B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Third Year, VI Semester

PE-Energy Resources										
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: 9**

Introduction to Energy Resources: Defining Energy ; various forms of Energy; Energy Resources Classification- Fossil Fuels (Conventional and Non-conventional Resources); Renewable and Non Renewable energy Resources; Primary Energy (Tradable and Non tradable); Commercial Energy; Non-Commercial Energy; Energy Outlook- Global versus India, Renewable and Non Renewable Energy Resources- Differentiate and option

Unit II **Hours: 10**

Study Of Various Energy Resources (Conventional Exploration & Production and Non-Conventional Exploration & Production of Fossil Fuels- Crude Oil, Natural Gas, Coal, Shale Gas, Gas Hydrates , CBM and CMM, 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; 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; Technological Advancements in Shale Gas Exploitation; 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 III **Hours: 10**

Renewable and new Energy Resources, Hydro-Energy- Power from Potential and Kinetic Energy of water; Principle of Hydro power; Location advantage; construction of dam, pen stock, turbine and Generator; Problem related to displacement of population, Mitigating the consequences; Example of Bhkhra- Nangal dam, Tehri Dam, Narmada dam and Ramganga Dam, Solar Energy- Solar Radiation and its measurement; Solar Energy Collectors; Solar Energy Storage ; Application of Solar Energy Wind Energy-Basic Principles; Nature of the wind; Power in the wind; Wind Energy Conversion System (WES) the Wind Mills; Electrical Generation System from wind Mills, Energy storage and transmission; Safety System; Environmental aspects, Incentives in India for Wind Energy Bio Energy- Energy from Biomass; Biomass Conversion techniques(Wet process, Dry Process); Photo Synthesis; Biogas generation; Types of Bio Gas plants; Community Biogas plants; Biomass as Source of energy; Methods for obtaining energy from Biomass; thermal Gassification of biomass; Pyrolysis (Destructive distillation)

Unit IV **Hours: 10**

Geothermal Energy- Introduction; Estimation of Geothermal Power; Geothermal Sources; Hydrothermal (Convective) Resources; Geo-pressure Resources; Hot- Dry Rock Resources; Prime Movers for Geothermal Energy Conversion; Application of Geothermal Energy Energy from Oceans- Ocean Thermal

Electric Conversion(OTEC); Energy from Tides(Tidal energy; Ocean Waves (Energy and Power from the waves; Wave energy conversion devices; Nuclear Energy-Nuclear fusion and Fission, Nuclear Fuels; Process of power generation from Nuclear plants Hydrogen Energy- Principle; Hydrogen generation process; Hydrogen Storage and Transportation;

Total Hours:- 39

Texts and References:

1. GD Rai, Energy Resources.
2. United Nations Framework Classification for Fossil Energy and Mineral Resources
3. Twindle, J and Weir, A. D. (2006) Energy Resources, 2nd Publication, Taylor and Francis Ltd.
4. Zou, C et al (2013) Unconventional Petroleum Geology, Elsevier
5. Max, M. D. (2003) Natural Gas Hydrate in Oceanic and Permafrost Environments, Kluwer Academic Publication
6. Nash, K. M. (2010) Shale gas Development, Nova Science Publishers, Incorporated
7. Rogers, R. (1994) Coal bed methane: principles and Practices, PTR Prentice Hall

GEOL- Structural Geology & Stratigraphy-Petro Engr. – GEOL 3003

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

Treatment of structural and stratigraphic geology with an emphasis on aspects of importance to petroleum engineering. Includes an investigation of mechanical principles relating to the earth's crust, descriptive study of nomenclature, causes of tectonic deformation, sedimentary processes and environments, and stratigraphic principles. Laboratory.

B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Third Year, VI Semester

PE- Production Engineering I										
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 : Surface and subsurface production equipments **Hours: 10**

Well equipments, Well head assembly – High pressure and low pressure, Christmas tree, Well head chokes – components, sizing and design, Surface and sub surface safety valves, Bottom-hole chokes and regulators, Circulation devices, Production packers – types, working and setting mechanism, Seating and unseating of packer, Tubing strings – Design, Inspection and Handling.

Unit II : Well Completion **Hours: 10**

Introduction, Completion techniques and string components, Completion design, Factors affecting design, Conventional and unconventional tubular configurations, Well completion fluids, Well Activation, Swabbing and Circulation, Well Perforation, Perforation fluids, Packer fluids, Well killing and control during completion.

Unit III : Well Servicing & Workover **Hours:10**

Workover system, workover rigs and selection, rig less workover including Endless/ Coiled tubing unit, minor & major workover jobs-diagnosis & remedial measures water shut off and gas shut off- Chemical treatment and conformance control. Workover & completion fluids - types & selection, Formation damage, Workover planning & economics, asphaltene wax.

Unit IV : Production System Analysis **Hours: 12**

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 of Skin effect, IPR in case of different drive mechanism. Vogel IPR equation, Standing's extension. Fetkovich approximation, Overall production system, pressure loss in tubing, multiphase flow regimes. Poetmann and Carpenter method, Gilbert's correlations. Optimum GLR. Heading cycle. Choke performance, types of chokes, Nodal Analys**is**

Total Hours: 42

Texts and References:

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

Courses highlighted with RED will be offered at SPT – PDPU Campus to the students not opting for credit exchange in that particular semester.

Courses highlighted with BLUE will be offered at Oklahoma Campus to the students opting for credit exchange in that particular semester.

Courses highlighted with BLACK are completely replicated with Oklahoma University.

Note +: At SPT – PDPU Campus, the laboratory component will be of two hours but the allotted credit will be 1.

B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Third Year, VI Semester

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

Tubing and packer design; hydraulic fracturing and acidizing; oil and gas well performance; vertical lift and choke performance; systems analysis; production operations.

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B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Third Year, VI Semester

PE-Reservoir Engineering I										
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
2	1	--	3	3	25	50	25	--	--	**100**

Unit I : Reservoir Engineering Fundamentals **Hours: 09**

Reservoir. Origin and distribution of hydrocarbon fluids. Lithology of petroleum reservoirs. Types of reservoir rock. Reservoir image. Well characteristics and potential. Recoverable reserves. Uncertainties. Production simulation and optimization.

Unit II : Characterization of Reservoir Rock **Hours: 10**

Porosity. Permeability - Darcy's Law, Permeability averaging – Series and Parallel, Transmissibility, Measurements of permeability heterogeneity, Porosity - Permeability relationship, Effective and relative permeability, Klinkenberg effect, Two phase and three phase relative permeability curve, Drainage and imbibitions process. Wettability. Surface forces and capillary pressure. Fluid saturations. Electrical conductivity of fluid saturated rocks. Coring and core analysis.

Unit III : Reservoir Fluid properties and Flow through porous media **Hours: 10**

Types of Fluids. Fluid Properties - Density, Viscosity, Compressibility, Formation volume factors, Critical properties, Phase behavior. Equation of state. Flow regimes and equations. Applicability of Darcy's law and other physical laws. Steady-state, Unsteady state and Pseudo-steady state flow. Single and Multiphase Flow. Skin factor. GOR and WOR Equations. Flow through fractures. Water and Gas Coning.

Unit IV : Reservoir Drive Mechanisms and Reserve Estimations **Hours: 10**

Reservoir energies and drives - water drive, solution gas drive, gas cap drive, gravity drainage drive and combination drive. Recovery factor; Volumetric reserve estimation. Stochastic Method, Decline curve analysis. Material balance equation for oil and gas reservoirs.

Total Hours: 39

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B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Third Year, VI Semester

Texts and References:

1. Ahmed, T.; Hydrocarbon Phase Behavior; Gulf Publishing Co.
2. Amyx J. W.; Bass D. M; and Whiting, R. L.; Petroleum Reservoir Engineering; McGraw Hill, Pub Co.
3. McCain W.D. Jr.; The Properties of Petroleum Fluids, 2nd Edition; Penn Well.

PE- Reservoir Engineering - I										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	--	--	3	3	--	--	--	--	--	100

Fundamentals of evaluation of oil and gas reservoirs. Reservoir volumetrics; material balance; Darcy's law and equation of continuity; diffusivity equation; streamlines; well models; introduction to well testing; decline curve analysis; natural water influx.

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B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Third Year, VI Semester

PE-Formation Evaluation with Well Logs										
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 : Formation Evaluation: **Hours: 09**

Basic Concepts of formation evaluation, Methodology to evaluate wells:

Unit II : Mud log and Drill Coring **Hours:10**

Weight on bit (WOB), Drill string rotation speed (RPM), Mud pump speed (SPM), Mud pump pressure (SPP), Rate of penetration (ROP), Percentage of gas in air and/or gas composition, Hydrocarbon staining on the cuttings, Lithology and texture of ditch cutting samples, Application and limitations of mud logging, Core analysis – drill core & side wall core analysis, Basics of drill coring Basics of side wall coring – percussion and rotary type Information obtained from cores:, Geological information; Petrophysical information and Advanced Rock Property.

Unit III : Wire line logs (Open hole & Cased hole) **Hours : 10**

Tool physics, measurement principles and data interpretation of the following: 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 and CBL /VDL logs Advance Logging tools including Casing Inspection tools, Formation micro imaging tool, Nuclear magnetic resonance (NMR) tool, Tough condition logging tool, Ultra sonic imaging tool and Formation testing tools Production logging tool **LWD (Logging while drilling) logs:** Tool physics, measurement principles and data interpretation, **Borehole seismic:** Time to depth conversion, Synthetic seismic generation, Gassmann fluid substitution, Investigation of possible AVO effect

Unit IV : Data Integration and Formation Evaluation **Hours : 10**

Integration of Mud data, Core data, Wire line, LWD and Borehole seismic data to understand the geology of the formation with respect to mineralogy, depositional environment, structure, stratigraphy, establishing possible marker horizons, hydrocarbon bearing zones of interest, occurrence of water bearing zones, Type of fluids and lithology, Techniques of Log Interpretation: Log interpretation methods, Cross-plotting methods including neutron density, sonic density & sonic neutron, Clean-sand / shaly-sand formation interpretation and Concept of invasion, Quantitative Formation Evaluation: Lithology, Porosity, Formation water resistivity, Fluid saturation determination, Identification of interesting zones for well testing and hydrocarbon production.

Total Hours: 39

Texts and References:

1. Toby Darling, Well log and Formation Evaluation, Gulf drilling Guides
2. Oberto Serra, The interpretation of Logging data , Elsevier Publication
3. Oberto Serra, Fundamentals of well log interpretation, Elsevier, 1984

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B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Third Year, VI Semester

PE- Formation Evaluation with Well Logs										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	--	--	3	3	--	--	--	--	--	100

Basic formation evaluation concepts, borehole environment, principles of resistivity, radiation, thermal and elastic wave measurements and measuring tools, applications to formation evaluation using commercial software package.

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B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Third Year, VI Semester

PE-Drilling Fluids and Cementation Laboratory[+]										
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	--	---	---	25	25	**50**

Laboratory Courses: Practical classes shall be based on theory course content of the corresponding courses.

Aim: To understand the characteristics of drilling fluid and cementation.

PE-Drilling and Production Engineering Lab										
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
1	**--**	**--**	**1**	**1**	**--**	**--**	**--**	**--**	**--**	

Properties of drilling and completion fluids; well control; oil and gas well testing; production operations; evaluation of artificial lift systems; gas measurement.

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B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Third Year, VI Semester

Elective - Contracts in Hydrocarbon Industry										
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: 10**

Historical background of the Oil and Gas trading, , Geopolitical history of Hydrocarbon exploration and trading, Life cycle of Petroleum Project, Fiscal System in hydrocarbon industry, Basic elements of Contracts, Basic terminologies of contract and legal. Basics of Upstream and Downstream regulatory Laws and Policies.

Unit II **Hours: 10**

Contracts in E & P Industry, Classification of contracts, Concession style, Sharing contracts- Production Sharing Contract, Terminologies, Attributes of PSC, Different PSC Models (Indonesian, Indian, Nigerian, Chinese, Equatorial New Guinea, etc). Risk Sharing Contracts, Joint Operating Agreements, JOA attributes, JOA Models, Farm out Agreements, Rig procurement contracts-Design and Fabrication aspects

Unit III **Hours: 9**

Elements of Transportation, Hydrocarbons transport, Contracts related to bougers, ship and pipeline, Tarrif mechanism- national and International, LNG contracts, LNG taxation and charges. Oil Tanker

Unit IV **Hours:10**

Hydrocarbon trading-Oil trading, Physical and Paper; Crude oil Markets- Spot, Barter, Future and forward. Oil Pricing mechanism, short term and long term, Level playing and swaping. Hydrocarbon Strategic storage, Contract Arbitration and dispute settlement.

Total Hours: 39

Texts and References:

1. Shippey, K. C. (2009) A short course on international Contracts, 4th Ed. World Trace press.
2. Tordo, S (2007) Fiscal System in Hydrocarbons: design issues. The World Bank
3. Ministry of P & G (Goverment of India) Model Production Sharing Contracts
4. Johnston, D (1994) International petroleum fiscal system and Production sharing contracts, Penn Well books.

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B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Third Year, VI Semester

Elective-Non Western Culture										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
			3	3						
The detailed course need to be taken from Oklahoma University										

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