Sixth Semester

Course Title: Well Testing
Course Code: PE 317
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, 1 tutorials and 1 practical.

Objective: This course is to provide a working knowledge of the current methodologies used in well production & testing and the concepts of porosity and permeability and be able to relate their respective influences on fluid flow in porous media

SN	Topic	No. of Lectures
PE 317	**Unit-1**: Well Stimulation: Method to estimate extent of Formation Damage, Causes, and Occurrence to reduce / avoid Formation Damage. **Unit-2:** Acidisation, Matrix Acidisation, Selection of Acid Formulation, Additives Selection, Procedure to carry out Acidisation Job.Fracture choice of Fluids and Additives and Selection thereof.Flow Measurement – Various methods and their selection.Demulsification and Desaltiny of Crude Oils + Heater Treaters. **Unit-3:** Storage of Oil: Design, Operation and Maintenance. Transportation of Crude Oils; Gas Pumps and Compressors. Pipelines: Construction, Maintenance, Operation and Precautions. Corrosion of Oil & Gas Equipment: Reasons & Methods to reduce/ avoid Corrosion Field Processing of Oil & Gas. **Unit-4: WELL TESTING:** Steady State and Transient Fluid and Flow Process in Petroleum Reservoir. Diffusivity Equation. Terminal Rate Solution. Build Up Tests. Multirate Testing, Interference and Pulse Testing. Reservoir Limit Test	**48**

Outcome:

- 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.
- Acquaint with types of well completion.
- Recognize and apply application of techniques to solve well productivity related

Problems.

- Illustrate various equipment and processes for the treatment on produced emulsion
- Understand mechanism and factors of oil field corrosion and methods for prevention.
- Understand and apply production logging operations

Books:

1. Oil Well Stimulation by Schechter
2. Production Engineering by Libro
3. Well Testing by John Lee
4. S. McAleese, "Operational Aspects of Oil and Gas Well Testing", Volume 1 (Handbook of Petroleum Exploration and Production) 1st Edition, 2004.
5. Horn R A, "Modern Well Test Analysis, A Computer Aided Approach", Petroway, Second edition, 1995.
6. Earlougher, R.C., "Advances in Well Test Analysis", Monograph Series, SPE,1977.
7. Bourdarot, G. "Well Testing, Interpretation Methods", 1st Edition, 1996
8. Chaudhry Amanatu, "Oil Well Testing Handbook" Gulf Professional Publishing, 2004.

Course Title: Reservoir Study - I

Course Code: PE 308

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, 1 tutorial.

Objective: The aim of learning this subject is that student will able to follow and understand the reservoir concepts such as reservoir behavior, rock characteristics and reservoir management.

SN	Topic	No. of Lectures
PE 308	**Unit I:** Petroleum origin and composition, Petroleum geology, Introduction to reservoir engineering, Elements of reservoir hydrocarbon migration and traps, Identification and location of reservoirs, Drilling operations and drilling fluids, Rheological behavior of drilling fluids, well completion and production. **Unit II:** Reservoir rock properties: Rock Compressibility, Porosity, Permeability determination,Relative, absolute and effective permeability, Combination of permeability in parallel and series beds, Porosity-Permeability relationship, Fluid saturation and significance, Wettability and contact angle, Boundary and Interfacial Tension, Capillary pressure, characteristics, measurement, imbibition, drainage and capillary number, Mobility and mobility ratio. **Unit III:** Reservoir fluid properties: Hydrocarbon classification, Phase behavior of hydrocarbon system, Ideal and Non-ideal system, Equilibrium ratio, Reservoir fluid sampling, PVT analysis for single and two component system and laboratory measurements, Gas-Oil formation volume factor, Resistivity factor and resistivity index. Reservoir drive mechanism: Primary, Secondary and tertiary recovery schemes, General material balance(MBE) in oil or combination reservoirs, Predicting primary recovery-Gas drive reservoir, Water drive reservoir and Oil reservoir. **Unit IV:** Fluid flow through porous media: Darcy's experiment, law and boundary conditions, Single and Multiphase flow, Linear and radial flow, Radial diffusivity equation in porous media for steady	**48**

	state, semi-steady state and unsteady state situations, Skin damage and skin pressure, Productivity Index, Methods to well stimulation. Introduction to enhanced oil recovery	

Outcome:

- Understand the rock and fluid properties of a hydrocarbon reservoir
- Describe the nature of the fluid flow and pressure distribution in a reservoir
- Understand the effects of production/ injection on recovery of reserves

Books

- Integrated Reservoir Studies (Fundamentals of Exploration and Production) Paperback – March 9, 2001 by Luca Cosentino, INR 5,280.
- Fundamentals of Reservoir Engineering (Developments in Petroleum Science) Paperback, 1983 by L. P. Dake, Elsevier Science Ltd; New impression edition, INR 4297.

Course Title: Petroleum Refining & Petrochemicals

Course Code: PE 313

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 2 lectures, 1 tutorial and 1 practical

Objective: The course will described various processes used in the petroleum refining industry and will provide information to produce different petroleum products like LPG, petrol, diesel, kerosene etc. from crude petroleum.

SN	Topic	No. of Lectures
PE 313	Petroleum Refining & Petrochemicals Unit I: Fractionation of Petroleum: Dehydration and Desalting of Crudes, Distillation of Petroleum. Unit II: Hydrodesulphurization, Catalytic Reforming, Isomerization, Catalytic Cracking, Coking, Alkylation processes. Unit III: Treatment of Kerosene, Sweetening processes, Treatment of Lubes, Air Blowing of Bitumen processes, Hydrogen production. Petrochemicals: Naphtha cracking, Production of polyethylene, and Synthetic fiber. Ammonia, Nitric Acid, Ammonium Nitrate, Urea. Unit IV: Phosphate fertilizers, super phosphate, Triple super phosphate, Mono and ammonium phosphate, Nitro phosphate, Mixed Fertilizers.	48

Outcomes:

- Establish the link between the upstream and downstream petroleum industry
- Know the composition of crude oil, along with its properties and characterization methods
- Understand the purification and fractionation process of crude oil
- Get conversant the conversion processes of the various products from distillation.
- Select a good grade of lubricating oil and bitumen
- Address the issues related to pollution from refineries

Books

- Handbook of Petrochemical production process, Robert A Meyers, McGraw Hill, INR 5816.
- Petroleum Refining Technology and economics, James H Gary and Glenn E. Hardwerk, Marcel Dekker Inc., New York, 5thedn. 2007, INR 6533.

Course Title: Reaction Engineering

Course Code: PE 319

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, 1 tutorial and 1 practical

Objective: The course will explain different types of reactions, analysis of reaction rate, reactors and reactor design applicable to petroleum refining industries.

SN	Topic	No. of Lectures
PE 319	Reaction Engineering Unit I: Rate of Reaction, elementary and non-elementary reactions molecularity and order of reaction, thermodynamics formulations of rates, mechanism of reaction, Temperature dependency from thermodynamics, Arrhenius, collision and Activated complex theories, Introduction of industrial reactors. Unit II:Integral and differential methods for analyzing kinetics data, interpretation of constant volume batch reactor data for zero, first second and third order reactions, half-life period, irreversible reactions in parallel and series, Auto catalytic reaction, enzyme catalyzed and surface catalyzed reactions. Interpretation of variable volume batch reactor data for zero, first and second order reactions. Unit III:Design equations for batch, plug flow, back mix, flow and semi batch reactors for isothermal, adiabatic reactions, holding time and space time for flow system; Design of batch, plug flow and mixed flow reactors for first and second order single reactions. Optimum reactor size of plug flow reactors in series / parallel reactions. Unit IV: Multiple reactions, independent, parallel and series reactions; mixed reactions, instantaneous and over all fractional yield, choice of reactors for simple and complex reactions and multiple reactor system; Introduction to Residence time Distribution of fluid in Vessel.	48

Outcome:

- Perform material balances to derive general reactor design equations
- Use the appropriate reaction kinetics in the reactor design equations
- Know the modelling of chemical reactors.

Books

- Levenspiel, O., Chemical Reaction Engineering, John Wiley and Sons, New York, 3/e, 1998.
- Fogler, H. S., Elements of Chemical Reaction Engineering, Prentice Hall, USA 4/e, 2005.
- Smith, J. M., Chemical Engineering Kinetics, McGraw Hill Publications, New York, 1981.

RESERVOIR ENGINEERING LABORATORY

Objectives:

To demonstrate the processes involved in operations, introduce laboratory techniques which are used to select and optimize geological interpretation and to develop interest in experimentation.

List of experiments:

- Saturation Determination, Dean-Stark Distillation Method.
- Fluid density using the Pycnometer method
- Liquid Viscosity Measurement using Capillary Type Viscometer
- Effective Porosity Determination by Helium Porosimeter Method
- Porosity Determination by Liquid Saturating Method
- Resistivity Measurements of Fluid-Saturated Rocks
- Capillary Pressure Measurement using Centrifuge Method
- Capillary Pressure Measurement using Porous Plate Method

Outcome:

- Students able to understand the equipment, Principles and operation and rock properties by analyzing data's.

List of Equipment's:

- Helium Porosimeter
- Porous Plate
- Pycnometer
- Dean-Stark Distillation
- Centrifuge
- Resistivity meter
- Capillary Type Viscometer