



PARUL UNIVERSITY - FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF PETROLEUM ENGINEERING

PROPOSED SYLLABUS FOR 3RD SEMESTER B. TECH. PROGRAMME

INTRODUCTION TO PETROLEUM GEOLOGY

(SUBJECT CODE:203120201)

Type of Course: B.Tech Petroleum Engineering

Prerequisite: Basics knowledge of Physics and rock structures. Understanding of Doppler effects and other acoustic laws are required

Teaching and Examination Scheme:

Teaching Scheme (h/week)				Examination Scheme							
				Internal Marks			External Marks		Passing Marks (Theory + CE)	Passing Marks (Practical)	Total Marks
Lect	Lab	Tut	Credit	T	P	CE	T	P	Int. + Ext.	Int. + Ext.	
3	0	0	3	20	-	20	60		40		100

Lect -Lecture; **Tut**- Tutorial; **Lab**-Laboratory; **T**- Theory; **P**-Practical;

Content:

Sr. No.	Topic	Weight age in %	Teaching Hrs.
1.	The Earth Introduction to origin, age, internal structure and constitution of earth; introduction to earth's lithosphere, atmosphere, hydrosphere, and biosphere; plate tectonic theory, tectonic elements of continents and oceans; continental drift; concept of isostasy.	22	10
2.	Crystallography, Mineralogy and Petrology Crystallography – unit cell, crystal systems, crystal faces, and crystal symmetry; concept of stereographic projection. Mineralogy – classification of minerals, physical and optical properties of rock forming minerals; classification and structure of silicates; brief descriptions of common silicates viz., olivine, pyroxene, amphibole, mica, feldspar and quartz; Concepts of solid solution and binary eutectic; Bowen's reaction series. Petrology – introduction; classification of rock types; formation, classification, texture and	34	15



Sr. No.	Topic	Weight age in %	Teaching Hrs.
	structure of igneous, metamorphic, and sedimentary rocks. Description of common Igneous Rocks viz., Rhyolite, Granite, Pegmatite, Basalt, Dolerite, and Gabbro; Sedimentary Rocks viz. Conglomerate, Breccia, Sandstone, Shale, and Limestone; Metamorphic Rocks viz., Slate, Schist, Gneiss, Quartzite, and Marble. Rock cycle; introduction to weathering of rocks with an emphasis on chemical weathering.		
3.	Structural Geology Domain of Structural Geology; concepts of strike and dip; parameters controlling deformation of rocks; deformation in rocks – descriptions of folds, joints, faults and their classifications; unconformity; geological maps and sections; map symbols.	22	10
4.	Source Migration and Trap Source, Source characterization, Source quantification, Oil and gas Window, Migration, Primary and Secondary migration, Mechanism of Migration, Migration quantification, Migration pathways, Traps, Classification of traps, Traps classification based on GWC and OWC, Trapping Mechanism, Seal, Seal integrity study, Seal style.	22	10

References:

1. AAPG Treatise on Petroleum Geology, 1999
2. AAPG, Development Geology Reference Manual, 1992
3. F. J. Pettijohn, Sedimentary Rocks
4. Ahr, W. M. (2008) Geology of Carbonate reservoir, John Willey and Sons.
5. Philip A. Alen & John R. Alen, Basin Analysis-Principles and Application.



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DEPARTMENT OF PETROLEUM ENGINEERING

PROPOSED SYLLABUS FOR 3RD SEMESTER B. TECH. PROGRAMME

INTRODUCTION TO DRILLING ENGINEERING-1

(SUBJECT CODE:203120203)

Type of Course: B.Tech Petroleum Engineering

Prerequisite: Basics of Physics and Maths for understanding the problems in Drilling Rig design

Teaching and Examination Scheme:

Teaching Scheme (h/week)				Examination Scheme							
				Internal Marks			External Marks		Passing Marks (Theory + CE)		Passing Marks (Practical)
Lect	Lab	Tut	Credit	T	P	CE	T	P	Int. + Ext.	Int. + Ext.	
3	2	1	5	20	20	20	60	30	40	25	150

Lect -Lecture; **Tut**- Tutorial; **Lab**-Laboratory; **T**- Theory; **P**-Practical;

Content:

Sr. No.	Topic	Weight age in %	Teaching Hrs.
1.	Basic Drilling Practices Well Planning, Drilling Rig: Components, Selection and Operating systems - Hoisting, Circulation and Rotary systems, Power transmission, Rig control system. Wire lines and service life evaluation, Drilling Fluids – Basics, Functions, Classification, Properties and Nature. Drilling fluids equipment related to pressure and separation. Formulations of drilling fluid, Mud systems like Pneumatic, Synthetic oil based, Inhibitive and Non-inhibitive	33	15



Sr. No.	Topic	Weight age in %	Teaching Hrs.
	Rheology models of drilling fluids Mud Hydraulics and Mud weight and Pressure loss calculations in round trip circulation cycle, Pore Pressure prediction, Fracture pressure,		
2.	Drill string, Casing and Bit Design Drill String - Components, functions and design, Casing Practices – Configuration, operation, properties, types and design, casing setting depth and hole sizes, liner design, casing handling practices Drill Bits – Types, Performance and Criteria for design.	23	10
3.	Cementation Techniques Cementing, Cements & cement slurry: Objectives of cementing, oil well cements, Classification of cement, Slurry design, Slurry additives, Factors influencing cement slurry design, Cementing equipment. Cementing Methods - Primary cementing, Stage cementing, Liner cementing, Plugging, Squeeze Cementing techniques in practice. Cementing calculations.	28	13
4.	Drilling Problems and Remedies Pipe sticking and failure, Lost circulation, Hole Deviation, Sloughing shale, Formation damage, Borehole instability. Drill string fatigue failure. Bit failure, wire line failure etc. Fishing and coring operations. Well kick and Blow outs: Problem, symptoms and controlling measures, Hole Cleaning.	16	7

References:

1. Carl Gatlin (1960), Petroleum Engineering: Drilling and Well Completion, Prentice Hall; 1st Ed.
2. Bourgoyne, Adam T. Jr., Martin E. Chenevert, Keith K. Millheim and F.S. Young Jr., Richardson, TX (1991), Applied Drilling Engineering, Society of Petroleum Engineers.
3. H Rabia (1986), Oil Well Drilling Engineering Principles and Practices, Kluwer Law International

List of Experiments



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Sr. No	Topic
1	To prepare the Drilling fluid and calibrate the equipment used in the drilling fluid laboratory.
2	To determine the Mud Weight using mud balance.
3	To determine the Marsh Funnel Viscosity of mud using marsh funnel.
4	To perform the Mud Rheology Test using rotational viscometer.
5	To determine the Filtration, Wall Building characteristics of mud using LPLT API filter-press.
6	To determine the Mud Resistivity using the conductivity meter.
7	To determine the Solid and Liquid Content in mud using the Baroid Sand Content Set.
8	To determine the Cation Exchange Capacity of the drilling fluid using the Methylene Blue Dye Test (MBT)
9	To estimate the Mud Weight Control using Bentonite and Barite.
10	To perform the Drilling Fluid Contamination test using Rotational Viscometer.



DEPARTMENT OF PETROLEUM ENGINEERING

PROPOSED SYLLABUS FOR 3RD SEMESTER B. TECH. PROGRAMME

PETROLEUM EXPLORATION TECHNIQUES

(SUBJECT CODE:203120207)

Type of Course: B.Tech Petroleum Engineering

Prerequisite: Basics of Physics and Geology

Rationale: The role of exploration is to provide the information required to exploit the best opportunities presented in the choice of areas, and to manage research operations on the acquired blocks.

Teaching and Examination Scheme:

Teaching Scheme (h/week)				Examination Scheme							
				Internal Marks			External Marks		Passing Marks (Theory + CE)		Passing Marks (Practical)
Lect	Lab	Tut	Credit	T	P	CE	T	P	Int. + Ext.	Int. + Ext.	
3	0	0	3	20	0	20	60	0	40	0	100

Content:

Sr. No.	Topic	Weight age in %	Teaching Hrs.
1.	Fundamentals of Petroleum Exploration Ingredients of Petroleum Exploration, Concept of source, reservoir, migration, trap and seal, Concept of Play, Lead, Prospect and Drillable Prospect, Types of Petroleum Traps-Structural, Stratigraphic and Combinational traps, Primary and Secondary Migration, E&P Life Cycle, Concept of Reserve, Lease and Reservoir, Techniques of Petroleum Exploration, Geochemical, Gravity, Magnetic, Electrical and seismic method of hydrocarbon exploration.	27	12
2.	Geochemical Analysis Geochemical seep, Classification of seep by Link, Weathering of seeps, a geochemical program for petroleum exploration, Surface	17	8



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Sr. No.	Topic	Weight age in %	Teaching Hrs.
	Reconnaissance, hydrocarbon Mud Logging, Rock Pyrolysis, Understanding S1, S2, S3, S1/S1+S2, Production Index, Hydrogen Index and Oxygen Index, Processing and interpretation of Geochemical data.		
3.	<p>Fundamentals of Seismic processing, Interpretation and Attribute</p> <p>Body waves and surface waves, Rayleigh, Love, P and S wave, Seismic acquisition principle, Seismic refraction and reflection surveys, Land and marine sources, Geophone, Hydrophone and Vibroseis survey, Seismic Fold, Signal and Noise, Seismic Processing, CDP/CMP and NMO, DMO, Seismic migration, Base map, Strike Line and Dip Line, 2D and 3D seismic, inline and cross line, 3D fold, time slice and its importance. Horizon and Fault mapping, Seismic impedance and reflection coefficient, convolution and autocorrelation, Synthetic generation, Time and depth map, VSP survey, Attributes: Amplitude, Frequency and Sweetness, AVO analysis, Classification of sands, Rock solid attributes.</p>	33	15
4.	<p>G and M Methods</p> <p>Gravity and magnetic prospecting, Instruments of G&M survey, Gravity and magnetic data correction, Interpretation of G&M anomaly, Correlation of Gravity anomaly with seismic anomaly. SP, Telluric and Magnetotelluric data interpretation, Electrical properties of hydrocarbon, Electrical conductivities, Resistivities of various lithology's, Dielectric constants, land airborne EM, Basic well logs, GR and SP logs, Shallow, Medium and Deep Resistivity logs, Porosity logs- Sonic, Neutron and Density logs, Importance of log interpretation, qualitative and quantitative Interpretation</p>	23	10

References:

1. Supriya Mohan Sengupta, Introduction to Sedimentology, A.A.Balkema publication.
2. Mamdough, R. Gadallah, Reservoir Seismology, Pennwell Books, Pennwell Publishing Company, Tusa, Oklahoma.
3. Telford, W M, Geldart, L.P., Sheriff, R.E. and Keys, D.E., Applied Geophysics, Oxford and IBH Publishing Co Pvt Ltd.



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DEPARTMENT OF PETROLEUM ENGINEERING

PROPOSED SYLLABUS FOR 3RD SEMESTER B. TECH. PROGRAMME

THERMODYNAMICS

(SUBJECT CODE: 203120209)

Type of Course: Petroleum Engineering

Prerequisite: Physics and mathematics of basic science, Element of Mechanical Engineering

Rationale: The application of the science of thermodynamics is found in many branches of engineering including chemical engineering. This subject provides the basic principles and the applications of thermodynamic in the fields of chemical engineering.

Teaching and Examination Scheme:

Teaching Scheme (h/week)				Examination Scheme							
				Internal Marks			External Marks		Passing Marks (Theory + CE)		Passing Marks (Practical)
Lect	Lab	Tut	Credit	T	P	CE	T	P	Int. + Ext.	Int. + Ext.	
3	0	1	4	20	0	20	60	0	40	0	100

Lect -Lecture; **Tut**- Tutorial; **Lab**-Laboratory; **T**- Theory; **P**-Practical;

Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	BASIC CONCEPTS: The terminologies of thermodynamics, the variables and quantities of thermodynamics, categorization of systems and processes. Energy classifications, point and path properties, energy in transition, heat and work, reversible and irreversible processes, phase rule.	15%	7
2.	FIRST LAW OF THERMODYNAMICS: The first law and internal energy, statements of first law for the non-flow and flow systems, enthalpy and heat capacity limitations of the first law.	15%	7
3.	SECOND LAW OF THERMODYNAMICS: Statements of the second law of thermodynamics, available and unavailable energies, The entropy function, applications of the second	15%	7



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	law.		
4.	HYDROCARBON RESERVOIR FLUIDS AND THEIR PHASE BEHAVIOR: Hydrocarbon (Petroleum) Reservoir Fluid composition and their physical Properties; Thermodynamic behavior of naturally occurring hydrocarbon (Oil, gas, condensate) system.	28%	12
5.	PVT ANALYSIS OF HYDROCARBON FLUIDS Collection of reservoir fluid samples for PVT study, PVT analysis: Constant composition expansion, flash liberation, differential liberation, separator test for PVT data of hydrocarbon fluids. Evaluation and correlation of physical and chemical properties of reservoir fluids including laboratory and empirical methods.	27%	12

References:

1. Introduction to Chemical Engineering Thermodynamics – Smith, J.M., Van Ness, H.C., & Abbot M. C, McGraw Hill VII Edition 2004.
2. A Text Book of Chemical Engineering Thermodynamics Narayanan K. V – Prentice Hall of India Pvt. Ltd. 2001.
3. Petroleum Reservoir Rock and Fluid Properties – Abhijit Y. Dandekar- Taylor and Francis- 2006.
4. Equations of State and PVT Analysis: Applications for improved Reservoir Modeling – Tarek Ahmed, Gulf Publishing Company, Houston Texas.



DEPARTMENT OF PETROLEUM ENGINEERING

PROPOSED SYLLABUS FOR 3RD SEMESTER B. TECH. PROGRAMME

FLUID FLOW OPERATIONS

(SUBJECT CODE: 203120205)

Type of Course: B.Tech

Prerequisite: Knowledge of Physics and Engineering Mathematics

Rationale: Various types of fluids are involved in chemical plants. Thorough knowledge of the flow behaviour of such fluids is essential to design and to operate such plants. This subject provides the basic understanding of the flow behaviour of fluids.

Teaching and Examination Scheme:

Teaching Scheme (h/week)				Examination Scheme							
				Internal Marks			External Marks		Passing Marks (Theory + CE)		Passing Marks (Practical)
Lect	Lab	Tut	Credit	T	P	CE	T	P	Int. + Ext.	Int. + Ext.	
3	2	0	4	20	20	20	60	30	40	25	150

Lect -Lecture; **Tut**- Tutorial; **Lab**-Laboratory; **T**- Theory; **P**-Practical;

Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	Introduction: Introduction to basic concepts of fluid, Properties of fluids, Dimensional Analysis, Dimensional homogeneity.	9%	4
2.	Fluid Statics and its Applications: Pressure concept, Hydrostatic equilibrium in Gravitational & Centrifugal fields, Manometers, Continuous gravity decanter, Centrifugal decanter	4%	2
3.	Fluid Flow Phenomena: Types of flow, Potential flow, One dimensional flow, Laminar flow, Reynolds number, Newtonian and non-Newtonian	11%	5



	fluids, Velocity gradient and Rate of shear, Viscosity of gases and liquids, Turbulent flow, Nature of turbulence, Eddy viscosity, Eddy diffusivity of momentum, Flow in boundary layers, Laminar and turbulent flow in boundary layers, Boundary layer formation in straight tube and flat plates, Boundary layer thickness, Boundary layer separation and wake formation		
4.	Basic Equations of Fluid Flow: Stream line and stream tubes, Average velocity, Mass velocity, Momentum balance, Bernoulli's equation without friction, Correction of Bernoulli's equation for fluid friction, Pump work in Bernoulli's equation	11%	5
5.	Flow of Incompressible Fluids in Conduits: Flow of incompressible fluids in pipes, Friction factor, Laminar flow of Newtonian and non-Newtonian fluids, Hagen-Poiseuille equation, Turbulent flow in pipes and closed channels, Effect of roughness, Friction factor chart, Drag reduction in turbulent flow, Equivalent diameter, Friction factor in flow through channels of non-circular cross section, Friction from changes in velocity or direction, Effect of fittings and valves, Practical use of velocity heads in design, Minimization expansion and contraction losses.	16%	7
6.	Flow Past Immersed Bodies: Introduction to Drag, drag coefficient, form drag, and streamlining, friction in fluids through bed of solids, fluidization, condition of fluidization, types of fluidization, application of fluidization, continuous fluidization, slurry and pneumatic transport.	11%	5
7.	Fluid Flow Measurement: Fluid flow measurement, Venturimeter, Orifice meter, Rotameter, Pilot tubes, Target meter, Magnetic meters.	9%	4
8.	Applications of Fluid Mechanics: Pipe and tubes, joints and fittings, pipe sizes, prevention of leakage around moving parts, stuffing boxes, mechanical seals, valves, pumps, characteristics of centrifugal pumps, NPSH, cavitations, positive displacement pumps, priming of pumps, fans, blowers and compressors, vacuum pumps,	20%	9



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	ejectors, Introduction to computational fluid dynamics(CFD).		
9.	Flow of Compressible Fluids: Continuity equation ,total energy balance equation, velocity of sound, process of compressible flow for isentropic expansion	9%	4

References:

1. Unit Operations of Chemical Engineering (TextBook)
McCabe W L, SmithJ C, Harriott; McGrawHill Publication
2. Chemical Engineering, Vol-I
Coulson & Richardson; Butterworth & Heinemann Publication
3. Fluid Dynamics and Heat Transfer
James G. Knudson and Donald L. Katz; McGraw Hill Publication
4. Introduction to Fluid Mechanics
R.W. Fox A.T Mac Donald and P.J. Pritchard; Wiley
5. Fluid Mechanics for Chemical Engineers
James O.; Wilkes Prentice Hall publication

LIST OF EXPERIMENTS

Sr. No	Topic
1	To understand the concept of fluid flow and fluid
2	To determine coefficient of discharge for V-Notch
3	To determine the Reynolds Number at different flow conditions
4	To determine the discharge coefficient of venturimeter
5	To determine the discharge coefficient of orificemeter
6	To verify Bernoulli theorem experimentally
7	To determine loss coefficients for different pipe fittings.



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8	To calibrate the rotameter
9	To Study different types of Pressure measurement devices
10	To study the characteristics of a Centrifugal pump