



PARUL UNIVERSITY - FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF PETROLEUM ENGINEERING

PROPOSED SYLLABUS FOR 4th SEMESTER B. TECH. PROGRAMME

HEAT AND MASS TRANSFER

(SUBJECT CODE:203120251)

Type of Course: B.Tech Petroleum Engineering

Prerequisite: Basic knowledge of Physics and Chemical engineering in various modes of heat transfer and various basic science equations in mass and momentum change.

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	-	20	60	-	40	-	100

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

Content:

Sr. No.	Topic	Weight age in %	Teaching Hrs.
1.	Heat Transfer Conduction: Steady-state and transient flow through various geometries, Convection: LMTD and NTU, overall heat transfer coefficient. Application of dimensional analysis to convection. Heat transfer rate and Heat transfer coefficient calculations. Double pipe parallel and counter-flow heat exchangers, natural and forced convection through tubes and outside tubes, Shell and tube heat exchanger, and finned tube heat exchanger. Boiling of liquids and condensation of vapors	27	12



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Sr. No.	Topic	Weight age in %	Teaching Hrs.
2.	Radiation Radiation from black and real surfaces, radiation transfer between black and grey surfaces, view factor, radiation shield, and multi-sided enclosures., Thermal insulation, Economic and critical thickness of lagging.	24	11
3.	Mass Transfer Diffusion in gases: Fick's law, determination and estimation of diffusion coefficient; diffusion through stagnant gas and equimolecular counter-diffusion. Diffusion in liquids: Mass transfer across phase boundaries, two-film theory and mass transfer coefficient.	27	12
4.	Gas Absorption, adsorption, Extraction and Distillation (flash and differential): Basic principles, laws, and calculations. Equilibrium, co-current and counter-current operations. Ideal stage concept and calculation of number of ideal stages. Efficiency. Packed bed and tray columns.	22	10

Texts and References:

1. Coulson and Richardson's Chemical Engineering Vol-1, 6th Ed, Elsevier (Butterworth and Heinemann).
2. Warren L. McCabe, Julian C. Smith, Unit Operations of Chemical Engineering, McGraw Hill.
3. Donald Q. Kern, Process heat transfer, Tata-McGraw-Hill.
4. Badger and Banchero, Introduction to Chemical Engineering, McGraw-Hill.



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DEPARTMENT OF PETROLEUM ENGINEERING

PROPOSED SYLLABUS FOR 4th SEMESTER B. TECH. PROGRAMME

INTRODUCTION TO DRILLING ENGINEERING-II

(SUBJECT CODE:203120253)

Type of Course: B.Tech Petroleum Engineering

Prerequisite: Basics of Physics and Maths and in addition to the concepts of drilling engineering -I

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	-	20	60	-	40	-	100

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

Content:

Sr. No.	Topic	Weight age in %	Teaching Hrs.
1.	Directional Drilling Directional Drilling Technology, Objectives of Directional Drilling. Tools for deflection & orientation. Directional well profiles and well path – deflection & corrections Motor Types: PD motors and Turbodrills; their description, power calculations and applications. Directional drilling problems & their remedies. Auto and Verti-track systems: Rotary steerable motors and geo-steering tools.	29	13
2.	Horizontal Well Drilling Horizontal Well Drilling, Introduction of Horizontal well drilling;	29	13



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Sr. No.	Topic	Weight age in %	Teaching Hrs.
	objectives & selection, drilling techniques and different well profiles, special mud requirements and their characteristics. Measurements while Drilling: objectives, MWD / LWD tools, Telemetry system and data interpretation Well Surveying: Objectives & methods. surveying analysis & calculations for well coordinates		
3.	Offshore Drilling Offshore oil and gas operations & ocean environment. Offshore fixed platforms, Wave forms and characteristics. Interaction with offshore structural elements. Environmental prediction and loading. Offshore structure. Fixed, mobile and floating. Fixed platform, Steel and concrete gravity structures. Interaction with floating vessels. Jack-up, drill ships and semi submersibles.	22	10
4.	Well Control Principles & Procedures The Anatomy of a KICK, Kicks - Definition, Kick Control (a) Dynamic kick control (b) Other Kick control methods- Driller & Engineer methods of kick control.	20	9

Text and References:

1. 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.
2. Joshi, S. D. (1991) Horizontal Well Technology, Penn Well Publishing.
3. Adam, N. J. (1980) Well control Problems and Solutions. Petroleum Publishing Company
4. Baker, R. (1998) A Premier of Offshore Operations Petroleum Extension Service, Division of Continuing Education, University of Texas at Austin in cooperation with International Association of Drilling Contractors, Houston, Texas.



DEPARTMENT OF PETROLEUM ENGINEERING

PROPOSED SYLLABUS FOR 4th SEMESTER B. TECH. PROGRAMME

ELEMENTS OF RESERVOIR ENGINEERING

(SUBJECT CODE:203120255)

Type of Course: B.Tech Petroleum Engineering

Prerequisite: Basics of Physics , Mathematics and Petroleum Geology

Rationale: The working tools of the reservoir engineer are subsurface geology, applied mathematics, and the basic laws of physics and chemistry governing the behaviour of liquid and vapour phases of crude oil, natural gas, and water in reservoir rock.

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	-	20	60	-	40	-	100

Content:

Sr. No.	Topic	Weight age in %	Teaching Hrs.
1.	Reservoir Rock Properties Porosity and permeability determination, combination of permeability in parallel & series beds, porosity permeability relationship, fluid saturation determination and significance, effective and relative permeability, wettability, capillary pressure characteristics, measurements and uses. Coring and Core Analysis	24	11
2.	Reservoir Fluids:	20	9



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Sr. No.	Topic	Weight age in %	Teaching Hrs.
	Phase behavior of hydrocarbon system, ideal & non ideal system, equilibrium ratios, reservoir fluid sampling, PVT properties determination, different correlations and laboratory measurements, data reduction, evaluation and application.		
3.	Flow of Fluids through Porous Media : Darcy's law, single and multiphase flow, linear, radial & spherical flow, steady state & unsteady state flow, GOR, WOR equations .	24	11
4.	Reservoir Drives and Reserve Estimation Reservoir drive mechanics and recovery factors ,Reserve resource & reserve concept, Different reserve estimation techniques: Volumetric, MBE, decline curve analysis.	32	14

Text and References:

1. Fundamentals of Reservoir Engineering – L. P. Dake – Elsevier, 17th Edition, 1998
2. Applied Petroleum Reservoir Engineering (Second Edition)- B. C. Craft and M. F. Hawkins Revised by Ronald E. Terry – Prentice Hall.
3. Worldwide Practical Petroleum Reservoir Engineering Methods – H. C. “Slip” Slider – Pennwell Publishing Company.
4. Advance Reservoir Engineering- Tarek Ahmed and Paul D. McKinney - Gulf Professional Publishing – Elsevier -2005



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DEPARTMENT OF PETROLEUM ENGINEERING

PROPOSED SYLLABUS FOR 4th SEMESTER B. TECH. PROGRAMME

PRODUCTION OPERATIONS-1

(SUBJECT CODE: 203120257)

Type of Course: Petroleum Engineering

Prerequisite: Physics and mathematics of basic science and transport phenomena of chemical engineering

Rationale: Production engineering include evaluating inflow and outflow performance between the reservoir and the wellbore and also designing completion system including tubing selection, perforating, sand control, matrix stimulation, and hydraulic fracturing.

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

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

Content:

Sr. No.	Topic	Weightage	Teaching hours
1.	Well Equipment and Completion Design: Well Head Equipment, Christmas tree, valves, hangers, flow control devices, packers, tubular and flow lines, Well completion Methods, Perforating Oil & Gas Wells - Conventional and Unconventional techniques viz. through tubing and tubing conveyed underbalanced	27	12



	perforating techniques, type size and orientation of perforation holes. Well activation, use of compressed air & liquid Nitrogen. Down-hole equipment selection, servicing, installation & testing, smart wells- intelligent completions		
2.	<p>Well Servicing & Workover:</p> <p>Workover system, workover rigs and selection, rig less workover including Endless/ Coiled tubing unit, minor & major workover jobs-diagnosis & remedial measures water shut off and gas shut off- Chemical treatment and conformance control. Wire-line operations, Workover & completion fluids - types & selection, Formation damage, Workover planning & economics, asphaltenewax ,Sand control techniques, Formation Sand Size analysis, optimum gravel - sand ratio, gravel pack thickness, gravel selection, gravel packing fluid & gravel pack techniques.</p>	20	9
3.	<p>Production System Analysis & Optimization:</p> <p>Self-flow wells - PI & IPR of self-flowing and artificial lift wells, production testing - back pressure test, flow after flow test & isochronal test, surface layout, test design & analysis of test data. Production characteristics of Horizontal and multilateral wells - coning, IPR & skin factor. Multiphase flow in tubing and flow-lines. Sizing, selection and performance of Tubing, chokes and surface pipes. Production Optimization – Nodal System analysis.</p>	26	12
4.	<p>Introduction to Artificial Lift Techniques</p> <p>Principle and application of artificial lift methods- Rod Pump (SRP/PCP), Gas Lift (Continuous/Intermittent), Electric submersible Pump (ESP), Hydraulic lifts (Jet Pump) etc.</p>	27	12

Texts and References:

1. Dr. GuoBoyun , Computer Aided Petroleum Production Engineering
2. H Dale Begg , Production Optimization , OGCI Publication ,tulsa.



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3. Kermit Brown, Technology of artificial lift method –. Vol2a ,2b.Penwell publishing company, Tulsa.

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DEPARTMENT OF PETROLEUM ENGINEERING

PROPOSED SYLLABUS FOR 4th SEMESTER B. TECH. PROGRAMME

HEAT AND MASS TRANSFER LAB

(SUBJECT CODE: 203120252)

Type of Course: B.Tech

Prerequisite: Laboratory

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.	
0	2	0	2	-	20	-	-	30	-	25	50

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

Content:

Sl no.	Title /Aim of the Experiments	Course Nature
1	Determination of thermal conductivity of solids	Heat Transfer
2	To study the performance of 1-2 fixed tube sheet heat exchanger and calculate overall heat transfer coefficient	Heat Transfer
3	Determination of Heat transfer coefficient in laminar flow	Heat Transfer



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4	To compare overall heat transfer coefficients for parallel flow and counter flow in double pipe heat exchanger	Heat Transfer
5	To determine the % extraction of diluted aqueous organic solution using suitable solvent.	Mass Transfer
6	Determine mass transfer co-efficient of liquid (water) evaporation to atmospheric air at elevated temperature.	Mass Transfer
7	To determine the efficiency of single stage leaching operation.	Mass Transfer
8	To determine the diffusion co-efficient of CCl ₄ in air & it's variation with temperature.	Mass Transfer



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DEPARTMENT OF PETROLEUM ENGINEERING

PROPOSED SYLLABUS FOR 4th SEMESTER B. TECH. PROGRAMME

ELEMENTS OF RESERVOIR ENGINEERING LAB

(SUBJECT CODE: 203120255)

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.	
0	2	0	2	-	20	-	-	30	-	25	50

RESERVOIR ENGINEERING LAB	
Sl. no	LIST OF EXPERIMENTS/APPARATUS
1	Preparation of cylindrical Core Plug from the sample by using core plugger.
2	To Trim a Core sample (obtained from plugging machine) using Trim Saw machine and measure its length.
3	Determination of Effective porosity of given core sample by saturation method.
4	Determine the Permeability of given sample by using Ruska Liquid Permeameter
5	Permeability measurement by using Gas Permeameter



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6	Determine the viscosity of oil sample by using capillary viscometer (Ostwald viscometer).
7	Determination of Density of given oil sample using pycnometer and hydrometer.
8	Determination of pour point of crude oil.
9	BHP chart analysis using travelling microscope.
10	Determination of emulsion stability