M. TECH IN PETROLEUM TECHNOLOGY (EXPLORATION)

SEMESTER-II

19PTE031 Applied Micropalaeontology										
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)**

Introduction to Micropalaeontology in Petroleum Exploration, Appraisal and Development Calcareous Microfossils (Foraminifera, Calcareous algae, Ostracods); Calcareous nannofossil.

UNIT-II **(9 Hrs)**

Siliceous microfossils (Diatoms, Radiolarians, Silicoflagilates); Phosphatic microfossils (Conodonts, and other phosphatic microfossils)

UNIT-III **(10 Hrs)**

Organic walled Microfossils (Acritarchs, Chitinozans, Dinoflagellates, Spores and Pollen; Palynofacies);

UNIT-IV **(10 Hrs)**

Biostratigraphy and Palaeoenvironment interpretation; Integrated stratigraphy; Application of Micropalaeontology in Petroleum Exploration, Appraisal and Development.
Case histories in Petroleum Exploraiton-Clastic system; Carbonate system.

REFERENCES

1) Jones, R. W. (1996) Micropalaeontology in Petroleum Exploraiton, Oxford Science Publication.
2) Bilal U. Haq and Anne Boersma, (1978) Introduction to Marine Micropalaeontology, Elsevier North-Holland, Inc., New York. 376pp

M. TECH IN PETROLEUM TECHNOLOGY (EXPLORATION)

SEMESTER-II

19PTE032 Petroleum Exploration-II										
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 **(9 Hours)**

Theory of waves, Body waves and surface waves, noise and noise analysis, Designing seismic refraction and reflection, understanding of 2D and 3D seismic, Hammer seismic survey, Low velocity zone, Time- Distance curve generation for Refraction seismic (Flat Refractors and Dipping Refractors), uphole survey, picking first arrival time and interpretation of refraction data.

UNIT-II **(10 Hours)**

Configuration for reflection seismic survey, survey instrument, Dynamic range of instrument, Noise analysis, seismic configuration, Geophone working principle, Derivation of Time-Distance curve for two layers and three layers dipping and non-dipping reflectors, Interpretation of seismic data, Acoustic Impedance and Reflectivity coefficient calculation, velocity estimation, stacking velocity and Root Mean square velocity, Loop tying, structural interpretation, stratigraphic interpretation, prospect generation, POS calculation, Generation of drillable prospect.

UNIT-III **(10 Hours)**

Basic seismic processing, Horizontal and Vertical seismic resolution, seismic sequence stratigraphy, colour, character and zero phaseness, AVO class sands, reservoir identification, bright spot, dim spot, flat spot, 4D reservoir monitoring, post stack radon transformation, 2D and 3D attributes, 4D time lapse survey.

UNIT-IV **(10 Hours)**

Case studies of structural and stratigraphic seismic interpretation (2D and 3D) for prospect generation, integration of seismic with well log data, Time model and depth model generation, preparation of facies maps and derived parameters, seismic inversion (deterministic and stochastic).

REFERENCES

Text Book

Milton B Dobrin, Introduction to Geophysical Prospecting, Mc Graw Hill

(1)...Interpretation of three- dimensional seismic data- Sixth Edition, AAPG Memoir 42 SEG investigations in Geophysics, No. 9

Reference Book

W M Telford, L.P. Gildart, Robert E Sheriff, 1990, Applied Geophysics, Cambridge University Press, Second Edition.

1. Donald A Herron, 2011, First steps in seismic interpretation, Society of Exploration Geophysicist.

M. TECH IN PETROLEUM TECHNOLOGY (EXPLORATION)

SEMESTER-II

19PTE033 Advanced Formation Evaluation										
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 (8 Hours)

Formation evaluation basics, Borehole environment, Invasion, Log acquisition, representation of log data on different tracks,Basic working principle of various logging tools, Coring and Core analysis,. Temperature logs, Closed hole environment

UNIT-II (10 Hours)

Lithology logs (SP, Caliper, and Gamma); Porosity Logs (Density, neutron and Sonic), Resistivity, Induction logs. Quick look analysis :-Overlay, (Logarathmic movable oil plot, Neutron density, density sonic, dielectric-porosity overlay) Cross Plots (Trend analysis and Grouping, Extrapolation, frequency plots, Z Plots. Sandy shale interpretation Fracture detection, Porosity from Resistivity

UNIT-III (10 Hours)

Special Logging Technique Nuclear magnetic resonance logging, Dip meter, image logging, gyroscopic log, geochemical log, vertical seismic profiling,

UNIT-IV (10 Hours)

Integrating and Interpreting data, Correlation of wells, Identification of Sequence stratigraphy tracts dual mineral interpretation, multi mineral interpretation, static model interpretation using well log and seismic, reservoir property evaluation for reserve estimation (gross sand, net sand, gross pay and net pay), Rw calculation and use of the same in Sw, Understanding Sw and Swi thin resistive sand interpretation in facies classification and reservoir property evaluation

REFERENCES

Texts and References: 1. Malcom Rider, Second Edition, 2002: The Geological Interpretation of well logs, Rider-French Consulting limited 2. Oeberto Serra & Lorenzo Serra, 2004 : Well logging - data acquisition and applications, Edition Serralog, France

M. TECH IN PETROLEUM TECHNOLOGY (EXPLORATION)

SEMESTER-II

19PTE034 Reservoir Engineering and Development Geology										
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 - 1: Reservoir Geoscience and Engineering Hrs- 10

Classification of reservoirs and reservoir types- based on rock types and fluid types. Oil reservoirs, Gas Reservoirs. Petrophysical parameters for understanding reservoir engineering. Drive mechanisms for understanding dynamic reservoir behavior during production.

Unit - 2: Reservoir data for model building and performance analysis Hrs- 10

Reservoir Data types: geology, seismic, geophysical well log, core and well testing and production data, Integration of all data for static and dynamic Reservoir Model building, Reservoir Performance analysis by various methods: volumetric, decline curve, material balance & simulation.

Unit - 3: Reservoir characterization and management – concept and processes Hrs- 9

Definition, history & fundamentals of reservoir management, synergic team approach; Integration of geosciences and engineering for reservoir characterization – exploratory stage, early and mature stage and for brown field – general workflow and case specific studies.

Unit – 4: Preparation of Development plans, technoeconomic evaluation with case studiesHrs 10

Developmental plans for Oil fields-depletion drive, mixed drives and water drive, Development plan for Gas fields. Importance of improved recovery processes in development plans and their screening criteria. Production Economics and Techno economic evaluation. Development plan of reservoir, surveillance & monitoring, revision of plans &strategies.Few case studies for preparing development plans.

REFERENCES

Texts and References:

1. Integrated Petroleum Reservoir Management- A team approach: AbdusSatter& Ganesh C. Thakur; Penwell Publishing Company, Tulsa, Oklahoma.
2. Development of oil and gas fields: Dr. Sant Kumar; Allied Printers, Dehra Dun, 248001, India.
3. Practical ReservoirEngineering and Characterization : Richard O. Baker,Harvey W. Yarranton, Jerry L. Jensen Gulf Professional Publishing, 2015
4. Reservoir Explorationand Appraisal : Luiz Amado Gulf Professional Publishing, 2013

M. TECH IN PETROLEUM TECHNOLOGY (EXPLORATION)

SEMESTER-II

19PTE035 Well Site Geology and Drilling Technology										
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)**

Type of well locations, Geo Technical Order, Well Design, Drill Rigs, Drill holes, Methods of Drilling, Drilling Controls

UNIT-II **(10 Hrs)**

Drilling Fluids, Offshore Drilling Technology; Geologging: Geological Control, Core logging, Mud Logging, Gas logging.

UNIT-III **(9 Hrs)**

Sub-Surface Pressures & Temperature, Drilling Complications, Casing and Cementation, Onshore and Offshore Well Completion, Offshore production system,

UNIT-IV **(10 Hrs)**

Production Logging, Surface Control Equipments, Well Problems & Analysis. Formation Damage, Work over Jobs, Well Stimulation, Duties of well site geologists and Documentation

REFERENCES

Gupta, P. K. and Nandi, P. K. (1995): Wellsite Geological Techniques and Formation Evaluation: A user's manual, Vol. Oil and Natural Gas Corporation, Dehradun

M. TECH IN PETROLEUM TECHNOLOGY (EXPLORATION)

SEMESTER-II

19PTE036E Enhanced Oil Recovery										
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

Unit - 1: Introduction to EOR processes Hrs-4

Definition, Difference of IOR and EOR, Target oil resource for EOR, General classification, Description a potential of different EOR processes

UNIT-II

Unit - 2: Theory of displacement of oil and gas Hrs-4

Microscopic and macroscopic displacement of fluids in a reservoir, Displacement efficiency in different system – linear, areal, volumetric, Definition and discussion of mobility ratio and mobility control processe for different types of fluids

UNIT-III

Unit – 3: Candidates for EOR processes and Selection Criteria Hrs –12

Miscible/Immiscible displacement processes - water flooding, gas injection, micro-emulsion flooding

Chemical Flooding - polymer flooding, Surfactant flooding, Micellar flooding related methods

Thermal recovery processes- in situ combustion, hot-water injection, steam flooding, SAGD

Microbial EOR

Selection criteria for EOR: Determination of residual oil (well test, reservoir performance, core analysis, cased /open hole logs, single well tracer), Laboratory studies, Field pilot test and evaluation, Tech economic feasibility, Full scale implementation, Monitoring and review

UNIT-IV

Unit – 4: Global Scenario of EOR and Some Case Studies Hrs - 6

Field scale implementation and their performance of various EOR schemes of local and global context

REFERENCES

Texts and References:

1. Enhanced Oil Recovery, I –Fundamentals and analyses – E. C. Donaldson, G. V. Chilingarian, T. F. Yen (Edited) – Elsevier Science Publishers B. V. - 1985
2. Enhanced Oil Recovery, II –Processes and operations – E. C. Donaldson, G. V. Chilingarian, T. F. Yen (Edited) – Elsevier Science Publishers B. V. – 1989.
3. Modern Chemical Enhanced Oil Recovery: Theory and Practice-James J. Sheng, Gulf Professional Publishing, Elsevier
4. Enhanced Oil Recovery – D. W. Green, G. P. Willhite – SPE Textbook Series Vol. 6 -1998.

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SEMESTER-II

19PTE037E Health Safety and Environment in Oil and Gas Sector										
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)**

Physical Hazards; Chemical Hazards Biological Hazards, Psychological Hazards, Ergonomic Hazards, Prevention & Remedial controls of Occupational Hazards In Oil & Gas Industry for each type of Hazards Engineering Control, Administrative Control, Medical Control,

Use of Personal Protective Equipment (PPE)

Understanding Fire: Fire triangle/tetrahedron, Stages of development of fire Flammability, Concept of flash / Fire point, volatility, Flammable Limits, Fire Detection; Fire signature, Smoke, Heat, Flame, Combustible Gas Detection Fire Prevention, Fire suppression , Process Safety: Safety Analysis Table, Safety Analysis Checklist & SAFE Chart

UNIT-II **(8 Hrs)**

Hazard & Risk Analysis,

Risk Matrix, HAZID, HAZOP, Safe Work Practices; Electrical Safety; Classification of Hazardous locations, use of electricity; Hazardous area Accident Investigations: Study of major accidents. Investigation techniques, Emergency Response planning Audits & Inspection. Audit methodology, protocol, typical check lists for Drilling rigs, Work over activities, logging.

UNIT-III **(6 Hrs)**

HSE Management System: Hours: 9 OISD, API RP 75, ISO 14000, ISO 9000, OSHAS 18000 Standards

UNIT-IV: **(8 Hrs)**

Environment Hours: Effect on eco-system; Air, Water, & Soil of HC‟s. Impact of Exploration & Exploitation of Hydrocarbon in Offshore, and Onshore, - Environmental Impact Assessment Oil Spills Control and their management.

Government of India Laws and Regulation; international Maritime Environmental Rules & Regulations. Safety in Exploration and Production. Downstream Safety: Implementing Agency PNGRB; Safety Regulations.

REFERENCES

NFPA, API 14 G & OISD Standards.

Marchell, V. and Ruchemann, S., Fundamentals of Process Safety, Institution of Chemical Engineers, Warwickshire, UK.

M. TECH IN PETROLEUM TECHNOLOGY (EXPLORATION)

SEMESTER-II

19PTE038E Application of Modern Instruments in Earth Sciences										
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 - 1: (10 Hrs)

X-ray Diffraction Methods : Fundamentals, Instrumentation, Sample preparation, and Data Acquisition, Analysis and Applications

X-ray Spectroscopy for Elemental Analysis:Fundamentals, Instrumentation, Sample preparation, and Data Acquisition, Analysis and Applications

Transmission Electron Microscopy&Scanning Electron Microscopy Fundamentals, Instrumentation, Sample preparation, and Data Acquisition, Analysis and Applications

UNIT-II

Thermal Analysis: Fundamentals, Instrumentation, Sample preparation, and Data Acquisition, Analysis and Applications

Vibrational spectroscopy for molecular analysis: Fundamentals, Instrumentation, Sample preparation, and Data Acquisition, Analysis and Applications

UNIT-III

HPLC and column liquid chromatography: Fundamentals, Instrumentation, Sample preparation, and Data Acquisition, Analysis and Applications

Mass spectroscopy: Fundamentals, Instrumentation, Sample preparation, and Data Acquisition, Analysis and Application

UNIT-IV

Uv-visible spectroscopy: Fundamentals, Instrumentation, Sample preparation, and Data Acquisition, Analysis and Application

Fluorescence spectroscopy: Fundamentals, Instrumentation, Sample preparation, and Data Acquisition, Analysis and Application

REFERENCES

1. Materials Characterization: Introduction to Microscopic and spectroscopic methods; yang Leng, John Wiley & Sons (Asia) Pte Ltd.
2. Chromatography in the petroleum industry. Edited by E.R.Adlard, Elsevier, Journal of Chromatography, Library volume -56
3. Spectroscopic Methods in Mineralogy and Material Sciences. Edited by Grant S. Henderson, Daniel R. Neuville and Robert T. Downs. Mineralogical Society of America, Geochemical Society, Series Editor Jodi J Rosso, 2014.
4. Principles of Fluorescence Spectroscopy, Joseph R. Lakowicz, Springer, third edition.
5. Spectrometric identification of organic compounds. Edited by Robert M. Silverstein,Francis X. Webster, David J. Kiemle, John Wiley & Sons. Inc.
6. Structure Determinationof Organic Compounds. Edited by Ern¨oPretsch · Philippe B¨uhlmann Martin Badertscher , Springer
7. Ultraviolet Spectroscopy and UV lasers. edited by PrabhakarMisra, Mark A. Dubinskii Marcel Dekker Inc, New York, Basel

M. TECH IN PETROLEUM TECHNOLOGY (EXPLORATION)

SEMESTER-II

19PTE039 Numerical Methods and Geostatics										
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

Interpolation by polynomials, divided differences, error of the interpolating polynomial, piecewise linear and cubic spline interpolation. Numerical integration, composite rules, error formulae. Solution of a system of linear equations, implementation of Gaussian elimination and Gauss-seidel methods, partial pivoting, row echelon form, LU factorization Cholesky's method, ill-conditioning, norms.

UNIT-II

Solution of a nonlinear equation, bisection and secant methods. Newton's method, rate of convergence, solution of a system of nonlinear equations, numerical solution of ordinary differential equations, Euler and Runge-Kutta methods, multi-step methods, predictor-corrector methods, order of convergence, finite difference methods, numerical solutions of elliptic, parabolic, and hyperbolic partial differential equations. Eigenvalue problem, power method, QR method, Gershgorin's theorem. Exposure to software packages like IMSL subroutines, MATLAB.

UNIT-III

Introduction to Geostatics, Probability Theory review, Spatial Analysis, Variogram Modelling, Estimation (Global and Local).

UNIT-IV

Cross validation, Estimators (Simple kriging, Indicator kirging, Block kriging); Geostatistical simulation (Cholesky decomposition, conditional simulation, sequential gaussian simulation-SGS)

REFERENCES

S. D. Conte and Carl de Boor, Elementary Numerical Analysis- An Algorithmic Approach (3rd Edition), McGraw-Hill, 1980

C. E. Froberg, Introduction to Numerical Analysis (2nd Edition),Addison-Wesley, 1981

E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley (1999)

M. TECH IN PETROLEUM TECHNOLOGY (EXPLORATION)

SEMESTER-II

19PTE040P Applied Micropalaeontology Practical										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hr/Wk	Theory			Practical		Total Marks
0	0	2	1	-	MS	ES	IA	LW	LE/Viva	100
					--	--	--	50	50	

1) Study of Benthic Foraminifera
2) Study of Planktonic Foraminifera
3) Study of Ostractods
4) Study of nanoplanktons
5) Study of spores and Pollens
6) Reconstructing Palynofacies
7) Well to Well Correlation based on microfossils
8) Interpretation of paleoenvironment based on Microfossils

19PTE041P Geoscience and Hydrocarbon Exploration Fieldwork										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hr/Wk	Theory			Practical		Total Marks
0	0	10	5	-	MS	ES	IA	LW	LE/Viva	100
					--	--	--	50	50	

The course is aimed at giving practical exposure to students for understanding concept of Basin, Structural geology, Paleontology, Sequence stratigraphy in the field.

REFERENCES

LAHEE, F. H. FIELD GEOLOGY, MC GRAW-HILL, PUBLICATION