Structure and Syllabus

TE (Petroleum Engineering)
University of Pune

(With effect from 2014-15)

T. E. (Petroleum Engineering) Semester – I

(W.e.f. Academic year 2014-15)

Code	Subject	Teaching Scheme (Weekly Load in hrs.)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
312381	Numerical Methods and Geostatistics	4	1	-	30	70	25	--	--	**125**
312382	Petroleum Geology 1	4	--	2	30	70	-	50	--	**150**
312383	Well Engineering: Drilling Operations	3	--	2	30	70	--	--	50	**150**
312384	Petroleum Production Engineering I: Production Operations	3	--	2	30	70	--	--	50	**150**
312385	Reservoir Engineering I	4	--	2	30	70	25	--	--	**125**
312386	Skill Development	--	--	2	--	--	50	--	--	**50**
Total of Semester – I		**18**	**1**	**10**	**150**	**350**	**100**	**50**	**100**	**750**

T. E. (Petroleum Engineering) Semester – II

Code	Subject	Teaching Scheme (Weekly Load in hrs.)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
312387	Petroleum Geology II	4	--	2	30	70	--	50	--	**150**
312388	Reservoir Engineering II	4	--	2	30	70	25	--		**125**
312389	Petroleum Production Engineering II	4	--	2	30	70	-	--	50	**150**
312390	Petroleum Field Instrumentation and Control	3	--	2	30	70	-	--	50	**150**
312391	Petroleum Equipment Design and Drawing	3	--	2	30	70	25	--	--	**125**
312392	Seminar	--	--	2			50	--	-	**50**
Total of Semester – II		**18**		**12**	**150**	**350**	**100**	**50**	**100**	**750**

Important Notes

1. In-Semester Theory examination will be conducted, approximately one and half month after the commencement of each semester
2. In-Semester Theory examination will be based on first three units from Syllabus and will be conducted by the University of Pune
3. Total time allotted for In-Semester Theory examination will be 1 hr 30 min
4. Total time allotted for End-Semester Theory examination will be 2 hrs 30 min

312381: NUMERICAL METHODS AND GEOSTATISTICS

(T. E. PETROLEUM ENGINEERING 2012 COURSE)

Code	Subject	Teaching Scheme (Weekly Load in hrs.)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
312381	Numerical Methods and Geostatistics	4	1	-	30	70	25	-	-	125

OBJECTIVES

1. To apply numerical techniques for different processes.
2. To learn finite difference techniques and optimization.
3. To understand basic principles of geostatistics in autocorrelation.

COURSE OUTCOMES

1. To apply finite difference techniques, interpolation, numerical integration in various engineering problems.
2. To apply numerical techniques for solving algebraic and differential equations encountered in petroleum engineering.
3. To solve initial and boundary value problems which do not have closed form solutions using numerical methods.
4. To apply the optimization techniques in planning and allocation of available resources.
5. To use statistical methods and regression analysis in analysing and interpreting experimental data.
6. To use conformal mapping and bilinear transformations in petroleum engineering problems.

Unit 1: Numerical Methods: (8 L)

Calculus of Finite difference, Finite difference Operators, Newton's, Lagrange's & Stirling's Interpolation formulae. Numerical differentiation & Numerical Integration, Trapezoidal Rule, Simpson's 1/3rd and 3/8th rules, Error analysis

Unit 2: Solutions of Equations: (8 L)

Solution of Algebraic and transcendental equations, Method of False position, Newton-Raphson method, Method of successive Approximation, Convergence and stability Criteria, Solution of System of Simultaneous Linear Equations, Gauss Elimination Method, Gauss Seidel Method, and Method of Least square for curve fitting.

Solution of Ordinary Differential Equations, Euler's Method, Modified Euler's Method, Runge-Kutta Method.

Unit 3: Finite Difference Techniques, Optimization: (8 L)

Solution of ordinary and partial differential equations using finite difference techniques.

Explicit and Implicit methods, Stiff differential equations, Estimation of errors and stability of algorithms.

Optimization techniques, Solution & formulation of linear programming problems, Simplex method

Unit 4: Statistics (8 L)

Measures of Central Tendency and measures of Dispersion, Moments, Skewness and Kurtosis. Correlation and Regression. Variogram, Variance and Kriging, Autocorrelation.

Unit 5: Probability (8 L)

Probability, Random Variable, Discrete & continuous, Cumulative Distributive function,

Probability Density function, Properties. Expectation, Probability models, Binomial, Poisson and Normal Distributions. Test of hypothesis, χ 2Distribution

Unit 6: Complex variable (8 L)

Functions of Complex Variables, Analytic Functions, Cauchy-Riemann Equations, Conformal Mapping,

Bilinear Transformation, Cauchy's Theorem, Cauchy's Integral Formula, Laurent's Series, Residue Theorem.

Term Work:

Term work shall consist of six assignments (one per each unit) based on performance and continuous assessment

Books:

1. Chapra S.C. and Canale R. P.; Numerical Methods for Engineers, Third Edition; McGraw-Hill, Inc.
2. Freund John; Probability and Statistics for Engineers; Prentice-Hall of India Pvt. Ltd.
3. Gupta Santosh K.; Numerical methods for Engineers, New Age International Publishers Ltd., Wiley Eastern Ltd.
4. Hildebrand F. B.; Introduction to Numerical Analysis.
5. Jensen J. L., Lake L. W., Corbett P. W. M. and Goggin D. J.; Statistics for Petroleum Engineers and Geoscientists; Prentice Hall.
6. Kreyszig E.; Engineering Mathematics; Wiley Eastern Ltd.

312382: PETROLEUM GEOLOGY I

(T. E. PETROLEUM ENGINEERING 2012 COURSE)

Code	Subject	Teaching Scheme (Weekly Load in hrs.)			Examination Scheme (Marks)					
		Lect.	Tut	Pract	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
312382	Petroleum Geology 1	4	-	4	30	70	-	50	-	**150**

OBJECTIVES

1. To understand basic principles of geology as a part of petroleum system.
2. To understand the relation between geologic processes and characteristics of sedimentary rocks.
3. To understand the spatiotemporal events in geological past

COURSE OUTCOMES:

1. Understands and apply principles of rock cycle and distribution of rocks on the surface of the earth
2. Realization of internal and external processes responsible for the dynamics of earth
3. Understands rock deformation
4. Understands the environment of deposition with knowledge of physical sedimentology
5. Recognize variation in paleolife and their significance
6. Understands the geological time scale and important events

Unit 1: Petrology: (8 L)

Geology in Petroleum industry: an overview

Mineralogy, Identification and physical properties of minerals. Introduction to igneous, sedimentary and metamorphic rocks, Rock cycle.

Unit 2:Internal and External Processes: (8 L)

Surface features of earth. Weathering, erosion, and denudation; Generation of sediments, Mass wasting, landforms.

Plate Tectonics and associated features. Earthquakes. Volcanism and geothermal energy, internal structure of earth,

Unit 3:Structural Geology: (8 L)

Rock deformation and deformation structures, strike and dip of rocks.

Folds: description, classification and mechanism of fold formation. Joints and Fractures. Faults: description, classification and mechanism of formation. Sealing and non-sealing faults. Fault

seal analysis, Structural associations.

Unit 4: Physical Sedimentology and Environment of Deposition: (8 L)

Sedimentation Processes. Bedforms generation, Texture and Structures of sedimentary rocks. Post- depositional changes.

Depositional environments: Broad overview, classification, Sedimentary facies. Typical depositional environments related to petroleum occurrence.

Carbonate Depositional System. Clastic Depositional System, Geological Heterogeneities.

Unit 5: Applied Palaeontology: (8 L)

Marine depth zones and fossils. Index fossils, mega fossils, microfossils, trace fossils. Systematics

Importance of microfossils in petroleum geology. Significance in the interpretation of depositional, environment, and correlation. Taphonomy — principles and practices

Unit 6: Stratigraphy: (8 L)

Principles of Stratigraphy, Stratigraphy and sedimentation, Wilson cycle. Unconformity, Transgression-regression. Litho-Bio-Chronostratigraphy, correlation,
Geological Time Scale, Important Events, Outline of Indian Geology.
Introduction to Sedimentary Basins of India

Term work:

Every student should carry out minimum ten exercises from the following list and submit the journal, which will form the term work.

List of Experiments:

1. Study of properties and identification of important rock forming minerals and rocks in hand specimens (minimum six practical sessions).
2. Study of topographic sheets
3. Study of Geological maps at least six maps.
4. Study of important sedimentary structures and textures.
5. Introduction to petrological and binocular stereomicroscope and study of carbonate and clastic rocks under microscope.
6. Study of important fossil forms.

Practical examination will be based on the experiments carried out as a part of term work.

Books:

1. Arthur Holmes; Principles of Physical Geology; Chapman and Hall.
2. Kunt Bjorlykke; Sedimentology and Petroleum Geology; Springer Verlag.
3. Sengupta S. M.; Introduction to Sedimentology; Oxford and IBH Publishing Company.
4. Shelly R. C.; Introduction to Sedimentology; Academic Press.
5. Nichols Gary: Sedimentology and Stratigraphy. Wiley Blackwell. 2nd edition. 2009. 432

312383: WELL ENGINEERING: DRILLING OPERATIONS

(T. E. PETROLEUM ENGINEERING 2012 COURSE)

Code	Subject	Teaching Scheme (Weekly Load in hrs.)			Examination Scheme (Marks)					
		Lect.	T	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
312383	Well Engineering : Drilling Operations	3	-	2	30	70	-	-	50	**150**

OBJECTIVES

1) To understand oil well drilling and operations engineering.
2) To get familiarized with field equipment drilling and practices nature of difficulties and actions to be taken.
3) To learn fundamental equations and calculations used in drilling engineering.

COURSE OUTCOMES

1. Understand drilling rig power system, hoisting system, rotary system, and circulation system.
2. Identify, formulate, and solve simple engineering problems related to drilling operations, drilling fluid, downhole problems etc.
3. Knowledge of well control equipment, directional drilling, importance of coring, fishing operations.
4. To be able to design simple casing and design cement slurry for cementation.
5. To work on laboratory equipment to measure drilling fluid properties, Rheology, Cement slurry properties etc.
6. Calculation of pressure losses in drill string and optimization of hydraulics.

Unit-1: Drilling Rig (6 L)

Rotary / top drive drilling for oil and natural gas, introduction to hardware system, power generation system, Hoisting, Rotary and Drilling Fluid circulation system, Types of onshore offshore rigs, Rig selection criteria. Horse power calculations for draw-works and rotary. Advantages and disadvantages of top drive system.

Unit-2: Drilling Operations and Difficulties (6 L)

Downhole drilling problems and solutions, factors affecting rate of penetration, drill off test, bit section, IADC classification of bit, dull bit gradation, circulation system, mud pumps, numericals related to mud pumps of circulation system, problems concerned with drilling fluid and drill pipe stuck up, geometry of a stuck pipe. Hole problems (lost circulation, kick etc)

Unit-3: Drilling operations: Well control, Coring and Fishing (6 L)

Well control equipment BOP, Introduction to directional, horizontal and multilateral drilling techniques. Types of well, Down hole motors, survey equipment, RSS , coring operations, Fishing tools and operations. Terminology used in directional wells and basic mathematics used in directional wells (DMS to Dec. Deg, co-ordinate system).

Unit-4: Casing and Cementation (6 L)

Casing, Functions, types, API grades properties of casing, Threads and couplings, Cementation functions, classification of cement, Strength retrogenion, Cement additives, Methods of cementation, Equipment accessories, Field problems pertaining to cementation job, Cement slurry calculations.

Unit-5: Drilling Fluids/ Mud engineering (6 L)

Drilling fluid, functions, types, compositions, properties of mud, Field test, Rheology, Additives and contamination, Selection of drilling fluids and mud, Conditioning equipment, Mud calculations, Hydrostatic pressure, Volume, Weight related calculations during drilling.

Unit-6: Hydraulics (6 L)

Fluid flow and associated pressures in the rotary rig circulating system, Pressure changes during tripping and casing operations, Types of flow, Pressure losses in pipe and annulus during drilling operations, pressure drop across bit nozzles, ECD (Flow models).

Term work

Every student should carry out minimum six exercises from the following list and submit the journal, which will form the term work.

List of experiments

1. Study of rotary, hoisting system and power transmission system on a drilling rig.
2. To determine mud density, marsh funnel viscosity and pH of given drilling fluid sample. Sand and liquid content in drilling fluid sample.
3. Mud rheology test to determine viscosity, gel strength of yield point using Fann viscometer. Measurement of filtration behaviour and wall cake building properties using dead weight hydraulic filtration for low pressure, low temperature test and to rest resistivity of each component.
4. Circulation system, rig hydraulics and pressure loss analysis during drilling fluid circulation.
5. Fundamentals of primary well control, kick and necessary equipment.
6. Total cation exchange capacity of the drilling fluid.
7. Differentials sticking coefficient using differential sticking tester.
8. Thickening time test and study of atmospheric pressure consistometer. Compressive strength test of cement. Methelene blue test (MBT)

Oral

Oral examination will be based on all engineering fundamentals of the subject and journal submitted.

Books

1. Gatlin C., 1960, Petroleum Engineering, Drilling and Well Completions, Prentice Hall. 341 pp.
2. Rabia H, 1985, Oil Well Drilling Engineering, Graham Trotman Ltd., 322 pp.
3. Azar, J. J, G. and Robello Samuel. 2007, Drilling Engineering, Penn Well. 471 pp.
4. Smith. D.K, 1990, Cementing' SPE Monograph Series, Vol. 4, 2nd Edition, 264 pp.
5. Mitchel R F (Editor), Drilling Engineering, In Petroleum Engineering Handbook Volume 2 , SPE Publication, 2007, 770 pp
6. Bourgoyne A. T, Millheim K K, Chenevert M E and. Young F S; 1991, Applied Drilling Engineering, SPE Text Book Series, 508 pp.

312384: PETROLEUM PRODUCTION ENGINEERING I:

PRODUCTION OPERATIONS

(T. E. PETROLEUM ENGINEERING 2012 COURSE)

Code	Subject	Teaching Scheme (Weekly Load in hrs.)			Examination Scheme (Marks)					
		Lect.	Tut	Pract	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
312384	Petroleum Production Engineering I: Production Operations	3	-	2	30	70	-	-	50	**150**

OBJECTIVES

1. To get familiarized with basic subsurface and surface production operations and equipment used
2. To understand typical problems during completion and production of a well and learn possible remedial measures to improve wellbore productivity.
3. To understand multiphase flow and Inflow Performance Relationship.

COURSE OUTCOME

1. Know surface facility equipment and facilities for production and separation of hydrocarbons
2. Knowledge of different types of bottom hole production tools and their utility
3. Understanding of multiphase flows and their equations for production operations
4. Understanding of different completion methods
5. Understanding of Inflow Performance Relationship
6. Understanding of important well problems and possible workover operations

Unit 1: Surface Production Equipment and Facilities: (6 L)

Well equipment, Casing hangers, Seal assembly, typical wellhead assembly and attachments, Typical Christmas tree assemblies, Components and design considerations of wellhead equipment and choke, Subsea wellhead and completion aspects, Surface Safety Valve, Sub-Surface Safety Valve, choke sizing.

Unit 2: Bottom-hole Production Tools and equipment: (6 L)

Subsurface control equipment, Surface Safety Valve, Sub-Surface Safety Valve, Bottom-hole chokes and regulators, Circulation devices, Expansion joints, Safety joints, Landing nipples, Polished bore receptacles, Blast joints, Flow couplings, Production packers, Types, Working setting mechanism, Seating and Unseating of packer. Length and force changes in tubing.

Unit 3: Multiphase Flow (6 L)

Introduction, brief review of reservoir aspects, Flow patterns during vertical and horizontal flow, Critical production rate and remedial measures to decrease in production.

Overall production system, pressure loss in tubing, multiphase flow regimes. Poettmann and Carpenter method. Gilbert's correlations. Optimum GLR. Heading cycle. Choke performance, types of chokes.

Unit 4: Well Completion Engineering: (6 L)

Objectives, Types of well completion with sketches, Production tubing, API grades,

Well completion procedure, Well completion fluid, Well activation, Swabbing and circulation,

Well perforation, Perforation fluid, Packer fluid, Factors affecting perforation efficiency,

Well killing and well control during completion, Factors to be considered in well completion,

Introduction to intelligent well completion. Completion for horizontal and multilateral wells. Tubing design consideration. Repeat Formation Tools and operation.

Unit 5: Inflow Performance Relationship (IPR I) (6 L)

Reservoir considerations in well design, 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. Exercises based on above topic.

Unit 6: Workover Operations: (6 L)

Workover fluids, Workover jobs, Water and gas coning, Squeeze cementation, Liquid loading of gas wells, Well problems identification, Mechanical problems of well and formation related workover problems, Solution to well production problems. Formation damage, types, causes.

Introduction to well stimulation operations, design considerations, Well completion and workover aspects of wells on artificial lift and gravel packed wells.

Term work

Every student should carry out minimum six exercises from the following list
This will form the basis for term work assessment. Analysis of data should be carried out using programming spreadsheet on computers wherever applicable.

1. Study of wellhead equipment, Christmas tree and flow control.
2. Design considerations of various well completion methods.
3. Bottom-hole equipment, installation, operational aspects and application.
4. Repeat Formation Testing tools and operations.

5. Tubing design consideration.
6. Well stimulation equipment and design of jobs.
7. Analysis of pressure and temperature effects on tubing, packer setting mechanism and force required to unseat a packer.
8. Study of multiphase regimes with their characteristics
9. IPR for two phase reservoir
10. Study of Gas Chromatography
11. Study of UV Spectrophotometer

Oral Examination will be based on the experiments performed and journal prepared for the same.

Books

1. Allen Thomas, and Alan Roberts; 1989, Production Operations, Volume 1 and 2; 3rd Edition, Oil and Gas Consultants International, Inc. 303 pp. and 363 pp.
2. Cholet H, 2000, Well Production Practical Handbook; Technip Editions; France, 540 pp.
3. Danish Ali, 1998, PVT and Phase Behavior of Petroleum Reservoir Fluids. Elsevier, 400 pp.
4. Gatlin C.; Petroleum Engineering, Drilling and Well Completions; Prentice Hall.
5. Mian M. A, 1992, Petroleum Engineering: Handbook for Practicing Engineer Vol. I and II; Pennwell Books.

312385: RESERVOIR ENGINEERING I

(T. E. PETROLEUM ENGINEERING 2012 COURSE)

Code	Subject	Teaching Scheme (Weekly Load in hrs.)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
312385	Reservoir Engineering I	3	-	2	30	70	25	-	-	**125**

OBJECTIVES

1. To understand a reservoir and know its properties.
2. To learn about basic rock and fluid properties relevant to petroleum reservoir.
3. To understand the causes of variation in the behaviour of rocks and fluids.
4. To understand the drive mechanism of a reservoir

COURSE OUTCOMES

1. Understand the rock properties and reasons for variation
2. Understand and explain the properties of fluid
3. Understand the phenomenon of presence of multiphase flow system in porous media and equations for the calculation of parameters
4. Gain insight into vapour – liquid, liquid – solid phase equilibrium
5. Understand and explain different drive mechanisms and factor of primary recovery
6. Calculate reserves of oil and gas by volumetric and material balance

Unit – I Rock and Fluid Properties (6L)

Porosity, Permeability, Relative permeability, horizontal, vertical permeability, Klinkenberg effect, Porosity- Permeability Relationship, Compressibility, Saturation: of oil, water and gas, Capillary pressure, wettability. Darcy Equation, Laplace – Young Equation,

Density, Viscosity, compressibility, formation volume factors,

Unit –II Phase Behaviour of Hydrocarbons (6L)

Properties of pure fluids, Property diagrams, Concepts of critical point, cricondentherm, cricondenbar, etc., Phase envelopes for different types of Reservoir fluids, Equations of state for ideal gases and real gases, Compressibility factor and compressibility charts

Unit – III Drive Mechanisms and Recovery Factors: (6 L)

Water drive, solution gas drive, gas cap drive, compaction drive and combination drive. Effect of rock properties and fluid properties on reservoir performance.

Unit – IV Phase Equilibrium Vapour –Liquid Equilibrium: (6 L)

Vapour – Liquid Separation, Flash Calculations, Multi-component Mixture, Phase Equilibrium for Complex Mixtures, Oil – Gas separation

Unit – V Rock Volumetric (6 L)

Techniques for estimating initial oil and gas in place. Capillary pressure equilibrium and the vertical distribution of fluids. Initial pressure distribution and determination of oil- water and gas water contact.

Unit VI Material Balance (6 L)

General material balance equations for different types of drive mechanism. Drive index and production characteristics

Term-Work

Every student should carry out any eight experiments from the following experiments and submit the journal, which will form the term work

1. Demonstration of Procedural part of core analysis and understanding importance of accuracy and precision in experimental work
2. Resistivity measurement for a rock sample.
3. Determination of contact angle on different surfaces with various fluids.
4. Determination of capillary pressure.
5. Study of fluorescence.
6. Determination of radioactivity in rocks.
7. Porosity Determination
8. Permeability Determination
9. Relative Permeability
10. Core flooding studies
11. Physical significance of poroperm relationship, manual calculations and calculations using spreadsheet.
12. Experimental determination of vapour – liquid equilibrium for binary mixtures.
13. Determination of Joule Thomson Coefficient.
14. Experimentation on Porous media – Effect of Curvature.
15. Determination of Bubble Point and Dew Point of multi-component mixtures using ASPEN / HYSYS or similar software
16. Calculation of reserves using different methods

Books

1. Craft B C and Hawkins M F, 1991, Applied Petroleum Reservoir Engineering, 2nd edition, Prentice Hall, 431 pp
2. Pierre Donnes, 2010, Essentials of Reservoir Engineering, Editions Technip, France, 410 pp.
3. Dake L P, 1994, The Practice of Reservoir Engineering, Developments in Petroleum Science, 36, Elsevier, 568 pp.
4. Tiab D, and Donaldson E.C., 2012, Petrophysics; 3rd edition, Gulf Publishing Co, 956 pp.
5. Dandekar A Y, 2011, Petroleum Reservoir Rock and Fluid Properties, Taylor and Francis.
6. Tarek Ahmed, 1989, Hydrocarbon Phase Behaviour, Contribution in Petroleum Geology and Engineering, Gulf Publication, 424 pp.

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312386 : SKILL DEVELOPMENT

(T. E. PETROLEUM ENGINEERING 2012 COURSE)

Code	Subject	Teaching Scheme (Weekly Load in hrs.)			Examination Scheme (Marks)					
		Lect.	Tut	Pract	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
312386	Skill Development	-	-	2	-	-	50	-	-	**50**

OBJECTIVES

1. To develop employable skills amongst the students
2. To develop awareness and hands on practice on software available in Petroleum Engineering
3. To understand and develop an area of interest for career development

COURSE OUTCOMES

1. Ability to work in team and understand lifelong learning skills
2. Ability to use knowledge of courses to analyse and develop methodology to solve the problems related to petroleum industry
3. Ability to carry out effective search for given problem
4. Ability to use excel and software for problem analysis
5. Ability to understand given topic and communicate effectively to the audience

Term Work:

Every student shall perform following exercises and assignments and submit a journal which will form the term work based on continuous assessment.

1. Problem solving, Data plotting and analysis using spreadsheet related to different subjects of second year and third year of Petroleum Engineering as practised in the industry (Minimum three exercises).
2. Study of any one of the standard software in petroleum engineering with respect to data input, data analysis and interpretation.
3. Creation of a comprehensive technical report from the given document/webinar, at individual level and in a group (Scribe report)
4. Awareness related to oil industry and companies involved at global scale and regional scale, Measuring Corporate Financial Performance and writing a brief one page report
5. Global, Regional, and Local Industry Trends and Expectations, with reference to oil and gas using oil and gas search engines and preparation of term report, Group activity, approximately 10 pages
6. Reading procedural part related to Health, Safety and Environment, understanding of environmental norms of India, Safety codes and standards (Regulatory Considerations), writing one case history
7. Professional ethics recommended by SPE International, discussion on examples

312387: PETROLEUM GEOLOGY II

(T. E. PETROLEUM ENGINEERING 2012 COURSE)

Code	Subject	Teaching Scheme (Weekly Load in hrs.)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
312387	Petroleum Geology II	4	-	2	30	70	-	50	-	150

OBJECTIVE

1. To understand the concept of petroleum system.
2. To understand subsurface mapping techniques.
3. To understand distribution of petroleum systems in time and space

COURSE OUTCOME

1. Ability to know and explain properties of hydrocarbons and associated water.
2. Ability to apply component of petroleum system
3. Ability to classify the sedimentary basins based on classical concept
4. Ability to recognize lateral and vertical variations in sedimentary sequence
5. Ability to apply classification of sedimentary basins to Petroliferous Basins of India
6. Ability to prepare different subsurface maps

Unit 1: Composition and Properties of Hydrocarbons: (6 L.)

Composition and properties of oil, gas and associated water. Occurrence of hydrocarbons.

Unit 2: Origin and Migration of Hydrocarbons: (6 L)

Introduction to the concept of Petroleum Geosystems. Origin of hydrocarbons, source rock evaluation. Migration of hydrocarbons: Primary, Secondary, Accumulation: Reservoir Rock, Properties. Unconventional natural hydrocarbon sources.

Unit 3: Hydrocarbon Traps and Seals: (6 L)

Kinds of Traps, Geological conditions giving rise to various traps in sand-shale sequence and carbonates. Seal rocks, geological conditions giving rise to seals, stratigraphic, sedimentary and structural.

Unit 4: Basin Analysis I (6 L)

Introduction to the concept of Basin Analysis. Classification, Lateral variations. Sedimentary Basins: Concept of sedimentation models, classification and development. Heat flow analysis, development of petroleum system

Unit 5: Basin Analysis II (6 L)

Introduction to the Geology of Petroliferous Basins of India. Distribution of Petroleum in time and space. Important world occurrences. Geology of Deepwater Deposits. Mapping subsurface structures, Seismic and sequence stratigraphy, use of modelling in hydrocarbon generation and exploration.

Unit 6: Well Site Geology: (6 L)

Subsurface data sources. Principles of subsurface geology. Introduction to production geology

Term work

Submission of journal containing above mentioned practical at the end of the term with continuous assessment throughout the semester.

1. Simple structural problems (at least 10).
2. Surface and subsurface geological maps (at least 6).
3. Description of cuttings, core and interpretation of data.
4. Preparation of lithology and composite log, preparation of Correlation charts.
5. Geology of Petroliferous Basins of India.
6. Geological Tour Report.

Books

1. Selley, R.C. 1998: Elements of Petroleum Geology, Academic Press.
2. Kunt Bjorlykke; Sedimentology and Petroleum Geology; Springer Verlag.
3. Leverson A. I.; Petroleum Geology; Freeman Press.
4. North F. K.; Petroleum Geology; Allen and Unwin. 2000, 712 pp.
5. Kunt Bjorlykke, 2010, Petroleum Geoscience: From Sedimentary Environment to Rock Physics, Springer, 518 pp.

312388: RESERVOIR ENGINEERING II

(T. E. PETROLEUM ENGINEERING 2012 COURSE)

Code	Subject	Teaching Scheme (Weekly Load in hrs.)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
312388	Reservoir Engineering II	4	-	2	30	70	25	-	-	**125**

OBJECTIVES

1. To understand the nature of hydrocarbon reservoirs.
2. To be familiar with pressure transient analysis
3. To understand pressure distribution in a reservoir.
4. To understand decline curve patterns for producing reservoirs

COURSE OUTCOME

1. An ability to understand and apply flow in porous media and related equations
2. Understand and apply basic well tests knowledge
3. Analyse and interpret data for oil and gas wells
4. Understand and apply knowledge of production data to realize type of decline
5. Understand different types curves available in literature, their utility and applicability in different conditions
6. Understand the heterogeneities and boundary conditions, and their effects

Unit I: Introduction and diffusivity equation (6 L)

Flow in porous media, diffusivity equation derivation, boundary equation, Ei solution to diffusivity equation, and other solutions to the diffusivity equation.

Unit II: Build – Up Tests (6 L)

Pressure build-up test, Pressure drawdown test, Variable rate buildup and flow tests: Their analysis and interpretation.

Unit IV: Gas Well Testing (6 L)

Gas Well Testing: Pseudo Pressure, Pseudo time, AOF, isochronal, modified isochronal, interpretation and analysis.

Unit V: Other Tests (6 L)

Interference tests, pulse tests, horizontal well test, their interpretation and analysis

Drill Stem Test, Operation, Their analysis and interpretation.

Unit-V: Type Decline Curves (6 L)

Decline curves; Arps equation, Fetkovitch, Blasingame type curves.

Harmonic, Hyperbolic, and Exponential Decline curves

Unit VI: Reservoir Heterogeneities and Boundaries (6L)

Effect of reservoir heterogeneities and boundaries on well responses.

Practical

Every student will perform minimum of 6 experiments using manual plotting / spreadsheets / standard software from the following list and submit the journal.

1. Pressure build-up test
2. Pressure drawdown test
3. Drill Stem Test
4. Gas well test
5. Interference/Pulse test
6. Multirate pressure build-up and flow
7. Decline curve analysis -Arps method
8. Decline curve analysis -using type curves

Term-Work

Submission of journal containing above mentioned practical at the end of the term with continuous assessment throughout the semester.

Books

1. Bourdarot, G, 1996, Well Testing, Interpretation Methods. Edition Technip.
2. Chaudhry Amanat U, 2004, Oil Well Testing Handbook, Gulf Professional Publishing, 699 pp.
3. Earlougher, R.C., 1997 “Advances in Well Test Analysis”, Monograph Series, SPE,
4. Holstein, E.D. (Editor), 2007, Reservoir Engineering and Petrophysics. V 5, In Lake L W (Editor) Petroleum Engineering Handbook, SPE International, 1689 pp.
5. Horn R A, 1995, Modern Well Test Analysis, A Computer Aided Approach, Petroway, Second edition, 257 pp.
6. Lee W. J. , 1982, “Well Testing”, Textbook Series, SPE, Richardson, TX, USA,

312388: PETROLEUM PRODUCTION ENGINEERING II

(T. E. PETROLEUM ENGINEERING 2012 COURSE)

Code	Subject	Teaching Scheme (Weekly Load in hrs.)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
312388	Petroleum Production Engineering	3	-	2	30	70	-	-	50	150

OBJECTIVES

1. To develop a logical built up of the various facets of the oil and gas production technology.
2. To study PVT properties of oil & gas and Inflow Performance Relationship of wells.
3. To understand multiphase flow correlations and stimulation needs to improve well productivity.
4. To get familiarized with basic design aspects of artificial lift techniques, equipment, operational procedure for the successful completion and production.

COURSE OUTCOMES

1. An ability to recognise and need for artificial lift technology
2. An ability to understand and apply basic principles of gas lift system and their classification
3. An ability to understand and apply operational and maintenance of has lift wells along with surface facilities
4. An ability to understand and apply other methods of artificial lift systems with awareness of their advantages and disadvantages
5. An ability to understand and apply inflow performance curves
6. An ability to understand and apply need of stimulation techniques and their types for enhancement in production

Unit 1: Gas Lift I: (6 L)

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.

Unit 2: Gas Lift II (6 L)

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 duals. Gas lift optimization, Types of Gas lift installations. Operational and maintenance aspect of gas lift wells. Surface facilities for gas lift. Power requirement.

Unit 3: Electrical Submersible Pump: (6 L)

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. Pumping unit, selection, and trouble shooting.

Selection criteria for artificial lift. Jet pumping. Plunger lift. Chamber lift. Hydraulic pumping, Progressive Cavity Pumps

Unit 4: Sucker Rod Pump: (6 L)

Introduction, definition, purpose and types of artificial lift. Stable and unstable flowing conditions. Pumping unit, types and merit, designation, surface and subsurface equipment, working principle. Pumping cycle. Design of sucker rod string, Tapered rod string, polished rod load, counter balance design, torque calculation, plunger stroke, prime mover horsepower requirements. Dynamometer cards, application. Operating and workover problems of SRP wells**.**

Unit 5: Nodal System Analysis: (6 L)

Introduction, inflow performance curves. Flow through porous media, directional conduit and horizontal pipe. Changes in flow conduit size. Functional nodes. Effects of different variables on production rates of a well. Graphical representation Pressure Traverse Curves

Unit 6: Well Stimulation: (6 L)

Introduction, need and enhancement of well productivity. Identification of treatment.

Limestone and sandstone Acidization. Acidization job analysis. Laboratory investigation. Planning and job execution.

Hydraulic fracturing. Overview of principles. Types of fracturing fluids, additives and Proppant. Well selection for stimulation job.

Design, planning and execution of hydraulic fracturing. Other stimulation techniques.

Practical

Submission of journal containing above mentioned practical at the end of the term with continuous assessment throughout the semester.

1. Estimation of fluid properties from different correlations.
2. Study of PVT analysis.
3. Developing IPR’s for producing oil and or gas wells.
4. Study of pressure losses in vertical tubing and evaluation of optimum tubing size.
5. Evaluating the pressure loss across choke.
6. Study and analysis of well stimulation job (Matrix Acidization).
7. Study and analysis of well stimulation job (Hydraulic Fracturing).
8. Study and design of sucker rod pump string.
9. Study and design of gas lift string.
10. To study and evaluate specifications for an electrical submersible pump.
11. Study of ESP

Reference Books

1. Danish Ali; PVT and Phase Behavior of Petroleum Reservoir Fluids.
2. Economides M. J.; Hill A. D.; Economides C. E.; Petroleum Production Systems; Prentice Hall, Petroleum Engineering Series.
3. Nind T, 1981,"Principles of Oil Well Production", McGrew Hill,
4. Galambhor and Guo, 2007, "Petroleum Production Engineering a Computer Assisted Approach".
5. Brown K. E., 1984, "The Technology of Artificial Lift Methods" (All Volumes), Pennwell Publications, Tulsa.

312390: PETROLEUM FIELD INSTRUMENTATION AND CONTROL

(T. E. PETROLEUM ENGINEERING 2012 COURSE)

Code	Subject	Teaching Scheme (Weekly Load in hrs)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
312390	Petroleum Field Instrumentation and Control	3	-	2	30	70	-	-	50	**150**

OBJECTIVES

1. To understand the fundamentals and principles of Process Control and Field Instrumentation
2. To understand the construction, working, performance characteristics and applications of various measuring instruments
3. To understand the recent trends in Petroleum Field Instrumentation and Control

COURSE OUTCOMES

1. Understand the terminologies related to instrumentation and control
2. Choose the proper measuring instrument for a parameter to be measured according to the operating conditions.
3. Measure and control flow of fluids under different conditions
4. Determine the transient response of first order and second order systems after proper classification.
5. Choose a proper controller for controlling a particular parameter.
6. Apply the principles of instrumentation and control for efficient production and transportation of crude oil

Unit – I: Introduction (6 L)

Classification of Instruments, Definitions, Units and Standards, Performance characteristics, Calibration requirement, Hierarchy of Standards, Measurement of Uncertainty, Codes and Symbols

Unit – II: Process Instrumentation (6 L)

Temperature measurement: Temperature scales, Instruments based on Non-electrical Methods, Electrical Methods and radiation methods

Pressure measurement: Pressure scales, Measurement of high pressure, low pressure and differential pressure

Level measurement: Measurement techniques for clear and opaque liquids, Remote level measurement
Viscosity measurement: Principle and working of different types of viscometers
Specific Gravity measurement: Baumé and API scales, hydrometer method, bubbler method, Float method, advanced methods

Unit – III: Flow Measurement and its Control (6 L)

Flow meters based on the principle of differential head, variable area, positive displacement, etc, Control valves: Construction, Working and Characteristics, Corrosion and maintenance aspects

Unit – IV: Introduction to Process Control (6 L)

Manipulated variables, Control variables, Disturbances, Process lags, Dynamic response of First order and second order systems, Transfer Functions

Unit – V: Control Strategies and Controllers (6 L)

Block Diagram of open loop and closed loop systems, Feed forward and Feedback control actions, Proportional, Derivative and Integral actions, Characteristics of P, PI, PD and PID controllers, Introduction to controller tuning

Unit – VI: Instrumentation and Control for Petroleum Field Operations (6 L)

Instrumentation and control for production operations, separation, transportation and storage of oil and gas. Introduction to PLC, DCS and SCADA systems

Term work

Every student shall perform minimum eight experiments from the following list and submit a journal which will form the term work.

1. Study and calibration of temperature measuring instruments
2. Study and calibration of pressure measuring instruments
3. Study and calibration of flow measuring instruments
4. Study and calibration of level measuring instruments
5. Study of control valves and its characteristics
6. Dynamic response of first order system (Thermometer)
7. Dynamic response of second order system (U-tube Manometer)
8. Simulating response of first order system using software like MATLAB (Effect of gain and response time)
9. Simulating response of second order system using software like MATLAB (Effect of gain, response time and damping coefficient)
10. Study of control actions P, PI and PID using software like MATLAB and Simulink
11. Study of PLC and SCADA

Books

1. Singh, S.K. (2009). Instrumentation and Process Control. I edition. Tata McGraw Hill
2. Stephanopolous, G. (2009). Chemical Process Control: An Introduction to Theory and Practice. II Edition. Prentice Hall of India
3. Liptak, B. Instrument Engineer's Handbook. Vol. 1 and Vol.2, III edition. CRC Press
4. Mian, M.A. (1992). Petroleum Engineering Handbook for the Practicing Engineer. Penwell Publishing Company
5. Eckman, D.P. (1952). Industrial Instrumentation. Wiley Eastern

312391: PETROLEUM EQUIPMENT DESIGN AND DRAWING

(T. E. PETROLEUM ENGINEERING 2012 COURSE)

Code	Subject	Teaching Scheme (Weekly Load in hrs.)			Examination Scheme (Marks)					
		Lect.	Tut	Pract	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
312391	Petroleum Equipment Design and Drawing	3	-	2	30	70	25	-	-	125

OBJECTIVES

1. To understand the fundamental concepts of equipment and machinery design.
2. To make student aware of different equipment and machineries used in petroleum industry.
3. To study different forces and stresses to be considered in the design process and to understand drawing related national and international standards and practices followed.

COURSE OUTCOMES

1. An ability to understand use of standards and codes in design activity.
2. An ability to understand the design of chain, gear system and brakes for draw works, bearing system for drilling bits.
3. An ability to understand selection of Pumps and valves in mud circulation system, compressor types and design.
4. An ability to understand design of pressure vessels, and types of separators.
5. An ability to understand fundamentals of heat exchanger design, and types of heat exchangers.
6. An ability to understand design of crude oil storage tanks.

Unit 1: Fundamentals of Design: (6 L)

Steps in design activity. Selection of material. Theories of failure. Stress concentration and factor of safety. Creativity in design activity. Use of standards and codes in design activity. design of shaft, keys and coupling. Design of belt drives. Types of pulleys, Design of pulleys (crown & travelling block) Wire ropes- advantages, construction, classification, factor of safety (wire rope sheaves drums), stresses in wire ropes, springs, fasteners, and various mechanisms.

Unit 2: Design of Mechanical Drive Components applied to petroleum equipment. (6L)

Classification of chains, power transmitting chains, power calculations. Design consideration for chain and gear drives, Types of gear Bevel gears. (Rotary system). Power transmission on a rig. Design principles applied to rig equipments. Design consideration for hoisting and rotary system. Design of simple band, band & block brakes (draw works) and introduction to bearing's and clutches, Engines and turbines, shale shaker, desander, desilter, degaser.

Unit 3: Pump Design and Types of Compressor (6 L)

Selection of pumps, types of valves. Specification of pumps, performance curve, system pump interaction, two pumps in parallel & series (flow sheet) and compressors – reciprocating ,rotary, centrifugal, reciprocating cylinder sizing. Cooling & lubricating system. Introduction to hydraulic and pneumatic circuit and their components. Introduction to mud circulation system & equipments, pipe fittings, valves, seals and jackets.

Unit 4: Types of spring and Design of Pressure Vessel: (6 L)

Design of shell. Design of head. Types of sealing materials and gaskets. Design of flanges. Design of nozzles. Classification and Design consideration of separators.

Unit 5: Design and types of Heat Exchanger and heaters: (6 L)

Design of shell (external pressure). Design of jackets and coil. Design of heat exchanger Nomenclature and types of heat exchangers,heaters and boilers,cooling towers , P .and ID's.

Unit 6: Design of Mixing , Storage System and welding: (6 L)

Design consideration for mixing. Types of agitators. Design of agitation system components.
Storage of hydrocarbon fluids, Introduction to oil and gas storage facility. Types of storage tank and their design considerations. Design of fixed roof cylindrical storage tank. Liquids, liquefied gases, highly volatile HC, solids, and sulphur containing fluids.
Types of welded joints

Term work

Detail design and drawing assignments from above syllabus should be carried out as a part of the term work.

List of Design Exercises:

1. Design of power transmission component.
2. Design of rotary pump / valve.
3. Design of pressure / reaction vessel.
4. Design of storage tank.
5. Design of heat exchanger.

(A) At least three detailed design assignments and their respective drawings concerned with the design should be drawn on A-0 drawing sheet.

(B) At least one assignment using design software

Books

1. Arnold Ken and Stewart Maurice; Surface Production Operations volume -I, Design of Oil Handling Systems and Facilities; Gulf Publishing Company, Houston, Texas.
2. Bhandari V. B.; Design of Machine Elements; Tata McGraw Hill.
3. Joshi M. V.; Process Equipment Design; MacMillan.
5. Khurmi R. S. and Gupta G. K.; A Text Book of Machine Design; Eurasia Publishing House (Pvt.) Ltd., 1994.

312392: SEMINAR

(T. E. PETROLEUM ENGINEERING 2012 COURSE)

Code	Subject	Teaching Scheme (Weekly Load in hrs.)			Examination Scheme (Marks)					
		Lect.	Tut	Pract.	Theory		TW	PR	OR	Total
					In Sem.	End Sem.				
312392	Seminar	-	-	2	-	-	50	-	-	50

COURSE OBJECTIVES

1. To develop good writing and communication skills
2. To develop self-learning skills
3. To develop an area of interest for long life learning

COURSE OUTCOMES:

1. An ability to recognize a problem/ topic of the area of interest
2. An ability to understand and analyse the problem /topic using extensive literature survey and systematic methodology
3. Ability to learn modern tools such as software for the handling of data and analysis
4. Practice skills of communication in front of varied audience.
5. An ability to prepare a technical report and present the same in front of the audience.
6. Ability to follow professional ethics by acknowledging original resource material

Seminar should be based on a detailed study of any topic related to Petroleum Engineering (preferably the advanced areas / application) preferably be relevant to the curriculum.

The student shall collect information from reference books, journals and internet to develop his /her own understanding of the topic and shall carry out a systematic methodology to analyse and evolve the topic using experimental work/software.

The report submitted should reveal the student's internalization of the collected information. Mere compilation from the net and other resources is discouraged.

The student shall submit a report for the seminar and present the same using the manuscript.

Format of the Seminar report should be as follows:

1. The report should be neatly written or typed on white paper. The typing shall be with normal spacing and on one side of the paper (A-4 size).
2. The report should be submitted with front and back cover of card paper neatly cut and bound or spirally together with the text.
3. Front cover: This shall have the following details.
    a. Title of the seminar report.

   b. The name of the candidate with roll number and examination seat number at the middle.
   c. Name of the guide below the candidate's details.
   d. The name of the institute and year of submission on separate lines at the bottom.
4. Seminar approval sheet.

The format of the text of the seminar reports:

1. The report shall be presented in the form of a technical paper. The introduction should be followed by literature survey. The report of analytical or experimental work done, if any, should then follow.
2. The discussion and conclusions shall form the last part of the text. They should be followed by nomenclature and symbols used followed by acknowledgement bibliography should be at the end. References should be written in the standard format. SPE format for Petroleum Engineering be followed in giving references.
3. The total number of typed pages, excluding cover shall be about 25 to 30 only. All the pages should be numbered. This includes figures and diagrams.
4. Two copies of the seminar report shall be submitted to the college. The candidate shall present the seminar before the examiners. The total duration of presentation and after-discussion should be about 20 minutes. (15 min + 5 minutes for question0 answer session).

Text books, and/or reference material

Reference material includes various journals available in the Library, e-recourses such as "ONE PETRO" and other relevant material available.

Seminar – Conduct, Evaluation:

1. Review – I: during month of February (Compulsory) as per the Academic Calendar.
2. Review – II : The last week of March (Optional)
3. Seminar is an individual activity with separate topic and presentation.
4. Duration of presentation – 15 minutes
5. Question and answer session – 5 minutes

Seminar Evaluation Scheme: based on rubrics developed on following lines**:**

1. Attendance during Semester
2. Attendance during Seminar presentation self and peer
3. Relevance of Seminar topic
4. Timely Abstract submission
5. Literature review
6. Technical contents
7. Presentation
8. Question and answer Session