PET 417E FLOW THROUGH POROUS MEDIA

Course Title		Flow Through Porous Media				
				Course Implementation, Hours/Week		
Code	**Semester**	**Local Credits**	**ECTS Credits**	**Theoretical**	**Tutorial**	**Laboratory**
PET 417 E	6	3	6	3	0	0
Department		Petroleum and Natural Gas Engineering				
Course Type		Compulsory		**Course Language**		English
Course Prerequisites		PET 212E MIN DD and PET 211E MIN DD				
Course Category By Content, %		Math & Basic Sciences	Engineering Topics; Check if Contains Significant Design (√)			Other
		-	100			-

Course Description	Derivation of the continuity equation and the diffusion equation for single phase flow in the reservoir. Introduction to the concepts of heterogeneity and anisotropy. Steady state, pseudo steady state and unsteady state flow regimes. Definition of productivity index of wells for various well geometries and fluid types during single phase flow. Introduction to two phase flow. Definition of mobility and mobility ratio. The fractional flow curve. The displacement process in porous media and the Buckley-Leverett Equation.
Course Objectives	1. To acquaint the students with the concepts, equations, analysis methods and tools used in reservoir engineering 2. Develop students' ability to apply a quantitative reasoning to reservoir engineering problems, 3. Develop students' ability to apply an integrated knowledge of math, physics, geosciences and engineering sciences to the solution of reservoir engineering problems.
Course Learning Outcomes	Students who pass the course will be able to: 1. Formulate mathematical models representing flow of single phase fluids in porous media 2. Describe the various flow regimes observed in the reservoir 3. Describe the effects of rock and fluid properties on the flow of fluids in porous media 4. Obtain the solutions to the diffusion equation for various different boundary conditions 5. Describe oil-water flow in the reservoir
Textbook	1. Dake, L.P., *Fundamentals of Reservoir Engineering*, Elsevier, 1981. 2. Wilhite, G.P., *Waterflooding*, SPE Textbook Series, Vol. 3, Richardson, TX, 1986.
Other References	1. Petroleum Reservoir Engineering-Physical Properties, Amyx, J. W., Bass, Jr. D. M and Whiting, R. L., McGraw-Hill, New York, USA, 1960. 2. Practical Petroleum Reservoir Engineering Methods, Slider, H. C., PennWell, Tulsa, Oklahoma, 1976.
Homework & Projects	Throughout the semester the students will be given one project.
Laboratory work	-
Computer Use	Students will be using the computer for their homework and projects.
Other Activities	-

Assessment Criteria	**Activities**	**Quantity**	**Effects on Grading, %**
	Midterms	1	20
	Quizzes	4-5	20
	Homework	0	0
	Projects	1	20
	Term Paper/Projects	-	-
	Laboratory Work	-	-
	Other Activities	-	-
	Final Exam	1	40

Weeks	Course Plan	Course Outcomes
1	Basic principles, definitions and parameters used in reservoir engineering studies	1, 2, 3, 4, 5
2	Continuity and diffusivity equations	1
3	Flow regimes	2
4	Derivation of productivity indices for slightly compressible fluids (vertical wells)	3,4
5	Derivation of productivity indices for slightly compressible fluids (partially penetrating wells and slanted wells)	3,4
6	Productivity indices for gas reservoirs	3,4
7	Averaging permeabilities in layered systems	3,4
8	Dealing with anisotropy	3,4
9	Flow Potential	3,4
10	Introduction to oil-water flow	5
11	Residual phase saturations and trapment	5
12	Relative permeability	5
13	Derivation of fractional flow equation	5
14	Review session	1, 2, 3, 4, 5

Related Performance Indicators
1a. The students will be able to demonstrate the ability to identify and formulate appropriate methods for solving petroleum, natural gas, and geothermal engineering problems **1b.** The students will be able to demonstrate the ability to apply engineering methods to reservoir, drilling and production engineering problems

Relationship of Course Learning Outcomes to the Performance Indicators		
	Performance Indicator	
Course Learning Outcome	**(1a)**	**(1b)**
1	x	
2		x
3		x
4	x	
5		x