# KOMAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
# (KUST)

| PETROLEUM PRODUCTION METHODS SYLLABUS | | | |
|---|---|---|---|
| **Course Title** | **Petroleum Production Methods** | | |
| **Course Code** | **PTE4355** | **No. of Credits** | **3 theoretical CH** |
| **Department** | **Petroleum Engineering** | **College** | **Engineering** |
| **Pre-requisites Course Code** | **PTE3315C** | **Co-requisites Course Code** | **N/A** |
| **Course Coordinator(s)** | **Muhammad Ali** | | |
| **Email** | **muhammad.ali@komar.edu.iq** | **IP No.** | |
| **Other Course Teacher(s)/Tutor(s)** | **None** | | |
| **Class Hours** | **SUN//TUE: 10:00-11:30Room: 203** | | |
| **Contact Hours** | **SUN: 13:00 - 16:00 Room: 308** | | |
| **Course Type** | **Departmental Requirement** | | |
| **Offer in Academic Year** | **Fall 2015** | | |

## COURSE DESCRIPTION

This course will discuss the petroleum production systems including the inflow and outflow performance concepts. This course will then investigate various well completion options and their design criteria. Furthermore, Well stimulation techniques, artificial lift, advanced well, perforations, work over operations and problem well diagnosis will be discussed in details.

## COURSE OBJECTIVES

The objective of this course is to learn principles of oil well and gas well production equipments and surface production operations. Furthermore, The objective of the course is familiarizing the students with concepts of well productivity, stimulation and various operational issues and to equip them with the knowledge to handle various workover jobs and field operations.

## COURSE LEARNING OUTCOMES

After participating in the course, students should be able to:

- Gain an overall knowledge of various hydrocarbon production processes from the time a reservoir is discovered to end users (ABET A, E),
- Identify the role of the petroleum production engineer in optimizing recovery (ABET A),
- Evaluate and optimize oil and gas well performance using Nodal Analysis (ABET A, E, K),
- Design suitable bottom hole completions systems (ABET E,K),
- Design principles of different perforation systems (ABET E,K),
- Classify the different types of artificial lift methods (A,E),
- Diagnose the problems of wells and to design work over operation (ABET A, E,K),
- Analyze the Advanced Wells Technologies. (ABET A).

| RELATED PROGRAM OUTCOMES: | |
|---|---|
| A | An ability to apply knowledge of mathematics, science, and engineering |
| E | An ability to identify, formulate, and solve engineering problems |
| K | An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice. |
| Reference:http://www.abet.org/eac-criteria-2014-2015/ | |

**GUIDELINES ON GRADING POLICY**

| Points | Percentage Scores | Grade |
|---|---|---|
| A<br>A- | 95–100<br>90-94 | 4.0<br>3.7 |
| B+<br>B<br>B- | 87–89<br>83-86<br>80-82 | 3.3<br>3.0<br>2.7 |
| C+<br>C<br>C- | 75–79<br>70-74<br>65-69 | 2.3<br>2.0<br>1.7 |
| D+<br>D<br>D- | 60–64<br>55-59<br>50-54 | 1.3<br>1.0<br>0.7 |
| F | 0–49 | 0 |
| I | Incomplete Course Work | |
| W | Official Withdrawal | |

**Passing Grade is 65% or above**

**COURSE CONTENTS**

Course topics include:

1. Introduction to Petroleum Production Methods
2. Reservoir Production Concepts
3. Performance of Flowing Wells and Nodal Analysis
4. Wellbore Completion Concepts , equipments and Designing
5. Wireline Services
6. Perforation
7. Well Stimulation Techniques
8. Artificial lift systems
9. Advanced Wells
10. Problem Well Diagnosis and Work over

****Note: Adding more chapters is governed by the time.***

**Course Teaching and Learning Activities:**

**Lectures:** during week, the theoretical and practical lectures will be presented throughout the semester; the discussion of practical work within lab will be organized and illustrated with activities.

**Assignments:** after the lectures, the assignment will be explained and given to students. It is expected to be done on weekly bases.

**Quizzes:** the contents of each lecture will be discussed during class for open question and answer to make sure every student will participate and active.

**In class brainstorming sessions:** provide students with enough sources and background knowledge briefly within the topics during class to top up their challenge packs to be more active.

**CLASS REQUIREMENT**

- A Scientific Calculator
- Notebook

***Note: Students must bring a notebook, a pen, notebook, calculator, and the periodic table to every class**

| Assessment Tool | Description | Weight |
|---|---|---|
| Quizzes | Four Quizzes are scheduled as shown in the semester schedule. Students will take 4 quizzes; all quiz grades will be counted toward your final grade (ABET A and E) | 10% |
| Assignments | Three assignments will be conducted during the semester; each assignment will be given as scheduled and posted on Google Classroom(ABET A and E) | 10% |
| Tests | Two tests will be conducted during the semester and each has 15% of the total grade. The test may include multiple-choice questions, True/False, short answers, and problem solving (ABET A, E and K) | 30% |
| Mid-term exam | Paper examination – all topics that were studied are included (ABET A and K) | 20% |
| Final Exam | Examination questions-all topics that were studied during the semester are included (ABET A, E and K) | 30% |

**ESSENTIAL READINGS: (Journals, textbooks, website addresses etc.)**

**Textbooks:**

1. Economides, M. J., Hill, A. D. and Ehlig-Economides, Petroleum Production Systems, Prentice Hall, 1993.
2. David, D, Production Technology 1, *Heriot-Watt University. Institute of Petroleum Engineering.*

**References:**

SPE technical papers in related subjects

## COURSE POLICY *(including plagiarism, academic honesty, attendance etc)*

KUST Academic Policy
http://sar.komar.edu.iq/files/Student%20hand%20Book%202013.pdf

Attendance:

- Students are expected to attend all lectures and must attend all examinations, quizzes, and practical exercises.
- There is no make-up work for students who miss classes without official permission.
- Student must arrange with the faculty to make-up the missed class.
- Students are subject to the regulation and policies mentioned in the KUST Student Handbook.
- KUST guidelines for lateness are as follows: Three occasions of lateness count as one absence. (You can be considered late the first minute of the lecture time).

## GUIDELINES FOR SUCCESS

1. Be able to work independently and in groups,
2. Pay-attention in the classes is the guarantee of success,
3. Extend your knowledge beyond the given textbooks in order to master the subject, and
4. Try not to miss the classes

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## Course calendar: Please check the academic calendar for 2015/2016

| Week | Beg/End dates | Topics (Chapters) | Course Discussion | Assessment |
|---|---|---|---|---|
| 1 | SEP 28 – OCT 1 | Introduction to Petroleum Production Methods | Role and Responsibilities of a Production Engineer, Basic layout and equipments of the production oil and gas field. Review of wellbore/reservoir connection and implications for fluid flow | |
| 2 | OCT 4- OCT 8 | Reservoir Production Concepts | Reservoir Depletion Concepts. Reservoir Drive Mechanisms. Solution Gas Drive. Gas-Cap Expansion Drive. Water Drive Reservoir. Gravity Drive. Compaction Drive. Combination Drive. Reservoir Depletion or Material Balance Concepts Application of Material Balance. | |
| 3 | OCT 11- OCT 15 | Reservoir Production Concepts | The Composite Production System. The Producing System. Utilisation of Reservoir Pressure. Supplementing Reservoir Energy. Fluid Injection into the Reservoir. Supplementing the Vertical Lift Process. | ASSIGNMENT-1 |
| 4 | OCT 18 – OCT 22 | Reservoir Inflow Performance and Nodal Analysis | Well Inflow Performance. Darcy's Linear and Radial, Flows in Different States. Non-Darcy Flow. Tubing Performance. Dry Gas Flow. Single Phase Liquid Flow. Gas-Liquid Mixture. | QUIZ-1 |
| 5 | OCT 25- OCT 29 | Reservoir Inflow Performance and Nodal Analysis | PI for oil and gas wells in steady state flow; concepts of flow in pipes and impact of pressure loss components; hydrostatic head and functional pressure loss gradients for oil, gas, vertical and inclined wells; | TEST-1 |
| 6 | NOV 1- NOV 5 | Reservoir Inflow Performance and Nodal Analysis | Exercise: Mathematical problems on Inflow Performance | Assignment-2 |

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| 7 | NOV 8 – NOV 12 | Wellbore Completion Concepts , equipments and Designing | Production Tubing. Specification of Tubing.Wellhead Systems. Xmas tree. Packers. Packer Applications. Wireline Nipple and Mandrel Systems. Subsurface Safety Systems. Tubing - annulus Circulation Equipment. | Quiz-2 |
| MID TERM EXAMINATION NOV 16 – NOV 21 | | | | |
| 8 | NOV 22- NOV 26 | Wellbore Completion Concepts , equipments and Designing | Bottom Hole Completion Techniques. Selection of Flow Conduit Between Reservoir and Surface Completion String Facilities. Completion String Components. Wellhead Xmas Tree. | |
| 9 | NOV 29- DEC 03 | Wireline Services | Surface Equipment for Wireline. Wireline Tool String. Wireline Operating Tools. Tubing Perforator.Consulting on a course project. | Assignment-3 |
| 10 | DEC 06- DEC 10 | Perforation | Options and advantages/disadvantages for perforating oil and gas wells; over balance and under balanced perforating; charge design and factors that influence performance; effect of completion and work over operations | Quiz-3 |
| 11 | DEC 13- DEC 17 | Well Stimulation Techniques | Decision to install sand control during the original completion design; definition of sand problem in the field; Surface equipment/operations to cope with sand production; sand control options; liner/screen design; gravel pack design; | |
| 12 | DEC 20- DEC 24 | Artificial Lift Methods | Explain the importance of Artificial Lift (AL) for world oil production; selection of AL based on ranking criteria; Types of Artificial Lift systems | TEST-2 |
| NEW YEAR HOLIDAY (27 DEC- 31 DEC) | | | | |

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| 13 | JAN 03 – JAN 07 | Advanced Wells | Horizontal Wells. Extended Reach Wells. Multi-lateral Wells. Intelligent ("Smart") Wells. Coiled Tubing Drilling. Underbalanced Drilling. Multiple Fractured Horizontal Wells. | Quiz-4 |
| 14 | JAN 10- JAN 14 | Problem Wells Diagnosis and Workover | Introduction. the Source of Well Problems.Reservoir Associated Problems. Productivity or Injectivity Problems.Reservoir Management Considerations. Completion Associated Problems... | |
| 15 | JAN 17- JAN 21 | Review Work | Review of the course | |
| FINAL EXAMINATION (JAN 24 – JAN 31) | | | | |