B.TECH-PETROLEUM ENGG. (UPSTREAM) COURSE STRUCTURE

(in line with Oklahoma University)

Fourth Year, VIII Semester

PE-Reservoir Modelling and Simulation

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 I : Reservoir Modeling **Hours: 10**

Introduction to Modeling – Geological Modeling, Types of Model & designing of various models depending on reservoir complexities, rock properties, fluid properties etc., Concept of Black Model and Compositional Model

Unit II : Reservoir Simulation **Hours: 10**

Introduction, Historical Background, Application of Simulator, Different models, Flow Conditions: Single phase, two phase & multiphase equations for one two & three dimensional models Special Concept: Explicit & implicit grid system, Finite difference & finite element method, Matrix solution, iterative method, stability criteria

Unit III : Data Preparation **Hours: 9**

Pesudo functions, Reservoir Model Solution Techniques: Implicit pressure and Explicit Saturation (IMPES) ; Implicit pressure & Implicit Saturation (IMPIS) , Preview of Numerical Solution Methods: Direct & Iterative method

Unit IV : History Matching **Hours: 10**

Mechanics and Parameter match Special Concepts: Coning and Compositional Models Simulation Optimization using Economic and Techno economic Evaluation Computation of Economic Indices viz. different variants based on technical and economic considerations Introduction to streamline simulation and comparison of conventional / streamline simulation

Total Hours: 39

Texts and References:

1. Crichlow, H. B. (1977) Modern Reservoir Engineering, A Simulation Approach, Prentice-Hall.
2. Franchi, J R. (2006) Principles of Applied reservoir Simulation, 3rd Edition. Gulf Professional Publication.
3. Aziz, K and Sattari, A (1979) Petroleum reservoir simulation, Applied Science Publishers
4. Peaceman, D. W. (1977) Fundamentals of numerical reservoir simulation, Elsevier Publication.

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B.TECH-PETROLEUM ENGG. (UPSTREAM) COURSE STRUCTURE

(in line with Oklahoma University)

Fourth Year, VIII Semester

PE-Production Engineering II										
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 I : Gas Lift Installation and Design **Hours:10**

Introduction, basic principles of gas lift, intermittent and continuous gas lift system. Unloading sequence Gas lift valves, classification, valve mechanics and calibration. Selection merits and demerits of different categories of gas lift valves. Gas lift design, basic principles of gas lift feasibility, design and operations, Examples of Mandrel Spacing Design Using IPO and PPO Valves. Design problems. Gas lift optimization, Types of Gas lift installations. Operational and maintenance aspect of gas lift wells. Surface facilities for gas lift. Power requirement.

Unit II: Pumping Methods **Hours: 10**

Electrical Submersible Pump - Introduction, surface and subsurface components of ESP. Downhole equipment and surface installations. Detail design of all specifications. Total dynamic head, number of stages and horsepower requirement, *Hydraulic pumping, Progressive Cavity Pumps*, *Sucker Rod Pump* - Introduction, definition, Stable and unstable flowing conditions. Pumping unit, surface and subsurface equipment, working principle. Pumping cycle. Design of sucker rod string.

Unit III GGS and Processing **Hours: 10**

GGS – layout, treatment and installations, Separators -Types of separator, Liquid level control and relative advantages/disadvantages of different type of separators, Dehydration & Desalting of Oil, De-emulsification and Desalting process Different types of storage system, Types & features of storage tanks, fixed roof and floating roof tanks. Design of storage tanks, transportation and metering system.

Unit IV : Production Problems and Well Stimulation Techniques **Hours: 09**

Problems-Analysis of well history, Reservoir considerations, Oil and gas coning, Water production problems in oil or gas wells, Source identification and control measures, Paraffines and Asphaltenes deposition and removal, Scales in oil field systems, Sand deposition, Sand control techniques, Formation Sand Size analysis, optimum gravel - sand ratio, gravel pack thickness and selection, gravel packing fluid & gravel pack techniques, Resin consolidation methods.

Well Stimulation - Formation damage, Need and enhancement of well productivity, Stimulation methods, Hydraulic fracturing – types of fracking fluids, additives and proppants, parameters for fracking, initiation of fractures, Acidizing – Matrix and Fracture, Nitroshooting and De-paraffination, Well stimulation using surfactants, Wave technology and microbial stimulation.

Total Hours:39

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B.TECH-PETROLEUM ENGG. (UPSTREAM) COURSE STRUCTURE
(in line with Oklahoma University)
Fourth Year, VIII Semester

Texts and References:

1. Nind T.E.W. (1964), Principles of Oil Well Production, McGraw Hill
2. H Dale Begg , Production Optimization , OGCI Publication,tulsa.
3. Kermit Brown, Technology of artificial lift method –. Vol 2a ,2b.Penwell publishing company, Tulsa.

PE-Production Engineering-II (PE-4423)										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	--	--	3	3	--	--	--	--	--	**100**

Artificial lift design; sucker rod pumping, electric submersible pumping, plunger lift, and gas lift; design of surface production equipment; oil and gas separation; oil treating; gas dehydration; single and two-phase flow through pipes, fluid measurement; pipeline system design.

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B.TECH-PETROLEUM ENGG. (UPSTREAM) COURSE STRUCTURE

(in line with Oklahoma University)

Fourth Year, VIII Semester

PE-Integrated Reservoir Management										
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 I : Petroleum Resource Management **Hours: 9**

Concept of PRMS, History of PRMS, Deterministic Reserve and Probabilistic Resource, P90, P50 and P10 scenarios, equivalence of deterministic and probabilistic scenarios, Appraisal and Field Development plans, Field Optimization, Concept of Capex, Opex , NPV, IRR and EMV estimation.

Unit II: Integrated Reservoir Management **Hours: 10**

Concept of Reservoir Management, Input to modeling, Concept of static and Dynamic Modeling, Structural modeling, Property modeling and Facies modeling, Simulation runs, History matching, Reservoir characterization, Mesh preparation, Gridding and Contouring, Cluster Analysis, Production Forecasting, Performance Analysis, Drive Mechanism- Solution gas drive, Gas-cap drive, Water drive, Gravity-drainage drive, Combination drive

Unit III : Field Development Studies **Hours: 10**

Conceptual field development studies, Deterministic and Probabilistic Resource estimation, Monte Carlo Simulation –P90, P50 and P10 Cases, Volumetric, Stochastic, Decline Curve analysis and Material Balance Calculations, Risking in Production Profile, Initial Field Development Plan Ingredients and considerations in Field development planning and implementation (Case Study), Differentiation in cases of oil, gas and condensate.

Unit IV : Stimulation Processes for plateau maintenance **Hours: 10**

Technology providers in Hydrocarbon Industries, Development and Deployment Cycles, Matrix Acidization, Technology of Acid Pumping, Coiled Tubing Operation, Hydraulic Fracturing, Work over operation, Sand control and screening guides

Total Hours: 39

Texts and References:

1. Integrated Reservoir Asset Management, John R Franchi, Elsevier
2. Integrated Petroleum Reservoir Management, Abdus Satter, Ganesh Thakur, PennWell Books
3. www.spe.org/industry/docs/PRMS
4. Sand Control, Penberthy Jr, and Shaughnessy, SPE series on special topics Vol-1 , Henry L Doherty series.
5. Well completion and services , Dennis Perrin, Oil and Gas Field Development technique series, Technip Editions

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B.TECH-PETROLEUM ENGG. (UPSTREAM) COURSE STRUCTURE

(in line with Oklahoma University)

Fourth Year, VIII Semester

PE-Integrated Reservoir Management (PE-4553)										
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
3	--	--	3	3	--	--	--	--	--	**100**

Application of petroleum engineering and geoscience principles to the design of the reservoir management plan. The management environment; integrated reservoir description; performance prediction; developing the reservoir management plan; economics

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B.TECH-PETROLEUM ENGG. (UPSTREAM) COURSE STRUCTURE
(in line with Oklahoma University)
Fourth Year, VIII Semester

PE-Dissertation and Seminar II							
Teaching Scheme					**Examination Scheme**		
L	**T**	**P**	**C**	**Hrs/Week**	**Report writing**	**V/V**	**Total**
0	**0**	**3**	**3**	**3**	**80**	**20**	**100**

Aim: To address specific industry and research related problems.

Unit 1: Experimentation and data analysis and Synthesis

Unit 2: Outcome, discussion and conclusion

Unit 3: Report Writing, Presentation and Viva-Voce

Text Books & **Recommended Software**:

1. Kothari, C. R. (2008) Research Methodology: Methods and techniques,
2. Murray, R (2002) How to write a thesis, McGrawal Hill Publication
3. Recent ENDNOTE Software for referencing
4. JABREF for Referencing.

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B.TECH-PETROLEUM ENGG. (UPSTREAM) COURSE STRUCTURE

(in line with Oklahoma University)

Fourth Year, VIII Semester

PE - Well Test Analysis and EOR										
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 Well Test Analysis **Hours: 10**

Principles of fluid flow for steady state, semi steady state & non steady state conditions. Diffusivity equation derivation & Constant Terminal Rate Solution, Drill Stem Testing: Equipment, DST Chart observation, analysis & interpretation

Unit 2:- **Hours: 10**

Pressure Transient Tests: Pressure Build-up / Draw-down tests, RLT (Reservoir Limit Test) etc. for both oil and gas. Advanced Pressure Transient Analysis, Gas Well tests: Flow after flow, isochronal, modified isochronal tests. Other tests: Interference and pulse tests, Pressure Fall Off test in Injection wells. Multi rate tests, pulse test, Average reservoir pressure. PBU / PDD in Horizontal wells, Type Curves & their uses

Unit-3 EOR and Water Injection **Hours: 10**

Introduction to EOR, Reservoir Engineering aspects of enhanced recovery methods, Water Flooding concepts – well spacing for fluid injection. Buckley Leverett Principle for immiscible flooding & Mobility Ratio Concepts.

Unit-4 Other EOR Techniques **Hours: 09**

Polymer Flooding, Surfactant flooding, Caustic flooding, ASP – Principles and applications. Miscible Flooding: Principles and applications of CO2 flooding, Dry & Enriched gas flooding. Inert Gas Flooding, WAG flooding, Thermal processes in EOR.

Total Hours: 39

Texts and References:

1. John Lee, Well Test Analysis.
2. R.C. Earlougher, Modern Well Test Analysis.
3. Mathews and Russel, Well Testing

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B.TECH-PETROLEUM ENGG. (UPSTREAM) COURSE STRUCTURE

(in line with Oklahoma University)

Fourth Year, VIII Semester

PE-Pipeline Engineering										
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 I : Introduction **Hours: 10**

Introduction to Pipelines, Responsibilities of pipeline engineers and designers, scope of pipeline, inputs and outputs, process diagram (PFD, PNID), course and standards, oil and gas terminology, types of platforms, pipeline elements, pipeline materials, material takeoff for onshore and offshore pipelines

Unit II : Pipeline Drawings **Hours: 9**

Field layouts, alignment sheet, riser and spool, GAD'S, crossing details, trench details, anode details, monel sheathing

Unit III : Pipeline Specification **Hours: 10**

Pipeline valve thickness calculations, cathodic protection, valves specifications & specialties, pipeline supports, clamps, configuration of equipments, pipeline installation methods, on bottom stability, free span calculations

Unit IV : Stress Calculation **Hours: 10**

Pipe stress Requirements, fatigue failure, stress intensification factor, code compliance, pipe support span calculations, piping design for leading types (sustain load – pressure, weight, expansion loads, hanger design, occasional loads), piping configuration, loops – types and sizing, cold spring, underground pipe, flange leak analysis, thrust force calculations, code compliances

Total Hours: 39

Texts and References:

1. Alkazraji Duraid, (2008) A quick guide to pipeline engineering WOODHEAD Publishing Limited
2. Vincent, Jecqes (2010) Fundamentals of Pipeline Engineering, Gulf Publishing
3. Antaki, G. A. (2003) Piping and Pipeline Engineering, Marcell Dekker.

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