



Faculty of Engineering
Department of Petroleum Geoscience

Module Guide 2014/15

Reservoir rocks and fluids

Module Code	
Module Level	2
Module Credit	
Semester	1
Module Lecturer	Dr Pavel Spirov
Other Module Team Members	TBC
Pre-requisites	None
Co-requisites	None
Student class contact time	30 hours
Student lab contact time	45 hours
Timetable details	TBC

1. Module Description

After completion of this course, students will know the basics of reservoir engineering. They will gain essential knowledge which each oil/gas engineer should know.

2. Learning Outcomes

By successful completion of this module students will be able to:

Learning Outcome	Learning Activity	Explanation
In this course will be studied basics of reservoir engineering. .	1. Lectures	Lectures will be divided into several modules
	2. Calculations and assignments.	There will be practical calculations and drawings in order to get deeper knowledge of petroleum industry.
	3. Lab work.	For better understanding will be handled several lab works

3. Assessment Details

Assessment Tasks	weighting for components (%)	Hand-in date (university week)	Rationale for the task
1. Midterm exam	30	TBC	To demonstrate knowledge and understanding of the module content
2. Lab work (Assignment & presentation)	20	TBC	To demonstrate the application of knowledge and understanding of the module content to a particular aspect of the subject
3. Final exam	50	Check University Exam timetable	To demonstrate knowledge and understanding of the module content

4. Teaching and Learning Details

The “reservoir fluids and rocks ” is a theory, lab based, practical assessments and pc demonstration module and will be delivered by a combination of lectures, discussion, experiments and software demonstration to show reservoir fluid properties. This course is essential for further development of oil and gas engineers.

5. Outline Syllabus

Week	Date	Content	Staff

No.			
1		<p>Module 1:</p> <p>Introduction to course</p> <p>Introduction to petroleum geology, introduction to oil and gas, introduction to reservoir, formation of reservoirs, geochemistry, crude oil origin, source rocks, reservoir rocks, kerogen types, oil window, elemental composition of crude oil and gas, basic analytical methods, requirement for formation of oil and gas fields, overview of oil and gas reserves</p>	Dr. Pavel Spirov
2-3		<p>Module 2:</p> <p>Geodynamics and reserves, exploration, Anatomy of oil & gas fields</p> <p>Geodynamics, reserves, looking for oil and gas, exploration methods</p>	Dr. Pavel Spirov Mr. Nazir - lab
4		<p>Module 3:</p> <p>Reservoir types, trap types, reserves</p> <p>types of reserves,</p> <p>Trap types, migration of oil and gas</p> <p>Drilling, introduction to drilling plan as exercise</p>	Dr. Pavel Spirov Mr. Nazir - lab
5		<p>Assessment 1</p>	Dr. Pavel Spirov Mr. Nazir

6		<p>Module 4: Porosity</p> <p>Define porosity, classification of porosity, discuss the factors affecting porosity,</p>	<p>Dr. Pavel Spirov</p> <p>Mr. Nazir - lab</p>
7		<p>Module 5: Fluid saturation</p> <p>Definition of the significance of the critical saturation for each phase, methods for determining fluid saturations , factors affecting fluid saturation</p>	<p>Dr. Pavel Spirov</p> <p>Mr. Nazir - lab</p>
8		<p>Module 6: Permeability and relative permeability</p> <p>Darcy law, Absolute, Effective Permeability, Relative permeability</p> <p>Reproduce relative permeability curves</p>	<p>Dr. Pavel Spirov</p> <p>Mr. Nazir - lab</p>
9		<p>Module 7: Compressibility</p> <p>Define the coefficient of isothermal compressibility of reservoir rock and describe methods for determining values of formation compressibility</p>	<p>Dr. Pavel Spirov</p> <p>Mr. Nazir - lab</p>
10		<p>Module 8: Electrical rock properties</p> <p>Define resistivity, resistivity factor, resistivity index,</p> <p>Electrical rock properties</p> <p>Measure resistivity of fluids and rocks in laboratory, compare resistivity of oil, water, salty water,</p>	<p>Dr. Pavel Spirov</p> <p>Mr. Nazir - lab</p>
11		<p>Assessment 2</p>	<p>Dr. Pavel Spirov</p> <p>Mr. Nazir</p>
12		<p>Module 9: Capillary pressure and surface tension</p> <p>Describe capillary pressure and surface</p>	<p>Dr. Pavel Spirov</p> <p>Mr. Nazir - lab</p>

		tension	
13		<p>Module 10: Wettability</p> <p>Wettability definition and calculation</p> <p>Wettability in laboratory</p>	
14		<p>Module 11: PVT properties</p> <p>PVT properties of oil, binary diagrams, classification of oil and gas reservoirs, oil reservoirs such as: Undersaturated oil reservoir, Saturated oil reservoir, Gas-cap reservoir.</p> <p>There will be also explained : black oil, ordinary, low shrinkage oil, near critical oil, low volatile oil.....),</p> <p>In gas reservoirs will be : Retrograde gas-condensate, Near-critical gas-condensate, Wet gas, Dry gas)</p>	<p>Dr. Pavel Spirov</p> <p>Mr. Nazir - lab</p>
		Assessment 3	<p>Dr. Pavel Spirov</p> <p>Mr. Nazir</p>
15		<p>Module 12 – Reservoir fluid properties</p> <ul style="list-style-type: none"> - Natural gases - Crude oil systems - Reservoir water systems <p>Gases = Ideal gases, Real gases EFFECT OF NONHYDROCARBON COMPONENTS ON THE Z-FACTOR, COMPRESSIBILITY OF NATURAL GASES, Z – compressibility factor, Gas formation volume factor, Gas formation volume factor,</p> <p>Exercise on $PV = RT$</p>	<p>Dr. Pavel Spirov</p> <p>Mr. Nazir - lab</p>

		Exercise on gas compressibility factor - z	
16		<p>Module 13: Properties of crude oil systems</p> <p>Fluid gravity Specific gravity of the solution gas Gas solubility Bubble-point pressure Oil formation volume factor Isothermal compressibility coefficient of undersaturated crude oils Oil density Total formation volume factor Crude oil viscosity Surface tension</p> <p>Crude oil gravity - Exercise</p>	<p>Dr. Pavel Spirov</p> <p>Mr. Nazir - lab</p>
17		<p>Module 14: development and production</p> <p>Stages of development</p> <p>Primary, Secondary, Tertiary recovery</p> <p>Natural drive mechanisms - Water drive (artesian and ellision) , Solution gas drive, Gas cap drive, Gravitational</p>	<p>Dr. Pavel Spirov</p> <p>Mr. Nazir - lab</p>
18		Assessment 4	<p>Dr. Pavel Spirov</p> <p>Mr. Nazir -</p>
		Overview of the course	
16		Final Exam	

Practical:

Week	Action
2	
3	Drilling plan
4	Laboratory determination of porosity
5	Laboratory determination of fluid saturation
6	Laboratory determination of permeability and relative permeability
7	Capillary pressure and surface tension
8	Wettability measurement methods
9	Viscosity and density, Exercise: crude oil gravity
10	Drawing of PVT diagrams

6. Reading and Learning Support List

Offshore book

- Offshore center Denmark

Basics of Reservoir Engineering

- Cosse

Reservoir engineering handbook

- Tarek Ahmed

7. Plagiarism and Collusion

All students are strongly advised to be familiar with Student Codes of Conduct on this matter and be aware of the Soran University and KRG Ministry of Higher Education and Scientific Research procedures as outlined in the: “Teaching Quality Assurance”, etc.

Good luck with your studies