criteria

- Marks Distribution: 50% of overall module grade.
- Passing Criteria: Minimum 50% required.
- Late Submission Penalty: Deduction of 10 points per day until 50% is reached.
- Grading Rubric Considerations: Clarity, completeness, accuracy, and justification.

Conclusion

This coursework requires approximately 50 hours and involves problem-solving in steel and composite structures. Regular feedback and adherence to the grading rubric will ensure an optimal outcome.