JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech. in PETROLEUM ENGINEERING

III YEAR COURSE STRUCTURE AND SYLLABUS (R18)
Applicable From 2018-19 Admitted Batch

III YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	PE501PC	Instrumentation and Process Control	3	1	0	4
2	PE502PC	Drilling Technology	3	0	0	3
3	PE503PC	Thermodynamics for Petroleum Engineers	3	0	0	3
4	SM506MS	Fundamentals of Management for Engineers	3	0	0	3
5	PE504PC	Well Logging & Formation Evaluation	3	0	0	3
6	PE505PC	Health, Safety & Environment in Petroleum Industry	3	0	0	3
7	PE506PC	Instrumentation & Process Control Lab	0	0	2	1
8	PE507PC	Drilling Fluids Lab	0	0	2	1
9	PE508PC	Energy & Environmental Engineering Lab	0	0	2	1
10	*MC510	Intellectual Property Rights	3	0	0	0
		Total Credits	**21**	**1**	**6**	**22**

III YEAR II SEMESTER

S. No	Course Code	Course Title	L	T	P	Credits
1	PE601PC	Petroleum Refinery Engineering	3	0	0	3
2	PE602PC	Petroleum Reservoir Engineering	3	1	0	4
3	PE603PC	Petroleum Production Engineering & Design	3	0	0	3
4		Professional Elective - I	3	0	0	3
5		Open Elective - I	3	0	0	3
6	PE604PC	Well Completion Testing & Servicing	3	0	0	3
7	PE605PC	Petroleum Reservoir Engineering Lab	0	0	2	1
8	PE606PC	Petroleum Product Testing Lab	0	0	2	1
9	EN608HS	Advanced Communication Skills Lab	0	0	2	1
10	*MC609	Environmental Science	3	0	0	0
		Total Credits	**21**	**1**	**6**	**22**

***MC - Environmental Science – Should be Registered by Lateral Entry Students Only.**

Note: Industrial Oriented Mini Project/ Summer Internship is to be carried out during the summer vacation between 6th and 7th semesters. Students should submit report of Industrial Oriented Mini Project/ Summer Internship for evaluation.

IMPORTANT: For Open Elective – I, Students should not opt for Fundamentals of Management for Engineers offered by CSE/IT, instead they are requested to opt for another subject.

Professional Elective - I

PE611PE	Surface Production Operations
PE612PE	Horizontal Well Technology
PE613PE	Transport Phenomena

PE501PC: INSTRUMENTATION AND PROCESS CONTROL

B.Tech. III Year I Sem.	L	T/P/D	C
	3	1/0/0	4

Prerequisites: Chemical Engineering Fluid Mechanics and Process Heat Transfer

Course Objectives: The subject is designed to understand the fundamentals and principles of Process Control and instrumentation It also provides the details of performance characteristics and applications of various instruments used in petroleum industry.

Course Outcomes: The student would be able to understand Process modeling fundamentals, idealized dynamic behavior, transfer functions, control system context like evaluate stability, frequency response, and other characteristics relevant to process control.

UNIT - I

Elements of instruments, static and dynamic characteristics, mercury in glass thermometer, bimetallic thermometer, pressure spring thermometer, static accuracy. Thermo electricity: Industrial thermocouples, thermocouple wires, thermo couple wells

Composition analysis, spectroscopic analysis by absorption, emission, mass and color measurement by spectrometers, gas analysis by thermal conductivity, analysis of moisture, gas chromatography, refractometer

UNIT - II

Measurement of Pressure and vacuum: liquid column manometers, measuring elements for gauge pressure and vacuum, indicating elements for pressure gauges, measurement of absolute pressure, measuring pressure in corrosive liquids

Measurement of head and level: Head, density and specific gravity, direct measurement of liquid level, pressure measurement in open vessels, level measurements in pressure vessels..

velocity meters, quantity meters, viscosity measurements. Recording instruments, indicating and signalling instruments, transmission of instrument readings, control center, instrumentation diagram

UNIT - III

Introduction to process control: Response of First order systems, Transfer Function of mercury thermometer, Transient response to step, impulse, sinusoidal forcing function, physical examples of first order systems, liquid level, mixing process, RC circuit, response of first order systems in series: Noninteracting and interacting systems

UNIT - IV

Response of Second order system to step, impulse and sinusoidal forcing function. Transportation lag .

The control system: Servo and Regulatory control problems, Development of Block diagram, Controllers and final control elements, Ideal transfer functions of P, PI, PD and PID Controllers. closed loop transfer functions, Stability: Stability analysis by Routh's Criterion

UNIT - V

Root locus: concept of root locus, plotting the root locus diagram.

Introduction to frequency response: substitution rule, Bode diagrams for First order, first order systems in series, second order system and for controllers and transportation lag. Bode stability criterion. Gain margin and phase margin, Z-N controller settings

TEXT BOOKS:

1. Industrial instrumentation by Donald P. Eckman, Wiley eastern, 1950.

2. Donald R. Coughanowr, Process Systems Analysis and Control, 2nd edition McGraw-Hill,1991

REFERENCE BOOKS:

1. Principles of industrial instrumentation by Patra Nabis, TMH.
2. Chemical Process Control Stephanoupoulous, G., Prentice Hall, India New Delhi. 1990.

PE502PC: DRILLING TECHNOLOGY

B.Tech. III Year I Sem.	L	T/P/D	C
	3	0/0/0	3

Prerequisites: Elements of Mechanical Engineering, Chemical Engineering Fluid Mechanics

Course Objectives:

- To understand various aspects involved in drilling a well including completion.
- To understand the plan of drilling a well, the process of drilling and various equipment used for drilling and design of the drill string.
- To know the drilling fluid importance and its properties and hydraulics.
- To understand different types of casings lowered in a well, the requirement of cementation in a well and cement slurry design.
- To understand different tools used for directional drilling and various techniques, fishing, stuck pipe and well control concepts.

Course Outcomes: The students will be able to

- apply the drilling concepts of a well from planning to rig mobilization to the location
- apply the concept of a drill string design for drilling
- decide the suitable drilling fluids during drilling
- do Casing and Cementation design
- carry out Directional drilling
- manage rouble shoot well control, stuck pipe and fishing problems
- to select the proper drilling equipment.

UNIT - I

Overview of drilling: Drilling plan- GTO -Types of drilling, Rotary bit technology- Drilling string basics. Drilling fluid properties- Drilling fluid hydraulics calculations- Bit Hydraulics- Optimization- Swab & Surge-pressures- Mud hydraulics analysis report- Lost circulation.
Disposing of the drilling fluids waste and drill cuttings waste.

UNIT - II

Hydrostatic pressure, Pore pressure, Causes of abnormal pore pressure, abnormal pore pressure evaluation- Mud logging methods - Measurement while drilling & logging while drilling data-Direct measurements of pore pressure. Formation integrity tests – Fracture gradient determination – Theory of wellbore – FIT procedural Guidelines – Predicting fracture gradient HPHT well design.

UNIT - III

Wellbore stability–Determination of the magnitude and direction of the in situ stress Determination of rock properties, Failure criteria – Stress distribution around a wellbore Procedure for determining safe mud weights to prevent hole collapse Preventing borehole instability Gas behavior in a well – Kick tolerance How to calculate kick tolerance – Influence of FG on kick tolerance – Kick tolerance while drilling – Kick tolerance graph – Modifying the calculate kick tolerance – Use of kick tolerance to calculate wellbore pressures.

UNIT - IV

Casing Functions of casing – Types of casing – Casing properties Casing specifications – Casing connections – Factors influencing casing design – Collapse criterion – Burst criterion – Combination strings – Tension criterion Compression loads – Biaxial effects – Triaxial analysis – Triaxial load capacity diagram Casing seat selection method.

Cementation: Introduction cement slurries-Typical field calculations- Cementing nomenclature-Cement additives – Cementation of liners.

UNIT - V

Directional drilling: Applications- Well planning- Down-hole motors- Deflection tools and techniques-Face orientation- Direction control with rotary assemblies- Navigation drilling systems.

Horizontal wells: Well profile design considerations – Torque and drag – Horizontal borehole stability – Extended reach well design – Multilateral wells.

Stuck pipe, well control: Kicks- Kick control- Pressure control theory- BOP-Special kick problems and procedures to free the pipes and Fishing operations. Types of fishing tools, Case studies of blow out control.

TEXT BOOKS:

1. Petroleum Engineering: Drilling and Well Completion, Carl Gatlin, Prentice-Hall, Inc., 1960.
2. Drilling Engineering, J.J. Azar and G. Robello Samuel, Pennwell Books, 2007.
3. Working Guide to Drilling Equipment and Operations, William Lyons, Gulf Publishing, 2009.

REFERENCE BOOKS:

1. Oil Well Drilling Engineering: Principles and Practice, H. Rabia, Graham & Trotman, 1985.
2. Drilling Engineering: A Complete Well Planning Approach, Neal Adams, Tommie Charrier Pennwell, 1985.
3. Practical Well Planning and Drilling Manual, Steve Devereux, Pennwell, 1998.
4. Primer of Oil Well Service, Workover and Completion, Petroleum Extension Service, University of Texas at Austin, 1997.
5. Formulas and Calculation for Drilling, Production and workover, Norton J. Lapeyrouse, 2nd Edition, Gulf Publishing, 2002.
6. Applied Drilling Engineering, Adam T. Bourgoyne Jr., Keith K. Millheim, Martine E. Chenevert and F. S. Young Jr., Society of Petroleum Engineers, 1991.
7. Well Engineering and Construction, Hussain Rabia, Entrac Consulting, 2002.
8. Drilling Fluids Processing Handbook, ASME Shale Shaker Committee, Gulf Professional Publishing, 2005
9. Fundamentals of Drilling Engineering, Robert F. Mitchell, Stefan Z. Miska, Society of Petroleum Engineers, 2011

PE503PC: THERMODYNAMICS FOR PETROLEUM ENGINEERS

B.Tech. III Year I Sem.	L	T/P/D	C
	3	0/0/0	3

Prerequisites: Engineering Mathematics, Engineering Physics

Course Objective: This course is to understand the laws of thermodynamics and their application in the analysis of chemical and engineering problems and to calculate thermodynamics properties of fluids and fluid mixtures using equation of state.

Course Outcome: Student should be able to identify a system and apply the laws of thermodynamics and should be able to estimate thermodynamic properties of substances in gas or liquid state

UNIT - I

Introduction: The scope of thermodynamics, defined quantities; temperature, volume, pressure, work, energy, heat, Joules Experiments, SI units.

The first law and other basic concepts**:** The first law of thermodynamics, thermodynamic state and state functions, enthalpy, the steady-state steady flow process, equilibrium, the reversible process, constant-V and constant- P processes, heat capacity.

UNIT - II

Volumetric properties of pure fluids: The PVT behavior of pure substances, virial equations, the ideal gas, the applications of the virial equations, Cubic equations of state, generalized correlations for gases.

The second law of thermodynamics-1**:** Statements of the second law, heat engines, thermodynamic temperature scales, thermodynamic temperature and the ideal-gas scale.

UNIT - III

The second law of thermodynamics-2: Entropy, Entropy changes of an ideal gas, mathematical statement of the second law, the third law of thermodynamics. Mollier diagram and steam tables.

Thermodynamics of flow processes; principles of conservation of mass and energy for flow systems, analysis of expansion processes; turbines, throttling; compression processes –compressors and pumps; calculation of ideal work and last work. Examples on hydrocarbons and natural gas.

UNIT - IV

Solution thermodynamics: Basic concepts of chemical potential, phase equilibria, partial properties, fugacity coefficient, residual and excess Gibbs free energy, correlations for the estimation of fugacity coefficient, residual and excess Gibbs energy in vapor liquid equilibria.

UNIT - V

Phase Equilibria: Gamma/Phi formulation of VLE, VLE from Virial equations of state, and cubic equations of state, Introduction to vapor- liquid–liquid equilibrium (VLLE), solid-liquid equilibrium (SLE), and solid vapor equilibrium (SVE), equilibrium adsorption of gases on solids. Correlations for petroleum fluids.

TEXT BOOK:

1. Introduction to Chemical Engineering Thermodynamics, J.M. Smith, H.C. Van Ness and M.M. Abbott, 7th ed. McGraw Hill, 2005.

REFERENCE BOOKS:

1. Characterization and Properties of Petroleum Fractions. M. R. Riaze, ASTM, USA, 2005.
2. Equation of state and PVT analysis. Tarek Ahmed, Gulf publishing company, Houston, 2007.

SM506MS: FUNDAMENTALS OF MANAGEMENT FOR ENGINEERS

B.Tech. III Year I Sem.	L	T/P/D	C
	3	0/0/0	3

Course Objective: To understand the Management Concepts, applications of Concepts in Practical aspects of business and development of Managerial Skills.

Course Outcome: The students understand the significance of Management in their Profession. The various Management Functions like Planning, Organizing, Staffing, Leading, Motivation and Control aspects are learnt in this course. The students can explore the Management Practices in their domain area.

UNIT - I

Introduction to Management: Definition, Nature and Scope, Functions, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management; Evolution of Management- Classical Approach- Scientific and Administrative Management; The Behavioral approach; The Quantitative approach; The Systems Approach; Contingency Approach, IT Approach.

UNIT - II

Planning and Decision Making: General Framework for Planning - Planning Process, Types of Plans, Management by Objectives; Development of Business Strategy. Decision making and Problem Solving - Programmed and Non-Programmed Decisions, Steps in Problem Solving and Decision Making; Bounded Rationality and Influences on Decision Making; Group Problem Solving and Decision Making, Creativity and Innovation in Managerial Work.

UNIT - III

Organization and HRM: Principles of Organization: Organizational Design & Organizational Structures; Departmentalization, Delegation; Empowerment, Centralization, Decentralization, Recentralization; Organizational Culture; Organizational Climate and Organizational Change.

Human Resource Management & Business Strategy: Talent Management, Talent Management Models and Strategic Human Resource Planning; Recruitment and Selection; Training and Development; Performance Appraisal.

UNIT - IV

Leading and Motivation: Leadership, Power and Authority, Leadership Styles; Behavioral Leadership, Situational Leadership, Leadership Skills, Leader as Mentor and Coach, Leadership during adversity and Crisis; Handling Employee and Customer Complaints, Team Leadership.

Motivation - Types of Motivation; Relationship between Motivation, Performance and Engagement, Content Motivational Theories - Needs Hierarchy Theory, Two Factor Theory, Theory X and Theory Y.

UNIT - V

Controlling: Control, Types and Strategies for Control, Steps in Control Process, Budgetary and Non-Budgetary Controls. Characteristics of Effective Controls, Establishing control systems, Control frequency and Methods.

TEXT BOOKS:

1. Management Essentials, Andrew DuBrin, 9e, Cengage Learning, 2012.
2. Fundamentals of Management, Stephen P. Robbins, Pearson Education, 2009.

REFERENCES:

1. Essentials of Management, Koontz Kleihrich, Tata Mc - Graw Hill.
2. Management Fundamentals, Robert N Lussier, 5e, Cengage Learning, 2013.
3. Industrial Engineering and Management: Including Production Management, T. R. Banga, S.C. Sharma, Khanna Publishers.

PE504PC: WELL LOGGING AND FORMATION EVALUATION

B.Tech. III Year I Sem.	L	T/P/D	C
	3	0/0/0	3

Prerequisites: General Geology and Petroleum Geology

Course Objectives:

- To know the logging terminology.
- To delineate hydrocarbons through direct and indirect means/methods.
- Determination of formation lithology through logs like S.P, G.R etc. and also depositional environment with the help of Gamma rays spectroscopy and Dip-meter tools.
- Determination of physical properties of the subsurface, strata like resistivity, porosity, thickness etc. through tools like latero, induction, density, neutron, etc.
- Hydrocarbon saturation estimation with the data acquired by the logging tools.
- Hydrocarbons reserves estimation in a particular block.
- Refinement of the log interpretation data with the help of advanced technology tools namely, Scanner, NMR, Modular formation tester etc.

Course Outcomes: From the well logs:

- Will be able to identify the lithology, depositional environment of subsurface strata.
- Will be able to calculate the porosity, permeability, thickness of different interesting layers in a well.
- Finally, the hydrocarbon saturation in different reservoir rocks can be calculated at the well site itself.

UNIT - I

Direct Methods: Mud logging- coring – conventional and sidewall coring - Core analysis.

Concepts of well logging: What is well logging? - Logging terminology-Borehole environment-Borehole temperature and pressure-Log header and depth scale-Major components of well logging unit and logging setup- Classification of well logging methods-Log presentation- Log quality control.

UNIT - II

Open hole logging: SP Logging- Origin of SP, uses of SP log-Calculation of salinity of formation water-Shaliness-Factors influence SP log.

Resistivity log: Single point resistance log (SPR)- Conventional resistivity logs- Response of potential and gradient logs over thin and thick conductive and resistive formations-Limitations of conventional resistivity tools. Focused resistivity log- Advantages of focused resistivity tools over conventional resistivity tools.

Micro resistivity log: Conventional and focused micro resistivity logs and their application.

Induction log: Principle of induction tool and the advantages. Criteria for selection of induction and lateral logging tool. Determination of true resistivity (Rt) of the formation-Resistivity index-Archie's equation.

UNIT - III

Gamma ray log: principle of radioactivity-Uses of gamma ray log- Determination of shaliness of formation-API counts- Calibration of Gamma ray tool-Statistical fluctuation- Time constant.

Natural Spectral Gamma ray log: Principle and application.

Caliper log: Principle and application of caliper tool.

Density log: Principle of density tool- Environmental Corrections-Porosity Determination-Tool calibration. Litho density log.

Neutron log: Principle and application of neutron tool. Porosity determination.

Sonic log: Principle and application of sonic log-Bore hole compensation-Determination of primary and secondary porosity, determination of mechanical properties of rock, elastic constants, fractures etc.

UNIT - IV

Cased hole logging: Gamma ray spectral log-Neutron decay time log-Determination of fluid saturation behind casing-Cement bond log- Casing collar log-Depth control- Perforation technique- Free point locater and Plug setting-Casing inspection logs.

Production logging: Solving production problems with the help of Fluid Density log- Temperature log and Flow meter logs.

UNIT - V

Advances in Well logging: Dip meter log-Formation tester-Cased hole resistivity logs -Nuclear magnetic resonance log & Scanner logs (Sonic scanner, MR scanner Rt scanner).

Outcome: Calculating the dip of the formations, collection of fluid samples from wells for confirmation of log interpretation, and also recording resistivity in cased holes.

Interpretation: Quick look interpretation- Cross plots. Neutron- Density, Sonic- Density, Sonic- Neutron cross plots-Hingle plot-Mid plot –Correlation- Hydrocarbon reserve estimate.

TEXT BOOKS:

1. Formation evaluation, Edward J. Lynch, Harper & Row, 1962.
2. Well logging and formation evaluation, Toby Darling, Elsevier, New York, 2005.
3. Well Logging & Reservoir Evaluation, Oberto Serra, Editions Technip, 2007.

PE505PC: HEALTH, SAFETY & ENVIRONMENT IN PETROLEUM INDUSTRY

B.Tech. III Year I Sem.

L	T/P/D	C
3	0/0/0	3

Course Objectives:

- To understand impact of petroleum industry operations on environment.
- To know the importance of safety, health and environment in Petroleum Industry.
- To learn fundamental requirements for the safety, health, and environmental management system

Course Outcome: The student is expected to be able to describe the basic components of safety, health, and environmental systems as defined by the Occupational Safety and Health Administration

UNIT - I

Introduction to environmental control in the petroleum industry: Overview of environmental issues- A new attitude.

Drilling and production operations: Drilling- Production- Air emissions.

UNIT - II

The impact of drilling and production operations: Measuring toxicity- Hydrocarbons- Salt- Heavy metals- Production chemicals- Drilling fluids- Produced water- Nuclear radiation- Air pollution- Acoustic impacts- Effects of offshore platforms- Risk assessment.

Environmental transport of petroleum wastes: Surface paths- Subsurface paths- Atmospheric paths.

UNIT - III

Planning for environmental protection: Environmental audits- Waste management plans- Waste management actions- Certification of disposal processes- Contingency plans- Employee training.

Waste treatment methods: Treatment of water- Treatment of solids- Treatment of air emissions.

Waste disposal methods: Surface disposal- Subsurface disposal.

Remediation of contaminated sites: Site assessment- Remediation processes.

UNIT - IV

Oil mines regulations: Introduction-Returns, Notices and plans- Inspector, management and duties- Drilling and workover- Production- Transport by pipelines- Protection against gases and fires- Machinery, plants and equipment- General safety provisions- Miscellaneous.

UNIT - V

Toxicity, physiological, asphyxiation, respiratory, skin effect of petroleum hydrocarbons and their mixture- Sour gases with their threshold limits- Guidelines for occupational health monitoring in oil and gas industry. Corrosion in petroleum industry- Additives during acidizing, sand control and fracturing.

TEXT BOOKS:

1. Environmental Control in Petroleum Engineering, John C. Reis, Gulf Publishing Company, 1996.
2. Application of HAZOP and What if Reviews to the Petroleum, Petrochemical and Chemical Process Industries, Dennis P. Nolan, Noyes Publications, 1994.
3. Oil Industry Safety Directorate (OISD) Guidelines, Ministry of Petroleum & Natural Gas, Government of India and Oil Mines Regulations-1984, Directorate General of Mines Safety, Ministry of Labor and Employment, Government of India.

REFERENCE BOOKS:

1. Guidelines for Process Safety Fundamentals in General Plant Operations Centre for Chemical Process Safety, American Institute of Chemical Engineers, 1995.
2. Guideline for Process Safety Fundamentals in General Plant Operations, Centre for Chemical Process Safety, AIChE, 1995.

PE506PC: INSTRUMENTATION AND PROCESS CONTROL LAB

B.Tech. III Year I Sem.	L	T/P/D	C
	0	0/2/0	1

Prerequisites: Basic knowledge of Instrumentation and Process Control

Course Objectives: Instrumentation and Process Control laboratory enables a "hands-on" environment that is important for developing students' understanding of theoretical ideas. Instrumentation and Process Control laboratory is equipped with different instruments like computer-based temperature measurement, level detection, pressure measurement, flow measurement etc. and different types of valves, and operations in process control loop. On different panels or rigs these are arranged in different control configurations to achieve specific control objectives.

Course Outcomes: By the end of the course, students should be able to:

- develop awareness of safety in the laboratory so that all laboratory work is carried out in a safe manner
- develop the ability to carry out experimental investigations of processes which include creating equipment diagrams and comprehensive safe operating procedures for various unit operations
- determine a specific set of experimental objectives
- develop the ability to work in a team and develop confidence through the application of previously acquired knowledge of unit operations, chemical reactions, process safety, and process control
- learn how to apply software tools typically used by process control professionals

List of Experiments:

1. Calibration and determination of time lag of various first and second order instruments Major equipment - First order instrument like Mercury-in-Glass thermometer and Overall second order instrument like Mercury-in-Glass thermometer in a thermal well
2. Experiments with single and two capacity systems with and without interaction Major equipment- Single tank system, Two-tank systems (Interacting and Non-Interacting)
3. Level control trainer
   Major equipment - Level control trainer set up with computer
4. Temperature control trainer
   Major equipment - Temperature control trainer with computer
5. Cascade control
   Major equipment - Cascade control apparatus with computer
6. Experiments on proportional, reset, rate mode of control etc.
   Major equipment – PID control apparatus
7. Control valve characteristics
   Major equipment – Control valve set up
8. Estimation of damping coefficient for U-tube manometer
   Major equipment - U-tube manometer
9. Calibration of Mercury in glass thermometer
10. Calibration of Thermocouple
11. Calibration of Pressure Gauge
12. Calibration of Rotameter

PE507PC: DRILLING FLUIDS LAB

B.Tech. III Year I Sem.	L	T/P/D	C
	0	0/2/0	1

Prerequisites: Drilling Technology

Course Objectives:

- To inform the students about the primary functions of drilling fluid
- To introduce the test procedures for controlling the properties of drilling fluid
- To introduce the common additives used to obtain the desirable properties under various drilling conditions
- To explain main factors governing the selection of drilling fluids
- To improve technical report writing skills

Course Outcome:

- The students will be able to design desired drilling fluid.
- They will be aware of weighing additives and viscofiers.
- They can control filter loss.
- They can maintain hydrostatic pressure to prevent the well and rig from getting damage.

List of Experiments:

1. Determination drilling fluid weight.
   Equipment: Mud Balance
2. Determination of mud viscosity.
   Equipment: Marsh Funnel
3. Determination of pH of mud.
   Equipment: pH meter and Hydrion pH dispensers
4. Determination of mud rheology (Viscosity, Gel strength, and Yield point).
   Equipment: Rheometer / Fann Viscometer
5. Determination of the loss of liquid from a mud.
   Equipment: Standard API Filter-press
6. Determination of a drilling mud cake and evaluate resistivity.
   Equipment: Fann Digital Resistivitymeter
7. Determination of the effect of adding bentonite on mud properties.
8. Drilling fluid contamination test (Salt, Gypsum & Cement contamination).
9. Determination of solid and liquid content and emulsion characteristics of drilling fluid.
   Equipment: Sand Content Set, Fann Emulsion and Electrical Stability Tester
10. Oil, water, solid and clay content determination.
    Equipment: Oil-Water Retort Kit
11. Determination of water ratios for portland cement slurry.
    (Effect of water ratio on free water separation normal and minimum water content and thickening time)
    Equipment: The Atmospheric Consistometer
12. Determination of compressive strength of cement test moulds.
    Equipment: Compressive Strength Testing Machine / UTM

PE508PC: ENERGY AND ENVIRONMENTAL ENGINEERING LAB

B.Tech. III Year I Sem.	L	T/P/D	C
	0	0/2/0	1

Prerequisites: Environmental Engineering and Energy Engineering

Course Objectives:

- To estimate pH, TDS & Conductivity, Hardness, Turbidity, Fluoride of ground & surface water
- To analyse the air to understand the pollution level
- To understand different parameters of fuel cell and concept of energy audit

Course Outcome: The student will be able to understand various aspects of energy and environment which are very much essential in the industry

List of Experiments:

1. Estimation of chemical and physical parameters of Ground and Surface water:
   pH, TDS & Conductivity, Hardness, Turbidity, Fluoride, Color analysis. Pesticide Microbial analysis: e-coli/ total coli forms bacteria
2. Estimation of physical parameters of waste water: pH, TDS, Hardness, Turbidity, Alkalinity etc.
3. Estimation of chemical parameters of waste water: COD, BOD, TSS
4. Water and waste water treatment: Small RO system for treatment of ground water.
   Same above system with UF membrane for turbidity removal and water disinfection.
5. Analysis of Air: Estimation of SPM, RSPM, Sox, Nox, CO and ozone in atmospheric air to study air pollution.
6. Fuel cell Test Kit [Energy]: A small ½ watt to 1-watt fuel cell with water electrolysis kit (H_2 and O_2 Generation) plus small volt meter and ammeter for measuring fuel cell performance (Three experiments can be conducted using this kit).
7. One small transparent anaerobic/aerobic biological reactor with slurry pump and aerator for treatment of industrial effluents to reduce COD levels.
8. Energy auditing of your Department.

List of Equipment:

pH meter, Colorimeter, TDS meter, Aerobic /Anaerobic reactor 25L capacity, BOD incubator, High accuracy analytical balance (5 digit), Desiccators, RO system with domestic 2''x12'' Membrane module, H_2S vial kit, Water analysis kit, UV-Vis spectrophotometer, High volume air sampler, Bomb calorimeter, Fuel cell test kit, Microscope.

*MC510: INTELLECTUAL PROPERTY RIGHTS

B.Tech. III Year I Sem.	L	T/P/D	C
	3	0/0/0	0

UNIT – I

Introduction to Intellectual property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

UNIT – II

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.

UNIT – III

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

UNIT – IV

Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.

Unfair competition: Misappropriation right of publicity, false advertising.

UNIT – V

New development of intellectual property: new developments in trade mark law; copy right law, patent law, intellectual property audits.

International overview on intellectual property, international – trade mark law, copy right law, international patent law, and international development in trade secrets law.

TEXT BOOKS & REFERENCES:

1. Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
2. Intellectual property right – Unleashing the knowledge economy, prabuddha ganguli, Tata McGraw Hill Publishing company ltd.

PE601PC: PETROLEUM REFINERY ENGINEERING

B.Tech. III Year II Sem.	L	T/P/D	C
	3	0/0/0	3

Prerequisites: Engineering Chemistry, Chemical Process Calculations

Course Objectives:

- To understand the various feed stocks of refinery and petroleum products.
- To get acquainted with basic separation and conversion processes used in refining of crude oil.
- To get familiarized with challenges involved in refining from viewpoint of environment.

Course Outcome: The student would be in a position to have advanced knowledge of feed-stocks used in the refinery, various conversion processes used to produce various petroleum products.

UNIT - I

Introduction: Overall refinery operations & Indian scenario.

Refinery feed stocks: Crude oil classification-Composition and properties-Composition of petroleum crude suitable for asphalt manufacture – Crude distillation curves.

UNIT - II

Petroleum Products: Low boiling products – Gasoline – Gasoline specifications – Distillate fuels – Jet and turbine fuels – Automotive diesel fuels; Heating oils –Residual fuel oils; wax and asphalt-Product blending.

Crude distillation: Atmosphere topping unit – Vacuum distillation –Auxiliary equipment – Products of these two units.

UNIT - III

Thermal & catalytic processes: Visbreaking, Hydrovisbreaking, Thermal cracking – Catalytic cracking fluidized bed catalytic cracking and Hydrocracking - Feed stocks – Feed treating – Catalysts process variables – Yield Estimation-Latest developments in cracking processes.

Coking: Types of petroleum coke-Properties and uses process description of delayed coking - Flexicoking and fluid coking – Yields.

UNIT - IV

Hydroprocessing and residue processing: Composition of vacuum tower bottoms – Processing options – Hydroprocessing options – Moving bed hydro processes – Solvent extraction Hydrotreating catalysts – aromatics
reduction – Process variables.

Catalytic reforming and isomerization: Catalytic reforming processes –Feed preparation & catalysts – Yields-Isomerization Processes and yields.

UNIT- V

Alkylation and polymerization: Alkylation feed stocks – Products –Catalysts – Hydrofluoric Acid and sulphuric acid alkylation processes –Comparison of processes-Polymerization processes.

Supporting processes: Hydrogen production and purification – Gas processing unit - Acid gas removal – Sulphur recovery processes – Waste water treatment and control of atmospheric pollution.

TEXT BOOK:

1. Petroleum Refining: Technology and Economics, J.H. Gary and G. E. Handwerk, 4th Edition, Marcel Dekkar, Inc., New York, 2001.

REFERENCE BOOKS:

1. Petroleum Refinery Engineering, W. L. Nelson, 4th Edition, McGraw Hill, New York, 1958.
2. Modern Petroleum Refining processes, 5th Edition, B. K. Bhaskara Rao, Oxford and IBH Publishing Co. Pvt. Ltd., 2008.
3. Practical Advances in Petroleum Processing, Chang S. Hsu and Paul Robinson, Vol. 1 & 2, Springer, 2006.

PE602PC: PETROLEUM RESERVOIR ENGINEERING

B.Tech. III Year II Sem.	L	T/P/D	C
	3	1/0/0	4

Prerequisites: Chemical Engineering Fluid Mechanics, Petroleum Geology, Chemical Process Calculations

Course Objectives:

- Recognize the central role of reservoir engineers in describing, evaluating and managing the reservoir system and, therefore, strive to gain a sound understanding of scientific principles used in the basic activities of reservoir engineering.
- Emphasize the impact of reservoir fluid behavior on reservoir exploitation.
- Understand the mechanics of oil and gas production in reservoirs and be able to apply the basic quantitative tools of reservoir engineering to analyze and/or predict the behavior of the reservoir under potentially useful production schemes.

Course Outcome: The student would be able to understand mechanics of oil production (natural reservoir energies and expulsion of fluids), and basic performance characteristics of various reservoir types to interpret performance characteristic curves for each reservoir type.

UNIT- I

Some basic concepts in Reservoir Engineering: Calculation of Hydrocarbon volumes – fluid pressure regimes – oil recovery and recovery factor – volumetric gas reservoir engineering – application of the real gas equation of state – gas material balance and recovery factor – Hydrocarbon phase behavior.
PVT analysis for oil: definition of the basic PVT parameters – collection of fluid samples – determination of the basic parameters in the laboratory and conversion for field operating conditions – alternative manner of expressing PVT lab analysis results – complete PVT analysis.

UNIT- II

Material balance applied to oil reservoirs : general form – the material balance expressed as a linear equation – reservoir drive mechanism – solution gas drive – gascap drive – natural water drive – compaction drive under related pore compressibility phenomena.
Darcy's law and applications: Darcy's law and field potential – sign convention – units and units conversion – real gas potential – datum pressures – radial steady state flow and well stimulation– two phase flow – effective and relative permeabilities.

UNIT- III

The basic differential equation for radial flow in a porous medium – derivation of the basic radial differential equation – conditions of solution – the linearization of the equation for fluids of small and constant compressibility.
Well inflow estimation for stabilized flow conditions: Semi - steady – state solution – steady state solution – example of the application of the stabilized inflow equations – generalized form of inflow equation under semi steady state conditions.

UNIT- IV

The constant terminal rate solution of the radial diffusivity equation and its application to oil well testing: The constant terminal rate solution – transient, semi steady state and steady state flow conditions – dimensionless variables – general theory of well testing – the Mathews, Brons, Hazebroek pressure build up theory - pressure build up analysis techniques – Multi Rate Drawdown testing – the effects of partial well completion – after flow analysis.

UNIT- V

Gas well testing: Linearization and solution of the basic differential equation for the radial flow of a real gas – the Russel, Goodrich etal. solution technique – the Al Hussainy, Ramey Crowford solution techniques – non– Darcy flow – determination of the non-Darcy coefficient F – the constant terminal rate solution for the flow of a real gas – general theory of gas well testing – multi rate testing of gas wells – pressure build up testing of gas wells – pressure build up analysis in solution gas drive reservoirs.

Natural Water influx: the unsteady state water influx theory of Hurst and Van Everdingen and its application in history matching – the approximate water influx theory of Fetkovitch for finite acquifiers predicting the amount of mater influx – application of influx calculation techniques to steam soaking.

TEXT BOOK:

1. Fundamentals of Reservoir Engineering, L.P. Dake, Elsevier Science, 1978 (17th Impression 1998).

REFERENCE BOOKS:

1. Reservoir Engineering Handbook, Tarek Ahmed, 3rd Edition, Gulf Professional Publishing, 2006.
2. Petroleum Engineering: Principles and Practice, J.S Archer & C.G. Wall, Graham &Trotman Inc. 1986.
3. Basic Reservoir Engineering, Rene Cosse, Editions Technip, 1993.
4. Petroleum Reservoir Engineering, James W Amyx, Daniel M. Bass Jr., Robert L. Whiting, McGraw Hill, 1960.

PE603PC: PETROLEUM PRODUCTION ENGINEERING AND DESIGN

B.Tech. III Year II Sem.	L	T/P/D	C
	3	0/0/0	3

Prerequisites: Chemical Engineering Fluid Mechanics, Petroleum Reservoir Engineering

Course Objectives: The students are expected to get knowledge of

- Fundamental concepts in petroleum production engineering.
- Reservoir fluids, efficient flow to the surface without damaging the reservoir dynamics/drive mechanisms.
- Various surface equipment's for process oil and gas after flow from wells.
- Sick well identification and remedial stimulation operations.
- Application of suitable artificial lifts on reservoir energy depletion.
- Crisis management.

Course Outcomes: After the course, the students will be able to:

- Determine the well head pressure, down hole pressure and operating oil/ gas flow rates of the reservoir.
- Identify formation damage and find remedial methods to bring the well back into production.
- Screen, design and operate artificial lifts on reservoir pressure depletions.
- Handle in case of any crisis at drilling/production installations.
- Process oil and gas before supply to refinery/consumers.
- Contribute to reservoir management as production engineers to prolong the reservoir life with optimum production.

UNIT - I

Petroleum production system over all view- production from various types of reservoir based on drive mechanisms field development method, Properties of Oil GOR, density, viscosity, pour point, Properties of gas specific gravity, compressibility, molecular weight, calorific value formation value factor.

UNIT - II

Reservoir deliverability- flow regimes- transient, steady state, pseudo steady state IPR for various types of wells, Well bore performance – single & multiphase liquid flow in oil wells, single phase & mist flow in gas wells, Choke performance – sonic & subsonic flow, single & multiphase flow in oil & gas wells, well deliverability nodal analysis, well decline analysis.

UNIT - III

Artificial lift methods-I: Sucker rod pumping system- selection of unit and types of unit. Load & power requirements, performance analysis dynagraph.

Other lift systems- electrical submersible pumps principle design & operation, hydraulic piston pumping, progressive cavity pumping, plunger lift, hydraulic jet pumping.

Artificial Lift Methods-II: Gas lift system evaluation of potential compression requirements, study of flow characteristics, principles of compression, types of compressors, selection of gas lift valves, types of valves, principles of valve operation, setting & testing, design installations.

UNIT - IV

Design of Equipment**:** Separators-Treaters-Producer Water Disposal Systems-Heat Exchangers-Pumping Systems- Compressors-Blowers-Turbines-Metering Systems and Pipeline Design.

UNIT- V

Production stimulation: Well problem identification- sick well analysis, Matrix acidizing- design for sandstone & carbonate reservoirs, Hydraulic fracturing – formation fracture pressure, geometry,

productivity of fractured wells, hydro fracture design, selection of fracturing fluid, propant, post frac evaluation.
Production optimization- self flowing wells, wells on gas lift, wells on sucker rod, separator, pipeline network, gas lift facilities, producing fields.

TEXT BOOKS:

1. Petroleum Production Engineering: A Computer Assisted Approach, Boyun Guo, William C. Lyons, Ali Ghalambor, Elesevier Science & Technology Books, 2007.
2. Petroleum Production Systems, M.J. Economides, A. Daniel Hill & C. E. Economides, Prentice Hall, 1994.

REFERENCE BOOKS:

1. Production Technology I-II, Institute of Petroleum Engineering, Herriot Watt University.
2. The Technology of Artificial Lift Method, Vol. 1, Brown E., Pennwell Books, 1977.

PE611PE: SURFACE PRODUCTION OPERATIONS (Professional Elective - I)

B.Tech. III Year II Sem.

L	T/P/D	C
3	0/0/0	3

Course Objective: This course is aimed to give an understanding of the principles and basic practice of surface production operations. The objective is to provide with a working knowledge of the current methodologies used in design of oil and gas handling systems and surface facilities. Principles and rules of designing and selecting the main components of petroleum production systems will be discussed.

Course Outcome: The student would be able to perform engineering calculations related to production tubing design for single-phase and two-phase flow in oil and gas wells.

UNIT - I

The production facility: Various types of facilities

Process selection: Controlling the process-Operation of a control valve: Pressure control- Level control- Temperature control- Flow Control- Basic system configuration: Wellhead and manifold- Separation- initial separation pressure- Stage Separation, Selection of Stages, Process flow sheet- Oil treating and storage- Lease automatic custody transfer- Water treating – Compressors- Gas dehydration- Well testing- Gas lift- Offshore platform considerations.

UNIT - II

Two phase oil and gas separation: Functional sections of a gas-liquid separator- Inlet diverter section- Liquid collection section- Gravity settling section- Mist extractor section- Equipment description of different separators- Scrubbers- Slug catchers- Selection considerations- Vessel internals- Mist extractors.

Three phase oil and water separation: Equipment description- Horizontal separators- Derivation of equation- Free-water knockout- Flow splitter- Horizontal three-phase separator with a liquid “Boot”- Vertical separator

UNIT - III

Crude oil treating: Equipment description of various treaters and heaters- Indirect and fired heaters- Waste heat recovery- Heater sizing- Vertical heater-treaters- Coalescing media- Horizontal heater treaters- Electrostatic heater-treaters- Oil dehydrators- Emulsion treating theory- Age of the emulsion- Agitation- Emulsifying agents- Demulsifiers- Field optimization- Changing the demulsifier- Demulsifier troubleshooting- Emulsion treating methods- General considerations- Chemical addition- Amount of chemical- Bottle test considerations- Chemical selection.

UNIT - IV

Oil desalting systems: Oil desalting systems-Equipment description of desalters- Mixing equipment- Globe valves- Spray nozzles- Static mixers- Process description- Single stage desalting- Two stage desalting.

Crude stabilization: Introduction- Basic principles- Process schemes- Equipment description- Stabilizer tower- Trays and packing- Stabilizer reboiler- Cooler- Reflux system- Feed cooler- Heater and stabilizer as a gas-processing plant.

UNIT - V

Produced water treating systems: Disposal standards- offshore & onshore operations- Characteristics of produced water- Scale removal- Controlling scale using chemical inhibitors- Sand and other suspended solids- Dissolved gases- Oil in water emulsions- Dissolved oil concentrations- Dispersed oil- Toxicants- Gravity separation- Coalescence- Dispersion- Flotation- Filtration- Equipment

description-Skim tanks and vessels- Types of configurations- Pressure vs atmospheric vessels- Retention time and performance considerations.

TEXT BOOKS:

1. Surface Production Operations, Ken Arnold & Maurice Stewart, Vol. 1, 3rd edition, Gulf Professional Publishing, 2008.
2. Petroleum and Gas Field Processing, H. K. Abdel-Aal and Mohamed Aggour and M.A. Fahim, Marcel Dekkar Inc., 2003.

PE612PE: HORIZONTAL WELL TECHNOLOGY (Professional Elective – I)

B.Tech. III Year II Sem.

L	T/P/D	C
3	0/0/0	3

Course Objectives: This course is designed to provide the broad background, necessary to understand and successfully apply the technology of horizontal wells at various elevations. The course provides various methods for predicting well performance based on expected production rate, drainage area, and fluid coning.

Course Outcome: The student would be able to understand recent well construction technologies and the reservoir characteristics required for designing horizontal wells and would study specialized drilling strategies like horizontal ones.

UNIT- I

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

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

UNIT- II

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

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

UNIT- III

Transient well testing: Introduction-Mathematical solutions and their practical implications- Generalized flow regimes- Pressure response- Detailed well testing flow regimes- Pressure directivities- Wellbore storage effects- Practical Considerations.

UNIT- IV

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

UNIT- V

Water and gas coning in horizontal wells: Critical rate definition- Water and gas coning in horizontal wells- Horizontal well breakthrough time in a bottom- Water drive reservoir- Breakthrough time for a horizontal well in a reservoir with gas cap or bottom water- Cone breakthrough time for horizontal wells in reservoir with both gas cap and bottom water- Critical rate for horizontal well in edge-water drive reservoir practical considerations- Field Histories.

TEXT BOOK:

1. Horizontal Well Technology, S. D. Joshi, PennWell Publishing Company, 1991.

REFERENCE BOOK:

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

PE613PE: TRANSPORT PHENOMENA (Professional Elective – I)

B.Tech. III Year II Sem.	L	T/P/D	C
	3	0/0/0	3

Course Objective: To assimilate the transfer processes in a unified manner.

Course Outcome: Ability to analyse the processes involving simultaneous flow, heat and mass transfer, to design packed bed flows and fluidization processes, to calculate heat and mass transfer.

UNIT - I

Viscosity and the mechanisms of momentum transfer: Newton's law of viscosity (molecular momentum transport), generalization of Newton's law of viscosity, pressure and temperature dependence of viscosity, molecular theory of the viscosity of gases at low density, molecular theory of the viscosity of liquids.

Thermal conductivity and the mechanisms of energy transport: Fourier's law of heat conduction (molecular energy transport), temperature and pressure dependence of thermal conductivity, and theory of thermal conductivity of gases at low density.

Diffusivity and the mechanisms of mass transport: Fick's law of binary diffusion (molecular mass transport), temperature and pressure dependence of diffusivities, theory of diffusion in gases at low density.

UNIT - II

Shell momentum balances and velocity distributions in laminar flow: shell momentum balances and boundary conditions, flow of a falling film, flow through a circular tube, flow through annulus, flow of two adjacent immiscible fluids, creeping flow around a sphere.

UNIT - III

Shell energy balances and temperature distributions in solids and laminar flow: shell energy balances; boundary conditions, heat conduction with an electrical heat source, heat conduction with a nuclear heat source, heat conduction with a viscous heat source, heat conduction with a chemical heat source, heat conduction through composite walls, heat conduction in a cooling fin, forced convection, free convection.

UNIT - IV

Concentration distributions in solids and laminar flow: shell mass balances; boundary conditions, diffusion through a stagnant gas film, diffusion with a heterogeneous chemical reaction, diffusion with a homogeneous chemical reaction, diffusion into a falling liquid film (gas absorption), diffusion into a falling liquid film (solid dissolution), diffusion and chemical reaction inside a porous catalyst.

UNIT - V

The equations of change: Derivation of the equation of continuity in Rectangular and Polar coordinates, the equation of motion, the equation of energy, the equation of continuity of a component in multi component mixture (in rectangular coordinates only) the equations of change in terms of the substantial derivative. Use of equations of change to solve one dimensional steady state problems of momentum, heat and component transfer, Introduction to Turbulent flow and Time smoothing

TEXT BOOK:

1. Transport Phenomena - R Byron Bird, Warran E Steward and Edwin N Lightfoot, John Wiley & Sons, Inc. New York.

REFERENCE BOOKS:

1. Transport Phenomena - Robert S Brodkey and Harry C Hershey, Mc Graw Hill Book Company, New York Tokyo-Toronto.
2. Transport Phenomena for Engineers - Louis Theodore, International Text-book Company, London.
3. Transport Phenomena - W.J. Book and K. M. K. Multzall, John Wiley & Sons Ltd, London, New York;

PE604PC: WELL COMPLETION, TESTING AND SERVICING

B.Tech. III Year II Sem.	L	T/P/D	C
	3	0/0/0	3

Prerequisites: Drilling Technology

Course Objectives:

- Knowledge of subsurface equipment below well head.
- Planning and designing of well completion after testing of the hydrocarbon zones available.
- Knowledge of subsurface circulating equipment and packers.
- Testing of multi zones in a well with DST/RFT with logging tools as well as surface testing equipment.

Course Outcomes: The student can

- Have the knowledge of various equipment used in & on wells.
- Have the knowledge of DST/RFT to know the initial potential of the wells.
- Plan and design the well completion depending of the casing policy and the number of objectives available in the well.
- Also plan for suitable safety valves in sub surface as well as on well head for the safe operation of the high pressure and high temperature wells.
- Also be a good work over engineer to repair and maintenance of a sick well.
- Be a good CTU (Coil Tubing unit) operator whenever rigs less operation are required to be taken up.

UNIT - I

Well completion: Types of wells- Completion functions- Types of completion.

UNIT - II

Mechanical aspects of well testing- Cased hole logging equipment and application and perforation methods and perforation equipment.

UNIT - III

Packers: Function- Application- Proper selection- Packer setting – Packer loads - water / gas shut off, horizon separation etc.

UNIT - IV

Completion equipment (SSD, SSSV, mandrels, locks etc.)- Data acquisition in wells- Fibre optics- Permanent gauges- Memory gauges- Intelligent completion equipment.

Tubing string design (dimension, materials and connections etc.) based on pressure, temperature, operating conditions- Media- Safety requirements.

UNIT - V

Drill Stem Testing: General Procedure and considerations- Test tool components and arrangement- Analysis of Test data.

HPHT and horizontal well completions- Workover equipment wireline- Scrubbing unit- Coil tubing completion and work over design and execution.

TEXT BOOKS:

1. Well Completion and Servicing, D. Perrin, Micheal Caron, Georges Gaillot, Editions Technip, 1999.
2. Primer of Well Service, Workover and Completion, Petroleum Extension Service (PETEX), University of Texas at Austin, 1997.
3. Well Testing, John Lee, Society of Petroleum Engineers, 1982.

REFERENCE BOOKS:

1. Well Completion Design, Jonathan Bellarby, Elsevier, 2009.
2. Petroleum Engineering: Principles and Practice, J.S Archer & C.G. Wall, Graham & Trotman, Inc., 1986.
3. Advanced Well Completion Engineering, Wan Renpu, Gulf Professional Publishing, 2011.

PE605PC: PETROLEUM RESERVOIR ENGINEERING LAB

B.Tech. III Year II Sem.

L	T/P/D	C
0	0/2/0	1

Prerequisites: Petroleum Geology, Reservoir Engineering

Course Objective: To make familiar students with reservoir fluid and rock properties such as Porosity, Permeability, Saturation, Wettability, Viscosity, Contact Angle, Surface Tension and Interfacial Tension

Course Outcome: The students should be in a position to

- predict the type of rock
- find out the amount of hydrocarbon in the reservoir
- determine the amount of recoverable hydrocarbon

List of Experiments

1. Determination of effective porosity by gas expansion method.
   Equipment: Helium Porosimeter (Nitrogen gas can be used in place of helium).
2. Determination of porosity and pore size distribution by mercury injection.
   Equipment: Mercury Porosimeter
3. Measurement of surface tension & interfacial tension with the ring tensiometer.
   Equipment: Ring Tensiometer
4. Determination of fluid density using Pycnometer and Hydrometer methods.
   Equipment: Pycnometer and Hydrometer
5. Liquid viscosity measurement using capillary tube viscometer (Ostwald type).
   Equipment: Capillary Tube Viscometer.
6. Determination of capillary pressure of reservoir rock (core) using porous plate method.
   Equipment: Capillary Pressure Cell
7. Measurement of contact angle (between oil, water and solid surface) using imaging method.
   Equipment: Image System Set-up
8. Measurement of Air Permeability.
   Equipment: Constant Head Permeameter with the Hassler cell / Gas Permeameter
9. Absolute permeability measurement of water.
   Equipment: Darcy Apparatus / Liquid Permeameter
10. Determination of relative permeability of oil-water using unsteady state method.
    Equipment: Relative Permeability Apparatus
11. Determination of relative permeability of gas-oil using unsteady state method.
    Equipment: Relative Permeability Apparatus

PE606PC: PETROLEUM PRODUCT TESTING LAB

B.Tech. III Year II Sem.	**L**	**T/P/D**	**C**
	0	**0/2/0**	**1**

Prerequisites: Petroleum Refinery Engineering

Course Objectives

- To aware of various petroleum products
- To know characteristics or properties of petroleum products
- To get acquainted with basic separation and conversion processes used in refining of crude oil

Course Outcome: Students will be able to understand which characteristics should be measured for the fuel while it is transporting, storing and usage.

List of Experiments:

1. Determination of Distillation characteristics of crude oil & its products.
2. Determination of Reid vapour pressure of crude oil & gasoline.
3. Determination of Viscosity of diesel and transformer oils.
4. Determination of Smoke point of kerosene.
5. Determination of Carbon residue of petroleum oils.
6. Determination of Flash & Fire points of gasoline, kerosene and other products.
7. Estimation of Water content in petroleum products.
8. Estimation of calorific value of LPG/gasoline.
9. Determination of Aniline point of gasoline and diesel oil.
10. Determination of Softening point of bitumen.
11. Determination of Cloud & Pour points of petroleum products.
12. Detection of Corrosiveness of petroleum products.

EN608HS: ADVANCED COMMUNICATION SKILLS LAB

B.Tech. III Year II Sem.

L	T/P/D	C
0	0/2/0	1

1. INTRODUCTION:

The introduction of the Advanced Communication Skills Lab is considered essential at 3rd year level. At this stage, the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalized context.

The proposed course should be a laboratory course to enable students to use 'good' English and perform the following:

- Gathering ideas and information to organize ideas relevantly and coherently.
- Engaging in debates.
- Participating in group discussions.
- Facing interviews.
- Writing project/research reports/technical reports.
- Making oral presentations.
- Writing formal letters.
- Transferring information from non-verbal to verbal texts and vice-versa.
- Taking part in social and professional communication.

2. OBJECTIVES:

This Lab focuses on using multi-media instruction for language development to meet the following targets:

- To improve the students' fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.
- To prepare all the students for their placements.

3. SYLLABUS:

The following course content to conduct the activities is prescribed for the Advanced English Communication Skills (AECS) Lab:

1. **Activities on Fundamentals of Inter-personal Communication and Building Vocabulary** - Starting a conversation – responding appropriately and relevantly – using the right body language – Role Play in different situations & Discourse Skills- using visuals - Synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, business vocabulary, analogy, idioms and phrases, collocations & usage of vocabulary.
2. **Activities on Reading Comprehension** –General Vs Local comprehension, reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading& effective googling.
3. **Activities on Writing Skills** – Structure and presentation of different types of writing – *letter writing/Resume writing/ e-correspondence/Technical report writing/* – planning for writing – improving one's writing.
4. **Activities on Presentation Skills** – Oral presentations (individual and group) through JAM sessions/seminars/**PPTs** and written presentations through posters/projects/reports/ e-mails/assignments etc.
5. **Activities on Group Discussion and Interview Skills** – Dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and organization of ideas and rubrics for evaluation- Concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele-conference & video-conference and Mock Interviews.

4. MINIMUM REQUIREMENT:

The Advanced English Communication Skills (AECS) Laboratory shall have the following infrastructural facilities to accommodate at least 35 students in the lab:

- Spacious room with appropriate acoustics.
- Round Tables with movable chairs
- Audio-visual aids
- LCD Projector
- Public Address system
- P – IV Processor, Hard Disk – 80 GB, RAM–512 MB Minimum, Speed – 2.8 GHZ
- T. V, a digital stereo & Camcorder
- Headphones of High quality

5. SUGGESTED SOFTWARE:

The software consisting of the prescribed topics elaborated above should be procured and used.

- Oxford Advanced Learner's Compass, 7th Edition
- DELTA's key to the Next Generation TOEFL Test: Advanced Skill Practice.
- Lingua TOEFL CBT Insider, by Dream tech
- TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)

TEXT BOOKS:

1. Effective Technical Communication by M Asharaf Rizvi. McGraw Hill Education (India) Pvt. Ltd. 2nd Edition
2. Academic Writing: A Handbook for International Students by Stephen Bailey, Routledge, 5th Edition.

REFERENCES:

1. Learn Correct English – A Book of Grammar, Usage and Composition by Shiv K. Kumar and Hemalatha Nagarajan. Pearson 2007
2. Professional Communication by Aruna Koneru, McGraw Hill Education (India) Pvt. Ltd, 2016.
3. Technical Communication by Meenakshi Raman & Sangeeta Sharma, Oxford University Press 2009.
4. Technical Communication by Paul V. Anderson. 2007. Cengage Learning pvt. Ltd. New Delhi.
5. English Vocabulary in Use series, Cambridge University Press 2008.
6. Handbook for Technical Communication by David A. McMurrey & Joanne Buckley. 2012. Cengage Learning.
7. Communication Skills by Leena Sen, PHI Learning Pvt Ltd., New Delhi, 2009.
8. Job Hunting by Colm Downes, Cambridge University Press 2008.
9. English for Technical Communication for Engineering Students, Aysha Vishwamohan, Tata Mc Graw-Hill 2009.

*MC609: ENVIRONMENTAL SCIENCE

B.Tech. III Year II Sem.

L	T/P/D	C
3	0/0/0	0

Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures
- Understanding the environmental policies and regulations

Course Outcomes:

Based on this course, the Engineering graduate will understand /evaluate / develop technologies on the basis of ecological principles and environmental regulations which in turn helps in sustainable development

UNIT - I

Ecosystems: Definition, Scope and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, ecosystem value, services and carrying capacity, Field visits.

UNIT - II

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT - III

Biodiversity And Biotic Resources: Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT - IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Wastewater Treatment methods: Primary, secondary and Tertiary.

Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Problems and Global Efforts: C**limate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol.

UNIT - V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspects Air Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-

economical aspects. Strategies for risk assessment, Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building, Ecological Foot Print, Life Cycle assessment (LCA), Low carbon life style.

TEXT BOOKS:

1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.
3. Environmental Science by Daniel B. Botkin & Edward A. Keller, Wiley INDIA edition.
4. Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.
5. Text book of Environmental Science and Technology - Dr. M. Anji Reddy 2007, BS Publications.