



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

B. TECH. III SEMESTER

MTL205 ADVANCED MATHEMATICS FOR PETROLEUM ENGINEERING

Laplace Transform: Definition and existence of Laplace transform, Properties of Laplace Transform and formulae, Unit Step function, Dirac Delta function, Heaviside function, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace transforms method.

Fourier Transform: Fourier Complex, Sine and Cosine transform, properties and formulae, inverse Fourier transforms, Convolution theorem, application of Fourier transforms to partial ordinary differential equation (One dimensional heat and wave equations only).

Complex Variable-Differentiation: Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties.

Complex Variable-Integration: Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof). Evaluation of real integrals using residue theory.

Probability Theory: Basic concepts of probability, conditional probability, Baye's theorem. Random variable and distributions: Discrete and continuous random variables, Moments, Expectation, Moment generating function, Binomial, Poisson and Normal distribution

BOOKS:

1. Advanced Engineering Mathematics, Jain and Iyengar, Narosa Publications.
2. Advanced Engineering Mathematics, Irvin Kreyszig, Wiley, India.
3. Advanced Engineering Mathematics, M. Greenberg, Pearson Education, India.
4. Engineering Mathematics for semesters III and IV, C.B. Gupta, Mc Graw Hill Education, India.
5. Advanced Engineering Mathematics, Denis Zill and Warren Wright, Jones & Bartlett India Private Limited.
6. Higher Engineering Mathematics, B. V. Ramana, Mc Graw Hill Education, India.
7. Spiegel; Laplace Transforms; Schaum's outline series.
8. Integral Transforms, Goyal and Goyal, Jaipur Publishing House, India.
9. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
10. Introduction to Probability and Statistics, Seymour Lipschutz and John J. Schiller, Mc Graw Hill Education, India.
11. Fundamentals of mathematical statistics, S.C. Gupta and V.K. Kapoor, Sultan Chand & Sons., India.

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

12. Probability and Statistics, Murray Spiegel, John Schiller, R. Alu Srinivasan, McGraw Hill Education, India.
13. Complex Variables and Applications, J.W. Brown and R.V. Churchill, McGraw Hill Education, India.

HUL202 ECONOMICS AND FINANCIAL MANAGEMENT

PEL201 DRILLING TECHNOLOGY –I

Introduction to Oil & Gas Well Drilling: Well planning, Drilling techniques in onshore, Offshore and deep sea environments, Types of wells

Rotary Drilling Technique: Rig components & functions, Lay out of the rig

Drilling System: Hoisting System, Mud circulation System, Rotation, power System, Rig wire line system handling & storage.

Casing String & Drill String:

Casing types, Functions of different casing, Selection and design of casing, Drill string components,

Drill Bits: Drill bit types and function

Geological considerations in Drilling:

Geo-technical order (GTO), Consideration while drilling through sub-hydrostatic, hydrostatic and super-hydrostatic zones. DST: Introduction & Application

Advanced Techniques in Drilling:

Introduction to Directional drilling, MWD, Steering motors,

Risks and its Prevention:

Well kick, precursors of blowout: Prevention and safety, Environmental issues, Overbalanced and underbalanced drilling, Thief zone, Lost circulation

Other Considerations While Drilling

Dog-legs, Side tracking and coring, Fishing

BOOKS:

1. Drilling Engineering-A complete well planning approach; Neal J. Adams; PennWell publishing Company; Tulsa, Okhlama.
2. Drilling Well Completions by Carl Gatlin, PHI Publication
3. Applied Drilling Engineering; Adam T. Bourgyne Jr., Keith K. Milheim; SPE casing design theory and practice; S.S. Rahman, G.V. Chilingarian; Elsevier

PEL202 PETROLEUM GEOLOGY

Introduction-Branches of geology useful to petroleum engineering, scope of geological studies in petroleum exploration & production.

Mineralogy-Minerals: General characteristics, Origin and composition, physical properties, classification, common rock forming minerals and clay minerals, basic of optical mineralogy, SEM, XRD., megascopic identification of common primary & secondary minerals.

**(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU
KOTA)**



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

Petrology-Rock forming processes. Rock cycle & Specific gravity of rocks. Igneous petrology- Introduction, structure of earth, Characteristics of different types of magma. Division of rock on the basis of depth of formation, and their chemical and mechanical characteristics. Chemical and mineralogical Composition. Texture and structure. Various forms of rocks. Classification of igneous rock, Field Classification chart. Descriptions of some common volcanic, hypabyssal and plutonic rocks. Sedimentary petrology & petrography: mode of formation of sedimentary rock, Texture and its types, grain size, grain shape, sorting & composition. Mechanically and chemically formed Structures. Classification of sedimentary rocks and their characteristics. Metamorphic petrology- Introduction, Agents and types of metamorphism, composition, and classification. Descriptions of some common metamorphic rock.

Structural Geology: Introduction of structural geology, Strength Behavior of Rocks- Stress and Strain in rocks. Concept of Brittle and Ductile deformation of rocks. Concepts of plate tectonics and continental drift. Attitude of planar and linear structures. Dip and Strike. Fold- Types and nomenclature, Criteria for their recognition in field. Faults: Classification, recognition in field. Identification of structures from bore-hole data. Joints & Unconformity: Types, Stresses responsible. Salt and mud domes. Effects of folds, faults & salt domes on strata and their importance in petroleum exploration. Tectonics and basin formation, elements of basin analysis.

Stratigraphy:

Earth's history in rock record, introduction of stratigraphic principles – lithostratigraphy, cyclostratigraphy, chronostratigraphy, event stratigraphy. Indian Geological time-scale, Introduction to paleontology, fossils & microfossils and their mode of preservation, significance of microfossils in petroleum exploration, broad stratigraphic subdivisions and associated rock types of important coal basins and oil basins of India

BOOKS:

1. Engineering and General Geology, Parbin singh, Katson Educational Series, 2008
2. Geology of Petroleum, A.I. Levorsen, CBS Publisher, 2nd Edition, 2006.
3. Element of petroleum geology, Richard C. shelley, Second Edition, 1998
4. Petroleum Formation and Occurrence, B. P Tissot, D. H. Welte, Springer-Verlag. Berlin Heidelberg NewYork Tokyo 1984.
5. Geological Techniques for Petroleum, Sahay B, Rai A. and Ghosh M.

PEL203 FLUID MECHANICS

Properties of fluids; Classification; Ideal fluid, Newtonian and Non-Newtonian fluids; Newton's law of viscosity. Pascal's and Hydrostatic law, manometers. Types of manometer

Fluid Statics: fluid pressure and its measurement.

Fluid Kinetics: Continuity equation; types of flow.

Fluid dynamics: One dimensional equation of motion; Bernoulli's equation; application; application of Bernoulli's equation. Friction losses in pipe flow, valves and fittings, k-values, sudden expansion and contraction, pipe flow problems Nozzle. Introduction to laminar & turbulent flow. Velocity Distribution for turbulent flow, concept of Reynolds number & friction factor.

Flow through Pipes – Darcy – Weisbach's equation. Head loss in pipes. Pipes in series/ Parallel. Classification, basic construction and application of different types of pumps.

**(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU
KOTA)**



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

Pump: Centrifugal pump, Principles and application in Bernoulli's theorem Types of Pump: Axial pumps, Gear pump, Plunger Pumps Vane pump, Reciprocation pump and Screw pump. Characteristic Curves of Pumps. Valves, types of valves.

Flow Metering: Metering of fluids; orifice meter, venturimeter, pitot tube, rotameter, Notches, Gas flow meters, coefficient of discharge.

BOOKS:

1. McCabe, W.L., Smith, Julian C. & Harriett, Peter, "Unit Operations of Chemical Engineering", McGraw Hill, New Delhi, 7/e, 2005
2. Dr. P N Modi Dr. S M Seth Hydraulics and Fluid Mechanics - Standard Books House
3. Engineering Fluid Mechanics, Kumar K.L., S Chand
4. R.K Bansal, Fluid Mechanics and Hydraulic Machine. S Chand

PEL204 DRILLING FLUIDS & CEMENTING TECHNOLOGY

Drilling Fluids: Overview of drilling fluids, clay chemistry and its application to drilling fluids, types of clays, hydration, flocculation, aggregation and dispersion.

Classification, types and applications of drilling fluids:

Water based, oil based, emulsion based, polymer based, surfactant based, foam based and aerated drilling fluids, Criteria of selection of drilling fluid additives and salinity of drilling fluids. .

Drilling Fluid Characteristics: Basic functions, properties, maintenance and treatments of drilling fluids, Drilling fluid requirement calculations.

Cementing:

Objectives of cementing, oil well cements. Classification of cement, slurry design, slurry additives, factors influencing cement slurry design.

Cementing Methods: Primary cementing, stage cementing, liner cementing, plugging, squeeze cementing techniques in practice. Deep well cementing, squeeze jobs, prevention of gas channeling, HT-HP environments, analysis and techniques of evaluation of cement job. Characteristics of good quality cementation. Cementing calculations

BOOKS:

1. Drilling Fluids Processing Handbook, Gulf publishing company
2. Azar, J. J., G. Robello Samuel; Drilling Engineering, Penn Well.
3. Drilling Mud and Cement Slurry Rheology Manual; Gulf Publishing Company.
Smith.P.K 'Cementing' SPE Publications 2nd Edition 1976

PRACTICALS

PEP201 PETROLEUM GEOLOGY LAB

List of Experiments:

1. Study of physical properties of the minerals
2. Study of physical properties of the rocks
3. Identification of minerals in hand specimen

**(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU
KOTA)**



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

4. Identification of rocks (Igneous) in hand specimen.
5. Identification of rocks (Sedimentary) in hand specimen.
6. Identification of rocks (Metamorphic) in hand specimen.
7. Study of thin section of important minerals & rocks.
8. Study of topographical features from Geological maps
9. Interpretation of geological structures from surface geological maps.
10. Interpretation of subsurface geological structures from borehole data
11. Preparation of subsurface structural contours map.
12. Identification of Geological features through wooden Models

Field visits for Geological structures & stratigraphy exposures.

PEP202 FLUID MECHANICS LAB

List of Experiments:

1. Reynolds experiment for Laminar, transitional and turbulent flow identification, through Reynolds apparatus
2. Verification of Bernoulli's Equation through Bernoulli's Theorem Apparatus.
3. Determination of coefficient of Discharge for Orifice, Venturimeter through Venturimeter and orifice meter test rig.
4. Estimation of losses through pipe fitting, sudden enlargement and contraction frictional Pressure drop in Circular pipes.
5. Verification of Darcy's Law through Darcy apparatus.
6. Demonstration of Gas-Liquid Multiphase flow regimes in horizontal and vertical flow through pipe and Numericals based on Lockhart Martinelli equation
7. To Study Construction, Working of Centrifugal, Reciprocating, Gear and Plunger Pumps through test rig
8. To Study pitot tube apparatus and cavitation apparatus in a pipe flow.

PEP203 DRILLING FLUIDS AND CEMENTING LAB

List of Experiments:

1. Determination of mud weight & mud density of drilling fluid sample using mud balance apparatus
2. Determination of mud viscosity of drilling fluid sample using Marsh funnel viscometer
3. Determination of apparent viscosity, plastic viscosity & yield strength of drilling fluid sample using rotational viscometer.
4. Determination of gel strength of drilling fluid sample using rotational viscometer.
5. Determination of filtration loss characteristics of drilling fluid sample using API filtration loss apparatus.
6. Determination drilling fluid sample characteristics using Retort kit.
7. Determination of Sand content in drilling fluid sample using sand content kit.
8. Determination of consistency of cement slurry.
9. Determination of the setting points of the cement based slurries.

**(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU
KOTA)**



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

TPN102 SOFT SKILL DEVELOPMENT -1

SAA100 SODECA (Anandam)

**(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU
KOTA)**



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

B. TECH. IV SEMESTER

CEL 101 ENVIRONMENTAL SCIENCE

HUL 201 GENERAL STUDIES

PEL 205 DRILLING TECHNOLOGY-II

Directional Drilling : Objectives, Types of deflection tools, tool orientation, Directional well profiles, Well path deflection & correction.

Down Hole Motors : Positive displacement motors and Turbo-drills –motor description, Power calculation and applications.

Horizontal Well Drilling: Horizontal well objectives and selection, Different profiles, Drilling techniques.

Measurements While Drilling: Objectives of MWD/ LWD, MWD tools, Telemetry system and data interpretation.

Offshore Drilling: Overview of physical ocean environment, geotechnical aspect, Offshore rigs-Barge, Fixed platforms, Jack-ups, Concrete gravity platforms, Submersibles, Semisubmersibles, SPAR, Drillships, TLPs, Station keeping- Mooring system, Subsea and surface BOP system, Subsea BOP, Drilling riser, Riser tensioner, Emergency disconnect system, Subsea drilling process,

Special Methods of Drilling : Aerated drilling, Under-Balanced drilling, HPHT Drilling, Plasma drilling, Jet Drilling, Extended reach drilling, Multilateral drilling,.

Well control: Definition, Purpose, Types, Causes and indicators of kick, Well shut-in, Shut-in pressures interpretation, Well killing methods

BOOKS:

1. Drilling & Casing Operations, Jim Short, J.A., Penwell Publishing Company, Oklahoma
2. Well Design Drilling & Production, Craft B.C., Prentice Hall 1962
3. Applied Drilling Engineering, Bourgoyne A.T, Millheim K K, Chenevert M E and Young F. S., SPE textbook series, 1991
4. Horizontal and Directional Drilling, Carden, R. S., Petroskills, 2007,
5. Working Guide to Drilling Equipment and Operations, Lyons W, Gulf Professional Publishing, 2010,
6. Well Engineering and Construction, Rabia, H., Gulf Publishing

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

PEL206 PETROLEUM PRODUCTION TECHNOLOGY-I

Surface Production Equipment: Well wellhead assembly and attachments, Casing hangers, Christmas tree assemblies, Valves, Components and design considerations of wellhead equipment and choke, Surface Safety Valve.

Subsurface Production Equipment: Sub Surface Safety Valve, choke sizing, Bottom-hole chokes and regulators, Circulation devices, Expansion joints, Safety joints, Landing nipples, Production packers,

Well Completion: Definition, purpose, well completion types, well completion equipment, well completion fluid, completion process, Well perforation- definition, purpose, method, equipment, perforation fluid, Well activation, Factors affecting perforation efficiency

Inflow performance relationship: Introduction to inflow performance, Productivity index. PVT properties of oil, water and gas. Flow efficiency, Darcy's Law, Formation damage diagnosis of Skin effect, IPR in case of different drive mechanism. Vogel IPR equation, Standing's extension. Fetkovich approximation.

Work over & Well stimulation:

Workover system, workover rigs and selection, Coiled tubing unit, Wire-line operations, Workover & completion fluids - types & selection, Well stimulation techniques: Hydraulic fracturing & Acidizing, Sand control techniques

BOOKS:

1. Production Operations Vol.- 1 & Vol. 2, Thomas O. Allen & Alan P. Roberts.
2. Surface production Operation Vol.-1 & Vol. 2, Ken Arnold & Maurice Stewart
3. Well Completion and Servicing, D. Perrin, Editions Technip

PEL207 RESERVOIR ENGINEERING-I

Fundamental concepts: Introduction to Hydrocarbon Reservoir, Pressure-Temperature diagram, Fluid pressure regimes

Rock properties: Porosity & Permeability: Types & Determination, Permeability in Series & parallel combination of beds Fluid saturation, Wettability, surface and interfacial tension, Capillary Pressure, Permeability- Klinkenberg effect, averaging absolute permeabilities, Rock compressibility, net pay thickness, reservoir heterogeneity

Crude oil properties: Density, gravity, viscosity, gas solubility, GOR, WOR, bubble point pressure, oil formation volume factor

Natural gas properties: Compressibility, gas formation volume factor, viscosity

Water properties: Viscosity, gas solubility, water formation volume factor

Flow of Fluids through Porous Media : Fluid types, flow regimes, Darcy's law, single and multiphase flow, linear, radial & spherical flow, steady state, unsteady state and pseudosteady state flow, ,

**(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU
KOTA)**



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

Phase behavior: Reservoir fluid sampling, PVT properties determination and their significance, Laboratory PVT Analysis

Drive Mechanism: Drive Mechanism and recovery factors, production behaviour of oil & gas reservoirs, Performance prediction of depletion drive, gas cap drive, water drive and combination drive

BOOKS:

1. Reservoir Engineering Handbook by Tarek Ahmed, Gulf publishing.
2. Basics of reservoir Engineering by R. Cosse, Editions Technip Publication
3. Fundamentals of Reservoir Engineering by L.P. Dake, Shell learning & development, Elsevier publication

PEL208 SEDIMENTOLOGY AND PETROLEUM GEOCHEMISTRY

Sedimentology:- Introduction to Sedimentology, characteristic of sedimentary rock, Detailed study of clastic, carbonate rocks, evaporites, coal and oil shales. Sedimentary Environments and Facies analysis:- Concept of sedimentary environments. Environmental parameters and their control. Classification of environments. **Continental Environments:** Fluvial, lacustrine, **Paluda, Eolian & Glacial. Transitional to Shallow Marine Environments: Deltas, Beaches and Barrier Islands, Clastic shelf, carbonate shelves and platforms, Deep Marine: Pelagic & Turbidites.** Concept of tectonics and sedimentation. Role of environmental analysis in petroleum exploration. Elements of sequence stratigraphy.

Petroleum Geochemistry:- Introduction to Petroleum Geochemistry, Theories of origin of petroleum, Biomass composition, Sedimentary organic matter, Transformation of sedimentary organic matter into kerogen, Transformation of kerogen into oil and gas. Migration of oil and gas: mechanism, pattern and barriers. Reservoir rocks and cap rocks. Entrapment of oil- types and mechanism. Accumulation of oil and gas. Composition and classification of petroleum, Laboratory analysis equipment and methods, Biomarkers, Stable isotopes, Source rock characterisation and evaluation in terms of quantity, quality and maturation of organic matter – Analytical techniques, Oil to oil and oil to source correlation, gas to gas and gas to source correlation, Quantification and Modelling of hydrocarbon generation and accumulation. Surface indications of subsurface oil and gas accumulations – microseeps. Surface geochemical prospecting methods, Unconventional petroleum sources: CBM, shale gas & oil and Gas hydrate. Geology of prospective basins of India.

BOOKS:

1. Geology of Petroleum, A.I. Levorsen, CBS Publisher, 2nd Edition, 2006.
2. Element of petroleum geology, Richard C. shelly, Second Edition, 1998
3. Petroleum Formation and Occurrence, B. P Tissot, D. H. Welte, Springer-Verlag. Berlin Heidelberg NewYork Tokyo 1984.
4. Geological Techniques for Petroleum, Sahay B, Rai A. and Ghosh M.

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

OPEN ELECTIVE

PRACTICALS

PEP206 PETROLEUM PRODUCTION TECHNOLOGY LAB

List of Experiments:

1. Measuring the density of petroleum products.
2. Measuring the specific gravity and API gravity.
3. Measuring the vapor pressure using Reid vapor pressure test apparatus.
4. Measuring the viscosity using U – tube Viscometer
5. Determination of the water in crude oil by distillation
6. Determination of the water in crude oil by the centrifuge.
7. Determination of the total salts content of crude oil by conductivity method.
8. Determination of natural gas composition using GC chromatography

PEP207 RESERVOIR ENGINEERING LAB

List of Experiments:

1. Determination of porosity of rock samples by Helium Porosimeter
2. Determination of permeability using Gas Permeameter.
3. Determination of permeability using Liquid Permeameter.
4. Determination of surface tension of various Petroleum fractions.
5. Determination of porosity of rock samples by saturation method.
6. Study of Ternary phase diagram with oil fraction/water/alcohol.
7. Study of computation of Amount of initial gas in place and gas reserves using production vs. time data and decline curve analysis method,
8. Study of computation of permeability and skin Using chart scanner and a recorded bottom hole, built-up chart and production data before shut down

PEP208 SEDIMENTOLOGY AND PETROLEUM GEOCHEMISTRY LAB

List of Experiments:

1. Identification of clastic and carbonate sedimentary rocks.
2. Ultimate and proximate analysis of sedimentary rocks
3. Study of thin section of Sedimentary rocks through Microscope
4. Petrographic study of carbonaceous sedimentary rock
5. Calculation of oil reserves in defined structures.
6. Structure contour map, description of structure, profile construction, marking oil/water contact, proposal for new well.
7. Finding oil-water contact from borehole data
8. Preparation of isopach maps of reservoir facies.

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

9. Interpretation of geological map, reconstruction of stratigraphic succession.
10. Study of Rock-Eval logs to identify source rock sequences & Quantification of hydrocarbon generation
11. Study of geochemical parameters of oil and gas to correlate petroleum pools
12. Study of surface microseep anomaly maps to prioritize prospects

Field visits for sedimentological Exposure.

TPN 103 SOFT SKILL DEVELOPMENT -2

SAA100 SODECA (Anandam)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

B. TECH. V SEMESTER

HUL203 INDIAN CONSTITUTION

PEL301 PETROLEUM PRODUCTION TECHNOLOGY-II

Oil and gas: Composition, classification, physico-chemical properties

Oil Surface Production Facilities: Gathering and collection of oil and gas: GGS, CTF and GCS - layout, sequential treatment, and safety features.

Field Processing of Oil & Gas: Flash and stage separation of oil & gas, Design of Oil & Gas separators. Demulsification, dehydration, stabilisation and desalting of crude oil.

Storage of Petroleum and Petroleum Products: Types of storage system, Design of storage tanks as per API and ASTM codes,

Artificial Lift Techniques: Definition and purpose of artificial lift, Inflow performance principles and descriptions of Artificial lift methods: Gaslift – continuous and intermittent; Chamber lift, Electrical submersible pumping, Sucker rod pumping; Progressive cavity pump; Plunger lift; Hydraulic pump – piston & jet type, Selection of artificial lift.

Gas processing: Gas sweetening methods, Gas dehydration methods

Water injection: Purpose, Sources of injection water, Water treatment methods, Water injection equipment

Offshore production system: Production platforms, Subsea wells, templates, manifolds, jumpers, Subsea wellheads, Wet tree, Dry tree, Production risers, Subsea flow lines, Subsea processing

BOOKS:

1. Surface Production Operations, Volume 1 & 2, Second Edition: Ken Arnold; Maurice Stewart, Gulf Professional Publishing; Edition-1999,
2. Production Operations Vol.- 1 & Vol. 2, Thomas O. Allen & Alan P. Roberts.
3. Well Completion and Servicing, D. Perrin, Editions Technip
4. Principles of Artificial Lift; Niadri Kumar Mitra and Adesh Kumar; Allied Publishers Pvt.Ltd.
5. The Technology of Artificial Lift Methods, Brown, K E

PEL302 RESERVOIR ENGINEERING-II

Reserve Estimation Techniques: Volumetric method, Generalized Oil & Gas MBE and its modification, Decline Curve analysis

Multi phase flow: Well performance – inflow performance, tubing performance.

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

Water influx : steady and unsteady state models, Reservoir pressure maintenance techniques, their advantages and limitations.

Gas and water coning: Coning in vertical wells, breakthrough time and after breakthrough performance, coning in horizontal wells, breakthrough time

Reservoir modeling and simulation: Computer model of petroleum reservoir, Types of reservoir models- geological models, reservoir simulation models. Development of geological model, Upscaling geological model to reservoir flow model, Inclusion of faults in reservoir flow model, Pseudorelative permeability curves, Gridding techniques, Simulation of multiple reservoirs, History matching, Production forecasting.

Reservoir Management: concepts, components and applications. Introduction to oil & gas field development: Rational development plan, Rate and order of drilling well, well spacing & pattern, selection of development scheme, economic aspect of development of oil and gas fields

BOOKS:

1. Advance Reservoir Engineering by T. Ahmed, P. D. McKinney, Elsevier.
- 2 Fundamental of Reservoir Engg by L.P Dake
- 3 Petroleum Reservoir Engg by Amyx, McGraw Hill 1998 .
- 4 Applied Petroleum Reservoir Engineering ,Craft B.C and Hawkins M.F , Prentice Hall Engle wood cliffs, N J1991

PEL303 PETROLEUM GEOPHYSICS

Gravity Method: Gravity survey, Gravity anomalies, data reduction. Regional and residual anomalies separation, Interpretation of anomalies map and application in hydrocarbon exploration.

Magnetic Method: Basic concepts and definitions. Elements of Earth's magnetic field, Field procedure, data reduction, aeromagnetic surveys. Interpretation of magnetic anomaly map and its application.

Seismic Methods: Seismic Waves: Body and surface waves; velocity and attenuation, reflection, refraction and diffraction. Seismic energy sources & detectors. Refraction methods: Geometry of refracted ray path, Horizontal beds (two layer cases) time-offset relationship, Field procedure, Application of seismic refraction method. Reflection methods: Geometry of reflection ray path. Horizontal & dipping beds (two layer cases). Time distance relationship, Multiples, seismic noise and their cause. 2D reflection survey: spread geometries. Common depth point shooting and its advantages. 3D reflection survey: geometries with swath shooting and cross spreads.

Seismic Data Processing:

Introduction to seismic data processing, 2D Processing sequences – preparation of processing geometry, quality checks, true amplitude recovery, deconvolution, filtering, velocity analysis, residual statics, noise elimination through multichannel filtering, parameter optimization for generation of final stacked section, DMO and migration, wavelet processing. 3D processing techniques – generation of time slice and stacked sections.

**(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU
KOTA)**



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

Seismic Data Interpretation: Study of seismic section and other geological aspects of prospecting, geological structural interpretation & seismic stratigraphic interpretation.

Reservoir Geophysics: Introduction to multi component seismic survey. Application of 3D and 3C seismic data in reservoir studies. AVO: types, classifications & importance. Vertical Seismic Profiling (VSP): acquisition, processing and interpretation. Use of cross-hole seismic tomography and AVO in reservoir management.

BOOKS:

1. Fundamentals of Geophysics, Lowri, W., Cambridge University Press. (1997).
2. Introduction to Geophysical Prospecting, Dobrin M.B., New York, McGraw-Hill, Inc.
3. Applied Geophysics, Telford, W.M., Geldart L.P., Sheriff, R.E., Keys, D.A. (1990).
4. Basic Exploration Geophysics, Robinson, E.S. and Coruh C., John Willey and sons, New York, 1998.
9. Planning Land 3-D Seismic Surveys, Andreas Cordsen, Mike Galbraith, and John Peirce Society of Exploration Geophysicists, Tulsa, 2000.
10. The Nature of Digital Seismic Processing, Roy O. Lindseth, Calgary, Alberta, Canada
11. Seismic Stratigraphy, Basin Analysis and Reservoir Characterization, (Handbook of Geophysical Exploration: Seismic Exploration, vol. 37) Paul C.H. Veeken; Elsevier.
12. Seismic Data analysis, OZ Yilmaz, Society of Exploration geophysicist, Tulsa 2000

DEPARTMENTAL ELECTIVE:

PEL304 APPLIED THERMODYNAMICS

Introduction and First law: The scope of thermodynamics, dimensions and units, measures of amount or size, force, temperature, pressure, work, energy and heat. The first law of thermodynamics and other basic concepts, Joules' experiment, internal energy. energy balance for closed systems, thermodynamic state and state functions, equilibrium, the phase rule, The reversible process, constant volume and constant pressure process, enthalpy, heat capacity.

The second law of thermodynamics: statements of the second law, heat engines, thermodynamic temperature scales, entropy. Entropy changes of an ideal gas, mathematical statement of the second law, entropy balance for open systems, Calculation of ideal work, the third law of thermodynamics. Classification and performance of internal combustion engines.

Refrigeration and Liquefaction: the Carnot refrigerator-V and T-S diagrams. Analysis of air standard cycles. Carnot cycle, The vapour –compression cycle, the choice of refrigerant, absorption refrigeration, the heat pump, liquefaction process. Vapour- Liquid Equilibrium: The nature of equilibrium, the phase rule VLE – Quantitative behaviour, VLE by modified Raoult's Law, VLE from k-value correlations.

Solution thermodynamics: theory, fundamental property relation, the chemical potential and phase equilibria, partial properties. Ideal-gas mixtures, fugacity and fugacity coefficients, pure species, species in solution, generalized coefficient, the ideal solution, excess

**(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU
KOTA)**



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

properties. Application ; liquid phase properties from VLE data, models for the excess Gibbs energy, Property changes of mixing, heat effects of mixing processes

Chemical Reaction Equilibria: The reaction coordinate, application of equilibrium criteria to chemical reactions, the standard Gibbs Energy change and the equilibrium constant, Effect of temperature on the equilibrium constants, relation of equilibrium constants to composition, Equilibrium conversions for single reactions, phase rule and Duhem's theorem for reacting systems.

BOOKS:

1. Introduction to Chemical Engineering Thermodynamics, Smith, J. M. and Van Ness H. C., McGraw-Hill, 6/e 2003.
2. Thermodynamics of Hydrocarbon Reservoirs, Abbas Firodabadi, McGraw-Hill Publishing, 1999.
3. Rao, Y.V.C. "Chemical Engineering Thermodynamics", Universities Press, India 2/e, 2001.
4. Kyle; B.G., "Chemical and Process Thermodynamics"; Prentice Hall, New York, 3/e, 1999
5. K V Narayanan Chemical Engineering Thermodynamics, PHI Learning, 2004.

PEL305 UNIT OPERATIONS FOR PETROLEUM INDUSTRY

Conduction: Introduction to unit operation and its application in petroleum engineering. Heat Transfer and its application, Modes of heat transfer one dimensional and two dimensional, heat rate equations, Theory of insulation, critical radius calculations, types of insulation material, conduction through slab, cylinder and sphere.

Convection: Convective heat transfer, natural and forced convection, co/counter/cross current contacting for heat transfer, individual and overall heat transfer coefficient, Fouling factor, Heat transfer with and without phase change conditions.

Heat Exchange equipment: Introduction to double pipe, shell and tube exchangers, condensers, extended surface equipment.

Evaporation- Type of evaporators and their applications single and multiple effect evaporators, operation of forward– backward and mixed feed operations,

Mass transfer and its application: Analogies in transfer process, basic concept of diffusion and interphase mass transfer. Mass transfer theory film theory Penetration and surface renewal theory

Distillation: Rectification, reflux ratio, calculation of numbers of plates by McCabe Thiele method, optimum reflux ratio

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

**Basic introduction to absorption, liquid liquid extraction, leaching
Drying: Equilibrium mechanism theory of drying, drying rate curve.
Introduction to filtration Sedimentation and settling.**

BOOKS:

1. Process Heat Transfer, Kern, D. Q. McGraw Hill USA
2. Unit Operation of chemical engineering, Mc Cabe, W.L. Smith, J C and Harriot, P., McGraw hill 1993
3. Mass transfer operation. Treybal, R.E. Kogakusha, McGraw Hill 1980.
4. Transport Process and Separation Processes Principles (Includes Unit Operations)
4th Ed, Geankopis, C. J., Prentice Hall
4. Principles of Unit Operations, Foust, A.S., Wenzel, L.A., Clump, C.W., Naus, L

OPEN ELECTIVE

PRACTICALS

PEP302 RESERVOIR MODELING AND SIMULATION LAB

Practical and exercises (Study) related to the application of oil field Simulator.:

1. Study of IMPES method of solution of simulation equation.
 2. Study of IMPIS method of solution of simulation equation.
 3. Study of finite difference approximation of linear pressure equation.
 4. Study of formulation of Multiphase flow Equation
 5. Study of direct process of solving system of equation.
 6. Study of Iterative process of solving system of equation.
 7. Study of history matching technique.
 8. Study of formulation of simulator flow chart.
- Hands on practices through simulation softwares on workstation (computer).

PEP303 HEAT TRANSFER LAB

List of Experiments:

1. To Measure the thermal Conductivity of Liquid and solid.
2. To measure the thermal conductivity of liquid and solid (linear model).
3. To measure the transfer conductivity measurements in linear and radial method.
4. To Measure the Emissivity of the Test plate Surface.
5. To Determine Stefan Boltzmann Constant of Radiation Heat Transfer.

**(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU
KOTA)**



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

6. To Determine the Surface Heat Transfer Coefficient for Heated Vertical Cylinder in Natural Convection.
7. Determination of Heat Transfer Coefficient in Drop Wise & Film Wise condensation.
8. To Study Performance of Simple Heat Pipes
9. To Study and Compare LMTD and Effectiveness in Parallel and Counter Flow Heat Exchangers.
10. To determine the total thermal conductivity and thermal resistance of the given compound resistance in series.
11. Testing and performance of different heat insulators.
12. To understand the importance and validity of Engineering assumptions through the lumped heat capacity method.

PEP304 SEPARATION PROCESS LAB

List of Experiments:

1. To determine diffusion coefficient of liquid vapour in air.
2. To study the mass transfer characteristics of a wetted wall column.
3. Liquid-liquid extraction in a packed column for co current and counter current flow of binary systems.
4. To study the absorption of a gas in a packed column and calculation of NTU and HTU.
5. Studies on solid-liquid extraction column. Studies on the sieve plate distillation unit.
6. Design of distillation Tower.
7. Air fuel ratio in a gas burner.
8. Pyrolysis and characterization of pyrolysis products.

PEN201 SEMINAR 1

SAA100 SODECA (Anandam)

PET301 INDUSTRIAL TRAINING (45 Days)

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

B. TECH. VI SEMESTER

PEL306 WELL LOGGING TECHNOLOGY

Well logging Technique: Introduction of well logging. Mud Logging Techniques. Subsurface Petro-physical measurements, Role of well logging in formation evaluation. Borehole environments & resistivity profile.

Wireline logging Methods: SP and Resistivity logs (focused resistivity, Lateral logs, MSFL, Induction log), Radioactive logs, and acoustic logs (principles, types of tools and applications). Evaluation of CBL/ VDL, USIT, SFT, RFT.

Production Logging: Introduction, type of tools, principles, limitations and applications.

Special Type of Logging Tools: Casing inspection tools (principles, application and limitation), Formation micro scanner (FMS), DSI, NMR logging principles. Logging in high-angle wells.

Log Interpretation and Analysis Techniques.

Standard log interpretation methods. Cross-plotting methods: neutron-density, sonic-density and sonic-neutron etc. Clean sand interpretation. Concepts of invasion – RXO, Tornado charts. Shaly sand interpretation.

BOOKS:

1. Open Hole Log Analysis and Formation Evaluation by Richard M. Bateman
2. Modern Open Hole Log Interpretation, John. T. Dewan
3. Well Logging Data Acquisition and Application O&L Serra ISBN-978295156125, TECHNIP.
4. Handbook of Well Log Analysis, S.J. Pirson
5. Log Interpretation Principles and Applications, Schlumberger Educational services.

PEL307 NATURAL GAS ENGINEERING

Properties and Measurement of Natural Gas: Introduction to Natural Gas, origin of natural gas, other sources of gaseous fluids. Phase behavior fundamentals, qualitative and quantitative phase behavior, vapor liquid equilibrium.

Equation of state: critical pressure and temperature determination. Gas compressibility, viscosity and thermal conductivity, formation volume factor.

Gas Reservoir Performance and Gas flow measurement: Fundamentals of gas flow in conduits, fundamentals of fluid flow in porous media, inflow performance curves, outflow performance.

Gas flow measurement: fundamentals, Methods of measurements, Orifice meters equation, turbine meters.

Flow of Gas in Production Tubing: Introduction, gas flow fundamentals, vertical and inclined single phase flow of gas, Calculating flow and static bottom hole pressure, Gas flow through restrictions. Temperatures profiling in flowing gas systems.

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

Natural gas Processing: Gas liquid separations, dehydration processes, absorption and adsorption by gas permeation.

Desulfurization processes: solid bed sweetening process, physical and chemical absorption processes, Acid gas removal. Integrating natural gas processing.

Gas Compression: Introduction, types of compressors, Selection, Thermodynamics of compressors, Design fundamentals for reciprocating, centrifugal and rotary compressors (single and multistage).

Gas Gathering and Transport Gas gathering system, steady state flow in simple pipeline system, steady state and non steady state flow in pipelines, solution for transient flow. Installation, operation and trouble shooting of natural gas pipelines.

BOOKS:

1. Beggs, D, H, Gas Production Operations. Edition Technip. 1984
2. Ikoku, Chi, "Natural Gas Production Engineering", John Wiley and Sons, 1984.
3. Kumar Sanjay, "Gas Production Engineering", Gulf Publishing Company, TX, USA, 1987.
4. "Gas Processes Suppliers Handbook", USA, 1980.
5. Lee, J, Wattenbarger, R. A., "Gas Reservoir Engineering", Society of Petroleum Engineers, TX, USA, 1996

PEL 308 WELL TEST ANALYSIS

Principles of Fluid Flow

Principles of Fluid Flow for steady state, semi steady state & non steady state conditions. Steady State Flow Tests (Indicator Diagram) and Gas Well Tests, Diffusivity Equation. Derivation & Constant Terminal Rate Solution

Pressure Transient Tests: Analysis and Pressure Draw-down Tests, Pressure buildup test, reservoir limit test (RLT etc. Multiple well testing, Wireline formation testing. Wireline while drilling formation Testing, Interference testing, Pulse testing, Multirate testing

Well-test analysis by use of type curves: Fundamentals of type curves, Ramey's type curve, McKinley's and Gringarten et al type curves.

Gas well testing: Basic theory of gas flow in reservoir, Flow-after-flow test, Isochronal test

BOOKS:

1. Well Testing, Lee, J., SPE
2. Advances in Well Test Analysis, Earlougher, Jr., R.C., SPE
3. Pressure Build Up and Flow Tests in Wells, Mathews, C.S. & Russell, D. G., SPE
4. Modern Well Test Analysis, Horne, R.N., Petroway

**(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU
KOTA)**



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

PEL309 HEALTH SAFETY AND ENVIRONMENT

Importance of Safety

Industrial safety and loss trends, safety and environmental concerns, development of industrial safety and loss prevention approaches – loss prevention. Total loss control, quality assurance, total quality management, concept of hazard system. The characterization of hazards, hazard sources and their realization.

Safety Hazards

Major process hazards: self-heating, flame propagation, limits of flammability, explosion, detonation and deflagration, toxic materials. Dosage, acute and chronic effects, threshold limits, fire, explosion and toxic release, effects of hazards.

Building a Safe Environment

Parameters determining probability and consequence of hazards, occupational health and hygiene, personal safety methods, work permit, material safety data sheet.

Hazard identification

Use of hazard indices, hazard and operability studies

Hazard Control

Major hazard control, legislation and laws, case studies of major hazard events.

Impact on Air

Air pollution: major pollutants, meteorology, lapse rate, dispersion, engineering control of air pollution. Safety aspects of H₂S leakage from oil and gas fields. Air pollution causes, remedies in fertilizer plants, petrochemical plants etc.

Impact on Water

Water pollution: physical, chemical and biological water quality parameters, pollution by oil spills. Ground water pollution near oil dispensing stations.

Pollution Control

Remediation of the environment, engineered systems for water purification, sludge treatment and disposal. Water pollution causes and remedies in oil production sites, refiners and in production of petrochemicals

BOOKS:

- 1..Daniel A. Crown chemical Process Safety Fundamental with Application Prentice Hall International Series
- 2.Loss Prevention in the Process Industries, Less, F. P., 2nd ed. Butterworth Heinemann, UK,
- 3.Environmental Engineering; Peavy, H. S., Rowe, D. R. and Tchobanoglous, G., McGraw Hill.
- 4.Chemical Process Safety, Sanders, R. E., Butterworth Heinemann,UK
- 5.Critical Aspects of Safety and Loss Prevention, Kletz, T. A., Butterworth Heinemann, UK.
- 6.StefenT Orszulik Environmental Technology in Oil Industry – Springer

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

DEPARTMENTAL ELECTIVE:

PEL310 PETROLEUM REFINERY ENGINEERING

Cracking Process: Atmospheric and Vacuum Distillation. Thermal conversion processes. conventional thermal cracking process. Visbreaking, Coking – Fluid coking, flexicoking, delayed coking etc.

Reforming: Catalytic conversion processes – fluid catalytic cracking, Hydrocracking, hydrogen production, Reforming.

Purification process

Alkylation, Polymerization process of crude oil. Isomerisation and Hydrotreating processes crude oil.

Crude oil Evaluation : Evaluation of crude oil for LOBS (Lube oilbase Stock).Steps in preparation of LOBS, deasphalting.

Solvent Extraction: Types of solvents available and their comparison, dewaxing. Hydro finishing of LOBS Hydrogenation processes for LOBS production.

BOOKS:

1. Petroleum Refinery Engineering, Nelson N.L., McGraw Hill Book Co., 1985
2. Petroleum Refining Technology and Economics', James H. G. and Glenn E. H. 4 ed., Marcel Dekker, Inc., 2001
3. Petroleum Refining, Waquier, J.P., Vol .I and II, 2 ed., Technip, 1995
4. Petroleum Processing Handbook, Mcketta S.S., Marcel Dekker, Inc., 1992
5. Modern Petroleum Refining Processes, B.K.Bhaskara Rao, 5 ed.Oxford and IBH Publishing Co. Pvt. Ltd., 2007

PEL311 BIOMASS CONVERSION

Introduction: World energy scenario, consumption pattern, fossil fuel depletion and environmental issues

Biomass: Availability and abundance, photosynthesis, composition and energy potential, virgin biomass production and selection, waste biomass (municipal, industrial, agricultural and forestry) availability, abundance and potential, biomass as energy resources: dedicated energy crops, annual crops (maize, sorghum sugar beet, hemp), perennial herbaceous crops (sugarcane, switchgrass, miscanthus), short rotation woody crops (poplar, willow), oil crops and their biorefinery potential, microalgae as feedstock for biofuels and biochemical, enhancing biomass properties for biofuels, challenges in conversion

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

Biorefinery: Basic concept, types of biorefineries, biorefinery feedstocks and properties, economics

Biomass Pretreatment: Barriers in lignocellulosic biomass conversion, pretreatment technologies such as acid, alkali, autohydrolysis, hybrid methods, role of pretreatment in the biorefinery concept

Physical and Thermal Conversion Processes: Types, fundamentals, equipments and applications; thermal conversion products, commercial success stories

Biodiesel Diesel from vegetable oils, microalgae and syngas; transesterification; FT process, catalysts; biodiesel purification, fuel properties

Bioethanol and Biobutanol: Corn ethanol, lignocellulosic ethanol, microorganisms for fermentation, current industrial ethanol production technology, cellulases and their role in hydrolysis, concepts of SSF and CBP, advanced fermentation technologies, ABE fermentation pathway and kinetics, product recovery technologies

Hydrogen, Methane and Methanol: Biohydrogen generation, metabolic basics, feedstocks, dark fermentation by strict anaerobes, facultative anaerobes, thermophilic microorganisms, integration of biohydrogen with fuel cell; fundamentals of biogas technology, fermenter designs, biogas purification, methanol production and utilization

BOOKS:

1. Donald L. Klass, Biomass for Renewable Energy, Fuels, and Chemicals, Academic Press, Elsevier, 2006.
2. Prabir Basu, Biomass Gasification, Pyrolysis and Torrefaction, Academic Press, Elsevier, 2013.
3. A.A. Vertes, N. Qureshi, H.P. Blaschek, H. Yukawa (Eds.), Biomass to Biofuels: Strategies for Global Industries, Wiley, 2010.
4. S. Yang, H.A. El-Enshasy, N. Thongchul (Eds.), Bioprocessing Technologies in Bio refinery for Sustainable Production of Fuels, Chemicals and Polymers, Wiley, 2013.
5. Shang-Tian Yang (Ed.), Bioprocessing for Value Added Products from Renewable Resources, Elsevier, 2007.

OPEN ELECTIVE

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

PRACTICALS

PEP306 FORMATION EVALUATION LAB

List of Experiments:

1. Study of correlation logs to identify bed boundaries.
2. Identification of fluid types in pore spaces by different resistivity logs.
3. Computation of porosity of the formation using porosity logs and Multiple porosity methods.
4. Computation of permeability from given data.
5. Identification of lithologies using cross plots.
6. Estimation of Shale contents from integrated (multiple well logs) approach.
7. Estimation of water/hydrocarbon saturation from Archie equation & Indonesian Equation.
8. Interpretation of Gas Sand from well logs.
9. Interpretation of CBL/VDL/USIT logs.
10. Interpretation of SFT and RFT logs and Image logs.

PEP307 HEALTH SAFETY AND ENVIRONMENT LAB

List of Experiments:

1. To determine the pH value of a given water Sample.
2. To determine the DO of a given water Sample.
3. To determine the COD of a given water Sample.
4. To determine the Chlorides in a given water Sample.
5. To determine the Fluoride content of a given water Sample
6. To determine the Acidity in a given water Sample.
7. To determine the Alkalinity in a given water Sample.
8. To determine the Total Hardness in a given water Sample.
9. To determine the Turbidity of a given water Sample.
10. To determine Total dissolved solids of a given water sample

PEP308 PETROLEUM PRODCUT TESTING LAB

List of Experiments:

1. Measurement of fire point- Flash point
2. Measurement of Cloud point
3. Measurement of pour point.
4. Measurement of Aniline point & Bromine number

**(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU
KOTA)**



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

5. Measurement of Reid Vapour Pressure
6. Measurement of Sulphur Content
7. Measurement of Carbon Residue.
8. Distillation of Petroleum and Petroleum products.
9. Measurement of surface tension by Tensiometer.
10. Measurement of surface tension by Platinum ring method.
11. Ternary phase diagram

PEN202 SEMINAR 2

SAA100 SODECA(Anandam)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

B. TECH. VII SEMESTER

PEL401 ENHANCED OIL RECOVERY TECHNIQUES

Introduction: Review of primary and secondary recovery, injection rate and pressures in secondary recovery. Flood Patterns and Coverage. Areal sweep efficiency, vertical sweep efficiency, displacement efficiency, mobility ratio, well spacing.

Flow of immiscible fluids through porous media. Continuity equation, equation of motion, solution methods Water flooding,

Immiscible Displacement processes: Fractional flow equation, Theory & practices- Buckley Leverette treatment of fractional flow and frontal advance equations.

Miscible Displacement Processes: Mechanism of miscible displacement, phase behavior related to miscibility, high pressure gas injection, enriched gas injection, LPG flooding, Carbon dioxide flooding, alcohol flooding.

Water flooding performance calculations: Frontal advance method, viscous fingering method, Stiles method, Dykstra-Parsons Method, Water for water flooding.

Chemical Flooding: Polymer flooding and mobility control processes, Micellar/ polymer flooding, phase behavior of micro-emulsions, phase behavior and IFT, wettability alterations, Alkali flooding.

Thermal Recovery Processes: mechanism of thermal flooding, hot water flooding, cyclic steam injection, estimation of oil recovery from steam drive, in-situ combustion, air requirement for in-situ combustion.

Microbial Enhanced oil recovery: Introduction and application.

BOOKS:

1. Enhanced Oil Recovery, Lake, L.W., Prentice Hall
2. Enhanced Oil Recovery, M.Latil, Editions Technip
3. Introduction to Enhanced Oil Recovery (EOR) Processes and Bioremediation of Oil-Contaminated Sites, Laura Romero-Zerón, Intechopen
4. Enhanced Oil Recovery, I, Volume 17A 1st Edition Fundamentals and Analyses, E.C. Donaldson G.V. Chilingarian T.F. Yen, Elsevier Science
5. Economically and Environmentally Sustainable Enhanced Oil Recovery, M.R. Islam, Scrivener Publishing LLC

PEL402 PROCESS DYNAMICS & CONTROL

First-order Systems: Introduction, Transfer Function, Linear Open-Loop Systems, Transient response (step response, impulse response, and sinusoidal response), response of first order systems in series. Non-interacting systems and interacting systems.

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

Second-order systems: Transfer function, step response, impulse response, sinusoidal response, transportation lag.

Linear closed-loop Systems: Control System: components of a control system block diagram. Negative feedback and positive feedback, servo problem and regulator problem.

Closed-Loop Transfer functions: Overall transfer function for single loop systems, overall transfer function for set-point change and load change, multi-loop control systems. Transient Response of simple control systems: P and PI control for set point change and for load change.

Controller and final control element: Mechanism of control valve and controller, transfer functions of control valve and controllers (P, PI, PD, and PID). Examples of a chemical reactor control system. **Stability:** Concept of Stability, Stability criteria, Routh test for stability, Root Locus.

Frequency Response: Introduction to Frequency Response, Bode Diagrams for First and second order systems, Bode stability Criteria, Ziegler-Nichols and Cohen-coon Tuning rules.

BOOKS:

1. Process Systems Analysis and control, Coughanowr, D.R., McGraw –Hill, 1991.
2. Chemical Process Control, Stephanopoulos, G, PHI,
3. Process Instrumentation R.P.Vyas Dinut publication.
4. Process Modelling, Simulation and Control for Chemical Engineers, Luyben, W.L, McGraw Hill,
5. Process Control Principles and Application, Surekha Bhanot, Oxford Higher Education/Oxford University Press, 2008
6. Process Control, Peter Harriott, Tata McGraw-Hill Publishing Company, 1964

DEPARTMENTAL ELECTIVE-1:

PEL403 UNCONVENTIONAL HYDROCARBON RESOURCES

CBM: Introduction & present status of coalbed methane- Global and Indian Scenario. Formation and properties of coalbed methane: Generation of coalbed methane gas & its properties, properties of coal as reservoir rock & accumulation. Geological and petrographic influences on coal, Pore geometry, Micropore, Mesopore and macropore, cleat system

Thermodynamics of coalbed methane: Sorption – principles, sorption isotherms – types and interpretation. CO₂, CH₄ and N₂ adsorption – desorption, hysteresis, langmuir isotherm, Swelling of coal matrix isotherm construction. CH₄ content determination in coal seams. Underground coal gasification, carbon dioxide sequestration

Overview of Drilling and Production systems of coalbed methane wells. Selection of Artificial lift for CBM wells. Hydro-fracturing of coal seams. Treating and disposing produced water. Testing of coalbed methane wells.

GAS HYDRATE: Introduction & present status of gas hydrates. Formation, accumulation and properties of gas hydrates. Thermodynamics, kinetics and phase behaviour of gas hydrates. Types of gas hydrate. Geological and geophysical exploration of gas hydrate. Drilling and production systems of gas hydrate

**(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU
KOTA)**



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

wells. Prevention & control of gas hydrates. Gas extraction from gas hydrates. Uses and application of gas hydrates

SHALE GAS/ OIL: Global Scenario of shale gas/ Oil production. Nature, origin and distribution of Shale Gas/ Oil. Characterization of Shale for Production of Shale Gas/ Oil. Extraction methods of Shale gas/ Oil: development of current practices. Location and size of production areas: estimated reserves and economics. Environmental issues in shale gas exploration. Markets and Globus impact on energy scenario. Economic factor of shale Gas/ oil production

BOOKS:

1. Carrol John, Natural Gas Hydrates: A guide for engineers, Gulf Publications, 2003.
2. Farooqi Ali, S M, Jones S A and Meldau R F, Practical Heavy Oil Recovery, SPE, 1997, 434.
3. James T. Bart is, Frank Camm, David S. Ortiz, Producing liquid fuels from coal: Prospects and policy issues. NETL, DOE, USA, 2008, 198 p
4. Coalbed Methane: Principles and Practices @ Halliburton company 2008

PEL404 FLUID FLOW THROUGH POROUS MEDIA

Properties of Reservoir Fluids:

Chemical composition of oil and gas. Physical properties of reservoir fluids. Thermodynamics of reservoir fluids. Gas deviation factor, compressibility and formation volume factor. Density and viscosity of reservoir fluids under changing temperature and pressure. Dew point, saturation pressure, bubble point pressure. Concept of pseudo- temperature and pseudopressure. PVT analysis of reservoir fluids.

Introduction to Reservoir rocks and Geology

Physico-chemical properties of reservoir rocks. Rock compressibility. Rock texture and mineralogy. Absolute and effective permeability, relative permeability. Core analysis, Log Interpretation

Static to Dynamic Model of Reservoir

Saturation of reservoir fluids. Wettability of reservoir rocks. Capillary pressure behavior and its effect on different rock and fluid flow properties

Integrated rock-fluid modeling. Historical account of modeling reservoir permeability.

Modelling of flow:

Darcy's law, its boundary conditions and modification for petroleum system. Darcy's model, Bernoulli's model, Kozeny's model, Kozeny-Carman's model, Hydraulic Flow-Unit approach. Tortuosity & core analysis vs hyper-Darcy flow and its impact on well performance and reservoir stability.

Reservoir Flow Behaviour

Dynamic and static flow regimes of fluids in proximal part of wellbore and in distal parts of reservoir. Selective and fractional flow of reservoir fluids in porous media.

Diffusivity equation and fluid front advancement.

**(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU
KOTA)**



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

BOOKS:

1. Reservoir Engineering Handbook by Tarek Ahmed, Gulf Professional Publication.
2. Well logging and Reservoir Evaluation by O. Serra ISBN-978-2-7108-0881-7. TECHNIP
3. Fundamental of Well Log Interpretation - O Serra, Elsevier Science Publishing Co., ISBN 0-444-42132-7. TECHNIP

DEPARTMENTAL ELECTIVE-2

PEL405 WORKOVER AND WELL STIMULATION

Well production problems: Paraffin wax and Asphaltene deposition, wax and asphaltene chemistry, deposition mechanisms, prevention, Gas hydrate formation, mechanism and prevention, Excess water production and control, Inorganic scale formation, prevention Corrosion, causes, mechanism, methods of corrosion control, Excess gas production, Sand production, causes and control

Formation damage: Definition, mechanisms, formation damage during various well operations

Workover: Definition, purpose, Difference between reservoir problem and mechanical problems, Types of workover

Workover rigs: Types of workover rigs over rigs & their application for workover operations

Work over operations: Drilling, Fishing, Squeez cementing, Zone transfer, Wax, Asphaltene, Scale and Hydrate removal methods, Sand control methods, Repair or replace downhole equipment, Water shutoff, Gas shutoff, Handling water and gas coning, Acidization, Evaluation of workover jobs

Well intervention: Definition, Scope, Intervention services – Wireline – Slickline, Braided line, Electric line, Components, Applications, Tractors – Components, Applications, Coiled tubing – Components, Applications

Well stimulation: Definition, Purpose, Types, Hydraulic fracturing- definition, process, frac fluids, proppants, equipment, calculations, Acid fracturing- definition, process, stimulation acids, Matrix acidisation- definition, process, equipment, calculations, emerging techniques for well stimulation

BOOKS:

1. Well Design Drilling and Production, Craft, Holden and Graves, Prentice Hall, 1962.
2. Well Control Problem Solutions, N J Adams
3. Petroleum Production Handbook, Thomas C Frick
4. Workover Well Control, Neal Adams
5. Petroleum Production Systems:- Michael J Economides (Daniel Hill)
6. Hydraulic Fracturing, Faust, G. C., SPE

**(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU
KOTA)**



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

PEL406 PIPELINE ENGINEERING

Objective and scope of pipeline :As a means of fluid transportation with special reference to crude oil/gas/refined products.

Design of Pipeline: Factors influencing oil, gas and refined products as pipeline design; Hydraulic surge and water hammer; specific heat of liquids, river crossing; pipe size and station spacing etc.

Theory and different formulae of the flow of fluids :Basic equations for the flow of fluids through pipes; different flow equations for laminar and turbulent flow of compressible and incompressible fluids, Introduction to the flow of Non- newtonian fluids through pipes, multiphase flow and loop pipelines.

Construction of pipelines: materials; project specifications, general equipment specifications (Pipes, valves and fittings),Installation of expansion loops and thermodynamic tapping plant.

Pigging: pigging technology, pig launcher and receiver, intelligent pigging, types of pigs.

Offshore Pipeline: design and control of Sag and Over bend; description of stinger and riser, articulated stinger, construction of offshore pipeline; method of underwater welding Prevention of hydrates, wax & scales. Crude conditioning and use of additives to improve flow conditions.

Corrosion: protection and control; design of cathodic protection system, pipeline automation. City distribution network of oil/gas. Lease and custody transfer.

BOOKS:

- 1.Piping Design Handbook: Macetta. John, M Dekar1992, CRC Press.
2. Pipeline and Risers : Young Boi ,Elsevier Ocean Engineering Book series 2001 Volume 3
3. Pipe Line Corrosion, Cathodic Protection: Parker M E and Peattie E G , Elsevier USA 2001

OPEN ELECTIVE

PRACTICALS

PEP402 PROCESS DYNAMICS & CONTROL LAB

List of Experiments:

- 1.To determine the time constant of a given thermometer and thermocouple
2. To study the open loop,three mode PID and two mode PD control

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

3. To study the working principal and calibration procedure of capacitance type level transmitter.
4. To obtain the step response of a single tank liquid level system to a step change in input flow and compare it with the theoretical response.
5. To study the inherent characteristics of control valve.
6. To study the theoretical time constant and damping coefficient of the manometer.
7. To study the interacting and non interacting mode of system.
8. To study the behaviour of an PID controller.
9. To study the tuning of controller using the Zeigler Nichols Method.
10. To study the stability of the system using the Bode Plot.

PED411 PROJECT PART-I

SAA100 SODECA (Anandam)

PET302 INDUSTRIAL TRAINING(60 Days)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

B. TECH. VIII SEMESTER

OPTION-A

HUL204 INNOVATION & ENTREPRENEURSHIP

DEPARTMENTAL ELECTIVE:

PEL407 OIL AND GAS FIELD DEVELOPMENT

Reserves: Proved, proved subeconomic and inferred reserves. Classification of reserves -: Proved: Categories A, B, C1; Proved subeconomic – Category Z; and inferred: Category C2. SPE/WPC definitions and classification of reserves:- Proved, unproved, probable and possible reserves. Estimation:- Volumetric estimation of in place reserves. Indian hydrocarbon exploration licenses policies: NELP, OLEP etc.

Development of Oil & Gas Fields: Rational development plan, Rate and order of drilling well, well spacing & pattern, selection of development scheme, economic aspect of development of oil and gas fields. Criteria for field development: Basic geological data for development planning. Data collection from initial wells. Discovery well. Delineation of the field limits. Production variants, performance prediction, Recovery factor, Stages of preparation of development plans. Computation of economic indices viz. Capital investment, payout period, IRR, Profile, Economic life etc. Analysis of different variants based on technical and economic considerations. Economic development of Marginal fields.

BOOKS:

1. Development of oil and gas fields by Sant kumar
2. Mohamad ismail Iqbal, Field Development Plan - Oil & Gas: Potential Impact of Reservoir Description and Development Options of Field, Lambert academic publishing

PEL408 OFFSHORE STRUCTURE

Loads on Offshore Structures: Wind Loads; Wave and Current Loads; Calculation based on Maximum base Shear and Overturning Moments; Design Wave heights and Spectral Definition; Hydrodynamic Coefficients and Marine growth; Fatigue Load Definition and Joint Probability distribution; Seismic Loads.

Concepts of Fixed Platform Jacket and Deck: Jacket concepts, redundant framing arrangement; Launch and Lift jackets; Simple Deck configurations for Lift and float-over installations; In-service and Pre-service Loads and analysis.

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

Dynamic Positioning: Types and Basic operations of a DP system, Major components of the DP system , DP rig vs moored rig , Types of thrusters used by DP vessels, Basic layout of a power distribution system onboard a DP vessel and associated protection systems, Power management system. Watch Circles - Drive-off ; Drift-Off.

Riser Systems: Riser system Components, Buoyancy, Riser Tensioners & Tensioning Criteria, Basic Riser Analysis, Riser Operations, Emergency Disconnect, High Current Operations.

Submarine Pipelines and Risers Route selection and Diameter / wall thickness calculations; Pipeline stability, free span calculations; Concrete coated pipelines and pipe-in-pipe insulated pipelines; Design using DNV 81 code.

BOOKS:

1. Hydrodynamics of Offshore Structures by S.K. Chakrabarti, SpringerVerlag
2. Handbook of Offshore Engineering by S.K. Chakrabarti, Elseviers, 2005.
3. Offshore pipelines by B. Gou, S. Song, J. Chacko and A. Ghalambor, GPP Publishers,2006
4. Structural Stability - Theory and Implementation by W.F.Chen and E.M.Lui by Elsevier

PRACTICALS

PED412 PROJECT PART 2

SAA100 SODECA (Anandam)

OPTION-B

HUL205 EQUIVALENT MOOC OF INNOVATION & ENTREPRENEURSHIP

PED413 INTERNSHIP

(A) Duration

- The duration of internship should be between 16 to 24 weeks.
- The external mentor should ensure that the attendance record of the student is maintained daily and the record along with total number of permitted/ unpermitted leaves be handed to the department at the end of approved internship duration.

(B) Nature of Internship

- Guiding principle behind internship would be improvement in knowledge/skills and

**(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU
KOTA)**



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

employability of the students and emphasis would be on core companies and practical work on any project.

- Students would be allowed internships in research institutes if they indicate profound interest in academics/research.
- For non-core companies, the department would frame a policy by constituting a department level committee. For each student choosing to go to such an organization, the department level committee would review each case on its merit after receiving the justification from the student.
- The special opportunity for whole semester internship is optional, subject to the student getting a suitable and justifiable project work to replace the course work and project in the college. The permission shall be granted only on merit of the problem statement and the proposed organisation, not for general training similar to mandatory summer training after third year, in which information on some aspects may be provided without a well-defined project objective.

SAA100 SODECA (Anandam)

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

Open Elective Courses

PEL209 UNIT OPERATION IN INDUSTRIES

Crystallization Objectives, crystal lattice, types of crystal, crystal form, size and habit, formation of crystals, super saturation theory, factors affecting crystallization process and crystal growth. Study of various types of crystallizers including Swenson walker, tanks, agitated & batch, circulating magma, vacuum and crystal crystallizer etc. Methods for prevention of caking of crystals. Brief study of spherical crystallization process. Numerical problems on crystal yield.

Evaporation- Basic concept of phase equilibria, factors affecting evaporation, heat transfer in evaporators, Duhring's Rule and Raoult's law evaporators including natural circulation, forced circulation & film Type of evaporators and their applications single and multiple effect evaporators, operation of forward– backward and mixed feed operations,

Distillation: Distillation: Raoult's law and its limitation, Henry's Law, Phase diagram, volatility & relative volatility, General parts of distillator, simple steam and flash distillation, batch and continuous distillation, rectification distillation columns and their efficiency, McCabe Thiele method for calculation of number of theoretical plates, azeotropic, molecular & steam distillation, mathematical problems, applications in pharmacy

Drying: Utilities of Drying; thermal properties; Equilibrium moisture content (EMC); Drying theories; methods of drying, Contact drying, Convective drying, freeze drying, radiation drying,

Superheated steam, Drying rate period; types of dryers Deep bed, Flat bed, Continuous, Recirculating, LSU, Fluidized bed, Rotary, Tray, Tunnel and solar, etc.

Mixing Definition, objectives, mechanism and theory of mixing. Type of mixtures: liquid mixing, powder mixing, semi solids mixing. Principle, material of construction, applications, advantages and disadvantages of shaker mixer, propeller mixer, turbine mixer, paddle mixer, planetary mixer, double cone mixer, V mixer, sigma mixer and colloid mill, ultrasonic mixer, etc.

BOOKS:

1. Process Heat Transfer, Kern, D. Q. McGraw Hill USA
2. Unit Operation of chemical engineering, Mc Cabe, W.L. Smith, J C and Harriot, P., McGraw hill 1993
3. Mass transfer operation. Treybal, R.E. Kogakusha, McGraw Hill 1980.

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

PEL312 TRANSPORTATION OF PETROLEUM PRODUCTS

Transportation of petroleum & Petroleum products. Basics of pipeline construction, Operation and protection. Pump and compressor stations. Instrumentation and control. Metering and measurements of oil and gas. Tank-Trucks and Rail Transportation, Oceanic Tanker Transportation, Inland Water, Coastal and Oceanic, Tanker Size, Power, Cargo Space, Marine Storage Terminals, Shore Installation. Line Specifications, Plastic Pipes.

Traffic management, Fire and safety rules. Indian and Global supply scenario of petroleum and petroleum products. Product quality control and management.

Bulk distribution and handling-domestic, commercial and industrial. Storage of petroleum products in fixed installations Standards and regulations.

Role of International oil companies and OPEC pricing mechanism. Administered and market determined pricing mechanism in India.

Crude Oil and Product Flow Characteristics, Transportation of Cryogenic Liquids, Heat Flux Estimation, Temp Gradient in Flowing fluid in Exposed and Buried Pipeline, Insulation Types and thickness, Rheology and Non-Newtonian Behaviour, Stress and Pressure Drop Calculations. Flow Equation, Pressure Drop Calculations. Wey Mouth and Panhandle Equation, Design Factors. Pressure Drop in Non-Horizontal Pipeline. Stress Conditions in Pipeline and Analysis.

Conservation of petroleum & its products. Spot and other market control mechanism.

BOOKS:

1. Production and Transport of Oil and Gas, Szilas, A. P, Part B: Gathering and Transport, Development in Petroleum Series, 18 B, Elsevier, 1986,
2. Offshore Pipeline Design, Analysis and Methods, Mouselli, A. H. Pennwell Books, Tulsa, m Oklahoma.
3. Surface Production Operations, Arnold, Ken and Stewart, Maurice Volume I and II, Gulf Publishing Company, London.
4. Modeling of Oil Product and Gas Pipeline Transport, Lurie Mikhail, Wiley, 2008

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

PEL313 MODERN SEPARATION TECHNIQUES

Basics of Separation Process:

Review of Conventional Processes, Recent advances in Separation Techniques based on size, surface properties, ionic properties and other special characteristics of substances. Process concept, Theory and Equipment used in cross flow Filtration, cross flow Electro Filtration, Surface based solid – liquid separations involving a second liquid.

Membrane Separations:

Types and choice of Membranes, Plate and Frame, tubular, spiral wound and hollow fiber Membrane Reactors and their relative merits, commercial.

Pilot Plant and Laboratory Membrane permeators involving Dialysis, Reverse Osmosis, Nanofiltration, Ultra filtration and Micro filtration, Ceramic- Hybrid process and Biological Membranes.

Separation by Adsorption:

Types and choice of Adsorbents, Adsorption Techniques, Dehumidification Techniques, Affinity. Chromatography and Immuno Chromatography, Recent Trends in Adsorption.

Inorganic Separations:

Controlling factors, Applications, Types of Equipment employed for Electrophoresis.

Dielectrophoresis, Ion Exchange Chromatography and Eletrodialysis, EDR, Bipolar Membranes.

Other Techniques:

Separation involving Lyophilisation, Pervaporation and Permeation Techniques for solids, liquids and gases, zone melting. Adductive Crystallization, other Separation Processes, Supercritical fluid Extraction, Oil spill Management, Industrial Effluent Treatment by Modern Techniques.

BOOKS:

1. King, C. J., “Separation Processes”, Tata McGraw Hill, 1982.
2. Roussel, R. W., “Handbook of Separation Process Technology”, John Wiley, New York, 1987
3. Nakagawal, O. V., “Membrane Science and Technology”” Marcel Dekkar, 1992

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

PEL314 HYDROCARBON ENGINEERING

Refinery Distillation Processes: Desalting, Process description of typical crude distillation, Fractional distillation, Vacuum distillation, Flooding, Weeping, Entrainment, setting of cut point, Crude assay analysis, ASTM, TBP, EFV, Distillation analysis curve calculation etc.

Fuel Refining and Lube Refining: Cracking, Coking, Reforming, Alkylation, Isomerization, Polymerization, and Sweetening etc. Solvent extraction, Dew axing, Propane deasphalting etc.

Hydro processing: Hydro cracking, Hydro treating, Hydro desulphurization

Oil and Gas separators: Principal of separation, Types of separators, their description. Various control and vessel internals, Oil and gas gravitational separator, Vertical two and three phase separator, Horizontal three phase separator etc.

Quality Monitoring of Petroleum Products : API gravity, Flash point, Fire point, Smoke point, Aniline point, Carbon residue, Kinetic viscosity, Pour point, Freezing point, octane number, Cetane number, Viscosity index, Diesel index, Calorific value, Burning test 24 hours, Characterization factor, Cloud Point, Vapour lock index, Carbon hydrogen ratio, Calculated ignition index, Carbon aromaticity index, U.O.P Characterization factor, Conrad son carbon residue, Water and sediment content.

Storage of Petroleum Products: Classification of inflammable liquids, Classification of storage tank, Floating roof tank, Fixed roof tank, Semi buried tank, Import/export loss, Breathing losses, Hazards and non-hazards area, and underground storage tank etc.

Marketing of Petroleum and Petroleum products: Role of International oil companies and OPEC pricing mechanism, Administered and market determined pricing mechanism in India

Natural gas: Structural analysis of gas industry, Types of natural gas, Units of natural gas, Impurities of natural gas, Natural gas quality, LNG Scenario in India etc.

BOOKS:

- 1 Nelson W. L., "Petroleum Refinery Engineering", Mc Graw Hill Book Co. ,(1985).
- 2 Watkins R. N., "Petroleum Refinery Distillation", Gulf Publishing Co.
- 3 Gary J. H., Handwork G. E., "Petroleum Refining Technology and Economics", Marcel Dekker, Inc., (2001).
- 4 Jones D. S. J., "Elements of Petroleum processing", John Wiley & Sons, (1995).
- 5 Waquier J. P., "Petroleum Refining" Vol. I & II , Technip, (1995)

(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU KOTA)



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

PEL315 UNCONVENTIONAL ENERGY RESOURCES

CBM: Introduction & present status of coalbed methane- Global and Indian Scenario. Generation of coalbed methane gas & its properties, properties of coal as reservoir rock & accumulation. Geological and petrographic influences on coal, pore geometry, micropore, mesopore and macropore, cleat system

Thermodynamics of coalbed methane: Sorption – principles, sorption isotherms – types and interpretation. CO₂, CH₄ and N₂ adsorption – desorption, hysteresis, Langmuir isotherm, Swelling of coal matrix isotherm construction. CH₄ content determination in coal seams.

Overview of Drilling and Production systems of coalbed methane wells. Selection of Artificial lift for CBM wells. Hydro-fracturing of coal seams. Treating and disposing produced water. Testing of coalbed methane wells.

Gas Hydrate: Introduction & present status of gas hydrates. Formation, accumulation and properties of gas hydrates. Thermodynamics, kinetics and phase behaviour of gas hydrates. Types of gas hydrate. Exploration of gas hydrate. Drilling and production systems of gas hydrate wells. Prevention & control of gas hydrates. Gas extraction from gas hydrates. Uses and application of gas hydrates

Shale Gas / Oil: Global Scenario of shale gas/ oil production. Nature, origin and distribution of Shale Gas/ Oil. Characterization of Shale for Production of Shale Gas/ Oil. Extraction methods of Shale gas/ Oil: development of current practices. Location and size of production areas: estimated reserves and economics. Environmental issues in shale gas exploration. Markets and Global impact on energy scenario. Economic factor of shale gas/ oil production

BOOKS:

1. Carrol John, Natural Gas Hydrates: A guide for engineers, Gulf Publications, 2003.
2. Farooqi Ali, S M, Jones S A and Meldau R F, Practical Heavy Oil Recovery, SPE, 1997
3. James T. Bart is, Frank Camm, David S. Ortiz, Producing liquid fuels from coal: Prospects and policy issues. NETL, DOE, USA, 2008, 198 p
4. A Guide to Coal Bed Methane Reservoir Engineering, Published by Gas Research Institute Chicago, Illinois USA.

**(As Per Choice Based Credit System (CBCSUG2020) Regulations of UD, RTU
KOTA)**



RAJASTHAN TECHNICAL UNIVERSITY KOTA
B. Tech. Petroleum Engineering Syllabus
For
University Departments

PEL 409 INTRODUCTION TO OIL AND GAS ENGINEERING

Physical Properties of Reservoir Rock

Core analysis, conventional core analysis, conventional core analysis, Porosity, effective porosity, primary porosity, secondary porosity, porosity measurement, permeability, Effective permeability, fluid saturation, electrical resistivity, Darcy's law, Single and Multiphase flow etc.

Special Core Analysis

Wettability, capillary pressure characteristics, relative permeability, oil window etc. Flow of fluids through porous media: Darcy's law, single and multiphase flow. Reservoir flow through porous media, reservoir drive mechanism etc. Petroleum Exploration: Gravitational, Magnetic, Seismic, Electrical, Radioactive, Well logging methods etc.

Drilling

Introduction to on-shore and offshore drilling operations, onshore drilling techniques, cable tool drilling, rotary drilling, vertical drilling, Directional drilling, Horizontal drilling, Offshore drilling rigs, drilling accessories components, drilling fluid circulation system, functions of drilling fluids, Mud parameters.

Production

Production problems and work over operations, Well stimulation method, Hydraulic fracturing, matrix treatment, acidizing etc. Open Hole Logging: Electrical Surveys, Radioactive Surveys, Introduction to Well Logging: Mud logs, Pressure logs, Core logs, Wireline logs etc.

BOOKS:

- 1 Berger B. D., Anderson K. E., "Modern Petroleum" Penn well books.
- 2 Bradley H. B., "Petroleum Engineering Handbook", SPE.
- 3 Cole F. W., Reservoir Engineering manual.
- 4 Carl G., "Petroleum Engineering Drilling and Well Completions", Prentice Hall.
- 5 Mc Cray, Cole, "Oil Well Drilling Technology", Oklahoma Press