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| **Course Teacher: Dr Pradip Borgohain** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 101** | **Petroleum Geology** | **3** | **0** | **2** | **4** | **60** | **40** | **100** |
| ***Introduction:*** The course is design to impart knowledge on the origin, occurrence, movement and accumulation of hydrocarbons within the earth’s crust. Petroleum geology refers to the specific set of geological disciplines, specially sedimentology, stratigraphy and structural geology that are applied to the search for hydrocarbon deposits. | | | | | | | |
| Course Content | 1. **Geology of Petroleum – an Overview**:  * Petroleum types, occurrences and properties * Origin, migration and accumulation * Reservoir traps- types and genesis  1. **Rocks & Minerals**:  * Common rock forming minerals * Rock types- Igneous, Sedimentary and metamorphic * Sedimentary rocks: processes of formation, depositional environment, texture and structure. Genesis of sediments (clastic & non clastic), classification and characteristics of clastic, non- clastic and evaporate rocks as reservoir. Grain size analysis  1. **Stratigraphy**:  * Concept of lithostratigraphy, biostratigraphy & chronostratigraphy. * Geologic time scale  1. **Structure, tectonics and basin evolution**:  * Types and causes of folds, faults & unconformity * Basin evolution processes and classification of basins on the basis of Plate Tectonics * Plate tectonics and oil prospecting  1. **Source Rock**:  * Source rock types * Kerogen types, maturation & significance * Source rock analysis : TOC, Rock-eval analysis * Role of time and temperature in petroleum generation  1. **Reservoir rock**:  * Types of reservoir rocks * Diagenesis and its impact on reservoir rock * Role of clay minerals within the reservoir rock * Classification of carbonate rocks. Porosity types in carbonate reservoir rock  1. **Petroleum Province**:  * Geographic and geologic distribution of oil and gas field in India with special reference to northeast India. | | | | | | | |
| Practical | * 1. Rock thin-section study under Microscope   2. 1-2 days field visit in outcropped area & preparation of geological cross-section   3. Grain size analysis and its interpretations with reference to reservoir characteristics   4. Measurement of Dip & Strike using Brunton Compass, calculation of true and apparent Dip with field exposure   5. Heavy mineral analysis   6. SEM analysis. | | | | | | | | |

**Books Recommended**:

* + 1. Petroleum Geology by F.K. North, Publisher : Allen & Unwin
    2. Elements of Petroleum Geology by R. C Selly. Publisher : Academic Press
    3. Basic Petroleum Geology by P. K . Lint. Publisher: OGCI
    4. Geology of Petroleum by A.I. Levorsen, Publisher: W.H. Freeman & co.
    5. Petroleum Formation & Occurrence By- Tissot, B.P. & Welte, D.H. Publisher: Springer
    6. Petroleum (Indian context) by D. Chandra & R.M. Singh. Publisher: Tara Book Agency, Varanasi
    7. Introduction to Sedimentology By S.M. Sengupta, Publisher : Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
    8. Principles of Sedimentology & Stratigraphy by Sam Bogs, Publisher : Pearson Education Ltd., London
    9. Sandstone Reservoir By John H. Barwis, et.al. Publisher : Spinger –Verlag
    10. Sedimentary structures by J.D. Collinson & D.B. Thompson Publisher : CBS Publisher & Distributors, New Delhi

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| **Course Teacher: Dr Borkha Mech Das** | | | | | | | | |
| Course  No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course  Marks | | TotalMarks |
| Theory | Tutorial | Practical | End  Sem | In  Sem |
| **PT 102** | **Geophysical**  **Exploration** | **2** | **0** | **2** | **3** | **60** | **40** | **100** |
| ***Introduction:*** Geophysical Exploration is an applied branch of geophysics that uses physical methods to measure the physical properties of the subsurface, along with the abnormalities in those properties at the surface of the earth. It is commonly used to detect the presence and position of geological deposits that could be economically used. It is also used to get a clear picture of the underlying structures including the spatial allocation of rock units, and to discover structures such as folds, faults and intrusive rocks. [Seismic](https://en.wikipedia.org/wiki/Reflection_seismology)  techniques are the most widely used geophysical technique in hydrocarbon exploration. They are used to map the subsurface distribution of stratigraphy and its structure which can be used to delineate potential hydrocarbon accumulations, both stratigraphic and structural deposits or "traps". [Gravity](https://en.wikipedia.org/wiki/Gravity_anomaly) and [magnetics](https://en.wikipedia.org/wiki/Aeromagnetic_survey) are also used, with considerable frequency, in oil and gas exploration. These can be used to determine the geometry and depth of covered geological structures including [uplifts](https://en.wikipedia.org/wiki/Tectonic_uplift), [subsiding basins](https://en.wikipedia.org/wiki/Sedimentary_basin), [faults](https://en.wikipedia.org/wiki/Fault_(geology)), [folds](https://en.wikipedia.org/wiki/Fold_(geology)), [igneous intrusions](https://en.wikipedia.org/wiki/Intrusion) and [salt diapirs](https://en.wikipedia.org/wiki/Salt_dome) due to their unique [density](https://en.wikipedia.org/wiki/Density) and [magnetic susceptibility](https://en.wikipedia.org/wiki/Magnetic_susceptibility) signatures compared to the surrounding rocks. | | | | | | | |
| Course  Content | 1. **An overview of the Subject** : A brief history of development of the subject; Scope of the subject in relation to hydrocarbon, mineral and ground water exploration; Geophysical properties of rocks and minerals; contrast and anomaly, Forward and inverse problems; Exploration strategies for the virgin areas and those having inadequate data. 2. **Introduction to various surface geophysical methods**: Gravity; Magnetic; Electrical Electromagnetic; Ground Penetrating Radar (GPR) Magneto-telluric; radioactive and seismic. 3. **Gravity and Magnetic methods**: The Earth’s gravitational field and its relation to gravity exploration , Gravitational effects over subsurface bodies having discrete shapes; Reduction of gravity data and Bouguer anomaly; Magnetism of the earth, Magnetic effects from buried magnetic bodies; Instruments for measuring gravity and magnetic effects on land, at sea and into the boreholes; gravity and magnetic data acquisition, processing and interpretation techniques in petroleum exploration 4. **Seismic Survey:**   **a.** Review of the theory of seismic waves, spherical spreading of seismic disturbance, reflection and transmission coefficients, seismic noise, Noise analysis; Time-Distance relationships for refraction and reflection events for multilayered earth. Differences between the refraction and reflection methods  **b.** Common depth point (CDP) techniques, Normal Move Out (NMO) and Dip Move Out (DMO) corrections; general discussion on seismic instruments and different energy sources, 2D & 3D seismic data acquisition, various processing steps and interpretation: Seismic to well correlation, synthetic seismogram, mapping of faults & horizons, concept of time-depth conversion, prospect identification and evaluation, pitfalls in seismic interpretations. A brief introduction to latest technologies in seismic survey. | | | | | | | |
| Practical | 1. Different types of field data corrections and interpretational techniques adopted for gravity and magnetic data (for studying the basement, mineral exploration and basin analysis)  2. Interpretation of seismic refraction data to find out the depth to bedrock in a dam site survey. Engineering refraction problem for the multi-layered earth to find out the depth of different layers, their respective thickness and nature of dip (direction and magnitude).  3. Uphole survey data interpretation for the determination of weathering layer (Low velocity layer) thickness as well as computation of weathering and sub- weathering layer velocities.  4.Interpretation of seismograms for reflection data using DIX method to find out actual velocities for different layers, using RMS velocities and calculation of the respective thickness.  5. Identification of unconformities, faults and different types of structural and stratigraphic elements in the seismic sections. | | | | | | | |

**Books Recommended:**

1. Introduction to Geophysical Prospecting by Milton B. Dobrin
2. Basic Exploration Geophysics by Edwin S. Robinson and Cahit Coruh
3. Outlines of Geophysical Prospecting by M.B. Ramachandra Rao

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| **Course Teacher: Dr M.A Chowdhury** | | | | | | | | |
| Course  No | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 103** | **Basic Drilling Technology** | **2** | **1** | **2** | **4** | **60** | **40** | **100** |
| ***Introduction:*** Introduction to oil well drilling technology, subsurface and wellbore pressure relations, equipment and materials required for drilling, rotary drilling processes including directional drilling, drilling fluids basics, casing policy, cementing equipment, materials and methods, laboratory testing of drilling fluids and cement. Degree level background in physics, chemistry & mathematics is required to undertake this course. | | | | | | | |
| Course Content | 1. Overview of rotary drilling: units and quantities, drilling geology, formation fluids and relevant properties, subsurface pressure and temperature, pressure relations within formation and well bore 2. Drilling equipment: rotary drilling rig – onshore/offshore; major components of drilling rig; drill string components; hoisting system loads and calculations 3. Drill bits: types, classification, selection; design factors, cutting mechanism, other/advanced types of bits 4. Directional drilling: applications, steering tools and methods, downhole motors, BHA components. Introduction to horizontal drilling, introduction to multilateral drilling/extended reach drilling 5. Drilling fluids: functions, composition, types, properties, selection; drilling fluid equipment 6. Casing: types and functions, liners, casing accessories; casing specifications, API standards, strength properties, casing design; casing policy 7. Cementing: types and API classes, properties of cement slurry and set cement, measurement of slurry properties, cement additives, types of cementing, principles of cementing casing/liner, cementing equipment, cementing job calculations. | | | | | | | |
| Practical | * 1. Drilling fluid testing: preparation of drilling fluids, measurement of physical, rheological, and chemical properties   2. Cement testing: preparation of cement slurry, measurement of slurry properties, setting time, etc. | | | | | | | |

**Books Recommended:**

1. Working Guide to Drilling Equipment and Operations, William C. Lyons
2. Oilwell Drilling Engineering, H.L. Rabia
3. Drilling Fluids Processing Handbook, ASME Shale Shaker Committee
4. Formulas and Calculating for Drilling, Production, and Workover, N.L. Lapeyrouse
5. Applied Drilling Engineering, A.T. Bourgoyne, K.K. Millheim, M.E. Chenevert. SPE Textbook Series

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| **Course Teacher : Dr Minati Das** | | | | | | | | |
| Course  No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 104** | **Reservoir Engineering-I** | **3** | **0** | **0** | **3** | **60** | **40** | **100** |
| ***Introduction:*** This course is an introduction to basic Reservoir Engineering. Properties of reservoir rock, different driving mechanism are important to study the reservoir in detail. Derivation of fluid flow in different condition for different fluids is important as this is the main mathematical tool of the reservoir engineering. How much amount of oil present in the reservoir, how much can be recovered and prediction of future performance from the reservoir can be estimated by different methods of reservoir estimation. | | | | | | | |
| Course Content | 1.Introduction of Reservoir Engineering  2. Properties of Reservoir rock  a) Porosity: Definition, Types of porosity  b) Permeability types: Definition, Types of permeability,  c) Relative permeability concept- single phase system, multiphase system-oil water system, gas/oil system  d) Fluid saturation  e) Wettability concept  3. Fluid flow in reservoir:  a) Classification of fluid flow system in porous media- flow regime: steady state flow; semi steady state flow, transient flow; horizontal flow, radial flow; number of flowing phases; single phase flow, multiphase flow; flow geometry  b) Darcy’s law, generalized from of Darcy’s law  c) Linear flow of incompressible fluids, steady state  d) Linear flow of gases, steady state  e) Horizontal steady state single phase flow of fluids; linear beds in series, linear phase in parallel, radial beds in series, radial beds in parallel, approximating flow geometries; radial flow of incompressible fluid; steady state radial flow of compressible liquids in bounded areas  f) Flow through fractured reservoirs  4. Driving mechanisms:  a) Primary recovery mechanisms-  Rock & fluid expansion, Depletion drive mechanism, Gas cap drive, Water drive mechanism, Combination drive mechanism, Gravity drainage : Oil and gas recovery under different driving mechanisms and recovery factors / recovery efficiency  5. Estimation of reserves:  a) Classification of oil & gas reserves  b) Estimation of oil & gas reserves by:  (i)Volumetric methods.  (ii) Material balance method- the material balance equation, basic assumptions in the Material balance method- the material balance equation, Schilthius equation of material balance for different cases. Drive index calculations.  (iii) Decline curve analysis | | | | | | | |

**Books Recommended:**

1. Tarek Ahmed, “Reservoir Engineering Handbook”, Elsevier, 2006
2. B.C.Craft and M.Hawkins “Applied Petroleum Reservoir Engineering”.
3. L.P.Dake “Fundamentals of Reservoir Engineering.”

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| **Course Teacher: Mr Ranjan Phukan** | | | | | | | | |
| Course  No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 105** | **Petroleum Fluids** | **2** | **0** | **2** | **3** | **60** | **40** | **100** |
| ***Introduction:*** This course is an introduction to the fundamental concepts of petroleum fluids. The course discusses the phase behavior of hydrocarbon systems and the classification of petroleum reservoirs. The properties of all the three petroleum fluids are discussed, followed by laboratory analysis of reservoir fluids. The course also discusses the equation of state and the phase equilibria. Students also get the hands on experience of analyzing the reservoir rocks and fluids in the practical classes. | | | | | | | |
| Course Content | 1. Fundamentals of Hydrocarbon Phase Behavior   Single-Component Systems  Two-Component Systems  Three-Component Systems  Multicomponent Systems  Classification of Reservoirs and Reservoir Fluids   1. Properties of Petroleum Fluids   Crude Oil Gravity  Gas Solubility  Bubble-Point Pressure  Oil Formation Volume Factor  Isothermal Compressibility Coefficient of Crude Oil  Undersaturated Oil Properties  Total-Formation Volume Factor  Crude Oil Viscosity  Behavior of Ideal Gases & Real Gases  Properties of natural gases  Properties of reservoir waters   1. Equations of State and Phase Equilibria   Equilibrium Ratios  Flash Calculations  Equations of State   1. Laboratory Analysis of Reservoir Fluids   Reservoir fluid sampling  PVT analysis | | | | | | | |
| Practical | 1. Reservoir Engineering Practical   Practical related to Petroleum Fluid Analysis, Core Analysis, Core  Flooding for Improving Oil Recovery by Waterflooding, Chemical and  Gas flooding | | | | | | | |

**Books Recommended:**

1. Tarek Ahmed, “Reservoir Engineering Handbook”, Elsevier, 2006
2. B.C.Craft and M.Hawkins “Applied Petroleum Reservoir Engineering”.
3. E.J.Burcik “Properties of Petroleum Reservoir Fluids”
4. L.P.Dake “Fundamentals of Reservoir Engineering.”
5. K.S.Pedersen and P.L.Christensen “Phase Behavior of Petroleum Reservoir Fluids”
6. “Core Analysis”, Teknica Petroleum Services Ltd, Alberta, 2001

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| **Course Teacher: Dr Subrata Borgohain Gogoi** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 106** | **Flow through porous media** | **2** | **1** | **0** | **3** | **60** | **40** | **100** |
| **Introduction:** A porous medium is a solid containing void spaces (pores), either connected or unconnected, dispersed within it in either a regular or random manner. These so called pores may contain a variety of fluids such as air, water, oil etc. If the pores represent a certain portion of the bulk volume, a complex network can be formed which is able to carry fluids. Only these permeable and porous media are taken into consideration in this volume. Fluid flow through porous media is the manner in which fluids behave when flowing through a porous medium, for example in the underground oil and gas reservoir rocks. As observed, some fluid flows through the media while some mass of the fluid is stored in the pores present in the media. The basic law governing the flow of fluids through porous media is Darcy's Law, which was formulated by the French civil engineer Henry Darcy in 1856 on the basis of his experiments on vertical water filtration through sand beds. | | | | | | | |
| Course Content | **1: General overview**  Displacement Fundamentals Factors Affecting Oil Recovery  Frontal Advance theory  Piston like movement  Pattern Floods Definitions: Mobility Ratios, Sweeping Efficiencies, Recovery Efficiencies, Trapped Oil Saturation Phase Behavior and Fluid Properties  **2: Porous Media** Relationship between transport properties and pore structure of porous material.  Transport properties of porous media.  Mechanisms of immiscible and miscible displacement (hydrodynamic dispersion) process in porous media. Relationships between pore structure and fluid transport. Network modeling and percolation theory.  **3: Microfluidics**  Soo and Radke theory  Microfluidic devices that simulate oil reservoirs  Capture mechanisms  Fluid flow phenomenon  **4: Simulation and Modeling**  **Petrel**  software platform for [exploration and production](https://en.wikipedia.org/wiki/Upstream_(petroleum_industry))  Perform [well](https://en.wikipedia.org/wiki/Well_logging) correlation  Visualize [reservoir simulation](https://en.wikipedia.org/wiki/Reservoir_simulation) results Eclipse Developed fields for production forecasts | | | | | | | |

**Books Recommended:**

* + - 1. Gogoi SB, “Petroleum Technology –Enhanced Oil Recovery Techniques”, pub. Oxford & IBH, 2014.
      2. Buckley, S.E. and Leverett, M.C.: "Machanism of Fluid Displacement in Sands," Trans.AIME 146 (1942)
      3. Craft, B.C. and Hawkins, M.F.:”Applied Petroleum Reservoir Engineering,” Prentice Hall, November 1964.
      4. Craft, B.C. and Hawkins, M.F.:”Applied Petroleum Reservoir Engineering,” Prentice Hall, November 1964.
      5. Latil, M.:”Enhanced Oil Recovery,” Techniq, 1980.
      6. Roger J M De Wiest and Jacob Bear, Flow through porous media**,** New York, Academic Press, 1969.

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| **Course Teacher: Dr Dhrubajyoti Neog** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 107** | **Production Technology** | **3** | **1** | **0** | **4** | **60** | **40** | **100** |
| ***Introduction:*** The course contents are intended to impart knowledge on crude oil recovery methods and multiplicity of problems involved during its extraction from sub-surface reservoirs. The curriculum aims to provide comprehensive and systematic discussion on a variety of oil field practices and wells performance evaluation techniques employed in the oil industry. | | | | | | | |
| Course Content | 1. **Introduction to Oil Recovery methods**:   Primary recovery, Secondary recovery, Improved Oil Recovery, Enhanced Oil Recovery, Recovery factor   1. **Well Completion Design:**   Well completion, types of well completion, Down-hole completion and tools, wellhead equipment, Multi-zone completion   1. **Well Activation methods**:   Displacement, Compressor application, Application of Nitrogen, Aeration, Swabbing, Coiled Tubing unit, Use of artificial lifts   1. **Performance Evaluation**:   Drawdown and Productivity Index (PI), Specific Productivity Index (SPI),Inflow performance relationship (IPR), GOR, WOR, GLR   1. **Flowing well performance**:   Determination of inflow performance, vertical lift performance- flow regime in vertical two phase flow, stable and unstable flowing conditions, choke performance, Nodal analysis   1. **Well stimulation Techniques:**   Well stimulation & concept of formation damage, well acidizing treatment, hydraulic formation fracturing, thermal stimulation, surfactant treatment, Microbial treatment   1. **Artificial Lift methods**: *Gas lift-* Continuous and intermittent gas lift, unloading operations, gas lift valve components and mechanics, Plunger lift, chamber lift *Mechanical pumping*-Sucker Rod Pumping, components and operation, SRP installation, ESP-components and operation, Jet pump, Hydraulic pump-operation and components, Progressive Cavity Pump. | | | | | | | |

**Books Recommended:**

1. Introduction to Petroleum Production Vol. I & II by D.R. Skinner

2. Principles of Oil Well Production by T.E.W. Nind

3. Production Operations Vol. I & II by Thomas & Roberts

4. Petroleum Engineering by Archer & C.G. Wall

5. Petroleum Engineering by Carl Gatlin

6. Applied Petroleum Reservoir Engineering by Crafts & Hawkins

7. Fundamentals of Reservoir Engineering by L.P Drake

8. Integrated Petroleum reservoir Management by Abdus Sattar and Ganesh C.

Thakur

9. Technical manual for Production Operations by R.K. Mukherjee. Institute of Oil &

Gas Production Technology, ONGC Ltd., Panvel

10.Well completion and Servicing, Oil & gas Field Development Techniques, Editions

Technip, D. Perrin

11.Enhanced Oil Recovery, Don W Green, G. Paul Willhite, SPE Textbook Series Vol 6.

12. Waterflooding, G. Paul Willhite, SPE Textbook Series, Vol. 3

13. Petroleum Production Handbook, Vol. I, Thomas C. Frick, Editor-in-Chief, R. William

Taylor, Associate Editor, Journal of Petroleum Technology

14. Thermal Methods of Oil Recovery, J. Burger P. Sourieau, M. Combarnous, Editions

Technip

15. Petroleum Exploration & Exploitation Practices, Dr. Bhagwan Sahay

16. Gas Lift Manual, Gabor Takacs, Ph.D. Petroleum Engineering Department, University of

Miskolc, Hungary

17. Modern Petroleum Technology, Volume I, Upstream, Edited by Richard A. Dawe, 6th

Edition

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| **AEC (Inter-Departmental)** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 1A1** | **Geological/Industrial Field work** |  |  |  | **2** | **30** | **20** | **50** |
|  | **The students will undergo Geological field work including mapping and sampling in the outcropped sections of Assam and Fold -Thrust belt areas of northeast India. The field work may include the laboratory visits in petroleum related industries/institutions.** | | | | | | | |

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| **Course Teacher: Dr Pradip Borgohain** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 201** | **Exploration and Development of Oil & Gas fields** | **2** | **1** | **0** | **3** | **60** | **40** | **100** |
| ***Introduction:*** The course includes the different Exploration techniques for search of underground oil and gas deposits, and evaluation in the case of discovery. Once the presence of commercially viable oil and/or gas deposit is confirmed, certain steps need to be followed to develop the oilfield scientifically for production. The course is also designed to through knowledge on the unconventional hydrocarbon resources and their exploration methods and application of sequence stratigraphy in hydrocarbon exploration. | | | | | | | |
| Course content | 1. **Well prognosis and economic analysis :**  * Prognostication * Classification and categorisation of reserves * Classification of drilling location * Economic analysis of the project * Preparation Well programme (GTO) * Geological data required for preparation of GTO   **2. Concept of Exploration and Development Methods & Techniques:**   * Geological, geophysical, geochemical remote sensing, microbial and other techniques   **3. Processing and integration of geological and geophysical data:**   * Preparation of different types of maps- structure contour, isopach, isopay, lithofacies map etc. * Correlation of well sections * Preparation of geological and seismo-geological sections   **4. Principles of development of oil & gas fields:**   * Concept of exploration & development cycle * Steps followed during development of oil & gas fields (Preparation of exploratory plan and drilling first exploratory well, collection and analysis of information during exploratory drilling, drilling of out step wells, preparation of a development plan and field development period) * Rational development system * Basic geologic data for development planning * Effects of reservoir characteristics on well completion * Drilling and well completion * Perforation and well activation * Estimation of reserves * Field development plan, well placement  1. **Concept of sequence stratigraphy and its application in Petroleum Exploration** 2. **Unconventional Hydrocarbon System: Occurrence, Distribution Production Technologies, Environment Impact** 3. **Future Exploration in India with special reference to Assam-Arakan Basin** 4. **Concept of various explorations licensing policy in India.** | | | | | | | |

**Books Recommended:**

1. Theoretical Principles of Exploration and Development of Oil & Gas Accumulation by Bakirov, A.D
2. Geophysical Prospecting by Dobrin Milton B.
3. Handbook for Prospectors by Richard M. Peaut
4. Petroleum Exploration Handbook by Moody, GbB.
5. Handbook of Subsurface Geology by Moore, C.A
6. Electrical methods in Geophysical Prospecting by George V. Keller
7. Development and Exploration of Oil and Gas Fields by Peace Publishers, Moscow
8. Geology of Petroleum by Levosen, A.I.
9. Geophysical Exploration by Heiland, C.A
10. New technologies for Exploration & Development of Oil and Gas Resources by Graham & Trotman
11. New Technology in Exploration Geophysics, by H. Roices Nelson Jr.
12. Formation Evaluation and Wellsite Geological Techniques by BhagwanSahay
13. Petroleum Exploration and Exploitation Practices by BhagwanSahay
14. Outlines of Geophysical prospecting by Ramchandra Rao
15. Seismic Stratigraphy by Robert E. Sherif
16. Applied Hydrodynamics in Petroleum Exploration by Eric C. Dahlbery
17. Depositional Sedimentary Environments by Reineck& Singh
18. Oil and Gas Traps by Melkom K. Jenyon
19. Petroleum Source Rocks by Barry Katz
20. Geology for Petroleum Exploration, Drilling and Production by Norman J. Hyne
21. New Technologies for the Exploration and Exploitation of Oil and Gas resources by Miller, JouliaAsselt&Angyris.

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| **Course Teacher: Dr M.A Chowdhury** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 202** | **Advanced Drilling Technology** | **3** | **1** | **0** | **4** | **60** | **40** | **100** |
| ***Introduction:*** Drilling practices, design and evaluation of oil well drilling systems such as drill string, casing, and bit; introduction to drilling hydraulics; identification and solution of drilling problems. Basics of well control. Advanced drilling technologies such as UBD, MD, CTD, HPHT, etc are also covered. Introduction to well planning and design. Completion of PT-103 Basic Drilling Technology course or equivalent is required to undertake this course. | | | | | | | |
|  | 1. Drilling hydraulics: hydrostatic pressures, rheological models, pressure drop calculations, surge/swab pressures basics, bit nozzles, cuttings transport basics, hydraulics optimization. 2. Drilling practices: ROP and factors affecting it; principles of hole deviation; BHA design, hole survey and measurement while drilling. 3. Drilling problems: drilling complications, directional drilling problems, preventive and remedial measures; fishing tools. 4. Well control: well kicks - causes, detection, and prevention; well control equipment, principles of well control and methods, well control operations. 5. Air and gas drilling: basic principles, aerated drilling, foam drilling, underbalanced drilling, managed pressure drilling, special equipment. 6. Advanced drilling technologies: casing drilling, coil tubing drilling, percussion drilling, turbo drilling for hard/abrasive formations, HPHT well drilling. 7. Well planning: Planning process, data acquisition and analysis; well design, drilling program. | | | | | | | |

**Books Recommended:**

1. Working Guide to Drilling Equipment and Operations, William C. Lyons
2. Oilwell Drilling Engineering, H.L. Rabia
3. Formulas and Calculating for Drilling, Production, and Workover, N.L. Lapeyrouse
4. Drilling Engineering, J.J. Azar
5. Applied Drilling Engineering, A.T. Bourgoyne, K.K. Millheim, M.E. Chenevert. SPE Textbook Series
6. Practical Well Planning and Drilling Manual, Steve Deverau

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| **Course Teacher: Dr. Minati Das** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical |  | End Sem | In Sem |  |
| **PT 203** | **Reservoir Engineering-II** | **2** | **0** | **2** | **3** | **60** | **40** | **100** |
| ***Introduction:*** Reservoir Pressure, Temperature, Formation Damage and other important reservoir parameters are discussed here to determine the production capacity of the well, optimum flow rate, skin factor and other characteristics of the reservoir study of well testing is very important. Analysis of type curve helps to find out reservoir characteristics. For forecasting future oil production, decision making and reservoir management reservoir simulation is an important technique. Simulation is the best cost-saving way to investigate the performance or test different configuration of a big system, which may cost a lot of money or require other resources or even be impossible to be investigated or changed. | | | | | | | |
| Course content | 1. **Introduction** to (i) Bottom Hole Pressure and Temperature, Mobility Hydroconductivity, Capacity, Piezoconductivity, Radius of Investigation, Formation Damage etc.   (ii) Fundamental flow equations and flow regimes   1. **Well test analysis:**  * Introduction, * Role of well test in Petroleum Industry * Different well test analysis   3. **Oil well testing:**   * Introduction, * Deliverability or P.I Test Analysis * Pressure Transient Well Test Analysis * Buildup Test Analysis * Theory of Buildup Test Analysis * The Ideal Buildup Curves, Actual Buildup Curves * Assumptions in ideal test theory, Qualitative Behaviour of field tests, Effects and Duration of afterflow * Determination of different reservoir parameter   4. **Type curves:**   * Definition * Fundamentals of type curves * Analysis of well tests using type curves   5. **Gas Well Testing**:   * Introduction, Basic theory of gas flow in reservoir * Deliverability Testing of Gas Wells. * Conventional back pressure tests * Isochronal tests * Modified Isochronal tests   6. **Reservoir Simulation:**   * Introduction, Why Reservoir Simulation * Objective of Reservoir Simulation * Application of Reservoir Simulation | | | | | | | |

**Books Recommended:**

1. Tarek Ahmed, “Reservoir Engineering Handbook”, Elsevier, 2006
2. B.C.Craft and M.Hawkins “Applied Petroleum Reservoir Engineering”.
3. L.P.Dake “Fundamentals of Reservoir Engineering.”
4. A.U.Chaudhry. “Gas Well Testing Handbook”

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| **Course Teacher: Mr Ranjan Phukan** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical |  | End Sem | In Sem |  |
| **PT 204** | **Advanced Reservoir Engineering** | **2** | **1** | **0** | **3** | **60** | **40** | **100** |
| ***Introduction:*** This course discusses fluid flow equations under steady, semi-steady and unsteady flow conditions. The concepts of natural water influx are introduced and the methods of calculating the water influx under different flow conditions taught. Immiscible displacement with reference to water flooding is also discussed. Finally, the concept of petroleum reservoir management is introduced to the students. | | | | | | | |
| Course content | 1. Reservoir Fluid Flow   Unsteady-State Flow  Constant-Terminal-Rate Solution  Pseudosteady-State Flow  Principle of Superposition  Transient Well Testing  2. Water Influx  Classification of Aquifers,  Recognition of natural water influx,  Water Influx Models  3. Principles of Waterflooding  Recovery Efficiency  Frontal Displacement Theory,  Fractional Flow Equation,  Frontal Advance Equation   1. Concepts of Integrated Reservoir Management   Definition of Reservoir Management  Fundamentals of Reservoir Management  Synergy & Intergration process | | | | | | | |

**Books Recommended:**

1. Tarek Ahmed, “Reservoir Engineering Handbook”, Elsevier, 2006
2. B.C.Craft and M.Hawkins “Applied Petroleum Reservoir Engineering”.
3. L.P.Dake “Fundamentals of Reservoir Engineering.”
4. Abdus Satter and Ganesh C. Thakur “Integrated Petroleum Reservoir Management: A Team Approach”

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| **Course Teacher: Dr Dhrubajyoti Neog** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical |  | End Sem | In Sem |  |
| **PT 205** | **Surface Production Operations** | **3** | **1** | **0** | **4** | **60** | **40** | **100** |
| ***Introduction:*** The course design presents a systematic and organized discussion on the field handling practices for crude oil in various installations that will help students learn surface production operations of the oil industry. The course describes some of the flow assurance methods and covers different oil field problems associated with handling of crude oil and its production from oil wells. | | | | | | | |
| Course Content | * 1. **Surface gathering system**:   Types of gathering systems, fluid flow behaviour, flow lines, headers, valves, flow behaviour in gathering systems  2. **Gas processing**:  Two-phase separators, test separators, different separator types, stage separators, Dehydrators, gas compressors, prime movers, gas sweetening process, sulphur recovery from gas, condensate separation  3. **Liquid processing**:  Oil-water emulsions, free-water knockout, Treating emulsions-gravity separation, heating separation, Thermo-chemical treating-vertical treaters and horizontal treaters, electrostatic separation-electrostatic treaters, safety precautions with treaters  4. **Surface handling of gas, oil and water**:  Underground storage of natural gas, liquid storage tanks, liquid pumps, vapour recovery from storage tanks, equipment associated with liquid storage tanks, effluent water treatment, salt water disposal  5. **Flow assurance:**  Scales, Hydrate, Paraffin chemistry, methods of removal,  preventing deposition and its control, Corrosion control, Formation  damage  6. **Sand control** : mechanism, mechanical methods, Gravel pack, Resin  Consolidations | | | | | | | |

**Books Recommended:**

1. Introduction to Petroleum Production Vol. II & III by D.R. Skinner

2. Production Operation Vol. II by Thomas & Roberts

3. Surface Operations in Petroleum Production Vol. I, II & III by Chilingarian, Robertson

A.R., Sanjay Kumar

4. Integrated Petroleum Reservoir Management by Abdus Sattar and Ganesh C. Thakur

5. Principles of Petroleum Reservoir Engineering Vol. II by Gian Luigi Chierici & translated

from the Italian by Peter J. Westaway

6. Petroleum Engineering-Principles and Practices by J.S. Archer & C.G Wall

7. Handbook of Natural Gas Engineering by Katz

8. Enhanced Oil Recovery Processes & Operations by Donaldson

9. Production & Transportation of Oil & Gas by Szilas, Development in Petroleum Science,

Vol. 3

10. Oilfield Processing, Vol. II: Crude Oil, Francis S. Manning, Ph.D. P.E & Richard E.

Thompson Ph.D. P.E

11. Surface Production Operations, Design of Gas Handling Systems and Facilities, Vol. I,

Vol. II, Ken Arnold Maurie Stewar

12. Petroleum Production Handbook, Vol. I, Thomas C. Frick, Editor-in-Chief, R. William

Taylor, Associate Editor, Journal of Petroleum Technology

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| **Course Teacher: Dr Subrata Borgohain Gogoi** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical |  | End Sem | In Sem |  |
| **PT 206** | **Enhanced Oil Recovery** | **2** | **1** | **2** | **4** | **60** | **40** | **100** |
| ***Introduction:*** Enhanced oil recovery (abbreviated EOR), also called tertiary recovery, is the extraction of crude oil from an oil field that cannot be extracted otherwise. EOR can extract 30% to 60%or more of a reservoir's oil,compared to 20% to 40% using  primary and secondary recovery.  There are three primary techniques of EOR: gas injection, thermal injection, and chemical injection. Gas injection, which uses gases such as natural gas, nitrogen, or carbon dioxide (CO2), accounts for nearly 60 percent of EOR production in the United States. Thermal injection, which involves the introduction of heat, accounts for 40 percent of EOR production in the United States, with most of it occurring in California. Chemical injection, which can involve the use of long-chained molecules called polymers to increase the effectiveness of waterfloods, accounts for about one percent of EOR production in the United States. | | | | | | | |
| Course content | **1: General EOR**  Common Aspects of EOR Methods Reservoir Engineering Concepts for EOR Introduction to Enhanced Oil Recovery Methods (EOR) Comparative Performance of Different EOR Methods Screening Criteria and Technical Constraints  **2: Miscible Processes**  General Overview of Solvent Methods Phase Behavior Fundamentals from: Pressure/Temperature and Pressure/Composition Diagrams Quantitative Representation of Phase Equilibria Processes: Gas Injection and Production Ternary Diagrams to Represent Gas Injection Processes: Miscible and Immiscible Processes Mechanisms of Oil Displacement. Diffusion and Dispersion Hydrocarbon Miscible Displacement  First Contact Miscible Processes  The Condensing-Gas Process  The Vaporizing-Gas Process  Minimum Miscibility Pressure (MMP) Carbon Dioxide Flooding Dissipation in Miscible Displacements Instability Phenomena (viscous fingering) Simulation Models as Reservoir Management Tools.  **3: Chemical and Polymer Flooding**  Fractional Flow Theory Dissipation in Immiscible Displacements Applications of Fractional Flow in Oil Recovery Calculations  Homogeneous Reservoirs:  Buckley-Leverett. One-dimensional displacement  Layered Reservoirs: Styles, Dykstra-Parsons and Johnson Methods.  Improved Waterflooding Processes: Polymer Flooding Rheology of Polymer Solutions Polymer Adsorption and Retention  Micellar-Polymer or Microemulsion Flooding Properties of Surfactants and Cosurfactants Surfactant-Brine-Oil Phase Behavior Performance Evaluation  Determination of Residual Oil Saturation-Tracers Laboratory Tests for Chemical Floods  **4: Thermal Processes**  Steam Injection Processes Cyclic and Continuous Steam Injection Thermal Properties of Fluids and Solids Steam Properties: Flow Rate and Quality Measurements. Temperature Effect on Reservoir and Fluid Properties  Viscosity Reduction  Thermal Expansion Oil Characterization for Thermal Reservoir Simulation Evaluation of Heat Losses Prediction of Steam Flood Performance  Cyclic Steam Performance: Marx-Langenheim model.  Steamflood Performance: Gomaa’s Method. Correlations.  **5: Microbial EOR**  Different Types  Effect of IFT  Effect of viscosity  Effect of pressure maintenance  Calculations of Efficiencies  **6: Experimental Study**  Surface tension and Interfacial tension measurements of surfactants and alkalis  Crude oil analysis  Determination of resins, waxes and asphaltenes  Reservoir produced water characterization by Water Analyser and Flame photometer  Rheological behaviour study  Porous media analysis  Determination of adsorption Isotherm of Chemicals on porous media | | | | | | | |

**Books Recommended:**

1. Gogoi SB, “Petroleum Technology –Enhanced Oil Recovery Techniques”, pub. Oxford & IBH, 2014.
2. Buckley, S.E. and Leverett, M.C.: "Machanism of Fluid Displacement in Sands," Trans.AIME 146 (1942)
3. Craft, B.C. and Hawkins, M.F.:”Applied Petroleum Reservoir Engineering,” Prentice Hall, November 1964.
4. Craft, B.C. and Hawkins, M.F.:”Applied Petroleum Reservoir Engineering,” Prentice Hall, November 1964.
5. Latil, M.:”Enhanced Oil Recovery,” Techniq, 1980.
6. Roger J M De Wiest and Jacob Bear, Flow through porous media**,** New York, Academic Press, 1969.

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| **Course Teacher: Dr Borkha Mech Das** | | | | | | | | |
| Course  No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course  Marks | | TotalMarks |
| Theory | Tutorial | Practical | End  Sem | In  Sem |
| **PT 207** | **Well logging** | **2** | **0** | **2** | **3** | **60** | **40** | **100** |
| ***Introduction:*** Well logging, also known as borehole logging is the practice of making a detailed record (a well log) of the [geologic](http://www.oilfieldwiki.com/wi/index.php?title=Geologic&action=edit&redlink=1) formations penetrated by a borehole. The log may be based either on visual inspection of samples brought to the surface (geological logs) or on physical measurements made by instruments lowered into the hole (geophysical logs). Well logging can be done during any phase of a well's history; drilling, completing, producing and abandoning. Well logging is done in boreholes drilled for the oil and gas, [groundwater](http://www.oilfieldwiki.com/wiki/Groundwater), minerals, geothermal, and for environmental and [geotechnical](http://www.oilfieldwiki.com/wi/index.php?title=Geotechnical&action=edit&redlink=1) studies. | | | | | | | |
| Course Content | 1. **Basic principles of well logging**: objective, classifications, equipment (sondes  /tools used in well logging including their basic principles, logging environment, calibration and quality control).  2. **Techniques of well logging (Types & Basic Principles):**  a) Conventional Open Hole Log Suite: SP logs, Caliper log, Resistivity logs, Natural Gamma ray (GR) log & Spectral Gamma ray log, Sonic logs, Neutron log, Formation Density log & Photoelectric log  b) Additional/Advanced Open Hole Log Suite: Dipmeter log/FMR, NMR, Formation Pressure test & Sampling.  c) Cement Evaluation Tools  d) Production Logging tools.  3. **Log Interpretation:**  - Quick look method of log interpretation  - Qualitative interpretation  - Quantitative interpretation  4. **Well log correlation: Basic principle & their uses.**  5. **Introduction to VSP and its principle and geoscientific advantages.**  6. **Advances in Logging tools**  - Logging while drilling – Rotary Steerable system  - Analysis behind casing (ABC) with special focus on CHFR | | | | | | | |
| Practical | 1. Analysis of log to determine lithology, shaliness etc.  2. Calculation of formation water resistivity.  3. Calculation of water saturation (Sw).  4. Calculation of Porosity.  5. Calculation of Shale volume.  6. Well log correlation | | | | | | | |

**Books Recommended:**

1. Geophysical Well-logging, Principles and Practices by J.P. Vaish
2. Well Logging in Nontechnical Language by David E. Johnson & Kathryne E. Pile.

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| **AECC (Inter-Departmental)** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical |  | End Sem | In Sem |  |
| **PT 2A1** | **Industrial Visit** |  |  |  | **2** | **30** | **20** | **50** |
|  | **The visit will be in the nearby oil industries. The evaluation of the visit will be based on the submission of the report followed by viva-voce and performance of the student during the visit. The report will be examined internally by the concerned Teacher(s) in – charge of the visit**  **End Sem: 30 marks (Seminar + Viva-voce+ performance during field)**  **In Sem: 20 marks (Report)** | | | | | | | |

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| **Course Teacher: Dr. Subrata Borgohain Gogoi** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 301** | **Petroleum Refining Engineering** | **2** | **1** | **2** | **4** | **60** | **40** | **100** |
| ***Introduction:*** Petroleum Refining Engineering deals withchemical engineering processes and other facilities used in petroleum refineries to transform crude oil into useful products such as liquefied petroleum gas (LPG), gasoline or petrol, kerosene, Aviation Turbine Fuel (ATF) or jet fuel, diesel, fuel oils, waxes, bitumen and other speciality products. Petroleum refineries are very large industrial complexes that involve many different physical and chemical units and auxiliary facilities such as utility units and storage tanks. Each refinery has its own unique arrangement and combination of refining processes largely determined by the refinery location, desired products and economic considerations. | | | | | | | |
| **Course content** | **1: General Overview**  An overview to petroleum refining industry in India, Crude oil characterization, Crude oil evaluation, Desalting, Stabilization  **2 Physical Processes**  Different types of distillation, Distillation fractions and their quality control, Liquid-Liquid Extraction for SKO and Waxes  **3: Chemical Processes**  An overview to petroleum refining industry in India., distillation fractions and their quality control Thermal Conversion processes, Thermal cracking, Visbreaking and Delayed Coking. Catalytic conversion processes, catalytic cracking, FCC, catalytic reforming, Hydrogen production from NG and Naphtha, Hydrocarcking, Hydrodesulphurization, Reforming, Petrochemicals from C2, Petrochemicals from Naphtha, Polymerization, BCPL products (LLDPE, HDPE, PP), FRIR [Film, Roto molding (big tanks), Injection molding (small tanks), Raffia (bags)] | | | | | | | |
| **Practical** | **Topics related to the contents of theory part** | | | | | | | |

**Books Recommended:**

1. Gary, J.H. and Handwerk, G.E. (1984). Petroleum Refining Technology and

Economics (2nd ed.). Marcel Dekker.

2. Leffler, W.L. (1985). Petroleum refining for the nontechnical person (2nd ed.).

PennWell Books.

3. Nelson, W (1958). Petroleum Refining Technology and

Economics (4th  ed.). McGraw-Hill Education

4. Rao, B (2003). Modern Petroleum Refining Engineering (2nd ed.). *Oxford & IBH.*

5. Cambell, A (1918).  Petroleum Refining (1st ed.). Charles Griffin and Company

Ltd.

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| **Course Teacher: Dr Borkha Mech Das** | | | | | | | | |
| Course  No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course  Marks | | TotalMarks |
| Theory | Tutorial | Practical | End  Sem | In  Sem |
| **PT 302** | **Drilling Fluids** | **2** | **1** | **2** | **4** | **60** | **40** | **100** |
| ***Introduction:*** Drilling fluids are used in rotary drilling method which generally consists of an aqueous clay suspension, containing weighting agents to increase the hydrostatic head and frequently also contains concentrated colloidal suspending and conditioning agents. Drilling fluids play a vital role in hole cleaning, suspension of cuttings, prevent caving, and ensure the tightness of the well wall, cooling and lubricating the drilling tool, transfer the hydraulic power and carry information about the nature of the drilled formation by raising the cuttings from the bottom to the surface, using a simple mixture of water and clays, to complex mixtures of various specific organic and inorganic products as additive. The successful completion of an oil well and its cost depend to a considerable extent on the properties of the drilling fluid. The cost of the drilling fluid itself is relatively small, but the choice of the right fluid and maintenance of the right properties while drilling profoundly influence total well costs. | | | | | | | |
| Course  Content | **1. Clay Mineralogy and the Chemistry of Drilling Fluids.**  Origin and occurrence of Clay minerals, Ion exchange, Clay swelling mechanism, The electrostatic double layer, colloid & surface chemistry.  **2. The Rheology of Drilling Fluids**  Laminar Flow Regime, Turbulent Flow Regime, Flow models, Influence of Temperature and Pressure on the Rheology of Drilling Fluids, Application of Flow Equations to Conditions in the Drilling Well, Rheological Properties Required for Optimum Performance.  **3. The Filtration Properties of Drilling Fluids**  Static Filtration, The Filter Cake, Dynamic Filtration, Filtration in the Borehole, Concept of AV, PV, YP, Gel strength, Filtration loss (Dynamic and static)  Mud cake thickness, Salinity, lubricity coefficient.  **5.Calculation:**  Mud weight increase calculations, mud weight decrease calculations, Calculation of hydrostatic head, Equivalent mud weight (EMW).  6. **Practical Implementations and innovations in drilling fluids.**  Drilling complicacy  -Stuck pipe  -Lost circulation/ mud loss  -Dogleg/ key seat  -Oil spotting | | | | | | | |
| Practical | 1. Mud weight analysis: Comparison of theoretical and experimental values.  2. Rheological and Filtration behaviour study.  3. Chemical Analysis.  4. Shale stability test. | | | | | | | |

**Books Recommended:**

1. Composition and Properties of Drilling and Completion Fluids by H. C. H. Darley and George R. Gray
2. Drilling Fluid Engineering by Pal Skalle.
3. Drilling and drilling fluids by G.V [Chilingarian,](https://www.osti.gov/search/author:%22Chilingarian,%20G.V.%22) P. [Vorabutr.](https://www.osti.gov/search/author:%22Vorabutr,%20P.%22)

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| **Course Teacher: Dr. Dhrubajyoti Neog** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 303** | **Well Servicing** | **2** | **1** | **2** | **4** | **60** | 40 | **100** |
| ***Introduction:*** The course covers different aspects of oil well workover operations associated with upstream petroleum industry and thus help in understanding types of sick wells. Its practical contents are intended to present the art of well servicing. | | | | | | | |
| Course content | 1.**Sick well**:  Sick well, problem analysis, identification and diagnosis of well problems, re-completing a new zone/reservoir, completing in multiple reservoir, techniques of perforation, perforation guns  2. **Workover operations & equipments:**  Workover, need for workover operations, workover procedure, well killing methods, Work string, casing scraper, Junk and Boot baskets, cement retainer, casing roller, bridge plug    3. **Workover fluids:**  Completion and workover fluids-Types, packer fluids  4**. Well Intervention**:  Wireline and its operations, wireline unit, wireline tools | | | | | | | |
| Practical | i. Reservoir produced water characterization by Water Analyser, Flame  photometer and Atomic absorption spectrophotometer  ii. Rheological behaviour study  iii. Porous media analysis   1. iv. Workover fluid formulation   v. Production well problem study | | | | | | | |

**Books Recommended:**

1. Technical manual for Production Operations by R.K. Mukherjee. Institute of Oil &

Gas Production Technology, ONGC Ltd., Panvel

2. Well completion and Servicing, Oil & gas Field Development Techniques, Editions

Technip, D. Perrin

3. Modern Petroleum Technology, Volume I, Upstream, Edited by Richard A. Dawe, 6th

Edition

4. Production Operation Vol. I, II by Thomas & Roberts

5. Petroleum Production Handbook, Vol. I, Thomas C. Frick, Editor-in-Chief, R. William

Taylor, Associate Editor, Journal of Petroleum Technology

6. Petroleum Exploration & Exploitation Practices, Dr. Bhagwan Sahay

7. Petroleum Production Engineering, 2nd Edition, by Xuehao Tan, Xinghui Liu, Boyun Guo,

ISBN: 9780128096123

8. Waterflooding, G Paul Willhite, SPE Textbook Series, Vol.3

9. ONGC Manual

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| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 3D1** | **Minor Project** |  |  |  | **4** | **60** | **40** | **100** |
| Course content | The students will undertake projects individually or as a team in consultation with the course teacher(s). | | | | | | | |

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| **In Sem**  **(40 marks)** | **Progress seminar (2nos.): 20+20= 40 marks** |
| **End Sem**  **(60 marks)** | **A. Project Report**: **30 marks**  **B**. **Seminar & viva- voce on Minor Project**: **30 marks** |

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| **Course Teacher: Dr Dhrubajyoti Neog** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 3G1** | **Oil Well Production Technology** | **3** | **1** | **0** | **4** | **60** | **40** | **100** |
| ***Introduction:*** The course provides an overview of the petroleum production technology and field handling practices for crude oil in various surface installations. Its contents are designed for geoscientists in other disciplines willing to learn crude oil production concepts. | | | | | | | |
| Course Content | 1. **Well Completion Design:**   Oil well production mechanisms, well completion-types, Down-hole completion and tools, wellhead equipment, Multi-zone completion, well activation   1. **Well performance**:   Drawdown and Productivity Index (PI), Specific Productivity Index (SPI), Inflow performance relationship (IPR), vertical lift performance- flow regime in vertical two phase flow, stable and unstable flowing conditions, choke performance, Nodal analysis   1. **Artificial Lift methods**: *Gas lift-* Continuous and intermittent gas lift, unloading operations, gas lift valve components and mechanics, Plunger lift, chamber lift *Mechanical pumping*-Sucker Rod Pumping, components and operation, SRP installation, ESP-components and operation, Jet pump 2. **Surface production operations:**   Surface gathering system-types, headers, two & three phase separators, Oil-water emulsions, free-water knockout, Treating emulsions-gravity separation, heating separation, Thermo-chemical treating-vertical treaters and horizontal treaters, electrostatic separation-electrostatic treaters, safety precautions with treaters | | | | | | | |

**Books Recommended:**

1. Introduction to Petroleum Production Vol. I & II by D.R. Skinner

2. Principles of Oil Well Production by T.E.W. Nind

3. Petroleum Engineering by Archer & C.G. Wall

5. Petroleum Engineering by Carl Gatlin

6. Fundamentals of Reservoir Engineering by L.P Drake

7. Well completion and Servicing, Oil & gas Field Development Techniques, Editions

Technip, D. Perrin

8. Enhanced Oil Recovery, Don W Green, G. Paul Willhite, SPE Textbook Series Vol 6.

9. Waterflooding, G. Paul Willhite, SPE Textbook Series, Vol. 3

10. Thermal Methods of Oil Recovery, J. Burger P. Sourieau, M. Combarnous, Editions

Technip

11. Petroleum Exploration & Exploitation Practices, Dr. Bhagwan Sahay

12. Gas Lift Manual, Gabor Takacs, Ph.D. Petroleum Engineering Department, University of

Miskolc, Hungary

13. Oilfield Processing, Vol. II: Crude Oil, Francis S. Manning, Ph.D. P.E & Richard E.

Thompson Ph.D. P.E

14. Surface Production Operations, Design of Gas Handling Systems and Facilities, Vol. I,

Vol. II, Ken Arnold Maurie Stewar

15. Petroleum Production Handbook, Vol. I, Thomas C. Frick, Editor-in-Chief, R. William

Taylor, Associate Editor, Journal of Petroleum Technology

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| **Course Teacher: Dr. Subrata Borgohain Gogoi** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 3G2** | **Environmental Technology & Management** | **3** | **1** | **0** | **4** | **60** | **40** | **100** |
| ***Introduction:*** Environmental Technology & Management will deal with the changes in the economic, social and cultural activities, due to Exploration and production operations of oil and gas. The extent of these changes is especially important to local groups, particularly indigenous people who may have their traditional lifestyle affected. The key impacts may include changes in land-use patterns, such as agriculture, fishing and hunting. Changes in the socio-economic systems due to new employment opportunities, when different members of the local groups benefit unevenly from induced changes. Changes in the socio-cultural systems such as social structure, organization and cultural heritage, practices and beliefs and secondary impacts such as effects on natural resources. | | | | | | | |
| Course content | 1. Introduction to Health, Safety and Environmental Management 2. HSE Terms and Definitions, Importance of HSE Management, HSE performance. 3. HSE Regulations and regulatory agencies for Oil and Gas Industry 4. Environmental issues and Management 5. Air pollution- Stack emissions, Flaring and fugitive release, Ambient air monitoring (SS, PM2.5, PM10) 6. Water pollution and wastewater management, Produced water management , MINAS, Zero-discharge, DM water 7. Oil spill Management 8. Waste management: Drilling waste, Rock cutting, oily sludge. 9. Environmental Management, monitoring and Impact Assessment.   10. Occupational Health and Safety Management  11. Risk assessment and management: (Qualitative and quantitative)  12. OMR & OISD [regulations dealing with fire, hazadous materials eg., radioactive]  13. Statutary regulations (FC/EC/PEL/ML) | | | | | | | |

**Books Recommended:**

1.   Orszulik, S (2016).   Environmental Technology in the Oil

Industry(2nd ed.) Springer.

2.   Cheremisinoff, NP (2016).   Pollution Control Handbook for Oil and Gas

Engineering (1st ed.) Scrivener.

3.   Chandrasekaran S, (2016).   Health, Safety, and Environmental Management in

Offshore and Petroleum Engineering (1st ed.) Wiley

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| **Course Teacher: Dr Pradip Borgohain** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 3G3** | **Petroleum Geochemistry** | **3** | **1** | **0** | **4** | **60** | **40** | **100** |
| ***Introduction:*** The course contents of **Petroleum Geochemistry** deals with the application of chemical principles in the study of the origin, generation, migration, accumulation, and alteration of petroleum. The aim of this course is to cover the advances in comprehensive way providing a background for understanding the basic concepts and principles of petroleum geochemistry and its applications to hydrocarbon exploration. | | | | | | | |
| Course Content | Introduction to Petroleum Geochemistry and Carbon Cycle.  Organic matter types in sediments, Conditions for accumulation of organic rich sediments, Chemical composition of biogenic matter, Oxicity and anoxicity  Isolation procedures of kerogens and associated soluble organic matter  Various geochemical methods for the identification of source rocks, Rock Eval Pyrolysis  Formation of petroleum and its composition  Role of time and temperature in formation of petroleum and its migration  Geochemical prospecting methods in petroleum exploration.  Integration of various geochemical field and laboratory data and their interpretation.  Use of Gas and Mass Chromatography in Hydrocarbon analysis, Oil –source correlation.  Introduction of biomarkers and its application in interpretation of depositional environment and thermal maturation. | | | | | | | |

**Books Recommended**:

* + 1. Petroleum Geochemistry and Geology - by J.M. Hunt, San Francisco: W. H. Freeman & Company
    2. Petroleum Geology - by F.K. North, Publisher : Allen &Unwin
    3. Petroleum Formation & Occurrence - by, B.P. Tissot&D.HWelte, Springer - Verlag
    4. Petroleum (Indian context) - by D. Chandra & R.M. Singh. Publisher: Tara Book Agency, Varanasi
    5. Advances in Petroleum Geochemistry - by J. Brooks & D. Welteed. New York: Academic Press
    6. An Introduction to Organic Geochemistry - by S D Killops& V S Killops
    7. Petroleum Source Rocks - by B. J. Katz (Ed.) Springer- Verlag
    8. Petroleum Geochemistry – by D. Satyanarayana, Daya Publishing House, New Delhi

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| **Course Teacher: Prof. Minati Das and Mr Ranjan Phukan** | | | | | | | | |
| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 3G4** | **Petroleum Reservoir Engineering** | **2** | **2** | **0** | **4** | **60** | **40** | **100** |
| ***Introduction*:**  This course introduces the audience to the fundamental concepts of petroleum reservoir engineering. The properties of reservoir rock, fluid flow equations, driving mechanisms, and estimation of reserves will be taught. Additionally, phase behavior reservoir fluids along with its PVT properties and laboratory analysis are dealt with. Material balance equation concepts too are discussed in detail. | | | | | | | |
| Course content | 1. Properties of Reservoir rock  a) Porosity: Definition, Types of porosity  b) Permeability types: Definition, Types of permeability,  c) Relative permeability concept- single phase system, multiphase system-oil water system, gas/oil system  d) Fluid saturation  2. Fluid flow in reservoir:  Fluid Flow in Reservoir  Flow regimes; Reservoir Geometry  Darcy’s law, generalized from of Darcy’s law  3. Driving mechanisms:  a) Primary recovery mechanisms-  Rock & fluid expansion, Depletion drive mechanism, Gas cap drive, Water drive mechanism, Combination drive mechanism, Gravity drainage   1. Estimation of reserves   5. Fundamentals of the Behavior of Hydrocarbon Fluids  Phase behavior concepts of single, binary and complex hydrocarbon;  Properties of the gaseous state; Properties of Liquid state.  6. Determination of Reservoir Fluid Properties  Sampling of Reservoir Fluids; Laboratory Analysis of Reservoir-fluid  Samples.  7. Properties of Reservoir Water  Physical and Chemical Properties of Water.  8. The Material Balance  Derivation of Material Balance Equation; Data for Material Balance;  Calculation of Oil in Place using Material balance equation. | | | | | | | |

**Books Recommended:**

1. Tarek Ahmed, “Reservoir Engineering Handbook”, Elsevier, 2006
2. B.C.Craft and M.Hawkins “Applied Petroleum Reservoir Engineering”.
3. E.J.Burcik “Properties of Petroleum Reservoir Fluids”
4. L.P.Dake “Fundamentals of Reservoir Engineering.”
5. K.S.Pedersen and P.L.Christensen “Phase Behavior of Petroleum Reservoir Fluids”

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| **Course Teacher: Dr M.A Chowdhury** | | | | | | | | |
| Course  No | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 3G5** | **Basic Drilling Technology** | **2** | **1** | **2** | **4** | **60** | **40** | **100** |
| ***Introduction:*** Introduction to oil well drilling technology, subsurface and wellbore pressure relations, equipment and materials required for drilling, rotary drilling processes including directional drilling, drilling fluids basics, casing policy, cementing equipment, materials and methods, laboratory testing of drilling fluids and cement. Degree level background in physics, chemistry & mathematics is required to undertake this course. | | | | | | | |
| Course Content | 1. Overview of rotary drilling: units and quantities, drilling geology, formation fluids and relevant properties, subsurface pressure and temperature, pressure relations within formation and well bore 2. Drilling equipment: rotary drilling rig – onshore/offshore; major components of drilling rig; drill string components; hoisting system loads and calculations 3. Drill bits: types, classification, selection; design factors, cutting mechanism, other/advanced types of bits 4. Directional drilling: applications, steering tools and methods, downhole motors, BHA components. Introduction to horizontal drilling, introduction to multilateral drilling/extended reach drilling 5. Drilling fluids: functions, composition, types, properties, selection; drilling fluid equipment 6. Casing: types and functions, liners, casing accessories; casing specifications, API standards, strength properties, casing design; casing policy 7. Cementing: types and API classes, properties of cement slurry and set cement, measurement of slurry properties, cement additives, types of cementing, principles of cementing casing/liner, cementing equipment, cementing job calculations | | | | | | | |
| Practical | * 1. Drilling fluid testing: preparation of drilling fluids, measurement of physical, rheological, and chemical properties   2. Cement testing: preparation of cement slurry, measurement of slurry properties, setting time, etc. | | | | | | | |

**Books Recommended:**

1. Working Guide to Drilling Equipment and Operations, William C. Lyons
2. Oilwell Drilling Engineering, H.L. Rabia
3. Drilling Fluids Processing Handbook, ASME Shale Shaker Committee
4. Formulas and Calculating for Drilling, Production, and Workover, N.L. Lapeyrouse
5. Applied Drilling Engineering, A.T. Bourgoyne, K.K. Millheim, M.E. Chenevert. SPE Textbook Series

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| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 3A1** | **Industrial Training** |  |  |  | **4** | **60** | **40** | **100** |
| Course content | The period of the training, which will not be generally less than 21 (twenty one) working days, will be decided in consultation with industry/institution. The evaluation of the field visit will be based on the submission of the training report, performance of the student during training and seminar and viva-voce on field training. The seminar & viva-voce will be held before a panel of internal examiners comprising of faculties of the Department.  **In sem: = 40 marks (Report)**  **End Sem: 60 marks (Seminar, Viva-voce & Performance during training)** | | | | | | | |

**PT-401 : Dissertation**

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| Course No. | Course Name | Teaching Scheme (Hours) | | | Credits | Course Marks | | Total Marks |
| Theory | Tutorial | Practical | End Sem | In Sem |
| **PT 401** | **Dissertation** |  |  |  | **20** | **180** | **120** | **300** |
| Course content | Every student will have to take up a dissertation work on a topic of practical/industrial importance during the fourth semester under supervision of a teacher in the department. There may be a co-guide for the dissertation from industrial organisations if and when required. | | | | | | | |

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| **In Sem** | **Progress seminar (2nos.): 60+60= 120 marks** |
| **End Sem** | **A. Dissertation Report**: **100 marks** [External examiner 50 marks + Internal examiner 50 marks]  **B**. **Seminar & viva- voce on dissertation**: **80 marks** (Examination Board including External examiner) |

***The CBCS Board of the Department may change the mode of examination and evaluation of the Dissertation from time to time as and when required.***