

## Well Test Analysis

1.1 Course Number: PE341

1.2 Contact Hours: 3-0-2 Credits: 11

1.3 Semester-offered: 3<sup>rd</sup> Year-Odd

1.4 Prerequisite: Basic Reservoir Engineering, Production Engineering

1.5 Syllabus Committee Member: Dr. Tushar Sharma, Dr. Vishnu C. Nair

2. **Objective:** This course is about the evaluation of testing the oil and gas wells. A well test is primarily conducted to predict the production resulting from transient rate response. Pressure build-up and after constant pressure flow is complicated and performed to achieve the subsurface objectives and safe operations.

3. **Course Content:**

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Principles of Transient Testing:	Introduction, Description of a well test methodology, typical flow regimes.	4
	The Analysis Methods:	Pressure curves analysis, type curve with wellbore storage & skin in homogeneous reservoir,	3
		Pressure derivative, type curve and other characteristics flow regimes, derivative response and data differentiation, and the analysis scales.	3
2	Wellbore Conditions:	Well with wellbore storage and skin, model description, matching procedure on pressure and derivative responses	3
		Infinite conductivity or uniform flux vertical fracture, Finite conductivity vertical fracture, Well in partial penetration, Slanted well, and Horizontal well.	4
	Effect of Reservoir Heterogeneities on well responses:	Double porosity models, Layered reservoirs with or without cross flow, composite reservoirs, and combined reservoir heterogeneities.	3

3	Effect of Reservoir Boundaries on well responses:	Single sealing fault in a homogeneous reservoir, Two parallel sealing faults in homogeneous reservoir, Two intersecting sealing faults in homogeneous reservoir.	4
		Closed homogeneous reservoir, Constant pressure boundary, Communicating fault, Effect of boundaries in double porosity reservoirs, Effect of boundaries in double permeability reservoirs, Effect of boundaries in composite reservoirs, and other boundary configurations.	3
	Special Tests:	DST, Impulse test, Constant pressure test, and rate decline analysis, and Vertical interference test.	3
4	Application to Gas Reservoirs:	Description of gas wells pressure behavior, Practical transient analysis of gas well tests, Deliverability tests.	10
	Application to Multiphase Reservoirs:	Perrine's method, Pseudo pressure method, and Pressure squared method.	
	Well Test Analysis of Horizontal Well:	Analysis of pressure of horizontal well for homogeneous and heterogeneous reservoir, Water falloff analysis in horizontal well, double porosity behavior in horizontal well, and other effects in horizontal wells	
Total			40

**Lab:** Analysis of well test data by software.

#### 4. Readings

##### 4.1 Textbook:

- a) Bourdet, D.: Well Test Analysis: The Use of Advanced Interpretation Models. Elsevier, Amsterdam, 2002.
- b) Earlougher, R. C. Jr.: Advances in Well Test Analysis. SPE of AIME, Dallas, Monograph, 1977.
- c) Matthews, C. S. and Russell, D. G.: Pressure Buildup and Flow Tests in Wells. Monograph Series, SPE of AIME, Dallas, 1967.
- d) Horne, R. N.: Modern Well Test Analysis: A Computer-Aided Approach. Petroway, Inc., Palo Alto, CA1990.
- e) Lee, J., Rollins, J. B., and Spivey, J. P.: Pressure Transient Testing, SPE, 003

##### 4.2 Reference books:

- a) Stanislav, J. F., and Kabir, C. S.: Pressure Transient Analysis. Prentice Hall, Englewood

Cliffs, NJ, 1990.

b) Govier, G. W.: Theory and Practice of the Testing of Gas Wells. Energy Resources Conservation Board, Calgary, Alberta, Canada, 1975.

**5 Outcome of the Course:**

To make course more understandable, the problems based on well tests such as build-up, draw-down, and multi-rate will be explained and solved in regular class room sessions and tutorials. The supplied home assignments will help and encourage students to know more about the subject and the well test procedures typically adopted by the petroleum engineers on filed.