17MPE112 : Advanced Reservoir Engineering										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	-	-	100

Unit - 1: **Hrs- 10**

Introduction to reservoir and reservoir engineering. Petroleum reservoir:type, drive mechanism, geometry, flow system and pattern, Single phase and multiphase fluid flow in different state (steady and unsteady) and different system (linear, radial, spherical) considering compressible, slightly compressible and incompressible fluid, Diffusivity equation and its application for reservoir flow system

Unit-2: **Hrs- 10**

Reservoir Data: type and acquisition. Bottom hole operation for pressure and temperature measurement, Reservoir fluid data: sampling, PVT studies and PVT parameters. Reservoir rock and fluid data: Core study, well log information, Transient well testing and interpretation information. Classification of flow system in porous media,

Unit – 3: **Hrs – 10**

Reservoir engineering principles and activities, Volumetric evaluation of petroleum reserves, Material balance equation and its application, Water Influx calculation, Decline curve analyses method and its application. Reservoir performance analysis by volumetric, material balance and decline curve methods with few case studies.

Unit – 4: **Hrs -9**

Reservoir Engineering activities and management, Reservoir performance analysis and monitoring, Preparation of development schemes, Concept of water flooding, IOR/EOR and workover jobs for reservoir management, Concept of reservoir simulation

Total Hrs - 39

Texts and References:

1. Fundamentals of Reservoir Engineering – L. P. Dake – Elsevier, 17th Edition, 1998
2. Applied Petroleum Reservoir Engineering (Second Edition)- B. C. Craft and M. F. Hawkins Revised by Ronald E. Terry – Prentice Hall.
3. Worldwide Practical Petroleum Reservoir Engineering Methods – H. C. “Slip” Slider – Pennwell Publishing Company.
4. Advance Reservoir Engineering- Tarek Ahmed and Paul D. McKinney - Gulf Professional Publishing – Elsevier -2005
5. Applied Reservoir Engineering (Vol – I & II)– C. R. Smith, G. W. Tracy, R. L. Farrar – OGCI Publications -1992.

17MPE113 : Advanced Drilling Engineering										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	--	--	100

Unit-1: **Hours: 13**

Design

Design of Drill string design, Casing design, Bit Selection, BOP design, Wellbore Hydraulics

Unit 2 : **Hours:13**

Directional Drilling

Directional Drilling Technology, Objectives of Directional Drilling. Tools for deflection & orientation. Directional well profiles and well path – deflection & corrections Motor Types: PD motors and Turbodrills; their description, power calculations and applications, Horizontal Well Drilling, Introduction of Horizontal well drilling: Objectives & selection, Drilling techniques and different well profiles, Special mud requirements and their characteristics. Well Surveying: Objectives & methods. Surveying analysis & calculations for well coordinates Directional drilling problems & their remedies Auto and Verti-track systems: Rotary steerable motors and geo-steering tools.

Unit 3 : **Hours : 07**

Drilling Problems

Pipe sticking, Lost circulation, Sloughing shale, formation damage, fatigue failure of drill string, Bit failure, wire line failure etc. Well control and hydrodynamic pressure, well control techniques

Unit 4: **Hours : 06**

Non-conventional drilling methods

Special Drilling Methods: Foam, under balanced, overbalanced, plasma, electrical, top drive, re-entry, extended reach, jet, multilateral, slim-hole and coil tubing drilling methods; Drilling HPHT wells, Drilling fluids for HPHT environment, Case study of HPHT drilling

Total Hrs -39

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
3. Jorden J R and Campbell F. L., , SPE, New York, 1986: Well Logging Vol. 1 and 2
4. Ellis, D. V. and Singer, J. M. 2nd edition, 2007: Well logging for Earth Scientist, Springer
5. Toby Darling, Well logging and Formation Evaluation, Gulf Professional Publishing, Elsevier Science

17MPE115 : Advanced Production Engineering										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	-	-	100

Unit 1: **Hours : 9**

Conventional Onshore Well Completion

Concept of Well Completion, Casing string types- Drive Pipe, Surface casing, Conductor casing, Intermediate casing, Production liner, Tubing; Casing Head, Casing Hanger, Casing Spool, Well Head integrity- Effect of leakage in A , B and C section, Mono Bore completion.

Unit 2: **Hours: 10**

Advanced (Offshore) Completion System

Introduction – Concept of Offshore well completion, Well Head and Christmas tree(Dry and Wet Type) , Tubing and Packer Completion, Single and Dual string Completion, Material Selection, Completion equipment; Intelligent and Smart completion; Hi-Tech Well Completion: Completion of Horizontal Wells, ERD and Multi Lateral wells, Downhole equipment requirements.

Unit 3: **Hours: 10**

Onshore Production System

Well head fitting & piping, Process flow diagram (PFD) for oil gas, Process control, separation of oil, gas,& water , types of separator, Separation mechanism. De- emulsifications & Desalination of crude. Indirect bath heater and Heater- treater. Produced water treatment. Storage of oil and gas, Liquefied Petroleum Gases (LPG& LNG), Transportation of oil& gas and metering systems.

Unit 4: **Hours: 10**

Offshore Production System

Elements of offshore production system--- Wells (Dry/Wet), well platforms/well servicing rigs, feeder subsea pipeline, process platforms, export pipelines for oil & gas, tankers for evacuation of oil, types of offshore platform - essential personnel, unmanned platform, process control and monitoring—RTU and SCADA system, well automation and optimization, processing of oil, gas and produced water, water injection, Utilities.

Total Hours: 39

Texts and References:

7) Dr. Guo Boyun , Computer Aided Petroleum Production Engineering
8) Deep water Petroleum Exploration & Production-By Willium Leffler, Richard Pattardozzi, Gordon Sterling
3. Shippen, M and Scott(2004) offshore multiphase production operation, Pennwell books.
4. Robinson,T(1992) - an introduction to offshore technology and terminology .
5. Floating Production System- By N.K. Mitra.

17MPE116 : Hydrocarbon Exploration Techniques										
Teaching Scheme					Exam Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	--	--	100

Unit 1: **Hours: 10**

Gravity and Magnetic Survey

Description of various types of gravimeter. Borehole gravimeter. Air borne gravimeter. Zero Spring length. Various types of Magnetometer. Bore hole and Air borne magnetometer. Unipolar gravity and Bipolar Magnetic. Poisson relation in relating to gravity and magnetic. Data Acquisition and Processing of gravity and magnetic data. Corrections applied to gravity and magnetic data. Paleomagnetic analysis. Field generated by magnetic forces. Monopole and dipole. Analysis of quadrapole. Derivation to understand Earth's magnetic field acting as a dipole field. Potential and simple surface distribution. Potential due to horizontal ribbon. Potential at an Exterior point for an arbitrary 3D body. Vertical and Gravity Anomaly due to fault. Gravity anomaly for a sphere, horizontal and vertical cylinder. Contouring of Bouguer Gravity Data and Separation of regional and residual. First order and second order gravity data. Zero contour of a second order gravity data. Downward and upward continuation of gravity data. Layered stripping of gravity and magnetic data. Sediment and Basement analysis using integrated gravity and magnetic data.

Unit 2: **Hours:10**

Electrical, Electromagnetic and Magnetotelluric method

Various configuration of acquiring data for apparent resistivity calculation. Derivation for Schlumberger Array, Werner Array, Pole Dipole Array, Dipole-Dipole Array. Evaluating anisotropy using two layer, three layer and multilayer base curve. Type curve analysis: A Type, Q Type, K Type, H Type. Understanding isotropic and anisotropic layers using transverse resistance and longitudinal conductance. Use of principle of equivalence. Self-potential methods. Self-potential equipment. Interpretation of self-potential data. Telluric and Magnetotelluric methods, origin and characteristics of Magnetotelluric fields and electric currents. Field equipment and operations. Mapping 3D anomalies. Measuring overburden depth and resistivity.

Unit 3: **Hours: 10**

Seismic Acquisition and Processing

Refraction, Reflection, Field methods and equipment. Fluid crew organization. Field Layouts and Equipments. Marine Equipments and methods. Measurement of velocity and density. Field processing of the raw data along with broute strap preparation. Software for initial processing and velocity estimation, average velocity, interval velocity, instantaneous velocity, stacking velocity, route mean square velocity, time-distance curve for refraction and refraction (two layers, three layers and multi layers). Acoustic impedance contrast. Stickogram preparation. SEGD and SEGY sections, various seismic processing steps. Static and Residual static correction. Automatic Gain control (AGC). Muting. Horizontal velocity analysis.

Tomogram preparation. Normal and Dip Move out. Final Stack. Migration.

Unit 4: **Hours:9**

Structural and Stratigraphic Seismic Interpretation

2D and 3D interpretation. Understanding time-lapse interpretation. Loop time and two way time map preparation. Advance velocity analysis. Gridding methodology and placement of faults. Depth – Map preparation. Isochron preparation. Isochrono-pach preparation.2D interpretation and preparation of 3D volumes from 2D data (pseudo 3D preparation).

Amplitude variation with Offset. Amplitude variation with Angle. Classes of Sand. Bright Spot, Dim Spot and Flat Spot. Understanding sequence stratigraphy from seismic interpretation. Mapping of transgressive sequences. Canyons. Dumps. Unconformity. Barrier Parts. Cheniers. Wedge-Out and Pinch out interpretation. 2D and 3D seismic attributes. Analysis of amplitude, frequency and sweetness, derived attributes. Use of attributes in understanding tuning thickness and Fresnel zone (vertical and horizontal resolution).

Total Hours: 39

Text Books and References:

1. Bhattacharya, P. *Direct current geoelectric sounding: Principles and interpretation*. Vol. 9. Elsevier, 2012.
2. Telford, William Murray, Lloyd P. Geldart, and Robert E. Sheriff. *Applied geophysics*. Vol. 1. Cambridge university press, 1990.
3. Dobrin, Milton B. *Introduction to geophysical prospecting*. International student edition,(McGraw-Hill Book Company, Inc.).
4. Telford, William Murray, Lloyd P. Geldart, and Robert E. Sheriff. *Applied geophysics*. Vol. 1. Cambridge university press, 1990.
5. Paul Weimer and Thomas L. Davis. Application of 3D Seismic Data to Exploration and Production, SEG Geophysical Developments, Series, No. 5.
6. Alsadi, Hamid N. "Seismic Hydrocarbon Exploration."

17MPE117 : Drilling Engineering Practical										
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
0	**0**	**2**	**1**	**2**	**--**	**--**	**--**	**50**	**50**	**100**

List of Experiments:

1. Preparation of WBM and OBM including determination of pH of drilling fluid using pH meter.
2. To calibrate the mud balance and determine the specific gravity / density of the mud.
3. To measure the viscosity of drilling fluid using Marsh funnel viscometer.
4. To determine the Rheology of the drilling fluid using Rheometer.
5. To determine the volumes of Water, Oil and Solids in Drilling Fluid using Retort kit.
6. To determine the Fluid loss using Low-temperature/low-pressure API filtration apparatus.
7. To determine the Sand content in drilling fluid using sand content kit.
8. To determine the alkalinity in Drilling fluid and in filtrate of drilling fluid by titration method.
9. To determine the Total hardness in drilling fluid by titration method. Field procedure to determining the total hardness in mud filtrate.
10. To determine the Calcium and Magnesium in drilling fluid by titration method. Field procedure to determining the Ca in mud filtrate.
11. Field procedure for determining cation exchange capacity.
12. To determine the Emulsion stability using Emulsion stability (ES) meter.
13. To measure the gel or shear strength of drilling fluid using Shearometer.
14. To determine the Resistivity of drilling fluid and mud cake using Analog Resistivity meter.
15. Prepare homogeneous cement slurry with the help of Constant Speed Mixer.
16. To measure the absolute density of cement slurry using pressurized mud balance.
17. To determine the thickening time of cement slurries under simulated wellbore conditions using HPHT Consistometer
18. To condition cement slurry to test temperature to enable further testing using Atmospheric Consistometer.
19. To estimate the volume of filtrate lost to the formation using HPHT Filter Press.
20. To determine the rheological properties and graphical behavior of cement slurries using automated computerized viscometer.
21. To determine the stability of Cement Slurry under static Conditions using free water test.

19PEM113					Geology for Reservoir Description					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	-	-	100

COURSE OBJECTIVES

- Demonstrate the concepts of Geoscience.
- Develop skills to predict lithology of Hydrocarbon bearing reservoirs.
- Develop Skills to identify and evaluate reservoir geology, its lithology, structure, Petrophysics etc.
- Imbibe and integrate the geological knowledge for reservoir description.

Unit-1: **TOTAL-- 8 Hrs.**

Introduction to Geology for Reservoir description, Reservoir rocks and minerals: Identification and classification; Rock forming processes, Plate Tectonics and Basin formation, Structural aspect of basins and its stress patterns.

Unit-2: **TOTAL-- 12 Hrs.**

Reservoir sedimentology, Sediment fabric and texture (Grain size and shape analysis), development of porosity and permeability in sedimentary rocks, Petrophysical properties of rocks (porosity, permeability). Reservoir geometry and sedimentology of rocks deposited in various Depositional environments (Continental, Marine, Evaporates).

Unit-3 **TOTAL-- 8 Hrs.**

Different types of reservoirs and their properties: sandstone reservoirs, carbonate reservoirs, evaporate reservoirs, shale reservoirs, unconventional reservoirs and basement reservoirs.

Unit-4 **TOTAL-- 12Hrs.**

Concept of Petroleum System, Proliferous basins of India, Petroleum system of selected basins of India and globe, Reservoir description of Important oilfields of India: (Bombay High –Carbonate, offshore) and Assam (Clastic-onshore), Reservoir description of Important oilfields of World selected examples: Carbonate reservoir-Ghawar, Saudi Arabia; and Clastic reservoirs-North Sea.

TEXT / REFERENCE BOOKS

1. Leverson, A, I., Geology of Petroleum, 2ed
2. Selley, R., 1985, Elements of petroleum Geology
3. Yu, X., Li, S and Li, S., 2018 Clastic Hydrocarbon Reservoir Sedimentology
4. Zou et al, 2013 Volcanic reservoirs in Petroleum exploration
5. Morton-Thompson and Woods, 1992, Development geology reference manual, AAPG methods in Exploration

19PEM112					Geology for Reservoir Description Practical					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	-	-	-	50	50	100

COURSE OBJECTIVES

- Demonstrate the concepts of Geoscience.
- Develop skills to predict lithology of Hydrocarbon bearing reservoirs.
- Develop Skills to identify and evaluate reservoir geology, its lithology, structure, Petrophysics etc.
- Imbibe and integrate the geological knowledge for reservoir description.

List of Experiments

1) **Identification of Common rock forming minerals in hand specimens.**
2) **Identification of Common Sedimentary rocks in hand specimens.**
3) **Identification of Common Igneous rocks in hand specimens.**
4) **Identification of Common Metamorphic rocks in hand specimens.**
5) **Study of Rocks and minerals under thin sections.**
6) **Sedimentary grain size analysis and interpretation**
7) **Preparing and interpreting Contour maps (Isopach, Isocore etc).**
8) **Reconstructing and interpretation of geological cross section**
9) **Stratigraphic and structural interpretation from geological cross section**
10) **Lithological correlation and fence diagram**

TEXT / REFERENCE BOOKS

1) Gokhale, N. M., 1991 A manual of problems in structural geology
2) Lisle, R., 2020., Geological Structures and Maps, 4th Edition
3) Dixon, D., 1992., The Practical Geologist: The Introductory Guide to the Basics of Geology and to Collecting and Identifying Rocks

17MPE122 : Integrated Reservoir Management										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25			100

Unit - 1: **Hrs-9**

Reservoirmanagement Concept & Process

Definition, history & fundamentals of reservoir management, synergic team approach; Integration of geosciences and engineering for reservoir extension, dynamic communication. Development plan of reservoir, surveillance & monitoring,revision of plans & strategies.

Unit - 2: **Hrs- 10**

Reservor Data & Model& Performance Analysis

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

Unit – 3: **Hrs –12**

Development Plans & Technoeconomic Evaluation

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.

Unit – 4: **Hrs -8**

Reservoirmanagement With Case Studies

Various activities of Reservoir Management: initial stage, intermediate stage and late stage, Synergetic approach for reservoir monitoring in different stage, Few case studies for various types of fields from both onshore and offshore.

Total Hrs - 39

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, DehraDun, 248001, India.

17MPE123 : Production Enhancement & Optimization										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25			100

Unit 1: **Hrs : 15**

Production Enhancement

Introduction -- Overview of production enhancement techniques:- Well Analysis and Remedial Measures, Low Productivity – Stimulation, Excessive Production of unwanted fluid, Water Control, Sand Control, Production Optimization. **Stimulation: -** Concept of Formation damage, Type & description of stimulation techniques to mitigate formation damage problem and address issues of low productivity, Design of matrix acidization and acid fracturing. Design of hydraulic fracturing, Multistage fracturing. **Excessive Production of unwanted fluid**: Reasons for excessive production of oil & gas, Causes and hazards of excessive sand production. Industry practices to contain their production. Application of Coil tubing Unit as new generation work over rig for well activation & well repair.

Unit 2 : **Hrs : 9**

Production optimization : Nodal System Analysis- An approach towards total system analysis, Monitoring, Design & optimization of two major lift techniques 1. SRP & 2. Gas lifts system.

Unit 3: **Hrs : 8**

Deep Sea Production : Introduction: Deep water facts & figures, Deep water technology aspect, Conceptual development planning, Deep water JIP, Fast trck development strategy, Indian scenario

Sub-Sea Production System:- Floating Production Platform-Mooring & Anchoring, Flow assurance in deep sea, New Technologies.

Unit 4 : **Hrs : 7**

Offshore Safety and fire protection : Safety aspects:-Process safety, Life extension, Well integrity, Rig interferences. Human factors and safety, ERR Process. Navigation aids, Fire protection system

Total Hrs:- 39

Texts and References:

1. Dr. Guo Boyun, Computer Aided Petroleum Production Engineering
2. H Dale Begg, Production Optimization , OGCI Publication, Tulsa.
3. Deep water Petroleum Exploration & Production-By Willium Leffler, Richard Pattardozzi, Gordon Sterling
4. Floating Production System- By N.K. Mitra.

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17MPE124: Advanced Enhanced Oil Recovery										
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
2	**1**	**0**	**3**	**3**	**25**	**50**	**25**	**--**	**--**	**100**

Unit 1: **Hours: 6**

Resource and Reserve within reservoir; Estimation of reserve using deterministic and stochastic technique, understanding primary; secondary and tertiary recovery; Development of primary production profile; Determination of secondary recovery profile; flow of immiscible fluids through porous media

Unit 2: **Hours: 12**

EOR and IOR differentiation; Water flooding; frontal advancement theory; types of water flooding and patterns used (5 spots, 7 spot, 9 spot, staggered, direct line, skewed and unscrewed); well spacing and design; unit mobility ratio and non unit mobility ratio; breakpoint and coning effect; stiles method; Buckley Leverette Equation and Dykastra Parson Equation; Associated Numerical.

Unit 3: **Hours: 8**

Various techniques used in EOR; Classification of methodologies and application of the same in various reservoir conditions, understanding mobility, mobility ratio and sweep efficiencies (vertical and horizontal sweeps), Alkaline Flooding, Polymer Flooding and Surfactant Methods (Chemical); CO_2 Gas Flooding, Foam induced Flooding.

Unit 4: **Hours: 10**

Miscible and Immiscible Flooding. Miscible Displacement Processes, Mobilization of residual oil, Condition of Miscibility, Matrix Acidization – Preparation of Acid, Induction of Acid, Skin Changes. Screening Criteria and description of usage for Thermal Methods. Hot fluid Injection. Insitu Combustion. Microbial EOR.

Total Hours: 36

Text and References:

1. Lake, L. W. (1989) Enhanced Oil Recovery, Prentice Hall
2. Latil, M. (1980) Enhanced Oil Recovery, Technip Publication
3. Donaldson, E. C.; Chilingarian,G. V. and Yen, T. F. (1985) enhanced oil recovery –I Fundamentals and Analysis, Elsevier.
4. Ganesh C. Thakur, Integrated Waterflood Asset Management
5. Teknica (2001); Enhanced Oil Recovery; Teknica Petroleum Services Limited

17BPE126: Petroleum Engineering Laboratory										
Teaching Scheme					Exam Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	4	2	4	--	--	--	50	50	100

Week 1

- Determination of Effective porosity of given core sample by saturation method
- To determine viscosity of given oil sample by using capillary viscometer

Week 2

- To determine the permeability of given sample by using Ruska Liquid Permeameter
- Permeability measurement by using Gas Permeameter

Week 3

- Productivity Ratio Analysis and Understanding the importance of Interference test
- Determine the rheological properties of a given oil sample using Rheometer

Week 4

- Draw a ternary phase diagram for solubility of water benzene isopropyl alcohol (IPA) solution.
- Water Coning using Resistance Analogy

Week 5

- Determine the Formation resistivity of the saturated rock sample
- Determine the acid value of the given oil sample.

Week 6

- Effect of confining pressures on a core in terms of Conductivity/ permeability using sweet water at Normal temperature by using FDS.

Week 7

- Effect of confining pressures on a core in terms of Conductivity/ permeability using sweet water at 70Degree Centigrade temperature by using FDS

Week 8

- Effect of confining pressures on a core in terms of Conductivity/ permeability using saline water of 1.05 Sp Gr. water at Normal temperature by using FDS.

Week 9

- Evaluation of particle size distribution of proppant in terms of No. of particles and size on each sieve by application of closure stress on it in crush cell by using FCS.

Week 10

- Calculate/ depict the trend of production Index of a given proppant by application of closure stress on it in crush cell by using FCS.

Week 11

- Calculate and depict the trend of conductivity/ permeability of proppant using normal water at normal temperature using conductivity cell by using FCS

Week 12

- Calculate and depict the trend of conductivity/ permeability of proppant using normal water at 70 degree centigrade temperature using conductivity cell by using FCS

Week 13

- To make core plug ready for experiment in Core Plugging and Core Trimming and Swabbing

19PEM111, Well Stimulation: Conventional & Unconventional Reservoirs

Teaching Scheme					Exam Scheme					Total Marks
L	T	P	C	Hrs/Week	Theory			Practical		
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	--	--	100

Unit-1 — **4 Hours**

Conventional vs Unconventional reservoirs

Geology and geochemistry, Source vs trap reservoirs, Physical properties, Mechanical properties, Well testing, Petrophysics analysis, Reservoir simulation, Production decline analysis

Geomechanics of the unconventional reservoirs

Failure mechanisms and criteria (compressive, tensile, shear, creeping, pore collapse, plastic behavior, Brittleness factors); Effective stress concept of the conductive elements; matrix, natural fractures, beddings, and induced fracture.; Stress profile and fracture height containment ; Stress shadowing effect; Understanding the critically stressed natural fractures and beddings

Unit-2 — **4 Hours**

Hydraulic fracturing: Design and modeling

Dynamic and static mechanical properties; Stress field; measurement and estimation; Fracturing fluid rheology; Fluid leakoff; fluid loss modeling, fluid shear history; Proppant selection; Pressure diagnostic techniques; Modeling a hydraulic fracture: Plain strain, elastic deformation, width development and fracture propagation; CGD, KGD, Fracpro, Gohfer, and new models for network fracturing

Unit-3 — **8 Hours**

International field examples demonstrating current technologies to develop unconventional reservoirs

Major shale oil and shale gas basins; Well-pad configuration and horizontal wells; Horizontal wells placement and spacing; Sweetspot identification; Well completion: Multistage fracturing; plug & perf, ball-activated sliding sleeves, coiled tubing activated. ; Fracturing stages, stages spacing and clusters spacing; Fracturing fluids; nano surfactants, slick water fracturing, high viscosity friction reducers; Proppant selection: local sand, light weight proppant, hybrid in size or density ; Complex fracture modeling; Diagnostic methods: DFIT, microseismic, fiber sensing, and tiltmeter; Water management; Production optimization

Unit-4 — **4 Hours**

Local examples: Case studies discussion & term papers

The SPE papers provided below will be covered as lectures and students' presentations.

Emerging technologies

1. Refracturing: when it is successful, candidate selection, procedures, economics and case histories.
2. IOR/EOR techniques
3. Waterless fracturing; energetic fracturing, Pulse fracturing, Cryogenic fracturing, Exothermic chemical pulse fracturing, and laser perforation/fracturing

Total Hours: 20

Text Books and Reference

17PEM128 : Well Test Analysis										
Teaching Scheme					Theory			Practical		Total
L	T	P	C	Hrs/Week	MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	-	-	100

Unit-1: **Hours: 6**

Mathematical preliminaries of Well Testing: Point source solution, Line source solution, Floe regime identification Pressure transient test type,

Unit 2: **Hours: 12**

Convolution and Deconvolution and Nonlinear Parameter Estimation

Convolution Integral, discrete Convolution, Discrete Convolution,Logarithmic Convolution, Rate-Pressure, Pressure-Pressure Convolution, Analytical deconvolution, Pressure-rate deconvolution, Pressure-Pressure deconvolution, Parameter estimation methods, problem for pressure-transient test interpretation

Unit 3: **Hours: 8**

Pressure Transient Test Design and Interpretation

Introduction, Pressure transient test design and interpretation workflow, Multi well interference test example, Horizontal well test interpretation

Total Hours: 26

Text Books and References :

1. Pressure Transient Formation and Well Testing: Convolution, Deconvolution and Nonlinear Estimation- F. J. Kuchuk, M, Onur, F. Hollaender, Elsevier, 2010

17MPE114 : Petroleum Formation Evaluation										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	-	-	100

Unit-1: **Hours: 9**

Fundamentals

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, data collected on Mud logs. Temperature logs, Closed hole environment

Unit 2 : **Hours:12**

Routine Logging

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 3 : **Hours : 10**

Special Logging Technique

Nuclear magnetic resonance logging, Dip meter, image logging, gyroscopic log, geochemical log, vertical seismic profiling, Cement bond log, variable density log, Logging while drilling and Measurement while drilling, Production Logging

Unit 4: **Hours : 8**

Integrating and Interpreting data

Synthetic seismogram preparation using seismic and well log, 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 and its effect in reserve estimation, thin resistive sand interpretation in facies classification and reservoir property evaluation

Total Hrs -39

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

19PEM134E					Oil and Gas Offshore Operations					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	-	-	100

COURSE OBJECTIVES

- ➢ Demonstrate the various offshore operations.
- ➢ Imbibe the knowledge of associated problems and their related remedies.
- ➢ Improve analytical skills to predict the suitable operation based on the offshore environment.
- ➢ Develop skill to propose best suitable strategy for performing offshore operation

UNIT-1 10 Hrs.

Introduction: Deep water facts & figures, Indian and Global Deep water exploration and production scenario, Introduction to Offshore, Environmental conditions, Wave, wind and undercurrent forces. Types and classification of Offshore Platforms. Offshore logistics.

UNIT-2 9 Hrs

Drilling and Well Completion: Techniques of drilling and completing in shallow water, associated problems, Techniques of drilling and completion in deep water, smart and intelligent well completion. Safety systems for offshore operations, Oil Processing in Offshore and Comparison with onshore.

UNIT-3 10 Hrs.

Deep water development & Flow assurance strategy, subsea completion, floating platforms, mooring and anchoring systems, ROV and ROT for well intervention. Flow assurance in deep water, prospective new technologies.

UNIT-4 9 Hrs.

Offshore Safety and fire protection: Safety aspects:-Process safety, Life extension, Well integrity, Rig interferences. Human factors and safety, ERR Process. Navigation aids, Fire protection system. Case history analysis and lessons learned

COURSE OUTCOMES

On completion of the course, student will be able to:

CO1- Relate Offshore operations with that of onshore operations.
CO2- Differentiate and illustrate offshore drilling and production platforms.
CO3- Apply the knowledge to tackle bottlenecks in offshore drilling and production operations.
CO4- Analyse offshore environment and predict techniques of various operation.
CO5- Plan strategy for offshore drilling and production operations.
CO6- Evaluate the feasibility of offshore operation in view with the offshore safety and environmental aspects.

TEXT / REFERENCE BOOKS

1. SSP singh, Jatin Agrawal and Nagmani (2019) Offshore operations and engineering, CRC Press, Taylor and francis group 281 p

17PEM131E					Petroleum Economics					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	-	-	100

Unit I Hours: 6

Background of the Oil and Gas Industry, Geopolitical history of Hydrocarbon exploration, Life cycle of Petroleum Project; Basics of Upstream and Downstream regulatory Laws and Policies

Unit-II, Hours: 6

Fiscal System in hydrocarbon industry; Economic model of oil and Gas property; Time Value of Money; Project cash flow; Key Economic Parameters (Net Present Value; Internal Rate of Return);

Unit III Hours: 6

Risk Analysis for Oil and Gas Property Evaluation; Risk and Uncertainty; Expected Monetary Value Concept; Decision tree and Simulation.

Unit IV Hours: 6

Hydrocarbon trading-Oil trading, (Physical and Paper; Crude oil Markets- Spot, Barter, Future and forward); Oil and Gas Pricing mechanism; Hydrocarbon Strategic storage, Arbitration and dispute settlement

TEXT / REFERENCE BOOKS

1) Tordo, S (2007) Fiscal System in Hydrocarbons: design issues. The World Bank
2) Abdel-Aal and Alsahlawi (2013) Petroleum Economics and Engineering
3) Hinkin, C (2017) Introduction to Petroleum Economics

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100 **Exam Duration: 3 Hrs.**

PART A: Part A/Question: <Short Notes, Problems, Numericals> **20 Marks**

PART B:<Justification, Criticism, Long answers, Interpretation > **80 Marks**

17MPE130 : Health, Safety and Environment in Oil and Gas Sector										
Teaching Scheme					Exam Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	4	25	50	25	--	--	100

Unit I **Hours: 06**

Physical Hazards Noise, Heat, Vibration, Illumination, Radiation, extreme climatic conditions etc, Chemical Hazards Hydrogen sulfide gas, Hydrocarbons, Ammonia, Chlorine, Formaldehyde, Hydrochloric Acid, Methanol, Sulphur, Sulphuric acid, Sodium Hydroxide, etc. Biological Hazards, Psychological Hazards, Ergonomic Hazards, Injuries, Burns etc 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(ref API 14 C)

Unit II **Hours:05**

Risk Matrix, HAZID, HAZOP, QRA (API 14 J, OISD) , Safe Work Practices : PTW, MOC, SIMOPS etc (ref API RP 75,OISD, OMR) , Electrical Safety;, Classification of Hazardous locations, use of electricity I Hazardous area (Ref IER, OISD, OMR, API RP 500 & 14 F) Accident Investigations: Study of major accidents like Piper Alpha, Flixborough, Bhopal etc., Investigation techniques Emergency Response planning Audits & Inspection. Audit methodology, protocol, typical check lists for Drilling rigs, Work over activities, logging, etc (ref OISD Standards)

Unit III **Hours: 07**

Occupational Health and Safety

Occupational Exposure to Gas leak and Explosions, Confined spaces, Electrocution, Emergencies and classification of emergencies, Various Emergency Plans, Emergency Response and Disaster Management Plans, Indicative preventive measures and procedures, Zoning and Maps, Layout and Flow Diagrams, Manpower Data, organogram of ERDMP, Siren codes, safe work practices and work permits, personal protective equipments, Fire safety, Health and safety audit.

Unit IV **Hours:06**

Environment and Environment Concepts: Effect on eco-system:- Air, Water, & Soil of HC‟s. Impact of Exploration & Exploitation of Hydrocarbon on Environment Environmental studies (Off shore & On Shore) - Environmental Impact Assessment Oil Spills Control and their management. State, Government of India and international Maritime Environmental Rules & Regulations. Drilling / Oil Storage / Effluent water / waste (solid & sludge) treatments their disposal and remediation of soil etc.

20PEM140 (Audit)					Reservoir Modelling and Simulation/ Petroleum Software					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hours/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/VIVA	
1	0	1	0	2	--	--	--	50	50	Pass/Non Pass

COURSE OBJECTIVE:

1.	To provide an in-depth knowledge on central role of reservoir simulation in petroleum industry
2.	To get acquainted to the basic reservoir simulation work flow in terms of development of geostatic model, upscaling to dynamic model.
3.	To provide hands-on training to CMG/tNavigator/other simulation software.

PRE-REQUISITES

Petroleum Geology; Petroleum Exploration; Reservoir Engineering; Well Logging and Formation Evaluation; Numerical Methods.

SYLLABUS

Unit -1: Geomodelling for reservoir Engineers **Hours: 06**

Exposure to reservoir simulation software; Integration of data sets into geo-static model; petrophysical property modelling; Up-scaling to Reservoir simulation model.

Unit –2: Numerical Modelling Core Flood Setup **Hours: 06**

Introduction to analytical/numerical models, Mathematical & numerical modelling of 1D flow model; validation / verification of simulation models, Buckley Leverett Solution.

Unit –3: History Matching **Hours: 06**

Developing simulation model using CMG/tNavigator software, Training of models into representative reservoir simulation model, Simulation study, developing and simulation of SPE First Comparative Solutions Project (https://doi.org/10.2118/9723-PA).

Unit –4: Water Flooding/EOR Simulation **Hours: 06**

Conceptualizing and developing reservoir simulation model for water flooding/EOR scenario, Numerical sensitivity study and field scale investigations.

Text & Reference Books:

1. John R. Fanchi - Principles of Applied Reservoir Simulation. 4-Gulf Professional Publishing (2018)
2. Khalid Aziz and Antonin Settari - Petroleum Reservoir Simulation. Applied Science Publishers (1979)
3. Donald W. Peaceman (Eds.) - Fundamentals of Numerical Reservoir Simulation-Elsevier (1977)
4. CMG Software Training Manuals.
5. Odeh, Aziz S.. "Comparison of Solutions to a Three-Dimensional Black-Oil Reservoir Simulation Problem (includes associated paper 9741)." *J Pet Technol* 33 (1981): 13–25. doi: https://doi.org/10.2118/9723-PA

COURSE STRUCTURE FOR M.TECH PETROLEUM ENGINEERING

SEMESTER – III

Course Code	Course Name	Teaching Scheme					Total Marks
		L	T	P	C	Hrs/wk	
MT611	Seminar	-	-	-	5	10	100
MT612	Project	-	-	-	14	20	100
MT613	Industrial Training	-	-	-	PP/NP		PP/NP
	Total				**19**	**30**	**200**

COURSE STRUCTURE FOR M.TECH PETROLEUM ENGINEERING

SEMESTER – IV

Course Code	Course Name	Teaching Scheme					Total Marks
		L	T	P	C	Hrs/wk	
MT621	Seminar	-	-	-	5	5	100
MT622	Project & Dissertation	-	-	-	24	24	100
	Total				**29**	**29**	**200**