UNIVERSITY OF PUNE

M.Sc (Applied) PETROLEUM TECHNOLOGY

(w.e.f. June 2008 for semester 1 and 2 and June 2009 for semester 3 and 4)

Semester I:

PT 1 Fundamentals of Petroleum Geology
PT 2 Principles of Sedimentology
PT 3 Interpretative Micropalaeontology & Stratigraphy
PT 4 Structural Techniques in Petroleum Exploration
PTP 1 Practical

Semester II:

PT 5 Fundamentals of Petroleum Geochemistry
PT 6 Depositional System Analysis and Petroliferous Basins of India
PT 7 Petroleum Exploration
PT 8 Environmental Management and Economics
PTP 2 Practical (Tour Report)

Semester III :

PT 9 Reservoir Dynamics
PT 10 Formation Evaluation I
PT 11 Drilling and Well completions
PT 12 Fundamentals of Computer and applications (Departmental Course)
PTP 3 Practical

Semester IV :

PT 13 Reservoir Performance
PT 14 Formation Evaluation II
PT 15 Production Operations
PTP 4 Practical
PTP 5 Project (Minimum 3 Weeks in an Oil Industry)

Note :

1. **Practical Examinations will be conducted at the end of each semester.**
2. **Their will be Four Theory and One Practical course in semester I, II and III.**
3. **Semester IV consists of Three Theory and Two Practical.**
4. **Practical PTP-4 is based on three theory courses of that semester where as PTP-5 consists of Project work .**
5. **Each Theory Course will be of 48 Hours duration and Practical of 90 Hours.**
6. **Each External theory Paper(University and Departmental) will be of 80 marks and 20 marks for internals.**
7. **The Internal marks will be given on the basis of continues assessment of students which will be in the form of tutorials, seminars, tests, attendance etc.**
8. **The PTP-5 practical consists of Project work of Minimum three weeks. The external examiners will conduct the Viva Voce and assess the project work for 80 marks and 20 internal marks will be assessed based on the performance at the project sites by the in charge and the internal guide .**

PT-9- RESERVOIR DYNAMICS

Unit No	Title	No of Lectures
1.	**Reservoir Conditions**	(06)
2.	**Drive Mechanisms**	(06)
3.	**Types of Petroleum Reservoirs**	(05)
4.	**Mechanics of Fluid Flow In Porous Media**	(10)
5.	**Influence of Reservoir Conditions on Producing Characteristics of an Oil Well**	(04)
6.	**PVT Studies**	(05)
7.	**Estimation Of Hydrocarbon Reserves**	(10)
8.	**Recent Trends in Reservoir Dynamics**	(02)
Total		48

Unit 1. Reservoir Conditions :

Reservoir pressure : reservoir 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, influence of these properties on oil and gas displacement in reservoir.

Viscosities of water, natural gas and oil, fluid compressibility under reservoir conditions.

Unit 2. 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

Unit 3. 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**.**

Unit 4. 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, Poiseulle's law for capillary flow – unsteady state, radial flow of compressible fluid (diffusivity equation and its applications.)

Unit 5. 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.

Unit 6. PVT Studies : Obtaining the data and evaluation**.**

Unit 7. Estimation Of Hydrocarbon Reserves :
a) 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**.**

Unit 8. Recent trends in reservoir dynamics :
CHDT, Probe Analysis etc

REFERENCE BOOKS	**Name of the Authors**
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	**Pirson**

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PT- 10- Formation Evaluation – I

UNIT NO.	NO. OF LECTURE	NO. OF LECTURE
1.	Mud Logging	03
2.	Measurement While Drilling	03
3.	Logging While Drilling	03
4.	Core Logging & Drill Stem Testing	02
5.	Wire - line Sampling	02
6.	Wire - line Logging	27
7.	Applications	08
Total		48

Unit 1. Mud Logging :

Introduction, Sample collection and analysis techniques, properties studied, gas detection techniques, shale density analysis, calcimetry, dolomimetry, study of thin section and core analysis. Interpretation of the collected data.

Unit 2. Measurement While Drilling (MWD)

Principles, Properties measured, instruments and application.

Unit 3. Logging While Drilling : (LWD)

Principles, Properties measured, instruments and application.

Unit 4. Core Logging & Drill Stem Testing :

Core Logging :

Conventional coring method, cleaning, marking and packing ,transportation and storage of cores. Properties studied from cores, Preparation of core log;

Drill Stem Testing(DST):

Open hole and Cased hole test, surface equipments, DST assembly , sequence of events in a simple DST, Applications;

Unit 5. Wire - line Sampling :

Rock sampling(side wall and slim hole), Fluid sampling and Pressure measurements :

Formation tester, Formation interval tester, Repeat Formation tester, Fluid sampler applications;

Unit 6. Wire - line Logging :

Introduction :

Petrophysics and log interpretation principles, Bore-hole Environment and logging practices :

Principles :

Tools, Log representation, Depth of investigation, Vertical Resolution, Qualitative & Quantitative interpretations and Applications of following methods :

Temperature log ; Caliper log : Self Potential log : Resistivity log :
Induction log ; Dielectric log : Natural Gamma Ray log :
Spectral Gamma Ray log

Unit 7. Applications :

a) Identification of Permeable layers using :
i) SP log ii) Invasion of layers iii) Microlog iv) Caliper log ;

b) Measuring thickness of beds using :
i) SP log ii) Resistivity log iii) Microresistivity log iv) Gamma Ray log

c) Wettability & Water-wet formations :
i) SP Method ii) Rxo/Rt ratio iii) Hingle plot iv) Pickett Cross-Plot
v) Rwa Method vi) Variable Rwe vii) Clean formation saturation
viii) Residual hydrocarbon saturation ix) Depleted- layer saturation

REFERENCE BOOKS	**Name of the Authors**
1. Encyclopedia of Well Logging	**Robert Desbrandes**
2. Fundamentals of Well Log Interpretation	**O' Serra**
3. Geologic Well Log Analysis	**Pirson**
4. Field Geologist Training Guide	**Alun Whittaker**
5. Mud Logging Hand Book	**Alun Whittaker**
6. Geological Interpretation of Well Log	**M.H.Rider**
7. Fundamentals of Quantitative Log Interpretation	**Schlumberger**

PT-11 : Drilling & Well Completion Operations

Unit No	Title	No of Lectures
1	**Introduction to well planning:**	2
2	**Rotary drilling**	13
3	**Rotary Drilling Bits**	3
4	**Drilling Fluids**	5
5	**Rig Hydraulics**	5
6	**Straight & Directional Hole Drilling**	6
7	**Complications In the Course of Drilling**	5
8	**Well completion Practice**	07
9	**Pressure Control**	02
	TOTAL	48

Unit 1 **Introduction to Well Planning:**

Well Planning objective, Classification of well types, Formation pressures, planning costs, Overview of the planning process.

Unit 2 **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 3 **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.

Unit 4 **Drilling Fluids:**

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 Wt. Rheological Properties, pH, Filtrate and filter cake.
Mud Contaminants : NaCl, Anhydrite, Gypsum, and Cement.
Mud Conditioning equipments.
Under balanced Drilling: Advantages & disadvantages.
Introduction to bore-hole strengthening fluids.

Unit 5 **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.

Unit 6 **Straight & Directional Hole Drilling:**

Straight Hole 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.

Unit 7 **Complications In the Course of Drilling:**
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
Drilling in HT-HP wells
Fishing Operations: Situations requiring fishing Job. Fishing Tools.

Unit 8 **Well Completion Practice:**
A) Casing:
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:

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). Primary & Secondary cementing Methods :Cement Evaluation (Temperature log, Radioactive tracers, Acoustic Logging Tools).

C) Types of Completions:

Open hole, Cased hole & Perforated completions; Liner Completion, Tubing less Completions, Casing with suspended tubing completions. Types of Tubing - packer completions: (Single string & Single packer, Commingled completion, Multiple string completion;
Advantages & Disadvantages of the different types of completions;
Packers: Functions & Types, Packer fluids.
Perforations: Types, Methods, Practical Considerations.

Unit 9 **Pressure Control:**

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

	REFERENCE BOOKS	**Name of the Authors**
1.	Applied Drilling Engineering, Text – Book Series, Vol. 2.	SPE
2.	Drilling Practices; Presented by Richord S. Corden. (Tulsa Publications).	Robert D. Grace, Jerald L. Shursen, Richord S. Cardon
3.	Oil well Drilling Engineering (Principles & Practices)	H Rabia
4.	Drilling Engineering (Pennwell)	Neal J. Addmas
5.	Field Geologist's Training Guide (Prentice Hall.)	Edited By Alun Whittaker
6	Oil Well Drilling Technology	McCray and Cole
7	Fundamentals of Drilling Technology and Economics	J.L. Kennedy
8	Drilling Technology Vol. I & II	J.A. 'Jim' Short
9	The Drill Stem API Manual	
10	Well Design, Drilling and Production	Craft, Holden, and Graves
11	Petroleum Engineering- Drilling and Well Completion	Carl Gatlin
12	Practical Well Planning and Drilling Manual	Steve Devereax

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PT-12- Computer Fundamentals and Applications

Unit No	Title	No of Lectures
1.	Introduction	06
2.	Number Systems	04
3.	Memory Managements	05
4.	Computer Software	04
5.	Operating System	04
6.	Analytical /Statistical Tools	04
7.	Application Software	11
8.	Data communication and Computer networks	08
9.	Introduction to 3D modeling / packages	02
	Total	48

Unit 1. Introduction :

Characteristics of computers
Computer generations
Types of computers
Block diagram, different units
Data representation in a computer – bits and bytes, files, directories
Input, output and storage devices

Unit 2. Number Systems :

Non Positional Number System
Positional Number System (Binary, Octal, Hexadecimal number Systems)
Conversion of One Number System to Another

Unit 3. Memory Managements :

Primary Storages
Storage Capacity : Bits, Byte, MB,KB,GB,TB;
RAM, ROM, PROM, EPROM;
Cache Memory, Function of cache Memory;
Secondary Storages: Punch Card, Magnetic Tape, Magnetic Disk, Floppy Disc, CD, DVD, Hard Disk, Pen Drive

Unit 4. Computer Software:

Definition, Relationship between Software and Hardware; Software development steps; Firmware, System Software and Application Software

Computer Languages :

Need, Analogy with natural language, Machine language, Assembly Language, High-Level language, Generations of languages;

Unit 5. Operating System :
Definition and services provided
Evolution of OS
Types of Operating Systems
Comparison between Windows, DOS, Unix and Linux OS

Unit 6. Analytical /Statistical Tools:
Introduction to "R" Statistical software, Simple commands & graphs.

Unit 7. Application Software :
Editors and Word Processors : Structure of a Document, Common Commands, Styles, Formatting;
Spreadsheets : Concept of Spreadsheet, use of financial and statistical functions, graphs
Database Management Systems: basic concepts, tables and queries, designing databases, simple queries, reports.

Unit 8 Data communication and Computer networks:
Basic elements, Data transmission modes, Speed, Transmission media, Digital and Analog transmission, Computer networks, Goals;.
Types of networks : LAN, MAN, WAN, topologies, Wireless communication, communication Protocols, Internetworking devices
Internet: History, Basic services, www, browsers;

Unit 9 Introduction to 3D modeling / packages

REFERENCE BOOKS	**Name of the Authors**
1. Computer Fundamental	**Rajaraman**
2. Inside the PC	**Peter Norton**
3. Computer Fundamentals :	**P K Sinha**
4. Computer Fundamental	**Ram B**
5. Computer Fundamental	**Oka Milind M**

PT- 13 - RESERVOIR PERFORMANCE

Unit No	Title	No of Lectures
1.	Introduction	03
2.	Pressure Build Up and Flow Tests in Wells	08
3.	Reservoir Performance	06
4.	Pressure Transient Analysis	06
5.	Development Of Oil and Gas Fields	04
6.	Enhanced Oil Recovery	08
7.	Reservoir Simulation	11
8.	Trends in oil field management – Techno- Economic;	02
Total		48

Unit 1. Introduction :
Activities in reservoir engineering, role of reservoir engineers, physical principles of reservoir engineering**.**

Unit 2. 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 draw-down analysis, multiple rate flow test analysis, drill stem test pressure analysis, pulse testing, importance of pressure analysis methods, injection well testing.

Unit 3. Reservoir Performance :
Permeability curves, reservoir limit tests (RLT), permeability and rate of production from reservoir parameters, productivity tests.

Unit 4. Pressure Transient Analysis :
Diffusivity equation and its solution, indicator diagram, IPR, Pseudo-pressure analysis, Flowing-well performance

Unit 5. Development of Oil And Gas Fields :
Theoretical fundamentals of development : Objective, criteria for rational development, parameters for development plan, stages of development**.**

Unit 6. Enhanced Oil Recovery:

Significance, secondary recovery of crude oil, initial production of oil, pressure maintenance, water flooding, immiscible gas injection.

Tertiary recovery of crude oil (miscible and thermal techniques), oil recovery by nuclear explosion, future of enhanced oil recovery.

Unit 7. 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,
History matching, forecasting future performance, simulating special processes

Unit 8. Trends in oil field management – Techno- Economic:

	Reference Books	**Name of the Authors**
1.	**Hydrocarbon Reservoir and well performance**	**T E W Nind**
2.	**Enhanced Oil Recovery**	**L W Lake**
3.	**Reservoir simulation**	**Calvin Mattax & R. L. Dalton**
4.	**Numerical Reservoir Simulation**	**Brij Nandan et al.,**
5.	**Enhanced Oil Recovery**	**Editor M M Schumacher**
6.	**Pressure Transient Analysis**	**J. P. Anand et al.,**
7.	**Worldwide Practical Petroleum Reservoir Engineering methods**	**Slider H. C.**
8.	**The Practice of Reservoir Engineering**	**L. P. Dake**

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PT- 14- Formation Evaluation – II

Unit No.	Title	No . OF LECTURE
1.	Density Log	04
2.	Litho–Density Log	03
3.	Neutron Log	05
4.	Induced Gamma – Ray Spectrometry (Chlorine Log)	04
5.	Thermal Decay Time Log	03
6.	Acoustics / Sonic Log	06
7.	Electro Magnetic Propogation Log	03
8.	Nuclear Magnetic Log	04
9.	Image Logs	03
10	Crossplots and Overlays	04
11	Interpretations	09
Total		48

Unit 1. Density Log :

Principles (Pair Production, Compton Scattering, Photo-electric effect), Absorption equation, Depth of investigation, Vertical resolution, The relation between the electronic density and bulk-density, Gamma Ray Sources, Detectors, Calibration units, The Tools, Measuring point. Fundamental factors influencing the measurement (Shales, Water, Hydrocarbon) Environmental effects (Time constant, recording speed, dead time, bed thickness, the borehole, mud-cake, casing, invasion) Geological factors (Rock composition, rock texture, sedimentary. Structure, temperature, pressure, depositional environment-sequential evolution) ; Applications

Unit 2. Litho–Density Log :

Physical principle of the tool (Photo-electric interaction, definition of the photoelectric absorption index, Pe of a composite material) Tool, Principle of measurement, radius of investigation, Vertical resolution, Measuring point, Statistical variation, Geological factors affecting measurements, Environmental effects on measurement; Applications (Minerological composition of the formation, fracture detection, sedimentological studies)

Unit 3. Neutron Log :

General, Measurement of the apparent hydrogen index (Principles, Spatial distribution of thermal neutrons and capture gamma rays), 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, Applications.

Unit 4. Induced Gamma – Ray Spectrometry (Chlorine Log) :

Principle, Measurement characteristics, The shale-compensated Chlorine log (SCLL), Uses. Modern induced gamma-ray techniques- inelastic and capture spectrometry (Principle, Fast neutron scattering, Thermal neutron capture), Reservoir analysis by spectroscopy, Measured spectra;
Measuring techniques:The window &"Weighed Least-Squares"(WLS) methods.

Unit 5. Thermal Decay Time Log :

Tool principle, Neutron Capture and diffusion, Measurement of the neutron population and Capture cross-section, Neutron source, detectors, spacing, units, Measure points, Vertical resolution, Depth of investigation. Factors influencing the $\sum$ measurement (The matrix $\sum$ma, Porosity,Fluids, Shales, Acidization). Environmental effects (Borehole Signals and diffusion, Tool centralization, Invasion, Time constant, Logging speed, bed thickness and vertical resolution). Geological factors affecting the $\sum$ measurement (Composition of the rock, rock texture, temperature, pressure).
Porosity and gas indication (porosity, gas indication from the count rates), Applications.

Unit 6 Acoustics / Sonic Log:

Acoustic Log : Fundamentals (Acoustic signals, period T, frequency f, Wavelength λ, Acoustic waves, Compress ional or longitudinal waves, Transverse or Shear waves, Sound wave velocities, Sound wave propagation, Reflection and refraction of waves, Acoustic impedance, Reflection Coefficient, Wave interference.)

Sonic Log : Principle of the Sonic Log, Earlier Tools, 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, Applications. Determination of Elasticity parameters using logs.
Measurement of sonic attenuation and amplitude:- Theoretical causes of attenuation (Loss of energy heat loss, Redistribution of energy).Causes of attenuation in the borehole (Open hole, Cased hole). Measurement of attenuation (Cement Bond Log, Attenuation index). Variable Density Log.

Unit 7. Electro Magnetic Propagation Log:

Principles, theory of measurement, measurement technique, depth of investigation, vertical resolution. Environmental factors influencing the response (Hole size and shape, fluid, mud-cake, temperature).
Energy losses (Interpretation in lossless formations, Interpretation in lossy formations).
Geological factors influencing measurement (mineralogical composition, texture, structure, fluids). Applications ;

Unit 8. Nuclear Magnetic Log :

Introduction, Principle, Tool, method of measurement, signal processing Geological and Environmental factors influencing measurement, Interpretation, Applications.

Unit 9. Image Logs:

Introduction, Electrical Imaging, the FMS and FMI, Electrical image interpretation, some generalities. Electrical image sedimentary interpretation, Electrical image structural interpretation.
Quantitative uses of electrical images.
Acoustic imaging, the borehole televiewer. Acoustic imaging tool Interpretation, generalities. Examples of Acoustic imaging tool interpretation, Acoustic imaging, Quantitative Interpretation of Acoustic images.

Unit 10 Crossplots and Overlays :

Porosity Overlays : Selection of Logs for Overlays, Gas detection from overlays.
Two-porosity Lithology Crossplots :- Introduction, The Acoustic-Density Crossplots, Effect of Secondary porosity, Effect of Gas and Shale, Mineral Identification – Evaporites, Sulphur, Coal, Metallic ores, Oil Shale.
The Density-Sidewall Neutron Crossplot :– Use, Effect of Gas and Shale**.**
Gas Saturation Crossplots- Use, Effect of Shale, Invasion Effects.
Shale Crossplot- Introduction, Density-Neutron Crossplots **;**

Unit 11 Interpretations:

Determination of porosity and lithology : Using lithology-porosity charts (M-N crossplot & MID crossplot) ;
Determination of : Absolute permeability & Relative permeability;
Predicting water production : Simple shaley formations;
Determining volume of clay ;
Determining the porosity ;
Determining saturation ;

REFERENCE BOOKS	Name of the Authors
1. Hand book of well log Analysis for oil and gas formation evaluation	
2. Geological well log analysis	Sylvian J.Pirson
3. Fundamentals of Electric Log Interpretation	M.R. Wyllie
4. Log Review Atlas	
5. The Log Analysis Hand book	
6. Basic well log analysis for geologist	G.B.Asoutts and Gibson
7. Hand book of well log analysis for oil and gas formation evaluation	
8. Handbook of sub-surface geology	A.C.Moore
9. Cased Hole and production log evaluation	James. J.Smolen
10. Encyclopedia of well logging	R. Besbrandes
11 Well logging and formation Evaluation	Tony Darling
12 Practical Formation Evaluation	Ransom Robert

PT- 15-PRODUCTION OPERATIONS

Unit No	TITLE	No of Lectures
1	Geological Consideration in Producing Operation	04
2	Well Testing Operations	03
3	Primary Cementing	03
4	Perforating oil and Gas Wells	03
5	Completion and Workover Fluids	04
6	Squeeze Cementing	03
7	Sand Control	04
8	Formation Damage	05
9	Surfactants for Well Treatments	03
10	Acidizing	04
11	Hydraulic Fracturing	04
12	Scale Deposition	03
13	Corrosion Control	02
14	Workover	03
	TOTAL	48

Unit 1. Geological Consideration in Producing Operation : .
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;

Unit 2. Well Testing Operations :
Well production testing; Drill stem testing;

Unit 3. Primary Cementing :
Introduction , cementing materials, cement additives, cement bonding and primary cementing practices;

Unit 4. Perforating oil and Gas Wells :
Types of perforators and evaluation of perforator performance;

Unit 5 Completion and Workover Fluids :
Selection criteria, clear water and oil fluids; water base and oil base muds; perforating and packer fluids; well killing;

Unit 6 Squeeze Cementing :
Theoretical and Practical consideration; Planning a squeeze job;

Unit 7 Sand Control :
Definition; Mechanical methods of sand control, Practical considerations in gravel packing;

Unit 8 Formation Damage :
Occurrence and significance; Basic effects of clays and water on damage, Reduced relative permeability; Increased fluid viscosity;

Unit 9 Surfactants for Well Treatments :
Characteristics ; use and action of surfactants, well stimulation with surfactants;

Unit 10 Acidizing :
Acis used; Acid additivites, Carbonate and Sandstone Acidizing;

Unit 11 Hydraulic Fracturing :
Introduction, mechanics of fracturing, propping the fracture, frac fluids, frac job design and performance;

Unit 12 Scale Deposition :
Causes, prediction and identification of scale , Scale removal and prevention;

Unit 13 Corrosion Control :
Introduction, types of corrosion, corrosion control;

Unit 14 Workover:
Conventional and Non – conventional workover systems, concentric tubing workovers;

REFERENCE BOOKS	**Name of the Authors**
1. Production Operation Vol.I & II	Allen & Roberts
2. Introduction to Petroleum Production Vol. II & III	D.R. Skinner
3. Polymer & Surfactant Flooding	Shah
4. Technical Manual For Production Operations	R. K. Mukerjee, IOGPT, ONGCL.

PRACTICAL COURSE FOR M.SC.-1I
SEMESTER-III
PTP- 3
(15 Practicals of 6 Hrs Each)

Reservoir Dynamics

1	**Fluid flow of Reservoirs.**
2	**Calculation of net volume of reservoir**
3	**Calculation of Formation volume factor from surface data.**
4	**Behaviour 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.**

Well Completion

1	**Pressure Build Up Analysis.**
2	**Dog leg Severity**
3	**Orientation of the Deflected Tools.**
4	**Mud weight – computation.**
5	**Drill collar weights.**
6	**Rig power system.**
7	**Mud calculations.**
8	**Cementation.**
9	**Lag Time Calculation**
10	**Trip Tank Problem.**
11	**Life of a well.**
12	**Pump stroke calculations.**
13	**Pressure Loss calculations**
14	**Pit Gain calculations.**
15	**Pull required to stuck pipe.**

Formation Evaluation-1

1	**Basic concepts :**
	Basic for log Analysis,Reservoir characteristics (Porosity & permeability in different reservoir rocks) Archies equation, formation factor,model formation cantaining both water & oil Bore hole environment.
2.	**S.P.log:**
	Behavior of S.P. curve & its scale of representation with unit used; Shale base line shale base line-shift.
	Determination of thickness of beds.
	Identification of porous & permeable beds.
	Shapes of S.P.curve to identify lithofacies.
	Calculation of shale % using S.P.curve.
3.	**Resistivity logs**.
	Introduction to NORMAL (SN & LN) & Lateral resistivity curves with representative scale & unit used.
	Behaviour of Resistivity curves against porous & permeable formations containing different types of fluids. Interpretation of +ve and –ve separations of Resistivity curves
	Correlating S.P.& Resistivity curves to identify conductive and non –conductive formations – Qualitative analysis
	Identification of fluid type from S.P. & Resistivity logs
	Calculation of using S.P.& Resistivity logs
	Interpretations from Micro log and Micro Lotero Log
	Interpretations of Induction logs.
4.	**Natural Gamma Ray Log:**
	Behaviour,scale,unit
	Correlating NGR log & Resistivity log for qualitative interpretations
	Determination of shale % from NGR Log.
5.	**Caliper Log:**
	Behaviour, representation, scale
	Quantitative & Qualitative .Interpretations.

PTP-4 :- Reservoir Performance and Production Operation

I : Reservoir Performance

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 behaviours of reservoir**
9	**Problems on Improved Oil Recovery (IOR)**
10	**Problems on Reservoir stimulation**

II : Production Operations

1	**Drill Stem Testing Analysis (DST)**
2.	**Skin due to Incomplete Perforations**
3.	**Mud Calculations**
4.	**Hole Problems**
5.	**Kick control and blow out prevention**
6.	**Cementing**
7.	**Hydraulic Fracturing**
8.	**Acidizing**
9.	**Calculation of static injection pressure**
10	**Oil and Gas Separator design**

PRACTICAL COURSE FOR M.SC.-1I
SEMESTER-IV
PTP-5
(15 Practicals of 6 Hrs Each)

Formation Evaluation-II

1	**Qualitative and Quantitative Interpretations of porosity logs** : (Density, Sonic & Neutron logs)
2	**Qualitative and Quantitative Interpretations of cased-hole logs (**Cement Bond logs, Acoustic logs)
3	**Fluid Movement interpretations using:** Temperature Surveys; NOIS logging ; Pulsed Neutron logging; Radio active Tracer logging.
4	**Determination of Residual oil Saturation from** : Log Inject- Log Technique using Pulsed Neutron log.
5	**Integrated approach to formation Evaluation:** Using Structural, Stratigraphy, Palaeontology, Seismic, Mudlogging, MWD, LWD, Core, RFT, DST and Wireline log data.

II- Project work

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