

Petroleum Facilities Design and Operation

- 1.1 Course Number: PE331
- 1.2 Contact Hours: 3-0-2 Credits: 11
- 1.3 Semester-offered: 3rd Year- Even
- 1.4 Prerequisite: Production Engineering, Reservoir Engineering
- 1.5 Syllabus Committee Member: Dr. Vishnu Chandrasekharan Nair, Dr. Shivanjali Sharma

2. Objective:

- i. To familiarize with working and design of oil and gas production systems
- ii. Understanding of various production problems and its mitigation

3. Course Content:

Unit-wise distribution of content and number of lectures

Unit	Topics	Sub-topic	Lectures
1	Well Completion	Well Completion, Well completion Methods, Well activation, Subsurface production and control equipment, Smart wells- intelligent completions	6
2	Workover, Well Stimulation	Well Production Problems and mitigation, Well Servicing and Workover: Workover system, workover rigs and selection. Workover and completion fluids, Formation damage, Workover planning and economics Well Stimulation Techniques - Type & description of stimulation techniques, Matrix acidization and acid fracturing. Hydraulic fracturing, Other stimulation methods	12
3	Surface facility equipment design	Surface facility equipment design: Introduction, Design of surface facilities, surveying and surface layout, Primary treatment of oil and produced fluids, Separators: operating principles and operational necessities, types of separators,	10

		design of separators, screening criteria for separators. Free water knockouts, oil dehydrators, Heater-treaters, operating principles and design. Desalters, introduction, design and description. Introduction to Produced Water, Soluble Water and Deck Drainage. Emulsions, introduction and treatment. Crude stabilization and solids removal, design of mesh and fines removal. Introduction and design of Multistage separator with crude oil treater and stabilizer	
4	Artificial lift	Artificial lift system design: Introduction, Sucker rod pumping- Pumping system, Surface and Subsurface Equipment, Power Requirements, Dynamometers and Troubleshooting, Design of SRP System, Principles of Gas Lift, Gas lift system, Gas lift Valves, Gas lift types: continuous and intermittent gas lift, Design of gas lift installations, Electrical submersible pump, Surface and sub-surface components of ESP, Accessories of the ESP systems, ESP configurations, Performance curves, Design and Selection of ESPs, Progressive cavity pumping- Surface and Subsurface Equipment, Geometry of Downhole Pump, Fit, Viscosity, Slip, Elastomers, Power Requirement, Design of PCP System, Hydraulic pump, Jet pumps and Plunger lift: Principles of operation, Surface and subsurface equipment, Basic design aspects, Artificial lift system screening and selection criteria	12
		Total	40

4. READINGS

4.1 TEXT BOOKS:

4.1.1. Nind, T.E.W: Principles of Oil Well Production, 1981, Mc. Graw - Hill Co.

4.1.2. Allen Thomas, and Alan Roberts; 1989, Production Operations, Volume 1 and 2; 3rd Edition, Oil and Gas Consultants International, Inc.

4.1.3. Guo, Boyun: Petroleum Production engineering, A Computer-assisted Approach,

2011, Elsevier.

4.1.4. Niladri Kumar Mitra: Principles of Artificial Lift, 2016, Allied Publishers Limited

4.1.5. Maurice Stewart and Ken Arnold, Surface Production Operations Vol. 1, Design of Oil Handling Systems and Facilities, Gulf Professional Publishing, 2007.

4.2 REFERENCE BOOKS:

4.2.1. Kermit E. Brown: The Technology of Artificial lift, 2a and 2b, 1983, Penn Well Books

4.2.2. Larry W. Lake: Petroleum Engineering Handbook Volume IV: Production Operations Engineering 2007. Society of Petroleum Engineers.

5. OUTCOME OF THE COURSE

At the end of the course, the students will have gained knowledge in the process and equipment design associated with oil and gas production.

*List of designs: -

1. Perforation design
2. Hydraulic fracture design
3. Fracture acidizing design
4. Gravel pack design
5. Squeeze cementing design
6. Design of sucker rod pump system
7. Continuous gas lift system design
8. Intermittent gas lift system design
9. Design of electrical submersible pump (ESP)
10. Design of jet pump
11. Design of progress cavity pump (PCP)