

University of Pune



Faculty of Engineering

Master of Engineering

Syllabus

For

ME ME (Petroleum Engineering)

Effective from June 2013

University of Pune
M.E. Petroleum Engineering, 2013 Course
Semester I

Code	Subject	Teaching Scheme	Examination Scheme					Credits	
			Lectures /Practicals	Paper		TW	Oral/ Presentation		Total
				In semester assessment	End semester assessment				
512101	Numerical Simulation in Petroleum Engineering	4	50	50	-	-	100	4	
512102	Geology in Reservoir Description	4	50	50	-	-	100	4	
512103	Advanced Drilling Engineering	4	50	50	-	-	100	4	
512104	Research Methodology	4	50	50	-	-	100	4	
512105	Elective I	5	50	50	-	-	100	5	
512106	Lab Practice I	4			50	50	100	4	
Total		25	250	250	50	50	600	25	

M.E. Petroleum Engineering, 2013 Course
Semester II

Code	Subject	Teaching Scheme	Examination Scheme					Credits	
			Lectures /Practicals	Paper		TW	Oral/ Presentation		Total
				In semester assessment	End semester assessment				
512107	Advanced Reservoir Engineering	4	50	50	-	-	100	4	
512108	Environmental Technology in Petroleum Engineering	4	50	50	-	-	100	4	
512109	Advanced Production Engineering	4	50	50	-	-	100	4	
512110	Elective II	5	50	50	-	-	100	5	
512111	Lab Practice II	4	50	50	-	-	100	4	
512112	Seminar I	4			50	50	100	4	
Total		25	250	250	50	50	600	25	

M.E. Petroleum Engineering, 2013 Course Semester III

Code	Subject	Teaching Scheme	Examination Scheme					Credits	
			Lectures /Practicals	Paper		TW	Oral/ Presentation		Total
				In semester assessment	End semester assessment				
512113	Advanced Well Testing	4	50	50	-	-	100	4	
512114	Advanced Well Control	4	50	50	-	-	100	4	
512115	Elective III	5	50	50	-	-	100	5	
512116	Seminar II	4	-	-	50	50	100	4	
512117	Project Stage I	8	-	-	50	50	100	8	
Total		25	150	150	100	100	500	25	

M.E. Petroleum Engineering, 2013 Course Semester IV

Code	Subject	Teaching Scheme	Examination Scheme					Credits	
			Lectures /Practicals	Paper		TW	Oral/ Presentation		Total
				In semester assessment	End semester assessment				
512118	Seminar III	5	-	-	50	50	100	5	
512117	Project Stage II	20	-	-	150	50	200	20	
Total		25			200	100	300	25	

M.E. (PETROLEUM ENGINEERING)

512101 Numerical Simulation in Petroleum Engineering

Teaching Scheme:

Lectures: 4 Hours/Week

Examination Scheme:

In semester assessment 50 Marks

End semester assessment 50 Marks

Credits: 4

Overview of Reservoir Geology and Engineering

Numerical Reservoir Simulation: Introduction and overview

Reservoir fluid and rock properties. Formulation of basic equations for single-phase flow. Discrete flow equations for single phase flow: finite difference approximation.

General reservoir flow equations. Reduction to the black oil model. Discretization of the black oil equations. Truncation errors and stability. Transmissibility, upstream weighing, implicit and explicit treatment of transmissibility.

Numerical dispersion and grid orientation effects. The IMPES method. Model and grid selection. Model initialization.

Representation and Treatment of wells in simulators. Pseudo-functions. Compositional reservoir simulator equations.

Fractured reservoir models. Thermal models. History matching. Planning and executing a reservoir simulation study.

Reservoir simulation and management.

Selecting a numerical method to solve the problem.

Reference Books:

- 1) Mattax, C. C. and Dalton, R. L.: Reservoir Simulation, SPE Monograph, 1990, 184 pp.
- 2) Fanchi, J. R.: Applied Reservoir Simulation, Gulf Publishing Co., 2006, 517 pp.
- 3) Koederitz, Leonard F, Lecture notes on Applied Reservoir Simulation, World Scientific, 2004, 205 pp
- 4) Thomas, G. W.: Principles of Reservoir Simulation, IHRDC Pub. 1982.
- 5) Carlson, M., "Practical Reservoir Simulation", Pennwell, 2003.
- 6) Chapra, S. C. and Canale, R. P.: Numerical Methods for Engineers, McGraw Hill, 1998
- 7) Zhangxin Chin, Reservoir Simulation: Mathematical Techniques in Oil Recovery, SIAM Series in Applied Mathematics, 2007, 248 pp

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512102 Geology in Reservoir Description

Teaching Scheme:

Lectures: 4 Hours/Week

Examination Scheme:

In semester assessment 50 Marks

End semester assessment 50 Marks

Credits: 4

Introduction to the Principles of Geology, Clastic and Carbonate Depositional Systems, Petroleum Geosystems, Spatial and Temporal Distribution of Hydrocarbons, Rock and fluid properties.

Sequence Stratigraphy and Basin Analysis,

Integrated Geological Studies, structural, stratigraphic and lithological model

Reservoir Heterogeneities / Anisotropies: understanding and mapping on different scales, development of static reservoir model,

Rock Physics, Petrophysical evaluation of rock properties, Rock properties distribution, 4 D Seismic

Geostatistics in Reservoir characterization. Autocorrelation

Reserves calculation, Risk Analysis in Exploration Ventures.

Petroliferous basins in India, classification

Reference Books:

- 1) Knut Bjørlykke, Petroleum Geoscience: From Sedimentary Environments to Rock Physics, Springer Publications, 2010, 518 pp.
- 2) Luca Cossentino, Integrated Reservoir Studies, Technip Publication, 2001, 328 pp.
- 3) Roger M. Slatt, Stratigraphic Reservoir Characterization for Petroleum Geologists, Geophysicists, and Engineers, Handbook of Petroleum Exploration and Production, 6, Elsevier Publications, 2006, 493 pp.
- 4) Daniel J Tearpock and Richard E Bischke, Applied Subsurface Geological Mapping, Prentice Hall Publications, 2010, 676 pp.
- 5) Jon Gluyas and Richard Swarbrick, Petroleum Geoscience, Blackwell Publishing, 2004, 390 pp.

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512103 Advanced Drilling Engineering

Teaching Scheme:

Lectures: 4 Hours/Week

Examination Scheme:

In semester assessment 50 Marks

End semester assessment 50 Marks

Credits: 4

Review of conventional drilling techniques. Review of drill string and casing design, conventional well control techniques. Cement rheology, gas well cementation

Study of directional drilling, horizontal drilling and multilateral drilling: types, objectives, technology, equipment, and methods, sidetracking techniques.

Intelligent (Smart) Wells. Down hole monitoring and control. Optimization of multilateral well performance.

Comparison of deviated and horizontal wells with vertical drilling techniques, reservoir engineering concepts and well completions. Applications of the drilling techniques in field development. Development of tight reservoirs. Recent Trends.

Well bore stability / rock mechanics – Mohr's Coulomb criteria 2D- 3D system, in-situ stress.

MWD, LWD, drilling economics, drilling optimization methods, associated problems. Economics of complex wells.

Case Studies from Petroleum literature.

Reference Books:

- 1) Burgoyne, A. T., Chenevert, M. Milheim, K., Young, F. S.: Applied Drilling Engineering, SPE Textbook Series, 1985.
- 2) Short, J. A.: Introduction to Directional and Horizontal Drilling, Penn Well Books, 1993.
- 3) Bernt Aadnoy, Iain Cooper, Stefan Miska, Robert F. Mitchell, and Michael L. Payne, Advanced Drilling and Well Technology, Society of Petroleum Engineers, 2009, 808 pp
- 4) Robert F. Mitchell and Stefan Z. Miska, Fundamentals of Drilling Engineering, Society of Petroleum Engineers, 2011, 696 pp.
- 5) Robert F. Mitchell, Petroleum Engineering Handbook, Volume 2: Drilling Engineering, 2007, 770 pp.
- 6) Lyons W., Working Guide to Drilling Equipment and Operations, Gulf Professional Publishing, 2010, 617 pp.

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512104 Research Methodology

Teaching Scheme:

Lectures: 4 Hours/Week

Examination Scheme:

In semester assessment 50 Marks

End semester assessment 50 Marks

Credits: 4

Research Problem: Meaning of research problem, Sources of research problem, Criteria / Characteristics of a good research problem.

Types of research: Descriptive vs. Analytical Research, Applied vs. Fundamental Research, Quantitative vs. Qualitative Research, and Conceptual vs. Empirical Research.

Research Methodology: An Introduction, Research Process, Basic Overview, Formulating the Research Problem, Defining the Research Problem

Literature Review: Review Concepts and Theories, Formulation of Hypothesis, Sources of Hypothesis, Characteristics of Hypothesis, Role of Hypothesis.

Tests of Hypothesis: Research Design, Sampling Design.

Data Collection, Observation Method, Interview Method, Questionnaires, Case Study Method.

Processing and Analysis of Data: Processing Operations, Statistics in Research, Descriptive Statistics, Inferential Statistics, Elements / Types of Analysis.

Interpretation of Data

Current trends in Research: Mono-disciplinary Research, Interdisciplinary Research, Role of Internet in Research, Threats and Challenges to Good Research

Writing a: BlogSpot, Article, Essay, Research Paper, Research Project, Legislation Drafting, Judgment Writing, Thesis, Dissertation, Book, Reviews - Book Review; Case Review Criteria of Good Research, Research Ethics, Intellectual property rights (IPR), Professional ethics.

Citation Methods: Foot Note, Text Note, End Note, Bibliography.

Reference Books:

- 1) C.R. Kothari, "Research Methodology Methods and Techniques", 2nd Edition Vishwa
- 2) Prakashan, 2006.
- 3) Wilkinson K.P, L Bhandarkar, "Formulation of Hypothesis" Himalaya Publication,
- 4) Mumbai, 2006
- 5) John W Best and V. Kahn, "Research in Education", PHI Publication, 2004
- 6) Ranjit Kumar, "Research Methodology- A step by step guide for beginners", 2nd Edition, Pearson education, 2005
- 7) Donald H.Mc Burney, "Research Methods", 5th Edition, Thomson Learning, 2006

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512105 ELECTIVE-I

Teaching Scheme:

Lectures: 5 Hours/Week

Examination Scheme:

In semester assessment 50 Marks

End semester assessment 50 Marks

Credits: 5

Students should select any two modules of 2 credits each of the following from Group I and any one module of 1 credit from Group II

GROUP I:

Module 1: Advanced Natural Gas Engineering (2 Credits)

Properties and Measurement of Natural Gas:

Phase behavior fundamentals, qualitative and quantitative phase behavior, vapor liquid equilibrium.

Equation of state, critical pressure and temperature determination. Gas compressibility, viscosity and thermal conductivity, formation volume factor.

Gas flow measurement and fundamentals

Reference Books:

- 1) Lee, J, Wattenbarger, R. A., "Gas Reservoir Engineering", Society of Petroleum Engineers, TX, USA, 1996.
- 2) Ikoku, Chi, "Natural Gas Production Engineering", John Wiley and Sons, 1984.
- 3) Mokhatab, s, Poe, W A and Speight, J G, Handbook of Natural Gas Transmission and Processing, Gulf Professional Publishing, 2006

Module 2: Unconventional Oil and Gas Reservoirs (2 Credits)

Unconventional oil: Heavy oil, extra heavy oil and bituminous, oil shales, their properties, thermal and non-thermal methods of oil recovery

Unconventional Gas: shale gas and basin centered gas, Present status of coal bed methane. Tight reservoirs.

Introduction and present status of gas hydrates. Formation and properties of gas hydrates.

Reference Books:

- 1) Farooqi Ali, S M, Jones S A and Meldau R F, Practical Heavy Oil Recovery, SPE, 1997, 434 pp.
- 2) Carrol John, Natural Gas Hydrates: A guide for engineers, Gulf Publications, 2003, 289 pp
- 3) United States Department of Energy, Modern Shale Gas: development in USA, A Primer, 2009, 116 pp.
- 4) Warner H R (Editor), Emerging and Peripheral Technologies, Vol. VI, Petroleum Engineering Handbook, SPE, 2007, 629 pp

Module 3: Seismic Interpretation (2 credits)

Basics: geological controls on the propagation, reflection, and refraction of seismic waves
Data acquisition and processing with emphasis on its potential impact on interpretation
2-D and 3-D interpretation techniques
Seismic interpretation of different structural styles: extensional, compressional, strike-slip, inverted, salt and gravity dominated basins
Seismic velocities, Sequence stratigraphy and seismic facies analysis
Acoustic impedance, DHIS, AVO

Reference Books:

- 1) Beacon, M, Simm, R and Redshaw, T. 3 D Seismic Interpretation. Cambridge University Press, 2003. 212 pp.
- 2) Coffeen J. A., "Interpreting Seismic Data Workbook", Penn Well Books, 1984.

Module 4: Well Logging Methods (2 Credits)

Introduction to logging, open and cased hole logging, logging environment, log measurement and tools

Resistivity and SP logging, Nuclear logging, NMR applications in Petrophysics and formation evaluation, borehole imaging, production logging

Reference Books:

- 1) George Asquith and Daniel Krygowski, Basic Well Log Analysis, Second edition, AAPG Methods in Exploration Series 16, 2004, 248 pp.
- 2) Toby Darling, Well Logging and Formation Evaluation, Gulf Publishing Company, 2005, 335 pp.
- 3) Edward D. Holstein, Editor, Reservoir Engineering and Petrophysics, SPE Petroleum Engineering Handbook, Volume V, 2007, 1659 pp.
- 4) Somlen J J, Cased Hole and Production Log Evaluation, Penn Well, 393 pp.

Module 5: Well Completion and Workover I (2 Credits)

Well completion: types of wells, completion functions, types of completion Well completion design

Mechanical aspects of well testing, Subsurface completion equipment and accessories, Well Head Equipment, Interval selection consideration and optimization of tubing dimensions for maximum Production, Special consideration for horizontal and multilateral completions, Perforation of oil and gas wells, Sand Control, Reservoir stimulation, Data acquisition, SCADA systems

Reference Books:

- 1) Gatlin, C.: Petroleum Engineering, Drilling and Well Completions, Prentice-Hall, Inc. (1960).
- 2) Thomas O Allen and Alan P Roberts, Production Operations: Well Completions, Workover and Stimulations, OGCI, Second Edition, Tulsa, 1984, Volume 1 and 2, 348 pp.
- 3) William K Ott and Joe D Woods, Modern Sandface Completion Practices handbook, Gulf Publishing, 2001, 152 pp.

Module 6: Human Rights (2 credits)

Human Rights – Concept, Development, Evolution: Philosophical, Sociological and Political debates, Benchmarks of Human Rights Movement, Human rights for woman, children and workers.

Human Rights and the Indian Constitution: Constitutional framework , Fundamental Rights & Duties, Directive Principles of State Policy, Welfare State & Welfare Schemes

Human Rights and State Mechanisms: Police & Human Rights, Judiciary and Human Rights , Prisons & Human Rights, National and State Human Rights Commissions

Human Rights of the Different Sections and contemporary issues: Unorganized Sector, Right to Environment, particularly Industrial sectors of Petroleum Engineering and Petrochemical Engineering , Globalization and Human Rights, Right to Development

Citizens' Role and Civil Society: Social Movements and Non-Governmental Organizations, Public Interest Litigation, -Role of Non Government organizations in implementation of Human rights, Right to Information

Human Rights and the International scene: International Concern for Human Rights, International Actions For the Protection of Human Rights, United Nations' Bodies in the Promotion of Human Rights, Primary Information with reference to engineering Industry. (2 hrs)

- UN Documents
- International Mechanisms (UN & Regional)
- International Criminal Court

Reference Books:

- 1) M. R. Ishay, The History of Human Rights, Orient Longman, New Delhi, 2004.
- 2) Conor Greaty and Adam Tomkins (Eds). Understanding Human Rights, London: Manshell, 1996
- 3) Michael Freeman, Human Rights: An Interdisciplinary Approach, Oxford: Polity, 2002.
- 4) Upendra Baxi, The Future of Human Rights, New Delhi: Oxford University Press, 2004
- 5) Study material on UNESCO, UNICEF website
- 6) Usha Ramanathan, Human Rights In India A MAPPING, Usha Ramanathan
This book can be downloaded in PDF format from IELRC's website at
<http://www.ielrc.org/content/w0103.pdf>
- 7) I Curtis F. J. Doebbler, Introduction to International Humanitarian Law CD Publishing, 2005.

Internal Assessment:

- (i) Assignments based on topics from syllabus and case studies as applicable to relevant discipline of Engineering.
- (ii) Power point and oral presentation based on of selected topic from syllabus.

Students should select any one modules of 1 credits each of the following Group II

GROUP II

Module 1: Reservoir Geomechanics (1 Credits)

Basic principles of rock mechanics, propagation of waves in rocks, pore pressure Measurement of stress orientation and magnitude, stresses around borehole and their determination in vertical and deviated wells, deformation, micromechanical failures, fracture development in open and closed system

Reference Books:

- 1) Mark D Zoback, Reservoir Geomechanics, Cambridge University Press, 2007, 505 pp
- 2) Erling Fjaer, Rune A Holt, Per Horsrud, Arne M Raaen and Rasmus Risens, Petroleum Related Rock Mechanics, Development in Petroleum Science, 38, Elsevier, 1992, 389 pp.

Module 2: Process Instrumentation and Control I (1 Credit)

Introduction to analog control systems, digital electronics, digital communication, various types of gates and circuits. types of electric motors, Prevailing industry standards

Field instrumentation, different types of measurements, controller, valves and DCS systems

Reference Books:

- 1) Bela Liptak; Instrument Engineer's Handbook; Fourth edition, CRC Press, 2003, 1861 pp
- 2) Coughanowr D.R.; Koppel L.B.; Process System Analysis and Control; McGraw Hill.1991, 586 pp

Module 3: Fundamentals of onshore and offshore pipeline systems I (1 credit)

Pipeline systems definition and applications, Codes and standards related to pipelines

Pipeline hydraulics: single-phase gas and liquids, multiphase fluids and heavy/waxy crudes

Major design considerations for strength, stability, and installation

Pipeline survey and mapping, Pipeline route engineering,

Pipeline materials and components, Corrosion and cathodic protection of pipelines

Reference Books:

- 1) Macetta, John. "Piping Design Handbook", M.Dekker , 1992
- 2) Young Boi, Subsea Pipelines and Risers. Volume 3. Elsevier Ocean Engineering Book Series, 2001

Module 4: Hydrocarbon Potential in India (1 Credit)

Classification of Petroliferous basins in India, Detailed understanding of category I, II and III basins in India.

Reference Books:

- 1) Lakshman Singh, 2009, Oil and Gas Fields of India 2nd Edition, 495 pp.
- 2) DGH Dockets on Petroliferous basins in India.

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512106 Lab Practice I

Teaching Scheme:

Practical: 4 Hours/Week

Examination Scheme:

Term Work: 50 Marks

Oral Presentation 50 Marks

Credits: 4

Each candidate should perform at least six experiments from the list of experiments given below and submit the journal, which will form the term work for the subject.

It is recommended that the students should study any one of the standard software in petroleum engineering with respect to data input, data analysis and interpretation.

Experiments based on:

1. Identification and description of important sedimentary rocks
2. Geological description of well cuttings/cores,
3. Log interpretation, preparation and evaluation of log cross-section
4. Data analysis of Pressure transient tests a) Pressure buildup b) Pressure draw down
5. Gas well testing data analysis a) Flow after flow test b) Modified isochronal test.
6. Study of typical step-by-step procedure for casing policy design.
7. Design of sand control system.
8. Design of a typical well completion job.
9. Study of different types of control,
10. To determine following properties of a given petroleum product: smoke point, flash point, cloud point, pour point, aniline point and diesel index, and Reid vapor point
11. Directional Drilling and deviation control.
12. Study of numerical solutions related to problems in Petroleum engineering using MATLAB or equivalent mathematical software package

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512107 Advanced Reservoir Engineering

Teaching Scheme:

Lectures: 4 Hours/Week

Examination Scheme:

In semester assessment 50 Marks

End semester assessment 50 Marks

Credits: 4

Fundamentals of reservoir fluid behavior, relative permeability studies, oil and gas well performance, gas and water coning, water influx,

Reservoir engineering concept of Enhanced Oil Recovery (EOR) classification, comparative performance of different methods. Screening process and technical constraints.

Basic equations for fluid flow in permeable media, mass conservation, energy equations, and momentum equations.

Phase behavior, fluid properties, displacement efficiencies, volumetric sweep efficiency.

Chemical EOR Methods: Polymer, surfactant polymer, alkaline.

Gas Processes: Miscible, immiscible, carbon dioxide, nitrogen, LPG.

Thermal Processes: Hot water, steam flooding, in-situ combustion.

Other EOR Processes: Microbial, huff and puff, Water Alternating Gas (WAG), Steam Assisted Gravity Drainage (SAGD).

Case histories from Petroleum Literature.

Reference Books:

- 1) Lake, L.: Enhanced Oil Recovery, PennWell Pub., 1991.
- 2) Donaldson, E. C., Chilingarian G. V., and Yen, T. F.: Enhanced Oil Recovery-I, Elsevier Pub., 1985.
- 3) Latil, M. : Enhanced Oil Recovery, Gulf Pub., 1980.
- 4) Green, D.W. and Willhite, G.P.: Enhanced Oil Recovery, SPE, 2003.
- 5) Nnaemeka Ezekwe, Petroleum Reservoir Engineering Practice, Prentice Hall, 2010, 801 pp.

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512108 Environmental Technology in Petroleum Engineering

Teaching Scheme:

Lectures: 4 Hours/Week

Examination Scheme:

In semester assessment 50 Marks

End semester assessment 50 Marks

Credits: 4

Quality Environment Management: Planning and resource allocation, performance and review, compensation, quality practices, Current environmental issues

Environmental control in Petroleum Industry, Drilling and production operations and environmental impact of discharge in the onshore and offshore areas, Environmental control of drilling fluids and produced water, and treatment. Planning for environmental protection.

Wastewater Treatment Technologies, solid waste disposal, hazardous waste, oilfield waste management. Operational practices and procedures

HAZOP Analysis, HAZID (Hazard Identification), QRA (Qualitative Risk Analysis), ALARP (As low as reasonably practicable), PTW (Permit to work), JSA (Job safety analysis), ATR (Action taken report), Safe work processes

Accidents in oil industry and environmental degradation, contingency plans, disaster management, Environmental Impact Assessment

Integrated Environmental Biotechnology in Petroleum Industry,

Environmental Regulations, sensitive habitats, Health and Safety laws, quality assurance. Decommissioning of oil and gas installations

Clean Development Mechanisms (CDM)

Reference Books:

- 1) Orzu Orszulik, "Environmental Technology in oil Industry", Springer –Verlag, 1996.
- 2) Reis, J. C.: Environmental Control in Petroleum Engineering, Gulf Pubs. 1996.
- 3) Boyce, A., "Introduction to Environmental Technology", John Wiley and Sons, 1996
- 4) American Petroleum Institute, Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry. 2004. 489 pp.
- 5) Islam M R, Chhetri A B and Khan M M. The Greening of Petroleum Operations, the Science of Sustainable Energy Production, Scrivener Publishing, 2010, 867 pp.
- 6) Kutz M and Elkamel Ali, Environmentally Conscious Fossil Energy Production, John Wiley and Sons, 2010, 363 pp.

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512109 Advanced Production Engineering

Teaching Scheme:

Lectures: 4 Hours/Week

Examination Scheme:

In semester assessment 50 Marks

End semester assessment 50 Marks

Credits: 4

Inflow and outflow performance, effect of tubing selection, perforation sizing on completion system, Introduction to formation damage and well stimulation

Types of flow regimes in vertical and horizontal pipeline system, multiple correlations and their applications

Flow lines, manifolds and gathering systems, Types of separators and their sizing, emulsion treating equipment, and their sizing, Study of process flow diagram and working of group gathering station and central processing facility.

Types of artificial lift well completion systems (gas-lift, electrical submersible pump, beam-pump, progressing cavity pump)

Introduction to subsea production system, API standards and field practices for production system optimization

Reference Books:

- 1) Allen Thomas, and Alan Roberts; Production Operations, Volume 1 and 2; Oil and Gas Consultants International, Inc.
- 2) William C Lyons, Working Guide to Petroleum and Natural Gas Production Engineering, Elsevier, 2010,315 pp.
- 3) Economides M. J.; Hill A. D.; Economides C. E.; Petroleum Production Systems; Prentice Hall, Petroleum Engineering Series.
- 4) Brown K. E., "The Technology of Artificial Lift Methods" (All volumes), Pennwell Publications, Tulsa 1984.
- 5) Nind T, "Principle of Oil Well Production", McGraw Hill, 1981
- 6) Galambhor and Guo, "Petroleum Production Engineering a Computer Assisted Approach", 2007.

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512110 ELECTIVE II

Teaching Scheme:

Lectures: 5 Hours/Week

Examination Scheme:

In semester assessment 50 Marks

End semester assessment 50 Marks

Credits: 5

Students should select any two modules of 2 credits each of the following from Group I and any one module of 1 credit from Group II

GROUP I:

Module 1: Well Log Interpretation (2 Credits)

Log interpretation, qualitative and quantitative, calculation of different petrophysical properties, empirical relationship between different zones and fluids, detection of overpressure

Mud logging principles, MWD and LWD.

Reference Books:

- 1) George Asquith and Daniel Krygowski, Basic Well Log Analysis, Second edition, AAPG Methods in Exploration Series 16, 2004, 248 pp.
- 2) Log Interpretation, Vol. I to IV and Document VIII; Schlumberger, 1979
- 3) Rider, M. H., "The Geological Interpretation of Well Logs" John Wiley Publishing Company, 2005

Module 2: Well Completion and Workover Operations II (2 credits)

Intelligent completion equipment, Tubing string design (dimension, materials, connections,) based on pressure-temp. Operating conditions, safety requirements,

HPHT and horizontal well completions, Work over equipment: Wire Line, Snubbing Unit, Coil Tubing, Completion and Work over design and execution,

Deepwater completions. Recent trends.

Books:

- 1) Thomas O Allen and Alan P Roberts, Production Operations: Well Completions, Workover and Stimulations, OGCI, Second Edition, Tulsa, 1984, Volume 1 and 2, 348 pp.
- 2) Bridges K.L, Completion and Workover Fluids, SPE Monograph Series Vol. 19, 2000, 96 pp.
- 3) William K Ott and Joe D Woods, Modern Sandface Completion Practices handbook, Gulf Publishing, 2001, 152 pp.

Module 3: Subsea Engineering (2 credits)

Introduction: sea and subsea environment, water depths, waves, wind and ocean currents. introduction to offshore oil and gas system.

Offshore Structures. Deep Offshore Drilling and Cementing: Procedures, equipment, rig hydraulics, casing support systems, well cementing jobs.

Overview of subsea systems. Control systems

Transportation: Offshore pipelines, tankers, offshore separation facilities and storage.

Flow assurance in subsea design and configuration

Reference Books:

- 1) Mazurkiewicz, B. K. : Offshore Drilling Completion and Production, ETA Offshore Seminars, PennWell Pubs., 1972.
- 2) Sheffield, R. Floating Drilling, Equipment and its use, Practical Drilling Technology, Volume-2, Gulf Publishing Co.
- 3) Mazurkiewicz, B. K. : Offshore Platforms and Pipelines, Trans Tech Pubs., 1987.

Module 4: Petroleum Production Enhancement Technology (2 credits)

Introduction to well stimulation, need for stimulation, and types of stimulation methods used in the industry, data sources and data needed for a successful stimulation job, data analysis for designing a stimulation job

Hydraulic fracturing, formation fracturing process, fracture geometry, productivity of fractured wells, hydraulic fracturing design for production enhancement, fracturing horizontal wells

Matrix acidizing, Acid rock interaction, sandstone and carbonate acidizing design

Reference Books:

- 1) Economides M J and Martin Tony, Modern Fracturing: Enhancing Natural Gas Production, ET Publishing, USA, 2007. 536 pp.
- 2) Economides M J and K G Nolte, Reservoir Stimulation. Second Edition, Prentice Hall, 1989, 408 pp.
- 3) Warner H R (Editor), Emerging and Peripheral Technologies, Vol. VI, Petroleum Engineering Handbook, SPE, 2007, 629 pp

Module 5: Introduction to Data Management (2 Credits)

Overview of Data Management: Definition, History of data management, Trends, Data lifecycle, Importance and value of data management, Information Orientation, Benefits of good data management, Business case aspects & barriers

Data Types: Definitions, Data types, Data models in E&P

Common Data Management Issues: Typical data issues (possible pitfalls), Causes of data issues, Data Management Best Practices Business impact

Data Management Framework: Data Governance, Data Architecture, Data Security, Reference & Master Data Management, Data Quality Management

Building and Sustaining the Data Management Framework: What to do, What not to do, Building consensus & engaging with the business

Reference Books:

- 1) David Hoppman, Effective Database Design, Pennwell Corporation, 2003, 263 pp.
- 2) Niravesh M, Aminzadeh F and Zadeh L A (Editors), Soft Computing and Intelligent Data Analysis for Oil Exploration, Development in Petroleum Science, 51, Elsevier, 2003, 768 pp.

Module 6: Cyber Law and Information Security-I (2 Credits)

Basic Concepts of Technology and Law: Basics of Information Technology, Basics of Indian Legal System, Information Technology Act 2000 (Amended), Relevant Amendments in all other laws

E-Contract: The essence of digital contracts, Law of Contract, Construction of E-contracts, Issues of security, Employment contracts, Consultant Agreements and Digital signature

Intelligent Property Issues in Cyber space: Domain names and related issues, Copyright in digital media, Patents in cyber world.

Rights of Neitzens and E- Governance: Privacy and freedom issues in cyber world, E-Governance, Cyber crimes and Cyber laws.

Information Security Fundamentals: Background, Importance, Statistics, National and International Scenario, Goals of security, Confidentiality, Privacy, Integrity, Non-repudiation, Availability.

Essentials of computer security - Sources of security threats – Intruders, Viruses, Worms and related threats - Threat identification - Threat analysis - Vulnerability identification and Assessment

Security Investigation: Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues

Security Policies and Management: Security Policy Design, Designing Security Procedures, Risk Assessment Techniques, Security standards, Security Models.

Reference Books:

- 1) Bakshi P M and Sri R K, Cyber and E-commerce Laws, Bharat Publishing House, 1st Edn, 2002
- 2) Syed shakil Ahmed, Rajiv Raheja, A handbook on Information technology: Cyber law and E-Commerce, Capital Law House, 2004
- 3) Rodney D Ryder, Business Process Outsourcing, Data Protection and Information Security, Wadhwa & Co., 1st Edn, 2001
- 4) Vakul Sharma, Information Technology Law and Practice, Delhi Law House, 3rd Edn, 2011
- 5) Lipton, K., Cyberspace Law Cases and Materials, 2nd edition. Aspen Publishers. NY: New York, 2006
- 6) Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, New Delhi, 2003
- 7) Micki Krause, Harold F. Tipton, Handbook of Information Security Management, Vol 1-3 CRC Press LLC, 2004.
- 8) Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, New Delhi, 2003

Students should select one modules of 1 credits each out of the following Group II**GROUP II:****Module 1: Fundamentals of onshore and offshore pipeline systems II (1 credit)**

Basic design considerations for pipeline facilities, Special design aspects, covering such issues as risers, slug catchers, pigging facilities, etc

Pipeline construction for cross country and offshore systems focusing on welding, Pressure testing, pre-commissioning, and commissioning, Pipeline integrity aspects including in-line inspection, Leak detection and emergency planning considerations, Repairs and modification considerations

Safety, environmental, and regulatory requirements

Reference Books:

- 1) Macetta, John. "Piping Design Handbook", M.Dekker , 1992
- 2) Young Boi, Subsea Pipelines and Risers. Volume 3. Elsevier Ocean Engineering Book Series, 2001.
- 3) Parker, M E and Peattie E G, Pipeline Corrosion and Cathodic Protection. Third Edition. Elsevier USA, 2001

Module 2: Refining Technology (1 credit)

Overview of refining flow, products, specifications, market in India and global scenario
Refinery Feedstocks, crude distillation, coking and thermal processes, catalytic cracking, hydrocracking, hydroprocessing and resid processing, hydrotreating

Catalytic reforming and isomerism, Alkylation and polymerization, product blending

Reference Books:

- 1) Nelson N.L., 'Petroleum Refinery Engineering', McGraw Hill Book Co. (1985)
- 2) James H. Gary and Glenn E. Handework, 'Petroleum Refining Technology and Economics', Fourth Edition, Marcel Dekker, Inc.(2001)
- 3) Waquier, J.P., '*Petroleum Refining*' Vol .I and II, Second Edition, Technip (1995)

Module 3: Process Instrumentation and Control II (1 credit)

Drilling rig instrumentation on land & offshore, SCADA system. PID control in dynamic positioning of floating vessels in deep sea operations.

Subsea control systems, equipment, types

Reference Books:

- 1) Arnold K (Editor), Facilities and Construction Engineering, Volume III, Petroleum Engineering Handbook, SPE, 2007, 613 pp.
- 2) Coughanowr D.R.; Koppel L.B.; Process System Analysis and Control; McGraw Hill.1991, 586 pp.
- 3) Harriot P.; Process Control; Tata McGraw Hill Ed

M.E. (PETROLEUM ENGINEERING)

512111 Lab Practice II

Teaching Scheme:

Practical: 4 Hours/Week

Examination Scheme:

Term Work: 50 Marks

Oral Presentation 50 Marks

Credits: 4

Each candidate should perform at least two experiments from any four groups from the following list given below and submit the journal which will form the term work for the subject.

Group I: Computer programming assignments for Reservoir Simulation

Group II: Kill sheet for surface and subsurface BOP, vertical and deviated wells

Group III: Study and design of artificial lift problems, Design of production facility.
Typical layout, process flow diagram

Group IV Spreadsheets related to performance prediction and economic evaluation
within the framework of Petroleum fiscal system of India

Group V:

- (a) Conceptual and mechanical design of a simple experiment to illustrate a reservoir rock/fluid property.
- (b) Study of corrosion of metals.
- (c) Study of Gas Chromatography to analyze hydrocarbons.
- (d) Study of properties of LPG.
- (e) ASTM Distillation
- (f) Chemical analysis of water.

Group VI Pressure drop calculations in piping for oil and gas transportation.

A detailed exercise based on pipeline design

Study of any one of the standard software in petroleum engineering with respect to data input, data analysis and interpretation is recommended.

M.E. (PETROLEUM ENGINEERING)

512112 Seminar I

Teaching Scheme:

Practical: 4 Hours/Week

Examination Scheme:

Term Work: 50 Marks

Oral/presentation: 50 marks

Credits: 4

Each student shall submit and present a seminar based on a state of art topic in petroleum engineering in the second semester.

The students shall select a topic in broad areas of petroleum engineering indicating recent trends of the industry. They shall carry out extensive literature survey to analyze, comprehend and synthesize the topic of study, supported by a proven case study.

A seminar report of about 30 typed pages shall be submitted under the supervision of a faculty member.

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512113 Advanced Well Testing

Teaching Scheme:

Practical: 4 Hours/Week

Examination Scheme:

In semester examination: 50 Marks

End semester examination; 50 Marks

Credits: 4

Well test objectives, well test concepts,

Fluid Flow in Porous Media: Derivation of diffusivity equation, solutions of the equation, dimensionless quantities.

Pressure Build-up Tests: Procedure, analysis, multi rate analysis, effects of fault, partial penetration, deviated wells.

Pressure Drawdown Tests: Procedure, analysis, multi rate analysis.

Sampling of reservoir fluids, field estimation of reservoir properties, fluid analysis and uses of data

Type Curve Analysis: Need, procedure, types of wells that can be analyzed, typical examples using at least three different type curves.

Drill Stem Test: Detailed procedure, analysis, equipment used.

Other Well Tests: Gas well tests, interference tests, fractured well test, horizontal well tests.

Production testing equipment and well head equipment.

Well test analysis and interpretation, type curves, Drill stem test, Operation, Their analysis and interpretation

Nodal Analysis

Reference Books:

1. Schlumberger, Introduction to Well Testing, 1998, 309 pp.
2. Horn R A, Modern Well Test Analysis, A Computer Aided Approach, Petroway, Second edition, 1995, 257 pp.
3. John Lee, John B. Rollins & John P. Spivey, Pressure Transient Testing, SPE Textbook Series, Vol. 9, 2003, 376 pp.
4. Bourdarot, G. Well Testing, Interpretation Methods. Edition Technip. 1996
5. Earlougher, R.C., "Advances in Well Test Analysis", Monograph Series, SPE, 1977.

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512114 Advanced Well Control

Teaching Scheme:

Practical: 4 Hours/Week

Examination Scheme:

In semester examination: 50 Marks

End semester examination; 50 Marks

Credits: 4

Review of drilling operations, fluids and functions, associated problems, causes of kicks, geology of normally / overpressure zones.

Review of rig hydraulics, pressure control procedures, kick indications, fluid dynamics in well control, problems and procedures in well control, underbalanced well control techniques.

Surface and subsurface equipment, valves, Blowout Preventers (BOP), BOP control system, operations, design considerations, blowout contingency planning, relief well design and operations.

Well control during testing, cementation operations, Well completion operations in abnormally pressured zones.

Offshore well control operations: Methodology, equipment, procedures, special considerations, multiwell hydraulic control system for subsea completions.

Safety Procedures.

Case Studies.

Reference Books:

- 1) Grace, D. G.: Advanced Blowout and well control, Gulf Pubs., 1994.
- 2) Adams, N., Kuhlman : Kicks and Blowout Control, PennWell Books, 1994.
- 3) Goins, W. C. Sheffield, Riley: Blowout Prevention, Practical Drilling Technology, Volume I, Gulf Pubs. 1983.
- 4) Adams, N.: Well Control Problems and Solutions, Petroleum Pubs., Co., 1980.
- 5) IADC, Well Control Manual, 2009.

M.E. (PETROLEUM ENGINEERING)

512115 Elective III

Teaching Scheme:

Lectures: 5 Hours/Week

Examination Scheme:

In semester assessment 50 Marks

End semester assessment 50 Marks

Credits: 5

Students should select any two modules of 2 credits each of the following from Group I and any one module of 1 credit from Group II

GROUP I:

Module 1: Integrated Reservoir Management (2 credits)

Reservoir Management Concepts and Processes, Fundamentals, Data acquisition, Interpretation and integration.

Static and Dynamic Reservoir Modeling, Integration of exploration and development technology

Applications of Improved Recovery Processes, new drilling, completion and production technology. Use of artificial intelligence.

Reference Books:

- 1) Ganesh Thakur, Reservoir Management, SPE Reprint Series No. 48, 1998, 200 pp.
- 2) Tarek Ahmed and Nathan Meehan, Advanced Reservoir Engineering and Management, Second Edition, Elsevier, 2012,
- 3) Satter, A. and Thakur, G. C.: Integrated Petroleum Reservoir Management, PennWell Pubs, 1994.

Module 2: Petroleum Resources Evaluation and Fiscal System (2 credits)

Petroleum resources classification, different terminology, Reserves classification methods, quantification, assessment of geosciences and reservoir engineering uncertainties, reserves reporting and auditing

Risk analysis of exploration prospects, economic analysis of exploration ventures, Exploration plays, Management of exploration projects as business ventures, Petroleum industry practices of exploration risk analysis

Classification of Petroleum Fiscal Systems, Current distribution of exploration and production contract types in different geographic regions, and their comparison with possible equivalence

Reference Books:

- 1) Mian M A, Project Economics and Decision Analysis, Volume I and II, Penn Well, 2011.
- 2) Peter R Rose, Risk Analysis and Management of Petroleum Exploration Ventures, AAPG Methods in Exploration No. 12, 164 pp.
- 3) Johnston, D, “International Exploration Economics, Risk, and Contract Analysis”, Pennwell Books, 2003.
- 4) Seba R. D., “Economics of Worldwide Petroleum Production”, OGCL Publications, USA, 1998.

Module 3: Petroleum Product Analysis (2 credits)

Basic properties and specifications of petroleum products, Property predictions

Product composition analysis

Types of composition (PONA, PNA, PIONA, SARA, elemental analysis), various analytical instruments and methods (Solvent separation, Chromatographic and Spectroscopic methods)

International Standards

API, ASTM standards for petroleum products, Modern perspectives for sampling, measurement, accuracy, precision and method validation

Reference Books:

- 1) Riazi.M.R, ‘Characterization and Properties of Petroleum Fractions’, I edition, ASTM International Standards Worldwide. (2005)
- 2) James G.Speight, ‘Handbook of Petroleum Product Analysis’, First Edition, John Wiley and Sons, Inc. (2002)

Module 4: Process Safety Engineering (2 Credits)

Historical Incident & Problem Areas, Risk Analysis Basics

Process Hazards Analysis Techniques – Overview, Layers of Protection, Inherently Safer Design, Hazards Associated with Process Fluids, Leakage and Dispersion of Hydrocarbon Releases, Combustion Behavior of Hydrocarbons, Sources of Ignition

Hazards Associated with Specific Plant Systems, Plant Layout & Equipment Spacing, Pressure Relief and Disposal Systems, Corrosion & Materials Selection, Process Monitoring and Control, Safety Instrumented Systems, Fire Protection Principles, Explosion Protection

Reference Books:

- 1) Center for Chemical Process Safety (CCPS), 2011, Guidelines for Auditing Process Safety Management Systems, 2nd Edition, 900 pp.
- 2) Center for Chemical Process Safety (CCPS), 2010, A Practical Approach to Hazard Identification for Operations and Maintenance Workers, 312 pp.

Module 5: GIS and Database Management in Petroleum Industry (2 credits)

Introduction to GIS, Spatial Data Models, Spatial Data Structures, Spatial Data Inputs, Visualization and Query of Spatial Data, Spatial Data Transformations, Tools for Map Analysis: single and multiple maps,

Basics of RDBMS, Possible applications of database in the oil and gas industry

Reference Books:

- 1) Burrough, P A and McDonnel R A, Principles of Geographic Information System, Oxford Univerosty Press, 1998
- 2) Timothy C. Coburn and Jeffrey M. Yarus, Geographic Information Systems in Petroleum Exploration and Development, AAPG Computer Applications in Geology,4, 2000, 398 pp
- 3) Longley, P. A., Goodchild, M. F. MaGuire, D. J. Rhind, D. W. Geographical Information Systems and Science, John Wiley and Sons, 2001.

Module 6: Cyber Law and Information Security-II (2 Credits)

Cyber Crimes and Intermediaries: Crime: Meaning and concept, Rights and liability-Civil, criminal and tortuous, Offences- concept and Legal parameters, Rights and liabilities of Intermediaries, IPR regime and Cyber Laws, Understanding Copy right information, Technology legal issues in internet and software copy right, Patents, Trade marks and Data base

Patents: Understanding Patents, International context of Patents, European Position on Computer related Patents, Legal position of US and India on Computer related Patents

Trademarks: Understanding trademarks, Trademark law in India, Infringement and passing off, Trademarks in Internet, Domain name registration, Domain name Disputes and WIPO

Physical and Environmental Security: Server room design, Fire fighting equipment, Temperature/humidity Control etc, Application Security: Databases, Email and Internet etc Organizational and Human Security, Human Factors in Security- Role of information security professionals.

Cyber Forensics: Introduction to forensic tools, Evaluation of crime scene and evidence collection, Usage of tools for disk imaging and recovery processes, Introduction to Information Security Standards, ISO 27001, PCI DSS etc.

Reference Books:

- 1) Vakul Sharma, Information Technology Law and Practice, Delhi Law House, 3rd Edn, 2011
- 2) Nandan Kamath, Law relating to Computers, Internet & E-Commerce: a guide to cyber laws, Universal Law Publishing Co. Pvt. Ltd., 2000

- 3) Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, New Delhi, 2003
- 4) Micki Krause, Harold F. Tipton, Handbook of Information Security Management, Vol 1-3 CRC Press LLC, 2004.
- 5) Michael E Whitman and Herbert J Mattord, Principles of Information Security, Vikas Publishing House, New Delhi, 2003
- 6) Thomas R Peltier, Justin Peltier and John blackley, Information Security Fundamentals, 2nd Edition, Prentice Hall, 1996
- 7) Jonathan Rosenoer, Cyber law: the Law of the Internet, Springer-Verlag, 1997.

Students should select one modules of 1 credits each out of the following Group II

GROUP II:

Module 1: Conversion Processes (1 Credit)

Coal to Gas conversion, Gas to Liquid, Coal gasification and liquefaction. Fisher Tropsch synthesis. Case studies, Indian examples

Reference Books:

- 1) James T. Bartis, Frank Camm, David S. Ortiz, Producing liquid fuels from coal: Prospects and policy issues. NETL, DOE, USA, 2008, 198 pp
- 2) Warner H R (Editor), Emerging and Peripheral Technologies, Vol. VI, Petroleum Engineering Handbook, SPE, 2007, 629 pp

Module 2: Transportation of oil and Gas (1 Credit)

Natural gas processing, Gas Gathering and Transport, Gas Compression, LNG risk based safety analysis

Installation, operation and trouble shooting of natural gas pipelines

Reference Books:

- 1) Mokhatab, s, Poe, W A and Speight, J G, Handbook of Natural Gas Transmission and Processing, Gulf Professional Publishing, 2006.
- 2) John L. Woodward and Robin M. Pitblado, LNG Risk Based Safety: Modeling and Consequence Analysis, AIChE, Wiley Publication, 2010, 396 pp.

Module 3: Clean Development Mechanisms (CDM) (1 Credit)

Carbon Credits Generation, Trading, Markets. Carbon credit calculations.

Clean Development Mechanisms (CDM), approved CDM methodologies

CDP Project Design Document, Case studies Petroleum Industry Energy savings.

Books:

- 1) American Petroleum Institute, Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry. 2004. 489 pp.
- 2) Lohmann Larry, Carbon Trading, Development Dialogue, 48, 2006, 362 pp.
- 3) Hester R E and Harrison R M (editors), Carbon Capture: Sequestration and storage, Issue in Environmental Science and Technology, The Royal Society of Chemistry, 2010, 325 pp.
- 4) Ibrahim Dincer · Adnan Midi Ili · Arif Hepbasli, T. and Hikmet Karakoc (editors), Global Warming: Engineering Solutions, A series in Green Energy and Technology, Springer, 2010, 632 pp.

M.E. (PETROLEUM ENGINEERING)

512115 Seminar II

Teaching Scheme:

Lectures/Practical: 4 Hours/Week

Examination Scheme:

Term work 50 Marks

Oral/Presentation 50 Marks

Credits: 4

Each student shall submit and present a seminar based on state of art topic in petroleum engineering in the first semester.

The students shall select a topic in broad areas of petroleum engineering indicating recent trends of the industry. They shall carry out extensive literature survey to analyze, comprehend and synthesize the topic of study, supported by proven case study.

A seminar report of about 30 typed pages shall be submitted under the supervision of a faculty member.

M.E. (PETROLEUM ENGINEERING)

512116 Project Stage I

Teaching Scheme:

Lectures/Practical: 8 Hours/Week

Examination Scheme:

Term work 50 Marks

Oral/Presentation 50 Marks

Credits: 8

The students, at individual level, under the supervision of an internal teacher and/or an external teacher/guide if required, shall undertake a dissertation in a specialized area of Petroleum Engineering.

The students shall first define the problem and scope of work of the project work. Individually they shall undertake an extensive library search on the topic selected to take an overview of developments. They shall prepare a manuscript based on literature survey in consultation with the guide and submit the same.

The report shall also include objectives of study, and methodology required to complete the project work of stage I.

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512117 Seminar III

Teaching Scheme:

Lectures/Practical: 5 Hours/Week

Examination Scheme:

Term work 50 Marks

Oral/Presentation 50 Marks

Credits: 5

Each student shall submit and present a seminar based on topic of dissertation related petroleum engineering in the first semester.

The students shall present literature review and developments related to dissertation indicating recent trends of the industry. They shall carry out extensive literature survey to analyze, comprehend and synthesize the topic of study, supported by proven case study.

A seminar report of about 30 typed pages shall be submitted under the supervision of a faculty member.

M.E. (PETROLEUM ENGINEERING)

512116 Project Stage II

Teaching Scheme:

Lectures: 20 Hours/Week

Examination Scheme:

Term work 150 Marks

Oral/Presentation 50 Marks

Credits: 20

The students, at individual level, under the supervision of an internal teacher and/or an external teacher/guide if required, shall undertake a dissertation in a specialized area of Petroleum Engineering.

Based on remarks received in stage I, the students at individual level may carry out dissertation at industry workspace or in house.

The study shall include experimental work, use of some software available in the company workplace or in house, analysis and synthesis of data, and consistency of results. The data may be compared with the published data.

The students at individual level, shall publish his/her findings at least one paper in reputed journals or national/international conference. Reprint of the same may be attached as annexure in the project.

The students shall submit three copies of dissertation work certified and forwarded by internal guide and mentor if any.