LONDON SOUTH BANK UNIVERSITY

Introduction to Reservoir Engineering

SCE-2-331

Faculty of Engineering, Science & the Built Environment

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1 UNIT DETAILS

Unit Title:	Introduction to Reservoir Engineering
Unit Level:	2 year
Unit Reference Number:	SCE-2-331
Credit Value:	15
Student Study Hours:	150
Contact Hours:	48
Private Study Hours:	102
Pre-requisite Learning (If applicable):	Fundamentals of Petroleum Engineering
Co-requisite Units (If applicable):	None
Course(s):	Petroleum Engineering
Year and Semester	Second Year, Semester 1
Unit Coordinator:	Dr Pedro Diaz
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Teaching Team & Contact Details (If applicable):	Dr Pedro Diaz, 020 78157953, diazp2@lsbu.ac.uk, E-238 Dr Ali Qubian, 020 78157948, qubiana@lsbu.ac.uk, E-242
Subject Area:	Applied Chemical Sciences
Summary of Assessment Method:	Coursework (50%): Project Examination (50%): 1.5 hours

2 SHORT DESCRIPTION

This unit is concerned with application of simple Petroleum Engineering methods using one or more small projects. The emphasis is on building a reservoir engineeering background and then apply this knowledge to the analysis and modelling of the required petroleum system; a taught course covers some basic principles and modelling techniques and use of a computer package such as Integrated Production Modelling (IPM). By taking the unit students become familiar with more open-ended projects, as a preparation for the Peroleum Engineering design project to be taken in the following year.

3 AIMS OF THE UNIT

— The aim is to provide you with the basic principles and concepts of Reservoir Engineering and give you practice in analysing a mini-project concerning the production of oil and gas from reservoirs.

— At the end of the Unit you should have a better understanding of how an oil or gas producing system behaves. You should have some idea how to develop a material balance and Pressure-Volume-Temperature (PVT) analysis. You will have a greater understanding of how to work with a computer modelling package such as IPM. These skills will help you in next year's design project, which you are all due to take.

4 LEARNING OUTCOMES

4.1 Knowledge and Understanding

On successful completion of this unit, you should:

i. be aware of the requirements for the oil and gas production systems and their modelling.
ii. have a general understanding of the theory of the application of reservoir Engineering to petroleum reservoirs.

iii. be aware of the sources of error in computer applications and of the engineer's responsibility to check and test computer derived data.

4.2 Intellectual Skills

Work with concepts in Engineering and their defining equations.
Use mathematics and science to support the analysis of engineering problems

4.3 Practical Skills

Carry out computer simulation tasks given software and instructions, recording data neatly and following up with discussion and conclusions.
Time and work organisation
Manipulate, sort and present data, identifying possible errors and inconsistencies.

4.4 Transferable Skills

General:

- Work effectively in a team to achieve an objective, with due respect and recognition to contribution from other members of the team
- Self management, time management and organisation

Engineering:

- Analyse and interpret computer simulated data and communicate same in an understandable form
- Use information technology in research, analysis and presentation
- Demonstrate problem solving skills, analytical skills and scientific reasoning

5 ASSESSMENT OF THE UNIT

Assessment will be by examination and coursework. The examination will be a 1.5 hour written examination, at the end of the semester, on the theoretical aspects of the fundamentals of reservoir engineering. The coursework element of the assessment includes a coursework project and marks for attendance at classes. A pass is required in both the coursework and the examination in order to pass the unit as a whole.

6 FEEDBACK

Feedback will normally be given to students 15 working days after the submission of an assignment.

7 INTRODUCTION TO STUDYING THE UNIT

7.1 Overview of the Main Content

7.1.1 The theoretical aspects of the unit

Petroleum Reservoir Fluids

Phase behaviour of hydrocarbon systems ideal and non-ideal gases and liquid systems; qualitative and quantitative phase behaviour; fundamental properties of gas, oils, and waters; PVT analysis; application of basic fluid properties to compositional analyses; separation and reservoir behaviour.

Fundamental Reservoir Engineering
(Physical Properties and Flow of Fluid through Porous Media)
Investigation of fundamental properties of reservoir rocks and fluids; Porosity, fluid saturations, permeability, interfacial tension, wettability, capillary pressure, effective and relative permeability, Darcy's law, steady and unsteady state fluid flow, investigation of Klinkenberg effect; two-phase relative permeability measurements

An introduction to oil and gas material balance equations, drive indices. Estimation of oil and gas reserves.

7.1.2 The practical (computer) aspects of the unit

Theory of Integrated Production Modelling
Project work
Complete a petroleum production project by hand and computer calculation.

Part (A): Hand Calculation

Purpose of Project
This project has been set to give you practice at working in small groups and writing a project report in advance of next year's design project. The emphasis is on: material balance equations, PVT analysis and other reservoir engineering method.

Part (B): Petroleum Production Modelling Project using IPM.

Project brief
The process to be studied is described in the Technical Brief to be issued at the start of the project. You are asked to set up a simulation of the process using IPM computer package as described in the Technical Brief

7.2 Overview of Types of Classes

The unit will be delivered by mixture of lectures, problem solving and computer practical classes, as show below:
Lecture 1.5h/w: Theory of reservoir engineering and modelling techniques and project based on hand calculation and a case study.
Computing 1.5h/w: Computer practical sessions (including project).
Details of times and locations are given in the published class timetables.

The lecture programme will be backed by substantial computational exercises. Much of the teaching will be through project work. On the one hand, you will be asked to demonstrate understanding of reservoir engineering principles. One the other hand, you will learn the application of computer techniques through staged practical exercises leading to a Petroleum Production modelling project.

Course and practical notes for the computer-based work will be disseminated via the Intranet site: http://www.lsbu.ac.uk/bb
Access to these notes will be staged through the semester. You are expected to study the Website notes prior to the lecture and practical classes.

7.3 Importance of Student Self-Managed Learning Time

There is a practical component of this unit where you perform calculations and simulations related to the topics covered in the lectures. The coursework reports have to be prepared and handed on time for their assessment. It is important that you make a good use of the time in the computer room in order to learn the use and application of the software, and to collect the relevant results efficiently.

7.4 Employability

Study of the unit should develop the student ability to acquire new theoretical knowledge and to put it into practice in some simulation problem. The computer simulation part aims to develop the student abilities in the use of the scientific method.

8 THE PROGRAMME OF TEACHING, LEARNING AND ASSESSMENT

The programme of classes below is intended only as a guide and is subject to modification according to rate of progress and unforeseen factors.

Week	Begins Monday	Content
1	24-Sep	Reservoir Fluids. Composition
2	01-Oct	Fluids properties.
3	08-Oct	Thermodynamic properties of the fluids. Phase behaviour
4	15-Oct	Formation Volume factors. PVT Analysis
5	22-Oct	Formation Volume factors. PVT Analysis
6	29-Oct	Porosity, Saturation, Volume of oil in place.
7	05-Nov	Interfacial tension,Wettability
8	13-Nov	Capillary Pressure, fluid Saturation
9	19-Nov	Leverett Equation
10	26-Nov	Drainage, Imbibition processes
11	03-Dec	Permeability. Darcy's Law. Average Permeability
12	10-Dec	Klinkenberg effect. Relative Permeability
13	07-Jan-08	Revision
14	14-Jan-08	Hand in course work
15	21-Jan-08	End of Semester Examination

9 LEARNING RESOURCES

9.1 Core Materials

Ahmed, T. H., (2006), Reservoir Engineering Handbook, ISBN 13: 978-0-7506-7972-5, Gulf Professional Publishing, ISBN 10: 0-7506-7972-7

CHIN, W. C., (2002), Quantitative methods in reservoir engineering, Gulf Professional Publishing; 1st edition, ISBN: 0750675683.

9.2 Optional Materials

Dake, L. P., (2001), The Practice of Reservoir Engineering (Revised Edition) Elsevier Science ISBN:0444506713,.

On-line materials:
Intranet notes on Blackboard:http://www.lsbu.ac.uk/bb

On-line IPM manuals