17BPE301 - Well Logging and 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 I **Hours: 12**

Introduction to Formation Evaluation, Mud Logging and Coring

Introduction to petroleum formation evaluation: Basic concepts, direct Methods: Mud logging, Hydrocarbon staining on the cuttings, Lithology and texture of cutting samples, Evaluation of geopressurized zone by mud logging, Coring techniques and analysis; Indirect Methods: LWD/MWD & Wireline Logging, Instruments/Tools details, Processes of recording and representation (Log charts with tracks). Correlation of core and logging data.

Unit II **Hours:12**

Open Hole Logging

Tool physics, measurement principles and data interpretation of the following including quantitative and qualitative analysis techniques: Caliper log; Electrical logs – SP and Resistivity logs (conventional, induction and micro devices), Radioactive Logs – Gamma Ray (natural and spectral), Neutron, Density and Elemental capture spectroscopy logs; Sonic Logs including Dipole shear sonic, Nuclear magnetic resonance (NMR).

Unit III **Hours : 08**

Data Integration and Formation Evaluation

Quantitative Analysis methods for lithology, shale volume, saturation from various logs

Unit IV **Hours : 07**

Cased Hole Logging and Production Logging

CBL /VDL logs, Advance Logging tools including Casing Inspection tools, Formation micro imaging tool, , Proppant Tracer Log, Ultra sonic imaging tool; Production Logging: Introduction, type of tools, principles, limitations & applications

Total Hours : 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

17BPE302 - Production Engineering I										
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 I **Hours : 08**

Petroleum Production System(Surface & Subsurface Equipments)

Role of Production Engineer/activities performed at various levels of field development and its exploitation. Petroleum Production System-Well Head Equipment, Charismas tree, valves, hangers, flow control devices, packers, tubular and flow lines.

Unit II **Hours : 11**

Well Completion&Testing

Introduction, Well Completion Methods and string components, Different types/designs of well completion, Conventional and unconventional tubular configurations, Conventional & periodic production testing, Perforating oil& gas wells-conventional and unconventional techniques viz, through tubing and tubing conveyed underbalanced perforation techniques, type size and orientation of perforation holes. Well activation, use of compressed air and liquid Nitrogen. Smart wells-intelligent completion.

Unit III **Hours : 10**

Introduction to Artificial Lift Techniques

Principle and application of artificial lift methods- Rod Pump (SRP/PCP), Gas Lift (Continuous/Intermittent), Electric submersible Pump (ESP), Hydraulic lifts (Jet Pump) etc.

Unit IV **Hours: 10**

Production System Analysis & Optimization

Reservoir considerations, Flow through porous medium around the wellbore, Introduction to inflow performance, Productivity index. PVT properties of oil, water and gas. Flow efficiency, Darcy's Law, Formation damage diagnosis, Skin effect, IPR in case of different drive mechanism. Vogel IPR equation. Pressure loss in tubing, multiphase flow regimes. . Choke performance, types of chokes. Overall production system pressure losses, Nodal system Analys**is.**

Total Hours: 39

Texts and References:

1. Dr. GuoBoyun , Computer Aided Petroleum Production Engineering
2. H Dale Begg , Production Optimization , OGCI Publication,tulsa.
3. Kermit Brown, Technology of artificial lift method –. Vol2a ,2b.Penwell publishing company, Tulsa.

17BPE303 - Petroleum Refinery 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 I **Hours : 09**

Origin–Exploration and production of petroleum–Types of crudes, crude composition–Characteristics and classification–Crude oil properties. IS 1448: Standard –Testing of Petroleum crude–Products: Specifications and their Significance.

Unit II **Hours : 10**

Pre-treatment of crude for Refining–Dehydration and desalting–Atmospheric distillation, Vacuum distillation of residue products–Treatment techniques for vacuum distillates with different processes like solvent extraction –Deasphalting, dewaxing, hydro fining, catalytic dewaxing and clay contact process–Production of lubricating oils. Hydro cracking, principles, process requirements, product yields and qualities and resid-cracking –Hydrotreating –Sulphur removal, hydro finishing.

Unit III **Hours : 10**

Thermal cracking – Processes, operating parameters, feed stock selection and product yields, Advantages –Types and functions of secondary processing – Visbreaking – Processes, operating parameters and advantages–Coking –Operating parameters and advantages. Fluid catalytic cracking –processes, operating parameters, feed stock selection and product yields –Advantages.

Unit IV **Hours : 10**

Principle, Processes, Operating Parameter and advantages of Reforming – Isomerisation – Alkylation – Polymerization. Asphalt manufacture, Air blowing technology, Bitumen Types and their properties, Acid gas removal and sulphur removal techniques.

Total Hours : 39

Texts and References:

1. Dr. B.K. Bhaskara Rao, Modern Petroleum Refining Processes (5th Edition)
2. Dr. B.K. Bhaskara Rao, A Text Book on Petrochemicals.
3. Marshall Sitting, Dryden's Outlines of Chemical Technology

17BPE304 - Unconventional Hydrocarbon Energy Resources										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	--	--	100

Unit - I **Hours – 5**

Introduction: Energy Facts

Survey of energy resources; Global vis-à-vis Indian energy scenario – demand and supply, and future projection; relation between GDP and energy demand; introduction to conventional, unconventional, renewable, nonrenewable energy resources in general, and unconventional hydrocarbon energy resources in particular; effect of use of various energy resources on environment/climate – Keeling curve; clean and sustainable energy resources; comparison between formations and mode of occurrences of various conventional and unconventional hydrocarbon energy resources.

Unit - II **Hours - 7**

Oil Shale, Shale Gas, and Tar Sand

Oil Shale: Definition and prospect, geological conditions for formation of oil shale, oil shale recovery technology, ex-situ and in-situ extraction processes of shale oil, various retorting processes, processes leading to maximisation of shale oil production; **Shale Gas**: Definition and prospect, the conditions of formation of shale gas, debate over extraction of shale gas from the subsurface, environmental issues, American experience, Marcellus shale gas project – an example of success story of shale gas exploitation, methods of production, hydrofracturing, composition of fracking fluid, water management, shale gas – Indian perspective; **Tar Sand**: Definition and prospect, distinction between heavy oil and bitumen, mineralogy and properties of oil sand, elemental composition and properties of bitumen, methods of recovery of bitumen by mining and advanced in-situ processes.

Unit – III **Hours – 5**

Gas Hydrate

Definition, History of Hydrate R&D, prospect, types of methane hydrate deposits, chemistry and structure of natural methane hydrate, Necessary Conditions for Methane Hydrate Formation, typical conditions of methane hydrate formation in nature vis-à-vis different gas hydrate stability zones, physical properties of hydrates and ice, geology of methane hydrates, exploration for methane hydrates – geological, geochemical and geophysical, gas hydrate – Indian perspective.

Unit – IV **Hours - 9**

Introduction to Coal Bed Methane

Definition and prospect, CBM, CMM, and AMM; an Overview on CBM vs. Conventional Reservoir – Gas Composition, Adsorption, Water Production, Gas Flow, Rock Physical Properties, Gas Content, Coal Rank, Gas Production. Fundamentals of Coal Geology: Genesis of Coal; Major Stratigraphic Periods of Coal Formation; Gondwana and Tertiary Coals of India; Influence of Coal Properties; Coal Chemistry – Molecular Structure, Macerals, Lithotypes, Functional Groups, Proximate Analysis, Ultimate Analysis; Significance of Rank – Definition and Measurement, Vitrinite Reflectance Measurement, Physical

Properties, Volatiles Generated, Micropores; Cleat System and Natural Fracturing. Sorption: Principles of Adsorption – different types of isotherms, Langmuir Isotherm, Methane Retention and its Content Determination in Coalseams; The Isotherm for Recovery Prediction; Model of the Micropores – Pore Geometry, Carbon Molecular Sieves; Coal Sorption of Other Molecular Species – Swelling of Coal Matrix, Heavier Hydrocarbons, Carbon Dioxide and Nitrogen; Effects of Ash and Moisture on Methane Adsorption. Decline Curves. Hydraulic Fracturing of Coal seams: Need for Fracturing Coals; Unique Problems in Fracturing Coals; Types of Fracturing Fluids for Coal; In-Situ Conditions; Visual Observation of Fractures, Water Production and Disposal: Water Production Rates from Methane Wells; Chemical Content; Environmental Regulations. Economics of Coalbed Methane Recovery: Tax Credit; Measures of Profitability; Costs; Structured Resource Evaluation.

Total Hours – 26

Texts 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

17BPE305 - Process Dynamics and Control										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	2	2	25	50	25	-	-	100

Unit I **Hours : 6**

Introduction to Process Dynamics and Control

Plant/Process, Sensors, Transmitters, Signal Conditioning, Feedback- Process Control Terminology: Manipulated Variables, Controlled Variables, Controlling Variables, Controller Efforts, set point /target Variables, Measured and Unmeasured Variables - Block diagram, Transfer Function, Importance of Negative and Positive Feedback - Introduction to industrial automation: Distributed Control System, SCADA, A/D, D/A, Data Acquisition.

Unit II **Hours : 7**

Process Modeling and Simulation

First Principle based Modeling (Conservation Laws) - Different types of mathematical representation of a process/system : Mathematical model in form of a differential equation , transfer function and state space equations - First Principle based modeling of Mechanical Systems: Rotational and Transational mechanical systems such as Spring-Mass-Damper, Suspension System etc., Electrical Systems: F-C analogy, F-V analogy, DC Motor, Electrical Systems Analogy with mechanical systems, Chemical Systems: Single Tank, Two Tank, Four Tank, CSTR etc., Electro-mechanical systems: electrically suspended ball - Linear Models and Deviation Variables - Linear Models and Deviation Variables: Taylor's series expansion and linearization, Concept of deviation variables, MATLAB exercise - Numerical Solution of linear and Non-linear Algebraic and Ordinary Differential Equations.

Unit III **Hours : 10**

Analysis of a Dynamic Behavior of a System

Time Response Analysis - Order and type of the system, Error, Poles, Zeros, ZPK Form, MATLAB functions, Standard Test Signals, Behavior of First Order System in response to standard test signals, Concept of time constant, Behavior of Second Order System - Time Response Specifications: Settling Time, Rise Time, peak time, Damping, dead time, speed of the response, Maximum Peak Overshoot - Special behavior of processes: Overshoot, Undershoot, Inverse Response, Integrating Process, Unstable systems, Minimum and Non-minimum Phase Behavior, Processes with dead time - Concept of Characteristic Equation, Routh-Hurwitz Criterion for stability analysis - Frequency Response Analysis - Frequency Response Specifications: Bandwidth, Gain cross-over frequency, Phase cross-over frequency, Gain Margin, phase Margin, cut off frequency, Resonance Peak etc.Stability analysis using Bode Plots, Polar Plots and Nyquist Plots

Unit IV **Hours : 3**

Industrial Automation

Conventional controller such as P, PI, PID controllers, tuning of PID controllers, Introduction to programmable logic controllers

Total Hours : 26

Texts and References:

1. B. A. Ogunnaike, W. H. Ray, "Process Dynamics, Modeling and Control", Oxford University Press, 1994.
2. Seborg, Edgar and Mellichamp, "Process Dynamics and Control", John Wiley, 2nd Edition, 2004.
3. J.F. Franklin, J.D. Powell, A. Emami-Naeini, "Feedback control of dynamic systems", Addison-Wesley Publishing Company, 1994.
4. B. Wayne Bequette, "Process Control: Modeling, Design, and Simulation", Prentice-Hall of India, 2006.
5. Katsuhiko Ogata, "Modern Control Engineering", Prentice-Hall, 3rd Edition, 2006.

17BPE306 - Introduction to Petroleum Software										
Teaching Scheme					Exam 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

Week 1 and Week 2: Kingdom Suite: Seismic and Geological Interpretation Software
Optimize Interpretations, Drilling decisions and field development

Week 3: Petrel: Geophysics, Geology and Modelling
Prestack processing, Microseismic, Reservoir Elastic Modelling, 1D Petroleum System Modelling

Week 4: Petrel-RE
Production Forecasting, Reservoir and Dual Scale Modelling

Week 5: RISC/CRYSTAL BALL
Reserve Estimation

Week 6: Interactive Petrophysics
Petro physical and Multiwell interpretation

Week 7 and Week 8: Saphir (KAAPA)
Pressure Transient Analysis and Production Behaviour

Week 9 and Week 10: WELLCAT (Landmark) and WELL FLO
Casing Design, Drill string design, Production Design, Tube Design, Production Optimization, Nodal Analysis

Week 11: GOHFER
Geomechanics Fracture Simulator, Hydraulic Fracturing: Design, Analysis and Optimization

Week 12: HTRI
Heat Exchanger Design and Simulation, Design of industrial-scale heat transfer equipment

Week 13:CHEMCAD/ASPEN/HYSYS
Chemical Process Simulation, Project/Process Design and Optimization

17BPE308 - Process Dynamics and Control 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. Experimention on PLC Dual Conveyer system control panel.
2. Single Board Heating System.
3. Verification of Kirchoff Law
4. Coupled Tank Interacting system / Quadruple Tank Work Station.
5. Process Instrumentation Trainer / Process control Trainer.
6. Industrial Plant Emulator
7. Control Moment Gyroscope.
8. Linear Inverted Pendulum.
9. Force Measurement using load cell / thermister .
10. Level Measurement using capacitive transducer.
11. Advanced control strategies for surfactant flooding in Enhanced Oil Recovery.
12. Rectilinear Apparatus study (Spring – Mass – Damper System)
13. Study of Conveyer Belt system..

17BPE309 - Petroleum Engineering Practical – I										
Teaching Scheme					Exam 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

Week 1: Make Core Plug ready for Experiment in Core Plugging

Week 2: Core Trimming and Swabbing

Week 3: Determination of Effective porosity of given core sample by saturation method.

Week 4: Determine the Permeability of given sample by using Ruska Liquid Permeameter

Week 5: Permeability measurement by using Gas Permeameter

Week 6 and Week 7: Study the petrophysical properties of core in core flooding apparatus

Week 8: Productivity Ratio Analysis and understanding the importance of Interference test

Week 9: Determine the viscosity of oil by using capillary viscometer.

Week 10: Drilling Equipments

Week 11: Sucker Rod Pumping System: A Case Study

Week 12: Study the working of Gas Lift system.

Week 13: Understanding of GGS System