University of Pune

Two Year M. Sc. Degree Course in Petroleum Technology

M.Sc. Petroleum Technology Part II Syllabus (Credit System)

(To be implemented from Academic Year 2014-15)

Equivalence of previous syllabus along with proposed syllabus

EQUIVALENCE

Semester	Present Courses (2008 Pattern)			Proposed Courses (Credit Based System)	
	Course Code	Course Name		Course Code	Course Name
III	PT - 9	Reservoir Dynamics		PT - 9	Reservoir Dynamics
	PT - 10	Formation Evaluation - I		PT - 10	Formation Evaluation - I
	PT - 11	Drilling and Well Completions		PT - 11	Drilling and Well Completions
	PT - 12	Fundamentals of Computer and Applications (Departmental Course)		PT - 12	Sequence Stratigraphy
	PTP - 3	Practicals in above courses		PTP – 5	Practicals in PT-9 & PT - 10
				PTP – 6	Practicals in PT-11 & PT - 12
				FWPW C- 3	Project Work Component
IV	PT - 13	Reservoir Performance		PT - 13	Reservoir Performance
	PT - 14	Formation Evaluation - II		PT - 14	Formation Evaluation - II
	PT - 15	Production Operations		PT - 15	Production Operations
	PTP - 4	Practicals in above courses		PT - 16	Introduction to Mud logging& Mud Engineering
				PTP - 7	Practicals in PT-13 & PT - 14
				PTP - 8	Practicals in PT-15 & PT - 16
				FWPW C- 4	Project Work Component

Course-wise Syllabus Semester III

UNITS TOPICS NO. OF LECTURES

PT-9: Reservoir Dynamics (4 Credits)

Unit 1.

Reservoir Geological Description : Characterisation and properties, sedimentary processes and environments related to reservoir development.

Reservoir Conditions :

Réservoir pressure: Réservoir pressure measurement, gradient, sources, anomalous pressure conditions. Reservoir temperature: temperature measurement, geothermal gradient, sources of heat energy. Phenomenon of interface amongst reservoir fluids: surface tension, interfacial tension, adhesion tension, formation of emulsion, wet ability, capillary pressure, and influence of these properties on oil and gas displacement in reservoir. Viscosities of water, natural gas and oil. Fluid compressibility under reservoir conditions.

Reservoir static and dynamic modeling

Drive Mechanisms: Natural sources of energy and their characteristics.

a) Dissolved gas drive b) Gas cap drive c) Water drive d) Gravitational segregation e) Combination drive.

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Unit 2:

Types of Petroleum Reservoirs:

a) Saturated and under saturated reservoirs b) Volumetric and non-volumetric reservoirs c) Finite and infinite reservoirs d) Gas reservoirs: perfect gas law, specific gravity of gases, real gases, gas volume factor, densities and gradients. e) Gas condensate reservoirs: characteristics. f) Under saturated oil reservoirs: solubility of gas, formation volume factor, compressibility of reservoir fluids**.**

Mechanics of Fluid Flow In Porous Media : Classification of reservoir fluid flow system, Darcy's law, linear flow of incompressible fluid – steady state, radial flow of incompressible fluid – steady state, Poiseuille's law for capillary flow – unsteady state, radial flow of compressible fluid (diffusivity equation and its applications.)

Unit 3: 15

Influence of Reservoir Conditions on Producing Characteristics of an Oil Well

a) Pressure conditions around a flowing well. b) Effect of following on pressure conditions in reservoir: Permeability and thickness of formation, rate of production, gas and water coning, WOR, GOR, casing and channel leak, stratified formation, gas and water production trends in reservoir.

PVT Studies: Obtaining the data and evaluation**.**

Unit 4:

Estimation of Hydrocarbon Reserves: 15

Gas reservoirs, calculating gas in place by volumetric method, unit recovery, recovery factor under water drive and Material Balance Equation (MBE). b) Under saturated oil reservoirs: calculation of initial oil in place by volumetric method and estimation of oil recoveries (unit recovery and recovery factor), Material Balance Equation. c) Oil reservoirs under simultaneous drives (dissolved gas drive, gas cap

drive and water drive.) d) Generalized material balance equation, its uses and limitations. Selection of PVT data, for Material Balance Equation**.**
Recent trends in reservoir dynamics: CHDT, Probe Analysis etc.
Total Number of Lectures: 60

PT- 10: Formation Evaluation – I (4 Credits)

Unit 1: 15
Logging Environment and Permeable Zone logs
Logging procedures, undisturbed reservoir, disturbance caused by drilling, Petro-physics and log interpretation

Natural Gamma Ray log: Principles :Tools, Tool Calibration, Log representation, Depth of investigation, Vertical Resolution, Qualitative & Quantitative interpretations and Applications**.**
Spectral Gamma Ray log: Principles: Tools, Log representation, Depth of investigation, Vertical Resolution, Qualitative & Quantitative interpretations and applications.
Temperature log: Principles: Tools, Log representation, Depth of investigation, Vertical Resolution, Qualitative & Quantitative interpretations and Applications.
Caliper log: Principles: Tools, Log representation, Depth of investigation, Vertical Resolution, Qualitative & Quantitative interpretations and Applications.

Unit 2: 15
Resistivity log:
Resistivity logs: Principles, Tools, Classification and Applications of Induction log, EPT logs
Self Potential log: Principles: Tools, Log representation, Depth of investigation, Vertical Resolution, Qualitative & Quantitative interpretations and Applications.
Dielectric log: Principles, Tools, Log representation, Depth of investigation, Vertical Resolution, Qualitative & Quantitative interpretations and Applications.

Unit 3: 15
Special Applications for Formation Evaluation
Wire - line Logging: Petro-physics and log interpretation principles, Bore-hole Environment and logging practices.
Logging While Drilling (LWD): Principles, properties measured, instruments and application.
Measurement While Drilling (MWD): Principles, properties measured, instruments and application.
Dip meter Log: Principles, properties measured instruments and application.

Unit 4: 15
Direct Measurements of Subsurface formation
Core Logging: Conventional coring method, cleaning, marking and packing, transportation and storage of cores. Properties studied from cores, Preparation of core log.
Formation Rock and Fluid Sampling Methods:
Rock sampling (side wall and slim hole), Fluid sampling and Pressure

measurements: Formation tester, Formation interval tester, Repeat Formation tester, Fluid sampler applications.

Drill Stem Testing (DST): Open hole and Cased hole test, surface equipments, DST assembly, sequence of events in a simple DST, applications.

MDT: principles, measurement and applications.

Total Number of Lectures: 60

PT- 11: Drilling and Well Completions (4 Credits)

Unit 1: 15

Introduction to Well Planning: Well planning objectives, Classification of well types, planning costs, Overview of the planning process.

Rotary Drilling: Drilling Team; Drilling Rigs: Onshore (Land rigs: Fixed & Portable rigs); Offshore: Mobile (Jack–Up, Semi-Submersible, Submersible, Drill – Ships); Fixed: Platform
Rigs, Major Rig Components.

Rig Systems: Power, Circulatory, Rotary, and Well-Control; Pipe handling equipments, Drill String Design. Drilling Cost Analysis.

Drilling Operations: Spudding-in, Drilling ahead, making a connection, tripping operations, monitoring the drilling process (Depth, ROP, WOB, WHO etc).

Unit 2: 15

Rotary Drilling Bits: Types of Bits: Roller cone Bits, Design Factors (Journal ample, Cone offset, Teeth Bearing (Anti-friction, friction), Bearing Lubrication. Fixed cutter Bits (PDC, TSP, Diamond Bits, Drag Bits). Criteria for Bit Selection.

Rig Hydraulics: Introduction, Pressure Losses, Surface Connection losses, Pipe, Annular losses, and Pressure drop across bit, Optimization of Bit hydraulics, Surface pressure, Hydraulic Criteria, Nozzle selection, Optimum Flow rate.

Mud chemistry & Engineering: Principle, Types of drilling muds, functions, applications, mud chemicals and properties etc.

Unit 3: 15

Vertical & Directional well Drilling:

Vertical well Drilling: Causes of Hole deviation (Mechanical factors, Formation characteristics) Bottom Hole Assembly (Slick, Pendulum, Packed); Measurement of hole verticality.

Directional Drilling: Reasons for directional drilling. Geometry of a directional well; Types of Directional Wells; Bottom Hole Assembly for directional wells; Directional Survey Instruments; Deflection Tools; Dog leg in directional wells.

Complications In the Course of Drilling: Formation Pressures – concept, causes and effects; Abnormal pressure conditions, Pipe sticking (Differential, Mechanical, Key – seating) Causes and Preventive measures, Lost circulation – Definition, Location of lost circulation zeros, Effect of lost circulation, curing of lost circulation, Lost circulation material; Fishing Operations (Situations requiring fishing Job. Fishing Tools)

Pressure Control: Causes of Kicks & Blowouts, Indications of well kick & short in procedure, Classic pressure control procedures (Drillers method, Wait & Weight method)

Unit 4: 15

Well Completion Practices:

A) Casing: Casing policy & design; Functions of Casing, Types of casing (Structural /Drive pipe, Conductor Casing, Surface casing, Intermediate or protective casing, production casing liners& their types. Casing Accessories, Strength properties (Yield strength, collapse strength, burst strength), Setting depth design procedures.

B) Cementation: Principles & practices; Introduction, Manufacture & Composition of Cements, General properties of oil well cements (Viscosity, thickening time, Density, Yield, Fluid loss, Free water, compressive Strength) Cement Additives (Density

Control, Accelerators, Retarders, Fluid-loss additives, Friction reducers, Lost circulation material, special cement). Job planning & execution. Primary & Secondary cementing Methods-Cement Evaluation (Temperature log, radioactive tracers, Acoustic Logging Tools), deciding number of stages, block cementation vs. blind squeeze.

C) Well Completion Design: Controlling factors, Reservoir considerations, Mechanical Considerations, Method of Completion,

Types of Completions: Open hole, Cased hole & perforated completions; Liner Completion, Tubing less Completions, Casing with suspended tubing completions. Conventional Tubular Configurations – Single & Multiple Zone Completions, Unconventional Tubular Configurations, Sizing Production Tubulars. Completion Intervals identification.

Types of tubular strings, Types of Tubing - packer completions: (Single string & Single packer, Commingled; Advantages & Disadvantages of the different types of completions; Packers: Functions & Types, Packer fluids; Perforations: Types, design, Methods, evaluation of perforator performance; perforation clusters, Practical Considerations. Completion Fluids.

Sub surface Control Equipments: Surface safety and catastrophe systems, bottom hole chokes and regulators, subsurface injection safety valves.

Total Number of Lectures: 60

PT- 12: Sequence Stratigraphy (4 Credits)

Unit 1: 15

Introduction to sequence stratigraphy: Historical Development, Interdisciplinary nature of sequence stratigraphy, Fundamental concepts of sequence stratigraphy: definitions and terminologies (accommodation space, Absolute and relative sea-level fluctuations, surfaces, system tracts, sequences, parasequences etc). Methods of Sequence Stratigraphic Analysis (introduction facies analysis: outcrops, core, and modern analogues, well logs, seismic data, Age determination, age determination techniques, workflow of sequence stratigraphic analysis)

Unit 2: 15

Basic concepts of Base level changes, accommodation and shoreline Shifts: Base level cycles, allogenic controls on sedimentation: significance and signatures,

sediment supply and energy flux, sediment accommodation (Definitions—Accommodation, Base Level, and Fluvial Graded Profiles, Proxies for Base Level and Accommodation, Changes in Accommodation), shoreline trajectories (Definitions, Transgressions, Forced Regressions, Normal Regressions), Stratigraphic surfaces: types of stratal terminations, sequence stratigraphic surfaces, system tracts (LST, TST, HST, FSST, RST, L&HAST).

Unit 3: **15**

Sequence Models: Types of stratigraphic sequences**,** sequences in fluvial systems**,** sequences in coastal to shallow-water clastic systems, sequences in deep-water clastic systems**,** sequences in carbonate systems.

Unit 4: **15**

Significance of Sequence Stratigraphy: Uses and Abuses of sequence stratigraphy, theory vs. reality in sequence stratigraphy, the importance of the tectonic setting, Precambrian vs. Phanerozoic sequence stratigraphy.

Total Number of Lectures: **60**

PTP V: Practicals related to PT – 9 and PT – 10 (4 Credits)

Unit 1: Reservoir Dynamics (2 Credits)

	TOPICS
1	Fluid flow of Reservoirs.
2	Calculation of net volume of reservoir
3	Calculation of Formation volume factor from surface data.
4	Behavior of gases at reservoirs.
5	Calculation of formation volume factor from charts.
6	Diffusivity equation and its practical applications.
7	The perfect Gas Law.
8	Estimation of hydrocarbon Reserves.
9	Specific gravity of reservoir fluids & gases.
10	Applications of Computer in Reservoir Studies.

Unit 2: Formation Evaluation – I (2 Credits)

	TOPICS
1	Principles of Wire-line logging Borehole Environment Examples of Log Scales Logging Header
2	Caliper Log:- Behavior of Caliper log, its interpretation & applications
3	Temperature Log:- a) Behavior of Temperature log, its interpretation & applications b) Estimation of Formation Temperature
4	Self Potential Log: - a) Examples of SP deflection from the Shale Baseline. b) Qualitative analysis of SP Log. c) Quantitative analysis of SP Log (Raw& Shale Volume Calculations)
5	Resistivity Log: - a) Basics of Resistivity. b) Illustrations of SP and Resistivity patterns. c) Example of DIL through Water bearing zone. d) Example of DLL through Water bearing zone. e) Example of DIL through HC bearing zone. f) Example of DLL through HC bearing zone. g) Calculation of Rt using Tornado Chart using DIL & DLL
6	Interpretations of a) GR, Caliper & Resistivity Logs. b) SP, Caliper & Resistivity Logs. c) GR, Caliper & Induction Logs. d) Calculations of Shale Volume using Gamma Ray Log
7	Use of Computers in Formation Evaluation.

PTP VI: Practicals related to PT – 11 and PT – 12 (4 Credits)

Unit 1: Drilling & Well Completions (2 Credits)

1	Rig power system.
2	Pump stroke calculations.
3	Drill collar weights.
4	Mud weight – computation.
5	Mud calculations.
6	Pressure Loss calculations
7	Cementation.
8	Dog leg Severity
9	Orientation of the Deflected Tools.
10	Pull required to stuck pipe.
11	Life of a well.
12	Applications of Computer in Drilling Operations.

Unit 2: Sequence and Seismic Stratigraphy (2 Credits)

1	Descriptions of basic concepts in seismic and sequence stratigraphy
2.	Identification of surfaces and sequences in outcrop exposures.
3.	Interpretation of seismic profiles in different settings
4.	Correlation of seismic logs
5.	Construction of Wheeler charts

Semester IV

PT- 13: Reservoir Performance (4 Credits)

Unit 1: 15

A) **Introduction:** Activities in reservoir engineering, role of reservoir engineers, physical principles of reservoir engineering**.**

B) **Pressure Buildup and Flow Tests In wells:** Uses of pressure information in petroleum engineering, types of pressure information, pressure build-up analysis (Horner's method), pressure drawdown analysis, multiple rate flow test analysis, drill stem test pressure analysis, pulse testing, importance of pressure analysis methods, injection well testing.

Unit 2: 15

A) **Reservoir Performance:** Permeability curves, reservoir limit tests (RLT), permeability and rate of production from reservoir parameters, productivity tests.

B) **Pressure Transient Analysis:** Diffusivity equation and its solution, indicator diagram, IPR, Pseudo-pressure analysis, Flowing-well performance.

Unit 3: 15

A) **Development of Oil and Gas Fields:** Theoretical fundamentals of development: Objective, criteria for rational development, parameters for development plan, stages of development**.**

B) **Enhanced Oil Recovery:** Significance, secondary recovery of crude oil, initial production of oil, pressure maintenance, water flooding, and immiscible gas injection. Tertiary recovery of crude oil (miscible and thermal techniques), oil recovery by nuclear explosion, future of enhanced oil recovery.

Unit 4: 15

A) **Reservoir Simulation:** Introduction, incentives for reservoir simulation; modeling concepts: Designing a reservoir model: Tank model, one-dimensional models, 2D aerial models, 2-D cross sectional and radial models, multi-layer models, 3 D models, representation of reservoir fluids and reservoir rocks, well models – coupling between well and reservoir. Selection of data, selecting grid and time step sizes.

B) **Forecasting future performance:** History matching, simulating special processes, Trends in oil field management.

Total Number of Lectures: 60

PT- 14: Formation Evaluation – II (4 Credits)

Principles, tools used (Vertical resolution VS and depth of investigation DOI), scale and representation of logs with their units, calibration and qualitative and quantitative applications of the following logging methods:

Unit 1: 15

Density Log: (Pair Production, Compton Scattering, Photo-electric effect), Absorption equation, Depth of investigation, Vertical resolution, relation between the electronic density and bulk-density, Environmental effects, Geological factors (Rock composition, rock texture, sedimentary. Structure, temperature, pressure, depositional environment-sequential evolution); Applications.

Litho–Density Log: Photo-electric interaction, definition of the photoelectric absorption index, ρe of a composite material, Geological factors affecting measurements, Environmental effects on measurement; (Mineralogical composition of the formation, fracture detection, sedimentological studies)

Neutron Log: Measurement of the apparent hydrogen index, Neutron logs and sources, Calibration and logging units, Tools, Depth of investigation, Vertical resolution, Measurement point, Factors influencing Measurement, Interpretation, Environmental effects, Geological factors affecting the hydrogen index.

Unit 2: 15

Thermal Decay Time Log: Neutron Capture and diffusion, Measurement of the neutron population and Capture cross-section, Measure points, Factors influencing the ρ_e measurement (The matrix ρma, Porosity, Fluids, Shales, Acidization). Environmental effects, Geological factors affecting the ρ_e measurement.Porosity and gas indication (porosity, gas indication from the count rates).

Acoustics / Sonic Log:

Acoustic Log: Fundamentals (Acoustic signals, period T, frequency f, Wavelength λ, Acoustic waves, Compressional or longitudinal waves, Transverse or Shear waves, Sound wave velocities, Sound wave propagation, Reflection and refraction of waves, Acoustic impedance, Reflection Coefficient, Wave interference.)Measurement of sonic attenuation and amplitude:-Cement Bond Log and Variable Density Log.

Sonic Log: Principle of the Sonic Log, Earlier Tools, and Borehole compensated tool, Measure point, depth of investigation, vertical resolution and units.Factors influencing measurement (the matrix, porosity and fluids, temperature and pressure, texture). Interpretation. Environmental and other effects (Transit time stretching, Cycle skipping, Kicks to smaller Δt, The borehole, Invasion, Radial cracking effects).Travel time integration. Sonic log rescaling. Determination of Elasticity parameters using logs.

Micrologs: Principles, Tools, Interpretations and Applications.

Unit 3: 15

Nuclear Magnetic Resonance Log: Introduction, Principle, Tool, method of measurement, signal processing Geological and Environmental factors influencing measurement, Interpretation, Applications.
Image Logs: Tool Design, Scale, representation and applications of Resistivity Imaging, Acoustic Imaging, Density Imaging, and Azimuthal Gamma Imaging

Unit 4: **15**
Crossplots and Overlays: Porosity Overlays: Selection of Logs for Overlays, Gas detection from overlays.
Two-porosity Lithology Cross plots :- Introduction, The Acoustic-Density Cross plots, Effect of Secondary porosity, Effect of Gas and Shale, Mineral Identification – Evaporites, Sulphur, Coal, Metallic ores, Oil Shale.
The Density-Sidewall Neutron Cross plot: – Use, Effect of Gas and Shale**.**
Gas Saturation Cross plots- Use, Effect of Shale and Invasion Effects.
Shale Cross plot: Introduction, Density-Neutron Cross plots.
Interpretations: Determination of porosity and lithology: Using lithology-porosity charts (M-N cross plot & MID cross plot)
Determination of: Absolute permeability & Relative permeability
Total Number of Lectures **60**

PT 15: Production Operations (4 Credits)

Unit 1: 15

Geological Consideration in Producing Operations: Introduction, Geologic factors affecting reservoir properties in sandstone and carbonate reservoirs.

Reservoir considerations in well completions: Fluid flow and pressure distribution around well bore and effects of reservoir considerations in well characteristics on well completion;

Problem Well Analysis: Problem wells, Problem Well Analysis Checklist.

Through-tubing Production Logging: Logging devices, Application of Through-Tubing Production Logging.

Unit 2: 15

Sand control: Definition; Mechanical methods of sand control, Practical considerations in gravel packing.

Formation Damage: Occurrence and significance; Basic effects of clays and water on damage, Reduced relative permeability; Increased fluid viscosity;

Surfactants for Well treatments: Characteristics; use and action of surfactants, well stimulation with surfactants.

Unit 3: 15

Acidizing: Acids used; Acid additivites, Carbonate and Sandstone Acidizing;

Hydraulic Fracturing: Introduction, mechanics of fracturing, propping the fracture, frac fluids, frac job design and performance;

Scale deposition: Causes, prediction and identification of scale, Scale removal and prevention;

Corrosion Control: Introduction, types of corrosion, corrosion control.

Unit 4: 15

Workover: Conventional Production Rigs, Non – conventional Workover Systems; Concentric Tubing Workovers; artificial lift.

Workover Planning: Reasons and applicability under different conditions; Workover Economics.

Completion and Workover Fluids: Selection criteria, clear water and oil fluids; water base and oil base muds; perforating and packer fluids; well killing.

Total Number of Lectures: 60

PT- 16: Introduction to Mudlogging& Mud Engineering (4 Credits)

Unit 1: 15

Objectives and duties of Mud Logger: Mud-logging unit, users, personnel and their duties. Use of Mud logging for safety, efficiency and formation evaluation, outputs from ML unit. Rig up and rig down.

Lag Time: Lag time and lag strokes, onshore and offshore differences, Lag time

calculation and verification.

Mud-logging Sensors: Data acquisition, Mud logging parameters, placement of sensors, principles of sensors as Depth, WHO, SPP, SPM, Torque, Flow out, Pit level, RPM, WHP, Mud resistivity, Mud weight, H_2S, HC Gas acquisition. Maintenance and calibration of equipments.

Chart Interpretation and Monitoring: Instantaneous and lagged parameters, data presentation, monitoring drilling logging, interpretation of events from charts as tripping, circulation, drilling, kick, check of lag time, gas chart etc.

Unit 2: 15

Sample collection: Different type of samples and methods of collection.

Cutting Sample description: Type of samples, collection and packing of samples, Cutting description, fluorescence and cut. Calcimeter, flurometer.

Coring: Conventional and other coring methods, cleaning of core, marking and packing, transportation and storage of cores. Properties studied from cores, Preparation of core log.

Unit 3: 15

Master Log & Well Report: Scales of log, plotting of different parameters, interpretative lithology, abbreviations, Descriptions and remarks.

Hydrocarbon Gas: Physical properties of gas, terminology, coal gas, hydrates, porosity permeability and gas, terms for recorded as BG, TG, CG, peak gas, degasser, and gas-detection system, inferences from recorded gas, gas diagrams and ratios.

Subsurface Pressures: Hydrostatic pressure, normal and over pressure, overburden, causes of overpressure, detection of over pressure, pressure log, kick indicators.

Unit 4: 15

Mud Engineering: Fundamentals of Fluid flow (Fluid flow, viscosity), Types & Flow (Laminar, Turbulent). Criteria for the type of flow. Types of Fluids (Newtonian & Non-Newtonian), Viscometers.

Mud Engineering: Functions of Drilling Mud, Types of Drilling muds (Water-base & Oil base) & their Chemical Additives.

Mud Properties: Mud Weight, Rheological Properties, pH, Filtrate and filter cake.

Mud Contaminants: NaCl, Anhydrite, Gypsum, and Cement.

Conditioning equipment: Shale shaker, sand trap, degasser, de-sander and de-silter.

Under balanced Drilling: Equipment and process.

Total Number of Lectures: 60

PRACTICALS

PTP VII: Practicals related to PT – 13 and PT – 14 (4 Credits)

Unit:-1 Reservoir Performance (2 Credits)

1	Pressure buildup tests for oil reservoir
2	Productivity Index tests.
3	Calculation of Unit Recovery.
4	Material Balance Equation.
5	Pressure buildup tests for gas reservoirs.
6	Gas Deviation factor.
7	Productivity tests.
8	Estimation of feature behaviors of reservoir
9	Problems on Improved Oil Recovery (IOR)
10	Problems on Reservoir stimulation
11	Applications of Computers in Reservoir Studies.

Unit 2: Formation Evaluation II (2 credits)

	Topics
1	Porosity determination from sonic log
2	Determination of water saturation
3	Determination of spacing between transmitter & receiver of sonic log
4	Determination of porosity from sonic log and correlating porosity values using compaction correction
5	Determination of shale percentage and (Φ correction from neutron –density log
6	Cross plots and overlays
7	Determination of shale percentage &(Φ correction from neutron- density cross plot
8	Porosity estimation in hydrocarbon zones $\Phi_{(N)}$&$\Phi_{(D)}$
9	Density- Side Wall Neutron log analysis
10	Determination of formation mineralogy
11	Interpretation of logs- GR, Calliper, $\Phi_{(N)}$, $\Phi_{(D)}$
12	GR, Calliper& Sonic
13	Matrix identification using: a) RHOB & NPHI cross plot; b) Δt & NPHI cross plot
14	Interpretation of GR, Caliper, $\Phi_{(N)}$, $\Phi_{(D)}$ Log.
15	Uses of Computer in Formation Evaluation.

PTP VIII: Practicals related to PT – 15 and PT – 16 (4 Credits)

Unit 1 : Production Operations (2 Credits)

1	Hydraulic Fracturing
2	Acidizing
3	Calculation of static injection pressure
4	Oil and Gas Separator design
5	Applications of Computers in Production Operations.
6	Skin due to Incomplete Perforations
7	Use of Computers in Production Operations.

Unit 2: Mud logging & Mud engineering (2 credits)

	Title
1	Calculation of Pressure gradient using mud weight.
2	Hydrostatic Pressure calculations using mud weight and depth.
3	Conversions: Pressure into mud weight, specific gravity to mud weight, specific gravity to pressure gradient.
4	Hydrostatic Pressure calculations- while pulling wet and dry pipe out of hole.
5	Surge and Swab pressures during tripping.
6	Lag Time Calculation
7	Pit Gain calculations.
	Calculations related to Drilling Fluids:-
8	Increased mud density/ reduce mud density. Mud weight calculation
9	Problems related to Mixing of fluids different densities.
10	Oil based mud calculations.
11	Oil/Water ratio calculations.
12	Uses of Computer in Mud logging& Mud Engineering.

REFRENCE BOOKS FOR SEM III AND SEM IV

Sr. No.	Book Title	Author
1	Reservoir Engineering	Clerk
2	Geology of Petroleum	I.A. Leverson
3	Petroleum Reservoir Engineering	Craft And Hawkins
4	Petroleum Geology	F.K. North
5	Petroleum Reservoir Engineering	Amyx, Bass, Whitting
6	Oil Reservoir Engineering	Sylvain J. Pirson
7	Encyclopedia of Well Logging	Robert Desbrandes
8	Fundamentals of Well Log Interpretation	O' Serra
9	Geologic Well Log Analysis	Sylvain J. Pirson
10	Field Geologist Training Guide	Alun Whittaker
11	Mud Logging Hand Book	Alun Whittaker
12	Geological Interpretation of Well Log	M.H. Rider
13	Fundamentals of Quantitative Log Interpretation	Schlumberger
14	Applied Drilling Engineering,	Text Book Series,Vol. 2.
15	Drilling Practices; Presented Richard S. Corden. (Tulsa Publications)	Robert D. Grace, Jerald L. Shursen, Richard S.Cardon
16	Oil well Drilling Engineering (Principles & Practices)	H. Rabia
17	Drilling Engineering (Pennwell)	Neal J. Addams
18	Field Geologist's Training Guide (Prentice Hall.)	Edited By Alun Whittaker
19	Oil Well Drilling Technology	McCray and Cole
20	Fundamentals of Drilling Technology and Economics	J.L. Kennedy
21	Drilling Technology Vol. I & II	J.A. 'Jim' Short
22	The Drill Stem	API Manual
23	Well Design, Drilling and Production	Craft, Holden, and Graves
24	Petroleum Engineering- Drilling and Completion Well	Carl Gatlin
25	Practical Well Planning and Drilling Manual	Steve Devereax
26	Hydrocarbon Reservoir and well performance	T. E. W. Nind
27	Enhanced Oil Recovery	L W Lake
28	Reservoir simulation	Calvin Mattax & R. L.Dalton
29	Numerical Reservoir Simulation	Brij Nandan et al.,

30	Enhanced Oil Recovery Editor	M. M. Schumacher
31	Pressure Transient Analysis	J. P. Anand et al.,
32	Worldwide Practical Petroleum Reservoir Engineering methods	Slider H. C.
33	Hand book of well log Analysis for oil and gas formation evaluation	Sylvian J.Pirson
34	Basic well log analysis	D. Krygowski, G. B. Asquith, & C. R. Gibson
35	Fundamentals of Electric Log Interpretation	M.R. Wyllie
36	The Log Analysis Hand book	E. R. Crain
37	Basic well log analysis for geologist	G.B. Asoutts and Gibson
38	Hand book of well log analysis for oil and gas formation evaluation	Sylvian J.Pirson
39	Handbook of sub-surface geology	A.C. Moore
40	Cased Hole and production log evaluation	James. J. Smolen
41	Encyclopedia of well logging	R. Besbrandes
42	Well logging and formation Evaluation	Tony Darling
43	Practical Formation Evaluation	Ransom Robert
44	Production Operation Vol.I & II	Allen & Roberts
45	Introduction to Petroleum Production Vol. II & III	D.R. Skinner
46	Polymer & Surfactant Flooding	Shah
47	Technical Manual For Production Operations IOGPT, ONGCL.	R. K. Mukerjee,
48	Principles of Sequence Stratigraphy, Elsevier	O. Catuneanu.
49	The Sedimentary Record of Sea-Level Change. Cambridge University Press,	Coe, A. L.
50	Best Practices in Sequence Stratigraphy: For Explorationists and Reservoir Engineers. Editions TECHNIP, Technology & Engineering	P. Homewood, P. Mauriaud, F. Lafont, J. Dumay, P. Sorriaux
51	The Geology of Stratigraphic Sequences. (Springer)	A. Miall
52	Sequence Stratigraphy, (John Wiley & Sons)	D. Emery, K. Myers
53	Sequence Stratigraphy of Foreland Basin Deposits: Outcrop and Subsurface Examples from the Cretaceous of North America, (AAPG).	J.C.Van Wagoner, G.T. Bertram
54	Siliciclastic Sequence Stratigraphy in well logs, cores, and outcrops: concepts for high-resolution correlation of time and facies, (AAPG).	J.C.Van Wagoner
55	Carbonate Sequence Stratigraphy: Recent Developments and Applications (AAPG)	R.G. Loucks, J.F. Sarg