Imperial College London

Department Of Earth Science & Engineering
Faculty of Engineering
MSc in Petroleum Engineering

STUDENT HANDBOOK
2016–17
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Welcome to the College

Congratulations on joining Imperial College London, the only university in the UK to focus exclusively on science, medicine, engineering and business.

From Fleming’s discovery of Penicillin to Gabor’s invention of holography, Imperial has been changing the world for well over 100 years. You’re now part of this prestigious community of discovery and we hope you will take this opportunity to make your own unique contribution.

We’re committed to providing you with the very best academic resources to enrich your experience. We also provide a dedicated support network and a range of specialist support services to make sure you have access to the appropriate help, whether that’s further training in an academic skill like note taking or simply having someone to talk to.

You’ll have access to an innovative range of professional development courses within our Graduate School throughout your time here, as well as opportunities to meet students from across the College at academic and social events – see page 6 for more information.

We actively encourage you to seek out help when you need it and try to maintain a healthy work-life balance. Our choice of over 340 clubs, societies and projects is one of the largest of any UK university, making it easy to do something different with your downtime. You also have free access to gym (following a one-off orientation fee of £40 in 2016) and swimming facilities across our campuses.

As one of the best universities in the world, we are committed to inspiring the next generation of scientists, engineers, clinicians and business leaders by continuing to share the wonder of what we do through public engagement events. Postgraduate students, alongside our academics and undergraduate students, make a significant contribution to events such as our annual Imperial Festival and our term-time Imperial Fringe events – if you’re interested in getting involved then there will be opportunities for you to do so.
Welcome
Professor Sue Gibson,
Director of the Graduate School

The Graduate School has several roles but our main functions are to provide a broad, effective and innovative range of professional skills development courses and to facilitate interdisciplinary interactions by providing opportunities for students to meet at academic and social events. Whether you wish to pursue a career in academia, industry or something else, professional skills development training will improve your personal impact and will help you to become a productive and successful researcher.

Professional skills courses for Master’s students are called “Masterclasses” and they cover a range of themes, for example, presentation skills, academic writing and leadership skills (see page 6 for more information).

All Masterclasses are free of charge to Imperial Master’s students and I would encourage you to take as many as you can to supplement your academic training. The Graduate School works closely with the Graduate Students’ Union (GSU) and is keen to respond to student needs, so if there is an area of skills training or an activity that you would like us to offer, but which is not currently provided, please do get in touch (see page 6).

The Graduate School also runs a number of exciting social events throughout the year which are an opportunity to broaden your knowledge as well as to meet other students and have fun. Particular highlights include the Ig Nobel Awards Tour Show, the Chemistry Show and the 3-minute thesis competition. You should regularly check the Graduate School’s website and e-newsletters to keep up to date with all the events and training courses available to you.

Finally, I hope that you enjoy your studies here at Imperial, and I wish you well.

Welcome
Dr Janet De Wilde,
Head of Postgraduate Professional Development

I would like to welcome you to the Graduate School programme for postgraduate professional development. Our team of tutors come from a wide variety of experiences and we understand just how important it is to develop professional skills whilst undertaking postgraduate studies and research. Not only will this development improve your success during your time at Imperial, it will also prepare you for your future careers. We are continually working to develop the courses we offer and over this year you will see a range of new courses including face-to-face workshops, interactive webinars and online self-paced courses. I encourage you to explore and engage with the diverse range of opportunities on offer from the graduate school and I wish you well in your studies.
The Graduate School

You automatically become a member of the Graduate School when you register as a postgraduate student at Imperial.

The Graduate School has been set up to support all postgraduate students at the College through:

- Training and development courses
- Networking activities, social and academic events to encourage cross-disciplinary interactions
- Forums to represent the views of postgraduate students throughout the College

‘Masterclass’ professional skills courses

You can see the full range of free professional skills courses for postgraduate students on the Graduate School website:

www.imperial.ac.uk/study/pg/graduate-school/professional-skills/masters

All courses can be booked online.

Contact us

Level 3, Sherfield Building, South Kensington Campus
020 7594 1383
graduate.school@imperial.ac.uk
www.imperial.ac.uk/graduate-school

Imperial Success Guide

The Imperial Success Guide is an online resource with advice and tips on the transition to Master’s level study. More than just a study guide, it is packed with advice created especially for Imperial Master’s students, including information on support, health and well-being and ideas to help you make the most of London.

www.imperial.ac.uk/success-guide
Introduction from the President of the Graduate Students’ Union

I am delighted to welcome you to Imperial, and to the Graduate Students’ Union (GSU). I hope that your time here will be fulfilling and valuable, and the GSU is here to try and facilitate this.

Imperial College London is such a wonderful and transformative place that provides a unique and thrilling environment for research and for advanced studies, and the graduate students are a vital and valued part of the wider community of Imperial. Our graduate students are at the forefront of the research done. Therefore, at the GSU we ensure that the experience here fosters both academic achievement and personal development in our students.

The GSU is a University-wide representative body for postgraduate students at Imperial. It promotes the interests and welfare of its members, provides social and recreational activities and advocate for you and your opinions to the University and bodies external to the university. I encourage you to become an active member of the GSU– through involvement in your departments and the many University societies, and through our representational and campaigning activities.

I wish you all a fantastic time here at Imperial. Please take advantage of our rich community, and hope to meet you all soon.

Ahmed Shamso
gsu.president@imperial.ac.uk
1. Introduction to the Department

Welcome from Head of Department

Congratulations and welcome to the Department of Earth Science and Engineering. We are a world class research ecosystem in which the boundaries of science and engineering are extended. Our Master’s students are highly prized and highly effective in industry and academia. The training you will receive will allow you to achieve great success and will make a lasting change to our understanding of the world around us. I wish you well in your activities and hope that you find your time with us an extremely rewarding experience.

I look forward to meeting you during the course of your degree in Earth Science and Engineering.

Mark Sephton
Head of Department for Earth Science & Engineering
Welcome from Programme Director

The Centre for Petroleum Studies is a focus for research, postgraduate teaching and professional development within the framework of petroleum sciences and engineering at Imperial College. Its main objectives are to facilitate multi-disciplinary research between geologists, geophysicists, petroleum engineers and members of other key disciplines in order to advance the state of the art in exploration, appraisal/development and reservoir management, and to plan and implement related post graduate teaching programs which reflect current best practice within the petroleum industry. The Centre has one of the largest concentrations of petroleum scientists and engineers in any UK academic institution with almost 50 members of staff providing research expertise across the complete exploration-production spectrum.

Research is mostly carried out within the Department of Earth Science and Engineering in cooperation with research groups in other science and engineering departments at the College.

Research expertise includes: seismic data processing and imaging; seismic interpretation; sequence stratigraphy; sedimentary petrology; regional tectonics and basin analysis; clastic deposition and reservoir systems; reservoir characterisation, petrophysics; petroleum geomechanics; reservoir physics; well test analysis; stochastic modelling; numerical simulation; reservoir engineering; multiphase flow; process engineering and environment engineering. Funding is largely obtained from industry.

We would like to wish the new students a very happy and successful year in the Department. As an MSc student in the Department, your work will contribute to the department’s success.

Professor Martin Blunt

[Signature]

Director, MSc Petroleum Engineering course
Research Groups & Sections in ESE

Earth Science and Engineering is a highly rated department performing multi-disciplinary research. It is organised into three broad Research Sections. All PhD students and academic staff belong to one of these sections. Research Groups operate across Research Sections in a matrix of scientific interaction. For further details: http://www3.imperial.ac.uk/earthscienceandengineering/research

Research Sections

The **Earth and Planets Section** (E&P) is concerned with understanding the processes that drive the Earth system, and in the formation and evolution of solid bodies within the Solar System. The Head of this section is Dr Gareth Collins.

The **Petroleum Geoscience and Engineering Section** (PGE) conduct pure and applied research in petroleum reservoir engineering, petroleum geology, and petroleum geophysics, and carbon-dioxide capture and sequestration. The Head of this section is Prof Ann Muggeridge.

The **Environment, Energy, Minerals and Modelling Section** (E²M²) are concerned with environmental engineering, low-carbon energy, mining and mineral processing, and modelling and measurement of the perturbed natural environment. The Head of this section is Prof Matthew Piggott.

Research Groups

The **Petroleum Engineering and Rock Mechanics Research Group (PERM)** performs research in all areas of petroleum engineering, including fluid flow in porous media, reservoir simulation, reservoir characterisation, hydrocarbon thermodynamics, rock mechanics and drilling, as well as topics such as subsurface carbon sequestration. The research involves the investigation of complex, non-linear phenomena in highly disordered geological media.

The **Impacts and Astromaterials Research Centre (IARC)** addresses a wide range of fundamental planetary science questions, ranging from the origins of the Solar System to the continuing evolution of the planets, asteroids and comets. The IARC initiative brings together planetary scientists, facilities and resources from the Department of Earth Science and Engineering at Imperial College London and the Mineralogy Department of The Natural History Museum.

The **Applied Modelling and Computation Group (AMCG)** is committed to both the development and application of innovative modelling techniques in Earth, nuclear engineering and biomedical sciences. The group is interested in the development and application of numerical methods for neutral particle radiation transport, for atmospheric, ocean and multiphase flows, for optimisation mathematics and its applications, and for the solution of inverse (imaging/tomographic) problems.
The Sedimentary Basins Group is concerned with the sedimentary and structural evolution of sedimentary basins, including their stratigraphic and depositional evolution, tectonics, diagenesis, palaeoenvironments, and surface processes.

The MAGIC Laboratory (MAss Spectrometry and Isotope Geochemistry at Imperial College London) uses isotope geochemistry to tackle a broad variety of questions in Earth, environmental, and engineering sciences, involving climate, oceans and biogeochemical cycles, magmatic processes, and cosmochemistry.
**Equality at Imperial**

Imperial College London is committed to promoting and embedding equality and diversity throughout the College. Equality and diversity forms an integral part of Imperial Expectations, the set of seven statements which articulate how the College expects its leaders, managers and supervisors to behave. The College’s Equality Objectives provide an overarching plan over a two year period, and are published in accordance with Imperial’s Public Sector Duty.

The College is an Athena SWAN Silver Institution, Stonewall Diversity Champion, Two Ticks employer and works with GIRES to promote respect for Trans people.

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**What we do in the Department**

The Department of Earth Science and Engineering welcomes staff and students from all over the world with a diverse range of beliefs and cultures. We believe this diverse cultural background complements the diverse technical background and expertise of our staff. Racist, sexist or any other discriminatory behaviour is not tolerated.

We aspire to create an environment where all individuals within the Department can achieve their potential and develop their career, removing barriers, eliminating discrimination and providing opportunities to thrive.

The Department of Earth Science and Engineering is an Athena SWAN Departmental Award holder since 2009 with a Silver status since 2012. We will be submitting our Athena SWAN silver renewal application in November 2016.

In addition to what the College already does to develop your career and to promote inclusiveness, the Department facilitates training sessions specific to different career stages for Personal and Professional Development. We host various events throughout the year to engage individuals from every walk of life. These events include the Annual Royal School of Mines Quiz, International Women’s and National Women in Engineering Day Celebrations, awareness events for religious festivals, the Annual ESE Away Day. These events, training sessions and opportunities to provide feedback, will be advertised throughout the year and we encourage everyone to take part.

We believe creating an equal, diverse and inclusive culture is everyone’s responsibility. We look to you, our next generation of students, to join us in our aspirations, provide feedback on our action plans, events and help shape the department into the best place to develop your career.

If you would like to know more about events or opportunities within the department, please contact Thomas Dray, Postgraduate Education Administrator, t.dray@imperial.ac.uk.
## Academic and Administrative Staff

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>Location</th>
<th>Office Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Martin Blunt</td>
<td>Course Director (MSc Petroleum Engineering)</td>
<td>2.38, Royal School of Mines</td>
<td>020 7594 6500</td>
<td><a href="mailto:m.blunt@imperial.ac.uk">m.blunt@imperial.ac.uk</a></td>
</tr>
<tr>
<td>Thomas Dray</td>
<td>Postgraduate Education Administrator</td>
<td>G24, Royal School of Mines</td>
<td>020 7594 7447</td>
<td><a href="mailto:t.dray@imperial.ac.uk">t.dray@imperial.ac.uk</a></td>
</tr>
<tr>
<td>Joanna Owens</td>
<td>Field Trips and Postgraduate Education Administrator (MSc Metals &amp; Energy Finance)</td>
<td>G24, Royal School of Mines</td>
<td>020 7594 6462</td>
<td><a href="mailto:j.owens@imperial.ac.uk">j.owens@imperial.ac.uk</a></td>
</tr>
<tr>
<td>Samantha Symmonds</td>
<td>Postgraduate Education Manager</td>
<td>G24, Royal School of Mines</td>
<td>020 7594 7339</td>
<td><a href="mailto:sam.symmonds@imperial.ac.uk">sam.symmonds@imperial.ac.uk</a></td>
</tr>
<tr>
<td>Emma Watson</td>
<td>Departmental Operations Manager</td>
<td>G23, Royal School of Mines</td>
<td>020 7594 6405</td>
<td><a href="mailto:e.watson@imperial.ac.uk">e.watson@imperial.ac.uk</a></td>
</tr>
</tbody>
</table>
English language requirement

If you are not a native English speaker you must meet the College’s English language requirements.

See the Admissions website for details:

www.imperial.ac.uk/study/pg/apply/requirements/english

For information on English language support available while you’re here, see page 27.

Attendance and absence

You must inform your Course Director if you are absent from the College for more than three days during term. If the absence is due to illness you must produce a medical certificate after seven days. If you miss an examination through illness you must produce a medical certificate immediately.

The Registry will be informed of all student non-attendances as the College is obliged to report the non-attendance of students on Tier 4 visas to the Home Office.

Please note that attendance of all lectures during term-time is compulsory. Registers are used throughout the course year. If for any reason you cannot attend a lecture, please let Thomas Dray know immediately.

Key dates 2016–17

Term dates

<table>
<thead>
<tr>
<th>Date</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 October–16 December 2016</td>
<td>Autumn term</td>
</tr>
<tr>
<td>7 January–24 March 2017</td>
<td>Spring term</td>
</tr>
<tr>
<td>29 April–30 June 2017</td>
<td>Summer term</td>
</tr>
</tbody>
</table>

Closure dates

<table>
<thead>
<tr>
<th>Date</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Christmas/New year</td>
<td>24 December 2016–2 January 2017</td>
</tr>
<tr>
<td>Easter holiday</td>
<td>12 April–18 April 2017</td>
</tr>
<tr>
<td>Early May bank holiday</td>
<td>1 May 2017</td>
</tr>
<tr>
<td>Spring bank holiday</td>
<td>29 May 2017</td>
</tr>
<tr>
<td>Summer bank holiday</td>
<td>28 August 2017</td>
</tr>
</tbody>
</table>
## Key events

<table>
<thead>
<tr>
<th>Date</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wessex Basin Field Trip</td>
<td>12 - 17 October 2016</td>
</tr>
<tr>
<td>SPE Elections</td>
<td>18 October 2016</td>
</tr>
<tr>
<td>Wytch Farm Project Presentations</td>
<td>15 - 16 December 2016</td>
</tr>
<tr>
<td>PG Sole Survey (Autumn Term)</td>
<td>Mid-December 2016 (TBC)</td>
</tr>
<tr>
<td>Term begins with two exams:</td>
<td>9 - 10 January 2017</td>
</tr>
<tr>
<td>Wytch Farm Phase 2 Presentations:</td>
<td>27 February 2017</td>
</tr>
<tr>
<td>Library Workshop</td>
<td>8 March 2017</td>
</tr>
<tr>
<td>Wytch Farm Phase 3 Presentations</td>
<td>24 March 2017</td>
</tr>
<tr>
<td>PG Sole Survey (Spring Term)</td>
<td>Mid-March 2017 (TBC)</td>
</tr>
<tr>
<td>Exams</td>
<td>2 – 4 May 2017</td>
</tr>
<tr>
<td>SPE Overseas Trip</td>
<td>5 – 16 May 2017</td>
</tr>
<tr>
<td>Imperial Festival and Alumni Festival</td>
<td>6–7 May 2017</td>
</tr>
<tr>
<td>Individual Project Outline Presentations</td>
<td>31 May 2017</td>
</tr>
<tr>
<td>Board of Examiners Meeting</td>
<td>2 June 2017</td>
</tr>
<tr>
<td>Deadline for submitting Thesis</td>
<td>31 August 2017</td>
</tr>
<tr>
<td>Research Project Presentations</td>
<td>12 – 13 September 2017</td>
</tr>
<tr>
<td>Board of Examiners Meeting</td>
<td>14 September 2017</td>
</tr>
<tr>
<td>Deadline for submitting corrected Thesis</td>
<td>29 September 2017</td>
</tr>
<tr>
<td>Postgraduate Awards Ceremonies:</td>
<td>May 2018</td>
</tr>
</tbody>
</table>
Careers Events and Timetable

Ms. Shashi Luther, the Liaison and Communications Manager, is the first contact for students, employers and staff and operates an ‘open door’ policy for students, normally Monday to Friday between 9:30 – 17:30.

Shashi Luther
G33, Royal School of Mines
020 7594 6445
s.luther@imperial.ac.uk

Shashi organises the career events, talks and presentations given by an extensive array of world class employers from the oil industry. She coordinates with the representatives of the oil industry and sets up a programme of company presentations, followed by job interviews within the Department.

There will be a lunchtime lecture session early in Term 1 focusing on general aspects of petroleum industry careers. This aims to provide an objective review of the wide range of career opportunities for all of ESE’s petroleum-related MSc students.

The current programme of company careers talks in the Department for 2016-17 is listed below. All students are welcome to attend any talk. The careers talks provide an ideal opportunity to get up-to-date information, ask questions and talk to recent hires about their experiences.

This programme of events develops over the year, so you should check the Careers Notice Board regularly.

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Company</th>
<th>Target Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>21 October</td>
<td>12:00</td>
<td>BP</td>
<td>Engineers &amp; Geosciences</td>
</tr>
<tr>
<td>24 October</td>
<td>17:00</td>
<td>Petroleum Experts</td>
<td>Engineers</td>
</tr>
<tr>
<td>25 October</td>
<td>12:00</td>
<td>Evolution Resources</td>
<td>Engineers &amp; Geosciences</td>
</tr>
<tr>
<td>27 October</td>
<td>17:00</td>
<td>Exxonmobil</td>
<td>Engineers &amp; Geosciences</td>
</tr>
<tr>
<td>02 November</td>
<td>17:00</td>
<td>Shell</td>
<td>Engineers &amp; Geosciences</td>
</tr>
<tr>
<td>03 November</td>
<td>12:00</td>
<td>Wintershall</td>
<td>Engineers &amp; Geosciences</td>
</tr>
<tr>
<td>08 November</td>
<td>12:00</td>
<td>Total</td>
<td>Engineers &amp; Geosciences</td>
</tr>
<tr>
<td>10 November</td>
<td>12:00</td>
<td>CGG</td>
<td>Engineers &amp; Geosciences</td>
</tr>
<tr>
<td>05 December</td>
<td>12:00</td>
<td>ERC Equipoise</td>
<td>Engineers &amp; Geosciences</td>
</tr>
</tbody>
</table>
Blackboard

Blackboard is Imperial College London’s virtual learning environment (VLE) and is used to teach courses and store materials online.

Blackboard enables you to view:

- Electronic copies of course notes
- Course Outlines
- Assignment questions/ answers
- Lecture videos
- Past exam scripts
- Individual project information/ advice
- Timetable
- Company presentations

Blackboard can be accessed via the link below:

💻 https://bb.imperial.ac.uk/

Blackboard app is also available to use with your mobile phone. More details can be found at:

💻 https://www.imperial.ac.uk/admin-services/ict/self-service/teaching-learning/elearning-services/blackboard/access/
2. Facilities

Imperial has a number of campuses in London and the South East. All have excellent travel links and are easily accessible via public transport.

Your main location of study will be:


Royal School of Mines, South Kensington

Royal School of Mines
Prince Consort Road
London
SW7 2BP

Computers and Printing

Computer access and printing is available at:

1.49/50: MSc teaching and computer room. Food and drink allowed but not at the computer desks.

3.36- 3.38: Computer rooms. No food or drink allowed except a bottle of water.

The Department’s postgraduate office is located at G24, Royal School of Mines and open Monday–Friday, 08.30 – 17.00.

Photocopiers

Three photocopiers are located in 2.43 (including a colour copier). Also available in room 2.43 are comb-binding facilities, a laminating machine, staplers and guillotines. The department also offers ON-LINE photocopying facilities in room 2.43 (please contact Carl Jurczuk if you wish to use the photocopiers ON-LINE). Photocopy cards can be bought from Carl Jurczuk in Room 2.43. Copier cards are rechargeable, but a £2.00 deposit is required for each card purchased.

Your ID card will contain printer credit when you receive it. This can be topped up by using the machines located in the library. Black and white printing costs 3p per A4 page in the department and the library, while colour printing costs 12p per A4 page in the department and the library.

Student Lockers

Lockers are located on the lower ground floor in the RSM Building.

If you wish to use one of these lockers then you should find one that is vacant, add a label with your name to the front and use your own padlock to secure. Please note all padlocks are removed at the end of each academic year and contents discarded.

Please note that ANY items left on top of the lockers will be removed and disposes of without warning.
**Bicycles**

Bicycles are not allowed in the building and must not be chained to the railings. Bicycle racks are located outside the RSM building and a bike cage is provided under the Faculty building. For access to the bike cage please fill in the form at the link:

[http://www.imperial.ac.uk/estates-facilities/travel/cycling/bike-parking/](http://www.imperial.ac.uk/estates-facilities/travel/cycling/bike-parking/)

**Security**

All students will be issued with a College Identity Card shortly after Registration. This is a necessary feature of your life in College as it acts as your Students' Union membership card, allowing you access to the all the sports and union facilities, as well as a security pass allowing you access to appropriate parts of the College and a Library Card. Any loss must be reported to Security. Please be particularly vigilant about your own security and that of your belongings. Please remember to keep any valuables locked up and never leave your belongings unattended.

Fire doors: please make sure that all fire doors are always shut after you - do not wedge them open.

**Internal and External Mail**

MSc student post can be collected from the cupboard located just outside 1.49/1.50 lecture room on the first floor of the Royal School of Mines. For all postal or faxing enquires please see ESE Reception, room G.22.

Outgoing mail to the College (including Silwood Park & Wye) should be put in the “Internal Mail Only” tray in Reception (G22). Outgoing external mail should be taken directly to the Post Office.

**Shuttle bus**

A free shuttle bus runs between our South Kensington, White City and Hammersmith Campuses on weekdays. Seats are available on a first-come, first-served basis. You need to show your College ID card to board. Download the timetable at:

[www.imperial.ac.uk/estates-facilities/travel/shuttle-bus](http://www.imperial.ac.uk/estates-facilities/travel/shuttle-bus)

**Maps**

Campus maps and travel directions are available at:

[www.imperial.ac.uk/visit/campuses](http://www.imperial.ac.uk/visit/campuses)

**Accessibility**

Information about the accessibility of our South Kensington Campus is available online through the DisabledGo access guides:

[www.disabledgo.com/organisations/imperial-college-london-2](http://www.disabledgo.com/organisations/imperial-college-london-2)
3. Expenses Policy

Expenses Policy – A summary for Students

- This is not an extensive summary and only addresses the most frequently asked questions regarding the College Expenses Policy.

- The policy applies to all spend on Imperial College business. An expense claim should be used to reimburse incidental expenses. Items such as travel, equipment and software should be purchased through the College.

- Negligence in the submission of claims may be regarded as a disciplinary offence.

- If you have had to pay for something in the performance of your duties for the College, our policy is to pay you back. The expense must be justifiable and reasonable according to the information in the Policy, which will make it a genuine expense.

**What can I claim for?**

You can only claim for incremental costs (i.e. additional costs) which you need to incur in order to further the College’s mission, over and above your ordinary living costs. You cannot claim any cost which you would have incurred anyhow in leading your private life.

- ✓ Travel
- ✓ Overnight costs and allowances
- ✓ Subsistence
- ✓ Tips and gratuities when included on a bill
- ✓ Business phone calls

**What I cannot claim for?**

- ✗ Equipment
- ✗ Broadband/Internet provision
- ✗ Mobile phone contracts or hardware
- ✗ Insurance
- ✗ Gifts
- ✗ Wages, salaries or fees
- ✗ Personal expenditure
Basic Rules and Rates

The most important thing to remember when incurring an expense is to **KEEP THE RECEIPT**. The College requires all original receipts in order to reimburse any expenses; if the receipt is lost or missing we may not be able to reimburse the full or any partial cost. All reimbursements require the approval of the account holder prior to incurring the expense. Please obtain this prior to incurring an expense and submitting an expense claim.

The below table outlines some of the basic rates that are often claimed by students:

<table>
<thead>
<tr>
<th>Item</th>
<th>Maximum with receipt</th>
<th>Maximum without receipt (if applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td>£7.50</td>
<td>£5</td>
</tr>
<tr>
<td>Lunch</td>
<td>£15</td>
<td>£5</td>
</tr>
<tr>
<td>Dinner</td>
<td>£25</td>
<td>£10</td>
</tr>
<tr>
<td>Hotel in London/Edinburgh</td>
<td>£150 per night incl. VAT</td>
<td>N/A</td>
</tr>
<tr>
<td>Hotel in UK (not London/Edinburgh)</td>
<td>£105 per night incl. VAT</td>
<td>N/A</td>
</tr>
<tr>
<td>Hotel outside UK</td>
<td>Please check the HM Revenue &amp; Customs Worldwide Subsistence Rates</td>
<td></td>
</tr>
<tr>
<td>Air/Rail Travel</td>
<td>This should always be booked in Standard or Economy class (for flights over 5 hours, premium economy may be booked)</td>
<td></td>
</tr>
<tr>
<td>Taxi/Car Hire</td>
<td>Approval prior to this type of travel must be sought from the Department Operations Manager. This type of travel may only be taken where there are no alternatives</td>
<td></td>
</tr>
<tr>
<td>Incidental Overnight Allowances (IOE)</td>
<td>Please check prior to travel that you are entitled to IOE’s. If so, £5 per day in the UK or £10 per day outside the UK may be claimed to a maximum of 30 days</td>
<td></td>
</tr>
</tbody>
</table>

The Department is able to book Flights, Car Hire, Accommodation, Trains and Conferences on your behalf. Please contact Helen Stoneham or Jacqueline Hughes if you require this assistance. **For further guidance please see the full expenses policy.**

---

Helen Stoneham  
G26, Royal School of Mines  
020 7594 2889  
h.stoneham@imperial.ac.uk

Jacqueline Hughes  
G22, Royal School of Mines  
020 7594 7333  
j.hughes@imperial.ac.uk
4. Working while Studying

If you are studying full time, the College recommends that you do not work part-time during term time. If this is unavoidable we advise you to work no more than 10–15 hours per week, which should be principally at weekends and not within normal College working hours.

Working in excess of these hours could impact adversely on your studies or health.

If you are here on a Tier 4 visa you can work no more than 20 hours a week during term time. Some sponsors may not permit you to take up work outside your studies and others may specify a limit.

If you are considering part-time work during term time you are strongly advised to discuss this issue with your supervisor or Postgraduate Tutor. If you are on a Tier 4 visa you should also seek advice from the International Student Support team regarding visa limitations on employment.

Please refer to our policy on working while studying:

You are responsible for looking after your own health and safety and that of others affected by your College-related work and leisure activities. You must:

- comply with all local and College policies, procedures and codes of practice and with the arrangements which the College has in place to control health and safety risks.
- ensure that your activities do not present unnecessary or uncontrolled risks to yourself or to others.
- attend appropriate induction and training.
- report any accidents, unsafe circumstances or work-related ill health of which you become aware to the appropriate person.
- not interfere with any equipment provided for Health and Safety.
- inform your supervisor or the person in charge of the activity in cases where you are not confident that you are competent to carry out a work or leisure activity safely, rather than compromise your own safety or the safety of others.

The College’s Health and Safety Policy can be found at:


Your Departmental safety contact is:

- Simon Davis
- 020 7594 6544
- simon.davis@imperial.ac.uk

You may be required to complete a Health & Safety induction on the first day of term.

The College Safety Department

The Safety Department offers a range of specialist advice on all aspects of safety. This includes anything which you feel might affect you directly, or which may be associated with teaching, research or support service activities.

The College’s activities range from the use of hazardous materials (biological, chemical and radiological substances) to field work, heavy or awkward lifting, driving, and working alone or late.

All College activities are covered by general health and safety regulations, but higher risk activities will have additional requirements.

The Safety Department helps departments and individuals ensure effective safety management systems are in place throughout the College to comply with specific legal requirements.
Sometimes the management systems fail, and an accident or a near-miss incident arises; it is important that we learn lessons from such situations to prevent recurrence and the Safety Department can support such investigations. All accidents and incidents should be reported online at:

- [www.imperial.ac.uk/safety](http://www.imperial.ac.uk/safety)

To report concerns or to ask for advice you should contact your programme director, academic supervisor or departmental safety contact in the first instance. You may also contact the Safety Department directly.

**Occupational Health requirements**

The College Occupational Health Service provides services to:

- protect health at work
- assess and advise on fitness for work
- ensure that health issues are effectively managed

The Service promotes and supports a culture where the physical and psychological health of staff, students and others involved in the College is respected, protected and improved whilst at work.

- [www.imperial.ac.uk/occupational-health](http://www.imperial.ac.uk/occupational-health)

**Health clearance for travel**

Please note: Postgraduate students travelling abroad for study or research have the same health clearance requirements as for staff. Clearance is compulsory for any travel to a tropical country. Information on arrangements for health clearance can be found at:

- [http://www.imperial.ac.uk/occupational-health/travel/](http://www.imperial.ac.uk/occupational-health/travel/)

If any vaccinations are required for the destination country then an appointment with the OH Service should be sought at least four weeks in advance of travel. Students will need to provide evidence that their trip is directly related to their study or research activity.

Clearance will be notified to the Course Director named on the health clearance questionnaire.
6. College Policies and Procedures

Regulations for students
All registered students of the College are subject to the Regulations for Students, the College Academic and Examination Regulations and such other regulations that the College may approve from time to time.

Appeal and complaints procedures
We have rigorous regulations in place to ensure assessments are conducted with fairness and consistency. In the event that you believe that you have grounds for complaint about academic or administrative services, or wish to appeal the outcome of an assessment or final degree, we have laid out clear and consistent procedures through which complaints and appeals can be investigated and considered:

Academic integrity
You are expected to conduct all aspects of your academic life in a professional manner. A full explanation of academic integrity, including information on the College’s approach to plagiarism is available on the Student Records and Data website:

Cheating offences policy and procedures
It is important that you learn how to properly attribute and acknowledge the work, data and ideas of others. Plagiarism is scientific misconduct, and students whose assessments can be shown to contain plagiarism are subject to penalties as outlined in the College’s Cheating Offences Policy and Procedures – see Appendix 3 of the Examination Regulations which can be found here:

Intellectual property rights policy
For further guidance on the College’s Intellectual Property Rights Policy, please contact the Research Office:

Use of IT facilities
View the Conditions of Use of IT Facilities:
Plagiarism

Plagiarism is the presentation of another person’s thoughts, words, images or diagrams as though they were your own. Another form of plagiarism is self-plagiarism, which involves using your own prior work without acknowledging its reuse.

Plagiarism is considered a cheating offence and must be avoided, with particular care on coursework, essays, reports and projects written in your own time and also in open and closed book written examinations.

Where plagiarism is detected in group work, members of that group may be deemed to have collective responsibility for the integrity of work submitted by that group and may be liable for any penalty imposed, proportionate to their contribution.

The penalties for plagiarism, and allowing plagiarisation of your own work, can include:

- reduced or zero marks for that piece of work or for the whole course module.
- a re-submission of the work after a specified time (typically two years) in the case of projects and dissertations.
- exclusions from future examinations of the University.
- Degrees already awarded may be withdrawn.

Plagiarism Awareness Course

The Graduate School’s online Master’s Plagiarism Awareness course is compulsory for all Master’s students. The course provides students with guidance and information about proper citation and attribution in their writing. Successful completion of the course will be recorded by the Graduate School and Departments will be informed when their students have completed it as part of the regular Graduate School Departmental reports. Completion of the course will be marked on student transcripts. Master’s students who progress to a doctorate will not be expected to take the doctoral version of the course but should be reminded about the course 6 months prior to submission of their thesis.

Access to the course

All Master’s students will be required to self-enrol onto the course which is available via Blackboard. Instructions on how to enrol onto the course can be found on the Graduate School’s Plagiarism Awareness Online Course webpage:

https://www.imperial.ac.uk/study/pg/graduate-school/professional-skills/masters/online/

The course will take approximately 1.5 hours to complete but can be saved and returned to at a later date. There is no limit to the amount of times you can take the course – it can be accessed anytime, so there will always be an opportunity to refresh understanding.

For further information, please refer to the Cheating Offences Policy and Procedures section on page 38 of this handbook.
7. Well-being and Advice

Student Space
The Student Space website is the central point for information on health and well-being.

🌐 www.imperial.ac.uk/student-space

Director of Student Support
The Director of Student Support has overall responsibility for all matters relating to student support and well-being.

🌐 www.imperial.ac.uk/people/d.wright

Departmental support and College tutors
Your Department has a system of academic and pastoral care in place to make sure you have access to the appropriate support throughout your time here. If you require any help or assistance, in the first instance you should contact your course director or course administrator.
**College tutors**

College tutors operate outside of any department. They provide guidance and assistance to students in regard to welfare issues and are also involved in College disciplinary matters involving students.

The college tutors for our department are:

- **Lorraine Craig (Academic Tutor)**
  - Phone: 020 7594 6436
  - Email: l.craig@imperial.ac.uk

- **Emma Passmore (Deputy Senior Tutor)**
  - Phone: 020 7594 6429
  - Email: e.passmore@imperial.ac.uk

For more information see:

- [www.imperial.ac.uk/student-space/here-for-you/college-tutors-and-departmental-support](http://www.imperial.ac.uk/student-space/here-for-you/college-tutors-and-departmental-support)

**Advice services**

The tutor system is complemented by a College-wide network of advice and support. This includes a number of specialist services.

**Careers Service**

The Careers Service has strong links to your Department and you will have a named Careers Consultant and Placement and Internship Adviser who will run both group sessions and individual meetings within your Department. You can arrange to meet with your linked Careers Consultant or Placement and Internship Adviser either in your Department or centrally on Level 5 Sherfield where the Careers Service is based.

Visit the Career Service’s website to:

- Book a careers appointment
- Find resources and advice on successful career planning

- [www.imperial.ac.uk/careers](http://www.imperial.ac.uk/careers)
Counselling and Mental Health

The Student Counselling and Mental Health Advice Service offers short-term counselling to all registered students. The service is free and confidential. Counsellors are available at the South Kensington, Hammersmith and Silwood Park Campuses.

www.imperial.ac.uk/counselling

The college supports mental health first aid and our departmental contact in Earth Science & Engineering is Peter Fitch (p.fitch@imperial.ac.uk)

http://www.imperial.ac.uk/health-and-wellbeing/mental-health/

External Support Services

The Samaritans
These provide a 24 hour confidential emotional support to anyone in emotional distress – you can drop into your local branch to meet with a Samaritans volunteer face to face.

46 Marshall Street, London, W1F 9BF
020 7734 2800 (Emergency No: 08457 909090).

London Nightline
A student-run telephone helpline offering confidential listening, support and information to students in London is open every night of term from 18.00 to 08.00.
020 7631 0101
listening@london-nightline.org.uk
http://nightline.org.uk/contact-us/instant-messaging/

Please visit the link below is see more available external support services:

http://www.imperial.ac.uk/counselling/other-sources-of-help/

Financial support and tuition fees

If you’ve got any questions about student financial support (loans, scholarships and research council studentships, US and Canadian loans) then contact the Student Financial Support team:
020 7594 9014
student.funding@imperial.ac.uk
If you suddenly find yourself in financial difficulties or experience an unexpected change in circumstances, you may be eligible to apply for emergency financial help through the Student Support Fund. The Fund offers a one-off payment of up to £2,000 to cover such emergencies as last minute accommodation and travel necessities, equipment and childcare. It does not have to be repaid.

www.imperial.ac.uk/students/fees-and-funding/student-support-fund

For tuition fees queries, contact the Tuition Fees team:

020 7594 8011
tuition.fees@imperial.ac.uk

**Imperial College Union (ICU) Advice Centre**

Imperial College Union runs the Advice Centre independently of the College with advisers on hand to provide free, confidential, independent advice on a wide range of welfare issues including housing, money and debt, employment and consumer rights, and personal safety.

www.imperialcollegeunion.org/advice

**Student Hub**

The Student Hub represents a single point of contact for all key administrative information and support. The Student Hub team can help you with enquiries about:

- Accommodation (including checking contracts for private accommodation)
- Admissions
- International student enquiries
- Research degrees
- Student financial support
- Student records
- Tuition fees

Level 3, Sherfield Building, South Kensington Campus
020 7594 9444
student.hub@imperial.ac.uk
www.imperial.ac.uk/student-hub
Health services

NHS Health Centre and finding a doctor

Even if you’re fit and healthy we recommend that you register with a local doctor (GP) as soon as you arrive in London. For help finding your nearest GP see the Student Space website:

www.imperial.ac.uk/student-space/here-for-you/find-a-doctor

There is an NHS Health Centre on our South Kensington Campus which you may visit during clinic hours if you’re feeling unwell. Students living within the practice catchment area are encouraged to register with the Centre.

www.imperialcollegehealthcentre.co.uk

NHS Dentist (based in the Health Centre)

Imperial College Dental Centre offers a full range of NHS and private treatment options.

www.imperial.ac.uk/student-space/here-for-you/dentist

Disability support

Disability Advisory Service

The Disability Advisory Service provides confidential advice and support for all disabled students and students with specific learning difficulties.

If you think you may have dyslexia or another specific learning difficulty but have never been formally assessed, the Disability Advisory Service offers initial screening appointments.

Room 566, Level 5, Sherfield Building, South Kensington Campus

020 7594 9755

disabilities@imperial.ac.uk

www.imperial.ac.uk/disability-advisory-service

Departmental Disability Officers

Departmental Disability Officers are the first point of contact within your department. They can apply for additional exam arrangements on your behalf, and will facilitate support within your Department.

The Disability Officer for our Department is:

Lorraine Craig (Academic Tutor)
More information on Departmental Disability Officers is available at:

www.imperial.ac.uk/disability-advisory-service/support/ddos

More information on procedures for the consideration of additional exam arrangements in respect of disability is available at:


Library and IT

Information and Communications Technologies (ICT)

If you’re having problems with technology (including computers, laptops and mobile devices), you can get help from ICT’s Service Desk.

020 7594 9000

www.imperial.ac.uk/ict/service-desk

Software shop

The Software shop offers a variety of general and subject specific software programs and packages for free or at a discounted price for Imperial students.

www.imperial.ac.uk/admin-services/ict/shop/software

Library services

The Central Library at South Kensington is open around the clock pretty much all year. Make sure you find out who your departmental librarian is as they’ll be able to help you find resources for your subject area. Also, don’t forget to check out the Library’s range of training workshops and our other campus libraries for access to specialist medicine and life sciences resources. Alongside these physical spaces and resources, the Library provides over 170,000 electronic books, journals and databases available both on and off campus and a free document delivery service to help you source books and articles from around the UK and the rest of the world:

www.imperial.ac.uk/library

The majority of the Earth Science collection is located on Level 4, including a large map collection and the print journals. Most of the Engineering and the Business and Finance collections are located on level 5. You can find material by using the search box on the library’s homepage:
The Library also provides access to thousands of electronic journals and books, as well as hundreds of databases containing journal literature and other publications. More information about these is available on the library homepage and on the ESE subject page:

http://www.imperial.ac.uk/admin-services/library/subject-support/earth-science-and-engineering/

Please forward any enquiries or requests regarding the Library and its resources to the ESE subject librarian Nicole Urquhart.

Religious support

The Chaplaincy Multi-faith Centre has chaplains from many different religions, as well as prayer rooms and information on places of worship. In addition, it runs meditation classes and mindfulness workshops for stress management. There is a student-run Islamic prayer room on campus and separate areas available for male and female Muslims.

www.imperial.ac.uk/chaplaincy

Support for international students

English language support

The Centre for Academic English provides free in-sessional English courses for international students while they are studying. These include classes and workshops on academic language, social language, the four skills of reading, writing, listening and speaking, 1-1 consultations with a tutor to work on a piece of academic writing or an oral presentation, self-study resources in the VLE Blackboard, and the Conversation Project, which partners students with a native-speaker volunteer to practise social and conversational English.

www.imperial.ac.uk/academic-english

International Student Support team

Students from outside the UK make up around half of our student population, so our International student Support team offers year-round support to help our international students settle into Imperial life. This includes UK visa and immigration advice and trips to different places of interest.

www.imperial.ac.uk/study/international-students
8. Student Records and Data

The Student Records and Data team are responsible for the administration and maintenance of the student records for all students studying at the College. This includes enrolments, programme transfers, interruption of studies, withdrawals and processing of examination entry for research degree students. The team also use this information to fulfil reporting duties to the Student Loans Company, Transport for London and the UKVI, as well as other external bodies.

The team is currently responsible for the processing of student results and awards on the student record system as well as the production and distribution of academic transcripts and certificates of award.

Student Records and Data produce a variety of standard document requests for both current and previous students including council tax letters, standard statements of attendance and confirmation of degree letters.

Appeal administration also sits within the team, as does the responsibility for confirming qualifications via the Higher Education Degree Datacheck service.

**Student records and examinations**

📞 +44 (0)20 7594 7268

✉️ records@imperial.ac.uk

**Degree certificates**

📞 +44 (0)20 7594 8037

✉️ certificates@imperial.ac.uk
9. Work-Life Balance

The pace and intensity of postgraduate study at Imperial can be demanding so it’s important to find time for outside interests.

**Imperial College Union**
The Union’s range of 340+ student-led clubs, societies and projects is one of the largest of any UK university, opening up lots of ways for you to enjoy your downtime.

[www.imperialcollegeunion.org/about-us](http://www.imperialcollegeunion.org/about-us)

**Graduate Students’ Union**
The Graduate Students’ Union is the postgraduate arm of Imperial College Union. The GSU works alongside the Imperial College Union President to ensure that the requirements of postgraduate students are catered for. It also organises a number of academic and social events during the year.

[www.union.ic.ac.uk/presidents/gsu](http://www.union.ic.ac.uk/presidents/gsu)

**Sport**
Beginners and semi-professionals alike will receive a warm welcome in our sports clubs, which are subsidised by Imperial College Union to make it a little bit cheaper to keep doing a sport you love.

Access to swimming facilities, including sauna, steam room and spa at Ethos sports centre, is completely free from your very first day. Gym facilities across all campuses are also free after you’ve completed a fitness orientation for a one-off charge (£40 in 2016–17).

[www.imperial.ac.uk/sport](http://www.imperial.ac.uk/sport)
10. Student Feedback and Representation

Feedback from students
The College and Union is committed to continually improving your education and wider experience and a key part of this is your feedback. Feedback is thoroughly discussed by your student representatives and staff.

Student representation
Student Representatives are recruited from every department to gather feedback from students to discuss with staff. More information about the role, and instructions on how to become an academic representative, are available on the Imperial College Union (ICU) website.

www.imperialcollegeunion.org/your-union/your-representatives/academic-representatives/overview

SPE
The Society of Petroleum Engineers is the largest individual-member organization serving managers, engineers, scientists and other professionals worldwide in the upstream segment of the oil and gas industry. Its purpose is to take charge of promoting the insertion of the students into the world of petroleum engineers.

The SPE committee provides a fantastic opportunity for our students to be represented and heard. It consists of positions such as the President, Vice-President, Treasurer and Social Secretary, all of whom are elected democratically by the students through elections. This encourages collaboration between students in deciding field trips, maintaining industry links with companies, and making a tangible difference to the running of the course. Further information about the SPE can be found on our website.

http://www.imperial.ac.uk/engineering/departments/earth-science/prospective-students/pg-courses/spe/

Staff-Student Committee
The Staff-Student Committee is designed to strengthen understanding and improve the flow of communication between staff and students and, through open dialogue, promote high standards of education and training, in a co-operative and constructive atmosphere. College good practice guidelines for staff-student committees are available here:

www.imperial.ac.uk/about/governance/academic-governance/academic-policy/student-feedback

We hold a Staff-Student committee every year. This provides students with the opportunity to express how they feel the course has been run directly with both academic and administrative staff in person. We welcome and value the views of our students and always strive to consider these in deciding how to run the course.
11. Student Surveys

Your feedback is important to your department, the College and Imperial College Union.

Whilst there are a variety of ways to give your feedback on your Imperial experience, the following College-wide surveys give you regular opportunities to make your voice heard:

- PG SOLE lecturer/module Survey or departmental equivalent
- Student Experience Survey (SES)
- Postgraduate Taught Experience Survey (PTES) – next due to run in spring 2018

The PG SOLE lecturer/module survey or equivalent runs at the end of the autumn and spring terms. This survey is your chance to tell us about the modules you have attended and the lecturers who taught them.

For PG SOLE your lecturers will receive their individual numerical results and comments shortly after the survey closes. To make the most of your opportunity to give your feedback, please do not use offensive language or make personal, discriminatory or abusive remarks as these may cause offence and may be removed from the results. Whilst this survey is anonymous, please avoid self-identification by referring to personal or other identifying information in your free text comments.

The Student Experience Survey (SES) is another opportunity to leave your views on your experience. This survey will cover your induction, welfare, pastoral and support services experience.

The Postgraduate Taught Experience Survey (PTES) is the only national survey of Master’s level (MSc, MRes, MBA and MPH) students we take part in. This is the only way for us to compare how we are doing against the national average and to make changes that will improve our Master’s students’ experience in future. PTES covers topics such as motivations for taking the programme, depth of learning, organisation, dissertation and professional development. PTES last ran in spring term 2016 and will run again in spring 2018.

All these surveys are anonymous and the more students that take part the more representative the results so please take a few minutes to give your views.

As a result of feedback to previous surveys, we have we have implemented several improvements to ensure the continuous smooth running of the MSc Petroleum Engineering course.

The Union’s “You Said, We Did” campaign shows you some of the changes made as a result of survey feedback:

www.imperialcollegeunion.org/you-said-we-did

If you would like to know more about any of these surveys or see the results from previous surveys, please visit:

www.imperial.ac.uk/students/academic-support/student-surveys/pg-student-surveys

For further information on surveys, please contact the Registry’s Surveys Team at:

surveys.registrysupport@imperial.ac.uk
12. After Graduation

Alumni services
When you graduate you will be part of a lifelong community of over 190,000 alumni, with access to a range of alumni benefits including:

- discounts on further study at the College and at Imperial College Business School
- alumni email service
- networking events
- access to the Library and online resources
- access to the full range of careers support offered to current students for up to three years after you graduate
- access to our Alumni Visitor Centre at the South Kensington Campus, with free Wifi, complimentary drinks, newspapers and magazines, and daytime left luggage facility

Visit the Alumni website to find out more about your new community, including case studies of other alumni and a directory of local alumni groups in countries across the world.

www.imperial.ac.uk/alumni

Opportunities for further study
After you have completed our MSc Petroleum Engineering course, you may wish to continue your studies through research. Our department offers many PhD opportunities for our graduates. Previous graduates have gone on to specialise not only in Petroleum Engineering but other areas such as Geophysics, Computer Modelling and Planetary Science.

To find out more about our PhD opportunities, please visit:

http://www.imperial.ac.uk/engineering/departments/earth-science/prosp-students/phd-opportunities/
The objective of the MSc curriculum is to train petroleum engineering professionals that understand the work flow concepts that are now prevailing in the oil industry and therefore are fully prepared to work in multi-disciplinary teams. The MSc curriculum, organised around five teaching modules, is intended to give students a full understanding of:

(1) the fundamental concepts of reservoir characterisation, reservoir modelling, reservoir simulation, and field management;
(2) the links between the various types of data; and
(3) the processes for integrating and processing all available information.

Details of the curriculum are attached. There are three principal elements to the course:

1) *Formal lectures, problems classes, and computer exercises*

These take place on a full-time, structured basis from October to March in the normal academic terms, for a total of 400 hours:

Module I provides fundamental knowledge on the reservoir rocks, fluids, production mechanisms and flow equations.

Module II addresses the reservoir characterisation process and the integration of knowledge from the various types of data into a reservoir model.

Module III deals with drilling, completion and well performance prediction.

Module IV is concerned with the simulation of the behaviour of the reservoir model and the prediction of reservoir performance.

Module V concentrates on surface facilities, safety and environment, and field development.
Lectures are supplemented by field trips, seminars from industry and communication skills. Formal examinations are conducted in January and in April.

2) Group project work

This is a 150-hour group exercise involving an integrated study of the evaluation and development of an oil field (currently, the Wytch Farm field). The objective is to inter-relate the separate subjects taught in formal lectures. Each group has to produce a detailed plan covering all aspects of field development beginning with exploration and ending with abandonment.

Data for the project is analysed with prevailing commercial software as part of Modules II to IV, and integrated into a development proposal as part of Module V. For the reservoir characterisation phase (Module II), the groups are multidisciplinary and include petroleum geologists from the MSc in Petroleum Geoscience in addition to petroleum engineers, thus reproducing the environment of an asset team. Time is made available in the timetable but some extra-curricular work is expected. This is assessed initially by presentation to the examiners at the end of the Spring term. After review and discussion, selected groups make further presentations to an invited audience from the industry. The best presentation is awarded the Colin Wall prize.

3) Individual projects

Further, more specific knowledge is developed during a three-and-a-half-month research project after formal examinations at the end of April. Students work on individual research type assignments until public presentation of the project in mid-September. Projects may be selected by the candidate, planned in co-operation with industrial sponsors or allocated by the Department.

Considerable emphasis is placed on communication skills, both written and oral. In the course of the year, all candidates can expect to make a contribution to the group project presentation and give a presentation on their individual project. These two are given to internal and external examiners and an invited audience from industry.

Formal classes are restricted to the conventional College term dates, but students will need to, and are expected to, continue with problems and computer work through the vacation when the College is open. The dates for College closures at Christmas and Easter will be available at the start of term. Students are expected to be in attendance from Monday to Friday at all other times. This applies particularly to seminars or lectures held by outside speakers or MSc presentations at all times.
ACADEMIC STAFF
involved with the MSc in Petroleum Engineering 2016/2017

**Teaching staff: Internal**

<table>
<thead>
<tr>
<th>Name</th>
<th>Phone No.</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Martin Blunt</td>
<td>46505</td>
<td>m.blunt</td>
</tr>
<tr>
<td>Professor of Petroleum Engineering &amp; Course Director</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Olivier Dubrule (Total)</td>
<td>47198</td>
<td>o.dubrule</td>
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<tr>
<td>Professor of Geostatistics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peter Fitch</td>
<td>49521</td>
<td>p.fitch</td>
</tr>
<tr>
<td>Senior Teaching Fellow in Petroleum Geoscience and Engineering</td>
<td></td>
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<tr>
<td>Alain C. Gringarten</td>
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<td>a.gringarten</td>
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<td>Professor of Petroleum Engineering</td>
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<tr>
<td>Matthew Jackson</td>
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<td>Total Professor of Geological Fluid Mechanics</td>
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<tr>
<td>Peter King</td>
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<tr>
<td>Samuel Krevor</td>
<td>42701</td>
<td>s.krevor</td>
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<tr>
<td>Lecturer in Clean Fossil Fuels</td>
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<td></td>
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<tr>
<td>Ann Muggeridge</td>
<td>47379</td>
<td>a.muggeridge</td>
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<td>Professor of Reservoir Physics</td>
<td></td>
<td></td>
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<tr>
<td>Velisa Vesovic</td>
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<tr>
<td>Professor of Transport Phenomena</td>
<td>47352</td>
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<tr>
<td>Robert Zimmerman</td>
<td>47412</td>
<td>r.w.zimmerman</td>
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<tr>
<td>Professor of Rock Mechanics</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Email addresses are followed with the suffix: @imperial.ac.uk
Visiting Professors and Lecturers

Deryck Bond, PhD (Consultant)
John Crawshaw, PhD
Gioia Falcone, PhD
Olivier Gosselin (Total)
Satinder Purewal, BSc, PhD
Sander Suicmez, PhD (Shell)
David Waldren, BSc, PhD (BP)
Paul F. Worthington, BSc, MSc, PhD, DSc, CENG, CGEOL (GCA)

Industry Lecturers

A. Baylaucq, (Total)
M. Dyson (Striatum)
I. Ellul, MSc, PhD, DIC, C.Eng. (Cisk Ventures, Ltd)
E. Jankowski (RPS Energy)
Xu Dong Jing, MSc, PhD (Shell)
Carmen Morataya (Consultant)
G. Simpson (RPS Energy)
P. Smith (RPS Energy)

plus contributors from Industry.
Accreditation – Institute of Material, Minerals & Mining (IoM3)

Both the MSc in Petroleum Engineering and MSc in Metals & Energy Finance are accredited by the Institute of Material, Minerals & Mining (IoM3) who act for the UK Engineering Council so that graduates qualify for CEng (Chartered Engineer).

Those of you who are interested in applying to become Chartered Engineers and join the IoM3 as student members can do so on graduation from your MSc. Providing you have the appropriate professional experience you can simultaneously apply for corporate membership of the IoM3 who will then process a separate application to be registered as a Chartered Engineer. For those of you who need to build up the necessary experience before being eligible for CEng you can transfer from student to Affiliate membership on completion of the degree.

More details can be obtained by contacting the Membership Development Manager below:

Sarah Boad
sarah.boad@iom3.org

The Accreditation Manager can be contacted below:

Helene Burd
helene.burd@iom3.org
COURSE CONTENT

1  FUNDAMENTALS

INTEGRATED RESERVOIR MANAGEMENT

COURSES

<table>
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<tr>
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This module  147  49  23.5%

INTRODUCTION

Course Introduction:  3  1  0.5% Prof. G. Hampson

FUNDAMENTAL KNOWLEDGE

Basic Petroleum Geology  18  6  3% Dr. P. Fitch
Overview of Unconventional Hydrocarbons  3  1  0.5% Prof. A. Fraser & F. Spathopoulos
Shale Gas and Hydraulic Fracturing  3  1  0.5% Dr. J. Crawshaw
Field Trip  27  9  4.5% G.J. Hampson, M.D. Jackson,
<table>
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<tr>
<th>Topic</th>
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<th>Section</th>
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<td>Uncertainty in Hydrocarbon Reserves</td>
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<td>Mr. S Purewal</td>
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<td>Gas Injection</td>
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<td>Flow in Porous Media</td>
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2. RESERVOIR CHARACTERISATION

RESERVOIR CHARACTERISATION

RESERVOIR MANAGEMENT DECISIONS

INTERPRETATION MODELS

COURSES

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<td>2.7. GROUP FIELD PROJECT: 3D Reservoir Model</td>
<td>69</td>
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WELL PERFORMANCE

COURSES

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<td>Production Engineering / Well Performance</td>
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### COURSES

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<td>4%</td>
<td>Prof. M. Blunt</td>
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<td>EOR</td>
<td>12</td>
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<td>Dr. S. Krevor</td>
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<td>Numerical Simulators</td>
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<td>Upscaling</td>
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<td>Schlumberger</td>
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<td>22</td>
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<td>O. Gosselin (with CPS staff)</td>
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### COURSES

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<td>Health, Safety and Environment</td>
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<td>19</td>
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<td>O. Gosselin &amp; Dr S. Purewal (with CPS staff)</td>
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</table>
6 COMMUNICATION SKILLS AND VISITING LECTURERS
Objective: To enable students to communicate with industrial colleagues and to be aware of the latest developments in the industry. All students will give a talk as part of the Group Project in the Autumn term.

A number of lectures will be given by visitors from the Industry and Government Institutions on aspects of Petroleum Engineering covering current industrial problems and practice, within each teaching module.

7 RESEARCH (450 hours, CPS staff)

Three-and-a-half month individual research project, usually on location with an oil producing or service company.
THE MSc INDIVIDUAL PROJECT

The individual project is one of the two main components of the course and a pass must be obtained in it in order to succeed on the course. It is a demanding task requiring the utmost in commitment and effort over an intensive period of around four months. For the project to be successful, it must meet the academic requirements demanded of MSc calibre work. These are

- Exercise of independent thinking and critical analysis and judgement.
- Technical content of substantial depth and relevance to Petroleum Engineering.
- Substantial volume of work achieved through effort and industry.

Students are warned that a project is not of an MSc calibre if it merely involves routine application of their knowledge or skill without demanding a high degree of their own thinking and scholarship. They must therefore make sure when they engage in an Industry-sponsored project, that they exercise their own independent thinking; the Company guides them, but the scholarship is theirs. Students should not act merely as a technical assistant in carrying out the project; they must participate in shaping it.

Assessment of the projects is based on industry and effort; oral presentation; written reports and poster.

Selection of the topic can be made as early as the Autumn term; a full list of the topics is made available around January of each year. These topics may be suggested by either Industry or Academic Staff; students may also choose a topic outside this list. Once a topic is selected, they discuss it with the appropriate Academic Staff to identify the following:

- The objective of the project.
- Deliverables aimed for.
- Where the work is to be conducted.
- Who will be the main supervisor.

This should be done preferably by the end of March and no later than end of April.

The time table is as follows:

- End of February: area of interest is defined;
- End of March: specific topic and general objectives defined;
- Mid-May: start project after the end of examinations;
- End of May: project review - a 10-minute presentation that highlights objectives, approach and plan for the Project;
- June-July-August: short progress forms sent to College;
- Early September: submission of draft report;
- Mid September: preparation of poster on project, handing in of written dissertation (16 page SPE technical publication format plus figures, diagrams etc.) followed by oral examination in front of Academic Staff and Industry visitors;
- Late September: submission of final report for binding.

The detailed instructions are given to the students at the appropriate time.

In recent years many (usually over 50%) of students carry out their project in the industry, normally in the offices of the companies, with of course academic co-supervision.

Further details, including poster design, are given during the term.
ASSESSMENT

The MSc and DIC Awards:

(1) The MSc of Imperial College is awarded for passes obtained in formal examination and classwork assessments and, separately, in a project report or dissertation. An outstanding performance in one area cannot compensate for failure in the other. A re-sit of one or more examinations is allowed only on the next occasion of the examinations, i.e. after a lapse of one year.

(2) The MSc award is an unclassified award, i.e. the result is 'Pass' or 'Fail'; however, exceptionally, a candidate may be recommended for an award of “Distinction”. This requires an overall performance in contributions to group work, in examination results, and in project work of a very high standard. The award of “merit” is also awarded for performance in group work, in examination results, and in project work to a high standard. It should be noted that minimum passes in all subjects will not necessarily be regarded as an examination pass for the MSc.

Any relevant topic is potentially examinable, whether presented by an internal member of staff, an external lecturer, or by a research or other student.

The assessment is in two parts;
- Part A - examination of formal lectures and group project.
- Part B - individual project

Both parts must be passed.

Part A includes the 5 teaching modules, the group project, coursework and examinations with the following weights:

<table>
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<tr>
<th>Modules</th>
<th>Weighting</th>
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<tbody>
<tr>
<td>COURSE WORK</td>
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<td>EXAMINATIONS</td>
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<tr>
<td>GROUP FIELD PROJECT</td>
<td>20%</td>
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<tr>
<td><strong>Total</strong></td>
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</table>

The Group Field Project report is assessed with allocations of marks for the oral presentations and effort given to the group by the student (as assessed by the project organiser).

Part B - The individual project assessment is based on the presentation both orally and poster and by a written report of the work, to be submitted in September.

Examinations

Examinations include formal sittings (taking no longer than 18 hours in total) together with coursework assessment which includes the 3 phases of the group project. Fuller details of times and typical information is given during the year.
Take-home assignments and homeworks (Part A)

There are take-home homeworks in most of the lectures. These are assessed and used as evidence of progress and of the student's understanding the course. They also test elements of numeracy and written communication skills.

Most of these are marked and are part of the MSc assessment. Their purpose is to give students a guide to their own progress, especially for those who have returned to study after a period in industry and for our overseas students to familiarise themselves with our examination procedures. There are also 3 phases of the Wytch Farm Field Development project. These are carried out in teams, phase 1 will be carried out with the MSc Petroleum Geoscience students, and phase 2 and 3 with fellow Petroleum Engineers.

Examinations (Part A)

The students take 5 written examination papers, all of 3 hours, in:

<table>
<thead>
<tr>
<th>Modules</th>
<th>Topics</th>
<th>Papers</th>
<th>Date</th>
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<tbody>
<tr>
<td>1. FUNDAMENTAL KNOWLEDGE</td>
<td>Rock Properties and Reservoir Fluids</td>
<td>1</td>
<td>Mid-January</td>
</tr>
<tr>
<td>2. RESERVOIR CHARACTERISATION</td>
<td>Well Testing and Flow in Porous Media</td>
<td>1</td>
<td>Mid-January</td>
</tr>
<tr>
<td>3-4. WELL AND RESERVOIR</td>
<td>Process Engineering and Field Development</td>
<td>1</td>
<td>Start of May</td>
</tr>
<tr>
<td>PERFORMANCE</td>
<td>Reservoir Mechanics and Secondary Recovery</td>
<td>1</td>
<td>Start of May</td>
</tr>
<tr>
<td>5. FIELD DEVELOPMENT</td>
<td>Well Production and Optimisation</td>
<td>1</td>
<td>Start of May</td>
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</table>

All papers are double marked and available for inspection by the external examiner. Individual staff examiners mark initially to their own scheme but the marks are reported to the MSc course Director. The Director collates all the marks. The marks are then totalled according to the current weighting scheme. These 'averaged' marks determine the ranking of the student. It is these marks that are reported to the University to be given to the candidates.

The major papers (Fundamental knowledge; Reservoir Characterisation; Well and Reservoir Performance; Field Development) are closed book examinations. The formulae needed that are difficult to remember or correlation graphs are provided when appropriate. The questions are typically the hand calculations carried out in the industry to check computer estimations and many questions are derived from real field data. We believe this method of examining gives the student the proper technical preparation for industry employment. The testing of understanding is demonstrated in the field project.

Students who fail one or two papers maximum, but have an average of 50% or above in the exams, may, after discussion at the examiners' meeting, be given an oral or further written work or both. Those that fail the oral, or have failed one or more papers and have an average of less than 50% in the exams will have their degree deferred until they re-sit the failed papers the following year. If they then pass, they will be placed in the examination pass list for that year.
The individual projects (Part B) are assessed by a report, a poster and a presentation of 15 minutes (plus 5 minutes for questions) to the examiners and representatives from the oil industry. The reports are read by two examiners and must obtain a mark of 50% or above. Marks received for the presentation and the poster are added to the report marks to determine the project marks. The candidates are awarded a pass for marks at 50% or above and a fail below 50%. Reports with marks below 50% are deferred for a period between one and eleven months, as determined by the Board of Examiners. They must be re-submitted before the end of the period and be found satisfactory to be awarded a PASS.

Marking scheme

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<th>Individual Project</th>
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<td>70% or above</td>
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<tr>
<td></td>
<td>No exam below 60%</td>
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<tr>
<td>Merit</td>
<td>60% average or above</td>
<td>60% or above</td>
</tr>
<tr>
<td></td>
<td>No exam below 50%</td>
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</tr>
<tr>
<td>Pass</td>
<td>No more than two exams below 50%</td>
<td>50% or above</td>
</tr>
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</table>

Candidates are notified of their performance and (if needed) any re-sits needed.

Examiners Meetings

Two Examiners' meetings are held; a preliminary meeting in late May to consider the Part A performance, and a meeting in September to consider all the results.

Programme Specification

Please visit the link below to find our Programme specification, which provides a concise summary of the main features of the programme and the learning outcomes that our students might reasonably be expected to achieve and demonstrate throughout the course.

https://workspace.imperial.ac.uk/earthscienceandengineering/Public/MSc%20Postgraduate/Programme%20Specification%202012.pdf

Examinations and Religious Obligations

Imperial College takes very seriously the religious obligations many of our students face, which can often clash with examination dates. Please visit the link below to find out more on our advice for students who may face this situation:

13. Board of Examiners

**Board of Examiners**

- Martin Blunt
- Ann Muggeridge
- Matthew Jackson
- Peter Fitch
- Robert Zimmerman
- Velisa Vesovic
- Alain Gringarten
- Sam Krevor
- Peter King
- Olivier Gosselin

**External examiners**

- Alistair Jones, BP
- Ken Sorbie, Heriot Watt University

It is common for Master's level students to have some form of academic or social interaction with their external examiners at some point during or after their studies as well as during the assessment process itself.

It is inappropriate for you to submit complaints or representations direct to external examiners or to seek to influence your external examiners. Inappropriate communication towards an examiner would make you liable for disciplinary action.

External examiners reports can be found here:

The following information provides a useful summary of the content of each topic which will be taught throughout the academic year.

**COURSE OUTLINE: INTRODUCTION TO PETROLEUM GEOLOGY**

Dr P. Fitch

**Aims**

1. To present an overview of the fundamentals of Earth Science
2. To outline the geological parameters and processes controlling oil and gas accumulations
3. To introduce the topic of Petroleum System Analysis
4. To demonstrate the role of Earth Sciences in petroleum exploration: acquisition and interpretation of data
5. To show the types and global distribution of “conventional reserves”
6. To review the definitions of conventional reserves and reserve estimation methods
7. To introduce the concept of uncertainty, risk and risk analysis in exploration projects
8. To review “unconventional resources”
9. To provide an overview of the petroleum systems of the North Sea Basin

**Objectives**

On completion of this module students should be able to:

(a) Identify and apply the principles of geology to controls on hydrocarbon generation, migration, and accumulation.
(b) Identify and characterise the main petroleum rock types (sandstone, mudstone, limestone and dolomite)
(c) Use and interpret key data relating the role of geology to petroleum exploration and in the quantification of conventional resources.
(d) Understand the potential unconventional hydrocarbon resources and their likely impact on future hydrocarbon supplies.
(e) Appreciate the impact of geology on reservoir thickness, quality, continuity, distribution, subdivisions and established “flow units”.
(f) Understand how geological features influence effective appraisal, development and managements of hydrocarbon fields.
(g) Recognise the importance of a multidisciplinary approach and integration of geological, geophysical and petroleum engineering data in field development and production – leading to an increased awareness of the relationships between the two MSc courses.

**Prerequisites**

No prior knowledge of geology is required.

**Duration**

18 hours of lectures and practical sessions during the Autumn term.

**Assessment**

The material presented in this module provides a foundation for the subsequent modules studied throughout the MSc Petroleum Engineering degree. It is not assessed directly but will feed into assessed assignments such as the Wessex basin field trip and the Field Development Project.

**Lecture syllabus (session plan)**
1) Module Introduction
2) Earth Science 101
3) Concepts: Rock types
4) Clastics: Sandstones
5) Clastics: Mudstones
6) Unconventional Reservoirs
7) Carbonates and evaporites
8) Hydrocarbon: generation, maturation and migration
9) Concepts: Stratigraphy and structures
10) Exploration methods & Petroleum Systems
11) Play concepts, conventional reservoir classification & controls
12) Reserves – estimation, risk and uncertainty
13) North Sea Basin Case Study
14) Global perspectives

To make the most of classroom contact hours suggested reading and short tasks will be set in advance and for 30-60 minutes during non-contact hours. Blackboard will be used to support independent study and revision.

Texts *(direction to relevant sections will be made during the module)*
Fitch, P, (2016), Introduction to Petroleum Geology – course notes. Imperial College London


COURSE OUTLINE: GEOSTATISTICS

Professor P. King

Aims

(1) To introduce the fundamental concepts and methods of geostatistical heterogeneity modelling.
(2) To present the basics of reservoir uncertainty quantification.

Objectives

At the end of the course students should:

(1) Understand the meaning of a variogram and the differences between kriging and simulation. Be able to make an informed choice of variogram model in practical situations.
(2) Know about the main approaches for modelling the distribution of reservoir facies in 3D and be able to choose the right one in practical situations.
(3) Understand the basic Monte-Carlo and geostatistical simulation tools for quantifying volumetric uncertainties and avoid the most common mistakes.

Timing

15 hours

Prerequisites

It is preferable that the students have a basic knowledge of probability and statistics. This includes discrete and continuous random variables, correlation versus independence between variables, and the impact of summing and multiplying random variables together. Some previous experience of Monte-Carlo simulation may be useful too. However all these concepts will be re-defined during the course.

Texts (from simplest to more complex)

http://www.mathsrevision.net/advanced-level-maths-revision/advanced-level-level-statistics

Pyrcz, M.J. and Deutsch, C.V., Geostatistical Reservoir Modelling, Oxford University Press, 2014


Chilès, J.P. and Delfiner, P, Geostatistics: Modeling Spatial Uncertainty, Wiley, 2012,

Syllabus

2. Reminders on Continuous Random Variables.
3. Geostatistics for Continuous Variables (Variogram, Kriging, Conditional Simulation…).
4. Reminders on Discrete Random Variables.
5. Facies Simulation (Indicator Simulation, Object-Based Models, Pluri-Gaussians, Multi-Point Statistics, Markov Transiograms…)
6. Uncertainties (Quantifying their Magnitude and Evaluating their Impact with Monte-Carlo and Geostatistics).
COURSE OUTLINE: FIELD PROJECT

G.J. Hampson, M.D. Jackson, P. Fitch, O. Gosselin and All CPS Staff

Description

This is a computer-aided field development training exercise which illustrates the integration required for field development. The project covers selected activities from drilling and reservoir characterisation to the design of the surface facilities, from economic forecasting of pre-performance to application to regulatory authorities. The field group project is carried out by groups of about five/six students.

Aims

(1) To serve as tutorial for taught courses
(2) To form a firm basis for integrating topics learned in formal lectures
(3) To encourage interdisciplinary ("lateral") thinking
(4) To train students to be team players in multi-disciplinary field management groups (asset management teams, business units etc. )
(5) To expose students to the most up-to-date reservoir management tools
(6) To familiarise students with all aspects of a field development process

Objectives

At the end of the field project, the student should

(1) be able to make provisional risk-weighted estimates of the hydrocarbon reserves
(2) provide technically acceptable development options for the field
(3) produce an economic evaluation of the project for the preferred development option
(4) be able to summarise all the studies conducted into a submission for development approval to regulatory authorities
(5) analyse the initial performance of the reservoir under the proposed development plan.

Timing

150 hours + extra time to be allocated for presentations by the project groups.

Texts

The recommended reading and reference list include:

- Wood Mackenzie Upstream Oil and Gas Publications for UK North Sea,
- ROBERTSON GROUP, Oil and Gas Fields of the North Sea. In 3 Volumes, Robertson Group, 1990

Assessment

Assessment will be based on:

(1) the overall technical quality of the work produced
(2) the deliverables during the routine presentations to Centre for Petroleum Studies (CPS) staff
(3) the contributions of individuals to Group work

**Project Implementation**

The following working practices are expectations from each project group:

1. each group must develop its own working procedures
2. responsibilities are individual as well as common
3. all members of each group must be familiar with all aspects of the project
4. groups should maintain certain professional working discipline. If for any reason, a Group underperforms, the reasons should timely be identified and cured in co-operation with the CPS staff as appropriate.

**Project Milestones/Deliverables**

The project follows the MSc course modular structure. Some of the group project deliverables will be integral parts of the lecture tutorials, others will be developed during dedicated sessions. Steps and milestones are as follows:

**Phase 1: Reservoir Characterisation** (during the “Reservoir Characterisation” Module)

**General description of the Project**

**Academic objectives of the Project**

**Project working procedures and expected deliverables**

**Assessment Procedures. Work schedule and structures**

**Prospect Evaluation:**

- Study the map.
- Study the allocated location in the North Sea (Regional Settings/Tectonic History, Depositional Environment, Source and Reservoir Rocks, Expected Stratigraphic Column, Porosity and Water Saturation estimates, recovery factors in the region, simple risk assessment by using regional risk factors as a guideline).

**Processing of Hard Data**

- Identify correlatable and uncorrelatable data
- Establish deterministic relationships between the correlatable data - this includes core permeability to core porosity; core porosity to log porosity; core permeability to well test permeability; Leverett J-Function for special core analysis
- Establish statistical relationships by generating statistical distribution function including PDFs

**Generation of Soft Data**

- Complete missing information for wells
- Generate interwell data: the followings may be used
  - Fence Diagrams
  - Interpretative contouring
  - Stochastic techniques - totally random processes (Monte Carlo Approach, sampling from PDFs)
  - Statistical techniques - Geostatistics (Use of Semi-Variograms and Kriging)

**Deliverables:** Processed Well Data

Maps for parameters at desired scale: these should include maps for permeability, porosity, irreducible and residual saturation, relative permeability end points, net-to-gross ratio, isopach, top surface.

STOIIP. 3D Reservoir model.

**Phase 2** (during the “Reservoir Engineering/Reservoir Performance” Module)

Generation of hydraulic tables for the optimal technical scenario and other alternative scenarios for use in integrated simulation application (approximate desired surface pressures, compressor requirements etc. will be selected, to be improved during Field Development Module).

Upscaling of data for use in simulation - Realisations based on different upscaling techniques (this will later be one of the parametric studies of performance prediction).
Basic reservoir engineering studies using upscaled parameters and estimation of recovery factors (also to be used for the control of simulation). Well performance data will be used to identify the required number of wells, and initial estimates of well spacing (patterns). The uncertainty in the performance of the reservoir under the optimal production scenario will also be studied.

Prediction studies to identify possible integrated solutions with surface facilities and economics to be assessed later.

Prepare
Identification of well locations and objectives.
Rate and total volume of fluids produced
Associated uncertainty analysis with range of possible outcomes

Drilling timing
Data Acquisition Programme (Coring, Mud Logging, Well logging, RFT, DST, Routine and Special Core Analysis Results and Others Planned)

Phase 3: Field Development
Design the surface facilities and if necessary iterate using the simulator.
Identify the best platform options for offshore applications.
Prepare plans of the activities - Project bar charts etc.;
Prepare abandonment plans.
Apply economics to find out the optimal CAPEX and OPEX; Assess project economics.
Perform a number of iterations until a feasible development scenario is established.
Summarise lessons learned
COURSE OUTLINE: SHALE GAS: DRILLING, HYDRAULIC FRACTURING AND GLOBAL WARMING

Dr J. Crawshaw

Aims
(1) to present information on shale gas as a new and clean (?) resource of fossil fuels
(2) to explain the oilfield process of “fracking” shale gas reservoirs, including
   - drilling the well
   - hydraulic fracturing
(3) to explain the concept of Global Warming Potential (GWP)
(4) to explore the importance of fugitive emissions of shale gas (methane)

Objectives
At the end of the course, students should:
(1) understand the importance of conventional and unconventional gas resources
(2) understand the pros and cons of shale gas recovery, in comparison with conventional resources, in terms of Economics, Politics and Environment
(3) understand the fundamentals of the fracturing process,
(4) understand the importance of Darcy's law for flow in porous media
(5) realise the limitations of Darcy’s law regarding shale gas production
(6) understand calculation of GWP of fugitive methane emissions in comparison with coal

Prerequisites
Basic knowledge of physics / chemistry is recommended.

Duration
3 hours of lectures during the Autumn term.

Assessment
This course will not be formally examined.

Lecture notes
Crawshaw J.P., 2015. Shale gas, Imperial College course notes (slides)

Texts:
Valko, P. and Economides, M.J. Hydraulic Fracture Mechanics, John Wiley and Sons Ltd (1995)

Additional literature on pore scale imaging and modelling (optional):
J. Crawshaw and E.S.Boek, Reviews in Mineralogy & Geochemistry 77, 431-458 (2013).
COURSE OUTLINE: PRODUCTION MECHANISMS

M. J. Blunt

Aims

(1) to introduce the fundamentals concepts of reservoir behaviour

Objectives

At the end of the course students should:

(1) understand concepts of primary, secondary and tertiary recovery
(2) appreciate the changes in reservoir behaviour as reservoir pressure drops

Timing

3 hours of lectures

Prerequisites

Courses 1.3 and 1.5

Texts


Assessment

There will be related homework in the ‘Reservoir Performance Predictors’ course in the Spring Term and it will be examined in the ‘Reservoir Engineering and Secondary Recovery’ exam in April.

Syllabus

1 Primary and improved/enhanced oil recovery.
2 Primary oil production; reservoir drives and production mechanisms; solution gas, gas cap, aquifer, gravity drainage, compaction. Recovery factors.
3 Secondary recovery; waterdrive, gas injection
4 IOR/EOR. Life of field recovery processes.
5 Gas reservoirs; water influx effects on gas reservoir production.
6 Concepts of depletion planning from reservoir mechanistic point of view.
7 Composition and how it affects reservoir behaviour.
COURSE OUTLINE: RESOURCES AND RESERVES CATEGORISATION (PRMS)

Dr. S. Purewal

Aims

(1) To outline the basic principles of resources/reserves categorisation (PRMS).
(2) To show the difference between resources and reserves
(3) To demonstrate the significance of risk and uncertainty.
(4) To highlight the deterministic and probabilistic assessment approaches.
(5) To highlight the challenges in assessing resources and reserves.

Objectives

At the end of the course, students should:

(1) Understand the different categories of reserves and resources.
(2) Appreciate the reasons for uncertainty and the need to address it.
(3) Be able to differentiate between deterministic and probabilistic methods.
(4) Be aware of the limitations of reserve assessment methods.
(5) Appreciate the relationship between reserves, development plan and economics.

Prerequisites

Firstly, a desire to understand the resources and reserves categorisation as outlined in the Petroleum Resource Management System (PRMS) including the treatment of uncertainty. Secondly, an open mind with regard to the pros and cons of various methods used for reserves assessment. Finally, an ability to recognise the potential for improvement.

Timing

3 hours of lectures during autumn term.

Assessment

This material will be assessed as part of Phase 1 of the Group Field Project

Texts

- “SPE/WPC Reserves Definitions Approved”, JPT (May 1997) 527.
- “Classification of Petroleum Resources on the Norwegian Continental Shelf”, The Norwegian Petroleum Directorate (July 1997).
Lecture syllabus

1. Reserves and resources definitions and guidelines.
2. Petroleum Resource Management System (PRMS)
3. Other Categorisation Systems.
5. Deterministic versus Probabilistic.
6. Estimation Methods
7. Undiscovered resources.
8. Decline Curve Analysis (DCA) examples and pitfalls
COURSE OUTLINE: GAS INJECTION

Dr V. S. Suicmez
Maersk Oil

Aims
The main aims of this course are:

(1) To familiarise the students with the practical aspects of the gas injection process.
(2) To discuss the reasons and best practices of the gas-based enhanced oil recovery (EOR).
(3) To identify the key enablers and disablers of the gas injection projects.

Objectives
At the end of the course, students should:

(1) Understand the requirements of the implementation of a gas injection project.
(2) Gain a clear understanding on dynamic PVT experiments such as the swelling test, slim tube and multi contact experiments.
(3) Understand the concept of miscibility and the estimation of the minimum miscibility pressure (MMP).
(4) Be familiar with the issues associated with the simulation of gas injection processes.

Prerequisites
Basic knowledge of phase behaviour, flow in porous media and reservoir simulation is recommended.

Timing
9 hours of lectures

Assessment
Work will be assessed by means of course work and via the in-class exercises.

Texts

Lecture syllabus

1. Introduction to EOR and Gas Injection
2. A recap on Phase Behaviour
3. Concept of Miscibility and the Estimation of the MMP
4. Simulation of Gas Floods
5. Practical Case Studies
Aims:

(1) To present the diffusion equation that governs single-phase flow of a fluid through a porous medium.
(2) To present the mathematical solutions to basic problems relevant to well-test analysis.
(3) To introduce advanced mathematical methods used to analyse flow through porous media such as Laplace transforms, eigenfunction expansions, and convolution.
(4) To present the fundamental equations governing the flow of multi-phase fluids and gases in porous media.

Objectives:

At the end of the course, students should:

(1) Understand the derivation of the pressure diffusion equation, and understand the significance of the parameters that appear in it, such as permeability and storativity.
(2) Understand the assumptions underlying the line-source solution to the diffusivity equation, and the logarithmic approximation to this solution.
(3) Understand the concepts of dimensionless time and dimensionless pressure.
(4) Understand, and be able to utilise, the concept of superposition, in both time and space.
(5) Understand the effects of skin, wellbore storage, and outer boundaries on well-test behaviour.
(6) Understand the use of Laplace transforms and convolution in solving diffusion-type problems.

Prerequisites:

In order to be able to follow the course, students would need the following preliminary knowledge:

(1) Good understanding of differential and integral calculus.
(2) Some familiarity with ordinary differential equations.

Timing:

27 hours of lectures and tutorials during the Autumn term

Texts:

Course notes will be distributed. Other relevant texts are:


Assessment:

Work will be assessed as part of the Flow in Porous Media and Well Test Analysis examination in January.
Lecture syllabus:

1. Diffusivity Equation: Darcy's law and definition of permeability; Potential, datum levels, and corrected pressures; Concept of Representative Elementary Volume; Conservation of mass equation; Diffusivity equation in Cartesian coordinates; Diffusivity equation in cylindrical coordinates; Steady-state Thiem-Dupuit solution for radial flow; Equations governing multi-phase flow.

2. Line-Source solution: Derivation of line-source solution via the Boltzmann transformation; Dimensionless pressure and dimensionless time; Criterion for applicability of line-source solution; Logarithmic approximation to line-source solution; Solution for instantaneous pulse of injected/produced fluid.

3. Pressure build-up tests and superposition: Buildup-test in infinite reservoir; Buildup-test in bounded reservoir; Multi-rate flow tests; Convolution integral for variable flow-rate tests.

4. Effect of linear boundaries: Principle of superposition of sources/sinks in space; Well near an impermeable linear fault; Well near intersecting impermeable linear faults; Well near a constant-pressure linear boundary.

5. Inner (wellbore) boundary conditions: Wellbore skin concept - steady-state model; Effect of wellbore skin on pressure tests; Wellbore-storage phenomena and wellbore-storage coefficient; Effect of wellbore storage on pressure tests.

6. Outer boundary conditions: Well in a circular reservoir: method of eigenvalue expansions; van Everdingen-Hurst solution for well in circular reservoir; Flow regimes in terms of dimensionless time; Dietz shape factors for non-circular reservoirs.

7. Laplace transform methods in well-test analysis: Introduction to Laplace transforms; Convolution principle in Laplace space; Numerical inversion of Laplace-space solutions using Stehfest algorithm; Solution for flow to a hydraulically-fractured well.

8. Naturally-fractured reservoirs: Warren-Root dual-porosity model; Dimensionless parameters for Warren-Root model; Flow to a well in dual-porosity reservoir; Dual-permeability model and other extensions.

9. Flow of gases in porous media: Derivation of governing equations for gas flow; Pseudo-pressure, p-squared method, etc.; Forchheimer equation and non-Darcy effects; Klinkenberg effect for gas flow.
COURSE OUTLINE: PETROPHYSICS – LOG AND CORE ANALYSIS

Dr. P Fitch & Prof. M Jackson

Aims
(1) To introduce the theory and practice of open hole log interpretation and core analysis.
(2) To present the limitations of current practices and describe the emerging technologies.

Objectives
At the end of the course, students should:

(1) Have a clear understanding of the fundamental physics involved in various petrophysical measurements from borehole logs and cores.
(2) Be able to conduct basic log interpretation to determine lithology and petrophysical parameters such as porosity, saturation for clean and shaly formations, and permeability prediction.
(3) Be aware of the current industry practices in formation evaluation and future trends.

Prerequisites
In order to follow the course, students should understand the fundamentals of reservoir geology and rock properties as outlined in section 1.1 and 1.3

Duration
36 hours of lectures and practical sessions in the autumn term (18 hours P Fitch, 18 hours M Jackson)

Assessment
Short questions and quantitative interpretation included in the Petrophysics & Seismic Techniques exam in May

Texts
(1) Module 2, Petrophysics (Well log analysis), P Fitch, Imperial College course notes, 2014.
(2) Module 2, Petrophysics (Core analysis), M Jackson, Imperial College course notes, 2014.
(7) J.S. Archer & C.G. Wall 1982: Petroleum Engineering
(8) R.P. Monicard : Properties of Reservoir Rocks – Core Analysis

Lecture syllabus
1. Introduction.
2. Acquisition and recording of basic well logs
   - Passive logs: gamma ray and spontaneous potential logs
   - Porosity logs: density, neutron, and sonic logs
   - Resistivity logs
3. Qualitative and quantitative log analysis
4. Advanced well logs
   - Nuclear magnetic resonance logs
   - Borehole image logs
5. Log analysis in shaly sand and carbonate formations
7. Relative permeability, irreducible saturation.
8. Electrical resistivity, formation factor, Archie’s law.
COURSE OUTLINE: RESERVOIR FLUIDS

Professor V. Vesovic

Aims

(1) To introduce the fundamental physical properties of reservoir fluids.

Objectives

At the end of the course students should:

(1) understand the fundamental concepts of hydrocarbon thermodynamics;
(2) understand the use of equation-of-state;
(3) be able to carry out simple phase-equilibria calculations;

Timing

12 hours.

Prerequisites

A basic understanding of thermodynamics, as covered in the first year of an engineering course

Texts

* Bradley H B Petroleum Engineering Handbook, Society of Petroleum Engineers, 1987, ISBN 1 55563 00013, chapters 23 (Phase diagrams), 21 (Crude oil properties and condensate properties and correlations), 20 (Gas properties and correlations), 22 (Oil system correlations), 17 (Measuring, sampling and testing crude oil)
* Bett, KE, Rowlinson, JS & Saville, G., Thermodynamics for Chemical Engineers, Athlone Press, 1975

Syllabus

Phase Behavior

Pure substance: PT-diagram, PV-diagram, critical properties, quality lines; Binary mixtures: PT-diagram, dew and bubble point lines, sub-critical and supercritical behavior, retrograde condensation; Multicomponent mixtures: black oil, volatile oil, retrograde gas, wet and dry gas;

Equation of State

Phase Equilibria

Two-phase flash calculation, Rachford-Rice equation, K-values, correlations, fugacity, bubble and dew point pressure;

Thermophysical properties

Formation volume factors, viscosity, isothermal compressibility;
Aims

(1) to introduce the essentials of how reservoir fluid samples are obtained and analysed
(2) to define the proper use of fluid analyses

Objectives

At the end of the course students should:

(1) appreciate the difficulties of obtaining valid reservoir samples
(2) know the different laboratory procedures for obtaining the needed PVT data
(3) know the methods of obtaining a PVT analysis for gas and oil
(4) know how to use the PVT analysis

Timing

6 hours of lectures

Prerequisite

Basic Fluid properties and well test analysis

Texts


Assessment

This will be assessed as part of Phase 1 of the Group project.

Syllabus

1 Laboratory measurement of PVT, gas and liquid PVT properties and viscosity.
2 Problems of getting correct sample. Good sampling procedures. Downhole and surface preferences. Rate of production and drawdown effects.
3 Thermodynamic path problems. Problems of gas-oil ratio; flash, differential separation, separator tests.
4 Analysis - gas chromatography and other methods. Volatile oils and gas condensates
5 Other properties - pour point, wax, asphaltenes, hydrates.
6 Fluid representations
7 Extension of fluid data at the reservoir scale
COURSE OUTLINE: WELL TEST ANALYSIS

Professor A. C. Gringarten

Aims

(1) To explain the contribution of well test analysis to reservoir characterisation and to the prediction of well performance
(2) To teach the practical aspects of well test analysis

Objectives

At the end of the course, students should:

(1) understand the fundamental concepts of well test analysis
(2) understand what results can be obtained from well test analysis
(3) be able to interpret any well test using a well defined, state-of-the-art methodology
(4) have a clear idea of the state-of-the-art in well test analysis
(5) know how to use and judge some of the prevailing commercial well test analysis software products

Prerequisites

In order to take full benefit from the course, students should understand the following concepts:

(1) nature and characteristics of reservoir rocks
(2) nature, characteristics and behaviours of reservoir fluids
(3) diffusivity equation and equations for the various flow regimes that dominate during a test
(4) superposition in time and space

Timing

36 hours during the Autumn term: 27 hours of lectures, 3 hours of tool presentations, and 6 hours of presentation by software vendors (Interpret/2, Pie, Pan Oil/Gas, Saphir)

Texts

Course notes will be distributed.
List of milestone technical publications will be provided.

Assessment

Work will be assessed by means of course work and as part of Phase 1 of the Group Project, and as part of the Flow in Porous Media and Well test Analysis exam in January.
Lecture syllabus

1. Introduction: Well testing as part of the integrated reservoir management process: well performance, reservoir performance and reservoir characterisation.

2. Well testing as a signal analysis problem. Concept of interpretation model. Interpretation and reservoir models. Identification and verification of the interpretation model.

3. Mathematical representations of the well test interpretation model

4-6. Well test interpretation techniques: Use of straight-line analyses, pressure log-log analysis and pressure derivatives and deconvolution. Tutorials 1 and 2. Use of well test analysis software.


13. Test design.

14. Practical considerations in well test measurements and analysis. Research areas.
COURSE OUTLINE: PRODUCTION LOGGING

N. Kotlar
Kappa Engineering

Aims

(1) To review the applications of production logging (PL) and the factors affecting the PL measurements.
(2) To review the most common PL tools.
(3) To cover the basics of PL interpretation in single and multi-phase flow.
(4) To highlight the potential limitations of the measurements and/or the interpretation models.
(5) To review the most recent tools for complex environments.

Objectives

At the end of the course, students should:

(1) Be familiar with the typical response of the most common PL tools.
(2) Understand the steps involved in PL interpretation and the underlying assumptions.
(3) Be able to perform single phase or 2-phase interpretations by hand.
(4) Have hands on experience on more complex situations using a PL interpretation software.

Prerequisite

In order to follow the course, students should understand the fundamentals of electric wireline data acquisition, reservoir fluid behaviour in the wellbore region, and completions.

Timing

9 hours of lectures in November.

Assessment

Course work will be given during the lecture.

Texts


Lecture Syllabus

1. Overview of the PL applications, and review of the many factors affecting the PL measurements
2. Presentation of the most common PL sensors
3. In-situ spinner calibration.
5. Multi-phase interpretation principles and models.
8. Special applications: Selective Inflow Performance, Temperature
COURSE OUTLINE: WELL PLANNING, ENGINEERING & CONSTRUCTION

Mr M.J. Dyson
Striatum Limited

Aims

1. Introduce the basic principles of well planning, design and construction.
2. Demonstrate how well design and construction contributes to optimal field development
3. Describe the practical stages of drilling and completing wells, and typical equipment used
4. Explain alternative completion designs and techniques for optimising production and well integrity
5. Raise awareness of safety, costs and operations management

Objectives

At the end of the course, students should:

1. Be able to articulate the basic principles of well planning, design and construction.
2. Understand how well design and construction contributes to optimal field development
3. Recognise the basic drilling and completion stages and equipment used
4. Possess a basic understanding of alternative completion designs
5. Appreciate well operations safety, costs and operations management

Prerequisites

No prior knowledge of well engineering or drilling is required or assumed

Timing

18 hours of lectures during Spring term.

Assessment

This material will be assessed as part of Phase 2 of the Group Field Project

Texts

1. A Primer of Oilwell Drilling, 6th edition, Ron Baker, Published by The University of Texas at Austin
2. Applied Drilling Engineering, Bourgoyne, Chenevert, Millheim and Young, Published by SPE

Lecture syllabus

1. Purpose of wells. Well planning.
2. Onshore and offshore drilling and well engineering
4. Casing and cementing.
7. Well control. Well control using mud; Casing selection & design. Primary cementing. BOPs. Drilling problems & control
8. Completion designs, well testing, sand control, selectivity, smart wells
9. Stimulation operations
10. Well maintenance
12. Safety
COURSE OUTLINE: RESERVOIR PERFORMANCE PREDICTION

M. J. Blunt

Aims

This course will describe how different, analytical methods can be used
(1) to assess the development potential of oil and gas reservoirs and
(2) to identify the principal mechanisms controlling the performance of producing reservoirs.
(3) to validate the predictions of numerical simulators

Objectives

On completion of this course students will be able to:

(1) Use material balance methods to identify the principal drive mechanisms in a reservoir.
(2) Estimate recovery efficiencies for a water-drive using the Buckley-Leverett method and extensions.
(3) Determine the best overall recovery strategy for a reservoir.
(4) Understand displacement processes.

Prerequisite

(1) Water and hydrocarbon PVT behaviour (formation volume factors, solution gas oil ratio etc.)
(2) Principal recovery mechanisms (primary: gas cap drive, aquifer, compaction etc., secondary: waterflood, tertiary: miscible, WAG etc.).
(3) Darcy’s Law, relative permeabilities, definition of fractional flow

Timing

The course will consist of 24 hours of lectures.

Tutorial question sheets will be handed out at intervals during the course. These are an integral part of the course. Some will revise the material learnt in lectures, others will supplement it. Material that is learnt through tutorial questions rather than lectures is still be examinable.

Texts

**Assessment**

This material will be assessed in the Reservoir Mechanics and Secondary Recovery exam in May.

**Syllabus**

1. **Review of links with rest of course**
   Reservoir engineering overview: oil vocabulary and definitions, data sources and reliability, fluid distribution and flow in reservoirs, concepts of the recovery factor.
   Recovery mechanisms. Meaning of average reservoir pressure, fluid types.

2. **Material Balance**
   Conservation of mass/conservation of volume.
   Classification of reservoirs (gas/oil/condensate)
   Gas reservoirs. Gas production, P/Z plots, effects of water influx on gas production, uncertainties.
   Oil reservoirs. Primary oil production, natural drive mechanisms including solution gas drive, gas cap, aquifer, gravity drainage. Implications for planning field development.
   Complete material balance in oil reservoirs including material balance calculations for fields below the bubble point and the significance of compressibility, effects of gas expansion, aquifer influx effects, combination drive.

3. **Displacement Mechanisms**
   Review concepts in immiscible displacement calculations - relative permeabilities, mobility ratio, fractional flow, saturation distribution, imbibition, drainage, residual saturation, capillary pressure.
   Microscopic sweep efficiency: Buckley-Leverett analysis to give post-breakthrough recovery calculations.

4. **Decline curve analysis**
   Review when used. Different curves: exponential, hyperbolic, etc.

COURSE OUTLINE: ENHANCED OIL RECOVERY

S. Krevor

Aims

(1) To introduce students to the main technologies and underlying physical concepts used for enhanced oil recovery

Objectives

At the end of the course students should:

(1) Understand the role of enhanced oil recovery in global oil production today
(2) Understand the main technologies that have been used, or are in use, for enhanced oil recovery
(3) Understand the physical principles behind technologies used for enhanced oil recovery

Timing

12 hours of lecture

Prerequisites

Reservoir performance prediction

Texts

Lake, L.W., 2010 Enhanced Oil Recovery Society of Petroleum Engineers

Assessment

There will be no marked assessment

Syllabus

1 Definition of EOR
2 Overview of prevalent technologies
3 The role of EOR in current and future oil production
4 Enhancing the recovery factor
5 Principles of gas injection
6 Principles of chemical EOR including low salinity flooding
7 Practical considerations
COURSE OUTLINE: PRODUCTION ENGINEERING/WELL PERFORMANCE

G. Falcone

Aim

(1) To introduce the fundamentals of oil and gas production engineering and well performance.
(2) To cover basic and modern petroleum production engineering by providing an understanding of integrated production systems, from reservoir to surface.
(3) To cover the practical aspects of production optimisation and troubleshooting.

Objectives

At the end of this course, students should be able to:

- Understand the fundamentals of integrated production systems
- Review and screen available input data to set up an integrated production model
- Select methods to optimise a production system and maximise the recoverable reserves

Prerequisites

Before taking this course the students should have a clear understanding of:

(1) the fundamentals of drilling and completions engineering
(2) the fundamentals of reservoir engineering
(2) reservoir fluids behaviour and characterisation
(3) static and dynamic reservoir data acquisition

Timing

27 hours during the spring term.

Texts

Course notes will be distributed.

References:

3. James P. Brill and Hemanta Mukherjee: Multiphase Flow In Wells, SPE Monograph Volume 17, SPE Dallas, TX (1977) 5.

Assessment

This material will be assessed as part of the Production Engineering and Well Performance exam in May.
In addition, an important and essential part of the Group Project (Phase 2) is on the materials covered in this course.
Aims

The objective of this course is to provide an understanding of the following:

1. The theoretical background.
2. Types of models and their uses.
3. Data sources and treatment in the simulator.
4. Limitations.
5. Practical considerations.

Objectives

At the end of the course, the student should

1. have the sound knowledge of principles of numerical reservoir simulation process, its limitations, uses and abuses,
2. be familiarised with the latest techniques of reservoir simulation,
3. be able to transform important reservoir engineering problems into manageable numerical simulation models,
4. have a sound understanding of the applicability areas and the limitations of the numerical simulators.

Timing

21 Hours during Spring Term.

Text

The main text will be the lecture notes. Recommended reading includes:


Assessment

Work will be assessed by means of course work.

Lecture Syllabus

1. Reservoir models Introduction
   Physical models; analogue models, comprehensive models, elemental models
   Mathematical models
Numerical models
Models as comparative tools

2 Equations and terminology
Mass Conservation
Darcy’s Law
Diffusivity equation
Finite difference
Implicit and Explicit formulation
Dispersion and weighting
Non Linearity and outer iterations
Linear Solvers

3 Buckley Leverett Displacement

4 Reservoir models
Model components: reservoir description, initialisation, model control, production data, output
Model types: Cross sectional models, sector models, cylindrical single well models, full field models

5 Grid systems
Cartesian systems
Cylindrical systems
Stream line grids
Special connections
Corner point representation
Local grid refinement
Non-orthogonality

6 Rock properties
Core data: Routine core analysis, porosity, permeability, special core analysis, compressibility, relative permeability, capillary pressure
Log data
Test data

7. Model relative permeability
Data manipulation
Three phase relative permeability
Vertical equilibrium
Pseudo relative permeability
Well pseudo relative permeability
Summary

8. Model capillary pressure
Manipulation of capillary pressure
Vertical equilibrium
Summary

9. Fluid properties and experiments
Single component properties
Properties of mixtures
Hydrocarbon types
Definitions: Saturation pressure, bubble point pressure, dew point pressure, oil formation volume factor, gas formation volume factor, gas deviation factor, solution gas content, gas gravity, coefficient of thermal expansion, isothermal compressibility
Experiments: Constant composition expansion, differential liberation, constant volume depletion, separator tests

10. Model fluid properties
Black oil fluid properties: Component, phase, phase mole fraction of a component, phase equilibrium, black oil
Data manipulation
 Spatial variations: variable bubble point, variable api gravity

11. Aquifer treatment
Hurst - van Everdingen
Carter Tracy
Fetkovitch
Numerical aquifer

12. Model well and production data
Production control data: targets, constraints, actions
Practical considerations: history match, prediction

13. Tutorials:
   Numerical dispersion
   Mobility weighting
   Time stepping and grid size
   Grid orientation effects
   IMPES versus fully implicit
   Simulator initialisation
   Grid refinement / Coarsening
   Pseudo-Relative permeability
COURSE OUTLINE: UPSCALING

Professor O. Gosselin

Aims

(1) to understand the multi-scale nature of data and recovery processes, and the related modelling/simulation issues
(2) to review the different techniques available to deal with change of scales
(3) to make the students aware of the problems and pitfalls of upscaling techniques, and aware of current trends and future evolution

Objectives

On completion of this course students will be able to:

(1) understand the context of “upscaling” fully
(2) determine when it is required, in relation with its scope
(3) identify the most appropriate methods for each property in a given reservoir/production context
(4) list the assumptions and limitations associated with these techniques
(5) validate the chosen methodology
(6) list the sources of model errors and uncertainties

Prerequisite

(1) Darcy’s Law, relative permeabilities, definition of fractional flow, Welge analysis
(2) Reservoir characterisation techniques
(3) Reservoir performance and principal recovery mechanisms
(4) Numerical flow simulation basics

Timing

The course will consist of 9 hours of lectures. Tutorial question sheets will be handed out during the course. These are an integral part of the course. Some will revise the material learnt in lectures, others will supplement it. Material that is learnt through tutorial questions rather than lectures is still be examinable.

Texts

- SPE Compact Disc (upscaling papers)

Assessment

This material will be assessed as part of the Group Field Project (Phase 2)

Lecture Syllabus

1. Review the multiple scale issues of data and processes
2. Review why and how upscaling is a part of the reservoir modelling workflow
3. Analyse and discuss the requirements for performance prediction, anisotropy and key heterogeneity, and which data are concerned
4. Review the required resolution of detailed geological models, simulation flow models, under constraints of computing resources and numerical models.
5. Upscaling of scalar properties: porosity, initial water saturation, net-to-gross, etc.
7. Two phase upscaling (pseudo rel. perm, Pc): analytical and numerical methods.
8. Sensitivity runs and related uncertainty quantification
9. Limitations of upscaling; validation of upscaled models.
10. Best practices; overview of tools available.
11. Future prospects and methods.
COURSE OUTLINE: PRACTICAL USE OF SIMULATORS

Schlumberger

Aims

(4) Introduce students to the practical use of reservoir numerical simulators

Objectives

The course emphasizes practical use of the software rather than simulation methodology. At the end of the course, students should be able to:

(5) Understand how a simulator initializes and executes
(6) Define the model grid geometry
(7) Describe rock and fluid properties
(8) Allocate initial pressure and saturation distribution
(9) Control wells under history matching and production regimes
(10) Specify and edit input and output data
(11) Build and execute a simulation model
(12) Analyze results through post processing

Prerequisites

English proficiency
Basic Windows and practical computing skills
A reservoir engineering background / completion of first term of lectures for this MSc course

Timing

18 hours of lectures during the Spring term.

Assessment

Part of Phase 2 of the Field Group project

Texts

- ECLIPSE Blackoil Reservoir Simulation Course, Schlumberger

Lecture syllabus

1  ECLIPSE features
2  File organization and structure
3  Grids
4  Fluid properties
5  Rock properties
6  Wells
7  Aquifer modelling
8  History matching
9  Prediction
COURSE OUTLINE: PETROLEUM ECONOMICS

Dr. E. Jankowski
RPS Energy

Aims

(1) To introduce the basic concepts and background for the financial and economic assessment of projects within the petroleum industry.

Objectives

At the end of the course students should:

(1) be able to model risk and uncertainty related to projects using probabilistic Resource methodologies such as monte carlo analysis techniques,
(2) have an understanding of different fiscal systems,
(3) be able to calculate the NPV and/or EMV of a project, understand what input data is necessary to undertake such a valuation, carry out Decision Tree Analysis and be able to select the best option from several possibilities,
(4) be able to carry out simple portfolio management decisions under conditions of uncertainty, including economic, technical and political risk,
(5) understand the relationship between economic valuation and the booking of Reserves.

Prerequisite

(1) Familiarity of field development and reservoir life cycle

Timing

18 hours during the Spring term.

Texts

- Wood Mackenzie *Upstream Oil and Gas publications for UK North Sea*

Lecture syllabus

1. Introduction to the Value Chain and the valuation process
2. Fundamentals of economic valuation (time value of money, discounting and NPV)
3. Estimating Resource volumes (volumetric formula, risk and uncertainty, probabilistic methods)
4. Reserves and Resources
5. Project risking (chance of discovery, chance of development, dependency)
6. Volumetric aggregation (consolidation of Reserves and Resources)
7. General framework of hydrocarbon fiscal systems
8. Project cash flow analysis (price forecasts, calculation of future cash flows, cash flow metrics)
9. Sources of finance
10. Non technical risk mitigation
Project development (development options, production forecasts, cost estimation and schedule)

Project valuation (unrisked and risked valuation of oil and gas projects, NPV vs. EMV)

Utility Functions

Portfolio valuation

Portfolio management and optimisation

Reserves and Resources – relationship between economic analysis and the booking of hydrocarbons
Aims

To provide a working knowledge of the design and operation of crude oil and gas processing and transportation systems including:

(1) The theory behind, and analysis of, the transportation of single and multiphase fluids through flowlines and pipelines
(2) The design and operation of oil and gas processing systems to address:
   a. Gas, oil, water separation
   b. The treatment of produced gas and oil
   c. The handling of emulsions
(3) Flow assurance
(4) Pipeline operations and real-time systems

Objectives

At the end of the course students must:

(1) be able to perform calculations of, and size, single and multiphase oil and gas pipelines in association with pump and compressor systems
(2) understand the necessity, and the principle, of well fluid treatment in field operation
(3) understand the principles of physical separation of liquid/liquid and gas/liquid separation and the function, components and different types of separators
(4) be able to design and work out the sizes of horizontal separation equipment
(5) be able to perform equilibrium flash calculations to determine the GOR, and other fluid properties of the produced oil and gas
(6) be able to optimise the separator operating pressure for maximum hydrocarbon liquid recovery
(7) understand the principle of emulsion treatment
(8) understand the necessity of, and the methods (such as absorption and adsorption processes), with their merits and demerits used in the field for the treatment of natural gas and gas condensates

Prerequisite

Before taking this course the students should have a clear understanding of:

(1) the nature, characteristics and behaviour of reservoir fluids
(2) the principle of well production
(3) fluid flow in pipelines.

Timing

27 hours (21 hours lecturing and 6 hours workshops)

Texts

1. Course notes.

Assessment

This material will be assessed as part of Field Development and Process Engineering exam in May. In addition, an important and essential part of the group project will be based on the materials covered in this course.

Lecture Syllabus

1. Introduction, Workflow, and Single Phase Systems
2. Pipeline Design – the Engineering Approach
3. Multiphase Systems
4. Flow Assurance
5. Surface Production Operations I
6. Surface Production Operations II
7. Pipeline Simulation I
8. Pipeline Simulation II
9. Distribution and Field Project
COURSE OUTLINE: OCCUPATIONAL HEALTH AND SAFETY

T. Ingram (Business Assurance Director – Port of Tyne)

Aim

1. To provide an introduction to occupational health, safety, environment and process safety in the work and major hazard environment.
2. To examine the consequences, influences and causes of a significant health and safety incidents.
3. To outline a basic systematic approach to managing health and safety and understanding the concepts of hazard and risk.

Objectives

By the end of the lecture, students should:

1. Have a broad appreciation of why health and safety at work is important
2. Have an understanding of the potential consequences of a breakdown in health and safety systems.
3. Appreciate what role they have to fulfil in ensuring their own safety and the safety of those round about them at work.

Prerequisites

No prior knowledge of occupational health and safety matters is required

Timing

One lecture of three hours

Assessment

It is anticipated that this material will be essential to the completion of the Group Field Project.

Texts

“Successful health and safety management” Health and Safety Executive ISBN 0 7176 1276 7
“Management of health and safety at work” Health and Safety Commission ISBN 0 7176 2488 9

“Managing for health and safety” (HSG65) – HSE – HSG65 2013

“The Public Inquiry into the Piper Alpha Disaster Report” (Cullen 1992)


A Guide to the Control of Major Accident Hazard (COMAH) Regulations ISBN: 9780717666058


“The Offshore Installations (Offshore Safety Directive) (Safety Case etc) Regulations 2015”
“Disastrous Decisions – The Human and Organisational Causes of the Gulf of Mexico Blowout”.
Hopkins, A – 2012

Syllabus

1. We will examine the failures that led to a major health and safety incident and the changes this brought about.
2. We will examine the wider operational and legal context within which the company involved in the incident was operating.
3. We will look at an industry framework for developing and maintaining major hazard health and safety systems.
4. We will look at how this system might have been applied to the incident considered.
5. We will look at how the system might be applied to the group project. We will consider the role of individuals in maintaining a safe working environment.