

**OLLSCOIL NA hÉIREANN, GAILLIMH
NATIONAL UNIVERSITY OF IRELAND, GALWAY**

WINTER EXAMINATIONS, 2000

SEMESTER I 2000-2001

B.E. DEGREE EXAMINATION

DESIGN OF STEEL STRUCTURES

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

Time allowed : *Two* hours

Answer *Two* questions

NOTES

The use of electronic calculators is allowed.

The use of the SCI Steel Handbook is allowed.

The use of BSI codes of practice 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 more than 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.

Question 1

- (a) The beam shown in Figure Q1 has a rigid-design moment connections at end supports A and D. The intermediate point loads (with a stiff bearing length of 50 mm) are applied through the top flange. The beam is effectively laterally and torsionally restrained at the supports and intermediate load points. Design the beam in Grade S275 steel. Ignore self-weight and the design of connections. The loads shown are factored.
- (b) Assuming that the lateral and torsional restraint at the intermediate load points beam is removed, choose a suitable UB section in Grade S275 steel, on considerations of lateral buckling alone. Detailed design calculations are **NOT** needed for this UB section, once you have made your choice based on initial calculations.

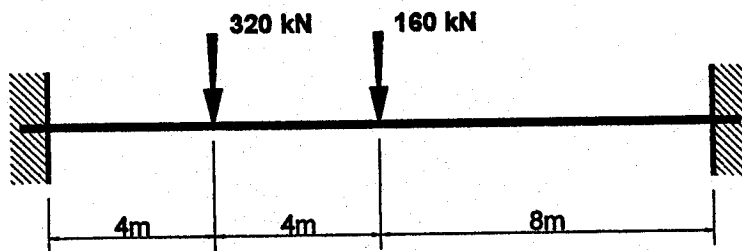


Figure Q1

Question 2

A simply supported plate girder, with factored loading as shown in Figure Q2, is laterally restrained along its length by a concrete floor slab. It is subject to an overall depth restriction of 1.2m. Design a suitable cross-section for this girder. In sizing the web plate to resist shear, five different designs are possible, depending on the shear resistance method adopted. Present these five design solution options in a summary tabular format.

The detailed design of endposts, load-bearing stiffeners, load-carrying stiffeners, and intermediate transverse stiffeners may be ignored : merely include suitable trial dimensions in design sketches. You may also ignore deflection design checks.

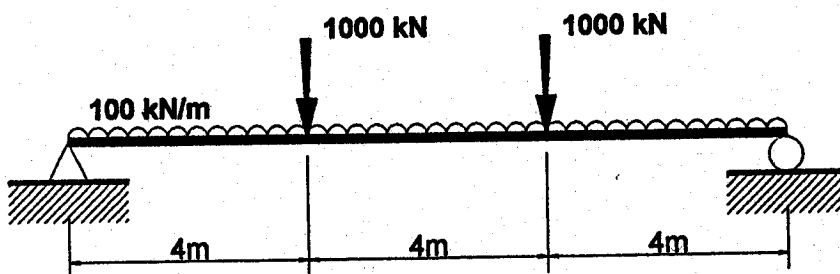


Figure Q2

Question 3

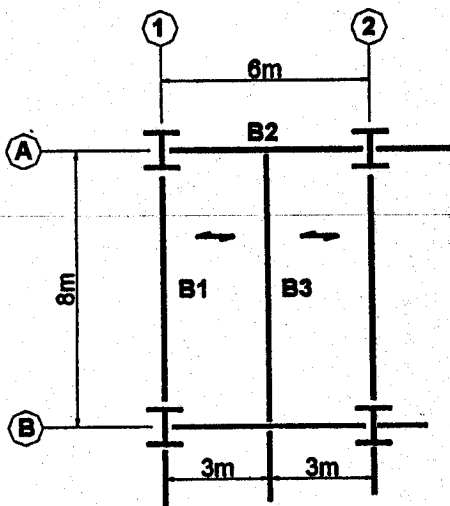
- (a) Figure Q3 shows a partial steelwork layout plan of a corner of a building. The factored uniformly distributed loading for the roof and floors is as follows:

	ROOF	FLOORS
DEAD LOAD	5 kN/m ²	7 kN/m ²
IMPOSED LOAD	2 kN/m ²	5 kN/m ²

Design the corner column stack A1 in Grade S275 steel. Assume a factored column self-weight (inclusive of finishes) of 2 kN/m. Note the one-way spanning slab direction in Figure Q3.

N.B. A suitable TABLE is provided to facilitate calculations.

- (b) Decide on a single splice location assuming a maximum transportable length of 12m.
- (c) Assuming that uplift of the upper column section occurs at the splice, sketch a suitable *trial* splice detail (annotated and dimensioned). Detailed design calculations are NOT needed for this splice connection.



LAYOUT PLAN
(PARTIAL)

