Fifth Semester

Course Title: Petroleum Production Engineering
Course Code: PE 301
Course Duration: One semester

Marks (University Exam): 100 marks (total)

Progressive Assessment: 50 marks

Practical: - No

Time of examination: 2 hours and 30 mins

Objective: To get familiarized with equipment and techniques used in production and completion of oil/gas well and practices nature of difficulties and actions to be taken.

SN	Topic	No. of Lectures
PE 301	**Petroleum Production Engineering** Well Head Testing,Perforation and Well Activation, Use of Compressed Air, Liquid Nitrogen, Swabbing .Surface Layout. Production Measurement Production Testing of Wells. Choke Performance,Oil and Gas Separator. Separator System Design. Optimum Separation Scheme. Multi-Phase Flow in Tubing and Flow Lines. Tubing Sizing and Performance,Horizontal Well Performance,Gas Lifts: Continuous and Intermittent Gas Lift System, Performance and Optimization Pumping: Sucker Rod Pumping of Oil. Electric Submersible Pumps; Operation, Design and Optimization Sand Control: Sand Consolidation, Gravel Packing, Performance Design and Techniques.Work Over: Deparaffination, Water Shut off; Squeeze Cement and Polymer Injection.Conventional and Coil Tubing Use. Application of Liquid Nitrogen. Production Optimization: Nodal Analysis, Smarts Wells, Intelligent Wells	**48**

Outcome:

- Student will be able to understand the basics of oil and gas production engineering techniques
- Student will be able practice both theory and practical of different production operations in the oil and gas wells such as artificial lifts and subsurface equipment's.

- Recognise the concept of well completion and work over job for a wellbore.
- Demonstrate well completion, well services and equipment's to improve production performance of a wellbore and do problem well analysis and apply new techniques to sustain production rates.

Books:

- Ryen Caenn, H. C. H. Darley and George R. 2011, Gray, Composition and properties of Drilling and Completion Fluids, Sixth edition, Gulf Professional Publishing, 701 pp.
- Herriot-watt university production engineering-I pdf
- Thomas O. Allen and Alan P. Roberts, 1989, Production Operations: Well Completions, Workover, and Stimulation, OGCI, Tulsa, Volume 1 and 2,

Course Title: Chemical Thermodynamics
Course Code: PE 302
Course Duration: One semester
Marks (University Exam): 100 marks (total)
Progressive Assessment: 50 marks
Practical:- No
Time of examination: 2 hours and 30 mins
Objective: To impart knowledge to the students on the work calculation of ideal and non-ideal gases, horse power, thermodynamics of gases and liquid hydrocarbons, phase rule of single, two, three multi-component and multi-phase systems

SN	Topic	No. of Lectures
PTE 302	**Introduction:** Maxwell relation, Law of Corresponding State, Fugacity and Fugacity of Gases and Gaseous Mixtures, Lewis fugacity Rules,Third Law of Thermodynamics **Ideal & Non-Ideal Solution:** Partial Molar Properties, Chemical Potential, Activity and Activity coefficient, Vapour-Liquid Equilibria, Gibbs-Duhem Equation, **Adsorption:** Adsorption Isotherms, Chemisorption, Phase Equilibria Calculation **Chemical Thermodynamics of Petroleum Hydrocarbons:** Free energy, change, heat of reaction, Entropy change, Heat capacity, Heat of formation, fugacity, Pressure – volume diagram, Density – Temperature diagram for one and two component system.	**48**

Outcome:

- To calculate the parameters such as specific heats, vapour pressure and compressibility factor and Calculate the heat of reaction, heat of formation, etc.
- Will be able to draw the P-T, T-X-Y diagrams for single and multi-component systems.

Books:

- Karen Schou Pedersen, Peter L. Christensen, Jawad Azeem Shaikh, “Phase Behavior of Petroleum Reservoir Fluids” 2nd edition, CRC Press, 1998.
- Abbas Firoozabadi, “Thermodynamics of Hydrocarbon Reservoirs” 1st Edition, Mc Graw Hill , 1999.

Course Title: Petroleum Chemistry

Course Code: PE 303

Course Duration: One semester

Marks (University Exam): 100 marks (total)

Progressive Assessment: 50 marks

Practical: No

Time of examination: 2 hours and 30 mins

Note for Examiner: The course schedule includes 3 lectures and 1 tutorial

Objective: The course is primarily focused on the oil and gas sector of the petroleum industry. The skills include knowledge of chemical composition and properties of petroleum (oil and gas), petroleum products and alternative fuels.

SN	Topic	No. of Lectures
PE 303	Petroleum Chemistry Unit I: Properties and General Characteristics of Hydrocarbon, Composition, Molecular types in Petroleum. Unit II: Characterization and Analytical Techniques for Crude Oil (TBP, ASTM and EFV distillation curves). Physical properties, UOP characterization factor, Thermal properties, Electrical properties, Optical properties, Chromatographic techniques, Spectroscopic methods (Principles and Applications of UV Visible, IR, and NMR Spectroscopy), Characterization of formation water. SARA Separation methods. Unit III: Additives to improve the quality of Diesel and Petrol, Catalysis and Applications of Catalysts (like Zeolite and other catalysts) in separation processes and also in petroleum industries. Unit IV: Instability and incompatibility of petroleum products.	48

Outcome: This course provide students with an understanding of Petroleum Chemistry and the skills needed for successful employment

Books

- The Chemistry and Technology of Petroleum, James G. Speight, Taylor & Francis, June 1991, INR 7,465

- Crude Oil Chemistry, V Simanzhenkov and R Idem, Marcel Dekker Inc., 2003. INR 14726

Course Title: Fluid Flow through porous media and Heat Transfer

Course Code: PE 305

Course Duration: One semester

Marks (University Exam): 100 marks (total)

Progressive Assessment: 50 marks

Practical: Yes

Time of examination: 2 hours and 30 mins

Note for Examiner: The course schedule includes 2 lectures, 1tutorials and 1 practical.

Objective: The course will provide information on different fluid dynamics accessories like valves, pumps and compressors, theories on fluid flow through porous media, heat transfer types and heat exchanger equipment's applicable to petroleum industries.

SN	Topic	No. of Lectures
PE 305	**UNIT- I :** Introduction to fluid flow: Fluid, Types of fluid, Types of fluid flow and geometry, concept of hydraulic diameter, Hydrostatic pressure, application of pressure, pressure measuring devices, Bernoulli's equation and its application in fluid flow, Hagen pouissellie equation and its use in pipeline transportation. Introduction to fluid transportation devices: Pumps, valves, compressors and blowers. **UNIT-II:** Rheology: Newtonian and Non-Newtonian Fluids, Psuedoplastic, dilatant, Bingham, Rheopectic, Thixotropic and Visco-elastic fluids. Introduction to elements of reservoir. Rock Properties: Porosity, Porosity in upstream and downstream processes, Ergun Equation, rock compressibility, Permeability, combination of permeability in parallel and series beds, Wettability, Interfacial Tension, Capillarity, Capillary pressure and Capillary Number, Darcy's Experiment, Mobility and Mobility ratio. **Unit III:** Fluid potential and flow rate, Darcy's experiment, Darcy's Law and Darcy's field equation, Sign convention and units, Boundary conditions, Single and multiphase flow, Linear and radial flow, Productivity index, Radial diffusivity equation in porous media for steady state, semi steady state and unsteady state situations. **Unit IV :** Well Stimulation: Radial steady state flow, Wellbore damage,	48

	Skin Pressure, Methods to stimulate well. Drive Mechanism: Primary, Secondary and Tertiary recovery schemes, Gas and oil drive reservoirs, Reservoir efficiencies and methods to oil recovery.	

Outcome:

Student will learn the use of Darcy's Law to calculate permeability of single phase; definition of interfacial tension; use of capillary pressure to determine saturation changes in reservoir; definition of effective and relative permeability; use of drainage/imbibition curves to characterize reservoir relative permeability.

Books

- J. Bear, Dynamics of fluid in porous media, Dover, 1972.
- A. K. Jain, Fluid mechanics, Khanna publisher, 2010.
- W. L. Mccabe, J. C. Smith, Unit operation of Chemical Engineering,

L. P. Dake, Fundamentals of Reservoir Engineering, Elsevier, 1983.