M. TECH IN PETROLEUM TECHNOLOGY (EXPLORATION)

SEMESTER-I

19PTE001 Reservoir Sedimentology and Sequence Stratigraphy

Teaching Scheme					Examination Scheme					
L	T	P	C	Hr/Wk	Theory			Practical		Total Marks
3	0	0	3	3	MS	ES	IA	LW	LE/Viva	100
					25	50	25	--	--	

UNIT-I **(10 Hrs)**

Sedimentology in Petroleum Geoscience; Facies diagnosis; facies models (clastic and carbonates). Classification of carbonate rocks; microfacies and carbonate diagenesis; porosity evaluation; pore geometry and performance of carbonate reservoir rocks; carbonate depositional environments.

Sandstone, environment of deposition of sandstone; sandstone classification, porosity evolution, sandstone diagenesis;

UNIT-II **(9 Hrs)**

Reservoir characteristics; Reservoir geometry and criteria for recognition of reservoirs deposited in eolian, fluvial, coastal, deltaic, shelf and deep sea depositional environment. reservoir heterogeneity and petrophysical analysis; reservoir sedimentology of Indian petroliferous basins

UNIT-III **(10 Hrs)**

Sequence stratigraphy in the historical context; advances in stratigraphy and process sedimentology, Basic principles of sequence stratigraphy: accommodation, chronostratigraphy, unconformities, scales of practice (outcrop, logs, cores and reflection seismic); introduction to stacking patterns and seismic reflection configurations and terminations, Parasequences as a correlation tool. Introduction to Sequence stratigraphic models, Carbonate factories, the "organic" factor, and sequence stratigraphy

UNIT-IV **(10 Hrs)**

Systems tracts; Characteristics of carbonate sequences and systems tracts, Sequence stratigraphy of systems not defined by shelfal accommodation: fluvial, alluvial, aeolian and slope (deep water). LST sequence (boundaries, incised valleys, slope fans, basin floor fans, and prograding complexes), TST sequences (incised valley fill, source rock and reservoir seal), HST sequence (alluvial, deltaic, shoreline complexes and shelf sands), Sequence stratigraphy in a mixed clastic/carbonate province, Selected exploration and production case histories.

REFERENCES

Emery, D, (1996): Sequence Stratigraphy, Blachwell Scientific Publ.
Miall, A.D. (1997): The Geology of Stratigraphic Sequence, Springer-Verlag.
Catuneanu, O. (2006): Principles of Sequence Stratigraphy, Elsevier.
Berg, R.R. (1986): Reservoir Sandstones, Prentice Hall.
Moore, C. H. (2001): Carbonate Reservoirs, Elsevier, Amsterdam.
Barwis, J.H. (1990): Sandstone Petroleum Reservoir, Springer-Verlag.
Zimmerle, W. (1995): Petroleum Sedimentology, Kluwer Academic Publ

M. TECH IN PETROLEUM TECHNOLOGY (EXPLORATION)

SEMESTER-I

19PTE002 Structural Geology and Reservoir Geomechanics										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hr/Wk	Theory			Practical		Total Marks
3	1	0	4	4	MS	ES	IA	LW	LE/Viva	100
					25	50	25	--	--	

UNIT-I **(10 Hrs)**

Fundamentals of structural geology, Physico-chemical parameters controlling the deformation in rocks in general, and brittle and ductile deformation of rocks in particular, Techniques of strain analysis, genesis and classification of folds, faults and joints.

UNIT-II **(9 Hrs)**

Plate tectonic concept, evolution of divergent boundary; convergent boundary, strike-slip boundaries, balanced cross section, Analysis of geological map and cross sections

UNIT-III **(10 Hrs)**

Understanding of stress field, Mohr's circle, deviatoric mean stress, representation of special status of stresses by Mohr's circle, Mohr-Coulomb failure envelop, communication, strength of geological materials, normally and over consolidated rocks, strength of drained and un-drained rocks and sediments, concepts of Atterberg limits,

UNIT-IV **(10 Hrs)**

Tectonic stress field, pore-pressure at depth in sedimentary basins; compartmentalisation, compressive and tensile failures in vertical wells, effects of reservoir depletion on stress field.

REFERENCES

1) Zobak, M. D. Reservoir Geomechanics;
2) Longuemare, P. Geomechanics in reservoir simulation;
3) Nauroy, J. F. Geomechanis applied to petroleum Engineering;

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SEMESTER-I

19PTE003 Petroleum Geology and Basin Analysis										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hr/Wk	Theory			Practical		Total Marks
3	0	0	3	3	MS	ES	IA	LW	LE/Viva	100
					25	50	25	--	--	

UNIT-I **(10 Hrs)**

Genesis of petroleum, Theories and their role in petroleum exploration strategy with special references to physiographic division of India, Preservation of organic matters in sediments and their conversion to petroleum. Different types of petroleum oil and gas derived from different types of organic matters. Physico-chemical properties of crude oil and natural gas, effect of pressure and temperature on crude oil, Migration of crude oil and gas. Primary, secondary and tertiary migration of oil and gas

UNIT-II **(10 Hrs)**

Petroleum accumulations resulting from various trapping mechanisms, significance and development of seals, various types of petroleum traps (Stratigraphic, structural and combination traps)

UNIT-III **(10 Hrs)**

Introduction to Basin analysis, Rheology, layered earth structure, isostacy, measuring compensation, load and deflection. Subsidance history of basin; Basin Models (Geodynamic model; Kinematic cooling models, McKenzie Stretching model; Tectonostratigraphic coupling) Quantitative dynamic stratigraphy (Forward and Inverse Models, Sedimentation Models, Stratigraphic models).

UNIT-IV **(9 Hrs)**

An overview of Sedimentary basins of India, Petroleum Geology of different category petroliferous basins of India

REFERENCES

1 Killops and Killops: Introduction to Organic Geochemistry.
2. B.P. Tissot and D.H. Welte: Petroleum Geology

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SEMESTER-I

19PTE004 Petroleum Exploration-I

Teaching Scheme					Examination Scheme					
L	T	P	C	Hr/Wk	Theory			Practical		Total Marks
3	0	0	3	3	MS	ES	IA	LW	LE/Viva	100
					25	50	25	--	--	

UNIT-I **(10 Hrs)**

Role of upstream regulator in policy framing for exploration. Differentiating between NELP and HELP and changes happened over the transition period. Concept of play, Lead, Prospect and Drillable prospect. Reconnaissance survey in petroleum exploration – use of gravity – magnetic survey, Geochemical indicators and evaluation, Litho-geochemical survey, Pedogeochemical survey, Gas Survey, Geochemical exploration new methods, Primary halo zoning.

UNIT-II **(9 Hrs)**

Gravity and Magnetic methods for hydrocarbon Exploration

Physical properties of materials and geophysical response, densities and magnetic susceptibilities of rocks, difference between gravity and magnetic methods, planning of geophysical campaign, airborne versus land surveys, Newton gravitational law, gravity acceleration, potential field main equations, equivalent layer, gravity anomalies, measurement devices, borehole gravity meter, theoretical foundation of magneto metric methods.

UNIT-III **(10 Hrs)**

Resolution of Potential Energy separations, spectral content of potential data, Filter types, regional residual separation, Derivative filters, pseudo gravity transformation, potential methods as a support for seismic interpretation, gravity & magnetic inversion.

UNIT-IV **(10 Hrs)**

Electrical and Electromagnetic methods, Resistivity measurement for oil and gas prospecting, current flow in a homogeneous anisotropic earth model, current flow in a horizontally stratified earth, principle of equivalence, Vertical Electrical sounding, Schlumberger sounding, Wenner Sounding, Expect of dip on interpretation, geological applications, structural mapping for oil, Electromagnetic methods for oil prospecting, Maxwell equations.

REFERENCES

Text Books

(1) W M Telford, L. P. Geldart, Robert E Sheriff, 1990, Cambridge University Press, Second Edition

(2) P K Bhattacharya and H P Patra, Direct Current Geoelectric Sounding, Principles and Interpretation, Elsevier

(3) Milton B Dobrin, Introduction to Geophysical Prospecting, McGraw Hill

Reference Books

(1) William J Hinze, Ralph R B Von Frese, Afif H Saad, Gravity and Magnetic Exploration, Cambridge Press

(2) S H Yungul, Electrical Methods in Geophysical Exploration of Deep Sedimentary Basins, Springer

M. TECH IN PETROLEUM TECHNOLOGY (EXPLORATION)

SEMESTER-I

19PTE005 Introduction to Electrical Engineering and Instrumentation

Teaching Scheme					Examination Scheme					
L	T	P	C	Hr/Wk	Theory			Practical		Total Marks
2	0	0	2	2	MS	ES	IA	LW	LE/Viva	100
					25	50	25	--	--	

UNIT-I **(4 Hrs)**

Introduction: Types of instruments: Indicating, recording, integrating,

UNIT-II **(8 Hrs)**

Analog DC and AC meters: Electromechanically meter movements, PMMC, Analog DC ammeters, Analog DC voltmeters, Analog AC ammeters and Voltmeters, Analog multimeters, Special purpose analog meters, Use of basic meters, meter errors, problems. Extending the range of meters, Loading effects and their elimination, true rms voltmeters.

Digital Meters: DVM and Digital multimeter, vector voltmeters, 7 segment and LCD display. Analog to Digital Converters and Digital to Analog Converters

UNIT-III **(8 Hrs)**

Oscilloscope: Oscilloscope subsystem, Principle of Operation, Cathode Ray Tube ,Display subsystem, Vertical deflection subsystem, Dual trace/Dual beam feature, Horizontal deflection subsystems, oscilloscope probes, oscilloscope controls, Front panel of an oscilloscope, Lissajous patterns oscilloscope photography, Digital storage oscilloscopes (DSO), Power scope. Attenuation probes, problems 8 15 5 Time & Frequency Measurement: Time Measurements, Frequency measurement, Harmonic Analysis and spectrum analyzers, Frequency Mixer problems. 3 10 6 Power & Energy

Measurement: Power in AC-DC circuits, singlephase power measurements, Poly-phase power and measurements, Electrical energy measurements, Power measurements problems

UNIT-IV **(6 Hrs)**

Measurement of Resistance & Bridges : Resistance and resistor, resistor type, measurement of resistance, Wheatstone Bridge, Making balanced Wheatstone Bridge measurement, Low value resistance measurement (Kelvin Double Bridge), problems. Measurement of Capacitance, Inductance, and Impedance: Hays Bridge, Schering Bridge, Maxwell bridge, Anderson Bridge, Q-factor, Capacitance and capacitors, capacitor circuit models and losses, capacitor types, color coding of capacitor, Inductor and Inductance, Inductor structure, Transformers, Impedance, Capacitance and Inductance, Capacitance and Inductance measurement, complete impedance measurement, frequency measurement, problems.

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REFERENCES

1. A. K. Sawhney -A course in Electrical and Electronic Measurements and Instrumentation.
2. Helfrick& Cooper-Modern Electronic Measurement & Instrumentation
3. Golding, E.W.- Electrical Measurement and Measuring Instruments
4. H.S Kalsi- Electronic Instrumentation

M. TECH IN PETROLEUM TECHNOLOGY (EXPLORATION)

SEMESTER-I

19PTE006E Unconventional Hydrocarbon Resources										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hr/Wk	Theory			Practical		Total Marks
2	0	0	2	2	MS	ES	IA	LW	LE/Viva	100
					25	50	25	--	--	

UNIT-I **(4 Hrs)**

Introduction to unconventional hydrocarbon resources; Petroleum Systems, Difference between Conventional and Unconventional. Low permeability (Tight) Sands:- Occurrence, resources, exploration methods, reservoir characteristics

Shale Reservoir (Gas and Oil) Occurrence, resources, exploration methods, reservoir characteristics

UNIT-II **(8 Hrs)**

Coalbed Gas: Occurrence, resources, exploration methods, reservoir characteristics

Gas Hydrates: Occurrence, resources, exploration methods, reservoir characteristics

UNIT-III **(8 Hrs)**

Heavy Oil: Occurrence, resources, exploration methods, reservoir characteristics

Gas Storage: Types and Locaiton of gas storage reservoirs

UNIT-IV **(6 Hrs)**

Case studies on global and Indian Unconventional Hydrocarbon resources,

REFERENCES

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SEMESTER-I

19PTE007E Application of Ichnology in Core Analysis

Teaching Scheme					Examination Scheme					
L	T	P	C	Hr/Wk	Theory			Practical		Total Marks
2	0	0	2	2	MS	ES	IA	LW	LE/Viva	100
					25	50	25	--	--	

UNIT-I **(4 Hrs)**

Introduction to Core analysis, Sedimentological description of Clastic core, Sedimentological description of non-clastic core, Introduction to Paleoecology and paleoenvironment, Fundamentals of Ichnology

UNIT-II **(8 Hrs)**

Study of Selected Trace fossils in cores, its characteristic, identification, documentation, interpretation, and its relation to depositional environment.

UNIT-III **(6 Hrs)**

Methodology for documenting ichnological data in cores, Ichnological logs, Ichnofabric constituent diagram. Statistical analysis of the ichnological data, Ichnofabric, Ichnodiversity and Ichnoabundance,

UNIT-IV **(8 Hrs)**

New techniques of Core analysis (Digital image analysis), Selected Case studies in Application of Ichnology in (a) Exploration, (b) Reservoir Studies, (c) Development Geology (North Sea Fields, Viking Formation, Ghawar Field, Indian Examples). Bioturbated Reservoirs case studies- Ghawar Field etc.

REFERENCES

Pemberton, S. G (1992) Applications of Ichnology to Petroleum Exploration: A Core Workshop, SEPM
Seilacher, A (2007) Trace fossil analysis
Knaust, D (2017), Atlas of Trace fossils in Well Cores, Appearance, Taxonomy, and Interpretation

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SEMESTER-I

19PTE008E Reservoir Thermodynamics										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hr/Wk	Theory			Practical		Total Marks
2	0	0	2	2	MS	ES	IA	LW	LE/Viva	100
					25	50	25	--	--	

UNIT-I **(8 Hours)**

Introduction to Petroleum reservoir and reservoir engineering, Reservoir Fluid Composition, Thermodynamic behavior of hydrocarbon system both gas and liquid, vapour liquid equilibria, PVT analysis, evaluation and correlation of physical properties of petroleum reservoir fluids including laboratory and empirical methods.

UNIT-II **(8 Hours)**

Introduction to reservoir media, concept of porosity, fluid saturation, wettability, capillary pressure and relative permeability, Salient features of Gas-Oil and Water-Oil relative permeability Curves, Three phase relative permeability, basic laboratory core data analysis for understanding petrophysical parameters.

UNIT-III **(10 Hours)**

Petroleum reservoir: type, drive mechanism, geometry, flow system and pattern. Integration of geosciences and engineering data for understanding dynamic reservoir during production.

REFERENCES

Texts and References:

1. Equations of State and PVT Analysis- Tarek Ahmed, Gulf Publishing Company, Houston, Texas, 2007
2. Petroleum Reservoir Rock and Fluid Properties – Abhijit Y. Dandekar- Taylor and Francis-2006.
3. PVT and Phase Behaviour of Petroleum Reservoir Fluids- Ali Danesh-Elsevier, 1998
4. Reservoir Engineering Handbook -Tarek Ahmed, Gulf Professional Publishing, Third Edition, 2006

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SEMESTER-I

19PTE009P Reservoir Sedimentology and Sequence Stratigraphy										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hr/Wk	Theory			Practical		Total Marks
0	0	2	1	2	MS	ES	IA	LW	LE/Viva	100
					--	--	--	50	50	

List of Experiments

1) Megascopic and microscopic study of Clastic cores;
2) Megascopic and microscopic study of carbonate cores;
3) Petrographic characterization of petroleum source rocks.
4) Preparation of geological maps and sections, and derivation of geological history in relation to petroleum prospects.
5) Delineating depositional Environment based on integrated geological data
6) Calculation of oil reserves;
7) Exercise on maturation studies;
8) Snail Model of Sequence stratigraphy, Identification of sequence boundaries and stratigraphic correlation
9) Study of the important Mesozoic/Cenozoic basins in light of sequence stratigraphic analysis.

19PTE010P Structural Geology and Geomechanics										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hr/Wk	Theory			Practical		Total Marks
0	0	2	1	2	MS	ES	IA	LW	LE/Viva	100
					--	--	--	50	50	

1) Interpretation of topographic maps and geological maps,
2) Preparation and interpretation of fence diagram.
3) Structure contour maps,
4) Isopach and isochore maps.
5) Analysis of Fracture and Lineament array.
6) Structural Geometry by stereographic projection.
7) Construction profiles of folds.
8) Analysis of stress

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SEMESTER-I

19PTE011P Petroleum Geology and Exploraiton										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hr/Wk	Theory			Practical		Total Marks
0	0	2	1	2	MS	ES	IA	LW	LE/Viva	100
					--	--	--	50	50	

Experiment 1- Collection of bouguer gravity data in a gridded format. Understanding of absolute gravity and relative gravity in the same area.

Experiment 2- Application of corrections to bouguer gravity data and separation of regional and residual gravity.

Experiment 3- Acquisition of magnetic data in a random walk and understanding of magnetic inclination and causes for magnetization in the subsurface.

Experiment 4- Acquisition of 6 channels refraction seismic data.

Experiment 5- Understanding the subsurface layering, folds and faults using the travel time data.

Experiment 6- Continuation of the 5^{th} Experiment

Experiment 7- Performing stochastic based resource estimation using seismic, well log and engineering data in accordance to the guidelines prescribed by PRMS 2013.