

OLLSCOIL NA hÉIREANN, GAILLIMH
NATIONAL UNIVERSITY OF IRELAND, GALWAY

SPRING EXAMINATIONS, 2000

THIRD CIVIL ENGINEERING

DESIGN OF STEEL STRUCTURES

Professor R. A. Falconer;
Professor P. E. O'Donoghue;
Dr. P. Ó hEachteirn;

Time allowed: *Two* hours

Answer *Two* questions, including Question 1

NOTES

The use of electronic calculators is allowed.

All dimensions are in mm, unless noted otherwise.

Assume all steelwork to be Grade S275, unless noted otherwise.

Member capacity tables in the steel handbook may be used to select members initially, but the capacity of the final choice of sections must be verified by calculation in accordance with the Codes.

An accuracy, in calculations, of two significant figures is adequate for the purposes of this examination.

Sketches, with dimensions, of your designs as they progress are particularly welcome.

All loadings shown are factored, and have been calculated from dead and imposed loads of equal magnitude.

1. Figure Q1 shows a simply-supported welded cantilevered truss, subject to the factored loading shown. Out-of-plane lateral support is provided at all nodes except node F.
- (a) Calculate the forces in the members. Present your results on a line diagram of the truss, showing each member's force beside it with a 't' or 'c' superscript, denoting whether the force is tensile or compressive
- (b) It is proposed to use rectangular hollow sections (RHS) throughout. Chose suitable sections for all members.
- (c) Sketch a suitable detail for Joint C, indicating type and location of welds.
- (d) List the local capacity checks required for Joint G.
Complete the local capacity checks required for Joint G.
Sketch a suitable detail for Joint G, indicating type and location of welds.

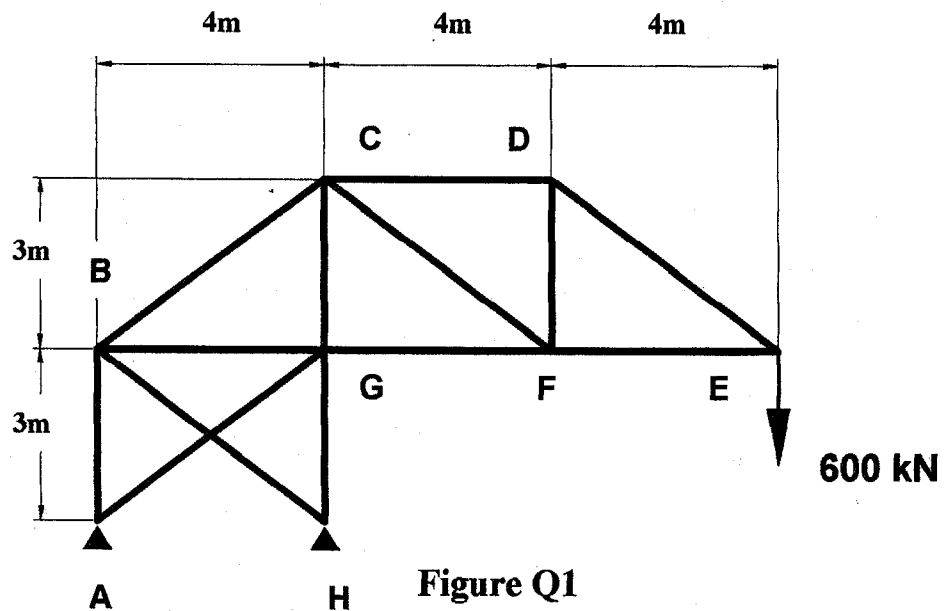


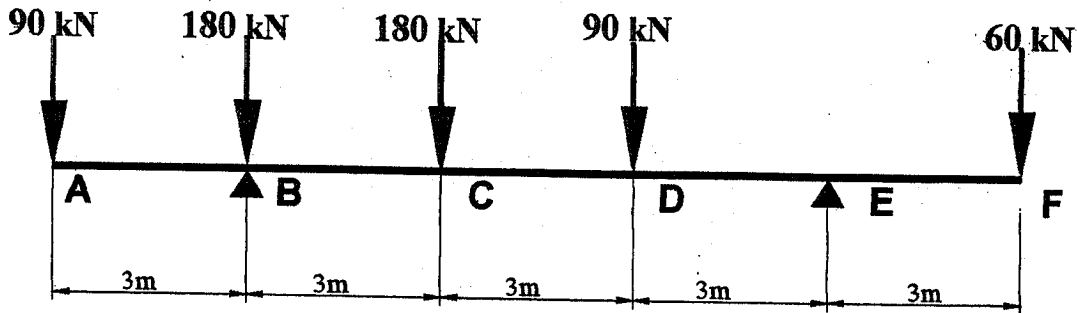
Figure Q1

2. Figure Q2 shows a simply-supported rolled I-beam, fully restrained laterally along its length and subject to the factored loading shown.

(a) Sketch the bending moment diagram and the shear force diagram.

(b) Chose a suitable section for the beam.

(c) Sketch a suitable detail for support B, assuming that the beam is supported vertically by 203x203UC46 columns at supports B and E.



3. Figure Q3 shows a rigid beam-to-column end-plate joint. The joint is loaded by a factored moment of 200 kNm and a factored shear force of 100 kN.

(a) Determine a suitable arrangement of bolts to connect the end plate to the column.

(b) Determine a suitable weldment arrangement to connect the beam to the end plate.

(c) Dimension the end plate fully.

Sketch your solution with full dimensions and details of bolts and welds.

(d) Complete the design of the column in the vicinity of the endplate.

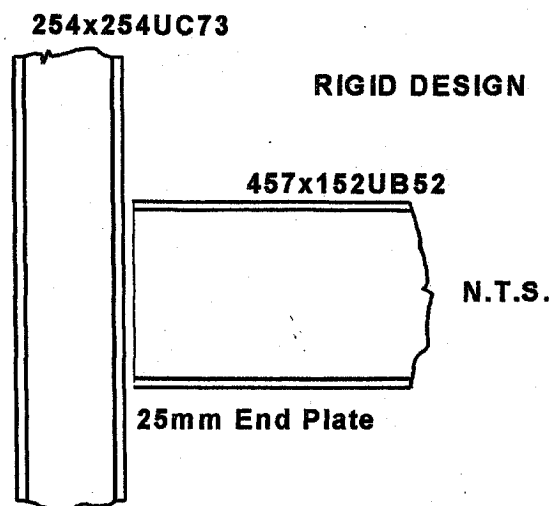


Figure Q3