

# Specialist Diploma: Offshore Engineering

Friday, 7 July 2017

**Timetable: 09.30 – 13.00**

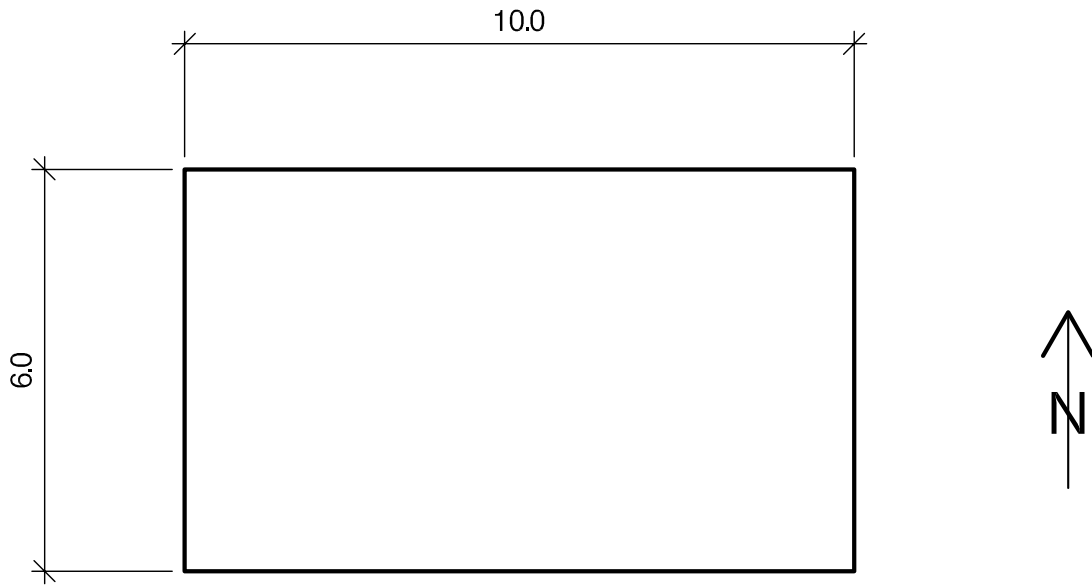
## Notes to Candidates

1. TO PASS THE EXAMINATION, CANDIDATES MUST SATISFY THE EXAMINERS IN BOTH PARTS OF THE QUESTION.
2. Examiners will only mark work written by hand during the examination. Candidates will not be allowed to include any previously prepared calculations, notes, sketches, diagrams, computer output or other similar material in their answer sheets. Any previously prepared information submitted by candidates will be ignored by the examiners.
3. A fair proportion of marks will be awarded for the demonstration of an understanding of fundamental engineering concepts, as distinct from calculation of member forces and sizes. NOTE: In the calculation part, establishing “form and size” is taken to mean compliance with all relevant design criteria, i.e. bending, shear, deflection, etc.
4. 60 marks are allocated to Section 1 and 40 marks to Section 2.
5. The Examiners are looking for sound structural designs. It should also be remembered that aesthetics, economy and function are important in any competent engineering scheme.
6. Any assumptions made and the design data and criteria adopted must be stated.
7. Good clear sketches are required; they should show all salient and structural features and should incorporate adequate details.
8. Candidates may not bring into the examination room any electronic devices capable of wireless communication, optical photography or scanning.  
  
The following devices are not permitted: Mobile phones, laptops, notebooks or portable computers and similar devices, iPads, tablets and similar devices, E-readers (e.g. Kindle) and similar devices, cameras, optical scanners and similar devices.  
  
Any candidates arriving at the examination room with such devices will be asked to switch them off and place them in a sealed bag kept by the Invigilator for the duration of the exam.
9. This paper is set in SI Units.

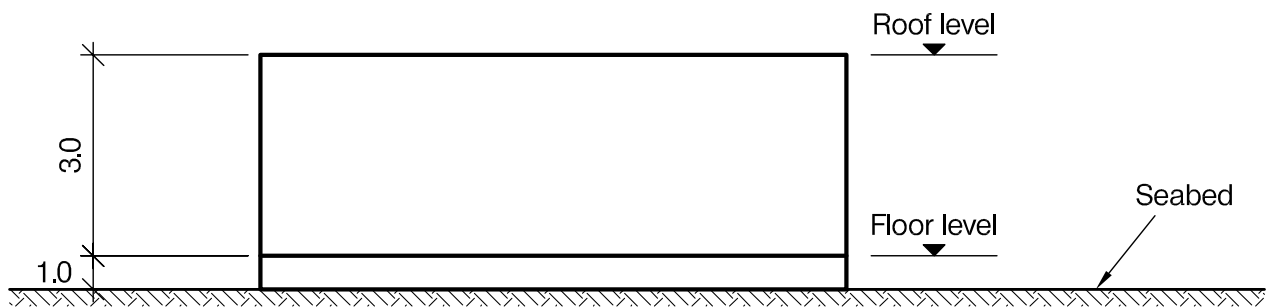


## A reminder on codes of practice

Any design code or standard may be used to answer the question in the paper, as long as reference to that code is consistent throughout and any assumptions made or design data adopted (including loadings other than those specified in the question) are stated at the beginning of the answer.



PLAN



ELEVATION (Looking North)

NOTE: All dimensions are in metres

FIGURE 1

# Subsea structure

## Client's requirements

1. A new subsea structure is to be installed on the seabed in 80m of water. The structure is to be 10.0m x 6.0m x 4.0m high, as shown in Figure 1.
2. The structure is to be located in an area that may experience fishing, and shall be designed to withstand fishing gear snag loads at any of the perimeter corners.
3. The structure is to be piled to the seabed for support. For the purposes of pile design the piles may be considered to be laterally supported at a depth of 5 pile diameters below the mudline.
4. The structure is to be open-sided, with a solid floor, and a roof protection system to prevent the passage of falling objects. Internal framing is to be avoided.
5. The structure is to be transported to its location on a Diving Support Vessel and lowered into position using the vessel crane, which has no heave compensation system.

## Imposed loading

6. Subsea structure internal equipment weight 600 kN (60 tonnes), uniformly distributed on floor area.  
Fishing snag gear load 1,000 kN (100 tonnes) in any direction.  
Maximum crane jib motion during installation 10m total heave in 10 seconds.  
Roof protection system to prevent passage of 0.5m diameter object with impact energy of 20kJ.

## Omit from consideration

7. In-place environmental conditions. Soil strength checks.

## Section 1

**(60 Marks)**

Prepare a design appraisal with appropriate sketches indicating two distinct and viable solutions for the proposed subsea structure. Indicate clearly the functional framing, load transfer and stability aspects of each scheme for the relevant temporary and permanent design cases. Recommend one solution, to be developed in the next section.

## Section 2

**(40 Marks)**

For the recommended solution prepare sufficient design calculations to establish the form and size of all principal structural elements. Include design sketches of the subsea structure, sufficient for estimating purposes and CAD drafting.

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