B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Second Year, IV Semester

PE – Thermodynamics										
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	30	60	10	--	--	**100**

Unit-1 **Hours: 10**

Introduction And First Law of Thermodynamics: The scope of thermodynamics, Dimensions and units, Measures of amount or size, Force, temperature, pressure, work, energy, heat, etc. Internal Energy, Enthalpy, The first law of thermodynamics, Energy balance for closed systems, Equilibrium, The Phase rule, The reversible process, Heat capacity, Application of first law of thermodynamics to steady state flow process. **Volumetric Properties of Pure Fluids** : PVT behavior of pure substances, Ideal and non-ideal gases, Equation of states, Virial, Cubic, Vanderwaals EOS, Redlich/Kwong (RK) EOS etc., Calculation of constants in terms of Pc, Tc, Vc. Generalized Correlations for gases and liquids.

Unit-II **Hours:10**

Heat Effects: Sensible heat effects, Temperature dependence of the heat capacity, Latent heats of pure substances, Approximate methods for the estimation of the latent heat of vapourization, Standard heat of reaction, Standard heat of formation, Standard heat of combustion, Temperature Dependence of ΔH^{o}, Heat effects of Industrial Reactions.

Second Law of Thermodynamics: Statements of second law of thermodynamics, Heat engines, Thermodynamic Temperature Scales, Concept of entropy. Entropy changes of an Ideal Gas, Third law of thermodynamics.

Refrigeration And Liquefaction: Carnot refrigerator, Vapour compression cycle, Absorption refrigeration, Choice of refrigerant, Heat pump, Liquefaction processes.

Unit III **Hours: 09**

Vapour/Liquid Equilibrium (VLE): Introduction The Nature of Equilibrium, the Phase Rule, Duhem's Theorem, VLEQualitative Behaviour, Azeotropic Mixtures, Maximum Boiling Azeotrope, Minimum Boiling Azeotrope, Simple Models for Vapour/Liquid Equilibrium ,Raoult's Law, Dewpoint and Bubblepoint Calucations with Raoult's Law ,VLE by Modified Raoult's Law,VLE from K,Value Correlations, Flash Calculations

Unit IV **Hours: 10**

Solution Thermodynamics: Theory: Fundamental Property Relation, The Chemical Potential as a Criterion for Phase Equilibria, Partial Properties, Equations Relating Molar and Partial Molar Properties , The Partial Molar Gibbs Energy and the Generalized Gibbs-Duhem Equation, Partial Properties in Binary Solutions, Relations among Partial Properties, The Ideal Gas Mixture , The Partial Molar Gibbs Energy and Fugacity, Fugacity and Fugacity Coefficient: Pure Species, Fugacity and Fugacity Coefficient: Species in Solution ,The Ideal Solution Model , The Lewis/Randall Rule , Excess Properties , The Excess Gibbs Energy and the Activity Coefficient, Nature of Excess Property

Total Hours:39

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B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Second Year, IV Semester

Text Book:

1. K.V.Narayanan "A Text book of chemical Engineering thermodynamics", Prentice Hall of India.

References:

1. Smith J.M, Van Ness H.C., Abbott M. M, "Introduction to Chemical Engineering Thermodynamics", the McGraw Hill Companies, Inc., USA, 7th Ed., 2005.
2. Elliot J. R. and Lira C.T., "Introductory Chemical Engineering Thermodynamics", Prentice Hall, 1999.
3. Hougen O.A., Watson K.M., and Ragatz R.A., "Chemical Process Principles Part,II" Thermodynamics, John Wiley 1970.
4. Perry's chemical engineers handbook, 7th edition, McGraw,Hill, USA, 2000.
5. Stanley I. Sandler, "Chemical, Biochemical and Engineering Thermodynamics", Wiley India Pvt. Ltd., 4th ed., 2007.
6. B.G. Kyle,"Chemical Process Thermodynamics", 2nd Edn., Prentice Hall of India Pvt.Ltd., New Delhi, 2000.
7. J.M.Prausnitz, R.N. Litchtenthaler, Molecular thermodynamics of fluid phase Equilibria, 3rd Edition,Prentice Hall.
8. Stanley M. Walas, Phase-Equilibria in Chemical Engineering,Wiley India Private Limited
9. J. M. Smith, H. C.Van Ness, M. M. Abbott "Introduction to Chemical Engineering Thermodynamics"; , The McGraw-Hill Companies, Inc.
10. S.I. Sandler, "Chemical, Biochemical and Engineering Thermodynamics"; Wiley India Edition.Narayanan "A text book of Chemical Enginnering Thermodynamics, Prentice-Hall of India Pvt. Ltd.
11. B.G. Kyle, "Chemical and Process Thermodynamics"; Prentice-Hall Inc.
12. Y.V.C. Rao " Introduction to Thermodynamics, 2nd Edition, Wiley Eastern Limited

PE-Thermodynamics (PE-2213)									
Teaching Scheme					**Examination Scheme**				
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**	
					MS	**ES**	**IA**	**LW**	**LE/Viva**
3	-	-	3	3	--	--	--	--	100

First and second law of thermodynamics are developed and applied to the solutions of problems from a variety of engineering fields. Extensive use is made of differential calculus to interrelate thermodynamics functions.

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B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Second Year, IV Semester

PE-Geo Mechanics & Strength of Materials										
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
3	0	--	3	3	30	60	10	--	---	**100**

Unit I **Hours : 10**

Rock Mechanics Tectonic stress field, Pore pressure at depth in sedimentary basin, Basic constitutive laws, Rock failure in compression, tension and shear, Faults and fractures at depth, Compressive and tensile failures in vertical wells, Determination of S3 from mini-fracs and extended leak off tests and constraining the magnitude of SHmax from well bore failures in vertical wells.

Unit II **Hours : 9**

Well bore failure and stress determination in deviated wells, Stress fields from tectonic plates to reservoirs around world., Well bore stability Critically stressed faults and fluid flow, Effects of Reservoir depletion

Unit III **Hours : 10**

Stress-Strain, Ductile Strength, Hardness, Brittleness, Principle Strain, Elastic constants and relations, Poisson's' ratio, Mechanical properties and tests – Static, Dynamic, Fatigue, Compression test; Thermal stresses – Bars subjected to tension, asymmetric loading, stress calculation of cylindrical vessels,

Unit IV **Hours : 10**

Mechanical properties of materials, Creep strength, Mohr circle, Torsion; Beam bending, Bending of composite beams; Transverse sheer; Combined loadings; Deflection of beams and shafts; Stress in columns; Alloying

Total Hours: 39

Texts and References:

1. Zobak, M. D (2010). Reservoir Geomechanics,
2. Longuemare, P (2001) Geomechanics in reservoir simulation, Technip
3. Nauroy, J. F. (2011) Geomechanis applied to petroleum Engineering., Technip
4. Valentin Popov (2010) Contact Mechanics and Friction: Physical Principles and Applications, Springer
5. R. K. Bansal (1996) A Textbook of Strength of Materials, Laxmi Publications Pvt Ltd.

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B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Second Year, IV Semester

PE-Mechanics of Materials (PE-2153)										
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 principle of mechanics, including the definition of stress, transformations and principal values for t strain tensors, kinematic relation review of conservation equations and the development and ap consecutive laws for idealized materials. Elementary elastostatics utilizing Hooke's Law; consecutive re linear-elastic continuum, including elastic parameters such as youngs modulus, shear and bulk moduli a ratio. Solution of elementary one- and two-dimensional mechanics problems, including thermal stresses beam flexure, shear and deflections, pressure vessel and buckling of columns.										

PE-Group Assignment and Presentation										
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
0	0	2	2	2	--	--	--	80	20	**100**
Assignments will be given to a group and assessment is done on the basic of group presentation.										

PE-Technical Communications (PE-3022)										
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
2	**-**	**-**	**2**	**2**	**--**	**--**	**--**	**--**	**--**	**100**
Skill to be developed: communicating effectively and efficiently; summarizing and distilling; reading for understanding; planning and writing business letters, memoranda, emails, resumes, technical reports; active listening; preparing and delivering oral technical presentations and interviewing skill.										

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B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Second Year, IV Semester

PE - Sedimentary and Petroleum Geology										
Teaching Scheme					**Examination Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
3	--	--	3	3	30	60	10	--	--	**100**

Unit I **Hours: 10**

Inorganic and organic theory, Transformation of organic matter into petroleum: Bacterial action, evolution of hydrogen and release of oil from sedimentary rocks, Role of heat and pressure, Composition of oil and gas. Mode of occurrences of petroleum. Source, Source characterization, Source quantification, Oil and gas Window, Migration, Primary and Secondary migration, Mechanism of Migration, Migration quantification, Migration pathways, Traps, Classification of traps, Traps classification based on GWC and OWC, Trapping Mechanism, Seal, Seal integrity study, Seal style.

Unit II **Hours: 10**

Sedimentary controls on porosity, permeability, and saturation, Reservoir geometry and exploration strategies and examples Control on Porosity, permeability and other basic properties of reservoir, Reservoir geometries and exploration strategies and examples. Petroleum system, Geochemical fundamentals of basin formation, Burial history curve, Tectonic subsidence analysis, Geothermic: steady state and rifting, Organic geochemistry: Quantity, quality and maturity, Reservoir-Traps-Seals and analogs, Basin classification, Quantifying uncertainty, minimizing risk and making decisions.

Unit III **Hours: 9**

Significance of Sedimentary in Petroleum Industry, Sedimentary Geology Basic and Processes (clastic and non clastic): Transport of sediments, Flow regimes, Diagensis, Textural Properties Sedimentary Structures: Physical, Biological and Chemical. Characterization and Classification of Clastic, Carbonate and Evaporite, rocks.

Unit IV **Hours: 10**

Depositional Environment; Continental Environment: Fluvial, Lake, Aeolian, and Alluvial Fan etc., Marginal marine: Estuarine, etc., Shallow Marine: Tidal Flats, Beach, Deltaic, Shelf Environment., Deep and Ultra Deep Marine environment. Reservoir Sedimentology, Reservoir geometry, Sandstone reservoir, Carbonate reservoir Examples of Indian and Global Classical sedimentary basins.

Total Hours:- 39

Texts and References:

1. AAPG Treatise on Petroleum Geology, 1999
2. AAPG, Development Geology Reference Manual, 1992
3. F. J. Pettijohn, Sedimentary Rocks
4. Leverson, Geology of Petroleum, CBS Publishers & Distributors
5. Warren, J. (2006) Evaporites: Sediment, resources and Hydrocarbon, Springer Publicaiton
6. Ahr, W. M. (2008) Geology of Carbonate reservoir, John Willey and Sons.
7. Philip A. Alen & John R. Alen, Basin Analysis-Principles and Applications.

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B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Second Year, IV Semester

PE-Reservoir Rock Properties (PE-3213)										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	-	-	3	3	--	--	--	--	--	100
Fundamental course establishing primary petrophysical concepts, properties and their measurement. Covers rock types, distribution, composition and structure, porosity, permeability, resistivity, wettability, water saturation, elastic moduli and includes effects of pressure and temperature on rock properties.										

PE-Geo Mechanics & Strength of Materials Laboratory+										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
--	--	2	1	2	--	--	--	25	25	50

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

Aim: To understand mechanical properties of rocks and its application in upstream hydrocarbon industry.

PE - Rock Properties Lab (PE-3221)										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
-	-	1	1	1	--	--	--	--	--	100
Laboratory course aimed at exposing the student to the measurement and analysis of reservoir properties such as porosity, permeability, fluid saturation, grain size, elastic moduli and pore throat sizes. The course will stress safety concerns appropriate for all laboratory procedures, error analyses and report writing.										

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B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Second Year, IV Semester

Elective - Engineering Graphics										
Teaching Scheme					**Exam Scheme**					
L	**T**	**P**	**C**	**Hrs/Week**	**Theory**			**Practical**		**Total Marks**
					MS	**ES**	**IA**	**LW**	**LE/Viva**	
2	1	--	3	3	30	60	10	--	--	**100**

Unit I **Hours 10**

Introduction to Engineering Graphics, Drawing instruments and accessories, lettering, lines and dimensioning. BIS - SP46. Use of plane scales and Representative Fraction, Free hand sketching **Engineering Curves:** Classification of Engineering Curves, Construction of Conics, Cycloidal Curves, Involutes and Spirals. **Projections of Points & Lines:** Introduction to principal planes of projections, Projections of the points located in same quadrant and different quadrants, Projections of line with its inclination to one reference plane and with two reference planes. True length of the line and its inclination with the reference planes.

Unit II **Hours 10**

Projections of Solids & Section of Solids: Classification of solids. Projections of solids like Cylinder, Cone, Pyramid and Prism with its inclination to one reference plane and with two reference planes. **Development of Lateral Surfaces:** Concept of development of the different surfaces. Parallel Line Development and Radial Line Development.

Unit III **Hours 10**

Orthographic Projections: Principle of projection, Principal planes of projection, Projections from the pictorial view of the object on the principal planes for View from Front, View from Top and View from Side using first angle projection method and third angle projection method, Full Sectional View.

Unit IV **Hours 9**

Isometric Projections and Isometric View or Drawing: Isometric Scale, Conversion of orthographic views into isometric projection, isometric view or drawing.

Total Hours: 39

Texts and References

1. N.D.Bhatt and V.M.Panchal "Engineering Drawing", Charotar Publishing House, Anand
2. K. Venugopal, "Engineering Drawing & Graphics", New Age International (P) Ltd.
3. D.A.Jolhe, "Engineering Drawing with an Introduction to AutoCAD",Tata McGraw-Hill Publishing Co.Ltd., New Delhi

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B.TECH-PETROLEUM (UPSTREAM) DETAIL COURSE STRUCTURE

(In line with Oklahoma University)

Second Year, IV Semester

Elective – Artistic Forms										
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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PE 227 Earth Science and Hydrocarbon Exploration Field Work

Teaching Scheme					Examination Scheme					
					Theory			Practical		Total
L	T	P	C	Hrs/Week	MS	ES	IA	LW	LE/Viva	Marks
0	0	10	5	--	--	--	--	50	50	100

Laboratory Courses: Practical classes/Field trips shall be based on theory course content of Earth science, Sedimentary geology, Petroleum Geology and Petroleum Exploration courses.

Aim : Field familiarization of exploration in sedimentary basin and petroleum System

Text and Reference Books

1. Coe, A. L. (2011) Geological field techniques, Wiley Blackwell Publication.
2. Compton, R. R. (1962) Manual of Field Geology