London South Bank University

EST 1892

Reservoir Engineering and Petroleum Economics

ENG_5_481

School of Engineering

Level 5

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1. MODULE DETAILS

Module Title:	Reservoir Engineering and Simulation
Module Level:	5
Module Reference Number:	ENG_5_481
Credit Value:	20 CAT points
Student Study Hours:	200
Contact Hours:	72
Private Study Hours:	128
Pre-requisite Learning (If applicable):	none
Co-requisite Modules (If applicable):	none
Course(s):	BEng (Hons) Petroleum Engineering
Year and Semester	2018-2019, Sem 2
Module Coordinator:	Dr Pedro Diaz
UC Contact Details (Tel, Email, Room)	020 78157953, diazp2@lsbu.ac.uk, FW-318
Subject Area:	Petroleum Engineering
Summary of Assessment Method:	Coursework 40 % Exam 60 %
External Examiner appointed for module:	Dr Abubakar Abbas, University of Salford

2. SHORT DESCRIPTION

This module introduces the fundamentals of reservoir engineering and presents selected economic concepts related to petroleum costing and management. It is intended that during this module, students will build a comprehensive reservoir engineering background and then apply skills learnt to the analysis and costing of selected petroleum production projects.

Reservoir engineering topics include rock and fluid properties, phase diagrams related to reservoir classification, reserves estimation, recovery processes and flow in porous media. Economic topics focus on the time value of money, profit and cost analysis, profitability indicators and economic objectives influencing evluation decisions. Understanding these fundamental topics will allow students to acquire the necessary skills required for future petroleum-based modules as well as the Petroleum Engineering Design Project which will be taken in the following year.

3. AIMS OF THE MODULE

The aim of this module is to introduce students to the fundamentals of reservoir engineering and petroleum economics.

Part A: Reservoir Engineering

- To introduce the role of a reservoir engineer and demonstrate how reservoir engineering integrates with other key petroleum engineering disciplines.

- To present and analyse fundamental aspects of reservoir engineering related to reservoir rock and fluid properties, flow and recovery.
- To examine reserve classification and provide an understanding of how reserves are estimated under static conditions.
- To introduce recovery mechanisms and show how these impact the quantification of reserves.

Part B: Petroleum Economics

- To provide an overall appreciation of economic evaluation objectives and indicate how these are related to profit and cost analysis.
- To apply reservoir engineering skills to the analysis and costing of selected petroleum production projects.
- To use and apply profitability indicators to perform investment decision analysis and project selection.
- To introduce the concepts of taxation, depreciation and inflation, company financial statements and ratio analysis

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4. LEARNING OUTCOMES

4.1 Knowledge and Understanding

- Appreciate, understand and apply reservoir engineering skills towards the analysis of rock and fluid properties, oil and gas recovery and reserve estimation.
- Understand and apply key economic principles towards the evaluation and selection of competing/parallel projects and investments

4.2 Intellectual Skills

- Think critically in the context of open-ended problems to provide solutions for real-world problems and typical industrial scenarios.

4.3 Practical Skills

- Research and undertake specific practical work and laboratories and be able to communicate and explain the results from experimental data, identifying possible errors and inconsistencies where applicable.
- Understand and practise safety-related legal obligations

4.4 Transferable Skills

- Communicate and work effectively in a team to achieve an objective, with due respect and recognition to contribution from other members of the team.

5. ASSESSMENT OF THE MODULE

Coursework (40%)
The coursework for this module will be assessed via:

- One 20% Laboratory Report
- Two 10% Laboratory Logbook

Examination (60%)
Written examination, normally 2.5 hours duration. Candidates to answer, typically, four out of six questions.

Breakdown of Components by Weighting:

Component	Sub-weighting	Weighting	Proposed Submission date**
Final Exam		**60%**	
Coursework		**40%**	
Logbook 1	10%		One week after experiment
Logbook 2	10%		One week after experiment
Laboratory Report	20%		26th March
TOTAL		**100%**	

6. FEEDBACK

Feedback will normally be given to students 15 working days after the final submission of an assignment or as advised by their module leader. General feedback, applying to all students, will also be placed on the module VLE site within 15 working days.

7. INTRODUCTION TO STUDYING THE MODULE

7.1 Overview of the Main Content

Part A: Reservoir Engineering
The role and function of a reservoir engineer; introduction to reservoir engineering; reservoir type identification; rock and fluid properties; phase behaviour; reserves estimation; recovery processes; fluid flow in porous media

1. Define the principal rock properties used in reservoir engineering and be familiar with the general procedure and calculations used in their determination.
2. Appreciate the different reservoir types occurring in nature, using the 'multi-component' pressure vs temperature phase diagram and describe their fluid phase behaviour during production, both in the reservoir as well as at surface conditions.
3. Understand reservoir fluid sampling procedures and PVT Analysis tests and determine selected fluid properties using both experimental and empirical methods.
4. Be familiar with the different categories of reserves, their definitions and the various methods used in their determination.
5. Use and apply Darcy's Law to oil and gas well flow rate determination.
6. Evaluate the various reservoir production drive mechanisms and typical recovery factors for each type.

Part B: Petroleum Economics
Economic objectives related to the factors influencing evaluation decisions; profits and costs for the oil and gas industry; the time value of money; simple and compound

interest calculations; annuities; net present value of a future revenue stream; profitability indicators to perform investment decision analysis.

1. Relate economic evaluation objectives to the factors influencing evaluation decisions.
2. Demonstrate an understanding of profits and costs for the oil and gas industry.
3. Use and apply the time value of money towards simple and compound interest calculations and annuities.
4. Determine present value of a future revenue stream.
5. Calculate the net present value of an investment opportunity and assess investment options.
6. Explain how a company's discount rate is established to represent its time value of money
7. Use and apply profitability indicators to perform investment decision analysis.

7.2 Overview of Types of Classes

Students are required to undertake directed self-study and prepare solutions/discussions to questions relative to various topic areas. Students will be encouraged to identify for themselves particular problems of difficulty and to use seminar discussions, where appropriate, for the resolution of these. Students must regularly access the Moodle site for this module. They should download the class/lecture material from the Moodle site, and do the recommended reading, before each lecture/class.

Where appropriate, students are also expected to download the relevant seminar questions and study them in advance of each seminar, in order to derive maximum benefit from seminar time. The programme of teaching, learning and assessment gives guidance on the textbook reading required for each week, the purpose of which is to encourage further reading both on and around the topic.

7.3 Importance of Student Self-Managed Learning Time

Student responsibility in the learning and development process will be emphasised.

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7.4 Employability

This module aims to meet the expectations of petroleum engineering employers and related disciplines. It will develop techniques for students to be able to demonstrate an awareness of reservoir engineering and their role in petroleum engineering practice. In addition to disseminating key reservoir engineering concepts, the module also attempts to build critical thinking skills and promote team-work amongst peers.

8. THE PROGRAMME OF TEACHING, LEARNING AND ASSESSMENT

The anticipated teaching and learning will be achieved through the following number of hours of activity:

Lectures: 2 hour lectures for 12 weeks; **Tutorials**: 3 hour tutorial sessions for 12 weeks; **Laboratory Workshop**: 7 hours in the semester.

9. STUDENT EVALUATION

A questionnaire will be distributed in week 10 in order to gather the student evaluation of the module.

10. LEARNING RESOURCES

10.1 Core Materials

Ahmed, T.H. (2006). Reservoir Engineering Handbook (3rd Ed.). Burlington, MA: Gulf Professional. ISBN:0-75067-972-7.

10.2 Optional Materials

Chin, W.C. (2002). Quantitative Methods in Reservoir Engineering. Woburn, MA: Gulf Professional. ISBN: 0-75067-568-3.

Dake, L.P. (2001). The practice of reservoir engineering (Revised Edition). Amsterdam: Elsevier Science. ISBN: 0-444-50671-3

Lake, L. (2006) Reservoir engineering and Petrophysics. Petroleum engineering handbook. Vol. 5. Society Of Petroleum Engineers, 2006.ISBN: 1-55563-120-8.

Archer, J.S. & C.G. Wall. Petroleum Engineering Principles and Practice. Graham Trotman. ISBN 0-86010-665-9.