Vision and Mission of the Institute

Vision

To be a premier institute of excellence developing highly talented holistic human capital that contributes to the nation through leadership in technology and innovation through engineering education.

Mission

1. To impart Personnel Skills and Ethical Values for Sustainable Development of the Nation.

2. To create Research & Industry oriented centers of excellence in all engineering disciplines.

3. To be a renowned IPR generator and repository for innovative technologies.

4. To develop Research and Industry oriented technical talent.

5. To benchmark globally the academic & research output.

Vision and Mission of the Department

Programme Education Objectives (PEOs)

Mapping of Mission statements to PEOs

Programme Outcomes (POs)

Programme Specific Outcomes (PSOs)

Mapping of POs and PSOs to PEOs

M.Tech Programme Course Structure & Syllabus

Dr. D. Linga Raju **Chairman**	Prof. K. V. Rao **Member**	Shri C.V.G. Krishna **Member**	Prof. Tarkeshwar Kumar **Member**
Dr. N. Chitti Babu **Member**	Dr P.Dinesh Sankar Reddy **Member**	Shri M.Kishore Kumar **Member**	Mr. K. Navneeth Kumar **Alumnus Member**

I Semester

S.No	Course No	Course Name	P.Os	Category	L*	T	P**	Credits
1	PC-1	1. Offshore Drilling. (PE stream) 2. A Fundamentals Of Petroleum Geology and Reservoir Engineering. (NON- PE stream)			3		0	3
2	PC-2	1.Reservoir Stimulation(PE stream) 2. Petroleum well Drilling and Production Engineering. (NON- PE stream)			3		0	3
3	PE-1	1. Advanced Numerical Methods and Applied Statistics. 2. CBM & Shale gas engineering.			3		0	3
4	PE-2	1. Transportation of Oil and Gas 2. Advanced Well Logging techniques & Well Testing Analysis.			3		0	3
5		Research Methodology and IPR.					0	2
6	L-1	Advanced Numerical Methods and Applied Statistics Laboratory (MATLAB Based)			0	0	4	2
7	L-2	Drilling Simulation Laboratory.			0	0	4	2
8	AC-1	Project Management.			2	0	0	0
				Total	14		08	18

*Clock – Hours
** One laboratory hour = 0.5 credits.

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II Semester

S.No	**Course No**	**Course Name**	**P.Os**	**Category**	**L***	**T**	**P****	**Credits**
1	PC-3	Artificial Lift Techniques.			3		0	3
2	PC-4	Reservoir Modeling & Simulation.			3		0	3
3	PE-3	1. Advanced EOR Techniques. 2. Advanced well completions.			3		0	3
4	PE-4	1. Flow Assurance. 2. Advanced horizontal well technology.			3		0	3
5	L-3	Reservoir Simulation Laboratory.					4	2
6	L-4	Flow Assurance Laboratory.			0	0	4	2
7	AC-2	Integrated Reservoir Management.			2	0	0	0
8		Internship in Petroleum industry and presentations. #			2	0	0	2
				Total	16		08	18

Industrial Training/Internship for at least 6-8 weeks during semester break.

*Clock – Hours
** One laboratory hour = 0.5 credits.

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III Semester

S.No	Course No	Course Name	P.Os	Category	L*	T	P**	Credits
1	PE-5	**MOOCs- I†**			0		0	3
2	OE	**MOOCs – II†**			0		0	3
3		In - house Project / external (Industrial /other academia) with dissertation.			0	0	20	10
				Total	0		20	16

†Faculty Advisor / Head of The Department will provide the list of MOOCs courses by the end of the second semester.

IV Semester

S.No	Course No	Course Name	P.Os	Category	L*	T	P**	Credits
1		In - house Project / external (Industrial /other academia) with dissertation.			0	0	32	16
				Total	0	0	32	16

*Clock – Hours
** One laboratory hour = 0.5 credits.

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Alumnus Member

1ST YEAR -1ST SEMESTER

OFFSHORE DRILLING

Learning objectives:
This course introduces:

- Off shore drilling and well completion techniques & Deep water technology.
- Understand the oil and gas offshore drilling operations.
- Have knowledge on different types of offshore structures, mobile units.
- Understand off shore drilling techniques.
- Gain knowledge on deep water drilling operations.
- Understand deep water production system.

Unit -I
Introduction to offshore oil and gas operations:
Introduction to offshore oil and gas operations-Sea states and weather: Meteorology, Oceanography, Ice, Sea bed oil-Buoyancy and stability.

Unit -II
Offshore fixed platforms and mobile units:
Offshore fixed platforms: Types, descriptions and operations- Offshore mobile units: Types description and installation. Station keeping methods like conventional mooring and dynamic positioning system.

Unit -III
Offshore drilling and well completions:
Difference in drilling from land, from fixed platform, Jackup, ships and semi submersibles. Use of conductors and risers. Deep sea drilling, Platforms and subsea completions, Deep water applications off subsea technology.

Unit IV
Advanced Drilling Techniques:
Direction drilling-Applications, Horizontal wells, MWD, LWD and ERD wells drilling techniques and tools.

Unit V
Deep water technology, Divers and Safety:
Introduction, Definition and prospects- Deep water regions, Deep water drilling rig- Selection and deployment, Deep water production system, Emerging deep water technologies- special equipment and system, Remote operation vessels (ROV), Principles of diving, Use of decompression chambers, life boats-Offshore environmental pollution and remedial measures.

Course outcomes:

After successful completion of this course, the student will be able to:

- Have overview of offshore drilling and well completion operations.
- Gain working knowledge of offshore drilling techniques.
- Gain working knowledge deep water drilling operations and production system.

Text books:

1. Offshore Drilling and completions Training Manual by DRIL-QUIP,INC.
2. Drilling Engineering Workbook, Baker Hughes Inteq,1995.

Reference books:

1. Applied Drilling Engineering, Adam T. Bourgoyne Jr., Keith K. Millheim, Martine E. Chenevert and F. S. Young Jr., Society of Petroleum Engineers, 1991
2. Well Engineering and Construction, HussainRabia, Entrac Consulting, 2002.
3. Fundamentals of Drilling Engineering, Robert F. Mitchell, Stefan Z. Miska, Society of Petroleum Engineers, 2011.

1ST YEAR -1ST SEMESTER

(Non-PE Stream)

FUNDAMENTALS OF PETROLEUM GEOLOGY & RESERVOIR ENGINEERING

Learning objectives:

The objectives of this course is to acquire knowledge on the

- Different sources, reservoir and cap rocks, characterization of reservoir rocks, classification.
- Temperature and pressure conditions for the generation of oil and gas from sediments.
- Overview of scenario of petroleum geology and reservoir engineering
- Basic idea of classification of reservoir pore space, permeability, migrations and entrapment.
- Fundamentals of reservoir engineering fluid flow in porous media and drive mechanisms.
- Differences in reservoirs and analyze the material balance equation.

Petroleum Geology:

Unit-I:

Source Rocks: Definition of source rock. Organic rich sediments as source rocks. Nature and type of source rocks - Claystone / shale. The process of diagenesis, catagenesis and metagenesis in the formation of source rocks. Evaluation of petroleum source rock potential. Limestone as source rocks.

Reservoir Rocks: Characteristics of Reservoir rocks – classification and nomenclature: Clastic Reservoir Rocks, Carbonate Reservoir Rocks, Unconventional, fractured and miscellaneous reservoir rocks. Marine and non-marine reservoir rocks.

Reservoir Properties and Cap Rocks: Reservoir pore space - porosity – primary and secondary porosity, Effective porosity, fracture porosity - permeability – effective and relative permeability relationship between porosity, permeability and texture. Cap rocks: Definition and characteristics.

Unit-II:

Hydrocarbon migration: Geological framework of migration and accumulation. The concept of hydrocarbon migration from source beds to the carrier beds - Carrier beds to the reservoir - Free- path ways for migration - Short distance and long distance migration.

Entrapment of hydrocarbons

Entrapment and accumulation of hydrocarbons - Classification and types of traps: Structural, stratigraphic and combination type of traps.

Sedimentary Basins: Sedimentary basins -origin and classification. Types of basins and their relationship to hydrocarbon prospects. Hydrocarbon accumulations of the following basins: Krishna-Godavari basin, Cambay basin and Mumbai off-shore.

Petroleum Reservoir Engineering: Unit-III

Some basic concepts in reservoir engineering: Calculation of hydrocarbon volumes- Fluid pressure regimes- Oil recovery and recovery factor-Volumetric gas reservoir engineering – Application of the real gas equation of state - Gas material balance and recovery factor-Hydrocarbon phase behavior.

Material balance applied to oil reservoirs: General form -The material balance expressed as a linear equation- Reservoir drive mechanism- Solution gas drive- Gas cap drive- Natural water drive- compaction drive under related pore compressibility phenomena.

Unit-IV

Darcy's law and applications: Darcy's law and field potential- Sign convention- Units and units conversion- Real gas potential – Datum pressures- Radial steady state flow and well stimulation- Two phase flow- Effective and relative permeability's.

Unit-V

The basic differential equation for radial flow in a porous medium- Derivation of the basic radial differential equation – Conditions of solution – The linearization of the equation for fluids of small and constant compressibility.

Course outcomes:

- Master the fundamental of petroleum geology and petroleum reservoirs engineering
- Evaluate different relationships to hydrocarbon prospects
- Have a good knowledge on hydrocarbon accumulations of the different basins
- Understand nature of source rocks and its evaluation.
- Knowing reservoir classification unconventional fracture and miscellaneous reservoir rocks and Cap rocks
- The student will be able to study the concepts of hydrocarbon migration, carrier beds, entrapment and hydrocarbon accumulation.
- Construct different material balance equation for different oil and gas reservoirs.
- Evaluate permeability for reservoir by applying Darcy law
- Have good knowledge on radial flow through porous media.

Text Books:

1. Geology of Petroleum,Levorsen, A.I., 2ndEdition, CBS Publishers, 2006.
2. Fundamentals of Reservoir Engineering, L.P. Dake, Elsevier Science, 1978 (17th Impression 1998).

Reference Books:

1. Richard, C. Selley, Elements of Petroleum Geology, Elsevier, 1997.
2. Sedimentary basins of India- ONGC bulleting
3. CainengZou et al., Unconventional Petroleum Geology, Elsevier, 2013.
4. Reservoir Engineering Handbook, Tarek Ahmed, 3rdEdition, Gulf Professional Publishing, 2006.
5. Petroleum Engineering: Principles and Practice, J.S Archer & C.G. Wall, Graham &Trotman Inc. 1986.
6. Basic Reservoir Engineering, Rene Cosse, Editions Technip, 1993.
7. Petroleum Reservoir Engineering, James W Amyx, Daniel M. Bass Jr., Robert L. Whiting, McGraw Hill, 1960.

1ST YEAR -1ST SEMESTER

RESERVOIR STIMULATION

Learning Objectives:
This course directs towards enhancement of theoretical concepts and practical learning aspects in reservoir stimulation techniques like hydraulic fracturing and acidization.

The student will be able to

- Understand the basics and concepts of reservoir stimulation techniques
- Identify the nature of formation damage and apply suitable reservoir stimulation technique
- Apply various fracturing models depending upon the reservoir parameters
- Design and analyze stimulation treatments
- Characterize and select the suitable fracturing fluid and proppant
- Carry out post treatment analysis and production forecast

UNIT-I:
Modeling of hydraulic fractures and Design: Conservation laws and constitutive equations- Fracture propagation models- Fluid flow modeling- Dimensionless fracture conductivity – Dimensionless productivity index – Designing for optimum length and width – Treatment Sizing – Proppant Placement Efficiency - Linear fracture-mechanics modeling for fracture height- Fracture-height prediction procedures- Techniques to measure fracture height. Fracturing diagnostic techniques- Pressure analysis

UNTI-II:
Fracturing fluids & Proppants - Characterization: Water base fluids- Oil base fluids- Multiphase fluids- Additives- Execution – Proppants – Sphericity – Roundness – Crush Resistance – Conductivity – Selection of proppants and fracturing fluids - Rheology- fluid behavior – flow regimes- fluid friction- Shear and temperature effects on fluid properties- Foam fracturing fluids- Slurry rheology- Proppant transport- Fluid loss- Formation and fracture damage- Proppants.

UNIT-III:
Fracture Diagnostics and Fractured well performance: Post-fracture well analysis- Pseudo radial concepts – Nodal Analysis - Interpretation for finite conductivity fracture wells with wellbore storage- Comparison of production forecasts for untreated and fractured wells. Fracture diagnostic techniques – Tiltmeters – Microseismics

UNIT-IV:
Formation Damage: Introduction- Quantifying Formation Damage -Flow Efficiency & Skin - Drilling-Induced - Caused by Completion & Workover Fluids - During Perforating & Cementing - Caused by Fines Migration - Caused by Swelling Clays - Damage in Injection Wells - Caused by Paraffin & Asphaltenes - Resulting From Emulsion & Sludge Formation - Resulting From Condensate Banking - Water Blocks - Wettability Alteration – Biological means of damage – Minimization Techniques

UNIT-V:
Acidization: Acidizing methods, Acid types & Chemistry – Reaction Kinetics – Acid Fracturing – Matrix Acidizing in Sandstones – Matrix Acdizing in Carbonates – Acid additives – Design the acid treatments
Outcomes:
The students will be able to:

- Gain the conceptual understanding of well stimulation techniques
- Gain working knowledge of fracturing methodologies of hydraulic fracturing.
- Assimilate data for the design of stimulation treatments.
- Design and analyze the well stimulation techniques like fracturing and acidization.
- Solve practical problems in fracturing and remedies to resolve the same.
- Solve practical problems in acidization and remedies to resolve the same.

Text Books:

1. Reservoir Stimulation, Michael. J. Economides, Kenneth G. Nolte, 2nd Edition, Prentice Hall, 1989.
2. Production Enhancement with Acid Stimulation, Leonard Kalfayan, PennWell Books, 2008.
3. Acid Stimulation, Syed A. Ali, Leonard Kalfayan, and Carl Montgomery, SPE Monograph, Vol.26, 2016

Reference Books:

1. Oil Well Stimulation, Robert S. Schechter, Prentice Hall, 1992.
2. Modern Fracturing Enhancing Natural Gas Production, Michael J. Economides, Tony Martin, ET Publishing, 2007.
3. Handbook of Hydraulic Fracturing, James G Speight, Wiley, 2016.

1ST YEAR -1ST SEMESTER

(Non-PE Stream)

PETROLEUM WELL DRILLING & PRODUCTION ENGINEERING

Learning objectives:

- Knowledge of drilling operations.
- Understand different casing and cementation techniques.
- Understand the basis of stock pipe, well control operations.
- Knowledge of basic reservoir considerations and well performance.
- Understand the well deliverability.

Drilling:

Unit-I

Overview of drilling: Drilling Planning Approaches- Drilling team- Types of drilling. Rotary bit technology- Drilling string basics.

Drilling fluids and hydraulics: Drilling fluid economics- Drilling fluid properties- Drilling fluid report hydraulics calculations- Bit Hydraulics- Lost circulation.

Unit-II

Casing & cementation: Casing standards- Casing coupling- Cementing: Introduction cement slurries-Typical field calculations- Cementing nomenclature- Cement additives- Casing & cementing analysis report.

Stuck pipe, well control: Kicks- Kick control- Pressure control theory- BOP-Special kick problems and procedures to free the pipes and Fishing operations.

Driller's logs: Sample logs- Miscellaneous logging devices.

Production Engineering Unit-III

Reservoir considerations - the flow of fluids into the wellbore. The concept of Productivity Index (PI) and the Inflow Performance Relationships (IPR) for oil and gas wells. Use of radial flow equation to define PI, and the factors affecting the shape of IPR curves. Use of generalized pressure functions. Transient IPR curves.

Unit-IV

Well performance prediction with reservoir pressure depletion and changes in gas oil ratio. Basic concept of single and multi-phase fluid flow in pipes. Vertical and inclined flow in oil and gas wells- energy and pressure losses, flow regime, correlation's and computational methods. Gas condensate wells.

Unit-V

Nodal Analysis: Introduction to Nodal Analysis. Performance prediction and surface pressure optimization. Evaluation of Choke performance for gas and multiphase flow. Determination of well deliverability for oil and gas wells.

Course outcomes:

- Gain knowledge on drilling operations and drilling fluid operations.
- Working knowledge on casing and cementation techniques.
- Have the knowledge of production engineering in to reservoir properties and well deliverability for oil and gas wells.

Text Books

1. Oil Well Drilling Engineering: Principles and Practice, H. Rabia, Graham & Trotman, 1985.
2. Working Guide to Drilling Equipment and Operations, William Lyons, Gulf Publishing, 2009.
3. Petroleum Production Engineering: A computer Assisted Approach, BoyunGuo, William C. Lyons, Ali Ghalambor, Elsevier Science & Technology Books, 2007.
4. Petroleum Production Systems, M. J. Economides, A. Daniel Hill & C. E. Economides, Prentice- Hall, N. J – 07488, 1994.

Reference Books:

1. Petroleum Engineering: Drilling and Well Completion, Carl Gatlin, Prentice-Hall, Inc., 1960
2. Drilling Engineering: A Complete Well Planning Approach, Neal Adams, Tommie CharrierPennwell, 1985.
3. Practical Well Planning and Drilling Manual, Steve Devereux, Pennwell, 1998.
4. Primer of Oil Well Service, Workover and Completion, Petroleum Extension Service, University of Texas at Austin, 1997.
5. Formulas and Calculation for Drilling, Production and workover, Norton J. Lapeyrouse, 2nd Edition, Gulf Publishing, 2002.
6. Applied Drilling Engineering, Adam T. Bourgoyne Jr., Keith K. Millheim, Martine E. Chenevert and F. S. Young Jr., Society of Petroleum Engineers, 1991.
7. Well Engineering and Construction, HussainRabia, Entrac Consulting, 2002.
8. Drilling Fluids Processing Handbook, ASME Shale Shaker Committee, Gulf Professional Publishing, 2005.
9. Fundamentals of Drilling Engineering, Robert F. Mitchell, Stefan Z. Miska, Society of Petroleum Engineers, 2011.
10. Production Technology I-II, Institute of Petroleum Engineering, Herriot Watt University.

1ST YEAR -1ST SEMESTER

ADVANCED NUMERICAL METHODS AND APPLIED STATISTICS

Learning Objectives:

- The course is designed to equip the students with the necessary mathematical skills and techniques that are essential for an engineering course.
- The skills derived from the course will help the student from a necessary base to develop numerical methods and design concepts.

Unit-I: Numerical Integration and Differentiation

Newton-Cotes Integration Formulas: The Trapezoidal rule, Simpson's rules, Integration with unequal Segments, Open Integration Formulas, Multiple Integrals.
Integration of Equations: Newton-Cotes Algorithms for Equations**,** Romberg Integration, Adaptive Quadrature**,** Gauss Quadrature, Improper Integrals.
Numerical Differentiation: High-Accuracy Differentiation Formulas, Richardson Extrapolation, Derivatives of Unequally Spaced Data, Derivatives and Integrals for Data with Errors, Partial Derivatives, Numerical Integration/Differentiation with Software Packages.

Unit-II: Ordinary Differential Equations

Explicit and Implicit Forms of Difference Equations, Taylor's and Euler's Methods,
Runge-Kutta Methods, Systems of Equations, Adaptive Runge-Kutta Methods, Stiffness of ODEs & Multi step methods, Gear's Algorithm, Finite Difference Technique for Boundary Value Problems (BVP), derivative boundary conditions, convergence and stability of finite difference schemes.

Unit-III:Partial Differential Equations Finite Difference Approximations.
Finite difference methods – Elliptic equations: Laplace equation, Solution Technique, Boundary Conditions, The Control-Volume Approach.
Finite Difference methods- Parabolic Equations: The Heat-Conduction Equation, Explicit Methods, A Simple Implicit Method, The Crank-Nicolson Method, Parabolic Equations in Two Spatial Dimensions.

Unit-IV: Finite element method

Finite-Element Method: The General Approach, Finite-Element Application in One Dimension Two-Dimensional Problems, Solving PDEs with Software Packages.

Unit-V: Application of Statistical Methods

Joint probability distributions, marginal distributions, conditional distribution, statistical independence.

Reliability applications: Failure rate – Failure Laws of Exponential, Normal, Weibull models, Reliability of a component - System reliability connected with parallelandseries components.

Outcomes:

At the end of the course, student will be able to:

- Solve Numerical Integration and Differentiation.
- Determine Ordinary Differential Equations and Partial Differential Equations
- The determine general solution to Finite element method and Application of Statistical Methods
- Calculate total derivative, Taylor's and Euler's Methods, Runge-Kutta Methods, Systems of Equations, Adaptive Runge-Kutta Methods, Stiffness of ODEs & Multi step methods.

Text Books:

1. "Numerical methods for engineers"; Steven C. Chapra, Raymond P. Canale; McGraw Hill higher education, 6th edition,2010.
2. "Probability and Statistics for Engineers and Scientists"; Ronald E. Walpole, Sharon L. Myers and Keying Ye; Pearson, Eighth edition.

Reference books:

1. "Mathematical Methods in Chemical Engineering"; Jenson V.G. and Jeffreys G.V; Academic press, 2nd edition.
2. "Advanced Engineering Mathematics"; Erwin Kreyszig, Wiley-India publication, 8th edition.
3. "Introductory Methods of Numerical Analysis", Sastry S.S; 4th Edition, PHI Learning Pvt. Ltd., 2006.

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1ST YEAR -1ST SEMESTER

COAL BED METHANE ENGINEERING & SHALE GAS ENGINEERING

Learning Objectives:

This course introduces the student the basics of coal bed methane by giving an overview of reservoir, drilling, production.

This course makes the students to:

- Have overview of scenario of CBM.
- Deal with basic principles of sorption and isotherms.
- Have basic idea of completions and driving of CBM reservoirs.
- Understand the hydrofrac job for coal seams.

COAL BED METHANE ENGINEERING

UNIT-I:

Introduction: Overview of coal bed methane (CBM) in India – CBM vs Conventional Reservoirs. Coal chemistry – Significance of rank – Cleat system and natural fracturing.

UNIT-II:

Sorption: Principles of Adsorption-The Isotherm construction-CH_4 retention by coal seams-CH_4 content determination in coal seams-The isotherm for recovery prediction-Model of the micro-pores-coal sorption of other molecular species.

UNIT-III:

Well Construction: Drilling-Cementing. Formation Evaluations, Logging: Borehole environment-Tool measurement response in coal-wire line log evaluation of CBM wells-Gas-In-Place calculations-Recovery factor-Drainage area calculations.

Hydraulic fracturing of coal seams: Need for fracturing coals-Unique problems in fracturing coals-Types of fracturing fluids for coal-In situ conditions-Visual observation of fractures. Water production and disposal from CBM wells

SHALE GAS ENGINEERING

UNIT-IV:

Origin of Shale Gas, characteristics of shale gas. Characteristics of shales containing gas. Drilling options in shale gas reservoirs, vertical drilling and hydro fracturing, horizontal drilling and hydro fracturing, Production complications in shale gas production stimulation of shale gas reservoirs

UNIT-V:

Evaluation of play in shale gas reservoirs various factors required to be analyzed for shale gas evaluation play visual kerogen analysis. Different case studies of shale gas deposits.

Outcomes:

By successful completion of this course, the students will be able to:

- Master the fundamentals of coal bed methane.
- Construct different isotherms.
- Evaluate different logs for CBM reservoirs.
- Have good knowledge on water disposal techniques and environmental laws.
- Understand reservoir drilling and production of CBM.

Text Books:

1. Coal Bed Methane: Principles and Practice, R. E. Rogers, 3rd Edition, Prentice Hall, 1994.
2. Coal Bed Methane, Robert A. Lamarre, American Association of Petroleum Geologists, 2008.

Reference Books:

1. Fundamentals of Coal Bed Methane Reservoir Engineering, John Seidle, Pennwell Corp., 2011.
2. Coal Bed Methane, Society of Petroleum, 1992.
3. A Guide to Coal Bed Methane Operations, B. A. Hollub, Society of Petroleum, 1992.

1ST YEAR -1ST SEMESTER

TRANSPORTATION OF OIL AND GAS

Course objectives:
The objectives of this course is to acquire knowledge on the

- Multiphase flow and transport of fluids pertaining to the oil sector, specifically crude oil, refinery products and natural gas.
- Characterization of multiphase flow in the oil sector with respect to heat, mass and momentum transfer.
- System design and operability in subsea system.

Unit-I
Physical and Transport properties: Physical and transport properties of crude oil, Petroleum liquids and Natural gas.

Unit-II
Modes of Crude Oil, Hydrocarbon Liquids and Gas Transportation: Tank-Trucks and Rail Transportation, Oceanic Tanker Transportation, Inland Water, Coastal and Oceanic, Tanker Size, Power, Cargo Space, Marine Storage Terminals, Shore Installation.

Unit-III
Pipeline Transportation of Oil: Crude oil and product flow characteristics, heat flux estimation, temperature gradient in flowing fluid in exposed and buried pipeline, insulation types and thickness, rheology and non-newtonian behavior. Pressure waves, water hammer; Slug transportation; Leaks and ruptures in pipelines; Isothermal oil transport; Non-isothermal oil transport; Methods of improving flow characteristics. Computer simulations.
Wax and Asphaltenes: Wax; Wax Management; Wax Remediation; Asphaltenes; Asphaltenes Control; Design Philosophies.

Unit-IV
Pipeline transportation of Natural gas: Temperature of flowing gases; Steady state flow & Transient flow in pipeline systems; Computer simulation of the flow in pipeline system.

Unit-V
Subsea System Engineering; Flow assurance challenges; flow assurance concerns; typical flow assurance process; fluid characterization and property assessments; steady-state hydraulic and thermal performance analyses; transient flow hydraulic and thermal performances analyses; system design and operability.
Heat Transfer and Thermal Insulation: Heat Transfer Fundamentals; U-Value; Steady-State Heat Transfer; Transient Heat Transfer; optimum insulation thickness calculations. Thermal Management Strategy.
Hydrates: Physics and Phase Behavior; Hydrate Prevention; Hydrate Remediation; Hydrate Control Design Philosophies.

Outcomes:

The student of this course will have:

- Sound knowledge of properties of fluids and their flow behavior in an oil industry pipelines.
- Acquire knowledge of all the transport phenomenon specific to the reservoir and oil industry.
- Preliminary knowledge of subsea system performance and challenges.

Text Books:

1. Production and Transport of Oil and Gas (Part B: Gathering and Transport), Szilas A.P, 2^{nd} Edition, Elsevier Publications, 1986.
2. Subsea Engineering Handbook, Yong Bai., QiangBai, Gulf Professional Publishing, Elsevier, 2012.

1ST YEAR -1ST SEMESTER

Advanced Well Logging Techniques & Well Testing Analysis

Learning objectives:

- Physical properties of the subsurface, strata like resistivity, porosity, thickness etc. through tools like latero, induction, density, neutron, etc.
- Log interpretation data with the help of advanced technology tools namely, Scanner, NMR, Modular formation tester etc.
- Analysis of flow and pressure tests in oil reservoirs, fractured wells.
- Flow Modelling in Reservoirs with respective to fracture porosity, pressure derivatives and multi rate tests of reservoir flows.

UNIT-I:
Latest advances in Micro and Spherically focused logs to image thin beds and different radioactive logs and their utility in calculating density, porosity and estimation of water saturation.

UNIT-II:
NMR logging and their recent advances in the industry. Understanding of fluid saturation from NMR logs. Identification of fractures through formation Microimager.

UNIT-III:
Principles and operation of Dip-meter logs. Interpretation of Dip meter logs to obtain structural dips of the layers encountered in the borehole and correlation of the same with the nearby offset wells.

UNIT-IV:
Application of Pressure and Derivative to Drawdown and Buildup Tests: Pressure-based analysis of flow and buildup tests- Derivative-based analysis of flow and buildup tests, TDS technique-Determining Average reservoir pressure-Drainage area and pore volume of bounded systems, oil in place.

Hydraulically Fractured Wells and Gas Well Testing: Uniform-flux and infinite-conductivity models of hydraulic fractures- Finite-conductivity: linear, bilinear, and elliptical flow-Geometry of inclined hydraulic fractures-Interpreting gas well tests using pressure and pseudo-pressure derivative.

UNIT-V:
Naturally Fractured Reservoirs and Carbonates: Indicators and types of NFR-Pseudo-steady state and unsteady state matrix flow models- Storativity and Porosity Partitioning coefficient-Fracture porosity from well logs and well test analysis Interpretation of interference and pulse tests, pressure derivative

Multiphase Flow, Multirate Tests, and Partially Perforated Wells: Conventional and modern interpretation of multi-rate tests- Applications of TDS, convolution and deconvolution techniques- Partially completed/penetrated/perforated wells-Vertical permeability from spherical flow, MDT.

Course Outcomes:

Students will be able to learn :

- Advanced theoretical knowledge of well logging.
- Well logging and data interpretation using advanced tools.
- Reservoir fracture porosity & pressure testing including build-up tests and pressure derivatives.
- Multirate analysis in naturally fractured reservoirs.

Text Books:

1. Open-Hole Log Analysis and Formation Evaluation, Richard M. Batemons, International Human Resources Development Corporation, Bostan, 1985.
2. Well Logging for Earth Scientists, Darwin V. Ellis, Julian M. Singer, Springer, 2007.
3. Petroleum Reservoir Engineering Practice, Nnaemeka Ezekwe, 1st Edition, Prentice Hall, 2010.
4. Advanced Reservoir Engineering, Tarek Ahmed and Paul D Mc Kinney, Gulf Professional publishing, Elsevier, 2005.

Reference Books:

1. Fundamentals of Well Log Interpretation: The Acquisition of Data, Oberto Serra, Elsevier, 1984.
2. Well Logging Handbook, Oberto Serra, Editions Technip, 2008.

1ST YEAR -1ST SEMESTER

ADVANCEDNUMERICALMETHODSANDAPPLIEDSTATISTICSLAB

Learning Objectives:

- To learn an overview of MATLAB
- To understand the different numerical methods to solved in pipeline engineering

Using MATLAB, Solving: Pipeline engineering problems.

- Least square analysis – Curve fitting.
- Numerical integration and differentiation problems.
- Problems concerned with Linear & Non-Linear Algebraic Equations.
- Different types of differentialequations
- Different types of Partial differential equations and estimations
- Parameters of algebraic equations.

Outcomes: At the end of the course, the students will

- Be thorough in the MATLABprogramming.
- Carry out process design, Develop new problem solving skills.
- Be able to pipeline design equipment pertaining to numerical methods.

1ST YEAR -1ST SEMESTER

DRILLING SIMULATION LABORATORY

Learning Objectives:

- Drilling simulation lab familiarizes student not only the normal drilling operations but also abnormal conditions in drilling.
- The student can get acquaintance with the drilling operations preventing abnormal conditions like Wall kicks, Blowouts, Mud losses etc.
- The student can have the knowledge how to handle the BOP, Panels, Choke manifold, Remote panel etc., in case of any emergency situation.
- Drilling simulation lab covers all abnormal drilling operations that help the student to have total knowledge of the drilling in live conditions.

The following experiments are to be carried out using a drilling simulator:

1. **Familiarization and line-up of operational components – I**: Sand pipe manifold, draw work console, drilling console.
2. **Familiarization and line-up of operational components – II:** Blow out preventer (BOP) panel, choke manifold, remote panel.
3. **Operation of major components:** Mud pumps, operating slow circulation rate, operating the rotary table, pulling weight on bit running in and pulling out of hole, remote choke panel operating.
4. **Kick identifications and well shut in procedures:** Setting flow alarms (deviation mud volume), setting flow alarms for return mud volume, identifying kick warning signs, Utilizing shut in procedures to kill well, well control computations.
5. Studies on the effect of weight on drill bit and rotary speed on the rate of penetration and wear of the bit.
6. Studies on the effect of mud density and flow rate on the penetration and wear of the bit.

Outcomes:

The student will be able to:

- Familiarize with abnormal drilling operations and handle any drilling situation without any panic.
- Be conversant with the BOP, control panel, remote control panel etc.
- To identify the abnormal activities much in advance and plan to prevent the Kick, Blowout etc.
- Become a very good drilling engineer by improving the rate of drilling even in critical conditions.

1ST YEAR -1ST SEMESTER

PROJECT MANAGEMENT

Course objectives:

- To know about project management and project techniques.
- To understand practical scheduling of the project and critical path scheduling.
- To understand the resource management, project budgeting, risk management and performance management.
- To know abbot the project portfolio management and operation management.

Unit-I

Project Management & Project Initiation Techniques:

Projects-Project Management-Organizing Project Management-Implementing a computer-Software selection-Project initiation Techniques-Breakdown structures-Project life cycles.

Unit-II

Scheduling: Scheduling-critical path scheduling-critical path chain and uncertainty-Estimating task duration schedules-Time compression-Practical scheduling.

Unit-III

Resources Management and Budgeting:

Different elements of resource management-Role based needs-Resource leveling-Practical Resource Scheduling-Concepts of budgeting and Cost Control Software for Cost Management.

Unit-IV

Risk Management and Maintaining the Plan, Performance Measurement:

Managing contingency-Risk management-Managing schedule cost and Technical Risk and Contingency, Computer bar approaches to schedule risk analysis-Maintaining the Plan, Change control and scope management, Real time status vs Period data, Automatic project management, Measuring the value of work accomplishment.

Unit-V

Project Portfolio Management, Project Management, Enterprise Project Management and Enterprise Resource Planning: Defining and implementing project portfolio management- Bridging the gap between operations management, project management: The important role of project portfolio management, Project selection and risk, The search for automated, integrated- Integrated PM and ERP-Defining PSA market, building PSA solutions-Making project management work.

Course outcomes:

- The learner understand the project management and project initiation technique.
- The student will be able to make the scheduling of the project and learn to manage the resources and budgeting of the projects.
- The student can be a future project engineer by adequate panning, risk assessment and can do performance measurement.
- The learner will understand how to manage the gap between operations management and project management and scheduling by actual work.

Text book:

1. Practical Project Management, Harvey A. Levine, John Wiley & Sons Inc, 2002.

Reference Books:

1. A Guide to Project Management, Frank Heyworth, Council of European Publishing, 2002.
2. Modern Project Management, Norman R. Howes, American Management Association, 2001.
3. Effective Project Management, Robert K. Wysocki and Rudd McGary, Third Edition, Wiley Publishing, Inc., 2003.
4. Project Management Made Easy, Entrepreneur Press and Sid Kemp, Entrepreneur Press, 2006.
5. Project Management Professional: Study Guide, Kim Heldman, SYBEX, Inc., 2002.
6. Project Management, Harold Kerzner, 7th Edition, John Wiley & Sons, Inc., 2001.

1ST YEAR -2nd SEMESTER

ARTIFICIAL LIFT TECHNIQUES

Learning Objectives:

- To understand the various artificial lift methods for the secondary recovery of the field.
- To gain knowledge on sucker rod lift system and the problems related to SRP operations.
- To understand the gas lift mechanism and design.
- To gain knowledge of different types of submersible pumps.
- Develop skills for the selection and type of artificial lift method for wells.

Unit-I

Introduction: Definition and Purpose of artificial lift selection-Reservoir pressure and well productivity-reservoir fluids-Types of artificial lift.

Unit-II

Sucker Rod lift: Sucker rod lift system-polished rod motion-load to the pumping unit-pump deliverability and power requirement-sucker rods-steel sucker rods-pony rods-FRP sucker rods-Non-API sucker rods-criteria for rod string design, advantages and limitations-Trouble shooting sucker rod lift installation.

Unit-III

Gas lift: Gas lift system-gas compression requirements sonic flow-subsonic flow- volumetric efficiency-stage compression-gas lift valve design-selection of gas lift valves-pilot valve-continuous and intermittent gas lift advantages and limitations.

Unit-IV

Electrical submersible pumps, Progressive cavity pumping: Electrical submersible pumps (ESP)-principle-hydraulic piston pumping-ESP design-ESP advantages and limitations.
Progressive cavity pumping: Plunger lift-working principle-design-plunger lift models-progressive cavity pumping (PCP) advantages and limitations.

Unit -V

Hydraulic Jet pumping: Hydraulic Jet pumping-selection of jet pump-advantages and dis-advantages.
Selection of artificial lift method: artificial lift method selection-gas lift vs pump assisted lift-installation and replacement of artificial lift-maintenance of artificial lift.

Outcomes:

Students of this course will acquire knowledge on:

- Oil well artificial lift techniques.
- The mechanical systems specific to oil lifting from crude oil wells including submersible pumps, jets, and artificial lifts and their working principles.

Textbooks:

1. Petroleum Production engineering: A computer assisted approach, Boyun GUO, William C. Lyons, Ali Ghalambor, Elsevier Science and Technology books 2007.
2. Petroleum Engineering Handbook-Production Operations Engineering, Volume 4, Joe Dunn Clegg and Larry W. Lake, SPE, 2014.

Reference Books:

1. Petroleum production systems, M.J. Economides, A. Daniel Hill & C. E. Economides, Prentice-Hall, N.J-07488, 1994.
2. The Technology of Artificial Lift Method, Brown, K.E, Volume 1-4, Penn Well Books, Tulsa, Oklahoma, 1977.
3. Production Technology I-II, Institute of Petroleum Engineering, Herriot Watt University, 2014.

1ST YEAR -2nd SEMESTER

RESERVOIR MODELING & SIMULATION

Course objectives:

- Gets knowledge of how to calculate single phases and multi-dimensional flow in reservoir.
- Will be able to understand difference flow equations and simulation of reservoir conditions.
- Will know modelling and well conditions in reservoir blocks.
- Will be able to solve linear and nonlinear flow equations for different fluids.

Unit-I

Introduction: Milestones for the engineering approach-Importance of the engineering and mathematical approaches.

Single-phase fluid equations in multidimensional domain: Properties of single-phase fluid-Properties of porous media- Reservoir discretization- Basic engineering concepts-Multidimensional flow in Cartesian coordinates- Multidimensional flow in radial-cylindrical coordinates.

Unit-II

Flow equation using CVFD terminology: Introduction- Flow equations using CVFD terminology- Flow equations in radial-cylindrical coordinates using CVFD terminology-Flow equation using CVFD terminology in any block ordering scheme.

Unit-III

Simulation with a block-centered grid: Introduction- Reservoir discretization- Flow equation for boundary grid blocks- Treatment of boundary conditions- Calculation of transmissibilities- Symmetry and its use in solving practical problems.

Simulation with a point distributed grid: Introduction- Reservoir discretization- Flow equation for boundary grid points-Treatment of boundary conditions-Calculation of transmissibilities - Symmetry and its use in solving practical problems.

Unit-IV

Well representation in simulators: Introduction- Single block wells- Multi block wells-Practical considerations dealing with modeling and well conditions.

Single-phase flow equations for various fluids: Pressure dependence of fluid and rock properties-General single-phase flow equation in multi dimensions.

Unit-V

Linearization of flow equation: Introduction- Nonlinear terms in flow equations- Nonlinearity of flow equations for various fluids- Linearization of nonlinear terms- Linearized flow equations in time.

Methods of solution of linear equations: Direct solution methods- Iterative solution methods.

Course outcomes:

- Will have overall knowledge of reservoir modelling using different equations.
- Will be able to assimilate about reservoir performance and simulation techniques
- Will be in position to solve different type flow equations for different types of fluids.

Text Book:

1. Petroleum Reservoir Simulation: A Basic Approach, Jamal H. Abou – Kasem, S. M. Fariuq Ali, M. Rafiq Islam, Gulf Publishing Company, 2006.

Reference Books:

1. Principles of Applied Reservoir Simulation, John R. Fanchi, Elsevier, 2005.Practical Reservoir Simulation, M.R. Carlson, PennWell, 2003.
2. Reservoir Simulation: Mathematical Techniques in Oil Recovery, Zhangxin Chen, Cambridge University Press, 2008.
3. Mathematics of Reservoir Simulation, Richard E. Ewing, Society for Industrial and Applied Mathematics (SIAM), 1983.

1ST YEAR -2nd SEMESTER

ADVANCED EOR TECHNIQUES

Learning Objectives:

This course introduces to advance EOR Techniques for field development.

The student will be able to:

- Estimate the hydrocarbon reserves.
- Distinguish various EOR techniques in terms of applicability.
- Select the appropriate EOR techniques for given reservoir conditions.
- Understand thermal, chemical and other EOR methods.
- Gain knowledge on regulations and various case studies.

Unit-I

Reserves Estimation and Recovery methods:

Introduction to Reserves estimation and Characterization, Brief description of IOR & EOR-Primary and Secondary Recovery Techniques, Advanced Classification of EOR techniques and their Screening Selection and evaluation of process, Methodology, Simulation sensitivity and decision analysis.

Unit-II

Thermal Recovery Methods:

Steam Injection: Method and its effect on reservoir field development using steam Injection method.
In-situ Combustion: Method and its effect on reservoir field development using In-situ combustion method.

Unit-III

Chemical Methods:

Polymer Flooding: Method and its effect on reservoir field development using Polymer Flooding method, Micellar Polymer Flooding.
Alkaline Flooding: Method and its effect on reservoir field development using Alkaline Flooding method, Miscible fluid displacement.
Solvent Flooding: Method and its effect on reservoir field development using Solvent Flooding method.

Unit-IV

Other Methods:

CO_2Flooding Method and its effect on reservoir field development using CO_2Flooding method, Microbial and Electro thermal EOR Process.

Unit-V

Regulations and economics of advanced EOR Techniques:

Reservoir Development planning using advanced EOR techniques Regulations, Public opinion, economics, Case studies of some advanced EOR techniques, Current status of various advanced EOR techniques-offshore vs. onshore.

Outcomes:

After successful completion of this course, the student will be able to:

- Gain the conceptual understanding of advanced EOR techniques.
- Gain working knowledge of EOR techniques.
- Select suitable EOR techniques.
- Analyze the effect of particular EOR techniques on field development.
- Check that particular EOR program follows the applicable regulations and standards.

Text Books:

1. Applied Enhanced oil Recovery, Aurel Carcoana, Prentice Hall, 1992.
2. Enhanced oil Recovery-field planning and development strategies, Vladimir Alvarado, Eduardo Manrique, Gulf Professional Publishing, 2011.

1ST YEAR -2nd SEMESTER

ADVANCED WELL COMPLETIONS

Course objectives:

The student will:

- Gain knowledge on well completion and their latest advantages.
- Understand intricacies of well completions.
- Gain information about completion equipment and their relation.
- Able to get knowledge of different types of well completions and their installation.

UNIT-I

Basics of Reservoir Completion: Inflow Performance Relationship, Perforating, Hydraulic Fracturing, Acid Fracturing

Sand Control: Rock Strength, Sand control Prediction, Sand production mitigation, Sand control screens, Gravel Packing, Chemical sand consolidation.

UNIT-II

Life of Well Operations: Types and methods of Intervening, Impact on Completion Design. Tubing well performance, Multiphase flow & tubing performance, Flow predictions, Temperature prediction and Control, Packer fluids, Production & Injection well sizing.

Material Selection: Down hole Corrosion, Metallurgy Selection, Corrosion Inhibition, Seals, Control Lines and encapsulation, Coatings and liners

Tubing Stress Analysis: Stress, Strain and Grades, Axial Loads, Burst, Collapse, Triaxial Analysis, Safety and design Factors, Load Cases, Tubing Connections

UNIT -III

Completion Equipment: On-land and subsea Christmas trees; Subsurface safety Valves, Packers, Expansion devices and anchor latches, Landing nipples, locks and sleeves, Mandrels and gauges, Capillary lines and cable clamps, Loss control and reservoir isolation valves, Crossovers, Flow couplings, Modules,

UNIT-IV

Well Completion Techniques: Deep water Completions. HPHT Completions, Completions with down hole flow control, Multilateral Completions, Dual Completions, Multipurpose Completions, Underbalanced completions, Coiled tubing and insert completions, Completions for Heavy oil and steam injection, Completions for Coal Bed Methane.

UNIT- V

Installation of Completion systems: Wellbore Clean-out and mud displacement, Completion fluids and filtration, Well clean-up and flow initiation.

Course objectives:

The student will:

- Make to understand about well completion techniques and latest advances.
- Will able to get information about well completions equipment and their selections.
- Get know about different well completion techniques and their installation.

Textbooks:

1. Advanced Well Completions, Renpu Way , 3rd Edition Gulf Publishing , 2011
2. Well Completion Design by Jonathan Bellarby, Elsevier, 2009
3. Subsea Drilling Well Operations and Completions, working document of the NPC North American Resource Development Study, 2011.
4. Off shore well completions and simulation: using hydraulic fracturing and other technologies.

1ST YEAR -2nd SEMESTER

FLOW ASSURANCE

Course objectives:

This course helps the students to learn problems associated with flow assurance in pipeline. Specifically,

- Overview of what is flow assurance?
- What are the items which will affect flow?
- Understand different types of flow, single, two and three phase flows.
- Different flow regimes and influence in fluid flow behavior in oil pipelines.
- Modeling of different flow regimes.
- Fluid flow affected by compositions of liquids, gases and operating conditions and their optimization.

Unit-I

Introduction to flow assurance; Pipe friction; Friction in Non-circular pipes; Friction loss in components.

Unit-II

Non-Newtonian Fluid & Friction; Transient flow; Transient flow; Simplified liquid flow solution; Heat Transfer Fundamentals; U-Value; Steady State / Transient Heat Transfer; Thermal management strategy and Insulation; Simulation Results & Program Testing.

Unit-III

Composition & properties of Hydrocarbons; Emulsion, Phase Behavior, Hydrocarbon Flow; Single, two, three & four phase regimes; conservation equations; 2 & 3 fluid models; friction, deposition & entrainment, solving two-phase three fluid equations; gas & Liquid slug including boiling & condensation.

Unit-IV:Hydraulics

Two Phase Liquid-Liquid Flow; Two Phase Liquid-Gas Flow, Two Phase Liquid-Solid Flow; Three Phase Gas-Liquid-Liquid Flow; Three phase Gas-Liquid-Solid Flow

Unit-V:Hydrates, Wax & Asphaltenes

Physics & Phase Behavior; Hydrate Prevention; Hydrate Remediation; Hydrate Control Design Philosophies; Recovery of Thermodynamic Hydrate Inhibitors.
Wax; Wax Management; Wax remediation; Asphaltenes; Asphaltene control design philosophies

Course outcomes:

The students will acquire knowledge of:

- Single phase, two phase and three phase flow in pipelines with respect to pipe friction losses, heat and mass transfer, flow models, boiling and condensation process.
- Hydrates preventions, remediation and control design.
- Wax control management.

Text Books:

1. "Pipe Flow-1 Single Phase Flow Assurance" – Over Bratland (e-Book).
2. "Pipe Flow-2 Multi Phase Flow Assurance" – Over Bratland (e-Book).
3. "Subsea Engineering Handbook" – Yong Bai & Qiang Bai – Gulf Professional Publishing.

Reference book:

1. "Natural Gas Hydrates in Flow Assurance" – Dendy Sloan et.al – GPP.

1ST YEAR -2nd SEMESTER

ADVANCED HORIZONTAL WELL TECHNOLOGY

Learning Objectives:

This course introduces fundamentals of horizontal wells by dealing with reservoir and production characteristics of horizontal wells and respective challenges.

The students will be able to:

- Understand the basics of horizontal wells and its reservoir properties.
- Have knowledge of different types of horizontal wells.
- Understand different horizontal well completion techniques.
- Understand the testing and flow performance using different equations.
- Gain knowledge on critical rates of flow and challenges during different rates of flow like gas and water coning.

UNIT-I:

Overview of horizontal well technology: Introduction- Limitations of horizontal wells- Horizontal well applications- Drilling techniques- Horizontal well length based upon drilling techniques and drainage area limitations- Completion techniques.

Reservoir engineering concepts: Skin factor- Skin damage for horizontal wells- Effective wellbore radius r'_w - Productivity index, *f*- Flow regimes- Influence of areal anisotropy.

UNIT-II:

Steady-state solutions: Steady-state productivity of horizontal wells- Effective wellbore radius of a horizontal well- Productivity of slant wells- Comparison of slant well and horizontal well productivities- Formation damage in horizontal wells- Field histories.

Influence of well eccentricity: Introduction- Influence of well eccentricity- Drilling several wells- Horizontal wells at different elevations.

UNIT-III:

Horizontal well completions : Introduction- different types of horizontal well completions - Types of fracture - Issues related to logging in horizontal wells – Well control measures in horizontal wells – Complications during drilling horizontal wells – mitigation..

UNIT-IV:

Pseudo-steady state flow: Generalized pseudo-steady state equation for horizontal wells- Shape factors of horizontal wells- Horizontal well pseudo-steady state productivity calculations- Inflow performance of partially open horizontal wells- Inflow performance relationship (IPR) for horizontal wells in solution gas-drive reservoirs- Predicting horizontal well performance in solution gas-drive reservoirs.

UNIT-V:

Water and gas coning in vertical and horizontal wells: Critical rate definition - Critical rate by production testing- Decline curve analysis - Characteristics of water cut versus recovery factor plots- Water and gas coning in horizontal wells- Horizontal well breakthrough time in a bottom water drive - Critical rate for horizontal well in edge-water drive reservoir - practical considerations.

Outcomes:

After successful completion of this course, the students will be able to:

- Have an overview of horizontal well technologies.
- Perform flow performance calculations of horizontal wells.
- Working knowledge of horizontal well completion techniques
- Solve challenges for different flow rates.
- Design a horizontal well.

Text Book:

1. Horizontal Well Technology, S. D. Joshi, PennWell Publishing Company, 1991.
2. Horizontal wells : Focus on the reservoir,Timothy R Carr, Erik P.Mason,Charles T.Feazel,AAPG 2003

Reference Book:

1. Horizontal Wells: Formation Evaluation, Drilling and Production Including Heavy Oil Recovery, Roberto Aguilera, G. M. Cordell, G. W. Nicholl, J. S. Artindete, M. C. Nq., Gulf Publishing Co., 1991.

1ST YEAR -2nd SEMESTER

RESERVOIR SIMULATION LABORATORY

Learning Objectives:

- The main objective is to simulate the exploitation of a real reservoir without the costs of real life trial and error, e.g. to test different production scenarios to find an optimal one before the reservoir is actually put on production.
- To develop reservoir simulation models for new reservoirs to maximize recovery of oil and gas and to make investment decisions.
- To develop reservoir simulation models for existing reservoirs to study production decline and production forecasts.

The students will be trained to be conversant with the software ECLIPSE Black-oil Reservoir Simulation, to model and solve reservoir engineering problems.

ECLIPSE features

- File organization and structure
- Selection of suitable by grid sensitivity studies.
- Fluid properties
- Rock properties
- Wells
- Aquifer modelling
- History matching consisting of adjusting the parameters of the model such as permeability, porosity etc. until the computed results for the historical period are close to historical data
- Prediction of properties permeability, relative permeability, saturation etc.

Software:

ECLIPSE Black-oil Reservoir Simulation.

Outcomes:

After the laboratory course, the students will be able to:

- Explain reservoir simulation fundamentals- the underlying equations and the numerical techniques used to solve them.
- Design a reservoir simulation model, construct the data set, execute the simulator, and view simulation results visually using post-processing software.
- Plan and conduct the calibration of a reservoir simulation model.
- Apply reservoir simulation technology to solve production and reservoir engineering problems in individual wells or patterns.
- Apply reservoir simulation technology to solve production and reservoir engineering problems in entire fields or reservoirs.
- Present results of an engineering study effectively in a written report.

1ST YEAR -2nd SEMESTER

FLOW ASSURANCE LABORATORY

Course objective:

- To gain knowledge of flow assurance issues.
- To understand the issues from various experiments.
- To visualize and gain information about flow assurance problems and how to overcome.
- To develop the counter measures by simulation studies

1. Evolution of flow assurance and multiphase transmission pipeline at subsea conditions.
2. Surge studies of cross country product transmission pipelines.
3. Life span estimation of pipeline with corrosion rate management and flow management.
4. Studies on basic data used in subsea pipeline simulation scheme.
5. Simulating deep water flow line connected via offline platform and sensitivity analysis and shutdown depressurization ramp up turn down and pigging.
6. Studies on flow line characteristics.
7. Studied on basic trunk line characteristics.
8. Studied on basic for pipeline size, flow rate and arrival pressure.
9. Basic data for steady state simulation cases.
10. Studied on multiphase flow at steady sate conditions

Course outcomes:

The student will be able to understand:

- Flow assurance issues by the experiment.
- By simulation and experiment how to overcome the issues and make necessary correction in design.
- Visualize issues Cleary by various studies.

1ST YEAR -2nd SEMESTER

INTEGRATED RESERVOIR MANAGEMENT

Course objectives:

- To understand the fundamental concepts of the reservoir and the management for setting goals and plans
- To develop reservoir model and mechanism for acquisition of data.
- To analyze the reservoir performance, material balance and mathematical simulations.
- To understand the reservoir management case studies , plans, importance and current challenges to integrate reservoir management

Unit-I

Introduction & Reservoir management Concepts:

Introduction to Reservoir Management-Definition-Fundamentals of Reservoir Management-Synergy and Team-Integration of Geoscience and Engineering-Integrating Exploration and Development Technology.

Unit-II

Reservoir Management Process:

Setting Goals, Developing Plan & Economics-Implementation- Survey lines and Monitoring- Evaluation-Revision of Plans Strategies-Reasons for failure of Reservoir Management Programs- Reservoir Management Case studies.

Unit-III

Data Acquisition, Analysis and Management and Reservoir Model:

Data Types-Data Acquisition and Analysis-Data Validation-Data Storing and Retrieval-Data Application-Example Data-Role of Reservoir Model: Geoscience-Seismic Data-Geostatistics, Engineering, Integration and Case Studies.

Unit-IV

Reservoir Performance Analysis and Forecast and Economics:

Natural Producing Mechanisms, Reservoirs-Volumetric, Decline Curve and Material Balance Method-Mathematical Simulation-Economics: Economic Criteria-Scenarios-Data-Economic Evaluation-Risk and Uncertainties-Economic Optimization Example.

Unit-V

Reservoir Management case studies, Plans, Importance and Current Challenges:

North ward Estes Field and Columbus Gray lease-McAllen Ranch Field-Brassey Oil Field-Means San Andres Unit-Teak Field and Esso Malaysia Fields-Reservoir Management Plans: Newly Discovered Field-Secondary and EOR Operated Field-Importance of Integrated Reservoir Management-Current Challenges and Areas of Further Work.

Course Outcomes:

- The learner will understand the concept of reservoir and its management.
- The learner will able to analyze the reservoir developing plans, evaluation and reason for failure.
- The learner can understand the performance of reservoir for different case studies.
- The learner will be able to integrate the reservoir management for its best results .

Textbook:

1. Integrated Petroleum Reservoir Management: A Team Approach, AbdusSatter and Ganesh Thakur, Penn Well Publishing Company, 1994.