

Syllabus of  
UNDERGRADUATE DEGREE COURSE

Petroleum Engineering



Rajasthan Technical University, Kota  
Effective from session: 2018 – 2019



# RAJASTHAN TECHNICAL UNIVERSITY, KOTA

## SYLLABUS

2<sup>nd</sup> Year - IV Semester: B.Tech. (Petroleum Engineering)

### 4PE2-01: Surveying

Credit: 3  
3L+0T+0P

Max. Marks: 150 (IA:30, ETE:120)  
End Term Exam: 3 Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Introduction to Surveying:</b> Objective of surveying and its importance, Classification, principles of surveying, Application of Surveying in various fields of Engineering.	3
3	<b>Linear &amp; Angular measurements:</b> Methods and Techniques. Theory and characteristics of electromagnetic waves, radio waves, infra red, laser waves, principle of distance measurement with EDMs.	8
4	<b>Theodolite:</b> The essentials of transit theodolite, definition and terms, temporary adjustments, measurement of horizontal and vertical angles, different operations and sources of error, theodolite traversing, Omitted Measurements.	8
5	<b>Total Station:</b> Principle, working and construction. Corrections to be applied.	6
6	<b>Leveling instruments:</b> Definition, different type of leveling instruments, curvatures and refraction corrections, reciprocal leveling, errors in leveling and problem solving, Contouring	6
7	<b>Plane Table Surveying:</b> Principle and Methods in brief.	4
8	<b>Global Positioning System (GPS):</b> Theory, principles and applications <b>GIS:</b> Introduction to GIS, Its application in mapping.	4
<b>Total</b>		<b>40</b>

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## SYLLABUS

2<sup>nd</sup> Year - IV Semester: B.Tech. (Petroleum Engineering)

### 4PE1-03/3PE1-03: Managerial Economics and Financial Accounting

Credit: 2

2L+0T+0P

Max. Marks: 100(IA:20, ETE:80)

End Term Exam: 2 Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Basic economic concepts-</b> Meaning, nature and scope of economics, deductive vs inductive methods, static and dynamics, Economic problems: scarcity and choice, circular flow of economic activity, national income-concepts and measurement.	3
3	<b>Demand and Supply analysis-</b> Demand-types of demand, determinants of demand, demand function, elasticity of demand, demand forecasting –purpose, determinants and methods, Supply-determinants of supply, supply function, elasticity of supply.	5
4	<b>Production and Cost analysis-</b> Theory of production- production function, law of variable proportions, laws of returns to scale, production optimization, least cost combination of inputs, isoquants. Cost concepts-explicit and implicit cost, fixed and variable cost, opportunity cost, sunk costs, cost function, cost curves, cost and output decisions, cost estimation.	5
5	<b>Market structure and pricing theory-</b> Perfect competition, Monopoly, Monopolistic competition, Oligopoly.	4
6	<b>Financial statement analysis-</b> Balance sheet and related concepts, profit and loss statement and related concepts, financial ratio analysis, cash-flow analysis, funds-flow analysis, comparative financial statement, analysis and interpretation of financial statements, capital budgeting techniques.	8
<b>Total</b>		<b>26</b>

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## SYLLABUS

2<sup>nd</sup> Year - IV Semester: B.Tech. (Petroleum Engineering)

### 4PE1-02/3PE1-02: Technical Communication

Credit: 2  
2L+0T+0P

Max. Marks: 100(IA:20, ETE:80)

End Term Exam: 2 Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Introduction to Technical Communication-</b> Definition of technical communication, Aspects of technical communication, forms of technical communication, importance of technical communication, technical communication skills (Listening, speaking, writing, reading writing), linguistic ability, style in technical communication.	3
3	<b>Comprehension of Technical Materials/Texts and Information Design &amp; development-</b> Reading of technical texts, Reading and comprehending instructions and technical manuals, Interpreting and summarizing technical texts, Note-making. Introduction of different kinds of technical documents, Information collection, factors affecting information and document design, Strategies for organization, Information design and writing for print and online media.	6
4	<b>Technical Writing, Grammar and Editing-</b> Technical writing process, forms of technical discourse, Writing, drafts and revising, Basics of grammar, common error in writing and speaking, Study of advanced grammar, Editing strategies to achieve appropriate technical style, Introduction to advanced technical communication. Planning, drafting and writing Official Notes, Letters, E-mail, Resume, Job Application, Minutes of Meetings.	8
5	<b>Advanced Technical Writing-</b> Technical Reports, types of technical reports, Characteristics and formats and structure of technical reports. Technical Project Proposals, types of technical proposals, Characteristics and formats and structure of technical proposals. Technical Articles, types of technical articles, Writing strategies, structure and formats of technical articles.	8
<b>Total</b>		<b>26</b>

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# RAJASTHAN TECHNICAL UNIVERSITY, KOTA

## SYLLABUS

2<sup>nd</sup> Year - IV Semester: B.Tech. (Petroleum Engineering)

### 4PE3-04: Sedimentology & Geochemistry

Credit: 3  
3L+0T+0P

Max. Marks: 150 (IA:30, ETE:120)  
End Term Exam: 3 Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Sedimentology:-</b> 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, Paludal, 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.	19
3	<b>Petroleum Geochemistry:-</b> 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.	20
<b>Total</b>		<b>40</b>

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## SYLLABUS

2<sup>nd</sup> Year - IV Semester: B.Tech. (Petroleum Engineering)

### 4PE4-05: Reservoir Engineering-I

Credit: 3  
3L+0T+0P

Max. Marks: 150 (IA:30, ETE:120)  
End Term Exam: 3 Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Fundamental concepts:</b> Introduction to Hydrocarbon Reservoir, Pressure-Temperature diagram, Fluid pressure regimes	5
3	<b>Rock properties:</b> 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	10
4	<b>Crude oil properties:</b> Density, gravity, viscosity, gas solubility, bubble point pressure, oil formation volume factor	4
5	<b>Natural gas properties:</b> Compressibility, gas formation volume factor, viscosity	4
6	<b>Water properties:</b> Viscosity, gas solubility, water formation volume factor	4
7	<b>Flow of Fluids through Porous Media :</b> Fluid types, flow regimes, Darcy's law, single and multiphase flow, linear, radial & spherical flow, steady state, unsteady state and pseudosteady state flow, GOR, WOR equation	6
8	<b>Phase behavior:</b> Equations of States (EOS), Reservoir fluid sampling, PVT properties determination and their significance, Laboratory PVT Analysis	6
<b>Total</b>		<b>40</b>

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## SYLLABUS

2<sup>nd</sup> Year - IV Semester: B.Tech. (Petroleum Engineering)

### 4PE4-06: Petroleum Production Engineering-I

Credit: 3  
3L+0T+0P

Max. Marks: 150 (IA:30, ETE:120)  
End Term Exam: 3 Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Surface Production Equipment:</b> Well wellhead assembly and attachments, Casing hangers, Christmas tree assemblies, Valves, Components and design considerations of wellhead equipment and choke, Surface Safety Valve.	9
3	<b>Subsurface Production Equipment:</b> Sub Surface Safety Valve, choke sizing, Bottom-hole chokes and regulators, Circulation devices, Expansion joints, Safety joints, Landing nipples, Production packers,	10
4	<b>Well Completion Engineering:</b> Well completion planning & design, Types of completion, Well completion equipment, Well completion fluid, Completion procedure, Well perforation, Shaped charge perforation operation., Perforation fluid, Well activation, Factors affecting perforation efficiency & productivity.	10
5	<b>Inflow performance relationship:</b> 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.	10
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## SYLLABUS

2<sup>nd</sup> Year - IV Semester: B.Tech. (Petroleum Engineering)

### 4PE4-07: Applied Thermodynamics

(Common with Chemical Engineering & Petrochemical Engineering)

Credit: 3  
3L+0T+0P

Max. Marks: 150 (IA:30, ETE:120)  
End Term Exam: 3 Hours

SN	Contents	Hours
1	<b>Introduction:</b> Objective, scope and outcome of the course.	1
2	<b>Review of first and second law of thermodynamics.</b>	7
3	<b>Vapor-liquid equilibrium:</b> phase rule, simple models for VLE; VLE by modified Raoult's law; VLE from K-value correlations; Flash calculations.	10
4	<b>Solution Thermodynamics:</b> fundamental property relationships, free energy and chemical potential, partial properties, definition of fugacity and fugacity coefficient of pure species and species in solution, the ideal solution and excess properties. Liquid phase properties from VLE, Models for excess Gibbs energy, heat effects and property change on mixing. UNIFAC and UNIQUAC models. Liquid-Liquid Equilibria; Vapor-Liquid-Liquid Equilibria; Solid-Liquid Equilibria; Solid-Gas Equilibria.	12
5	<b>Chemical reaction equilibria:</b> equilibrium criterion, equilibrium constant, evaluation of equilibrium constant at different temperatures, equilibrium conversion of single reactions, multi-reaction equilibria. Introduction to molecular/statistical thermodynamics.	10
<b>Total</b>		<b>40</b>

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2<sup>nd</sup> Year - IV Semester: B.Tech. (Petroleum Engineering)

### 4PE4-21: Reservoir Engineering Lab

**Credit: 2**  
**OL+OT+4P**

**Max. Marks: 100 (IA:60, ETE:40)**

#### List of Experiment

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



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### 4PE4-22: Sedimentology & Geochemistry Lab

Credit: 2  
OL+OT+4P

Max. Marks: 100 (IA:60, ETE:40)

#### List of Experiment

1. Identification of clastic and carbonate sedimentary rocks.
2. Study of thin section of Sedimentary rocks.
3. Calculation of oil reserves in defined structures.
4. Structure contour map, description of structure, profile construction, marking oil/water contact, proposal for new well.
5. Finding oil-water contact from borehole data
6. Preparation of isopach maps of reservoir facies.
7. Interpretation of geological map, reconstruction of stratigraphic succession.
8. Study of Rock-Eval logs to identify source rock sequences
9. Study of geochemical parameters of oil and gas to correlate petroleum pools
10. Study of surface microseep anomaly maps to prioritize prospects
11. Quantification of hydrocarbon generation
12. Field visits for sedimentological Exposure.



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2<sup>nd</sup> Year - IV Semester: B.Tech. (Petroleum Engineering)

### 4PE4-23: Surveying Lab

Credit: 1  
OL+OT+2P

Max. Marks: 50 (IA:30, ETE:20)

#### List of Experiment

1. Measurement and adjustment of included angles of traverse using prismatic compass.
2. To determine the reduced levels using Tilting Level.
3. To determine the reduce levels in closed circuit using Dumpy Level.
4. Prepare contour map by levelling.
5. Measurement of horizontal angle.  
By method of repetition.  
By method of Reiteration.
6. Study of Global Positioning System (GPS) and measurement with GPS.
7. Study of total station and measurement with total station.

**Note : Above exercise must be performed using Total station to the maximum possible extent**



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### 4PE4-24: Applied Numerical Methods (Sessional)

Credit: 1  
OL+OT+2P

Max. Marks: 50 (IA:30, ETE:20)

#### List of Experiment

1. Numerical solution of non-linear algebraic and transcendental equation by bisection, iteration, false position, secant and Newton Raphson methods.
2. Numerical solution of system of linear simultaneous equations by Gauss elimination and Gauss Seidel methods.
3. Interpolation by Lagrange's interpolation formula.
4. Numerical evaluation of definite integral by Trapezoidal, Simpson's 1/3rd, Simpson's 3/8th, Weddle and Gaussian quadrature formulae.
5. Numerical solution of first order ordinary differential equation by Euler's, Modified Euler's, second and fourth order Runge-Kutta, Adams-Moulton and Milne's method



# **RAJASTHAN TECHNICAL UNIVERSITY, KOTA**

## **SYLLABUS**

**2<sup>nd</sup> Year - IV Semester: B.Tech. (Petroleum Engineering)**

**4PE8-00: Social Outreach, Discipline & Extra Curricular Activities(SODECA)**

**Credit: 0.5**

**Max. Marks: 25**

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