COURSE STRUCTURE FOR B.TECH. Fourth year

SEMESTER VII			B.TECH. Fourth year										
Sr. No	Course Code	Course Name	Teaching Scheme					Exam Scheme					
								Theory			Practical		Total
			L	T	P	C	Hrs/wk	MS	ES	IA	LW	LE/Viva	Marks
1	PE-413	Unconventional Hydrocarbon Resources	2	0	0	4	2	30	60	10	--	--	100
2	PE-414	Integrated reservoir mgmt and oil and gas field development	3	0	0	6	3	30	60	10	--	--	100
3	PE-415	Artificial Lift Techniques	3	1	0	7	4	30	60	10	--	--	100
4	PE-416	Work over and Stimulation	3	1	0	7	4	30	60	10	--	--	100
5	PE-420	Reservoir Modeling and Simulation	3	1	0	7	4	30	60	10	--	--	100
6	PE- 417	Industrial Training and Viva-Voce	0	3	6	6	9	--	--	--	80	20	100
7	PE-418	Pre Project Dissertation & Seminar	0	0	6	3	6	--	--	--	80	20	100
		Total	**14**	**6**	**12**	**40**	**32**						700

MS = Mid Semester, ES = End Semester; IA = Internal assessment (like quiz, assignments etc)
LW = Laboratory work; LE = Laboratory Exam

PE 413 Unconventional Hydrocarbon Resources										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	--	4	2	30	60	10	--	--	100

Unit-1 **4 Hrs**

Introduction- Energy resources; Conventional Energy Resources; Un-Conventional Energy Resources; Difference between Conventional and un Conventional, HC resources, Conventional Energy Resources (Simple introduction) (a). Crude Oil (b). Natural Gas (c) Coal

Unit-2 **14 hrs**

Un Conventional Energy Resources- (Detail study required), CBM – formation; Resource potential mapping; Seismic analysis and other methods for assessing the potential; Award procedure for CBM block in India ; status of CBM bidding round; Current CBM Production; Future prospects; Players in India; Global Scenario, CMM- formation; Resource potential mapping; methods for assessing the potential; Award procedure for CMM block in India ; status of CMM; Current CMM Production; Future prospects; Players in India; Global Scenario, Shale Gas- Introducing Shale Gas; Shale Rock formation; History of Shale Gas; US success Story; Replication possibilities US experience in India; Shale gas Global Potential ; Shale Gas initiatives in Europe and Asia; Shale Gas Potential in India; major Shale Plats in India; Shale Gas a game changer; Status of Regulatory regime in India for shale gas; Analysing the issues related to shale gas exploration in India; Results of Preliminary explorative studied carried out in India- Cambay Basin by Reliance; Cambay Basin(Sanand) by GSPC; Damodar Basin by ONGC; Dholka Field by Joshi Technology, Gas Hydrates- The concept of gas in hydrates; possible location of gas hydrates; Global versus Indian experience; potential of estimated gas from hydrates; artificial Hydrate concept; application of artificial Gas hydrate for gas transportation Insitu gasification of Coal and lignite

Unit-3 **5 hrs**

Estimation of Unconventional Energy Resources Methods of estimation, Indian scenario' potential of various unconventional sources,

Unit-4 **`5 hrs**

Detail study of CBM and Shale Gas Exploration, Technology, Land and water requirement, Environmental issues, Global Experience- US, Europe, China, Australia and India

Total 28 Hrs

Text Book and references

1. **Zou, C et al (2013) Unconventional Petroleum Geology, Elsevier**
2. **Max, M. D. (2003**) Natural Gas Hydrate in Oceanic and Permafrost Environments, Kluwer Academic Publication
3. **Nash, K. M. (2010)** Shale gas Development**,** Nova Science Publishers, Incorporated
4. **Rogers, R. (1994)** Coal bed methane: principles and Practices, PTR Prentice Hall

PE 414 Integrated Reservoir Management and oil and gas Field Development

Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	6	3	30	60	10	--	--	100

Unit -1 Pet. Resource Management 8 Hrs

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 -2 Field Development Studies 12 Hrs

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 - 3 Integrated Reservoir Management 12 Hrs

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 – 4: Stimulation Processes for plateau maintenance 10 Hrs

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

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

PE 415 Artificial Lift techniques										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	7	4	30	60	10	--	--	100

Unit 1: **8Hrs**

Basic principles and descriptions on artificial lift methods; Gas lift-continuous and intermittent, chamber lift, plunger lift/sucker rod pumping, hydraulic pumping,- Piston and Jack type, electrical submersible pumping, selection of suitable artificial lift methods

Unit 2: **12 Hrs**

Continuous gas lift system (Pressure operated valves)- Graphical and analytical methods, intermittent gas lift system; Single point injection, standard tubing installation (pressure operated valves)- Graphical and analytical methods.

Unit 3: **10 Hrs**

Rod Pumping system (SRP and PSP) design and related calculations, (Surface and subsurface design aspects)

Unit 4 **12 Hrs**

Centrifugal electric submersible pumping system, Hydraulic pumping, piston and jet, related equipment and accessories, Monitoring of SRP and GL system.

Total Hours 42

Texts and References:

1. Brown, Karmit (1984) The technology of artificial lift methods, Vol 1, 2, 3 and 4a & b, PPC Books publication.
2. Takacs, G (2005) Gas Lift Manual, Penn Well publication
3. Craft, B. C.; Holden, W. R and Graves, E. D (1962) Well design : drilling and production, Prentice-Hall.

PE 416 Workover and Stimulation										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	--	7	4	30	60	10	--	--	100

Unit – 1: Work Over and Stimulation **Hours: 12**

Basic concept, various stimulation method, matrix acidization, Coiled Tubing, Hydraulic fracturing, Sand Control, productivity index, Jv and Jh, Jh/Jv, Mobilty Ratio

Unit – 2: Matrix Acidization **Hours: 10**

Formation Damage, Problems with formation damage, understanding formation damage, skin, effect on production, rock composition and mineralogy, clay types, effect on production, rock composition and mineralogy, clay types, extraneous solid entrainment, fracture proppant plugging, chemical damage, mechanism of matrix acidization, sandstone acidization, fluid selection, acid jobs, chemical reactions, surfactants, foam diversion

Unit – 3: Coiled Tubing **Hours: 10**

CT intervention, limitation, CTU component, Injector head, Guide Arch, stripper, BOP, CT downhole tool, operating procedure, activation by N2, CT downhole tool, CT software

Unit – 4: Hydraulic Fracturing **Hours: 10**

Fracturing Fluid, Proppants, candidate selections and fracturing, Fracture design, insitu stress, frac geometry, frac treatment design, Sand Ingression, reasons for sand entry into wellbore, Control technique-mechanical and chemical techniques, Gravel Pack, N2 purging, acid fracturing, frac fluids and environment problems.

Total Hours: 42

Text books:-

1. Allen, T. O and Roberts, A (1993) Production operations: Well completion, Workover and stimulation, Oil & Gas Consultants International, Inc
2. Economides, Michael J.; A. Daniel Hill, Christine Ehlig-Economides, Ding Zhu (2012) Petroleum Production system, Prentice Hall
3. Economides, Michael J (2000) Reservoir Stimulation, John Willey

PE 420 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	0	0	6	4	30	60	10	--	--	100

Unit – 01 Reservoir Modeling: **Hours: 12**

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 – 02 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 – 03 Data Preparation: **Hours: 10**

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 – 04 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: 42

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.

PE 417 Industrial Training and Viva-Voce							
Teaching Scheme					Examination Scheme		
L	T	P	C	Hrs/Week	Report writing	V/V	Total
0	3	6	6	9	80	20	100

Aim: To get exposure on day- to-day activities of various segments of hydrocarbon industries.

PE 418 Pre Project Dissertation and Seminar							
Teaching Scheme					Examination Scheme		
L	T	P	C	Hrs/Week	Report writing	V/V	Total
0	0	6	3	6	80	20	100

Aim: To address specific industry and research related problems.

Unit 1: Problem Identification

Unit 2: Literature survey and Methodology

Unit 3: Framing of Experimentation set up and Preliminary data collection

Unit 4: Future Deliverables & Expected Outcome

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.