# DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY

# LUCKNOW

# Study & Evaluation Scheme with Syllabus

# for

# B.Tech. Fourth Year

## Petroleum Engineering

**(Effective from the Session: 2017-18)**

**4th Year VII-SEMESTER**

| S. No. | Subject Code | Subject Name | L-T-P | ESE Marks | Sessional | | Total | Credit |
|---|---|---|---|---|---|---|---|---|
| | | | | | CT | TA | | |
| 1. | NOE071 to 074 | Open Elective-I | 3-1-0 | 100 | 30 | 20 | 150 | 4 |
| 2. | NPE701 | Water Flooding and Enhanced Oil Recovery | 3-0-0 | 100 | 30 | 20 | 150 | 3 |
| 3. | NPE702 | Offshore Drilling and Petroleum Production Practices | 3-1-0 | 100 | 30 | 20 | 150 | 4 |
| 4. | NPE031 to 034 | Departmental Elective-III | 3-1-0 | 100 | 30 | 20 | 150 | 4 |
| 5. | NPE041 to 044 | Departmental Elective-IV | 3-1-0 | 100 | 30 | 20 | 150 | 4 |
| 6. | NPE751 | Petroleum/Oilfield Equipment Design Drawing | 0-0-3 | 30 | | 20 | 50 | 2 |
| 7. | NPE752 | Industrial Training | 0-0-2 | | | 50 | 50 | 1 |
| 8. | NPE753 | Project | 0-0-6 | | | 100 | 100 | 3 |
| 9. | NGP701 | GP | | | | 50 | 50 | |
| Total | | | | | | | 1000 | 25 |

CT: Class Test **TA**: Teacher Assessment **L/T/P**: Lecture/ Tutorial/ Practical

**Open Elective-I:**

a. NOE071 Entrepreneurship Development
b. NOE072 Quality Management
c. NOE073 Operations Research
d. NOE074 Introduction to Biotechnology

**Departmental Elective-III:**

a. NPE031 Petroleum Formation Evaluation
b. NPE032 Corrosion Technology in Petroleum
c. NPE033 Refinery Losses
d. NPE034 Petroleum Product Economics

**Departmental Elective-IV:**

a. NPE041 Distillation Process
b. NPE042 Multi Component Separation
c. NPE043 Advanced Geo Physics
d. NPE044 Supply Chain Management

**4th Year VIII-SEMESTER**

| S. No. | Subject Code | Subject Name | L-T-P | ESE Marks | Sessional | | Total | Credit |
|---|---|---|---|---|---|---|---|---|
| | | | | | CT | TA | | |
| 1. | NOE081 to 084 | Open Elective-II | 3-1-0 | 100 | 30 | 20 | 150 | 4 |
| 2. | NPE801 | Health safety & Environment Management in Petroleum Industry | 3-1-0 | 100 | 30 | 20 | 150 | 4 |
| 4. | NPE051 to 054 | Departmental Elective-V | 3-1-0 | 100 | 30 | 20 | 150 | 4 |
| 5. | NPE061 to 064 | Departmental Elective-VI | 3-1-0 | 100 | 30 | 20 | 150 | 4 |
| 6. | NPE851 | Seminar | 0-0-3 | | | 50 | 50 | 2 |
| 8. | NPE852 | Project | 0-0-12 | 100 | | 200 | 300 | 7 |
| 9. | NGP801 | GP | | | | 50 | 50 | |
| Total | | | | | | | 1000 | 25 |

CT: Class Test **TA**: Teacher Assessment **L/T/P**: Lecture/ Tutorial/ Practical

**Open Elective-II:**

a. NOE081 Non Conventional Energy Resources
b. NOE082 Nonlinear Dynamic Systems
c. NOE083 Product Development
d. NOE084 Automation & Robotics

**Departmental Elective-V:**

a. NPE051 Coal Bed Methane and Gas Hydrates
b. NPE052 Deep Sea Production System
c. NPE053 Surface Operations For Oil & Gas Production
d. NPE054 Design of Catalytic Systems in Petroleum Engineering

**Departmental Elective-VI:**

a. NPE061 Chemical Reaction Kinetics
b. NPE062 Hazards Management
c. NPE063 Process Equipment and Piping Design
d. NPE064 Storage and Transportation of Crude Oil and Natural gas

# NPE701: WATER FLOODING AND ENHANCED OIL RECOVERY

## UNIT I

Enhanced oil recovery methods – Definition – Schematic representation of enhanced oil Recovery – Techniques involved in EOR – Chemical flooding – Hydrocarbon or Gas injection – Thermal recovery methods.

## UNIT II

Chemical oil recovery methods – Polymer, surfactant/polymer and alkaline flooding – Carbon dioxide (CO2) flooding.

## UNIT III

Thermal recovery – fire flooding – steam flooding – mechanism of hydrocarbon miscible flooding
– mechanism of nitrogen and flue gas flooding – mechanism of CO2 flooding – Mechanism of surfactant/polymer flooding – Mechanism of alkaline flooding – Mechanism of steam flooding.

## UNIT IV

Criteria for gas injection - Criteria for chemical methods – criteria for thermal methods. Microbial EOR methods (MEOR).

## UNIT V

Laboratory design for EOR – Preliminary test – Water analysis – Oil analysis – Core testing – Viscosity testing.

**BOOKS:**


1. Von Pollen. H.K. and Associates. Inc., “Fundamentals of Enhanced oil Recovery” – Penn Well publishing co., Tulsa (1980)
2. Latil M. et al., “Enhanced oil recovery” – Gulf publishing co. Houston (1980)
3. Standard Hand Book of Petroleum & Natural Gas Engineering” – 2nd Edition 2005-William C. Lyons & Gary J. Plisga-Gulf professional publishing comp (Elsevier).

# NPE702: OFFSHORE DRILLING AND PETROLEUM PRODUCTION PRACTICES

## UNIT I

Introduction to offshore oil and gas operations.Sea States and Weather: Meteorology, oceanography, ice, sea bed soil. Buoyancy and stability.

## UNIT II

Offshore Fixed Platforms: Types, description and operations.
Offshore Mobile Units: Types, description and installation. Station keeping methods like conventional mooring & dynamic positioning system.
Offshore Drilling: Difference in drilling from land, from fixed platform, jackup, ships and semi submersibles. Use of conductors and risers. Deep sea drilling.

## UNIT III

Offshore Well Completion - Platforms and subsea completions, Deep water applications of subsea technology.
Offshore Production: Oil processing platforms, gas processing platforms, water injection platforms, storage, SPM and SBM, transportation and utilities.

## UNIT IV

Deep water technology: Introduction, definition & prospects. Deep water regions, Deep water drilling rig – selection and deployment, Deep water production system, Emerging deep water technologies – special equipment and systems, Remote operation vessels (ROV).

## UNIT V

Divers and Safety: Principles of diving use of decompression chambers, life boats. Offshore Environmental Pollution and Remedial Measures.

**BOOKS:**


1. Standard Hand Book of Petroleum & Natural Gas Engineering" – 2nd Edition 2005-William C.Lyons & Gary Gulf-Gulf professional publishing comp (Elsevier).
2. Wellsite Geological Techniques for petroleum Exploration by Sahay.B et al.
3. Petroleum Exploration Hand Book by Moody, G.B.

# NPE031: PETROLEUM FORMATION EVALUATION

## UNIT I
Petrophysical measurements to sub-surface engineering.

## UNIT II
Indirect Methods: SP and resistivity logs, radioactive logs, acoustic logs (principles, types of tools, limitation and applications). Evaluation of CBL/ VDL, USIT, SFT, RFT.

## UNIT III
Production Logging: Introduction, type of tools, principles, limitations and applications.

## UNIT IV
Special Type of Logging Tools: Casing inspection tools (principles, application and limitation), Formation micro scanner (FMS), NMR logging principles. Logging in high-angle wells.

## UNIT V
Log Interpretation and Analysis Techniques.Standard log interpretation methods.Cross-plotting methods: neutron-density, sonic-density and sonic-neutron etc.Clean sand interpretationConcepts of invasion – RXO, Tornado charts.Shaly sand interpretation

# NPE032: CORROSION TECHNOLOGY IN PETROLEUM

## UNIT I

Corrosion in oil and gas production. Introduction to corrosion control. Definitions: Materials involved. Basic corrosion principles, corrosion rate. Electrochemical reactions. Electrode potentials-passivity-temperature-pressure-velocity-conductivity-pH-dissolved gases.

## UNIT II

Forms of corrosion-uniform-pitting-Galvanic erosion-Intergranualar and weld corrosion, selective Leaching, stress corrosion. Hydrogen embitterment-Fatigue. Role of oxygen in oil filed corrosion-downhole and surface equipment-water flood Removal of oxygen, analysis and criteria for control.

## UNIT III

Role of carbon dioxide (CO2) in corrosion-Effect of temperature and pressure Corrosion of well tubing and other equipments. Role of hydrogen sulphide (H2S)-Corrosion in downhole, surface, storage and pipelines.

## UNIT IV

Corrosion prevention-Cathodic protection. Principles of operation-applications Galvanic systems, corrosion prevention-coatings-corrosion prevention inhibitors-types of corrosion inhibitors-choice and selection.

## UNIT V

Oil treatment corrosion-crude oil properties-desalting-distillation and other processing case histories, sweetening processes-subsea systems corrosion. Inspection and corrosion monitoring case history-oil storage tank corrosion-Oilfield and oil treating facilities-offshore platforms-down hole equipments.

**BOOKS:**


1. “Corrosion control in Petroleum production”-TPC 5-2-nd edition H.G.Byars Houston, texas, 1995.
2. Chemical engineering series, coulson and Richardson, Mc Graw Hill Publications.
3. Standard Handbook of Petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary C Plisga. Gulf Professional Publishing.

# NPE033: REFINERY LOSSES

## UNIT I

Heating of crude oil through exchangers, pipe still heaters, their type and constructional features, Estimation of heat duty, combustion calculation and heat transfer area in different parts in pipe still heater. Calculation of pressure drop and stack height.

## UNIT II

Atmospheric distillation, Principles and mode of excess heat removal flash zone calculation and estimation side draw temperatures. Design aspects. Posatmospheric distillation, t treatment of straight run products.

## UNIT III

Vacuum distillation Column internals and operational aspects for lubes and asphalt's Cracking feed stocks.

## UNIT IV

Pressure distillation and gas fractionating units. Difference between various types of distillation Regaining of products of pressure distillations**.**

## UNIT V

Lubrication oils, Specifications, characteristics, Production lube specialties, additives, Refining of lubrication oil-solvent chemical and hydrogenation method dew axing, deasphalting etc. Asphalt and asphalt specialties. Air blowing and emulsification techniques.

**BOOKS:**


1. B.K. Bhaskar Rao., "Modern Petroleum Refining Processes", 2nd Ed., Oxford and IBH publishing Co. Pvt. Ltd., New Delhi 1990.
2. W.C. Edmister "Applied Hydrocarbon Thermodynamics", Gulf Publishing, Houstan, Texas 1961.
3. W.L. Nelson, "Petroleum Refinery Engineering", McGraw-Hill, 1964.
4. M.V. Winkle, "Distillation, Chemical Engineering series", McGraw-Hill, 1961

# NPE034: PETROLEUM PRODUCT ECONOMICS

## UNIT I

Supply and demand curves, the elasticity of supply and demand, public finance concepts such as consumer surplus, excise and export taxes. Forecasting techniques for the energy industry, including energy prices. Demand and supply for natural gas, cured oil and pipeline transportation, determinants of energy demand, energy markets, energy pricing, stability and performance of energy markets.

## UNIT II

The economics of investment, Discounted cash flow analysis, Cost Benefit Analyses, Internal Rate of Return, NPV, Profitability Index, Natural Monopoly theory, National competition Policy, Gas Market Regulation, taxation of the oil and gas industry, government policy and trade permits, Monte Carlo analysis, Net Back Pricing, Transfer Pricing and regulatory aspects.

## UNIT III

Application of petroleum engineering principles and economics to the evaluation of oil and gas projects, evaluation principles, time value of money concepts, investment measures, cost estimation, price and production forecasting, risk and uncertainty, project selection and capital budgeting inflation, escalation, operating costs, depreciation, cost recovery.

## UNIT IV

Petroleum exploration and production contracts. Sharing of the economic rent, portfolio management. Value creation, Corporate finance & return on capital, economic appraisal methods for oil filed development, reservoir model costs and calculations.

## UNIT V

Case studies: Economic study of an oil filed development project, petrochemical plant project, natural gas break even price, natural gas liquefaction cost, LGN transport cost, investment profitability study for a gas pipeline.

**BOOKS:**


1. Industrial Economics – An Introductory Textbook. R.R.Barthwal, 2nd Edition, New Age International Publisher.
2. Managerial Economics – D.N.Divedi. 6th Revised Edition. Vikas Publishing House Private Ltd.
3. Standard Handbook of Petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary, C Plisga. Gulf Professional Publishing.
4. Petroleum Engineering Handbook. Bradely, H.B. Society of Petroleum Engineers. Richardson. Texas.
5. The Encyclopedia Americana, International Edition Volume 9, Grolier Incorporated.

# NPE041: DISTILLATION PROCESS

## UNIT I
Nature, origin and distribution of oil shale. Petrology and geochemistry of oil shale.

## UNIT II
Oil shale retorting and extraction process. Characterization of oil shale. Supercritical extraction oil from shale.

## UNIT III
Mathematical modeling of oil shale pyrolysis. Economic factor of shale oil production.

## UNIT IV
History of shale gas production. Extraction methods: development of current practices. Location an dsize of production areas: estimated reserves and economics.

## UNIT V
Environmental issues in shale gas exploration. Shale gas markets and globus impact on energy scenario.

# NPE042: MUTI COMPONENT SEPARATION

## UNIT I

Introduction to the Fundamentals of Distillation. Multi component flash calculation, Isothermal flash calculation, Adiabatic flash calculation.

## UNIT II

Approximate methods for multi component – multistage separation, Design methods and simulation methods for multistage contactor Fenske – Underwood – Gilliland (FUG) method for distillation.

## UNIT III

Multistage counter-current cascade – Group method for absorber and stripper Rigorous method for multi component – multistage separation Introduction to MESH equation

## UNIT IV

Historical development of different rigorous multi component distillation calculation method. Classification of different method based on solution scheme.

## UNIT V

Thiele – Geddes method with theta ($\theta$) method of convergence Wang and Henke tridiagonal matrix algorithm for complex distillation column

# NPE043: ADVANCED GEO PHYSICS

## UNIT I

Physical Basis of Geophysical exploration – Various surface and sub surface methods and their classifications – Physical Properties of rocks and minerals exploited in exploration and factors that control them Geophysical anomalies

## UNIT II

Gravity Prospecting – Principles – Earth Gravitational Field Units – Variations in the Gravitational field – Newton's Law – Geoid , Spheroid and normal gravity field – Absolute and relative measurement of Gravity – Gravimeters and their field operation – Field procedure – Interpretation of Gravity data and Applications of Gravity methods.

## UNIT III

Radiometric Prospecting: Fundamentals of radioactivity – Rate of radioactivity decay – Successive disintegration and radioactive equilibrium – Natural radioactive elements – Radio active Series – Nature of radioactive emission – Artificial radioactivity – Radioactivity of rocks. Radiation measuring devices – Processing and Interpretation data – applications of radiometric methods.

## UNIT IV

Seismic methods, fundamentals of elasticity – bulk modulus – Poisson's ratio – Elastic Seismic wave theory – Body and surface waves – Primary and Secondary waves – Seismic Instruments - Seismic channels – Applications of Seismic data – Interpretation of field data

## UNIT V

Introduction to Well logging techniques – Well conditions – SP and Resistibility logging – Qualitative interpretation of SP and resistibility logs – applications.

**BOOKS:**


1. Introduction to Geophysics by Dobrin.
2. Principles of Geophysics by Ramachandran.
3. Quantitative Geophysics and Geology by Louis Lliboutry.
4. Principles of applied Geophysics by D.S. Paranis

# NPE044: SUPPLY CHAIN MANAGEMENT

## UNIT I

Definition, Marketing process, dynamics, needs, wants and demands, marketing concepts, environment, mix, types. Philosophies, selling versus marketing,organizations, industrial versus consumer marketing, consumer goods, industrial goods, product hierarchy

## UNIT II

Cultural, demographic factors, motives, types, buying decisions, segmentation factors demographic -Psycho graphic and geographic segmentation, process, patterns.

## UNIT III

Objectives, pricing, decisions and pricing methods, pricing management. Introduction, uses, process of marketing research.

## UNIT IV

Components of marketing plan-strategy formulations and the marketing process, implementations, portfolio analysis, BCG, GEC grids.

## UNIT V

Characteristics, impact, goals, types, and sales promotions- point of purchase- unique selling proposition. Characteristics, wholesaling, retailing, channel design, logistics, and modern trends in retailing.

**BOOKS:**


1. Govindarajan. M, “Marketing management – concepts, cases, challenges and trends”, Prentice hall of India, second edition 2007.
2. Philip Kolter, Koshy Jha, “Marketing Management”, Pearson Education ,Indian adapted edition.2007
3. Ramasamy and Nama Kumari, “Marketing Environment: Planning, implementation and control the Indian context”, 1990.
4. Czinkota & Kotabe, “Marketing management”, Thomson learning, Indian edition 2007
5. Adrain palmer, “ Introduction to marketing theory and practice”, Oxford university press IE 2004.
6. Donald S. Tull and Hawkins, “Marketing Research”, Prentice Hall of Inida-1997.
7. Philip Kotler and Gary Armstrong “Principles of Marketing”, Prentice Hall of India, 2000.
8. Steven J. Skinner, “Marketing”, All India Publishers and Distributes Ltd. 1998.
9. Graeme Drummond and John Ensor, Introduction to marketing concepts, Elsevier, Indian Reprint, 2007.

## NPE751: PETROLEUM/ OILFIELD EQUIPMENT DESIGN DRAWING

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

## NPE752: INDUSTRIAL TRAINNING

The students must submit the report to their institute complete 4 week Industrial Training after the completion of their 6th semester. Students may opt this course at any relevant Industry/Research Lab for 4 weeks.

## NPE753/ NPE852: PROJECT

The students would be allotted an Industrial Project or any Research Project in the beginning of the VII semester itself. He/ She may continue this project in detail, later in the (8th) semester. The assessment of ESE will be done by the faculty member of the other department within the same institute.

# NPE801: HEALTH SAFETY AND ENVIRONMENT MANAGEMENT IN PETROLEUM INDUSTRY

## UNIT I

Toxicity, Physiological, Asphyxiation, respiratory and skin effect of Petroleum Hydrocarbons (including mixtures), sour gases (eg Hydrogen sulphide and carbon monoxide etc) with their thresh-hold limits. Effect of corrosive atmosphere and additives during acidizing, sand control and fracturing jobs etc.

## UNIT II

Hazards analysis, developing a safe process, failure mode analysis, safety analysis (API-14C) safety analysis function evaluation chart (synergic approach).

## UNIT III

Manual & automatic shut down system, blow down systems. Gas detection system. Fire detection and suppression systems.

## UNIT IV

Personal protection systems & measures. HSE Policies, standards & specifications Disaster & crisis management.

## UNIT V

Environment concepts, impact on eco-system, air, water and soil. The impact of drilling & production operations on environment, Environmental transport of petroleum wastes. Offshore environmental studies, offshore oil spill and oil spill control. Oil mines regulations and other environmental legislations. Environmental impact assessment. Waste treatment methods, waste disposal method, remediation of contaminated sites. Air & noise pollution.

# NPE051: COAL BED METHANE AND GAS HYDRATES

## UNIT I

Present status of coal bed methane. Formation and properties of coal bed methane. Thermodynamics of coal bed methane.

## UNIT II

Exploration & Evaluation of CBM. Drilling, completion and logging of coal bed methane wells. Hydro-fracturing of coal seam, Activation of well. Production installation and surface facilities.

## UNIT III

Well operation and production equipment. Treating and disposing produced water. Testing of coal bed methane wells.

## UNIT IV

Introduction & present status of gas hydrates. Formation and properties of gas hydrates. Thermodynamics of gas hydrates. Exploration & evaluation of gas hydrates. Phase behavior of gas hydrates. Kinetics of gas hydrates.

## UNIT V

Drilling and completion of gas hydrate wells. Prevention & control of gas hydrates. Gas hydrates accumulation in porous medium. Gas extraction from gas hydrates. Uses and application of gas hydrates.

# NPE052: DEEP SEA PRODUCTION SYSTEM

## UNIT I

Drilling and Well Servicing structures – Definitions – Design specifications – Maintenance and use of Drilling and wall servicing structures.

## UNIT II

Hoisting Systems - Design – Rating and Testing – Inspections – Supplementary and Requirements – Manufacture and Tolerances.

## UNIT III

Rotary Equipments - Swivel and Rotary Hose – Rotary Table and Bushing - Bits and Down hole tools.

## UNIT IV

Mud Pumps – Pump installations – Pump operations – Drilling Muds and Completion fluids – Suspended solids and Transport Cuttings – Nonaqueous fluids – Oil base and synthetic – Base muds – Drilling fluids activities – Clay chemistry.

## UNIT V

Drill strings – compositions and design – Drill Collar – Drill Pipe – Tools Joints –Drill String Design.

**BOOKS:**


1. Standard Handbook of Petroleum and Natural Gas Engineering. 2nd Edition. William C Lyons, Gary C Plisga. Gulf Professional Publishing.
2. 1.Rabia.H. 'Oil Well Drilling Engineering, Principles And Practices' Graham And Trotman Ltd. 1985.
3. Mc.Cray. A.W and Cole.F.W. 'Oil Well Drilling Technology' University of Oklahoma Press, Norman 1959.

# NPE053: SURFACE OPERATIONS FOR OIL & GAS PRODUCTION

**Field Processing of Oil & Gas :** Flash and stage separation of oil & gas; oil & gas separators, mist extractor, fluid level and pressure control system. Vertical and horizontal separators, metering separators. Working pressure and safety feature in oil & gas separators. Special problems in oil and gas separation. Removal of suspended solid & water from oil & gas. Scrubbers and wash tank. Demulsification and desalting.

**Storage & Transport :** Types & features of storage tanks Fixed roof and floating roof tanks. Specification, maintenance and operation of tank batteries, Vapour control and gravity conservation measures. Vapour recovery system. Metering of oil & gas, Sampling and Testing of crude oil. Gauging equipment and methods. Water and sediment determination. Orifice and other metering devices and their characteristics. EOR Processes (Surface facilities): Treatment of water for reservoir compatibility. Design consideration for water handling and injection system. Pumps types & sizing, Injectivity problems. Gas compression for injection, gas compressors. Design consideration for gas collection and distribution system for injection.

# NPE054: DESIGN OF CATALYTIC SYSTEMS IN PETROLEUM ENGINEERING

**A: Oil & Gas Field Development:**

**Development of Oil & Gas Fields :** Rate and order of drilling well, well spacing & pattern, selection of development scheme, economic aspect of development of oil and gas fields. Production variants, performance prediction, Recovery factor, sample examples, Stages of preparation of development plans Sample examples & case studies. Computation of economic indices viz. Capital investment, payout period, IRR, Profile, Economic life etc. Analysis of different variants based on technical and economic considerations. Economic development of Marginal fields. Innovative ways to economize Asset development.

**B: Design Oil and gas separation system. Heater-treater.**

**C: Artificial Lift Technology:**

**Basic principles and descriptions of Artificial lift methods :** Gaslift - continuous and intermittent, chamber lift, plunger lift/sucker rod pumping, hydraulic pumping – piston & jet type. **Design of Continuous gas lift system (pressure operated valves) -** graphical and analytical methods. Design of Intermittent gas lift system; single point injection standard tubing installation (Pressure operated valves) - graphical and analytical methods. Sucker rod pumping system, Centrifugal electric submersible pumping system. Design of Electrical submersible pumping system

# NPE061: CHEMICAL REACTION KINETICS

Introduction to general modeling : Introduction to concept geological modeling. Types of model and designing of various models depending on reservoir complexities, rock properties, fluid properties – concept of back oil model, compositional model.

1. Overview: Introduction, Historical background, application of simulator, various types of models.
2. Flow Conditions: Single phase, two phase and multiphase flow equations for one, two and three dimension models.
3. Special Concept: Explicit and implicit, grid system, finite difference & finite element method, matrix solution, iterative method, stability criteria.
4. Data Preparation
5. Pesudo functions
6. Reservoir model Solution Techniques: Implicit Pressure and Explicit Saturation (IMPES), Implicit pressure and Implicit saturation (IMPIS).
7. Preview of numerical solution methods: Direct process, iterative process.
8. History Matching : Mechanics and parameters of match
9. Special Concept on Coning and Compositional Models simulation.
10. Optimization using Economic and Techno-economic evaluation: Computation of economic indices viz. different variants base on technical and economic consideration.
11. Introduction to streamline simulation & comparison of conventional/Streamline.

# NPE062: HAZARDS MANAGEMENT

## UNIT I

Geology and its perspectives. Formation of core, mantle, crust, hydrosphere, atmosphere and biosphere - Elementary ideas of continental drift and plate tectonics - Evolution of ocean and continental basins.

## UNIT II

Ecology, ecosystem and biotic communities, human impact on air, land, soil, water, climate and forest resources - conservation of resources, coping with natural hazards.

## UNIT III

Natural Environmental Hazards: Various domains and classes of natural hazards- tropical cyclones, floods, landslides and earthquakes - Prediction control and awareness of earthquakes- volcanic types, distribution and causes - coastal erosion.

## UNIT IV

Introduction to Environmental Hazards Management - Global Climate Change: Causes, trends, consequences, and management challenges- Mitigation measures of volcanoes, prevention and controls of landslides.

## UNIT V

Environmental degradation and pollution - Air pollution - Water pollution and Soil pollution. Cyclones- types and effects - Droughts- types and factors contribution for drought - Floods- causes and forecast.

**BOOKS:**


1. Smith, K. Environmental Hazards: Assessing Risk and Reducing Disaster. Third Edition. 2001. Routledge Press.
2. Burton, I, R.W. Kates, and G.F. White, The Environment as Hazard, Second Edition. Guilford Press. 1993
3. Godschalk, et. al., Natural Hazard Mitigation: Recasting Disaster Policy and Planning. Island Press. 1999.

# NPE063: PROCESS EQUIPMENT AND PIPING DESIGN

## UNIT I

Detailed design and drawing of enclosures, supports and standard flanges, storage vessels including Unfired Pressure Vessels, Reaction Vessels.

## UNIT II

Heat Exchangers: Detailed Design And Drawing of Various Types of Heat Exchangers.

## UNIT III

Distillation Column: Detailed Design And Drawing of Distillation Column. Absorber: Detailed Design and Drawing of Absorber.

## UNIT IV

Fundaments of fluid flow through pipes-Calculation of pressure drop for Newtonian & non-Newtonian fluids, incompressible & compressible fluids and two-phase flow, Calculation of Economic pipe diameter, insulation thickness, equivalent length, Slurry transport and pipelines Engineering flow diagram, nomenclature and equipment elevation.

## UNIT V

Piping layout, line pressure drop, piping analysis, stress analysis of curved pipelines, yard piping, Piping codes, standards and specifications-ASME, ASTM, API Piping components-pipes, pipe ends, pipe fittings, end fittings, flanged joints, valves, valve codes and standards, valve classification, valve components, bolts, gaskets (fasteners and sealing).

# NPE064: STORAGE AND TRANSPORTATION OF CRUDE OIL AND NATURAL GAS

## UNIT I
Crude oil Trade, Selection of Port Location, Ship Building/Shipyards.

## UNIT II
Commercial Sourcing of Natural Gas, Different Kinds of Regasification Techniques, Regasification Process & Cold Utilization, Synchronization of Degasified gas and Pipelines, Current Status in India.

## UNIT III
Transportation techniques of crude oil, Pipeline specification, Corrosion Prevention techniques, Pressure drop, Pumps and Booster station, Wax deposition and prevention, Chemical treatment.

## UNIT IV
Basic Engineering Aspects of Terminal Design, Design of Liquefaction Train, Ship Building/Shipyards, Storage Facilities.

## UNIT V
Supply & Demand, Variation Gas Field & Aquifers, Technical Qualities and Storage, Properties of Storage Reservoir, Rocks & Fluids.
Flow through Storage Reservoir; Inventory Concept, Pressure- Content Hysteresis, Inventory Verification, Gas Flow Performance, Gas Deliverability.
Design & Development of Underground Storage Fields: Operation of Storage Fields. Threshold Pressure. Water Influx/Efflux Quantities. Aquifer Equilibrium Pressure. Error and Uncertainty. Gas Storage in Salt Cavity & Caverns: Thermodynamics, Temperature and Pressure Effect. Recent Developments.
Advanced Storage Techniques, Case Histories.

**BOOKS:**


1. Oilfield Processing: Crude Oil (Oilfield Processing of Petroleum R. Solvay, Pennwell Books 1995.
2. Advances in Environmental Control Technology: Storage Tank Paul Cheremisinoff Gulf Professional Publishing; 1ST edition (May 9, 1996)