17MPE121 : Reservoir Modeling and Simulation										
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-8**

Introduction and need for Reservoir Simulation. Basic reservoir Engineering concepts and Reservoir –Fluid and rock properties. Traditional Modeling Approaches, Reservoir Simulation Approach; Single phase fluid flow equations in multidimensional domain in Cartesian and radial –cylindrical coordinates.

Unit –2: **Hrs- 12**

Simulation with a Block-Centered and Point-distributed Grid: Reservoir discretization, flow equation for boundary gridblocks. Calculation of transmissibilities. Well Representation in simulators. Practical considerations dealing with well operating conditions

Unit –3: **Hrs –10**

Modeling two-phase and multiphase flow in Petroleum reservoir. The black oil model: Basic differential equations and numerical solutions. Compositional modeling: Basic differential equations and numerical solutions of compositional flow.

Unit – 4: **Hrs -9**

Design of Study Objectives, Analysis of reservoir Data: Geophysical, Geological and Engineering data; Development of Simulation Model: Model selection and grid selection; History matching, Reservoir performance analysis by classical reservoir engineering methods vis-a-viz Reservoir Simulation method Final Advice.

Total Hrs - 39

Texts and References:

1. Basic Applied Reservoir Simulation-TurgeyErtekin, Jamal H Abou-Kassem and Gregory R. King, SPE Textbook Series, Volume 7.
2. Petroleum Reservoir Simulation: a basic approach – J. H. Abou-Kassem, S. M. Farouq Ali, M. R. Islam, Gulf Publishing Company, Houston, Texas, 2006.
3. Reservoir Simulation-mathematical Techniques in Oil Recovery-Zhangxin Chen, Society for Industrial and Applied Mathematics, Philahelphia.
4. Computational Methods forMmultiphase Flows in Porous Media-Zhangxin Chen, GuanrenHuan and Yuanle Ma, Society for Industrial and Applied Mathematics, Philahelphia.

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

17MPE125 : Advanced Process Dynamics and Controls										
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

Unit1: **Hours: 9**

Basic Modelling Principals

Steady state model, Dynamic Model, Continuous system modelling Definition and classification of first order and second order systems, Ideal input functions, Dynamic response of the process, Final control element, stability analysis of closed loop system,

Unit 2: **Hours:10**

Frequency ResponseAnalysis

Frequency response of a dynamic system, experimental methods of dynamic model development, controller tuning and controllersynthesis, closed loop response and controller synthesis in frequency domain.

Unit 3: **Hours: 10**

Digital simulation of process and control system

Liner interpolations in two dimensions, integration algorithms, modeling non- linear systems, lead- leg element, Implicit convergence, modeling for non ideal mixing, distributed parameter system, distillation column dynamic and control, Bode plot, Inverse bode plot, Nyquist plot, Nichol's plot.

Unit 4: **Hours:10**

Control of Unit Operations and Processes

Control of Heat Exchangers, Evaporators, Crystallizers, Brine system, Liquid- Liquid Extraction column, Distillation column, Control of Unit Processes, Programmable Logic Controller.

Total Hours: 39

Text Books and References:

1. Sarkar P.K., Advanced Process Dynamic and Control, PHI Learning private limited, Delhi
2. Ogata , K. Modern control Engineering, 5th Edition, Prentice Hall Publishers

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

17MPE128 : 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

17MPE129 : Advanced Natural Gas Engineering										
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-1: **Hours : 7**

Introduction

What is natural gas – Utilization of natural gas – Natural gas industry (World and India) – Natural gas reserves – Types of natural gas resources – Future of natural gas industry. Properties of natural gas, Phase Behavior Fundamentals.

Unit -2: **Hours : 8**

Steady-State Flow of Gas through Pipes

Introduction. Gas flow fundamentals. Vertical and inclined single-phase flow of gas. Gas flow over hilly terrain. Gas flow through restrictions. Temperature profile in flowing gas systems.

Multiphase Gas-Liquid Flow: Introduction. Approximate method for two-phase systems. Multiphase flow. Loading in gas wells.

Unit – 3: **Hours : 7**

Gas and Liquid Separation and Gas Processing

Introduction- Separation equipment. Types of separators. Separation principles. Factors affecting separation. Separator design. Stage separation. Low temperature separation. Gas cleaning. Flash calculations. Dehydration, Acid gas removal process and Desulphurization process

Unit-4 : **Hours : 8**

Gas Flow Measurement and Transportations

Measurement fundamentals. Methods of measurement. Orifice meter. Other types of measurement. Introduction to gas transportation: Gathering systems. Steady-state flow in simple pipeline systems. Steady-state flow in pipeline networks. Unsteady-state flow in pipelines. Some approximate solutions for transient flow. Pipeline economics.

Total Hours: 26

Text Books and References:

Petroleum Production Handbook, Bradly HB.

2) Introduction to Petroleum Production Volume 1 & 2:- Dr. Skimmer

3) Handbook of Natural Gas Processing, James G Speight.

4) Natural Gas Engineering, Kelkar, M., 2005.

5) Gas Reservoir Engineering, Lee, W.J., Wattenbarger, R.A., 1996.

6) Natural Gas Engineering Prodcution and Storage, Katz: D.L., McGraw-Hill Publishing Company, New York, 1990.

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.

Upstream safety: Implementing Agency OISD (for on- land blocks0 directorate of Mine Safety(for Off- Shore Blocks),Safety in Rig operation; Safety in Exploration and Production.

Downstream Safety: Implementing Agency PNGRB; Safety Regulations(Technical Standard,Specification and Safety Standards T4S), Emergencies, Mutual Aida; Emergency Response and Disaster Management Plan ERDMP)

Text Books and References:

1. Less, F. P., Loss Prevention in the Process Industries, 2nd ed., Butterworth Heinemann, UK.
2. Peavy, H. S., Rowe, D. R. and Tchobanoglous, G., Environmental Engineering, McGraw Hill, New York.
3. Sanders, R. E., Chemical Process Safety, Butterworth Heinemann, UK, Year.
4. NFPA, API 14 G & OISD Standards.
5. Marchell, V. and Ruchemann, S., Fundamentals of Process Safety, Institution of Chemical Engineers, Warwickshire, UK.