Offshore Engineering

MSc Programme

Study guide

2006/2007

www.masteryourfuture.nl

TU Delft

Delft University of Technology

Disclaimer

This guide has been compiled with the utmost care by the Faculty. There are a number of items about which further information will only become available after this guide has been published. For this reason the information published in this guide can be subject to change. Changes, additional information and more detailed course descriptions are available on Blackboard: blackboard.tudelft.nl and/or on the SIS website www.tudelft.nl/sis.

Table of contents

2 > Disclaimer
3 > Table of contents
5 > Personal details
6 > Preface
7 > Academic calendar 2006/2007
9 > TU Delft – University Facts and Mission
9 > International Office
10 > Service desk
10 > Blackboard
11 > Schedules
11 > TU Delft Library
12 > Regulations
12 > European Student Union (AEGEE)
12 > TU Delft's Student Union (VSSD)
14 > Useful web addresses
14 > Addresses
18 > Map of TU Delft
22 > 1. Introducing Offshore Engineering and its Curriculum
22 > 1.1. Defining Offshore Engineering
23 > 1.2. The Dutch Offshore Industry
24 > 1.3. The Delft Offshore Curriculum
31 > 1.4. Industry - Curriculum Interplay
32 > 1.5. University Curriculum Support
33 > 1.6. Special Curriculum Features
36 > 1.7. Related Information etc.
39 > 2. Pre-Curriculum Preparation
39 > 2.1. Pre-University Experiences
39 > 2.2. General Dutch TH (BEng) Preparation
40 > 2.3. General Preparation during University BSc
42 > 2.4. Pre-MSc Study Planning
43 > 3. Admission
43 > 3.1. Introduction
43 > 3.2. University Admissions Criteria
44 > 3.3. Additional Offshore Engineering Selection Criteria
46 > 3.4. TU Delft and Other IDEA League BSc Graduates
46 > 3.5. Other (International) University Engineering BSc Graduates
47 > 3.6. Dutch TH (BEng) Graduates
47 > 3.7. Foreign Engineering Technology Graduates

48 > 4. Offshore Engineering Curriculum Details
48 > 4.1. Curriculum Structure
49 > 4.2. Designing one's Individual Programme
50 > 4.3. The Offshore Engineering Core Curriculum
54 > 4.4. Bottom Founded Structures Specialisation
55 > 4.5. Dredging Engineering Specialisation
57 > 4.6. Floating Structures Specialisation
59 > 4.7. Subsea Engineering Specialisation
61 > 4.8. Additional Specific Curriculum Elements
62 > 4.9. Additional Electives
65 > 5. Management Aspects
65 > 5.1. Personal Study Management
66 > 5.2. Managing One's Teachers
67 > 5.3. The Offshore Website
69 > 6. A Foreign Study Setting
69 > 6.1. Motivations
70 > 6.2. Appropriate Foreign Activities
72 > 7. Diplomas and One's Professional Future
72 > 7.1. Current and Past Situation
72 > 7.2. Dual Degrees (in the Future)?
74 > 7.3. Employment Statistics
75 > 7.4. Early Offshore Career Experiences
81 > 7.5. Other Professional Career Paths
82 > 7.6. A PhD Study
83 > Appendix: Industrial Practice and Thesis Work Procedures
83 > A1 Introduction
83 > A2 Industrial Practice - OE5680
84 > A3 Thesis - OE5690
84 > A3.1. Basic Thesis Set-Up
85 > A3.2. Thesis Breadth and Depth
86 > A3.3. An Industrial Thesis
86 > A3.4. Lab Work
87 > A3.5. Other Thesis Forms
87 > A3.6. Thesis Procedures
90 > Organisation
90 > Faculties
99 > Overview of Courses

Personal details

name

address

postal code / city

telephone

mobile

e-mail

NOTIFY IN CASE OF EMERGENCY:

name

address

postal code / city

country

telephone mobile

MEDICAL INFORMATION:

medications

allergies

passport no

blood group

organ donor: yes / no; card no:

If found, please return this student guide or contact the owner.

Preface

Since 1926 Dredging Engineering and since 1975 Offshore Engineering courses are given at the Delft University of Technology. In 2004 these two specialisations merged and formed the new MSc programme Offshore Engineering, a two-year curriculum leading to the MSc degree in Offshore Engineering. The programme consists of four specialisations: Fixed (Bottom Founded) Structures, Floating Structures, Subsea Engineering and Dredging Engineering. Students with a BSc degree in Civil Engineering, Mechanical Engineering, Marine Technology and Ocean Engineering can enrol in this programme. Students with a different background should first consult the staff of Offshore Engineering to explore the possibilities.

Offshore Engineering is multidisciplinary and is a cooperation between Civil Engineering, Mechanical Engineering and Marine Technology. Starting September 2006, the administration and most of the staff of Offshore Engineering are housed in the Faculty 3mE of the Delft University.

This study guide is written as a guideline for students already enrolled in the MSc programme Offshore Engineering and for students who consider choosing Offshore Engineering to obtain their master's degree. It concentrates on the academic content of the curriculum and it links to the profession it serves. It also presents practical information regarding the organization and the logistics of the curriculum.

Since information may change, the latest information can always be found on our website: www.offshore.tudelft.nl. This applies in particular to the class schedules.

If you have any remarks or comments on this guide, please let us know.

We wish you a very successful stay in our Offshore group and with your study. Your success will depend to a large extent on how much energy you are willing to put in being an active participant in Offshore Engineering.

On behalf of the Offshore team,

Dr.ir. S.A. Miedema
Education Director of Offshore Engineering

Academic calendar 2006/2007

Fall semester

4/9/06			15.00 Aula: opening academic year
4/09	-	20/10	scheduled teaching activities
23/10	-	3/11	no scheduled activities/ examinations/ scheduled teaching activities
6/11	-	22/12	scheduled teaching activities
27/12	-	5/1/07	Christmas vacation
8/1/07	-	12/1	no scheduled activities
15/1	-	2/2	examinations

Spring semester

5/2/07	-	23/3	scheduled teaching activities
26/3	-	5/4 (do)	no scheduled activities/ examinations/ scheduled teaching activities
10/4 (Tue)	-	27/4	scheduled teaching activities
6/4			Good Friday
9/4			Easter Monday
30/4	-	4/5	no scheduled activities (May vacation)
7/5	-	8/6	scheduled teaching activities
17/5, 18/5			Ascension day
26/5			no scheduled activities
28/5			Whit Sunday
11/6	-	15/6	no scheduled activities
18/6	-	6/7	examinations
20/8	-	31/8	examinations/repeats

Note: examinations are usually called 'tentamens' in Dutch. Formally an 'examen' in Dutch is the degree audit taking place at the end of a programme phase such as a Propaedeuse (end of first year), a Bachelor or a Master phase. These 'examens' are formalities in the Dutch university system. There are no end-of-year examinations!

Class hours for Delft University of Technology

Period	Time		
1.	08.45	–	09.30
2.	09.45	–	10.30
3.	10.45	–	11.30
4.	11.45	–	12.30
5.	13.45	–	14.30
6.	14.45	–	15.30
7.	15.45	–	16.30
8.	16.45	–	17.30

TU Delft – University Facts and Mission

Founded in 1862, Delft University of Technology is the oldest, largest, and most comprehensive university of technology in the Netherlands. With over 13.000 students and 2100 scientists (including 200 professors), it is an establishment of both national importance and significant international standing. Renowned for its high standard of education and research, the University collaborates with other educational establishments and research institutes, both in the Netherlands and overseas. It also enjoys partnerships with governments, branch organisations, numerous consultancies, the industry, and companies from the small and medium business sectors.
Delft University of Technology has eight faculties offering a host of engineering programmes, many of them unique in the Netherlands.
Working together with other educational establishments, various research institutes, international business partners and the industry, TU Delft aims to provide students with all the necessary tools for a successful career: an excellent education, relevant, practical experience, and the broadest possible knowledge base. Detailed information can be obtained from the website www.tudelft.nl

International Office

This office will be your first point of contact at the University. The International Office staff handles the application procedure, financial and housing matters, and the distribution of student ID cards. The International Office comprises the central TU Delft Student Registration Office, which registers you as a student when you are admitted to TU Delft.

The Student Facility Centre publishes a Guide to Services, which is available from Julianalaan 134 or can be obtained by phoning +31 (0)15 27 88012 or emailing sfc@tudelft.nl

TU Delft International Office
PO Box 5
2600 AA Delft

The Netherlands
Tel: +31 (0) 15 27 88012
Fax: +31 (0) 15 27 85690
E-mail: admission@tudelft.nl
Website: www.studyat.tudelft.nl

Visiting address:
Julianalaan 134
2628 BL Delft
The Netherlands

Around October 2006 the International Office and the Student Facility Centre will move to a new location at the Mekelweg.
Postal address:
Jaffalaan 9A
2628 BX Delft
Visitors' entrance at the Mekelweg

Service desk

The Service Desk provides you with your transcripts, timetables and exam dates, and it posts the exam results. Here you submit forms, you inform them of recently acquired marks, and a change of address. The Service Desk tracks student progress, i.e. the number of credits and marks you obtain and any group work done in a semester and/or academic year. More information is available on servicepunt.tudelft.nl
The Service Desk is open Monday to Friday, from 8.00 to 17.00 hours.

Blackboard

Blackboard provides you with the most recent information about your courses. It is a commercial E-learning medium that serves as a virtual notice board for announcements, timetables, presentation of programme materials, practice materials, exercises and solutions as well as interesting links. You can enter the system using the 'Preview' button in the login

screen, but to access all information, you need a personal login ID.
Website: blackboard.tudelft.nl
Request assistance through Blackboard-support@tudelft.nl

Schedules

For up-to-date schedules, go to blackboard.tudelft.nl or the campus website of your faculty.

TU Delft Library

The TU Delft Library consists of a central branch located behind the Aula and seven faculty branches in a number of locations. The collection, the excellent study facilities, the modern PCs and the package of services in each library are designed to provide you with optimal access to relevant science and technology literature. On the Library's website, www.library.tudelft.nl, you can find all information you need if you want to visit a library or use one of the services of the TU Delft Library.

Customer Services TU Delft Library:
Tel: +31 (0)15 27 85678
Fax: +31 (0)15 27 85706
E-mail: library@tudelft.nl
Website: www.library.tudelft.nl

Opening times central branch:

	Tuition period	Examination period	Summer holiday
Monday - Thursday	9.00 - 22.00	9.00 - 24.00	9.00 - 17.00
Friday	9.00 - 18.00	9.00 - 22.00	9.00 - 17.00
Saturday - Sunday	10.00 - 18.00	10.00 - 22.00	closed

The opening times of the faculty libraries can be found at www.library.tudelft.nl under 'locations'.

Opening times central information desk:

Monday - Thursday	9.00 - 19.00
Friday	9.00 - 17.00
Saturday	10.00 - 13.00
Sunday	closed

Every first Monday of the month: 11.00 - 19.00

Regulations

There are a number of formal regulations for the faculty organization, the programmes and their execution. These are:

- The Faculty Regulations
- The Course and Examination Regulations ('Onderwijs- en Examen-reglement').
- (Per programme) The Execution Regulations of the Education and Examination Regulations ('Uitvoeringsregeling').
- The Rules and Guidelines of the Board of Examiners ('Regels en Richtlijnen van de Examen Commissie').
- The Student Charter ('Studentenstatuut')

These regulations are published yearly on the web, see the Blackboard community of the programme involved. In case of doubt, your Director of Education or your Study Adviser will be glad to inform and advise you.

EUROPEAN STUDENT UNION (AEGEE)

AEGEE is the European students' association, represented in 271 cities in 40 countries. Over 17,000 member students are actively involved in travelling, participating in fun and pleasure events and conferences on topics that concern you. There are a lot of possibilities to travel to other places in Europe, meet new people and make friends everywhere! In every city there is an independent local association such as AEGEE-Delft.
Check out the website: www.aegee-delft.nl

TU DELFT'S STUDENT UNION (VSSD)

The purpose of the VSSD is to safeguard the interests of all students studying at Delft University of Technology. The Union mainly focuses on areas such as education, income, legal status and housing. The VSSD is a member of the National Student Union (LSVB) and of the ISO (a national student body). As well as representing the collective interest of students, the VSSD also provides support and services to individual students by helping them with financial, housing, study and other problems, and through the publication and sale of reasonably priced textbooks.

Office:
Leeghwaterstraat 42 (building 45 on map)
Tel: +31 (0)15 27 82050
Fax: +31 (0)15 27 87585
E-mail: balie@vssd.nl
Website: www.vssd.nl
Opening hours: Monday to Thursday 08.30-17.00, Friday 08.30-13.00

Shop:
Leeghwaterstraat 42,
Tel: +31 (0)15 27 84125
Fax: +31 (0)15 27 81421
E-mail: winkel@vssd.nl
Opening hours: Monday to Friday between 10.30-14.00 and 15.00-17.00

USEFUL WEB ADDRESSES:
www.tudelft.nl (general information about Delft University, history, programmes, research, etc.)

www.studyat.tudelft.nl (information about all BSc and MSc programmes offered by Delft University of Technology, information about the requirements, how to apply, costs, funding, insurance, housing, medical and pastoral care, facilities for special needs students etc.)

www.ideeenlijnOS.tudelft.nl (You can post your suggestions and comments with a view to improving the services provided by O&S on this website. You can also use this address for complaints, of course.)

www.snc.tudelft.nl (TU Delft Sports & Cultural Centre)

www.dsdelft.nl/centrum (information about Delft)

www.denhaag.org (for activities in the nearby city of Den Haag)

www.uitaandemaas.nl (activities in Rotterdam)

www.amsterdam.nl (activities, news, public transport in and around Amsterdam)

ADDRESSES:
Delft University of Technology (TU Delft)
Visiting address:
Julianalaan 134
2628 BL Delft
The Netherlands

Postal address:
PO Box 5
2600 AA Delft
The Netherlands

Tel: +31 (0)15 27 89111
Fax: +31 (0)15 27 86522
E-mail (for questions): voorlichting@tudelft.nl
(For information about the city of Delft, please see www.delft.nl)

Education and Student Affairs
Tel: +31 (0)15 27 84670
E-mail: OS@tudelft.nl
Website: www.OS.tudelft.nl

- Central Student Administration (CSA)
PO Box 5
2600 AA Delft
Tel: +31 (0)15 27 84249
E-mail: msc2@tudelft.nl
Website: www.csa.tudelft.nl/
Office hours: 8.30-17.00

- International Office
Julianalaan 134
2628 BL Delft
Tel: +31 (0)15 27 88012
E-mail: msc2@tudelft.nl
Website: www.studyat.tudelft.nl

- Student Facility Centre (SFC)
Study Advisers:
Opening hours: Monday to Friday 09.00-17.00.
Student Psychologists:
Tuesday and Thursday 11.30-12.30
Julianalaan 134
2628 BL Delft
Tel: +31 (0)15 27 88012
E-mail: sfc@tudelft.nl

Around October 2006, Education and Student Affairs (i.e. CSA, International Office, Student Facility Centre) will move to a new location on the Mekelweg.
Postal address:
Jaffalaan 9A
2628 BX Delft
Visitors' entrance at the Mekelweg

Sports & Cultural Centre
Mekelweg 8-10
2628 CD Delft
Tel: +31 (0)15 27 82443
E-mail: sportcentrum@tudelft.nl
Website: www.snc.tudelft.nl
Monday to Friday: 08.30-23.30; Saturday and Sunday: 08.30-19.00.

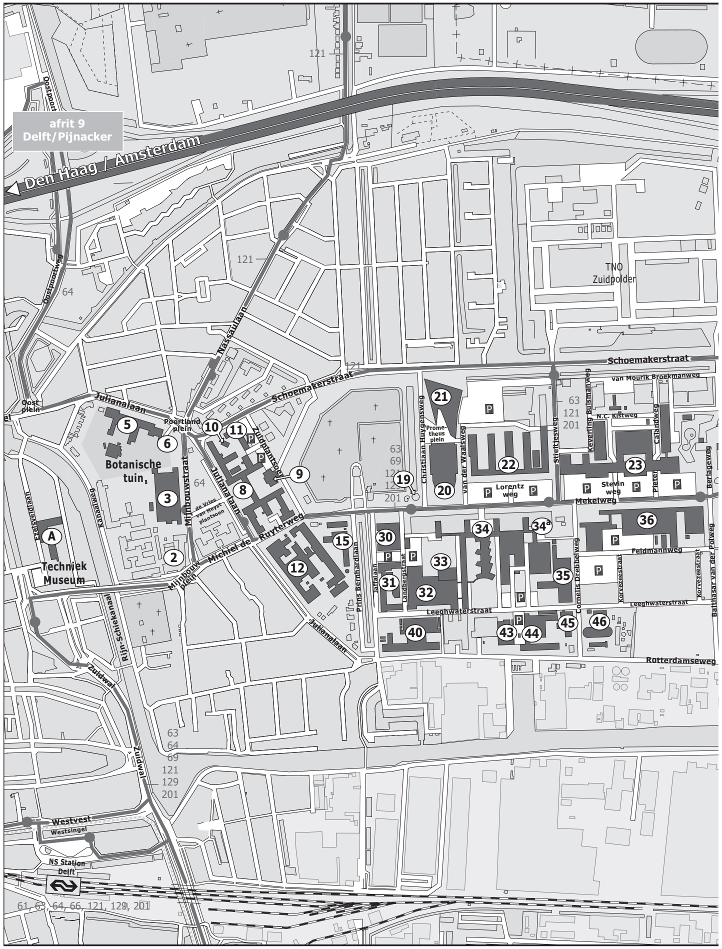
Student Health Care: SGZ
Surinamestraat 4
2612 EA Delft
To make an appointment, call +31 (0)15 212 1507
Monday to Friday 8.30-12.15

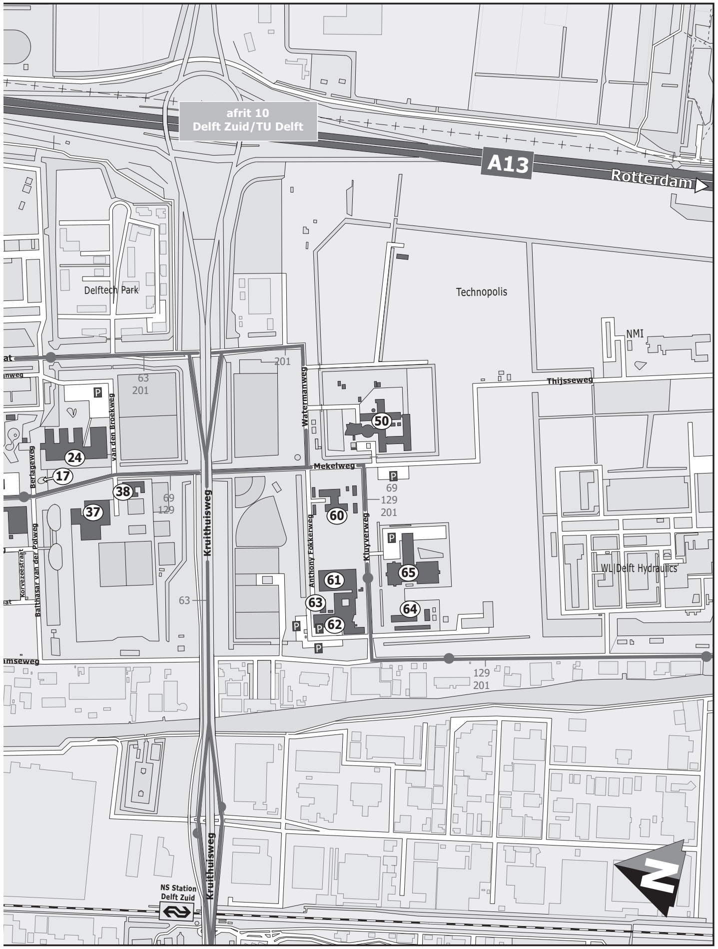
Stichting DUWO
(Delft Housing Agency)
Marlotlaan 5
2614 GV Delft
Tel: +31 (0)15 219 2200
E-mail: info@duwo.nl
Website: www.duwo.nl
Office hours: Monday to Friday 08.30-17.00.

Student Restaurants in Delft
- University main cafeteria, Aula, Mekelweg 5
- SnC Café, Mekelweg 8
- Sint Jansbrug, Oude Delft 50-52

- Koornbeurs, Voldersgracht 1
- Alcuin, Oude Delft 123
- CSR, Oude Delft 9
- De Bolk, Buitenwatersloot 1-3
- Novum, Verwersdijk 102-104

Map of TU Delft





= busstop

A	Ezelsveldlaan 61	Delft Technology Museum
2	Mijnboouwplein 11	No longer owned by TU Delft
3	Mijnbouwstraat 120	Applied Earth Sciences
5	Julianalaan 67	Biotechnology (Kluyver Lab)
6	Poortlandplein 6	Botanic Gardens
8	Julianalaan 132-134	TU Delft Corporate Office
9	Zuidplantsoen 2	MultiMedia Services (MMS)
10	Zuidplantsoen 6	Tempel
11	Zuidplantsoen 8	Real Estate and Facility Management
12	Julianalaan 136	Delft ChemTech
15	Prins Bernhardlaan 6	Kramers Laboratorium voor Fysische Technologie
17	i-WEB:	Vehicle for Research, Education and Design
19	Mekelweg 3	Stud: student employment agency
20	Mekelweg 5	Aula Congress Centre
21	Prometheusplein 1	TU Delft Central Library
22	Lorentzweg 1	Faculty of Applied Sciences
23	Stevinweg 1	Faculty of Civil Engineering and Geosciences
24	Berlageweg 1	Faculty of Architecture
28	Mourik Broekmanweg 6	TNO Building and Construction Research
30	Jaffalaan 9	OTB Research Institute
31	Jaffalaan 5	Faculteit of Technology, Policy and Management
32	Landbergstraat 15	Faculty of Industrial Design Engineering
33	Landberghstraat 19	Composites Laboratory INHOLLAND/TU Delft
34	Mekelweg 2	Faculty of Mechanical, Maritime and Materials Engineering
34a	Cornelis Drebbelweg 9	Executive Board
35	Cornelis Drebbelweg 5	Examination rooms
36	Mekelweg 4 + 6	Faculty of Electrical Engineering, Mathematics and Computer Science
37	Mekelweg 8	TU Delft Sports Centre
38	Mekelweg 10	TU Delft Cultural Centre
40	Rotterdamseweg 137	Materials Engineering
41	Rotterdamseweg 139	Electronic and Mechanical Support Division
42	Rotterdamseweg 139a	ROB

43	Leeghwaterstraat 36	Cogeneration plant
44	Rotterdamseweg 145	Yes!Delft/Technostarters
45	Leeghwaterstraat 42	Wind tunnel & VSSD
46	Leeghwaterstraat 44	Process and Energy Laboratory (API)
50	Mekelweg 15	Radiation Radionuclides & Reactors (R3) / Reactor Institute Delft (RID)
51	Watermanweg 42	Wind energy building
52	Thijsseweg 11	No longer owned by TU Delft
61	Kluyverweg 3	Vliegtuighal
62	Kluyverweg 1	Faculty of Aerospace Engineering
63	Anthony Fokkerweg 1	SIMONA
64	Kluyverweg 2	High Speed Laboratory
65	Kluyverweg 4 + 6	Delft Transport Centre (DTC)

1. Introducing Offshore Engineering and its Curriculum

1.1. DEFINING OFFSHORE ENGINEERING

The following definition of offshore engineering is relevant to the current curriculum. It is centered around three words:

- Engineering
- Applications
- Man-made structures

It also includes the five characteristics given below.
Offshore engineering concerns professional engineering. This is:

1. The systematic and responsible application of science and other organized knowledge for practical purposes at the highest level, where these applications
2. are situated at sea away from the coast, and
3. are centered in a more or less localized area on, in or under the sea, and where these applications deal with man-made structures (hardware) that
4. by design and method of construction or utilization are strongly influenced by the environmental conditions at the intended area, while accepting the natural circumstances and the state of the environment in that area as given facts, and
5. serve for the exploitation of natural resources on, in or under the sea or for the support of a public utility.

These five features are believed to be characteristic and exclusive; they distinguish offshore engineering from other fields of engineering. When each and all of these five characteristics are met, and only then, can one speak of offshore engineering as it applies to this curriculum. In short, one can say that the final objective of the OE MSc curriculum is to prepare graduates for the design of fixed, floating and subsea structures (including pipelines, dredging equipment and other hardware items) to be located or used on, in or under the sea.

1.2. THE DUTCH OFFSHORE INDUSTRY

Dutch engineering and construction firms have been active serving the offshore industry since even before oil and gas production started from the North Sea sometime around 1970. The Dutch have played a part in much of the history of the offshore industry since the first platform was placed out of sight of land in 6 meters of water in the Gulf of Mexico in 1947. This is generally recognized as the start of the offshore industry. The history of the Dutch dredging industry is much longer even: dredging started as a typical Dutch trade and the development of dredging equipment is firmly anchored in Dutch industry.

In 1998 and 1999 the Dutch Stichting Nederland Maritime Land carried out a large-scale evaluation of the economic importance of 11 separate segments of the Dutch Maritime Cluster of companies and agencies. The second largest of these segments - surpassed only by the sea harbour segment - was the offshore segment. The relative importance of the 11 sectors included in the Dutch Maritime Cluster is shown in figure 1.1. Although the data are old by now, the significance has not really changed since 1999.

Some further statistical details on the offshore segment include:

Companies involved	343
Total income	3,516 billion Euro per year
Total added value	1,609 billion Euro per year
Total export income	1,331 billion Euro per year
Total employment	32 900 persons

It would be misleading, however, to assume that all of these 343 companies need university-trained offshore engineers or to assume that all of the above 32 900 persons are university graduates. It is a fact, though, that Offshore Technology requires relatively many professionals with an advanced level of education.

In practice, the OE MSc Degree curriculum is currently designed - and staffed - to provide industry with approximately 35 graduates per year.

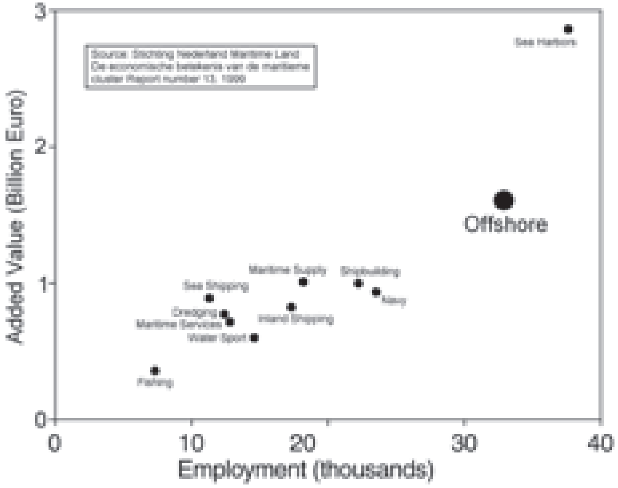


Figure 1.1 The Relative Importance of Dutch Maritime Cluster Sectors

Dredging as indicated in figure 1.1 refers to the companies that **utilize** rather than build dredging equipment. The builders of dredging equipment - a group also served by the TU Delft Offshore Engineering MSc Degree curriculum - are included in the Shipbuilding sector in the above figure.

1.3. THE DELFT OFFSHORE CURRICULUM

Curriculum Objectives and Profile

All TU Delft MSc curricula last nominally two academic years. Within these two years - by building upon a participant's BSc background - the overall offshore engineering curriculum objective is to prepare successful participants for an active role in society that is related in some way to the offshore or dredging equipment industry - especially when this latter equipment is to be used in exposed or deep water locations. This may seem pretty broad; another form of objective follows from the definition of offshore engineering given in section 1.1: The curriculum prepares participants to design and work with man-made structures in the sea.

One way to represent a curriculum's objectives from a technical point of view is via a profile. The profile is a graphical representation of the technical activities for which its participants are being prepared. The primary (horizontal) axis of the profile includes the life-cycle of an engineered object. This starts with helping a client to define the problem to be solved, proceeds in various steps through the design and ends with the removal and re-cycling of the object at the other end of its life-cycle. Intellectual development levels associated with each of the life cycle steps are indicated on vertical axes. One of these axes - on the left in figure 1.2 - indicates the desired knowledge level; a parallel axis - on the right - indicates skill. (Knowledge is defined here as what one knows; skill is one's handiness at using his or her knowledge.)

The intellectual development levels can be interpreted as follows:

1. **Undeveloped.** This is a zero-level corresponding to that of an entering BSc freshman. Note that in the current MSc case it should be obvious that much of knowledge and skill associated with the profile will come from one's BSc educational experience.
2. **Awareness.** One can recognize a problem and discuss it (to some extent) with others even though the person cannot solve the problem independently.
3. **Routine.** This equips one to solve commonly-occurring problems using well-known, standard procedures. This is typically the graduation level of many engineering technologists - at least in Europe. A university graduate can also explain the procedure and its background to others.
4. **Advanced.** One can handle more difficult problems - for which one must find or develop a somewhat original solution or methodology. The person can also document the particular solution development. He or she can also evaluate the relative merits of various solution alternatives.
5. **Superior.** One can now work with new and more complex problems (probably only within one's specialty area) and develop, evaluate and document solutions for them. This is the highest level attainable at the university alone.

The information presented in this section has defined the objective for the offshore engineering MSc Degree curriculum. The next section presents the general structure and summary content of the curriculum.

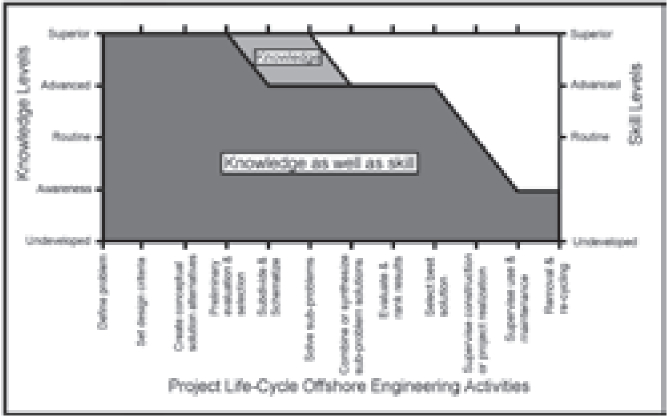


Figure 1.2 The Delft University of Technology Offshore Engineering MSc Degree Curriculum Profile

Curriculum Structure and Associated Courses

This section presents a quick summary of the OE MSc Degree curriculum's structure and content. This information is needed to check that the curriculum meets recognized standards. More curriculum detail can be found in chapter 4.

The curriculum currently includes a series of core courses and specialisations. Each specialisation includes additional courses needed - as a major - to function optimally within that area; a minor uses a subset of the same courses to provide at least a minimum capability.

Core Courses

All participants in the offshore engineering curriculum must complete the following (or equivalent) courses given in table 1.1; these courses serve all four of the specialisations. Depending on one's Bachelor curriculum, participants may skip some parts of the core courses. The list represents a maximum of 86 ECTS credits of work (including 14 credit points earned by an industrial practice training period and 37 by completion of the thesis). One academic year is equivalent to 60 ECTS credits.

Table 1.1 Offshore Engineering Curriculum Core Courses

Survey of Offshore Engineering lectures
Introduction to Offshore Structures
Survey of Offshore Engineering project
Physical Oceanography
Short Waves
Wind Waves
Offshore Hydromechanics
Applications in Soil Mechanics
Probabilistic Design

Bottom Founded Structures Specialisation

The bottom founded structures specialisation is targeted primarily on fixed structures - for the offshore oil and gas industry but also for offshore wind farms. The specialisation includes the 14 credits of courses given in table 1.2.

Table 1.2 Bottom Founded Structures Specialisation Courses

Bottom Founded Structures
Offshore Soil Mechanics
Structural Dynamics
Basic Finite Element Methods (exercise)

Dredging Engineering Specialisation

The dredging specialisation includes a background in floating structures associated with conventional dredging and the design of subsea dredging equipment for work in deeper waters. This specialisation includes 15 credits of course work as listed in table 1.3.

Table 1.3 Deep Sea Dredging Equipment Design Courses

Pumps and Slurry Transport
Dredging Processes
Dredging Equipment
Drive System Principles

Floating Structures Specialisation

The offshore industry uses all sorts of floating structures - especially in deeper water. This specialisation includes the 18 credits of courses as listed in table 1.4.

Table 1.4 Floating Structures Specialisation Courses

Floating Structures
Offshore Moorings
Dynamic Positioning Systems
Structural Dynamics
Basic Finite Element Methods (exercise)
Drive System Principles

Subsea Engineering Specialisation

Subsea Engineering is the 'youngest' specialisation within the offshore engineering curriculum - at least in terms of the number of years since it was first introduced at the Delft University of Technology. It centres on the design of all sorts of equipment for use below the sea surface and on the sea bed. This specialisation includes the 14 credits of course work as listed in table 1.5.

Table 1.5 Subsea Engineering Specialisation Courses

Marine Pipelines
Subsea Engineering
Dynamic Positioning
Drive System Principles

Industrial Practice or Project and Thesis

Each participant is expected to get acquainted with the offshore industry through an industrial practice which provides for up to 14 credits. In certain cases it may be replaced by an in-house project or exercise.
The curriculum is concluded with a 6 months thesis project, mostly done in industry, valued at 37 credits.

Additional Elective Courses

Most offshore engineering participants can include about 20 credits of electives within their curriculum programme plan. Of course one may add further electives : 120 credits is a minimum, not a maximum. This space is normally filled with most any topics for which the participant can provide a viable motivation. Some of the most directly offshore-related curriculum elements are listed in table 1.6.

Table 1.6 Selected Elective Curriculum Elements

Introduction to Wind Energy
Offshore Wind Farm Design
Marine Engineering Geology
Hydrography
Sea Floor Mapping
Properties of Hydrocarbons and Oilfield Fluids
Drilling, Completion and Surface Facilities
Petroleum Engineering
Gas and Oil Processing Offshore

One will see from the lists above that there is a certain overlap between specialisations since some courses serve more than one specialisation.

The above information provides the basis for comparison with an international educational standard that is presented first in the following section.

International Educational Standard

The most widely used standard for engineering educational programmes come from the Accreditation Board for Engineering and Technology (ABET) in the United States. The ABET criteria have been developed more or less via a consensus among the various professional engineering societies in the USA. The American Society of Civil Engineers (ASCE) has a primary say in the ABET requirements for Civil Engineering as well as Ocean Engineering programmes - both rather significant for the offshore engineering curriculum being discussed here. ASCE published a suggested revision of the requirements (referred to as the Body of Knowledge) for both Civil Engineering professional recognition as well as university engineering curricula in January of 2004. The ASCE Body of Knowledge - with slight adaptations for offshore engineering - is used here.

The current ASCE criteria stipulate little in terms of technical content; ASCE does not wish to limit technical diversity between different universities. Instead, their criteria focus more on how a graduate is expected to work. Their (adapted) list includes the 17 items listed in table 1.7.

Table 1.7 ASCE Body of Knowledge Items

1. An ability to apply knowledge of science, mathematics and engineering.
2. An ability to design and conduct experiments as well as analyze their results.
3. An ability to design a system to meet desired needs.
4. An ability to function in multi-disciplinary teams.
5. An ability to identify, formulate and solve engineering problems.
6. An understanding of professional and ethical responsibility.
7. An ability to communicate effectively.
8. An understanding of the global and societal impact of engineering solutions.
9. Recognition of the need for, and an ability to engage in life-long learning.
10. Knowledge of contemporary issues.
11. An understanding of techniques, skills, and modern tools of engineering practice.
12. An ability to apply knowledge in a specialized area (such as offshore engineering).
13. An understanding of the principles of project management.
14. An understanding of business fundamentals.

15. An understanding of construction.
16. An understanding of the supervision, use and maintenance of constructed facilities.
17. An understanding of the role of a leader and leadership principles.

It should be explicitly noted that it is proposed that these 17 requirements must be met in order to obtain professional registration as engineer in The United States. They form a realistic basis for European countries as well, although the system of professional registration may be different or non-existing.

Relationship Matrices

Those students interested in how the above 17 items and the project life-cycle engineering activities (figure 1.2) actually relate to the curriculum courses can obtain the relevant matrices at the Offshore website.

1.4. INDUSTRY - CURRICULUM INTERPLAY

Industry has been involved with offshore engineering education at the Delft University of Technology since the first offshore course was taught there. Industry today provides teachers for occasional offshore engineering classes and is routinely actively involved in the coaching of thesis students. Even some entire courses are taught by experts from outside the university - with a bit of university supervision to assure quality, of course.

Additionally, a wide spectrum of industrial and professional organizations as well as leading offshore engineering executives have been consulted before major curriculum decisions have been made.

A separate booklet, **An Industry's Guide to the Offshore Engineering MSc Degree Curriculum**, describes the curriculum for industry and details how they can interact with it. It is available from the Offshore Engineering office and can be found as well via the website: www.offshore.tudelft.nl

Participants in the OE MSc Degree curriculum will interact with industrial practitioners starting early in their study career. Several of the team who teach the Survey of Offshore Engineering lectures in the first quarter of the first MSc year come from industrial specialties. Participants can also meet industrial practitioners during field trips such as those regularly organized by the Dispuut Offshore Technologie (DOT, the offshore students society). More specific excursions are sometimes included as an element in a specific course as well. The initiative for these usually lies with the teacher involved.

More intense and more individual interaction with industry can develop as each participant's study progresses. Many elect to include a period of industrial practice in their programme. Some target an industrial problem via their elective integrating exercise work and most thesis projects are carried out in industry.

Additional contacts - special lectures, symposia, and field trips - will come via participation in the Dispuut Offshore Technologie at the university and via the offshore technology division within the Royal Institution of Engineers (KIVI). Addresses, etc. of these organizations are listed in the last section of the current chapter.

All of these interactions enhance the professionalism within the programme and ease each participant's transition from being a graduate student to becoming a productive and innovative industrial leader.

1.5. UNIVERSITY CURRICULUM SUPPORT

The offshore engineering MSc Degree curriculum is supported by both the university and industry. This section concentrates briefly on the university side.

Offshore Engineering draws on expertise and teaching staff primarily from four teaching faculty units:

- Applied Earth Sciences (Petroleum Engineering)
- Civil Engineering
- Maritime Technology
- Mechanical Engineering

Staff from these groups are assisted - as already mentioned in section 1.4 - by a team of industrial teachers as well.

The professor of offshore engineering provides overall leadership for and supervision of university offshore activities - including this curriculum. He is supported by a Curriculum Leader and an Education Director.

1.6. SPECIAL CURRICULUM FEATURES

Professional School

A professional school or curriculum means that:

1. Employers (industry in the case of offshore engineering) have influenced and agree to the overall curriculum objectives and the route chosen to reach these,
2. Industry actively supports the curriculum and its participants by:
    - Providing support in the form of guest lectures and participant coaching during industrial practice or thesis work, etc. This involves "invisible money" - costs which the industry absorbs directly.
    - Providing direct financial support via earmarked contributions for offshore engineering education. This involves "hard cash".
3. Performance - for both the curriculum, its staff and its participants - is measured in terms of results rather than effort. A consequence of this is that everyone must be prepared to deliver extra effort when the (academic) situation necessitates it. Luckily, there can be some more relaxed moments as well.
4. Everyone involved - faculty, participants and industry - is accountable for (respectively):
    - Being professional and instilling professionalism in curriculum participants.
    - Embracing professionalism as much as possible by - among other activities - being accountable for current and past actions including obtaining and retaining all necessary knowledge and skill as well as

behaving in an adult and professional manner whenever in public.
• Supporting the curriculum and its participants to the best degree possible.

Items 1 and 2 depend upon industry in the case of offshore engineering; item 3 relates to the university and all those (staff as well as participants!) involved with the curriculum. Item 4 links back to the first three. All of these criteria are met by the offshore engineering curriculum and its teaching faculty. While many may not realize it, industrial financial support for the offshore engineering curriculum is significant and based to a great extent on its professional approach.

A Learning Community
A university learning community is a limited group of people - both teachers and participants such as those in the offshore engineering curriculum - **who actively work together** so that participants acquire knowledge, skills and attitudes. (Note that since examinations involve evaluation rather than acquisition of the above, individual work is appropriate during these!) Classes are often relatively small as is shown in figure 1.3. This enhances the learning community atmosphere.

Figure 1.3 Participants awaiting the start of a class.

Active learning can be done both individually - by looking up something not covered in class using library facilities - as well as collectively in impromptu or more formal and long-lasting teams.

A goal of a learning community is the enhancement of active interaction between participants as well as between participants and their teacher-coaches. As one participant stated it, "We are expected to stop sitting and start walking!" Continuing the analogy, faculty members will walk along too and serve more as coaches helping one to develop intellectually by processing information - as opposed to just absorbing and regurgitating it.

A special feature of the offshore curriculum is that its teacher-coaches also come from a variety of organizational units within the university.

A learning community is really analogous to work methods common in modern industrial settings; it is an exercise in what happens daily in engineering practice! Students will be working together and sharing the responsibility for a product (a report, for example) just as in a 'true' industrial setting. On the other hand, participants will still be required to work independently as well; this is not a curriculum for students who wish to freeload and 'be carried on the shoulders of their team mates'.

Project and exercise work integrates theory and practice; it allows (or forces, depending upon one's point of view) participants to apply recently learned theory to practical situations and to cross the boundaries introduced artificially as a result of subdividing the curriculum into discrete courses for teaching, participant evaluation and administrative purposes.

Classroom Facilities
Many offshore classes for the 2006-2007 academic year have been scheduled in room 2.99 of the Civil Engineering Building, Stevinweg 1, Delft. This classroom with a capacity of about 35 participants includes the following standard equipment:
• Blackboard, chalk and eraser.
• Flip-over pages with coloured marking pens. These pages can be torn off

and hung along a side wall with magnets on a metal strip, if desired.
- Overhead projector for (roughly) A4 size transparencies. This works best when it projects upon the blank wall of the room.
- Beamer with remote control including a laser pointer. The projector accepts input from either of two computers or VHS video.
- Whiteboard for beamer projection.
- A desktop PC is located permanently in the room. Files can be transferred to this computer from either a CD-ROM or memory stick (USB). Check with the course supervisor about logging in on this computer.
- VHS video which projects via the beamer on to the whiteboard.
- Connection cable for one's own laptop PC.

Note that a projector for 35mm slides is not part of the standard equipment. This can be requested a few days before it is needed, however.

Professional Perspectives
Experience with over 200 offshore-related graduates (from recent earlier TU Delft offshore programmes) indicates that:
- In times of offshore industrial prosperity the programme produces too few graduates. Graduates have to choose which job to accept.
- Graduates function very admirably in other sectors and business areas - independent of the prosperity of the offshore industry at that moment.

More information about graduates and their first job experiences can be found in chapter 7.

1.7. RELATED INFORMATION ETC.

Several documents, a website and a newsletter complement this booklet. **An Offshore Participant's Survival Manual** is provided to all participants as they enter the OE MSc Degree curriculum. It provides information on a variety of aptitudes such as structuring ideas for a report or presentation, time management, and use of a library. All of these are skills that will be useful throughout one's study and later professional career as well. Most find that it helps them become more effective curriculum participants as well as engineers later.

Administrative procedures associated with the more formal status of offshore engineering as a separate MSc Degree curriculum also require formulation of a set of formal Offshore Engineering Teaching and Examination Rules (OER).

A newsletter, **Offshore Engineering News**, is e-mailed periodically (primarily) to students registered in the files of the curriculum leader. It includes the latest information about courses, curriculum modifications (hopefully also improvements!), etc. It also occasionally includes more general topics which can be of less specific offshore interest. It can be read via the offshore website as well. It is occasionally distributed to others when appropriate.

Obviously, the **Offshore Engineering News** can only be sent to (prospective) participants who are registered as such with the curriculum leader and whose address is up-to-date. The curriculum leader can be contacted via the address, etc. given below. **Each participant is urged to keep the Offshore Secretary informed on his/her up-to-date address**, which after completion of the course is entered in our Alumni database.

Web-based information on the OE MSc Degree curriculum is developing rapidly. More detailed course descriptions, class schedules and the **Offshore Engineering News** are available via the home page at: www.offshore.tudelft.nl . Lecture notes and Powerpoint presentations of lectures are usually placed on Blackboard, which may be accessed through a link at the offshore website or directly.

Further sources of information about offshore engineering include:
- The main offshore engineering offices
  Mekelweg 2
  2628 CD Delft
  Tel: +31 (0)15 27 84758
  E-mail: info@offshore.tudelft.nl

- Satellite offshore engineering offices can be found in the building for
  Civil Engineering
  Stevinweg 1
  Room 2.86 and neighbouring rooms.

- The Offshore Engineering Curriculum Leader
  Room 7-1-134
  Mekelweg 2
  2628 CD Delft
  Tel: +31 (0)15 27 89445
  E-mail: OECL@offshore.tudelft.nl

- Offshore Society ''Dispuut Offshore Technologie"
  Room 2.74
  Stevinweg 1
  2628 CN Delft
  Tel: +31 (0)15 27 85260
  E-mail: dot@offshore.tudelft.nl

- Offshore Technology Division ''Afdeling Offshore Techniek" of the
  Royal Institution of Engineers ''Koninklijk Instituut van Ingenieurs"
  Prinsessegracht 23
  2514 AP Den Haag
  Tel: +31 (0)70 391 9900

2. Pre-Curriculum Preparation

2.1. PRE-UNIVERSITY EXPERIENCES

Offshore engineering utilizes basic skills in mathematics and physics, just as most other engineering disciplines. In addition to this, its international orientation makes it an English-language industry - just as is this study curriculum. Even if one gets by with Dutch (or some other language) around the bar or coffee table, international offshore engineering communications (either spoken or written) will almost certainly be in English; including English in one's high school programme will prove to have been essential as a minimum. In addition, OE MSc graduates with special language abilities prove to be extra valuable on the job market.

Participants with a mentality for innovation are especially welcome within offshore engineering. The relative 'youth' of the offshore industry makes it a haven for innovation. Indeed, several Dutch offshore companies have made significant international names for themselves by remaining on the innovative forefront of their sector. One might say that there is (still) plenty of room for those who are stimulated by the unknown and respond to it with innovative ideas. These are traits one would associate (in a more extreme form) with Gyro Gearloose or Willie Wortel; one is probably born with an inventor's trait - or not.

These are all traits and aptitudes that a participant will probably have before starting on his or her university study. Additional academic preparation before one starts the OE MSc Degree curriculum are described in the remainder of this chapter in sections tailored to different groups of potential participants.

2.2. GENERAL DUTCH TH (BENG) PREPARATION

The Delft University of Technology encourages those who have completed a Dutch TH or HBO programme (leading to a Bachelor of engineering degree) to continue their professional development in Delft. Only a very few selected Dutch BEng graduates may be allowed to start directly on a Masters Degree curriculum in Delft. Others have two choices:

1. The first route is for them to complete a special Pre-Master's Offshore Programme that amounts to a bit more than a half year of very rigorous work spread out over one academic year. Only a very limited number of offshore engineering curriculum courses should be attempted before most of this transition programme has been finished.
2. If one is less certain about a choice for offshore engineering, one might be wiser to join in a post-HBO programme that more or less matches their HBO BEng Degree. This will yield a Delft BSc Diploma with which they may enter the offshore engineering MSc Degree curriculum.

TH students considering a move to Delft for the OE MSc Degree curriculum can of course gain additional insight about possible further preparation by reading the next section of this chapter as well.

More details about special preparatory programmes for Dutch TH graduates can be found in section 5.6. Note as well that some Dutch TH curricula are currently experimenting with integrating a TU preparatory programme into the latter year of their own curriculum.

2.3. GENERAL PREPARATION DURING UNIVERSITY BSC

Obviously, all participants entering the OE MSc Degree curriculum are expected to already have (or be very close to having) a Bachelor of Science degree in some relevant field of engineering. Relevant, in this context can include at least the following (generic) BSc degree studies:

- Civil Engineering
- Mechanical Engineering
- Naval Architecture, Maritime or Marine Technology
- Ocean Engineering (not available in Delft)

Motivated prospective participants with other BSc specialties, such as chemical, aeronautical, or petroleum engineering, for example, are certainly not ruled out, however.

Whatever one's BSc background, the following basic preparation is expected; subject areas rather than specific courses are listed:

- Mathematics through differential equations and probability
- Fluid mechanics
- Mechanics - statics
- Mechanics - dynamics of rigid bodies
- Mechanics - strength of materials

In addition to a background including all of these subject areas, all participants are expected to have had experience with some form of engineering design. This could be structural design for a civil engineer, or machine design for a mechanical engineer, while a petroleum engineer would probably have designed a reservoir drainage system, for example. The important generic aspect of this experience is that of making and defending motivated choices from among multiple technical alternatives.

Note that it is current TU Delft policy that any TU Delft BSc graduate from any one of the BSc curricula listed above may take part in the OE MSc Degree curriculum - irrespective of his or her more specific preparation via electives or other BSc curriculum choices. Obviously, since not all of these preparations will be identical, prospective participants can enhance their preparation by optimizing their choices while still carrying out BSc work.

Experience so far indicates that all BSc students entering the OE MSc Degree curriculum will find the transition is easiest if they have included include as much mechanics as well as design and team project experience as possible in their BSc programme.

Note that no BSc curriculum is expected to provide any specific offshore engineering preparation. Those who - in whatever way - have had a certain degree of specific preparation may find that they can be exempted from corresponding (parts of) otherwise required OE courses.

2.4. PRE-MSC STUDY PLANNING

The cumulative and more structured sequence of courses which make up the OE MSc Degree curriculum make it almost essential that a new participant begin his or her offshore educational experience at the beginning of that sequence which starts each Fall. Timing is essential here; one participant discovered when he arrived in the third week of the semester that he had already missed an entire segment of the oceanography and waves course.

The lesson from this must be that in order to derive optimum benefit from the offshore curriculum, one must start it at the beginning of the academic year in the fall and plan to devote significant attention to it. Those who plan to complete quite some additional (academic) work along with the OE MSc Degree curriculum usually become disappointed in one way or another. This disappointment can stem from the pure work load, but also from class scheduling conflicts, for example.

On the other hand, there is usually little problem if a person - with adequate but sometimes alternative qualifications - would like to take part in an offshore engineering course that may count as an elective in some other MSc Degree curriculum. Such a person can maximize his or her chance of success by having an adequate preparation and by making sure that full course participation can be scheduled appropriately.

3. Admission

3.1. INTRODUCTION

This section briefly describes the selection procedures used to choose new participants for the offshore engineering MSc Degree curriculum. Readers are specifically reminded that the information presented here is in addition to the more general requirements imposed either centrally by the Delft University of Technology. One can find more information on the general requirements via the website **www.studyat.tudelft.nl**

A major motivation for extra restrictions is the limited capacity of the OE MSc Degree curriculum. Facilities and/or staff are simply not available to accommodate an unlimited number of participants in some of the most important and required courses. The curriculum capacity is about 35 new participants per year.

The selection criteria in section 3.3 apply in a strict sense only to persons working toward the Offshore Engineering MSc Degree. All others are invited to take part in individual OE courses as long as they meet the following conditions:

1. They have the requisite background knowledge, and
2. There is sufficient teaching staff and facilities space available for them to participate.

3.2. UNIVERSITY ADMISSIONS CRITERIA

University MSc admissions criteria are quite general in that they are valid for all MSc Degree curricula. The questions that must be affirmatively answered before the university will admit a potential student include the following:

- Does the applicant have financing for study and his or reasonable living expenses for a stay lasting usually between two and three years?
- Can the applicant be expected to be successful obtaining any (further) necessary permits for a legal stay in The Netherlands for the required time period?

- Does the applicant have a sufficient general technical background? Can he or she be reasonably expected to complete a study in Delft successfully?
- Does the applicant have a sufficient specific background in order to enter the desired curriculum? If not, a different curriculum or a remedial study programme may be suggested; usually this question is answered by the university after consultation with desired curriculum leaders, by the way.

This last item is in the grey area between university criteria and those specific to offshore engineering that are discussed in the next section.

3.3. ADDITIONAL OFFSHORE ENGINEERING SELECTION CRITERIA

The following criteria will be used when selecting participants for the OE MSc Degree curriculum:

1. **Sufficient Background to Succeed**
   This criterion related directly to the last item above. In general all prospective participants are **required** to bring a sufficient development of the following knowledge to the offshore engineering curriculum:
   - Basic physics and chemistry commensurate with what a Dutch student would normally “bring” from high school.
   - University level mathematics through partial differentiation as well as probability and statistics.
   - Statics and strength of materials, preferably augmented with some form of structural analysis.
   - Dynamics of rigid bodies.
   - Basic fluid mechanics at a university level.
   - Design experience (in a generic sense)

In addition to these requirements, participants who also have worked in teams on project work, etc. will find it easier to adapt to the curriculum’s active learning environment.

2. **Reasonable Participation**
   Generally, participants in the survey of offshore engineering exercise - OE4602 (see chapter 6) are expected to have completed at least 15 ECTS credits of additional offshore course work by the end of that course. This is because field development team members are expected to apply knowledge gained during other, offshore engineering courses in their contribution to their team’s field development plan. Note that this is usually a temporary restriction; if one fails to meet this criterion in one year, his or her situation a year later will be much better, hopefully.

3. **Motivation**
   The OE MSc Degree curriculum already has a reputation for not being the easiest path to a Masters Degree in Delft. A highly motivated participant will accept this fact and do his or her professional best to be a success in spite of this difficulty - even if his or her BSc background may have been a bit less spectacular academically. Good grades alone do not necessarily lead to one becoming a good (offshore) engineer.

4. **Past Academic Performance**
   In spite of item 2, those who have performed especially poorly during their entire BSc career will find it more difficult to convince the Curriculum Leader that acceptance is a proper choice in their case - especially if competition for placement is more severe.

5. **BSc Background**
   The background-integrating character of the OE MSc Degree curriculum can best be demonstrated if its participants come from as wide a spectrum of academic backgrounds as possible. Applicants from the less common backgrounds among those applying will find that they may be accepted more easily. On the other hand, an improperly prepared participant may have to spend too much effort to ‘catch up’ with the expected entry-level background outlined in the previous chapter.

6. **Residency**
All offshore engineering MSc participants are required to accumulate at least 60 ECTS credits of academic work while physically in The Netherlands.

These criteria should be kept in mind when reading the remainder of this chapter in which separate sections relate to different specific groups of (potential) participants.

3.4. TU DELFT AND OTHER IDEA LEAGUE BSC GRADUATES

Any persons with a Bachelor of Science degree in one of the areas leading directly to a Delft MSc Degree curriculum is - in principle - allowed to apply for that curriculum here in Delft. Many of those with a background listed in section 2.4 should be able to participate in the OE MSc Degree curriculum without insurmountable difficulties. One is reminded that no BSc curriculum is expected to include any specific offshore-related courses.

Note that TU Delft students may be allowed to start on their MSc programmes before they have fully completed all requirements for their Bachelors degree. In general and where possible, the OE MSc Degree curriculum will follow the rules for this that are stipulated by the participant's BSc degree-granting faculty. Students are requested to register as an offshore pre-master in this case.

3.5. OTHER (INTERNATIONAL) UNIVERSITY ENGINEERING BSC GRADUATES

Anyone with an internationally recognized Bachelor of Science degree in one of the fields listed in section 4.4 should contact the Delft University of Technology admissions office as well as the offshore engineering curriculum leader to discuss admission. Since space within the curriculum is sometimes limited, it is wise to establish this contact as early as possible.

Anyone with a Bachelor of Science degree in an area not listed in section 2.4 should contact the offshore engineering curriculum leader for advice and suggestions.

3.6. DUTCH TH (BENG) GRADUATES

Dutch BEng graduates - who are already participating in a special transition programme in Delft (leading to one of the appropriate - see section 2.4 - TU Delft BSc degrees) - will be treated just like any other TU Delft BSc students (or ultimately BSc graduates). Those who are more certain of their desire to pursue an offshore engineering MSc degree may instead take part in the specific pre-master's offshore transition programme to be discussed with the Curriculum Leader.

Any Dutch BEng graduate wishing to be admitted directly to the OE MSc Degree curriculum should contact both the university admissions office as well as the offshore engineering curriculum leader for advice and suggestions.

3.7. FOREIGN ENGINEERING TECHNOLOGY GRADUATES

Those with (US) Bachelors degrees in engineering technology awarded in one of the engineering fields listed in section 2.4 will be in much the same position as Dutch students with a BEng degree; see the section above. These persons can gain a first impression about admission by reading section 3.6, above. They should be warned, however, that the primary language at the BSc level - and thus in the pre-offshore engineering programme - within the Delft University of Technology is Dutch instead of English! This can make it especially difficult for them to 'repair' any shortcomings in their BSc preparation.

4. Offshore Engineering Curriculum Details

4.1. CURRICULUM STRUCTURE

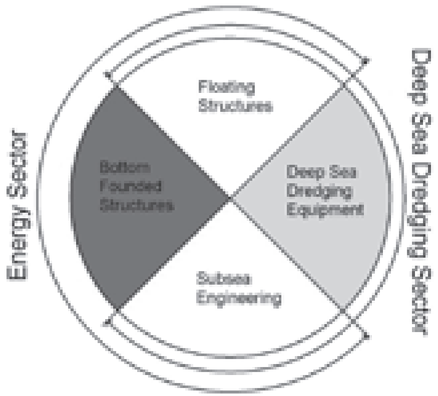
Now that the curriculum has been described in general terms and the requirements for admission to it have also been well-defined, attention in this chapter can switch to the more detailed description of the courses which make up the offshore engineering MSc curriculum. One is reminded that the entire MSc curriculum lasts two academic years. This amounts to a total of 120 ECTS credits of work.

The four specialisations:

- Bottom founded structures.
- Dredging engineering
- Floating structures.
- Subsea engineering.

can be grouped in two sectors, Energy and Deep Sea Dredging Equipment as is shown in figure 4.1.

Figure 4.1 Offshore Engineering Specialisation Sectors



It is expected that most participants will formulate a programme based in one of these two sectors. Note that two specialisations, Floating Structures and Subsea Engineering, are relevant for either sector.

In addition to this association with sectors, each specialisation may be included as either a major (This optimizes one's technical functionality in that specialisation) or as a minor that provides a minimum functional background.

Generally speaking, each participant is expected to include the following in his or her own study programme:

- The common core curriculum.
- One specialisation as a major.
- One additional specialisation as a minor.

The next section highlights how one should design his or her own programme. The remainder of this chapter provides more details about offshore engineering curriculum elements. More details about individual courses can be found in the appendix of this booklet. The most up-to-date information - such as the exact day-to-day teaching schedule - can be found via the offshore website: www.offfshore.tudelft.nl

4.2. DESIGNING ONE'S INDIVIDUAL PROGRAMME

Many beginning MSc participants are concerned and insecure about what seems like a myriad of decisions that they feel they have to make - about their own specific programme choices (which courses to include) - without sufficient information. Indeed, nearly everyone arrives at the doors of the offshore engineering curriculum without bringing any specific preparation from their BSc programme experience.

It will be refreshing for these new arrivals to know that most of their programme decisions can be delayed at least until they (individually) have had a few weeks to become oriented within offshore engineering; this reduces the pressure and gives one time to develop a better motivation for making programme choices. One will find, for example, that only one OE course taught in the first quarter of the first MSc year is associated with a specific

specialisation. Feel free as well to consult with the OE curriculum leader about professional objectives and programme choices.
He can be reached with a question or for an appointment via an e-mail to OECL@offshore.tudelft.nl .

4.3. THE OFFSHORE ENGINEERING CORE CURRICULUM

Introduction
This section outlines course requirements that are more or less universal - independent of one's further choices. The knowledge and skill conveyed by these activities forms the 'heart' of the offshore engineering curriculum; nearly all of the subsequent offshore engineering courses build upon these. These courses are coloured green on the "Offshore Engineering MSc Curriculum Diagram" which may be downloaded from the website www.offshore.tudelft.nl .

Detailed information on the core and specialisation courses is provided in the overview of courses. Also contact details of the teachers are given there.

Survey of Offshore Engineering Lectures - OE4601
3 ECTS credits; required for all OE MSc Degree participants.
Objectives:
- Introduce Offshore Engineering and place it in a broader professional context.
- Help participants confirm that their curriculum choice is the correct one.
- Place other curriculum courses in perspective and motivate participation in them.
- Prepare participants to discuss specialized problems with experts from many of the technical fields that support offshore engineering activities.

Survey of Offshore Engineering Project - OE4610 – a team exercise
8 ECTS credits; required for all OE MSc Degree participants.
Primary Teaching Staff: Each team will be coached by one member of the staff of Offshore Engineering. Specialists from industry will provide consultancy to the teams.

Objectives:
- Practice subdividing a large technical problem into a number of smaller, more schematized but linked problems for more specific solutions.
- Practice gathering of additional information and discussing specialized problems with experts from many of the technical fields that support offshore engineering activities.
- Integrate the knowledge and skills from other courses into the solution of a realistic offshore engineering (oil field development) problem.
- (Continue to) develop one's professional 'survival' aptitudes.

Introduction to Offshore Structures – OE4603
3 ECTS credits; required for all OE MSc Degree participants.
Objectives:
- Obtain an overview of the floating and bottom founded structures commonly used in offshore
- Understand the main design drivers of such structures

Oceanography – CT5317a (first part of the full course, worth 3 ECTS)
1 ECTS credits; required for all OE MSc Degree participants
Objectives:
Obtain a general awareness of the marine environment aspects most relevant to offshore engineering.

Short Waves – CT4320a (first part of the full course, worth 4 ECTS)
2 ECTS credits; required for all OE MSc Degree participants except those possessing a BSc degree in Maritime Technology.
Objectives:
Obtain a general awareness of the marine environment aspects most relevant to offshore engineering with specific emphasis on ocean waves

Wind Waves – CT5316
3 ECTS credits; required for all OE MSc Degree participants.
Objectives:
Obtain a general awareness of the marine environment aspects most relevant to offshore engineering with specific emphasis on ocean waves

Offshore Hydromechanics - OE4620

8 ECTS credits; required for all OE MSc Degree participants unless partially exempted via earlier course work or equivalent study.

Objectives:

Understand the interaction between the sea and an object in it. This object may be:

- A ship or other large structure.
- A marine riser or similar slender (non-rigid) structure.
- An offshore tower or jacket structure.
- A marine pipeline on or near the sea bed.
- A grain of sand and the related sea bed morphological changes.

Probabilistic Design - CT4130

4 ECTS credits; generally required for all OE MSc Degree participants.

Objectives: Become prepared to handle uncertainties in a design situation. These (technical) uncertainties can proceed from either:

- Loadings such as those caused by irregular waves.
- Long term extreme environmental conditions.
- Man-machine interactions.
- Material property variations.

Figure 4.2 A Gulf of Mexico platform after (just) surviving a major hurricane.

Soil Mechanics applications – AES1730

3 ECTS credits; required for all OE MSc Degree participants except those possessing a BSc degree in Civil Engineering.

Objective: Provide a basic background in soil mechanics. It is intended for all Offshore Engineering MSc Degree participants who have not (yet) completed a course in this subject.

Thesis - OE5690

37 ECTS credits; required for all OE MSc Degree participants.

Teaching Staff: The coaching team is dependent upon topic, but usually including the offshore engineering curriculum leader and at least two other TU Delft faculty members including at least one full professor who serves as coaching team chairman. Each industry-sponsored thesis also includes at least one representative from the hosting company or agency.

Scheduling: Second half of the second MSc year, subject to the participants progress.

Coaching Scheduling: Completely flexible with coaches' agenda limitations.

Objective: The thesis is a medium by which a participant demonstrates attainment of a professional level within his or her Offshore Engineering MSc Degree programme.

Note: Appendix A3 provides more details about thesis work.

Specialisation Inclusion

In addition to the requirements listed above, all participants are required to include two specialisatons within his or her own offshore programme. This assures that the graduate will have sufficient background breadth as well as depth to function effectively as a professional after graduation.

A first specialisation is included as a major; the second may be included as a major or minor within the offshore engineering MSc Degree curriculum. The four specialisations are summarized in the following four sections of this chapter.

4.4. BOTTOM FOUNDED STRUCTURES SPECIALISATION

Introduction

Fixed, Bottom-Founded Structures include the fixed tower structures with a piled foundation, but also other structures such as jack-up structures in their elevated operating position or even monopile structures now being used for offshore wind energy applications. Of the roughly 9000 offshore structures in place around the world, a majority is of the fixed type, and even today the majority of new offshore structures being built is of this type.

Bottom Founded Structures - OE4651

6 ECTS credits; required for this specialisation as a **major** or **minor**; elective for others.

Objective: This course brings together knowledge from supporting courses for the design of a fixed, bottom founded offshore structure.

Figure 4.3 A drilling and production platform

Structural Dynamics - CT4140

4 ECTS credits; required for this specialisation as a **major** or **minor** unless exempted via earlier course work or equivalent study; elective for others.

Objective: This course prepares participants to carry out dynamic response computations on structures that have distributed masses.

Finite Element Methods – WB1217 practical

1 ECTS credit; required for this specialisation as a **major** unless exempted via earlier course work or equivalent study; elective for others.

Objective: To enhance the understanding of FEM calculations by some exercises.

Offshore Soil Mechanics - OE4624

3 ECTS credits; required for this specialisation as a **major**; elective for others.

Objective: To prepare participants for offshore geotechnical problems by applying and extending one's basic knowledge of soil mechanics for common problems - such as cyclically loaded piles - encountered in offshore applications.

4.5. DREDGING ENGINEERING SPECIALISATION

Introduction

The dredging engineering specialisation involves the design of equipment for moving solids from, to, or over the bottom of the sea in water depths where offshore engineers normally work. The design of more conventional dredging equipment is discussed more or less along the way. This specialisation will always be included in any programme focused on deep sea dredging.

Drive Systems Design Principles – OE4623

3 ECTS credits; required for this specialisation as a **major** or **minor**; elective for others.

Objective: To become familiar with the most common drive systems in offshore and dredging and with their typical performance and control properties.

Dredging Pumps and Slurry Transport - OE4625
4 ECTS credits; required for this specialisation as a **major** or **minor**; elective for others.
Objective: This course prepares one to design and optimize a pipeline - pump system for slurry transport. Factors including the length and slope as well as overall pipeline wear and energy efficiency are all considered in relation to the rate of solid material transport.

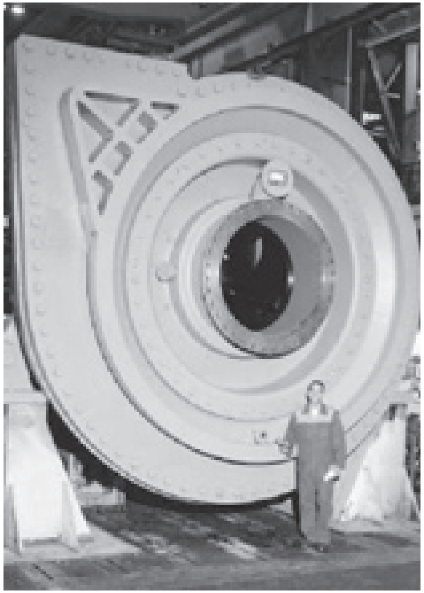


Figure 4.4 Even a dredge pump housing can be large.

Dredging Processes - OE4626
4 ECTS credits; required for this specialisation as a **major** or **minor**; elective for others.
Objective: This course prepares one primarily to design equipment details in order to achieve:
• Optimum cutting efficiency in sand, clay and rock.
• Optimum retention of dredged materials in a (temporary) storage hopper.

Deep Sea Dredging Equipment Design - OE5671
4 ECTS credits; required for this specialisation as a **major** or **minor**; elective for others.
Objective: This course prepares one primarily to design dredging equipment for specialized applications - such as diamond mining or gas hydrate recovery - in deeper (in the offshore sense) water.

4.6. FLOATING STRUCTURES SPECIALISATION

Introduction
There are many types of floating offshore structures. Ship-type vessels are used commonly to support drilling rigs in deeper water - often at more remote locations. Semi-submersible platforms are used for this purpose as well and to support many other activities for which a relatively stable operating base is needed. More recent developments include tension leg platforms - a sort of tethered semi-submersible - and spar platforms. Another relatively recent development is the Floating Production, Storage and Offloading (FPSO) vessel.

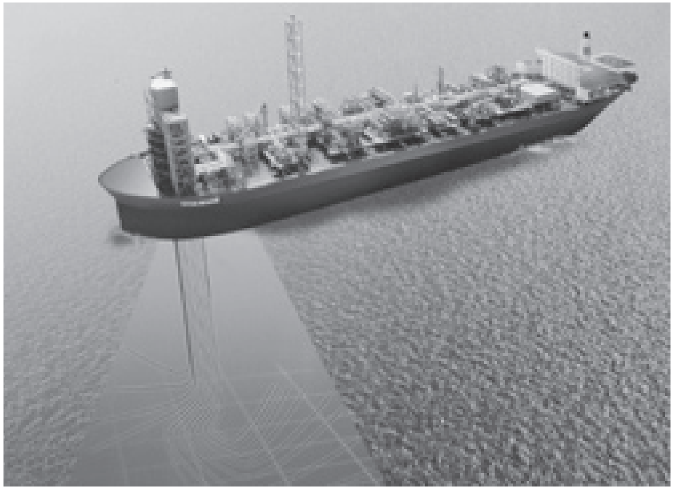


Figure 4.5 FPSO sketch showing riser connections to subsea wells.

Floating Structures - OE4652
4 ECTS credits; required for this specialisation as a **major** or **minor**; elective for others.
Objective: To explain in more detail the design and properties of the floating structures reviewed in OE4603.

Drive Systems Design Principles – OE4623
3 ECTS credits; required for this specialisation as a **major** or **minor**; elective for others.
Objective: To become familiar with the most common drive systems in offshore and dredging and with their typical performance and control properties.

Offshore Moorings - OE5664
3 ECTS credits; required for this specialisation as a **major** or **minor** (see note); elective for others.
Objective: Participants are prepared via this course to design an offshore mooring system.

Note: Any participant who has Floating Structures as a **minor** is required to include either Offshore Moorings or Dynamic Positioning in his or her programme.

Dynamic Positioning - OE5663
3 ECTS credits; required for this specialisation as a **major** or **minor** (see note); elective for others.
Objective: To familiarize the participants with the aspects of DP : position measurement, control theory and thruster selection.

Note: Any participant who has Floating Structures as a **minor** is required to include either Dynamic Positioning or Offshore Moorings in his or her programme.

Structural Dynamics - CT4140
4 ECTS credits; required for this specialisation as a **major** unless exempted via earlier course work or equivalent study; elective for others.
Objective: This course prepares participants to carry out dynamic response computations on structures that have distributed masses.

Finite Element Methods – WB1217 practical
1 ECTS credits; required for this specialisation as a **major** unless exempted via earlier course work or equivalent study; elective for others.
Objective: To enhance the understanding of FEM calculations by some exercises.

4.7. SUBSEA ENGINEERING SPECIALISATION

Introduction
Subsea engineering relates to the design of equipment for an ever-increasing myriad of activities which takes place under water and usually on the sea bed. As oil fields are being located in deeper and deeper water (500 m depth is considered shallow by subsea engineers), it becomes more and more cost-effective to replace facilities on the sea surface with equipment on the sea bed to perform the same operation.

Some are even considering carrying out some processes - separation of oil and water in the production flow is an example - somewhere along the well bore, even before the production flow reaches the sea bed in the first place. This avoids having to transport this water at all.

On a more conventional scale, subsea engineering includes remote control of subsea wellheads, robots to carry out a variety of manipulations to hardware on the sea bed, and even self-locking or self-releasing systems for various types of anchoring systems.

Figure 4.6 Subsea wellhead equipment during fabrication and shop testing.

Subsea Engineering - OE4654

4 ECTS credits; required for this specialisation as a **major** or **minor**; elective for others.

Objective: The course prepares participants to work with others designing and specifying specialized equipment to be used for subsea work in deep water.

Drive Systems Design Principles – OE4623

3 ECTS credits; required for this specialisation as a major or minor; elective for others.

Objective: To become familiar with the most common drive systems in offshore and dredging and with their typical performance and control properties.

Marine Pipelines - OE4653

4 ECTS credits; required for this specialisation as a major or minor; elective for others.

Objective: The course prepares participants to design oil and gas as well as multi-phase marine pipelines from the points of view of:

• Internal flows and flow assurance.
• Pipeline route selection and design for stability in place.
• Pipeline construction and installation.

Dynamic Positioning - OE5663

3 ECTS credits; required for this specialisation as a major; elective for others.

Objective: To familiarize the participants with the aspects of DP: position measurement, control theory and thruster selection.

4.8. ADDITIONAL SPECIFIC CURRICULUM ELEMENTS

Introduction

This section describes two additional formal curriculum elements that are not formal classroom courses. Since each of these elements includes a minimum of 8 ECTS credits, one is usually not allowed to include both in his or her programme plan.

Integrating Exercise - OE5670

11 ECTS credits; elective for all participants.

Teachers: Topic-dependent; supervised by the Curriculum Leader.

Scheduling: Flexible; usually early in one's second MSc year.

Objectives: This curriculum element is provided in order to allow a participant to:

• Further develop his or her skill level in some area of offshore engineering by getting additional practice with the application of methods learned from (other) classes.
• Polish up his or her research and reporting skills (in a broad sense) as preparation for a thesis project.

Some participants find industrial sponsors for this 'mini-thesis' work. This is fine as long as the overall scope can be fit into a time period of about 8 weeks.

Industrial Practice - OE5680
8 to 14 ECTS credits corresponding 6 to 10 weeks of work; elective for all participants.
Teachers: Topic-dependent; supervised by the Curriculum Leader
Scheduling: Flexible; generally not before completion of the Survey of Offshore Engineering Project - OE4602 and a total of at least 40 offshore engineering course credits.
Objective: The objective of industrial practice is to let a participant see how what has been learned in the classroom is utilized in practice. This brings each participant in direct contact with the engineers, technicians and skilled workmen carrying out the result of engineering design. By working closely at all levels, one develops an appreciation for skills and an understanding of these peoples' problems.

4.9. ADDITIONAL ELECTIVES

Introduction
This section first presents a description of a few quite specifically offshore-relevant courses before giving guidelines for choosing the additional electives needed to 'fill out' one's programme to a minimum of 120 ECTS credits.

Short Waves – CT4320
4 ECTS credits; elective for MSc participants who have not yet followed a comparable course.
Objective: Understanding the mechanics of short (i.e. with respect to water depth) gravity surface waves. Part of this course is included in the core curriculum for 2 credits.

Physical Oceanography – CT5317
3 ECTS credits; elective for any MSc participant.
Objective : Obtain a general awareness of the marine environment aspects most relevant to offshore engineering. Part of this course is included in the core curriculum for 1 credit.

Offshore Wind Farms - OE5662
4 ECTS credits; elective for all OE MSc participants with adequate preparation.
Objective: This course combines knowledge from the design of bottom founded structures and from wind energy conversion systems and applies it to the design of an offshore wind farm.

Petroleum Engineering – TA3440
3 ECTS credits; elective for any MSc participant
Objective: To understand the field development process and equipment.

Acoustic Remote Sensing and Sea Floor Mapping – AE4-E13
4 ECTS credits; elective for all OE MSc participants.
Objective: Participants become aware of methods (along with their advantages and disadvantages) for mapping the sea bed and details on it. Positioning of objects on the sea bed is also discussed.

Gas- and Oil Processing Offshore – WB4418
4 ECTS credits; elective for any MSc Participants
Objective: Familiarization with all aspects of oil and gas processing on offshore structures.

Selecting Other or Additional Electives
If one were to select all of their programme courses from those listed in this booklet, he or she could be developing a rather narrow-minded career objective - at the least. This section gives some guidelines for choosing additional elective courses intelligently. The pool from which these may be chosen is seemingly endless; certainly any higher-level BSc course as well as any MSc course offered by any Dutch university is potentially acceptable.

Any remaining elective programme activities can be used for a variety of purposes. They are listed here in order of academic priority:

1. **Repair any shortcomings in one's Bachelors programme.**
   They provide - at the beginning - the opportunity to alleviate possible preparation deficiencies. This has top priority. Persons joining the Offshore Engineering MSc curriculum directly from a Dutch HBO school may, for example, include a few credits from their pre-offshore preparation programme (see section 5.6) in this category.

2. **Gather additional knowledge and skills to support one's choice of thesis topic.**
   This is a high priority requirement. Failure to gather an appropriate background to carry out a thesis project can lead to frustration and otherwise unnecessary delays in one's thesis work. Unfortunately, a few past participants can testify to this in hindsight.

3. **Develop one's own specific interest - whatever that might be.**
   As job competition increases - also after one has been employed for a time - and a most suitable candidate for a higher position is being selected - it is often one's additional interests and skills that help determine the selection result. Elective courses within the offshore curriculum can be used to (further) develop any such special interests. Typical examples might be courses in (project) management, law, economics, public speaking, etc.

In general, one can have quite some freedom in choosing courses within the framework of priorities outlined above. One important rule, however, is that a participant must (be able to) justify all of his or her choices to curriculum leader.

5. Management Aspects

5.1. PERSONAL STUDY MANAGEMENT

An industrial recruiter once stated: "It does not matter to me how long a student has spent on his or her study as long as he or she can provide a plausible explanation of why it has taken longer than the nominal time."

Good management of oneself and one's activities - especially those that take place in more direct interaction with university staff (such as oral exams or a quiz, an exercise or project and thesis work) - makes a good impression on everyone: University staff, one's parents (who may be paying the tuition bill!) and even prospective employers.

A special feature of good management is that work is delivered in a nicely completed way on or before the given deadline.

A Gantt diagram is a very good personal activity management tool. This somewhat calendar-like graphical image is a representation of all the activities to be carried out (even those outside the curriculum!) along with their durations and time planning. Chapter 8 of **An Offshore Participant's Survival Manual** gives more information about the Gantt diagram and its use.

One should also be wary of taking on a task that is too dependent upon completion of work by others - even coaches! An occasional participant has been 'left empty-handed' when his or her own work cannot progress further because of another person's failure to complete his or her work on time.

One aspect of personal study management is the sequence of events. Every participant should successfully have completed all courses required for his/her selected major/minor, before endeavouring into a thesis project.

5.2. MANAGING ONE'S TEACHERS

Several participants seem to think that they are the only participant in the OE MSc curriculum. While it is fortunate for continuation of the curriculum within the university that this is not the case, the other side of the coin is that each participant must arrange his or her coaching activities around their coaches' other tasks. As anyone who has arranged a common meeting with a group of coaches can testify, this is often a major logistic task in itself!

Because of each coach's full agenda it is also a misnomer to expect him or her to give immediate and full attention to a report from the moment that it is submitted. It makes little difference whether the work is part of a thesis report or an exercise - or most anything else for that matter.

All of this leads to the following more or less binding suggestions for working with and submitting work to one's coaches:

1. A written report (such as a segment of a thesis, or whatever else) is required as a basis upon which to discuss one's work or progress with a coach or coaching committee.
2. It is most appropriate that any written report first be checked by one's day-to-day coach. He or she can help the participant remove the most glaring technical and language blunders before the report is circulated to a wider audience - including the rest of one's thesis committee. Participants must remain aware of the fact that this cycle - including corrections - takes time as well.
3. Any written work (including that submitted in step 2 above!) to be discussed should be received by the persons involved at least **one week prior** to the planned discussion. Many participants overestimate the speed at which they can carry out work and as a consequence violate this rule by submitting material too late.
4. In order to take his or her evaluation and coaching work seriously, any coach who receives work which does not conform to the above rules has the option of demanding that the discussion meeting be postponed and thus re-scheduled.

5.3. THE OFFSHORE WEBSITE

Introduction

This section explains more about the offshore website - www.offshore.tudelft.nl - and especially its special features for offshore participants. The website allows at least three levels of access:

1. Public access is open to anyone who finds the website - www.offshore.tudelft.nl - and uses any of the 'buttons' on that or subsequent pages they can display.
2. Participant access that opens a new realm of more specific possibilities. One can access, review and in some cases update (parts of) one's own record in the database, for example.
3. Course Leader access in which he can make, modify and delete participant's data. He also enters course scheduling information or new issues of the **Offshore Engineering News**. His possibilities and privileges need not be explained here, however.

Public Features

The most important public features of the offshore website include:

1. A bit of general information about application procedures for foreign students considering participation in the Delft Offshore Engineering MSc Degree curriculum is available.
2. A detailed list of the programme requirements for each of the four specialisations is included in tables. (These can also be found among the centrefolds of this booklet.)
3. A quarter-by-quarter course schedule is given in a diagram. (This is also a centrefold.) By clicking on the box representing most courses in that diagram, one jumps to the formal description for that course.
4. The latest issue of the **Offshore Engineering News** is posted with its headlines listed on the left of the home page screen. One can even review a limited number of past issues via the archive also available via the site.
5. The class schedule for the current week is very popular because the offshore the curriculum is seldom exactly the same from one week to the next. Most any of the offshore engineering curriculum courses can

be found here. One can also review a day, a course, or even an entire quarter, if desired.

6. A facility to find addresses, etc. of various offshore staff members.
7. A posting of staff office hours is also being implemented.

Participant's Features

Logging In

Participants who are registered with the Curriculum Leader and have provided him with a correct e-mail address can access the participant section of the website by clicking on the blue arrow in the upper right-hand corner of the home page. One will then be asked to supply a password. If one is using this facility for the first time, one will not have a password. Instead, one should click on "Trouble logging in?" After providing one's university registration ID number, the website will mail a password to that person's e-mail address in the offshore database - provided of course that that person is listed there with the given ID number.

Once one successfully logs in at a later time, one can - and should - change his or her password from time to time.

A Participant's Record

Once logged in, each participant has access to his or her own information in the offshore database. This is set up with a number of tabbed sheets which - after a first page of general information such as name and address, etc - progress through one's academic career from late in one's BSc study (if done in Delft) on through the offshore engineering MSc Degree curriculum and even on to include one's status as an alumnus.

Note that one cannot modify the list of courses chosen; only the course leader can do this in consultation with the participant involved. Even so, participants as well as (recent) alumni can modify any of the fields in this database that are displayed with a white background. This includes one's address, etc. but perhaps more importantly, one can enter the date (yymm as a 4-digit integer number) to indicate when one has received a final grade for each course.

The database displays the sum of the credits one has selected as well as the credits one has completed - provided that a numerical date value is entered for completion. Users are warned that this database has no official status; if the records kept by the university disagree with the data here, then the university's record will very likely be given priority. Note that the credits counters are only activated when a database page is read. In order to see the results of - and store! - any new updates, one should switch to a different tab in his or her database and then - if necessary - return to the original one.

Another important point is that only one grade - that for the final thesis - is kept in this database. This grade, especially, is often used for reference purposes when suggesting job candidates to companies, etc. In contrast to most all other grades, this one need not be an integer value, by the way; a 7.5 (for example) will not normally be rounded off to an 8.

Other grades are posted in the participants pages in Blackboard.

6. A Foreign Study Setting

6.1. MOTIVATIONS

It can be culturally as well as intellectually especially enriching to conduct up to one year of MSc work in a country foreign to both one's native country (and the Netherlands, if this is not one's native country). In the past, offshore participants have carried out parts of their OE academic work in such countries as: Great Britain, Norway, France, Mainland China, Singapore, the United States, and even Tunisia and Oman.

Why go to a foreign country? The cultural reason has already been mentioned. A meaningful experience can be that of communicating in a group that does not share knowledge of a common language, for example.

A foreign setting can be handy from a technical point of view, too. Often participants who go to a foreign location do so in order to make use of specific equipment or expertise that is there. A participant went to Norway some years ago to study the degradation of ice by waves; the lab there had both the climate and the facilities to do this easily. All must concede that other locations can offer better opportunities in some areas than can be provided in Delft or even in the Netherlands.

There is a negative side to working in a foreign setting, however. Foreign study does cost more money most of the time in spite of all the various scholarship funds that may be available. Cultural aspects such as a possible language barrier will consume extra time as well. Communications with the 'home front' including one's TU Delft coaches is more cumbersome as well. Luckily, e-mail does a lot to alleviate this latter problem.
Whatever one does - for academic work - in a foreign country, the TU Delft OE Curriculum Leader remains involved with the evaluation and acceptance of any work.

6.2. APPROPRIATE FOREIGN ACTIVITIES

Industrial Practice - OE5680
Obviously industrial practice can be carried out at most any location as long as it brings the participant closer to (engineering) practice. While some form of offshore engineering experience is valued, this is not a (formal) requirement. An occasional participant has devoted his or her industrial practice period to a development aid project - sometimes in a very remote location. On the other hand, one girl spent her practice period as member of the Dutch delegation to The United Nations! Some form of appropriate practice site can be found in most any country. These are most often arranged via a Dutch company or organization, however. Contacts for foreign positions also often result from study tours to foreign countries organized by the offshore engineering society. Participation in these tours can be very valuable to one's further study and career.

Elective Courses
The next most popular foreign academic activity involves elective courses. These can be done at most any academic institution of sufficient quality.

There is a maximum of flexibility with regard to these courses; they add a new specialisation or profile to one's OE programme rather than contribute to its primary educational core.

Exercise Work - OE5670
Some participants have done exercise work at a foreign location - often at a foreign university and sometimes in a laboratory, there. Their task was then to help with an on-going experimental research project and - of course - to report on their part in that work and their results. One should not start on such an adventure unless one is sure that a result will be forthcoming. See section 7.2 for more about the risks involved.

Thesis Work - OE5690
Qualified participants can carry out thesis work in a foreign country. In such cases, these persons are usually temporarily adopted into a local research team and carry out and report on a more-or-less independent (for reporting purposes) study as their contribution to that team.

Required Courses
The inclusion of a generic required course such as advanced mechanics is usually possible. This is because all engineering schools offer such courses; they are often really quite similar.

The equivalent of most of specifically required TU Delft OE courses are more difficult to find at other institutions. In general, one can better not try to replace these in one's programme plan.

7. Diplomas and One's Professional Future

7.1. CURRENT AND PAST SITUATION

It should be obvious that it is the Offshore Engineering Master of Science Degree curriculum that is described in this booklet. All participants wishing to obtain this degree are required to register for this curriculum with the central university administration.

Offshore Engineering - in one form or another - has been included in one way or another for more than 25 years in the following Delft University of Technology (masters) degree programmes:

- Applied Earth Sciences (Petroleum Engineering)
- Civil Engineering
- Marine Technology (Naval Architecture)
- Mechanical Engineering

In each case, these degree-granting faculties have allowed their participants to include offshore engineering in the MSc-phase of their study. Usually, this has been done by combining - to the extent possible - a primary requirement that one get a well-defined background in the degree area with a more secondary importance attached to offshore engineering.

7.2. DUAL DEGREES (IN THE FUTURE)?

Background

On the one hand, there appears to be no superficial reason why a participant could not - in the future - earn Master of Science Degrees in both offshore engineering and one of the above 'more conventional' fields if one wished to. On the other hand, the concept earning two degrees at the same time has already brought up some intriguing questions such as: Can one earn 'double credits' for a course; in other words, can a single course or thesis count toward two different degrees at the same time? As of this writing, a few questions such as these have been posed but no definite policy has been determined. First impressions are that policy makers in high administrative positions - rather than the educational practitioners who are nearer to participant's (and professional recognition) needs - have

decided that dual degrees are forbidden. Even so, at least one case is known in which a MSc student earned a degree at a foreign university while - at the same time - accumulating elective credits for his Delft programme there.

Why Grant Dual Degrees?

If there is indeed a possibility to earn 'dual' masters degrees such as in Offshore Engineering and in Civil Engineering at the same time, then the question arises as to why one would want to do this. It all has to do with one's (formal) recognition as an engineering professional.

The Dutch Situation It is not necessary to work for dual degrees for the sake of professional recognition within The Netherlands; the Dutch professional title 'Ingenieur' is apparently coupled to the successful completion of nominally five years of study in Delft which includes any of its MSc Degrees.

A Foreign Situation Systems for assuring the quality of practicing engineers - and the right to use the title Professional Engineer (in the USA) or Chartered Engineer (in the UK), for example - vary from country to country. In the USA, one must pass a state-administered two-day examination to earn recognition; in the UK recognition is granted by one of its Institutions of Engineers. Neither country has a system for recognizing Offshore Engineers - as a separate profession - however; this can potentially result in difficulties for one wishing to practice engineering in such countries. While one might successfully obtain professional recognition in such cases in the field associated with his or her Bachelors Degree, this is not at all certain. The 'more conventional' (dual) degree can be 'inexpensive insurance' for such a situation.

At present, dual degrees are not normally permitted within the Delft University of Technology. Anyone expecting this to be problematic to his/her career abroad should consult with the Curriculum Leader.

7.3. EMPLOYMENT STATISTICS

Figure 7.1 is compiled from first employer data from those who have already completed the offshore engineering since the total (BSc + MSc) curriculum duration was restored to 5 years in Delft. The percentages listed in the table are indicative only and are somewhat biased by the fact that a disproportionate number of Dutch graduates with a civil engineering background is included.

Note that many of the general engineering and contracting firms in figure 7.1 also do offshore work; it is just not an exclusive activity with them. Interestingly, 7% of the graduates went on to further study, some for a deeper specialization and some for business.

In summary, the available statistics indicate that there is certainly employment for graduates of the OE MSc curriculum - especially in the private industrial sector. Additionally, they show that a significant number of the graduates find equally rewarding work outside the direct offshore engineering application area. Apparently, offshore graduates are well prepared to work in a wide range of professional positions.

Offshore employees are also mobile. They can be sent to many parts of the (usually more developed) world. Their mobility in the sense of changing jobs from company to company is also often high relative to workers in many other branches as well.

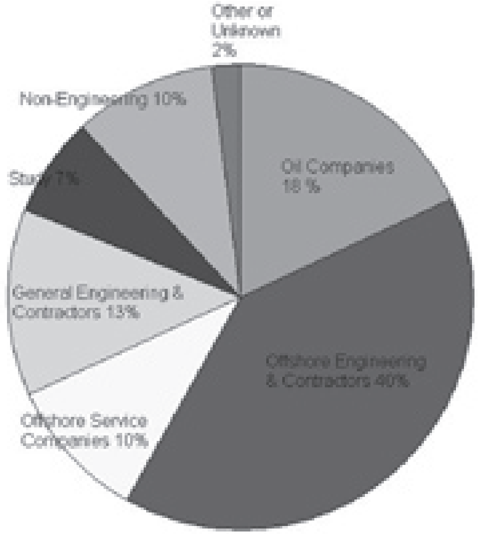


Figure 7.1. Offshore Engineering Graduate Employment Statistics

7.4. EARLY OFFSHORE CAREER EXPERIENCES

A common question in the minds of prospective participants is, “What do young offshore engineers do?” This section includes texts written by several recent graduates with a civil offshore engineering background. They were asked to describe what they were doing as young engineers in industry.

The following four contributions have been selected to illustrate the variety of activities offshore graduates carry out in the industry for which they have their primary preparation.

The last section of this chapter lists a few other career paths chosen by offshore graduates.

Saskia

Saskia wrote the following about 15 months after she started work with Heerema Marine Contractors: "I started working in the Structural and Marine engineering department. As many know, Heerema Marine Contractors performs many heavy lift operations using their fleet of semi-submersible crane vessels. My first project was preparations for the lift of a tower deck off the coast of South Africa. Swell (long waves) from the southern seas is nearly always present here. Swell can be very hazardous in such operations and can be present even when the sea looks pretty calm. Swell can cause very unpleasant and unanticipated motions of the load once it is lifted from the barge. I calculated the dynamic behaviour of the crane vessel, the barge and even of the deck hanging in the crane on the crane vessel using spectrum transformation techniques [from Offshore Hydromechanics, ed.]. On the basis of this work, we were able to estimate under which wave conditions the deck could be installed and which measures should be taken to dampen the motions.

"After this experience, I worked for a while on several other lift projects, including the installation of a steel tower and deck in the Norwegian sector of the North Sea. I performed analyses for the transportation, lift and up-ending of the tower as well as for the installation of the deck. I went offshore in August and October to supervise some offshore operations including a deck lift. This was a critical operation and we had been waiting on the weather for weeks. In consultation with the captain and project superintendent, we were able to alter the lift operation a bit - based upon analyses - so that the lift operation could be carried out.

"Most recently, I have been working more on deep water (1000 meters or more) developments. This reminds me of my own thesis work on the behaviour of steel catenary risers for deep water applications. I am now investigating the laying and fatigue service life of steel pipelines in very deep water. I am on the team developing procedures for laying pipes using the J-lay method; this is a very exciting prospect."

Remco

Remco reports - about a year after graduation: "I am currently employed by Marine Structures Consultants, a company that does design, engineering and computer simulation of offshore structures. The company is more or less specialized in jack-up platforms as well as semi-submersibles and dredges.

"I spent the first few months on site specific assessment (SSAs) of jack-up platforms. This involved the use of in-house-developed non-linear FEM software to determine the leg forces and jacking system loads and to check these values against the appropriate certifying regulations such as those from DNV or API. If all environmental conditions are below certain prescribed maxima, then the rig can be used without further analysis.

"Since every jack-up is different (even those of the same model can have different weight distributions, etc.) and every location has its own unique wave height, water depth and soil conditions, a SSA is needed even if only one environmental condition exceeds the given minimum. Since most contractors want to limit down-time as much as possible and to work in deeper water, SSAs are often needed.

"I am now working within a project team on the overall design and FEM analysis of a semi-submersible drilling rig. My task is to prepare the structural FEM models, interpret the results and to propose design solutions to the problems revealed by the analysis. This work brings together floating stability, hydrodynamic loading and shipbuilding disciplines in addition to FEM methods; it demonstrates the interdisciplinary character of offshore work. This FEM work links well to my thesis on a FEM analysis of a new type of anchor in the soil.

"The company is bidding for the design of a new jack-up for even greater water depths (up to 140 meters) and harsh, North Sea conditions. The first of these designs will require a lot of FEM work!"

Martin

Martin completed a thesis on the effect of air cushions beneath large floating concrete structures such as a floating airport before graduation. He wrote the following text about 18 months after completing his study:

“During my final year of university I started working for an agency through which I was employed on a part-time basis at a small offshore engineering company.

“During that time (about half a year) I worked on a project to develop a new method for the relocation of abandoned offshore pipelines. The work included theoretical hydrodynamic calculations and the execution of model tests in a wave tank.

“After my graduation I continued working at the same company on a full-time basis. I became project engineer and executed two concept studies. The first for a large Dutch oil & gas company considered the technical and economic feasibility of a mobile, reusable platform for gas production in the A and B blocks of the Dutch Continental Shelf.

“The second study was a pre-design of a Russian drilling and accommodation platform, which could be transformed into a production platform upon completion of the wells. I was leading about 3 to 5 draftsmen and 2 structural engineers on each project. I attended meetings with the clients representatives and with subcontractors such as a drilling company and installation contractors.

“During that time (about half a year) I worked on a project to develop a new method for the relocation of abandoned offshore pipelines. The work included theoretical hydrodynamic calculations and the execution of model tests in a wave tank.

“After my graduation I continued working at the same company on a full-time basis. I became project engineer and executed two concept studies. The first for a large Dutch oil & gas company considered the technical and economic feasibility of a mobile, reusable platform for gas production in the A and B blocks of the Dutch Continental Shelf. The second study was a pre-design of a Russian drilling and accommodation platform, which could be transformed into a production platform upon completion of the wells. I was leading about 3 to 5 draftsmen and 2 structural engineers on each project. I attended meetings with the client’s representatives and with subcontractors such as a drilling company and installation contractors.

“I learned a lot about other disciplines in a short time and recognized and applied a lot of things that I had learned in Delft.

“Currently I am working for a large engineering company as a structural design engineer. Though I have only been working here for six months, I already have executed numerous different projects. I started in a small team with a feasibility study considering a riser tie-in to an existing gravity base platform.

“I performed a structural capacity review of the topsides of that same GBS using a 3-D finite element programme. The interaction between the various disciplines was sometimes very close or even overlapping. As a structural engineer one is immediately involved in all aspects of the design.

“The last few months I have been involved in the tail-end engineering of the construction of an FPSO. The work included solving site queries, replying to Lloyds (the insurer’s) queries relevant to their appraisal of the structural work, and providing engineering support for the construction yard team.

“Now (when the offshore business was a bit weaker for the company) my next project is the foundation design of an onshore light hydrocarbons plant to be built in Argentina. This will be a new challenge; there is a lot to learn and to do.”

Bart

Bart was an Assistant Structural Engineer with a large engineering and contracting firm, Stork Engineers and Contractors when he wrote this about six months after completing his study: "Structural means that my main discipline lies in designing the beams, stringers, nodes, plates, etc., of, for example, a topside of an offshore platform.

"In other words, I (try to) deliver the 'frame' in which the other divisions of the company (like Piping, Instrumentation and Process) can place the machinery that is necessary to get the whole 'factory' going.

"The company's offshore work concentrates primarily on fixed offshore structures; the first project I worked on was an offshore platform for Elf Petroland. Such a project starts with a meeting where the different disciplines gather and brainstorm to set the boundary conditions. Then, very roughly, the actual project goes as follows:

- The Process division looks at the processes and informs Instrumentation
- Instrumentation decides what instruments and equipment to use and informs Piping
- Piping tries to make an optimum lay-out of all this."

[Editor's remark: These steps would be more integrated today!] "This results in a plan in which all instruments and equipment have been placed and therefore all 'loads' are known. From here on, the structural engineer has to design a platform (sub- and/or superstructure) which will be able to carry these loads and will last for at least the design life as has been specified in the boundary conditions.

"I mainly worked on the connections of the main beams of the superstructure to the platform legs, which were ring-stiffened joints, and on equipment supports.

"Besides these fixed platforms, the company also wants to (re)penetrate the market for the design of floating production, storage and off-loading units (FPSOs), which basically are factories built on old tankers. My function in a newly created FPSO-team will be bidding.

"Bidding is the process in which the complete project has to be thought through quickly but thoroughly (other companies will do the same and will be bidding too!) in order to come to a cost estimate, which forms the basis for the bid. A few questions a bidder has to think of include: - Which instruments and what kind of equipment do we need? - What are the costs of the instruments/equipment and who will supply it? - What kind of structural concept do we choose? - How much does this structural plan cost (this needs a basic strength calculation!)? - Do we buy, build or rent the tanker? - ...

"I especially requested this function, because firstly, this way I hope to do a lot of (differing) projects in a relatively short period of time and secondly, because bidding concerns a complete project and not just the structural part of it. Both reasons are based on the desire to learn as much as possible about offshore engineering possibilities and hence to find my professional development route."

7.5. OTHER PROFESSIONAL CAREER PATHS

The above examples all come from the offshore industry. Not every offshore graduate chooses to work in that field however; roughly 20% find other ways to make themselves just as useful to society. A number of perhaps less obvious alternatives already chosen by recent graduates illustrates the spectrum of other possibilities:

- Bernold, who also happens to have earned a degree in Economics from Erasmus University in Rotterdam while studying in Delft, now works for the ABN-AMRO Bank.
- Mark's first job was with the product promotion department of Proctor and Gamble.
- Ketut has completed his PhD degree within the Fluid Mechanics group in Civil Engineering in Delft; he was offered a similar position at Cambridge University, by the way.
- Glynn works for Toornend and Partners, Management Consultants.

7.6. A PHD STUDY

It has already been indicated in section 7.3 that about 8% (or about 1 in 12) of the offshore MSc graduates continue their studies after earning their offshore degree. Some broaden their background via a complementary study such as business; a more select group of others choose to work toward a PhD or Doctor of Science degree.

It is often easiest if one does this more or less directly after completing the MSc Degree; it prevents one from losing his or her academic study mentality momentum. Also, while more have chosen to remain in Delft for their PhD work, this is not a requirement, either. Indeed, one graduate - obviously some time ago now - successfully completed a PhD degree at Texas A&M University after working for a short time in the offshore industry in Houston, Texas.

A PhD study at Delft lasts a nominal four years, but usually takes five. Most new candidates are evaluated after one year; this is when the formal decision to accept or reject them as PhD candidates is made.

One of the major hurdles to continuing on for a PhD anywhere is funding to pay the candidate a salary as well as to cover all the other associated expenses - think possibly of experimental apparatus that must be designed and fabricated.

Qualified Delft MSc participants can find it easier to arrange timely funding and make the transition to the PhD study than other potential PhD candidates. This is because:

1. They are already well-know to the faculty members. This can motivate them to make the extra effort needed to help find funding and other arrangements.
2. If a plan becomes clear soon after one starts on his or her MSc thesis, then this can reduce the time gap between one's MSc graduation and the award of funding.
3. The specialisation of one's MSc thesis can be modified so that one's PhD work becomes an in-depth extension of the MSc thesis work.

Appendix : Industrial Practice and Thesis Work Procedures

A1 INTRODUCTION

This appendix gives more details about two very significant elements of the Offshore Engineering MSc Degree curriculum: Industrial practice and thesis work. The first of these activities must be carried out with industry or another external agency; most of the theses are carried out in the same way.

In most cases, each participant should treat the acquisition of one of these positions just like applying for a job. He or she should prepare a resume stating professional objectives and giving a bit of his or her professional history and submit this to potentially attractive 'employers' for consideration.

Note that while industrial contacts are stimulated within the Offshore Engineering curriculum, industrial practice is not an absolute requirement. The Curriculum Leader does, however, encourage each participant to include at least some industrial contact within his or her programme plan.

A2 INDUSTRIAL PRACTICE - OE5680

8 to 14 ECTS credits.
Teachers: Topic-dependent; supervised by the Curriculum Leader,
E-mail: OECL@offshore.tudelft.nl
Scheduling: Flexible; generally not before completion of the Survey of Offshore Engineering Project - OE4610 and a total of at least 40 offshore engineering course credits have been completed.

The objective of industrial practice is to let a participant see how what has been learned in the classroom is utilized in practice. This brings each participant in direct contact with the engineers, technicians and skilled workmen carrying out the result of engineering design. By working closely at all levels, one develops an appreciation for skills and an understanding of these peoples' problems.

In contrast to some other reports, one's industrial practice report need not be lengthy. Key questions to be answered include:
- What and where was the assignment?
- Between what dates was it carried out?
- What was actually carried out (without all the technical and potentially sensitive details)? A statement such as: "I was assigned to keep track of and schedule the use of the company's single land-based heavy lift crane so that there was a minimum of delay to the several projects which needed it." can be sufficient. It is not necessary to report all the details of the actual scheduling carried out.
- What were my observations while doing this work?
- What did I learn from the experience?

Some participants keep a day-to-day logbook of their activities during their industrial practice period. This can be a valuable appendix to their report.

A3. THESIS - OE5690

37 ECTS credits; corresponding to 26 (nominal) weeks of work.
Teaching Staff: The coaching team or thesis committee is dependent upon topic, but usually including the offshore engineering curriculum leader and at least two other TU Delft faculty members including at least one full professor who serves as coaching team chairman. Each industry-sponsored thesis also includes at least one representative from the hosting company or agency.

A3.1. BASIC THESIS SET-UP

Normally a required thesis culminates one's learning experience in all TU Delft MSc curricula. It serves to prove that the participant has indeed intellectually processed and can utilize much of the material that has been included in his or her study and can apply (and even extend if necessary) this knowledge for the sake of a realistic and practical problem.

The university maintains close contact with each thesis participant - independent of where this is carried out. He or she is coached from the start by a committee including the following persons:
- A full professor who serves as Chairman of the thesis committee. He will most likely be the full professor "closest" to the thesis topic,
- A full professor from the participant's (additional) degree faculty (when appropriate); see section 7.2.
- The offshore engineering curriculum leader or other coordinating person,
- A coach from the industry involved, if appropriate - see below.
- Any additional university coaches needed for their expertise.

At least three TU Delft staff must be included in any thesis committee, by the way.

This thesis committee usually meets at intervals with the participant from the time that his or her thesis proposal is submitted. By involving the entire team from the start of the thesis work, the participant can be reasonably sure that his or her work will meet both the requirements imposed by the hosting industry as well as those of the university. The offshore group was among the first to use coaching teams for participant theses; they have been universally successful.

Section 6.2 discusses modifications to this when one carries out a thesis in a foreign country.

Each participant concludes his or her thesis with a public presentation, normally about one week after the final meeting with his thesis committee.

A3.2. THESIS BREADTH AND DEPTH

Generally, each thesis can be divided into two segments: The first, usually taking the first few weeks, is one in which the participant surveys a problem and defines a number of more detailed problems which must be solved. The second portion taking the remaining time is devoted to solving - in quite some detail - at least one of the problems described during part one.

In this way, the OE participant demonstrates two of the abilities that distinguish him or her from those of a lesser technical level:
1. He or she can oversee and survey a larger problem.
2. A university engineer is capable of exploring a specific (detail) problem in more depth.

A3.3. AN INDUSTRIAL THESIS

A special feature of OE MSc Degree curriculum is that a large majority of its thesis projects result from specific industrial questions. Indeed, most qualified OE participants carry out their thesis in industry - using industry facilities and with day-to-day industrial coaching. Most participants receive a modest salary or some other form of compensation from their host industry while carrying out this thesis work. This strong industrial link assures the practical relevance of the projects and at the same time eases the participant's transition to becoming a productive member of an industrial society.

The industry providing the thesis will of course also impose certain requirements - such as desiring that the participant be present each day and during normal working hours (at least!). It can be difficult to integrate what some (still!) consider to be a 'normal student' life into an industrial thesis project.

Another potential industrial requirement is one of confidentiality of the results of one's work. Such a restriction need not be a problem for the university nor for the thesis participant as long as all are made aware of it in a timely fashion. Normally the university requires that confidentiality is suspended two years after completion of the thesis.

A3.4. LAB WORK

A few OE participants choose to include laboratory work within their thesis. Lab work must be planned carefully and often well in advance. In many cases, special equipment must be obtained or even fabricated; this takes time during which the thesis participant can do little - at least on his or her thesis! The use of specific lab facilities must usually be planned well in advance as well.

As a result of all this, those planning a laboratory thesis should be prepared to allow more (total) time to complete their work. The personal satisfaction of having designed and carried out such work can compensate the extra effort involved. Although all course work directly related to the thesis

should - obviously! - be completed ahead of time if possible, it can be handy to reserve some planning 'space' for (extra) elective courses and/or exams to fill up any gaps that may arise in the execution of an experimentally-based thesis.

A3.5. OTHER THESIS FORMS

Of course there are many thesis forms available. Lab work, mentioned above, needs special attention, but a thesis can also be targeted more on analysis or design, on theory versus practice, concentration on a specific area or including more breadth - to give just a few examples. Each OE participant should carry out a careful self-analysis of his or her abilities and desires as part of the thesis selection process.

A3.6. THESIS PROCEDURES

Planning is important in any activity - including a thesis project. It has been said that "He who fails to plan, plans to fail." While admittedly it is difficult to plan an unknown (thesis writing) process, a plan with suggested project milestones should be included as part of the proposal. These milestones - once the committee has approved the plan at their first meeting with the participant - can serve as a basis for planning the next meeting.

As any participant who has had to postpone a thesis committee meeting can testify, it is often a major task in itself to arrange a mutually convenient new meeting within a reasonable time.

When making a plan, be sure to remember that committee members need to have at least a week to review the written materials submitted for discussion at their next meeting with the participant. While a week may seem long to some, too many participants fail to realize that they are not the only participant in this learning community. In the past (and probably in the future, unfortunately), any committee member can and may call off a meeting for which the materials are not received well ahead of time.

A corollary of this is to be sure that anything submitted is also clearly marked. Written materials should have a title, date and author's name at least.

A document file should also have a good identifying name which links it to a person; thesisdraft.doc is not such a name!

After approximately six month from the start of the thesis work, the participants presents his report in a meeting with his thesis committee. Note that the report **must** be available to the committee members no less than one week before the planned date of this presentation. The presentation itself usually is done with help of power point slides and may take in the order of two hours. This is the non-public part of his MSc examination. Assuming that his report and presentation are considered satisfactory, the participant will be admitted to the public presentation and defense of his thesis, usually about one week after the closed door session. Immediately after the public defense, the committee will withdraw to discuss the grade. Returning within minutes, the chairman of the committee will hand over the MSc in Offshore Engineering diploma.

Many of the most successful participants keep their thesis committee members informed and up-to-date on developments; they manage their committee instead of waiting for the committee to manage them. Additionally, participants should feel free to consult with any of their thesis committee members on an individual basis between committee meetings if necessary.

Internship

Usually a internship is arranged via one of the staff members of the section to which your specialisation belongs. In addition to this you can visit the Information Centre of the Student Facility Centre (see above). They offer a lot of information, not only on a large number of companies abroad, but also on financially related affairs, working permits, visa, etc.
Additional information on both study and internship abroad is available at the TU Delft website (www.tudelft.nl) > Campus Portal > Student Affairs > Internship, study, jobs.

International Coordinator 3mE
Mrs M.P.I. Toppenberg
Room 8C, ground floor
Mekelweg 2
2628 CD Delft
Tel: +31 (0)15 27 86959
Fax: +31 (0)15 27 88340
E-mail: m.p.i.toppenberg@3me.tudelft.nl

FACULTIES

The Faculty of 3mE

The faculty Mechanical, Maritime and Materials Engineering (3mE) offers the MSc programmes Biomedical Engineering (BME), Materials Science and Engineering (MSE), Mechanical Engineering (ME), Marine Technology (MT), Systems and Control (SC) and Offshore Engineering (OE). The faculty also participates in the interfaculty MSc programmes Transport, Infrastructure and Logistics (TIL).

The organisation of the faculty and the structure of the educational board and board of examiners of the faculty are described in the faculty regulations. The dean has the final responsibility for the faculty. He is assisted by the Director of Education. Together with the department heads they form the management team. The dean is supported by the Faculty Staff and is advised by a number of advisory boards.

Dean

Prof.drs. M. Waas
Room 8F-1-14
Tel: +31 (0)15 27 85401
E-mail: m.waas@tudelft.nl

The Faculty of Civil Engineering and Geosciences

Civil Engineering is concerned with the development, design, production and management of the physical infrastructures required to safeguard the safety, health, business activity and sustainability of our society. These facilities are built to provide services such as water management, soil management, urban development, flood protection, drinking water production, waste treatment, transport by water, rail and road, and to perform other functions for the public (such as utilities and offices).

Education support staff

The education support staff is executing the education support of the study Offshore Engineering. For all issues related to the Offshore Engineering study the students can get information. The Education Support Staff consists of the following persons:

Ir. G.H.G. Lagers
Curriculum Leader
Tel: +31 (0)15 27 89445
E-mail: OECL@offshore.tudelft.nl

Dr.ir. Eric Logtenberg
Manager
Department O&S
Tel: +31 (0)15 27 89520
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Dorothea Brouwer
Assistant Coordinator Education
Tel: +31 (0)15 27 83302
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Fatma Çinar
Assistant International Coordinator
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Teuni Eden
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Ewoud van Luik
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Tel: +31 (0)15 27 85734
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Susanne van der Meer
Secretary and Quality Assurance
Tel: +31 (0)15 27 85499
E-mail: s.d.w.m.vandermeer@tudelft.nl

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Educational Adviser
Tel: +31 (0)15 27 85921
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Mascha Toppenberg
International MSc coordinator
Tel: +31 (0)15 27 86959
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Dr.ir. Sape A. Miedema
Director of Education
Tel. +31 (0)15 27 88359
E-mail: s.a.miedema@tudelft.nl

ir. Jaap v.d. Zanden
Study Advisor
Tel: +31 (0)15 27 82996
E-mail: j.vanderzanden@tudelft.nl

Education Support Staff
Mekelweg 2
2628 CD Delft
Location 8C, ground floor
Tel: +31 (0)15 27 85499
Fax: +31 (0)15 27 88340

Education committee

The education committee advises the dean and the education director on the contents and the structure of the study programme and the examinations. The education committee consists of three lecturers and three students. The education director takes also part in the meetings.

Chairman
Prof.ir. W.J. Vlasblom
Tel: +31 (0)15 27 83973
E-mail: w.j.vlasblom@tudelft.nl

Secretary 3mE
Dorothea Brouwer
Tel: +31 (0)15 27 83302
E-mail: d.j.w.m.brouwer@tudelft.nl

Board of examiners

The board of examiners consists of all lecturers involved in the study programme. The board of examiners is responsible for the rules and regulations of the examinations and the assessment of the examination results. Requests can be addressed to the board of examiners for participating in a deviating study programme.

Chairman
Prof.drs.ir. J.K. Vrijling
Tel: +31 (0)15 27 85278
E-mail: j.k.vrijling@tudelft.nl

Secretary 3mE
Ewoud van Luik
Tel: +31 (0)15 27 85734
E-mail: e.p.vanluik@tudelft.nl

"Dispuut Offshore Technology"

The "Dispuut Offshore Technologie" (DOT) is the Offshore Engineering Association for all offshore students at Delft University of Technology. It is presided by an annually changing board, consisting of five offshore engineering students. The aims of the DOT are to motivate and to interest all offshore engineering students for the offshore study programme and further to keep the current offshore students posted of current activities in the offshore technology industry and to bring the students in contact with the offshore industry.
Contact between offshore students and the industry is very important. It is one of the most important tasks of the DOT to bring students, in any possible way and as early as possible, in contact with the offshore industry. This is being done by organizing lectures, symposia, study tours, excursions and films. Also, some subjects in the program are taught by personnel from the industry.

Dispuut Offshore Technologie
Room 2.74, CE
Tel: +31 (0)15 27 85260
E-mail: dot@offshore.tudelft.nl
Website: www.dot.tudelft.nl

Foreign Student Financial Support (FSFS)

Delft University of Technology provides financial assistance to foreign students in cases where their study suffers delay due to special circumstances like physical illness, physical or sensory disorder, mental problems, insufficient organisation of the educational programme by the faculty.

Mrs. Teunie Eden, study advisor for all Offshore students, as well as Harrasment Counsellor (see below).
Specialisms: Exchange students, International MSc-students, social programme international students
Mekelweg 2
2628 CD Delft
Room 8C, ground floor
Tel: +31 (0)15 27 82176
E-mail: t.eden@tudelft.nl

Ir. Jaap v.d. Zanden, study advisor for all students.
Specialisms: Graduate students, polytechnic students, quality control, student mentors
Mekelweg 2
2628 CD Delft
Room 8C, ground floor
Tel: +31 (0)15 27 82996
E-mail: j.vanderzanden@tudelft.nl

Dyslexia

Students suffering from dyslexia usually have problems reading and understanding long texts. This may hamper 'normal' academic progress. These students are therefore advised to contact one of the study advisers and to set up a remedial plan. Important issues are:

- A planned study delay often helps
- If necessary, extra time for examinations can be requested
- Studying with a fellow student often improves academic progress
- IBG offers extra student grants

Harassment Counsellor

If you have problems you can turn to the Harassment Counsellor appointed by the Faculty. These counsellors operate on a strictly confidential basis and can offer advice, information, support and assistance to victims of harassment. When necessary they may enlist the assistance of mediators. They can also assist and guide you should you wish to submit your complaint to the TU Delft Complaints Committee. All actions are subject to your permission and approval. If you experience any problems in this area, do not hesitate! Everyone at TU Delft has the right to feel safe and respected!

The Harassment Counsellor of our Faculty is:
Mrs T. Eden
Mekelweg 2
Room 8C, ground floor
Tel: +31 (0)15 27 82176
E-mail: t.eden@tudelft.nl

Facilities

In this study guide, locations in the faculty building are indicated by means of a number and a letter between brackets which can be found on the map on the campus site of 3mE > Facilities. The floor is also indicated (BG= ground floor, 1st = first floor, etc.).

Lecture Rooms / Meeting Rooms

Lecture rooms are used for lectures, presentations and instruction. The table below summarises all lecture rooms, giving their capacity and location. Meeting rooms are available for meetings, discussions etc. for small groups of students. Reservations can be made at the education and student affairs desk.

Room	Capacity	Location
A	300	6, BG
B	200	6, BG
C	150	6, BG
D	150	6, BG
E	70	6, BG
F	70	6, BG
J	50	8D, 1st
K	30	8G, 1st
L	30	8G, 1st
P	40	4

Individual study facilities

Individual study places are available at several locations in the faculty. Some of these are equipped with computers. These places are free to use, without a reservation. Places should be left clean and tidy. In addition to the study places at the Faculty, there are individual study places in the central library. In the library you are expected to observe silence. There, the same rules apply as those for the faculty study places.

Computer rooms

In addition to the computers at the study places, computers are also available in the computer rooms. All computers provide access to the Internet. The computer rooms are open for use by students, unless they are being used for teaching. In that case, there is restricted access. A schedule on the door of each computer room shows when the room will be in use. The table below gives an overview of all computer rooms and their location.

Room	Location
Athena	building part 4, 1^{st}
Parthemus	building part 4, 1^{st}
Pallas	building part 4, 1^{st}
Design studios	building part 8G, Ground Floor

Overview of Courses

MASTER'S PROGRAMME OFFSHORE ENGINEERING 2006

AE3-W02	Introduction to wind energy
AE4-E13	Acoustic remote sensing and sea floor mapping
AES1730	Soil mechanics applications
CT4130	Probabilistic Design
CT4140	Dynamics of Structures
CT4320	Short Waves
CT5316	Wind waves
CT5317	Physical Oceanography
OE4601	Survey of Offshore Engineering lectures
OE4603	Introduction to Offshore Structures
OE4610	Survey of offshore engineering projects
OE4620	Offshore Hydromechanics
OE4623	Drive system design principles
OE4624	Offshore soil mechanics
OE4625	Dredge Pumps and Slurry Transport
OE4626	Dredging processes
OE4651	Bottom Founded Structures
OE4652	Floating Structures
OE4653	Marine Pipelines
OE4654	Sub Sea Engineering
OE5662	Offshore Wind Farm Design
OE5663	Dynamic Positioning
OE5664	Offshore moorings
OE5670	Integrating Exercise
OE5671	Design of dredging equipment
OE5680	Industrial Practice
OE5690	Thesis
TA3440/PE+RG	Petroleum Engineering
WB1217	Strength of materials 2
WB4418	Gas and oil processing offshore

MSC OE 1ST YEAR

AES1730	Soil mechanics applications
CT4130	Probabilistic Design
CT4320	Short Waves
CT5316	Wind waves
CT5317	Physical Oceanography
OE4601	Survey of Offshore Engineering lectures
OE4603	Introduction to Offshore Structures
OE4610	Survey of offshore engineering projects
OE4620	Offshore Hydromechanics
WB1217	Strength of materials 2
MSc OE Bottom Founded Structures	
CT4140	Dynamics of Structures
OE4624	Offshore soil mechanics
OE4651	Bottom Founded Structures
WB1217	Strength of materials 2
MSc OE Dredging Engineering	
OE4623	Drive system design principles
OE4625	Dredge Pumps and Slurry Transport
OE4626	Dredging processes
OE5671	Design of dredging equipment
MSc OE Floating Structures	
CT4140	Dynamics of Structures
OE4623	Drive system design principles
OE4652	Floating Structures
OE5663	Dynamic Positioning
OE5664	Offshore moorings
WB1217	Strength of materials 2
MSc OE Sub sea Engineering	
OE4623	Drive system design principles
OE4653	Marine Pipelines
OE4654	Sub Sea Engineering
OE5663	Dynamic Positioning

MSC OE 2ND YEAR

OE5670	Integrating Exercise
OE5680	Industrial Practice
OE5690	Thesis

Course	Code: AE3-W02	Course title: Introduction to wind energy	ECTS: 4
Education Period	1st Education Period, 2nd Education Period		
Exam Period	none		
Instructor	Dr. G.J.W. van Bussel; E-mail: G.J.W.vanBussel@tudelft.nl Ir. W.A. Timmer; E-mail: W.A.Timmer@lr.tudelft.nl Ir. W.A.A.M. Bierbooms; E-mail: W.A.A.M.Bierbooms@tudelft.nl		
Education Method	Lecture + assignment		
Judgement			
Course Contents	Introduction, status, technology, market, wind climate, Weibull, wind shear, turbulence. Momentum theory, power coefficient, power curve, BEM, airfoil/blade design. Annual yield, farm efficiency, capacity factor, dynamics, principles of modelling. Design assignment I: rotor Control strategies, safety, pitch/stall. Drive train, generator characteristics, fixed vs. variable rpm direct drive. Presentation of assignment 1: rotor design. Assignment II: Drive train and generator. Dynamics, principals of modelling, important degrees of freedom and excitations, Campbell diagram, relation between noise requirements, rpm, tower and blade frequency. Presentation of assignment II: Drive train and generator. Assignment III: Dynamics. Stiffness, strength and fatigue as design drivers, GRP fatigue. Design considerations. Presentation of assignment III: Dynamic. Assignment IV: Fatigue. Offshore aspects, support structures, maintenance and installation techniques, social and environmental aspects: noise, visual, bird impact. Presentation of assignment IV: Fatigue. Assignment V: Control. Cost breakdown of turbine, -park, calculation of KWh costs. Invited speaker. Presentation of assignment V: Control Assignment VI: Economy. Presentation of assignment VI: Economy, Evaluation of course. Excursion to manufacturer or wind power plant		
Study Goals	Introduction to wind energy application and design of wind energy conversion systems. Integration of knowledge from various fields of engineering on wind turbine design.		
Literature and Study Materials	'Wind energy Explained', Manwell, McGowan, Rogers. It is possible to borrow the book from the secretariat of the wind energy section. Lecture notes. Recommended literature: Guided tour at www.windpower.dk		
Contact			
Expected prior knowledge			
Remarks	This is multidisciplinary course, attended by students from various departments (LR, ITS, CITG, OCP).		

Course	Code: AE4-E13	Course title: Acoustic Remote Sensing and Sea Floor Mapping	ECTS: 4
Education Period	2nd Education Period		
Exam Period	2nd Exam Period, 3rd Exam Period		
Instructor	Dr.ir. M. Snellen; E-mail: m.snellen@lr.tudelft.nl Prof.dr. D.G. Simons; E-mail: D.G.Simons@tudelft.nl		
Education Method	Lecture		
Judgement			
Course Contents	Relevant physical oceanography; Elements of marine geology (seafloor topography, acoustical properties of sediments and rocks); Underwater sound propagation (ray acoustics, ocean noise); Interaction of sound with the seafloor (reflection, scattering); Principles of sonar (beam forming); Underwater acoustic mapping systems (single beam echo sounding, multi-beam echo sounding, sidescan sonar); Non-acoustic techniques (lidar); Data analysis (refraction corrections, digital terrain modelling, data fusion); Applications (hydrographic survey planning and navigation, coastal engineering); Current and future developments.		
Study Goals	Seafloor mapping is concerned with the determination of seafloor topography/morphology, the dynamic behaviour therein and the mapping of seafloor material properties. Applications range from hydrography, navigation, geology and geophysics to marine biology and coastal engineering. The various acoustic remote sensing techniques for seafloor mapping are explained on the basis of the following: The basic physical principles on which the techniques are based; The sonar signal processing principles; The behaviour of the acoustic sensing signals in the underwater medium. The pros and cons of the various techniques (including nonacoustic techniques) are discussed. At the end of the course the student is capable of designing a seafloor mapping survey for a particular application.		
Literature and Study Materials	Handouts: Simons, 'Seafloor Mapping' 2003		
Contact			
Expected prior knowledge			
Remarks			

Course	Code: AES1730	Course title: Soil mechanics applications	ECTS: 3
Education Period	1st Education Period		
Exam Period	Differently to be announced		
Instructor	Prof.dr.ir. F.B.J. Barends; E-mail: F.B.J.Barends@tudelft.nl Dr.ir. D.J.M. Ngan-Tillard; E-mail: D.J.M.Ngan-Tillard@tudelft.nl		
Education Method	3 practicals (laboratory and test data interpretation) of 3 hours each and 19 hours lectures and exercises.		
Judgement			
Course Contents	The course reviews basic aspects of soil mechanics such as stresses and strains, deformation and strength and ground water flow. It covers a wide range of applications of soil mechanics in construction: prediction of settlements due to consolidation, calculation of bearing capacity of shallow and deep foundations, calculation of earth pressure for retaining structures (dikes, sheet pile wall, quay wall), analysis of slope stability, principles of soft ground tunnelling and ground improvement techniques. Practical laboratory work supports the theory of consolidation. Permeability and oedometer tests are conducted and results are interpreted using the Kopjan, Bjerrum and a, b, c methods.		
Study Goals	This course is tailored for (engineering) geology students, road and railway and offshore engineering students who have no knowledge of soil mechanics and geotechnical engineering. It is organized at the start of the MSc to ensure all students are optimally prepared to follow the courses of their core programme and select electives focussing on geotechnical engineering.		
Literature and Study Materials	- Handouts Applied Soil Mechanics written by Frans Barends; - Soil tests manual; - Soil mechanics by A. Verruijt, 2001. All available in digital format on blackboard.		
Contact			
Expected prior knowledge			
Remarks			

Course	Code: CT4130	Course title: Probabilistic Design	ECTS: 4
Education Period	1st Education Period, 2nd Education Period		
Exam Period	2nd Exam Period, 4th Exam Period		
Instructor	Dr.ir. P.H.A.J.M. van Gelder; E-mail: P.H.A.J.M.vanGelder@tudelft.nl Prof.drs.ir. J.K. Vrijling; E-mail: J.K.Vrijling@tudelft.nl Prof.ir. A.C.W.M. Vrouwenvelder; E-mail: A.Vrouwenvelder@citg.tudelft.nl Ir. M.A. Burgmeijer; E-mail: M.A.Burgmeijer@tudelft.nl		
Education Method	Lectures, Excercise, participation is voluntary. Half point bonus for exam if exercise is passed satisfactorily.		
Judgement	One mark, based on written exam and a voluntary exercise. Half point bonus for exam if exercise is passed satisfactorily. This bonus is valid for one year.		
Course Contents	Objectives of probabilistic design of civil structures. Probability Calculus; Steps in a Risk Analysis; Inventory of possible unwanted events, effects and consequences; Determining and evaluating the risk. Decision-making based on risk analysis; Decision-making under uncertainties; Probabilistic analysis of the decision problem; Frame of reference concerning safety; Current Dutch safety standards; Generally applicable safety standards. Reliability of an element; Limit state functions, strength and load; Ultimate and serviceability limit states; Strength of concrete, steel, timber, soil, etc; Loads of traffic, wind, waves, water, earthquakes, precipitation, ice, etc; Time dependence. Reliability calculation methods; Level III methods; Numerical integration; Monte Carlo method; Level II methods; Non-linear limit state functions; Non-normally distributed variables; Dependent random variables; Comparison of different calculation methods. Failure probability and life span; Deterioration processes; Risk calculation of systems with a variable rate of failure; Non availability; Markov processes; Load combinations. Strength calculation with level I method; Linking the level I method to the failure probability calculation; Standardisation of alpha-values; Load combinations for level I strength calculations. Reliability of systems; Probability of failure of the serial system; Probability of failure of the parallel system; FMEA (Failure Modes and Effects Analysis); FMECA (Failure Modes, Effects and Criticality Analysis); Event tree; Fault tree; Cause consequence chart; Reliability of correctable systems. Scheduling the realisation of activities; Introduction to scheduling uncertainties; Influence of corrective		

	measures on duration and costs; Maintenance; Introduction to maintenance strategies; Effect of maintenance on risk; Influence of inspections. Application areas; Structural safety of buildings, dikes, offshore platforms, bridges, etc; Maintenance and management; Quality assurance; Safety management; Geostatistics; Reliability of software.
Study Goals	After the course, the student has to be able to do Level I, II and III calculations, risk-based optimisations and system probability calculations.
Literature and Study Materials	obligatory lecture note(s)/textbook(s): Probabilistic Design Available at Bookshop Civil Engineering. recommended other materials: Practice exams. Available at Bookshop Civil Engineering, also on blackboard.
Contact	
Expected prior knowledge	
Remarks	

Course	**Code: CT4140**	**Course title: Dynamics of Structures**	**ECTS: 4**
Education Period	3rd Education Period		
Exam Period	3rd Exam Period		
Instructor	Dr.sc. A. Metrikine; E-mail: A.Metrikine@tudelft.nl		
Education Method	Lectures		
Judgement	Based on the result of the written exam.		
Course Contents	Introduction. Challenging dynamic problems of modern civil engineering; Types and sources of dynamic loading on structures; Dynamic behaviour of systems with 1and 2 degrees of freedom revisited: main phenomena, introduction to the Fourier Analysis, aero-elastic instabilities (galloping and flutter).Vibrations of discrete systems with N degrees of freedom (N DOF).Derivation of equations of motion; Free vibrations of undamped N DOF systems: natural frequencies and normal modes, modal mass matrix and modal stiffness matrix, the Rayleigh method; Forced vibrations of undamped N DOF systems: Modal Analysis, the steady-state response to a harmonic load, the frequency-response function. Modal Analysis, Fourier Analysis, the steady-state response to a harmonic load of N DOF systems with viscous damping. Vibrations of one-dimensional (1D) continuous systems of finite length. Derivation of equations of motion for beam in bending, beam in shear, rod in axial motion, rod in torsion and taut cable; The boundary and interface conditions for continuous systems; Free vibrations of undamped 1D continuous systems: the method of separation of variables, natural frequencies and normal modes; Forced vibrations of 1D continuous systems (both with and without viscous damping): Modal Analysis, Fourier Analysis, the steady-state response to a harmonic load. Waves of one-dimensional (1D) continuous systems. Excitation, propagation, reflection and transmission of pulses in cables and rods; Harmonic waves and representation of travelling pulses as the superposition of the harmonic waves; Dispersion Analysis; The steady-state response of piles and rails to harmonic loads.		
Study Goals	The goal of this course is to introduce various dynamic models of structures and to acquaint the students with the main ideas and methods of structural dynamics.		
Literature and Study Materials	Mandatory Material:1. Spijkers J.M.J., Vrouwenvelder, A.C.W.M., Klaver E.C., Structural Dynamics; Part 1: Structural Vibrations. Lecture Notes CT 4140. 2. Metrikine, A.V., Vrouwenvelder, A.C.W.M., Structural Dynamics; Part 2: Wave Dynamics. Lecture Notes CT 4140.3. Lecture Slides (available on Blackboard)		
Contact			
Expected prior knowledge			
Remarks			

Course	Code: CT4320	Course title: Short Waves	ECTS: 4
Education Period	1st Education Period		
Exam Period	1st Exam Period		
Instructor	Dr.ir. A.J.H.M. Reniers; E-mail: A.J.H.M.Reniers@tudelft.nl		
Education Method	Lectures, exercise		
Judgement	Based exclusively on written exam, using pre-assigned indicative weights per question		
Course Contents	Introduction to the mechanics of short gravity surface gravity waves, typically encompass both sea and swell waves, for applications in coastal and offshore engineering. Topics include (but are not restricted to) wave refraction, wave diffraction, wave reflection, wave energy balance, wave breaking, radiation stresses, wave statistics and forces on structures.		
Study Goals	Insight in and knowledge of the mechanics of gravity surface waves in the context of coastal and offshore engineering; knowledge of computation methods; ability to apply these.		
Literature and Study Materials	syllabus: Short Waves Available at Bookshop Civil Engineering. recommended other materials: English Lecture Notes, available from the lecturer.		
Contact			
Expected prior knowledge			
Remarks	Admission to the written examination only after completion of program of exercises		

Course	Code: CT5316	Course title: Wind waves	ECTS: 3
Education Period	2nd Education Period		
Exam Period	2nd Exam Period		
Instructor	Dr.ir. L.H. Holthuijsen; E-mail: L.H.Holthuijsen@tudelft.nl		
Education Method	lectures		
Judgement			
Course Contents	Methods of observing and measuring waves at sea are explained with reference to various in-situ and remote sensing techniques. Waves are initially characterised with primary parameters such as the significant wave height. Waves are then characterised in more detail with the variance density spectrum (involving the Fourier transform). A simple method for wave prediction in idealised conditions is introduced, resulting in universal wave growth curves. Then, using the concept of the spectrum, the processes of generation by wind, non-linear wave-wave interactions and white capping are described. These processes are integrated with spectral wave propagation in numerical wave models. The short-term statistics of the waves (in particular the instantaneous values of the surface elevation and its extremes such as crest heights) is given, treating the sea surface elevation as stationary, Gaussian process. Sources for long-term statistics are given and three different approaches of analysis are treated. The response of structures to the excitation of wind waves is defined in terms of spectral response functions of linear systems.		
Study Goals	To gain insight and knowledge of the phenomenon of wind waves and the qualitative and quantitative description of this phenomenon. To learn the basis of simple and advanced mathematical models to predict waves for given conditions of wind, bathymetry, coast lines etc. To understand the basic technique to compute linear responses of structures to wind wave excitation.		
Literature and Study Materials	syllabus: Available at Bookshop Civil Engineering.		
Contact			
Expected prior knowledge	Linear theory of surface gravity waves, basic statistics Partial differential equations		
Remarks	Observing and measuring wind waves, qualitative and quantitative description of wind waves, spectral characterisation Growth curves, qualitative description of processes of wave growth and dissipation; spectral wave prediction models Statistical description of wind waves, response spectra		

Course	Code: CT5317	Course title: Physical Oceanography	ECTS: 3
Education Period	1st Education Period		
Exam Period	1st Exam Period		
Instructor	Dr.ir. L.H. Holthuijsen; E-mail: L.H.Holthuijsen@tudelft.nl		
Education Method	lectures exercise		
Judgement	Bonus Assignment calculation Exam grade		
Course Contents	Description Properties of sea water relevant to Physical Oceanography Equations of motion with Coriolis Force Currents without friction: Geostrophic currents, thermal wind relationship, Taylor-Proudman, Inertial oscillations, Potential Vorticity Currents with friction; Ekman layer; Ekman transport, Wind driven circulation Themohaline effects Waves, Tides		
Study Goals	Insight into the basic physics governing flow in the oceans. Derivation of the equations of motion with Coriolis force. Understanding the wind driven circulation and the thermohaline circulation. Knowledge of tides and waves.		
Literature and Study Materials	Materials obligatory lecture note(s)/textbook(s): "An introduction to Physical Oceanography" Available at the Blackboard website. obligatory other materials: Available at the Blackboard website. recommended other materials: Available at the Blackboard website.		
Contact			
Expected prior knowledge	CT5317 uses CT2100CT5317 uses CT3310		
Remarks	Summary Properties of sea water, equations of motion with Coriolis Force, wind driven circulation, thermohaline effects, waves, tides.		

Course	Code: OE4601	Course title: Survey of Offshore Engineering lectures	ECTS: 3
Education Period	1st Education Period		
Exam Period	1st Exam Period		
Instructor	Ir. G.H.G. Lagers; E-mail: G.H.G.Lagers@tudelft.nl		
Education Method	lectures		
Judgement	Grades are assigned upon the result of a written Quiz held in the examination period at the end of the first quarter. An individual re-examination can be scheduled at a mutually convenient time after that date.		
Course Contents	This course is comprised of a series of informational classes on Monday and Friday afternoons during the first quarter. They form the minimum technical knowledge base for this course. Lecture notes for the various class topics will be available (as much as possible) at the start of each Monday or Friday afternoon class session. It is advisable that each participant gathers his or her notes in a loose leaf ring binder. Materials and classroom discussions will generally be in English. This group of classes is scheduled universally in the first three hours of each Monday or Friday afternoon during the first quarter. The last hour of each afternoon is generally used to amplify information presented via videos.		
Study Goals	Participants successfully completing this course can expect to: Be aware of the diversity of facets involved in the design of structures for offshore oil and gas production. Know how and where to find more information on any of the topics involved Be able to make motivated choices for additional relevant courses		
Literature and Study Materials	recommended other materials: "Glossary of Offshore Terms" by Prof.dr.ir.J.H. Vugts et al. Available at Bookshop Civil Engineering. Several (15 - 20) notes segments that complement the first quarter Tuesday and Friday afternoon classes. Available at the lecturer or at lecture.		
Contact	Secretariat of OE, Mrs. J. Baan		
Expected prior knowledge			
Remarks	Summary Survey of a variety of topics from Petroleum Engineering, Chemical Engineering, Geodesy and Marine Technology that contribute to the development of an offshore oil and gas field. The course is taught by a team of roughly 20 teachers led by the Offshore Engineering Curriculum leader.		

Course	Code: OE4603	Course title: Introduction to Offshore Structures	ECTS: 3
Education Period	2nd Education Period		
Exam Period	2nd Exam Period		
Instructor	Prof.ir. J. Meek; E-mail: J.Meek@offshore.tudelft.nl Ir. G.H.G. Lagers; E-mail: G.H.G.Lagers@tudelft.nl		
Education Method	lectures; exercise		
Judgement	Single mark based on written examination		
Course Contents	The course explains design principles of jack-up platforms, jacket platforms, gravity structures, offshore ships, spars, TLPs and semi-submersibles. The level is introductory.		
Study Goals	Understanding of which offshore structures exist and how their preliminary design is achieved.		
Literature and Study Materials	obligatory lecture note(s)/textbook(s): Syllabus in preparation, expected available in September 2006		
Contact	Secretariat of OE, Mrs. J. Baan		
Expected prior knowledge			
Remarks	Summary Review of design principles of Offshore Structures		

Course	Code: OE4610	Course title: Survey of offshore engineering projects	ECTS: 8
Education Period	4th Education Period		
Exam Period	Exam by appointment		
Instructor	Ir. G.H.G. Lagers; E-mail: G.H.G.Lagers@tudelft.nl		
Education Method	exercise		
Judgement	Grades are assigned based upon the team reports and presentations and on the result of an oral discussion between each individual participant and his team supervisor after the final project report has been submitted. A single grade is assigned for the entire 8 credits.		
Course Contents	This course - in its full form - is divided into a number of elements that are fully integrated with the project work. These elements include the following: Project team plenary meetings with the coach - often on a weekly basis. Occasional General Line discussions for all teams together. Occasional methodology activities in conjunction with the general line discussions. Team meetings with the coach held (often) at weekly intervals. A personal journal. Each element is described a bit below. Project Team Plenary Meetings: Each project team (as a group) is required to hold a scheduled meeting with the course leader (or primary project coach) usually no more than once per week starting later in the first quarter of the academic year. In order to avoid course conflicts, these meetings are generally scheduled during the lunch break. Bringing your lunch with you is not forbidden! These sessions serve as a 'fixed point' in each project team's activities. It is here that subgroups within a team can exchange information and the coach can discuss activities and progress with each team. An occasional session can be devoted to a methodology topic; see below. No more than five teams (of no more than 7 participants each) are formed each year. Each team works with the same general information and each serves as a design consultant to the same external company on the same project. A bit of (good-natured) competition between the teams makes their activities even more interesting! General Line Discussions: A retired oil company manager will provide a series of talks describing how he and his team have approached the development of an offshore oil field. His purpose is to 'paint the big picture'; to help student to put the more specific material from the informational classes in a proper perspective for integration in their project. Methodology Meetings: A teacher will discuss and initiate classroom activities primarily relevant to		

	immediate overall objective of these sessions is to increase the effectiveness of each participant's project work activity. "The Offshore Student's Survival Manual" serves as guide for this activity series. Sessions are generally scheduled either during a team meeting or in conjunction with - usually directly after (and sometimes in place of) - the General Line discussions. Personal Journal: Each participant is 'required' to keep a personal course journal as outlined in chapter 5 of the "Survival Manual". It can be reviewed at appropriate times by the coach.
Study Goals	Participants successfully completing this course can expect to: Be aware of the diversity of facets involved in the design of structures for offshore oil and gas production. Know how and where to find more information on any of the topics involved. Be able to make motivated choices for additional relevant courses. Have experienced how conflicting requirements must be accommodated in a responsible offshore design. Be somewhat skilled with the use and integration of knowledge gained from this and companion OE curriculum courses. Bea more affective worker in teams and individually. Be able to utilize simple project analysis and management techniques. Be more actively involved in one's own learning process. Be aware of the economic constrains imposed on industrial projects.
Literature and Study Materials	recommended other materials: A PC or laptop running a recent, English Language version of EXCEL will be needed for QUE$TOR computations at home - if so desired. Much project background material will have to obtained from the university library system. recommended lecture note(s)/textbook(s): "An Offshore Student's Survival Manual" by W.W. Massie, MSc, P.E. "Glossary of Offshore Terms" by Prof.dr.ir. J.H. Vugts et al. Several (15 to 20) notes segments from OE4601 Software: QUE$TOR. All of this information is or will be made available when needed via the team coach.
Contact	Secretariat of OE, Mrs. J. Baan
Expected prior knowledge	OE4610 is applying the knowledge of most preceding courses, in particular OE4601 and OE4651-54
Remarks	Summary Application of a variety of topics from Petroleum Engineering, Chemical Engineering, Mechanical Engineering, Civil Engineering, Geodesy and Marine Technology for the conceptual development and evaluation of an offshore oil and gas field. Participants work in multi-background teams of up to seven persons each.

Course	Code: OE4620	Course title: Offshore Hydromechanics	ECTS: 8
Education Period	2nd Education Period, 3rd Education Period		
Exam Period	3rd Exam Period		
Instructor	Ing.ir. P. Naaijen; E-mail: P.Naaijen@tudelft.nl Ir. G.H.G. Lagers; E-mail: G.H.G.Lagers@tudelft.nl		
Education Method	lectures; exercise		
Judgement			
Course Contents	Offshore Hydromechanics is built up from four related modules. Each module has its own content and educational objectives.1. Basic principles: Hydrostatics, constant flow phenomena and waves The treated theory includes: Stability computations for all sorts of floating structures - including those with partially filled water ballast tanks, etc. Bending of a free-hanging drill strings Constant 2-D potential as well as real flows and the forces which they can exert on structures Wave theory and wave statistics Module 1 (text chapters 1 trough 5) provides basis knowledge for all the succeeding modules. Classes on this module are held during the first three weeks of the course; this is usually soon followed by a quiz covering this module; 2. Floating Structures 1: Wave forces & motions Upon completion of this segment participants will have superior knowledge of: Application of linear (wave) potential theory to ships and other floating structures for the computation of external and internal forces as well as ship motions. Module 2 covers chapters 6, 7 and parts of chapter 8. It is scheduled directly after module 1 and prepares the student for a part of the exercises included in module 5 as well as the further development of this project in module 3. A few computational exercises as well as a lab session complement this module. 3. Floating Structures II: wave forces & motions, non-linear problems, applications Participants completing this segment successfully will have a superior knowledge of and be able to predict the motion of floating bodies in the sea. They will be familiar with first order ship motions in irregular waves as well as drift forces, resulting from non-linear phenomena. They can also apply this to applications such as station keeping and the determination of offshore workability. Module 3 (text chapters 8 through 11) builds upon knowledge gained in modules 1 and 2. One computational exercise is related to this module. 4. Slender Cylinder Hydrodynamics and Sea Bed Morphology. This module gives successful participants a superior knowledge of:		

	The Morison equation and its extensions as well as with methods to determine its coefficients and approximate methods for predicting the survival loads on an offshore tower structure. The computation of hydrodynamic forces on pipelines. In addition, these persons will also have an advanced knowledge of the morphology interaction between the sea bed and pipelines and other small objects. Module 4covers text chapters 12 through 14; module 1 provides the necessary prerequisite knowledge for this. One exercise and one lab session in module 5 relate to module 4. Classes for module 4 will be held in the weeks directly following the classes for module 1. A single lab session (also relating to module 1) and one computational exercise are included in this module.
Study Goals	Course Objectives: Participants who have successfully completed the course will be able to carry out computations at a superior knowledge level involving: Module 1 (2 cry): Hydrostatics, floating stability and 2-D potential flows, as well as regular and irregular waves and their spectra. Module 2 (2 CE): Computations relevant for first order forces on and resulting motions of ships. Module 3 (2 EC): Non-linear forces on and resulting ships motions; workability prediction. Module 4 (2 EC): Hydrodynamic forces on slender structures including marine pipelines. In addition, successful participants completing module 1 will have a basic awareness of ship propulsion systems and their computations. Those completing module 4 will have an advanced knowledge of sea bed morphology. Study paths: The following module combinations can be appropriate; each is covered via a series of classes. Note that a minimum of two modules including module 1 is normally required of everyone. Modules 1, 2, 3, 4 (8 credits)Full course; required for all OE Degree participants unless knowledge of specific modules has already been obtained via one's BSc curriculum. Modules 1, 2, 3 (6 credits)Complete discussion of ship hydromechanics; elective for Hydraulic or Mechanical Engineering students. Modules 1, 2 (4 credits)Limited discussion of first order ship hydromechanics for students needing only a more limited scope of knowledge. Elective for Hydraulic or Mechanical Engineering students. Modules 1, 4 (4 credits)Potential flows, real constant flows, Morison Equation and Morphology. Elective for Naval Architecture or Hydraulic Engineering students. Note: The groups who may want to utilize a particular combination are listed as suggestions. In general, anyone with the prerequisite knowledge is welcome to participate in (parts of) this course.

Literature and Study Materials	obligatory lecture note(s)/textbook(s): "Offshore Hydromechanics" by Journee and Massie "Offshore Hydromechanics" Exercises by Journee. Both are available by the teachers or may be downloaded off the internet address: www.shipmotions.nl "SEAWAY" by Journee available at teacher and the internet address: www.shipmotions.nl
Contact	Secretariat of OE, Mrs. J. Baan
Expected prior knowledge	OE4620 uses CT4320, CT5316 and basic fluid mechanics
Remarks	Summary Offshore Hydromechanics includes the following modules - all of which are normally required for OE MSc Degree participants: Hydrostatics, static floating stability, constant 2-D potential flow of ideal fluids, and flows in real fluids. Introduction to resistance and propulsion of ships. Review of linear regular and irregular wave theory. One lab session accompanies this module in combination with module 4. Analytical and numerical means to determine the flow around, forces on, and motions of floating bodies in waves. One lab session and a few exercises accompany this module. Higher order potential theory and inclusion of non-linear effects in ship motions. Applications to motion of moored ships and to the determination of workability. One exercise accompanies this module. Interaction between the sea and sea bottom as well as the hydrodynamic forces and especially survival loads on slender structures. One lab session accompanies this module along with module 1. One exercise is also involved.

Course	**Code: OE4623**	**Course title: Drive system design principles**	**ECTS: 3**
Education Period			
Exam Period			
Instructor	Dr.ir. S.A. Miedema; E-mail: S.A.Miedema@tudelft.nl		
Education Method			
Judgement			
Course Contents			
Study Goals			
Literature and Study Materials			
Contact			
Expected prior knowledge			
Remarks			

Course	Code: OE4624	Course title: Offshore soil mechanics	ECTS: 3
Education Period	2nd Education Period		
Exam Period	2nd Exam Period		
Instructor	Prof.dr.ir. F. Molenkamp; E-mail: F.Molenkamp@tudelft.nl Ir. J.P. Oostveen; E-mail: J.P.Oostveen@tudelft.nl		
Education Method	lectures; exercise		
Judgement	grade is determined on the basis of a written examination. The exercises must be finished before this can take place.		
Course Contents	This course brings successful participants to a superior knowledge level in the following geomechanics areas for application to offshore structures: Axially loaded piles: The behaviour of piles under alternating tension and compression. Non-linear responses as well as numerical solutions are handled. Laterally loaded piles: The behaviour of piles under alternating horizontal forces is handled. Non-linear responses as well as numerical solutions are provided. Large spread footings: Numerical computations of the behaviour of spread footings using the Brinch Hansen theory are discussed. Pore pressure enhancement: The build-up of pore pressures under large foundations subject to cyclic loads as well as in the sea bed as a response to ocean surface waves is derived. Lateral and vertical support of pipelines: Bedding of pipelines and their protection are discussed. Soil investigations in the field as well as in the lab to support the above topics are discussed as well. Participants complete a series of exercises to enhance their skill level in most of the above areas.		
Study Goals	Offshore Soil Mechanics extends one's basic knowledge of soil mechanics so that successful participants are prepared to design offshore foundations for fixed offshore structures at a superior knowledge level. They also become aware of the geotechnical problems associated with pipelines and other seabed structures.		
Literature and Study Materials	obligatory lecture note(s)/textbook(s): Offshore Soil Mechanics by Prof.dr.ir. A. Verruijt. Also available on the internet: geo.verruijt.net Available at Bookshop Civil Engineering. recommended other materials: Lecture notes will be provided.		
Contact			
Expected prior knowledge	OE4624 uses CT2090OE4624 uses CT4399		
Remarks	Summary Successful participants can design offshore foundations at a superior knowledge level. This course makes this possible by extending one's basic knowledge of soil mechanics to include a number of typical offshore applications. Topics include: Axially and laterally loaded piles: linear and non-linear behaviour and computations, Shallow spread footings for large structures: linear and non-linear behaviour and computations, Influences resulting from cyclic pore pressure in the sea bed. Field (at sea) and lab studies.		

Course	Code: OE4625	Course title: Dredge Pumps and Slurry Transport	ECTS: 4
Education Period	3rd Education Period		
Exam Period	3rd Exam Period		
Instructor	Dr.ir. S.A. Miedema; E-mail: S.A.Miedema@tudelft.nl A.M. Talmon; E-mail: A.M.Talmon@tudelft.nl		
Education Method	lectures		
Judgement			
Course Contents	The purpose of this course is to convey knowledge of the various physical processes associated with slurry handling and transport during dredging. This knowledge is needed for the design of dredging equipment and for planning efficient equipment operations. The various processes are discussed and theories and simulation models that describe the processes are presented and compared during the course. The course can be broken down into four elements: 1. Pumps and engines a. Pump characteristics and cavitation b. Influence of particles on pump characteristics. 2. Hydraulic transport in pipelines a. Two-phase (solid-liquid) flow through pipelines; b. Newtonian slurries; c. Non Newtonian slurries; d. Inclined and long pipelines. 3. Pump and pipeline systems a. Operation point and areas b. Production factors. 4. Case studies		
Study Goals	To gain knowledge about the two-phase flow, pipelining and pumping.		
Literature and Study Materials	obligatory lecture note(s)/textbook(s): Dredge Pumps and Slurry Transport byV. Matousek. Available at the Mechanical Engineering bookstore; Blackboard (downloads)recommended other materials: book Slurry Transport Using Centrifugal Pumps by K.C. Wilson et al, ISBN 0 7514 0408		
Contact			
Expected prior knowledge			
Remarks	Summary After a short overview of dredging as a whole, this course concentrates on principles of pipeline transport of slurries and on the design of a transportation system comprised of pipelines and slurry pumps.		

Course	Code: OE4626	Course title: Dredging processes	ECTS: 4
Education Period	3rd Education Period, 4th Education Period		
Exam Period	4th Exam Period		
Instructor	Dr.ir. S.A. Miedema; E-mail: S.A.Miedema@tudelft.nl		
Education Method	lectures		
Judgement			
Course Contents	The course focuses on 3 main dredging processes: The cutting of sand, clay and rock; The sedimentation process in hopper dredges; The breaching process. These are explained in detail. Exercises allow participants to apply the knowledge gained in practical situations.		
Study Goals	Understand and reproduce the Mohr circle; Understand and reproduce the theory of passive and active soil failure; Understanding the soil mechanical parameters important for cutting processes; Understanding and make calculations regarding the 2-D cutting theory in water-saturated sand; Understanding and make calculations regarding the 2-D theory in clay; Understanding and reproduce the settling of grains in water; Understanding and reproduce the loading cycle of a hopper dredge; Being able to determine the loading cycle of a hopper dredge, base on the modified Camp model by Miedema and Vlasblom; Understanding and reproduce the basic cutting theory of rock cutting; Understanding and reproduce the breaching process.		
Literature and Study Materials	obligatory lecture note(s)/textbook(s): The course material is downloadable from:http://www.dredgingengineering.com and from Blackboard Available at as download from blackboard .		
Contact			
Expected prior knowledge	OE4626 uses CT4399		
Remarks	Summary The course focuses on 3 main dredging processes: The cutting of sand, clay and rock; The sedimentation process in hopper dredges; The breaching process. Participants successfully completing this course will be equipped to make predictive quantitative determinations related to these processes.		

Course	Code: OE4651	Course title: Bottom Founded Structures	ECTS: 6
Education Period	3rd Education Period		
Exam Period	3rd Exam Period		
Instructor	Prof.dr.ir. J. Wardenier; E-mail: J.Wardenier@tudelft.nl Prof.ir. J. Meek; E-mail: J.Meek@offshore.tudelft.nl		
Education Method	lectures; exercise		
Judgement	Grades are based upon a combination of a grade for the written examination as well as grades earned for the exercise work. The combined exercise grades provide20% of the final grade; the remaining 80% is from the exam.		
Course Contents	This course includes 7 related segments as follows: General introduction and general design considerations such as material choice in relation to design, loads and relevant load combinations, construction and later inspection as well as removal of the structures at the end of their economic life. Fixed steel support structures are given the most significant attention in this course. Quantitative design of steel structures including the dimensioning of individual members strength as well as stability is covered as is the design analysis for joints in such structures. Fatigue is being discussed as well. Participants become cognizant of construction, transport and installation aspects to the extent that these factors dictate the design. More limited attention is given to inspection, and repair of existing structures. Concrete Structures and their design, transport and installation are given a very cursory treatment. (Such structures are currently forbidden in the Atlantic Ocean and North Sea under 'normal' circumstances because of uncertainties related to their removal.) Compliant Towers and their specific design characteristics are discussed to some extent as an extension of the knowledge gained in block 2, above. Structural design aspects of decks to provide space the drilling, production, power generation and life-support systems are discussed. The analysis modelling of elevated jack-up rigs is discussed in relation to that for fixed steel tower structures. The evaluation of suitability of a given rig for a given job at a given location is considered as well. The failure modes and design codes for fixed steel offshore structures are discussed briefly.		

Study Goals	The objective of this course is to integrate knowledge from hydromechanics, probabilistic design, dynamics and structural design so that participants are able to carry out the design and related analysis of fixed steel structures in the sea at a superior knowledge level. An exercise enhances each participant's skill and understanding.
Literature and Study Materials	obligatory lecture note(s)/textbook(s): Books: "Handbook of Bottom Founded Offshore Structures" by Prof.dr.ir. J.H. Vugts is available via the OE offices in the Civil Engineering building. Specific notes: Handouts for exercises are available in class and on Blackboard; PowerPoint presentation slides of all lectures are posted on Blackboard. Software: Participants may check their exercise computations using SESAM on a university computer. recommended other materials: English-language EXCEL software will be convenient for carrying out some of the exercise computations.
Contact	Secretariat of OE, Mrs. J. Baan
Expected prior knowledge	OE4651 uses CT4130OE4651 uses CT4399OE4651 uses OE4601OE4651 uses OE4620OE4651 uses OE4624
Remarks	Summary Treatment at an advanced to superior knowledge level of fixed steel structures ad complaint towers and their superstructures as well as jack-up platforms in their working (elevated) position. The course covers the entire range of the design cycle from concept evaluation through abandonment, although primary attention focuses on those factors most important to the structure's design. Design analysis steps are applied primarily to fixed steel platforms in the sea. Participants complete a series of exercises during the course in order to reinforce their understanding and skill with the use of the concepts taught.

Course	Code: OE4652	Course title: Floating Structures	ECTS: 4
Education Period	3rd Education Period		
Exam Period	3rd Exam Period		
Instructor	Ir. G.H.G. Lagers; E-mail: G.H.G.Lagers@tudelft.nl		
Education Method	lectures; exercise		
Judgement	Student grades are determined on the basis of the exercise work and a written examination. The exercise contributes at least 20% of the grade.		
Course Contents	This course first surveys the various forms and types of floating structures in relation to the functional requirements placed upon them. A major portion of the course focuses on a specific type of floating structure - such as a FPSO production platform for deep water - and its design. This design is then discussed in some detail in such a way that the classroom sessions augment the series of steps within the design exercises.		
Study Goals	Participants in this course will become capable - at an advanced knowledge level - of leading the design of a floating offshore structure. They will be familiar with the (potentially) conflicting requirements resulting from safety, topside processes, floating stability, response to waves, structural strength and fatigue, positioning as well the available margins for compromise needed to achieve a responsible design. The exercises integrate the course topics and reinforce the concepts learned.		
Literature and Study Materials	syllabus: Being prepared. recommended other materials: Floating Structures, a Guide for Design and Analysis, ISBN: 1-870553-357		
Contact	Secretariat of OE, Mrs. J. Baan		
Expected prior knowledge	OE4652 uses CT4130OE4652 uses CT4140OE4652 uses OE4601OE4652 uses OE4620		
Remarks	Summary Design - at an advanced knowledge level - of floating offshore structures and elements thereof: semi-submersibles, FPSOs, spar platforms, floating jack-up structures and elements such as reinforced (hull) plating and mooring turntables. Important design parameters. Application of methods of analysis and criteria in design: wave loading and motion in waves, floating stability, (dynamic)positioning, structural strength and fatigue. Safety assessment and codes in relation to design.		

Course	Code: OE4653	Course title: Marine Pipelines	ECTS: 4
Education Period	3rd Education Period		
Exam Period	3rd Exam Period		
Instructor	Ir. G.H.G. Lagers; E-mail: G.H.G.Lagers@tudelft.nl		
Education Method	lectures		
Judgement	Participants are assigned grades based upon a written examination that covers all three aspects of the course		
Course Contents	Offshore Pipelines concentrates on three aspects of subsea pipeline design: The internal and structural design of pipelines for oil, gas and multi-phase (liquid gas) flows Pipelines are dimensioned based upon flow in relation to properties of the transported material as well as capital and operating costs involved. The need for and means of providing thermal insulation is discussed Means of assuring flow in pipelines are discussed as well. Pipeline route selection Routing of pipelines through the sea as well as their shore approaches are discussed. Special attention is given to sub-sea tie-ins, pipeline and cable crossings, pipeline protection from fishing gear, shore approaches and pipeline trenching. The consequences of pipeline temperature changes and upheaval buckling are discussed as well as the stability of pipelines on or in the sea bed. Pipelines installation This segment presents current and new technologies for the installation of pipelines in waters of various depths from a few tens of meters to depths measured in kilometres and the role which installation plays in the design of the pipeline. Special attention is given to supporting FEM calculations, start-up and lay-down and to welding technology. A classroom exercise integrates the knowledge gained. Upon successful completion, participants will be able to function at an advanced to superior knowledge level in pipeline design teams.		
Study Goals	Participants completing this course successfully will be able to function at a advanced to superior knowledge level productively and quantitatively in marine pipeline design teams.		

Literature and Study Materials	recommended other materials: Flow Assurance by Dr. S. Cochran et al. Marine Pipelines by Prof.dr. A. Palmer Installation by R. Heemskerk et al. All will be available via the OE offices in the Civil Engineering Building Some students may want to use English language EXCEL for pipeline design computations recommended lecture note(s)/textbook(s): Subsea Pipeline Engineering, by Andrew C. Palmer and Roger A. King; ISBN 1-59370-013X
Contact	Secretariat of OE, Mrs. J. Baan
Expected prior knowledge	OE4653 uses CT4130OE4653 uses OE4601OE4653 uses OE4620OE4653 uses OE4654
Remarks	Summary Offshore Pipelines includes three aspects of subsea pipeline design: Flow assurance in pipelines. The internal design and dimensioning of pipelines for oil, gas and multi-phase flow, and the route selection. Pipeline route selection includes both deep sea and shore approach routing as well as design for stability in or on the sea bed. Pipeline installation methods and their effect on pipeline design.

Course	Code: OE4654	Course title: Subsea Engineering	ECTS: 4
Education Period	2nd Education Period		
Exam Period	2nd Exam Period		
Instructor	Ir. G.H.G. Lagers; E-mail: G.H.G.Lagers@tudelft.nl		
Education Method	lectures		
Judgement	Grades are assigned based upon a written examination		
Course Contents	Subsea Engineering will include the following elements: Introduction and historical survey Engineering aspects of subsea wells Subsea oil and gas pumping Risers and subsea control Diverless methods of intervention and deep water systems Subsea installation, maintenance and repair Subsea exploration Reliability engineering in relation to subsea work These elements will be integrated and linked to a field development scenario via a series of short in-class exercises carried out by teams of students.		
Study Goals	Participants successfully completing this course will be able to function meaningfully in both a qualitative and quantitative sense at a routine to advanced level in design team working on subsea engineering problems.		
Literature and Study Materials	obligatory lecture note(s)/textbook(s): Specific notes: "Subsea Engineering" by J. Preedy Available at the section secretariat. recommended other materials: Some students may want to use a laptop computer with English language EXCEL for classroom design computations		
Contact	Secretariat of OE, Mrs. J. Baan		
Expected prior knowledge	OE4654 uses OE4601		
Remarks	Summary Subsea Engineering is concerned with how the need to work in or under the sea affects operations being carried out there. Topics include drilling and hydrocarbon well maintenance activities as well as control systems, remotely operated vehicles and their capabilities, installation of hardware on the sea bed, and how all of these are affected by concerns for safety and reliability. A series of short exercises will be carried out during the classes. Because of the breadth of topics covered, only a routine to advanced knowledge level will be achieved.		

Course	Code: OE5662	Course title: Offshore Wind Farm Design	ECTS: 4
Education Period	1st Education Period		
Exam Period	1st Exam Period		
Instructor	Ir. J. van der Tempel; E-mail: J.vanderTempel@offshore.tudelft.nl		
Education Method	Lectures plus exercise		
Judgement	Based on quality, pace and reporting of the exercise work		
Course Contents			
Study Goals			
Literature and Study Materials			
Contact			
Expected prior knowledge			
Remarks	summary Combining knowledge from the design of bottom founded structures and wind energy conversion systems, the course concentrates on the design of an offshore wind farm. Installation and maintenance logistics are discussed as well as the transportation of electric power to shore.		

Course	Code: OE5663	Course title: Dynamic Positioning	ECTS: 3
Education Period	1st Education Period		
Exam Period	1st Exam Period		
Instructor	Ir. G.H.G. Lagers; E-mail: G.H.G.Lagers@tudelft.nl		
Education Method	exercise; lectures		
Judgement	Written examination with open questions		
Course Contents	Dynamic Positioning System Design includes the following subjects, each to be dealt with in 2 hours of class: Introduction: definition of Dynamic Positioning, short history of its development, areas of application, normal system composition, special devices for special purposes. Design of the control algorithms, basic PID controls, signal/noise ratios and their effect on filter design, consequences of applying digital computers, Kalman optimal control routines, redundancy on the control system side. Ergonomics in the operator interface design. Systems available on the market. Physical options for position measurement and their inherent strengths/weaknesses, equipment involved		

	in position measurement, reliability of the position signal, redundancy in equipment and principles, dead reckoning modes. The importance of measuring oscillatory ship motions. Design implications of the selected measurement systems. Physical options for generating thrust on a floating vessel. Available thruster sizes. Thruster efficiency. Response times of thrust dranges. Mechanical limitations and reliability. Thrust feed-back modes. Thruster-hull interaction. The 3-D case of ROV control. System performance analysis in the design phase and in operation. Ship-board consequences of the installation of a DP system. Central or distributed controls. Interfaces with the power plant. Placing the position reference sensors. An exercise in failure mode effect analysis and questions.
Study Goals	The objective of this course is to prepare participants to under-stand (at a routine knowledge level) and to participate in teams doing the design of dynamic positioning systems for a variety of offshore and subsea engineering applications. Successful participants will also be able to work fruitfully with those more expert in supporting disciplines to come to an optimised dynamic positioning system for a given application.
Literature and Study Materials	syllabus: Dynamic Positioning System Design Available at the section secretariat.
Contact	Secretariat of OE, Mrs. J. Baan
Expected prior knowledge	OE5663 uses OE4620
Remarks	Summary This course unites the disciplines of: Control theory and system design Hydromechanics Mechanical Engineering Position monitoring to present theory needed to design a dyna-mic positioning or tracking system for offshore applications such as work ships on the sea surface and autonomous as well as towed underwater vehicles.

Course	**Code: OE5664**	**Course title: Offshore moorings**	**ECTS: 3**
Education Period	1st Education Period		
Exam Period	1st Exam Period		
Instructor	Dr.ir. S.A. Miedema; E-mail: S.A.Miedema@tudelft.nl		
Education Method	lectures; exercise		
Judgement	Grades are assigned base upon participant performance during either of the following two evaluations held a few days after each participant submits a written report describing and 'selling' his or her design exercise solution: Each member of a small group of participants (3 to 5) gives a short oral presentation of his or her design at a mutually convenient time. The audience consists of at least the other group participants and the course teacher. Each presentation is followed by a short discussion with the entire group. Each grade is then determined on the basis of:* The quality of the design as presented in the written report.* The 'sale' of the design during the oral presentation and its defence during the discussion.* The quality of the discussion questions (about other participant's work) posed during the discussion. Those who cannot join in such a group session, may simple discuss their report with the course teacher in one-to-one setting to determine a grade.		
Course Contents	The classroom activities are structured around the following 8 elements each taking roughly 3 hours of classroom time: Intro-duction:The present the scope and typical applications of what is to be covered. It motivates participants to continue (or stop) their course participation. Anchors: Soil properties are reviewed to the extent that they are important to anchor behaviour in the soil. (Note that a significant number of participants usually come from Marine Technology - and outside the IOE MSc curriculum; they have no background in soil mechanics.) Special attention is given to specific anchor-related soil properties such as dilatency. The behaviour of a number of different anchor types is demon-strated in a laboratory session. Anchor Line Mechanics: Catenary line theory is reviewed along with practical ways of solving the resulting equations in an effective way. MOOR40 software is demonstrated as a means of doing the routine computations for simplified cases consisting of a symmetric radial pattern of identical catenary mooring lines. Anchor Line Materials and Com-ponents: The materials and accessories that make up a mooring system are presented along with their relative merits. XSMoorings Demonstration: XSMoorings software is given to participants to determine the static behaviour of more realistic and complex mooring system configurations. This software is demonstrated. Moored Object Dynamics: A graphical method for solving the Duffing Equation (for a single mass-spring system with a non-linear spring) is presented and used to determine the response		

	characteristics of a typical mooring system. Exercise Introduction: The exercise requirements are explained along with a suggested approach to achieving an optimum mooring design. The most important economic evaluation steps are touched upon. Participants integrate the knowledge gained from the classes to come to a most economical design for a mooring system meeting given specifications. This exercise functions as well to structure each participant's own study effort. The exercise normally takes in the order of 70 hours of participant time -including the economic computations and the reporting. An excursion to something relevant to offshore moorings is held if this can be conveniently arranged.
Study Goals	The classes are set up to give the student practical insight - supported by applied theory - in the design and optimisation process for an offshore mooring system. The exercise forces each student to integrate the knowledge gained and to make practical engineering and economic compromises in a realistic engineering situation. Successful completion prepares one to function qualitatively and quantitatively at a superior knowledge level in a mooring design team.
Literature and Study Materials	obligatory lecture note(s)/textbook(s): Books: Vrijhof Anchor Manual Specific Notes: Collected Offshore Moorings Data by W.W. Massie, MSc, P.E.Software:MOOR40 and XSMoorings Available at the section secretariat. recommended other materials: Handy background information comes from:OE4652 Design of Floating Structures OE5663 Dynamic Positioning System Design recommended lecture note(s)/textbook(s): Deep Water Fibre Moorings Barge Mooring Available at the Civil Engineering library. Recommendations ...... Single Buoy Moorings Effective Mooring Available via the Central Library of the TU Delft
Contact	
Expected prior knowledge	OE5661 uses CT4399OE5661 uses OE4620
Remarks	Summary The course treats the design of offshore mooring systems literally from the ground up: Starting with the anchor and its soils mechanics in the sea bed, via the mechanics of a single mooring line and system of lines. The course concludes by touching on other mooring concepts and the dynamic behaviour of the moored object as a non-linear mechanical system. Classroom teaching is augmented by laboratory demonstrations and (when possible) a relevant excursion. A mooring design exercise is coupled to this course; it enhances each participant's design skill and awareness of economics in design.

Course	**Code: OE5670**	**Course title: Integrating Exercise**	**ECTS: 11**
Education Period	None (Self Study)		
Exam Period	4th Exam Period, none		
Instructor	Ir. G.H.G. Lagers; E-mail: G.H.G.Lagers@tudelft.nl		
Education Method	Exercise		
Judgement	Based on exercise report and oral presentation		
Course Contents			
Study Goals			
Literature and Study Materials			
Contact	Secretariat of OE, Mrs. J. Baan		
Expected prior knowledge			
Remarks	summary Further skill development in a particular area of offshore engineering. Often performed in-house at the TUD, sometimes sponsored by industry.		

Course	**Code: OE5671**	**Course title: Design of dredging equipment**	**ECTS: 3**
Education Period			
Exam Period			
Instructor	Dr.ir. S.A. Miedema; E-mail: S.A.Miedema@tudelft.nl		
Education Method			
Judgement			
Course Contents			
Study Goals			
Literature and Study Materials			
Contact			
Expected prior knowledge			
Remarks			

Course	Code: OE5680	Course title: Industrial Practice	ECTS: 8
Education Period	None (Self Study)		
Exam Period	none		
Instructor	Ir. G.H.G. Lagers; E-mail: G.H.G.Lagers@tudelft.nl		
Education Method	practical		
Judgement	Each participant's report should be approved by the industrial coach before the university grading procedure can be started. The experience will then be graded by a TU Delft coach after an oral discussion with the participant and possible contact with the industrial coach. The grade will be based upon two aspects: The content of the experience (in relation to the above objective) and the quality of the report.		
Course Contents	Each participant must 'procure' his or her industrial practice opportunity via the submission of a resume, etc. to the company involved. The teacher listed above can help with initial contacts. Once a agreement had been reached with a company, the participant is to report this to the OE course leader before departure. He may make specific agreements about contacts during progress of the work. Each student must submit a report at the end of his or her experience period documenting what has been done and giving his or her impressions from that experience. Unless otherwise arranged beforehand, this report must be submitted within 2 months from the end of the industrial practice period - both to the university and to the industrial host.		
Study Goals	The objective of industrial practice is to expose participants to the day-to-day use of university-gained knowledge in a practical setting. While doing this, the participant enhances his of her interpersonal skills and professional attitude while in more direct contact with (engineering or other industrial) practice.		
Literature and Study Materials	obligatory lecture note(s)/textbook(s): "An Offshore Student's Survival Manual" by W.W. Massie recommended lecture note(s)/ textbook(s): "An Industry's Guide to the Offshore Engineering MSc Degree Curriculum" by W.W. Massie (to be given to one's industrial contact person).		
Contact	Secretariat of OE, Mrs. J. Baan		
Expected prior knowledge			
Remarks	Summary The objective of industrial practice is to expose participants to the actual use of university-gained knowledge and skills in a practical setting. The participant must carry out this activity 'where the action is' - on a job site or in an office outside the TU Delft academic environment. The timing of this activity depends only on the work schedules of the participant and his or her host company.		

Course	Code: OE5690	Course title: Thesis	ECTS: 37
Education Period	None (Self Study)		
Exam Period	Exam by appointment		
Instructor	Ir. G.H.G. Lagers; E-mail: G.H.G.Lagers@tudelft.nl		
Education Method	exercise		
Judgement	The thesis grade is determined by the coaching committee. Both the product of the work and the process leading to it are considered in the evaluation.		
Course Contents	Each participant devotes roughly a month at the start of his or her thesis to a general orientation about the chosen problem. This phase is carried out in cooperation with the coach most closely associated with the given problem and may be completed before a full thesis committee has been formed. The result of this step is to be a written thesis proposal in which the problem is described along with the participant's suggestion of how to solve or alleviate it. A time schedule of activities is included at this stage as well. Additional members of the thesis committee are selected based upon their expertise in relation to the work proposed. A first plenary meeting of the committee is arranged to discuss the proposal. The thesis is carried out in close cooperation with the participant's primary coach. The entire thesis committee meets with the participant at appropriate intervals (often 6 to 10 weeks) to discuss progress and remaining work to be done. When a participant is working in a foreign country, this discussion generally takes place by e-mail more on a one-to-one basis. A public thesis presentation is held after the thesis committee has reviewed and approved the final draft of the complete thesis and the participant has completed all of his or her other degree requirements. Each participant must also complete a one page abstract of the work for publication before the presentation is held. Participants are encouraged to write and submit a paper for (potential) publication as well. This can take place after the thesis presentation.		
Study Goals	The thesis is the participant's final proof of his or her (offshore) engineering competence. When it is carried out in industry, it often eases the transition from the university study life style to that of a productive industrial worker.		

Literature and Study Materials	recommended other materials: "An Offshore Participant's Survival Manual" by W.W. Massie "An Industry's Guide to the Offshore Engineering MSc Degree Curriculum" by W.W. Massie (to be given to one's industrial contact person).Available at the section secretariat.
Contact	Secretariat of OE, Mrs. J. Baan
Expected prior knowledge	
Remarks	Summary The thesis is the participant's final proof of his or her (offshore)engineering competence. It is usually an individual study resulting in a significant report and when possible an accompanying paper for publication. Each participant is encouraged to select a thesis project that is consistent with his or her professional objectives. Most theses are carried out in cooperation with industry or other outside agency in some way, although this is not a specific requirement.

Course	Code: TA3440/ PE+RG	Course title: Petroleum Engineering	ECTS: 3
Education Period	3rd Education Period		
Exam Period	3rd Exam Period		
Instructor	Dr. J. Bruining; E-mail: J.Bruining@tudelft.nl Prof.bsc.msc.ph. P.K. Currie; E-mail: P.K.Currie@tudelft.nl Dr.ir. J.D. Jansen; E-mail: J.D.Jansen@tudelft.nl Dr. P.L.J. Zitha; E-mail: P.L.J.Zitha@tudelft.nl		
Education Method	Lectures		
Judgement			
Course Contents	Lectures:- Petroleum life cycle. Unit conversion. Hydrocarbon properties - Reservoir engineering 1: volumetrics - Reservoir engineering 2: multi-phase flow - Drilling and well technology - Production technology and facilities - Petroleum economics. Health, safety & environment - Field management. New technology & research		
Study Goals	- Provide an overview of the petroleum industry.- Illustrate some of the underlying physics.- Illustrate some of the engineering aspects.- Expose students to staff members of the petroleum engineering (PW) section.- Give an impression of the research activities in the PW section.		
Literature and Study Materials	1) Jahn, F., Cook, M. and Graham, M.: 'Hydrocarbon Exploration and Production', Elsevier, 1998. 2) Handouts.		
Contact			
Expected prior knowledge			
Remarks			

Course	Code: WB1217	Course title: Strength of materials 2	ECTS: 3
Education Period	2nd Education Period		
Exam Period	2nd Exam Period, 3rd Exam Period		
Instructor	Ir. M.G. van de Ruijtenbeek; E-mail: M.G.vandeRuijtenbeek@tudelft.nl Ir. G. Wisse; E-mail: G.Wisse@tudelft.nl		
Education Method			
Judgement			
Course Contents			
Study Goals			
Literature and Study Materials			
Contact			
Expected prior knowledge			
Remarks			

Course	Code: WB4418	Course title: Gas and oil processing offshore	ECTS: 4
Education Period	3rd Education Period		
Exam Period	Differently to be announced		
Instructor	Z. Olujic; E-mail: Z.Olujic@tudelft.nl		
Education Method	Lectures (4 hours per week)		
Judgement			
Course Contents	The course consists of a number of modules covering all process design aspects of gas and liquid processing offshore: high pressure thermodynamics of multi-component mixtures, gas hydrate forming and prevention, multiphase production and transport, gas/liquid separation, pumps and compressors, auxiliary systems, platform layout, safety considerations, most recent offshore technology developments.		
Study Goals	The student is able to design specific aspects of offshore installations for treatment and transport of natural gas loaded with condensate. More specifically, the student must be able to: design components of offshore installations taking into account all process design aspects of gas and liquid processing offshore:1. high pressure thermodynamics of multi-component mixtures2. gas hydrate forming and prevention3. multiphase production and transport4. gas/liquid separation5. pumps and compressors6. auxiliary systems7. platform layout8. safety considerations9. most recent offshore technology developments		
Literature and Study Materials	Course material: Bound course material consisting of chapters written by persons involved with the course, edited by Z. Olujic References from literature: D.L. Katz and R.L. Lee, Natural Gas Engineering, McGraw-Hill, New York 1990;F.S. Manning and R.E. Thompson, Oilfield Processing of Petroleum (Volume 1, Natural Gas), PennWell Books, Tulsa, 1991., J.M. Campbell, Gas Conditioning and Processing (Volumes 1 and 2), Campbell Petroleum Series, Norman, OK, 1984		
Contact			
Expected prior knowledge	wb4403		
Remarks	Open assessment: Working out and discussion of two separate process design assignments Process design assignments are carried out by two or more students depending on the size of the problem, and are mostly concentrated around the separation therein and the multiphase flow calculations for a situation from practice.		