University of Southern California Viterbi School of Engineering

PTE 587 - SMART COMPLETIONS, OILFIELD SENSORS AND SENSOR TECHNOLOGY

SPRING 2013, MON. 6:40-9:20 PM, OHE 132

Instructors: Ehsan Tajer, PhD, invited lecturer, email: tajer@usc.edu Also, a number of industry experts are invited to present the *state of the art* in related subjects.

Office Hours: Mon. 5:00-6:20 PM , HED 302

Course Objectives: This elective course is one of the four graduate-level classes offered in the emphasis area of the *Smart Oil Field Technologies*. It is intended to introduce a broad range of advanced subjects related to the intelligent completions, oilfield sensors, and the applications of optimal control theories in the oilfields equipped with *smart wells*, in order to achieve an improved reservoir performance.

The lectures are divided into two main sections: first, we will review the physical principles of common oilfield sensors (i.e. temperature, pressure, multi-phase flow, water cut, strain,...). There are two main categories of sensors: electronic and optical. Optical fibers offer distributed sensing , i.e. multiple measurement points along the production strings. There will be special emphasis on fiber optic sensing. Then, we will review the technology and applications of the interval control valves (ICVs).

In the second part of the semester, we will discuss the analytical processes on the various data sets collected from *smart wells*. The principles of system optimization and control for hydrocarbon recovery improvement will be discussed. During the semester, we will review published case studies demonstrating the opportunities offered by *smart completions* and the challenges yet to be addressed.

Prerequisites: Introductory courses in reservoir and production engineering.^{*} Some of the assignments require programming; familiarity with one of the programming languages is essential. (Preferred programming language is MATLAB.)

Textbook: Class notes and readings to be assigned.

Useful References:

Course Outline:

Lecture 01: (Jan. 14, 2013)	"Course overview"E. Tajer
Lecture 02: (Jan. 28, 2013)	"Physical principles of oilfield sensors"E. Tajer
Lecture 03: (Feb. 04, 2013)	"Fiber optics -part 1"R. Motaghian
Lecture 04: (Feb. 11, 2013)	"Fiber optics -part 2"R. Motaghian
Lecture 05: (Feb. 25, 2013)	"Interval control valve technology"M. Konopczynski
Lecture 06: (Mar. 04, 2013)	"Reliability of sensors and control valves"E. Tajer
Midterm Exam	
Lecture 07: (Mar. 25, 2013)	"Multiphase metering technology"R. Chokshi
Lecture 08: (Apr. 01, 2013)	"Real time flow allocation"L. Saputelli
Lecture 09: (Apr. 08, 2013)	"Smart completins in multi-laterals"E. Tajer
Lecture 10: (Apr. 15, 2013)	"System optimization and control"E. Tajer
Lecture 11: (Apr. 22, 2013)	"Term project presentation"Students
Lecture 12: (Apr. 29, 2013)	"Term project presentation" Students

Grade Policy: Grading is based on:

Homework:	30%
Midterm Exam:	15%
Final Exam :	15%
Term Project:	40%

Grade	А	A-	B+	В	B-	C+	С	C-	D+	D	D-	F
Score	95-100	90-94	85-89	80-84	75-79	70-74	65-69	60-64	55-59	50-54	45-49	<45

Homework Policy: Homework sets will be assigned during the semester. Late homework will not be accepted, unless permitted by the instructor. Group discussions and problem solving are highly encouraged, however, each student must submit his/her individual final work.

Term Project: Details related to the term project will be provided on March 4, 2013 (lecture 6).

Academic Honesty: All students are expected to adhere to the USC Student Conduct Code. *SCAMPUS*, the Student Guidebook, contains the Student Conduct Code. (*Appendix A*). http://www.usc.edu/dept/publications/SCAMPUS/gov/

In case of suspicion of academic dishonesty, student(s) will be referred to the Office of Student Judicial Affairs and Community Standards for further review.

Students with Disabilities: Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. It is located in STU 301 and is open 8:30 a.m.5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.