



OFFICE OF THE REGISTRAR :: DIBRUGARH UNIVERSITY :: DIBRUGARH

Ref. No. DU/DR-A/Course Curriculum(P.E.)/23/852

Date: 17.08.2023

NOTIFICATION

As recommended by the Board of Studies (BoS) in Petroleum Engineering, DUIET, in its meeting held on 16.05.2023, the 128th Meeting of the Academic Council, Dibrugarh University held on 30.06.2023 vide Resolution No. 20 has approved the *Revised course curriculum of B.Tech. in Petroleum Engineering, DUIET, Dibrugarh University for the batches 2022 onwards* with effect from the academic session 2023-2024.

A copy of the Revised Course Curriculum is attached herewith.

Issued with due approval.

Alexandra
17/08/2023

Deputy Registrar (Academic)
Dibrugarh University.

Alexandra

Copy to:

1. The Hon'ble Vice-Chancellor, Dibrugarh University for kind information.
2. The Deans, Dibrugarh University, for kind of information.
3. The Registrar i/c, Dibrugarh University for kind of information.
4. The Director, Dibrugarh University Institute of Engineering and Technology (DUIET), Dibrugarh University, for kind information.
5. The Controller of Examinations i/c, Dibrugarh University for information.
6. The Programmer, Dibrugarh University, with a request to upload the notification and syllabus in the Dibrugarh University Website.
7. File.

Alexandra
17/08/2023

Deputy Registrar (Academic)
Dibrugarh University

Alexandra

Course Structure and Content of Department of Petroleum Engineering,
DUIET, Dibrugarh

(For the Batch admitted in 2022 onwards)

Semester III (Second year)
Curriculum Branch/Course: Petroleum Engineering

Subject	Code	Credit Structure			Total Credit	Contact hours
		L	T	P		
Mathematics- III	PE-1301	3	0	0	3	3
Mechanical Engineering	PE-1302	2	0	0	2	2
Geology for Petroleum Engineers	PE-1303	3	0	0	3	3
Principles of Drilling Engineering	PE-1304	3	0	0	3	3
Chemistry of Petroleum and Petroleum Refining	PE-1305	3	0	0	3	3
Principles of Surveying and Remote Sensing	PE-1306	3	0	0	3	3
Surveying Lab	PE-L-1301	0	0	1	1	2
Geology for Petroleum Engineers Lab	PE-L-1302	0	0	1	1	2
Internship-I (Social and Rural Internship)	MC-301	0	0	0	3	0
Universal Human Values and Ethics	PE-1407	2	0	0	1	2
	Total	19	0	2	23	23

Semester IV (Second year)
Curriculum Branch/Course: Petroleum Engineering

Subject	Code	Credit Structure			Total Credit	Contact hours
		L	T	P		
Numerical Methods	PE-1401	3	1	0	4	4
Sedimentary and Petroleum Geology	PE-1402	3	0	0	3	3
Production Engineering-I	PE-1403	3	0	0	3	3
Reservoir Engineering-I	PE-1404	3	0	0	3	3
Instrumentation and Control system	PE-1405	3	0	0	3	3
Technical English	PE-1406	2	0	0	1	2
Indian Knowledge system	MC-302	2	0	0	1	2
Petroleum Product Testing Lab	PE-L-1401	0	0	1	1	2
Reservoir Engineering Lab	PE-L-1402	0	0	1	1	2
	Total	19	1	2	20	24

Semester V (Third year)
Curriculum Branch/Course: Petroleum Engineering

Subject		Code	Credit Structure			Total Credit	Contact hours
			L	T	P		
Managerial Economics and Accountancy		PE-1501	2	1	0	3	3
Production Engineering-II		PE-1502	2	1	0	3	3
Reservoir Engineering-II		PE-1503	3	0	0	3	3
Reservoir Modeling and Simulation		PE-1504	3	0	0	3	3
Core Elective-I	Designs of Drilling Engineering	PE-CElv.-1505(1)	2	1	0	3	3
	Well Control Systems	PE-CElv.-1505(2)					
Core Elective-II	Enhanced Oil Recovery	PE-OElv.-1506 (1)	3	0	0	3	3
	Flow Assurance	PE-OElv.-1506 (2)					
Core Elective-II	Petrochemicals	PE-CElv.-1507(1)	3	0	0	3	3
	Unit Operations	PE-CElv.-1507(2)					
Production Engineering Lab		PE-L-1501	0	0	1	1	2
Drilling Fluid Lab		PE-L-1502	0	0	1	1	2
Chemistry of Petroleum Lab		PE-L-1503	0	0	1	1	2
Internship II (Academic Internship)		MC-501	0	0	0	4	0
Constitution of India(Audit Course)		MC-502	0	0	0	0	0
Total			18	3	3	28	27

Semester VI (Third year)
Curriculum Branch/Course: Petroleum Engineering

Subject		Code	Credit Structure			Total Credit	Contact hours
			L	T	P		
Principles of Water Flooding (Open Elective-II)		PE-OElv.-1602	3	0	0	3	3
Oil and Gas Well Testing		PE-CElv.-1603	3	0	0	3	3
Core Elective-IV	Petroleum Exploration-I	PE-CElv.-1604(1)	3	0	0	3	3
	Micropaleontology in Fossil Fuel Industry	PE-CElv.-1604(2)					
Advanced Drilling Engineering		PE-1605	3	0	0	3	3
Natural Gas Engineering and Hydrogen Energy		PE.-1606	3	0	0	3	3
Pipeline Engineering		PE-1607	2	1	0	3	3
EOR Lab		PE-L-1601	0	0	1	1	2
		Total	17	1	1	21	20

Semester VII (Fourth year)
Curriculum Branch/Course: Petroleum Engineering

Subject		Code	Credit Structure			Total Credit	Contact hours
			L	T	P		
Petroleum Exploration-II (Open Elective-IV)		PE-OElv.-1701	3	0	0	3	3
Core Elective -V	Core Analysis	PE-CElv.-1702(1)	3	0	0	3	3
	Advanced Production Engineering and Management	PE-CElv.-1702(2)					
Offshore Operations		PE-1703	3	0	0	3	3
Petroleum Formation and Evaluation		PE-1704	2	0	0	2	2
Project-I		PE-P-1701	0	0	0	4	4
Internship III (Industrial Training)		MC-701	0	0	0	4	3
Total			11	0	0	19	18

Semester VIII (Fourth year)
Curriculum Branch/Course: Petroleum Engineering

Subject		Code	Credit Structure			Total Credit	Contact hours
			L	T	P		
Open Elective-V	(1)Energy Economics	PE-OElv.-1801(1)	3	0	0	3	3
	(2) Computational Fluid Dynamics	PE-OElv.-1801(2)					
Occupational Health and Safety		PE-1802	3	0	0	3	3
Core Elective - VI	(1) Unconventional Energy	PE-CElv.-1803(1)	3	0	0	3	3
	(2) Heat and Mass Transfer	PE-CElv.-1803(2)					
Project-II		PE-P-1801	0	0	0	4	4
Composite Viva- Voice		PE-C-1801	0	0	0	2	2
		Total	9	0	0	15	15

COURSE CONTENT

3RD SEMESTER

SUBJECT: MATHEMATICS-III

PE-1301

3L-0T-0P:03 Credits

(PDE, Complex Variables and Transform Calculus)

Module 1: Partial Differential Equations

Solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral method. Flows, vibrations and diffusions, second-order linear equations and their classification, Initial and boundary conditions (with an informal description of well-posed problems), D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, Solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables. Boundary-value problems: Solution of boundary-value problems for various linear PDEs in various geometries.

Module 2: Complex Analysis

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties. Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy-Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour. Evaluation of definite integral involving sine and cosine. Evaluation of certain improper integrals using the Bromwich contour.

Module 3: Transform Calculus

Polynomials – Orthogonal Polynomials – Lagrange's, Chebysev Polynomials; Trigonometric Polynomials; Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic

functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method. Fourier transforms, Fourier Integrals. Fourier integral theorem (without proof). Fourier Transform and inverse transform. Fourier Sine & Cosine Transform, inverse transform. Z-transform and Wavelet transforms: properties, methods, inverses and their applications.

Text Books

- [1] B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 36th Edition, 2010.
- [2] H. K. Dass, *Advanced Engineering Mathematics*, S Chand and Company Pvt. Ltd, Reprint 2014.
- [3] M. D. Raisinghanian, *Advanced Differential equations*, S Chand and Company Pvt. Ltd

Reference Books

- [1] G.B. Thomas and R.L. Finney, *Calculus and Analytic geometry*, 9th Edition, Pearson, Reprint, 2002.
- [2] Erwin Kreyszig, *Advanced Engineering Mathematics*, 9th Edition, John Wiley & Sons, 2006.
- [3] W. E. Boyce and R. C. DiPrima, *Elementary Differential Equations and Boundary Value Problems*, 9th Edition, Wiley India, 2009.
- [4] S. L. Ross, *Differential Equations*, 3rd Edition, Wiley India, 1984.
- [5] E. A. Coddington, *An Introduction to Ordinary Differential Equations*, Prentice Hall India, 1995.
- [6] E. L. Ince, *Ordinary Differential Equations*, Dover Publications, 1958.
- [7] J. W. Brown and R. V. Churchill, *Complex Variables and Applications*, 7th Edition, McGraw Hill, 2004.
- [8] N.P. Bali and Manish Goyal, *A text book of Engineering Mathematics*, 9th Editions Laxmi Publications, 2014.

SUBJECT: MECHANICAL ENGINEERING

PE-1302

2L-0T-0P:02 Credits

UNIT I

Fundamental Concepts of Thermodynamics:

Introduction and Definition of thermodynamics System, Macroscopic & microscopic approaches, System, Surrounding and universe, Phase, Concept of continuum, Density, Specific volume, Pressure, temperature. Thermodynamic equilibrium, Thermodynamic Properties, State, Path, Process, Cyclic and non cyclic processes, Reversible and irreversible processes, Quasi static process Energy and its forms, Work and Heat, Enthalpy.

UNIT II

Fundamental Concepts of Thermodynamics and Properties of Steam:

Zeroth law of thermodynamics, First law of thermodynamics. Processes - flow and non -flow, Control volume, Flow work and non - flow work, Steady flow energy equation, Unsteady flow systems and their analysis. Second law: Limitations of first law of thermodynamics Essence of second law, Thermal reservoir, Heat engines. COP of heat pump and refrigerator. Statements of second law and their equivalence, Carnot cycle, Cannot theorem, Thermodynamic temperature scale, Clausius inequality. Concept of entropy.

UNIT III

Properties of Steam:

Properties of steam, Phase transformation process and its graphical representation on P-V, T-V & T-s diagram, Steam Tables, Processes involving steam in closed and open systems. Introduction to I.C. Engines: Two & four stroke Si and C.I. engines. Otto cycle, Diesel cycle, Dual cycle.

UNIT IV

Fluid Mechanics:

Definition of fluid, types of fluid, Properties of fluids, fluid statics, Forces on fluids, Newton's law of viscosity, pressure depth relationship for compressible and incompressible fluids, Fluid flow: Laminar, Transitional and turbulent flows, fluid flow through a circular tube or pipe: Hagen-Poiseuille equation, Bernoulli's equation, Pressure drop in pipes, Friction Losses in Laminar flow and Turbulent flow, Continuity Equation, Flow measuring devices for petroleum industries: venturimeter, orifice meter, Rotameter, Pumping of oil and gas, reciprocating pumps and centrifugal pumps, NPSH calculations.

UNIT V

Heat Transfer and Mass Transfer:

Introduction to heat transfer and general concepts of heat transfer by conduction and convection, Conduction: Basic concepts of conduction in solids, liquids, gases, steady state temperature fields and one dimensional conduction without heat generation e.g. through plain walls, cylindrical and spherical surfaces, composite layers, etc. Insulation materials, critical and optimum insulation thickness, Convection: Fundamentals of convection, Basic concepts and definitions, Heat transfer equipment: types of exchangers, viz. double pipe, shell and tube, heat transfer calculation for co-current and counter-flow double pipe heat exchanger: LMTD and overall heat transfer. Condensation of pure vapors, film wise on vertical and horizontal tube.

BOOKS:

1. Holman, J.P.: "Thermodynamics, Tata Mc Graw Hill book Co. NY.
2. Nag, P.K.: Basic and Applied Thermodynamics, Tata McGraw Hill, New Delhi (2009)
3. Rajput, R.K., "Text Book of Fluid Mechanics", S. Chand and Co., New Delhi (1998).
4. Bansal, R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P) Ltd., New Delhi (2005).
5. Kern, D.Q., "Process Heat Transfer", McGraw Hill Book (1950).
6. Dutta, B.K., "Heat Transfer: Principles and Application", Prentice-Hall of India Pvt. Ltd., New Delhi (2004)
7. Nag, P.K.: Heat and Mass Transfer, McGraw Hill, New Delhi

SUBJECT: GEOLOGY FOR PETROLEUM ENGINEERS

PE-1303

3L-0T-0P:03 Credits

1. Mineralogy: Introduction to minerals: General properties; Classification of minerals and properties of common rock forming minerals.
2. Petrology: Introduction to rocks; Classification and description of some common rocks.
3. Stratigraphy: Principles of stratigraphy; Broad stratigraphic subdivisions and associated rock types of important coal belts and oil fields of India.

4. Concepts of palaeontology; Fossils, their mode of preservation and significance as indices of age and climate; Concept of index fossils;
5. Structural Geology: Unconformities, folds, faults and joints – their nomenclature, classification and recognition, Effects of folds and fractures on strata and their importance in exploration activities.
6. Forms of igneous intrusions - dyke, sill and batholith.
7. Interpretation of topographic (structural) maps; Attitude of planar and linear structures; Effects of topography on outcrops.

SUBJECT: PRINCIPLES OF DRILLING ENGINEERING

PE-1304

3L-0T-0P:03Credits

1. Well Planning: Introduction to oil well drilling, Drilling planning approaches.
2. Rotary Drilling Method: Rig parts, selection and general layout.
3. Drilling Operations & Practices: Hoisting, Circulation, Rotation, Power system, Well Control System
4. Well tubular: Casing String and Drill String
5. Drill Bits: Classification and design criteria of drag, rotary, roller, diamond and PDC bits, Bit Selection.
6. Coring: Different methods of core drilling.
7. Well Problems and Solutions: Fatigue failure, Pipe sticking, Lost-circulation, Sloughing shale, Swabbing, surge, gas cap drilling.
8. Oil Well Fishing: Fish classification, tools and techniques.
9. Well Head Testing, Hermetical Testing.

SUBJECT: CHEMISTRY OF PETROLEUM AND PETROLEUM REFINING

PE-1305

3L-0T-0P:03Credits

PART A: CHEMISTRY OF PETROLEUM (Credit= 1.5)

1. Advance electrochemistry: Reversible and irreversible cells; Fuel cells; Reference electrodes and indicator electrodes; Ion selective electrodes; Application of electrode potentials; Potentiometric titration;
2. Corrosion and corrosion control: Principles of corrosion, methods of corrosion control, cathodic and anodic protection, corrosion inhibitors. Surface coatings, Corrosion Monitoring. Case Studies of Corrosion in Petroleum industry including metals and alloys used in Petroleum Industry.
3. Advanced surface chemistry: Interfacial phenomena; Wetting; Surface tension measurements; Electrokinetic phenomena; Zeta potential and its measurement. Adsorption: Types of adsorption isotherm, Gibb's adsorption equation, BET equation, surface area of adsorbents, Application of Adsorption on the surface of solids, adsorption of high molecular compounds.
4. Analytical techniques: UV-Vis Spectrophotometry, Atomic Absorption Spectrophotometer (AAS), IR Spectroscopy, Liquid and Gas Chromatography and Solvent extraction methods.

Text/Reference Books -

1. A Textbook of Engineering Chemistry- Shashi Chaula
2. Engineering Chemistry-Wiley (India) Publication
3. Organic Spectroscopy- William Kemp

Part –B: PETROLEUM REFINING (Credit= 1.5)

1. Composition of Petroleum: Physical properties of Petroleum. Crude classification, Evaluation of crude oil. Refinery products - specifications, properties, test methods. Additives and their uses.
2. Refinery Equipment Design: Pipe still heater. Distillation column, Heat exchangers and condensers.
3. Petroleum Refining Process: Multi-component distillation. Coking, Cracking, Reforming, alkylation, Isomerisation, Hydro-processes.

4. Specialty Products: Lube Oil Production, Propane De-asphalting, solvent extraction, De-waxing, Hydro-finishing. Wax Production, Carbon black & Petroleum Coke Production.

Text/Reference Books -

1. Modern Petroleum Refining Processes- B. K. Bhaskar Rao
2. Petroleum Refining Engineering- W. L. Nelson
3. Petrochemical Technology Assessment- John Wiley
4. Petrochemicals – B. K. Bhaskar Rao

SUBJECT: PRINCIPLES OF SURVEYING AND REMOTE SENSING

PE-1306

3L-0T-0P: 03Credits

1. Fundamental concepts: Introduction, definitions, surveying, classification of surveying, principles of surveying, errors.
2. Chain Surveying : Different methods, direct measurement, instruments for chaining, ranging out survey lines, chaining , measurement of length with the help of tape, error due to incorrect chain, chaining on uneven or sloping ground, errors in chaining, tape corrections.
3. Compass Traversing: Introduction, bearing and angles, the theory of magnetic compass, classification of compass, magnetic declination, local attraction, errors in compass survey, adjustments of closing errors.
4. Plane Table Surveying : General : Accessories, working operations, methods of plane tabling, two point problem and three point problem, Advantages and Disadvantages of plane table surveying.
5. Levelling: Different methods of levelling, curvature and refraction, reciprocal levelling. Difference of elevation – single observation, reciprocal observation.
6. Contouring: Definition, characteristics of contours. Use of contour maps, direct and indirect methods of contouring.
7. Measurement of area: area bounded by irregular boundaries- Mid ordinate rule, average ordinate rule, trapezoidal rule, Simpson’s rule; area by double meridian distances, area by coordinates, planimeter.
8. Measurement of volume: measurement from cross-sections, prismoidal formula, trapezoidal formula, capacity of reservoir.

9. Electromagnetic-distance Measurements: Electromagnetic waves, modulation, types of EDM, total station.
10. Photographic surveying: Introduction, terrestrial and aerial photograph, horizontal position of a point from terrestrial photograph, horizontal and vertical angles from terrestrial photograph, focal length determination; scale of vertical photograph, computation of length and height from vertical photograph, relief displacement, scale of tilted photograph, tilt distortion, flight planning, stereoscopic vision, parallax in aerial photograph, measurement of parallax.
11. Remote sensing : Electromagnetic energy, electromagnetic spectrum, interaction of electromagnetic energy with matter, remote sensing sensor systems, platforms, ideal and real remote sensing system, data acquisition and interpretation, application of remote sensing, remote sensing in India.

SUBJECT: SURVEYING LAB

PE-L-1301

0L-0T-1P: 01Credits

Chaining of a line using Chain/Tape/Tachometer and Recording of details along the chain line, Measurement of area – Cross staff survey, Traversing by compass and graphical adjustment, Determination of distance between two inaccessible points., Fly Leveling, Reciprocal leveling, Profile Leveling, Contouring, Plane Table Survey: Traversing, Resection by Trial and Error method, Measurement of horizontal and vertical angles, distance using Theodolite, measurement of horizontal and vertical distances, directions, elevations, computation of area, using Total Station, Setting of simple curve using tape or/and theodolite, Total Station, Setting

SUBJECT: GEOLOGY FOR PETROLEUM ENGINEERS LABORATORY

PE-L-1302

0L-0T-1P: 01 Credit

1. Rock thin-section study, Identification of optical properties of rock forming minerals under petrological microscope
3. Study of diagenetic alterations in reservoir rock
4. Grain size analysis and its interpretations with reference to reservoir characteristics
5. Construction of geological maps and cross-section.
6. Construction of sub-surface maps using exploration data.

SUBJECT: Universal Human Values and Ethics (AUDIT COURSE)

PE-1407

2L-0T-0P: 1 Credits

Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

Expected Outcome:

On completion of this course, the students will be able to-

1. Understand the significance of value inputs in a classroom and start applying them in their life and profession
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Understand the value of harmonious relationship based on trust and respect in their life and profession
4. Understand the role of a human being in ensuring harmony in society and nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

Module I:

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self-Exploration – what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self-exploration.
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority

5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the human aspirations: understanding and living in harmony at various level.

Module II :

Understanding Harmony in the Human Being - Harmony in Myself

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
2. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'
5. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail.
6. Programs to ensure Sanyam and Swasthya

Module III :

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

1. Understanding harmony in the Family- the basic unit of human interaction
2. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfilment to ensure Ubhay-tripti.
3. Trust (Vishwas) and Respect (Samman) as the foundational values of relationship
4. Understanding the meaning of Vishwas; Difference between intention and competence
5. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship.
6. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals
7. Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyavastha)- from family to world family.

Module IV :

Understanding Harmony in the Nature and Existence - Whole existence as Co-existence

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature.

3. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space.
4. Holistic perception of harmony at all levels of existence.

Module V:

Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
4. Competence in Professional Ethics:
 - a) Ability to utilize the professional competence for augmenting universal human order,
 - b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models
5. Case studies of typical holistic technologies, management models and production systems.
6. Strategy for transition from the present state to Universal Human Order:
 - a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers
 - b) At the level of society: as mutually enriching institutions and organizations

Text Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

References:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991

4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome’s report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow.
Reprinted 2008.

Mode of Evaluation:

Assignment/ Seminar/Continuous Assessment Test/Semester End Exam

4TH SEMESTER

SUBJECT: NUMERICAL METHODS

PE-1401

3L-1T-0P: 04Credits

Module 1:

Solution of polynomial and transcendental equations - Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Relation between operators.

Module 2:

Interpolation of Unequal intervals-Lagrange's Interpolation formula. Interpolation of Equal intervals-Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

Module 3:

Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predictor-corrector methods. Partial differential equations: Finite difference solution two dimensional Laplace equation and Poisson equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

Textbooks:

- [1] H. K. Dass, *Advanced Engineering Mathematics*, S Chand and Company Pvt. Ltd, Reprint 2014.
- [2] B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 36th Edition, 2010.

References:

- [1] P. Kandasamy, K. Thilagavathy, K. Gunavathi, *Numerical Methods*, S. Chand and Company, 2nd Edition, Reprint 2012.
- [2] S.S. Sastry, *Introductory Methods of Numerical Analysis*, PHI, 4th Edition, 2005
- [3] Erwin kreyszig, *Advanced Engineering Mathematics*, 9th Edition, John Wiley & Sons, 2006.

SUBJECT: SEDIMENTARY AND PETROLEUM GEOLOGY

PE-1402

3L-0T-0P: 03Credits

SECTION – A (Sedimentary Geology)

1. Introduction: Sedimentary processes, Textural properties, Sedimentary structures, Sedimentary environment, Reconstruction of sedimentary environment
2. Pore morphology and its significance, Important rock groups with special reference to sandstones and carbonates, Role of sedimentology in petroleum exploration.
3. Tectonics, basic concept of sequence stratigraphy, Elements of basin modeling.

SECTION – B (Petroleum Geology)

1. Physical and chemical characteristics of crude oil
2. Origin of petroleum, Source rock and maturation, Reservoir rocks and cap rocks
3. Migration of hydrocarbons: mechanism, pattern and barriers.
4. Entrapment of oil and gas: types and mechanism.
5. Geology of sedimentary basins of India –producing and prospective basins.

Text/Reference Books -

1. Boggs, S.Jr., 1987, Principles of Sedimentology and Stratigraphy, Merrill Publ.Co..
2. Miall, A.D., 1990, Principles of Sedimentary Basin Analysis, Springer Verlag
3. Reading, H.G. (Ed.), 1996, Sedimentary Environments and Facies, Blackwell Science2
4. Collinson, J., Mounney, N., Thompson, D., Sedimentary Structures, Terra Publishing, 3rd Edn.,2006.
5. Nicholls, G.Sedimentology and Stratigraphy. Wiley-Blackwell,1999.
6. Prothero, D.R.and Schwab, F.Sedimentary Geology: An introduction to Sedimentary Rocks and Stratigraphy, 2nd Edn., W.H.Freeman,2003.
7. Selley, R.C., Applied sedimentology, 2nd Edn., Academic Press,2000.

8. Tucker, M.E. Sedimentary Petrology, 3rd Edn., Blackwell Science, 2001
9. Petroleum Geology by F.K. North, Publisher: Allen & Unwin
10. Elements of Petroleum Geology by R. C Selly. Publisher: Academic Press
11. Basic Petroleum Geology by P. K. Lint. Publisher: OGCI
12. Geology of Petroleum by A.I. Levorsen, Publisher: W.H. Freeman & co.
13. Petroleum Formation & Occurrence By- Tissot, B.P. & Welte, D.H. Publisher: Springer
14. Petroleum (Indian context) by D. Chandra & R.M. Singh. Publisher: Tara Book Agency, Varanasi

SUBJECT: PRODUCTION ENGINEERING – I

PE-1403

3L-0T-0P: 03 Credits

1. Characteristics of crude oil and natural gas, classification of crude and its physicochemical properties.
2. Introduction to Productivity Index (PI) & Inflow Performance Relationship (IPR).
3. Well Completion: Importance of Well Completion, Well Completion Equipment, Well Completion Methods.
4. Well Perforation: Introduction, Well Perforating Methods, Perforating Gun Types, Shaped Charge, Type, Size, Depth and Orientation of perforation holes, Shot Density, Standoff, Explosives in perforation, Explosive Train.
5. Well activation: Importance of Well Activation, Well Activation methods viz. Displacement, Compressor Application, Application of Nitrogen, Aerisation, Swabbing etc.
6. Artificial Lift Technology: Basic principles and descriptions of Artificial Lift Methods, Continuous and Intermittent Flow Gas Lift, Design of Gas Lift System, Plunger Lift, Chamber Lift, Sucker Rod Pumping (SRP), Electrical Submersible Pumping (ESP), Hydraulic Pumping (HP).
7. Well Stimulation Techniques: Importance of Well Stimulation, Acid Solutions for Acidizing, Acid Additives, Matrix Acidizing, Fracture Acidizing, Hydraulic Fracturing, Wave Technology, Microbial Stimulation.
8. Introduction to Well Servicing: Objectives and Applications, production problems.

Text Book References:

1. Principles of Oil Well Production- T. E. W. Nind.
2. Applied Petroleum Reservoir Engineering- Craft and Hawkins.
3. The Technology of Artificial Lift Methods, Volume 1- Kermit E. Brown.
4. Petroleum Engineering Handbook-Howard B. Bradley.
5. Oil and Gas Field Development Techniques: Well Completion and Servicing- Denis Perrin, Michel Caron and Georges Gaillot.
6. Production Operations: Well Completions, Workover and Stimulation, Volume 1- Thomas O. Allen and Alan P. Roberts.
7. Production Operations: Well Completions, Workover and Stimulation, Volume 2- Thomas O. Allen and Alan P. Roberts.
8. Dictionary of Petroleum Exploration, Drilling & Production- Norman J, Hyne.

SUBJECT: RESERVOIR ENGINEERING-I

PE-1404

3L-0T-0P: 03 Credits

Unit I: Fundamentals of petroleum, petroleum reservoir, reservoir engineering, classification of petroleum reservoir.

Unit II: Reservoir rock properties: porosity, permeability, combination of permeability in parallel and series beds, porosity permeability relationship, effective and relative permeability, fluid saturation and significance, wettability, capillary pressure, surface tension /interfacial tension.

Unit III: Reservoir fluid properties, reservoir fluid sampling, PVT properties, different correlations and laboratory measurements, phase behavior of hydrocarbon system.

Unit IV: Reservoir drive mechanics and recovery factors, generalized MBE, drive indices, performance prediction of depletion, gas-cap, water and combination drive.

Unit V: Reserve estimation: Resource and reserve concept, estimation of petroleum reserves, latest reserves classification.

Text/Reference Books -

1. Reservoir Engineering Handbook- Tarek Ahmed

2. Advanced Reservoir Engineering- Tarek Ahmed, Paul D. Mcinney
3. Phase Behavior of Petroleum Reservoir Fluid- Pederson, Chrisgtensen
4. Estimation and Classification of Reserves of Crude oil, Natural Gas & Condensate- Chapman Corrnquist
5. Fundamental of Reservoir Engineering- L. P. Dake
6. Applied Petroleum Reservoir Engineering- Craft and Hawkins

SUBJECT:INSTRUMENTATION AND CONTROL SYSTEM

PE-1405

3L-0T-0P: 03 Credits

UNIT I

Importance of measuring of Instruments in Process Control, Classification of Instruments, Elements of an Instruments, Static & Dynamic Characterization of Instruments, Errors in measurements & Error Analysis, Selection of instrument for a particular Measurement, transducers.

UNIT II

Measurement of Temperature: Thermocouples, Resistance Thermometer, Expansion Thermometers, Pyrometers.

Measurement of Pressure & Vacuum, Hydrostatic type, Elastic Element type, Electrical Type and other type of instruments like McLeod Gauge, Thermocouple gauge, Knudson Gauge, Ionization Gauge.

UNIT III

Instruments for Measurement of Flow rate & level: Variable Area & variable head flow meters, Volumetric and Mass flow rate meters, Linear velocity measurement systems, Anemometers, Pressure type, Resistance & Capacitance type, Sonic & Ultrasonic, Thermal type Level meters.

UNIT IV

Instruments for Measurement of Viscosity: Redwood, Saybolt, Engler, Cup & Cone type, Rheo & other types of viscometers.

UNIT V

Dynamic modeling of first and second-order process, Interacting and non-interacting processes, Nonlinear and integrating processes, Classification of controllers and control strategy, types of control: P, PI, PD and PID

Books:

1. Eckman, D.P., Industrial Instrumentation, Wiley Eastern Ltd., New York 1990.
2. Jain, R.K., Mechanical and Industrial Measurements, Khanna Publishers.
3. Coughnaowr, D. R., "Process Systems Analysis and Control", McGraw-Hill, Inc.
4. Stephanopolous, G., "Chemical Process Control", Prentice-Hall.

SUBJECT: TECHNICAL ENGLISH

PE-1406

2L-0T-0P: 01 Credits

1. Communication skills (What is communication skills? Necessity of skills in the corporate sector, The flows of communication, Barriers of communication, LSRW skills, Verbal and non-verbal communication)
2. Workplace etiquette (Team management, Grooming and dress code, How to address people in the corporate sectors, Mock interviews, Problem solving aptitude and handling conflicts, Management of time in a corporate sector-notes making)
3. Job Interviews (Pre-interview preparation techniques, Resume writing, Practice through mock interviews and group discussions, Problem solving and practicing through potential interview questions)
4. Presentation Skills (How to make an effective power point presentation, Breaking down Laskowski's acronym on 'AUDIENCE' in a presentation, Techniques of organising materials and points in a seminar report, Actual practice of presenting a report and evaluation)
5. Group Discussion (GD)- (Relevance and purpose of group discussion, mechanism of group discussion, Importance of subject knowledge in a GD, Range of topics in a GD and Strategies for an effective GD)
6. Business Writing (How to make business drafts, e-mails by avoiding mistakes in grammar,

punctuation, spelling, wordiness and jargons; how to make technical reports and business letters effectively)

7. English Pronunciation and conversation (Role playing, Practicing through GDs and mock interviews, Reading aloud, Critical reviewing of a current topic orally)

8. Vocabulary Test (Prefixes, Suffixes, Homonyms, Homophones, Synonyms, Antonyms, Words often confused, One word substitution, Foreign terms and expressions, Idioms and phrases, Abbreviations and acronyms)

Reference Books:

1. Effective Technical Communication: M. Ashraf Rizvi; Tata McGraw Hills.
2. Professional Communication Skills: A.K.Jain, Prabir S.R.Bhatia; S.Chand and Co.
3. Communicative English for Engineers and Professionals: Nitin Bhatnagar & Mamta Bhatnagar; Pearson Education ltd.
4. A Communicative Grammar of English: Leech, Geoffrey & Svartvik; Pearson

SUBJECT:INDIAN KNOWLEDGE SYSTEM

MC-302

2L-0T-1P: 01 Credit

SUBJECT:PETROLEUM PRODUCT TESTING LABORATORY

PE-L-1401

0L-0T-1P: 01Credit

- (i) Determination of ductility of bitumen.
- (ii) Copper strip corrosion experiment
- (iii) Softening point determination of bitumen
- (iv) Specific gravity experiment
- (v) pH, salinity determination
- (vi) Cetane number and octane number of fuel
- (vii) Viscosity of fuel
- (viii) Smoke point of kerosene

(ix) Flash point and fire point of fuel

(x) Reid vapor pressure of fuel

SUBJECT: RESERVOIR ENGINEERING LABORATORY

PE-L-1402

0L-0T-1P: 01 Credit

1. To prepare the core samples from conventional core/outcrops in desired shape, size and smoothness.
1. To clean the given Core Samples using Soxhlet Apparatus.
2. To clean the given Core Samples using Ultrasonic Cleaner.
3. To determine the dryness fraction of core samples in Humidity Cabinet.
4. To determine the Porosity of given Core Samples using Helium Porosimeter.
5. To determine / estimate the the Gas Permeability and Liquid Permeability/Absolute Permeability using Gas Permeameter.

COURSE CONTENT

5th SEMESTER

SUBJECT: MANAGERIAL ECONOMICS AND ACCOUNTANCY

PE-1501

2L-1T-0P: 03 Credits

1. Nature, scope and methods of managerial economics.
2. Managerial Economic Concepts – Incremental concept; Opportunity Cost concept; Equi-marginal concept; discounting concept; Risk & Uncertainty.
3. Law of Diminishing Marginal Utility.
4. Demand Analysis – Meaning & type; Law of Demand – features; Exceptions; Market Demand Schedule & Curve; Elasticity of Demand – Price elasticity, cross elasticity & income elasticity.
5. Indifference Curve approach and its properties.
6. Supply – its law, elasticity & curve.
7. Types of markets; Pricing under various market conditions – Perfect competition, imperfect competition & monopolistic competition.

8. Profit & Profit measurement.
9. Inflation – meaning; Demand-pull, cost-push inflation; Inflationary gap; Causes and steps to control inflation.
10. National Income – Concepts & methods of measurement; Difficulties in measuring national income.
11. Nature, scope and methods of managerial economics.
12. Managerial Economic Concepts – Incremental concept; Opportunity Cost concept; Equi-marginal concept; discounting concept; Risk & Uncertainty.
13. Law of Diminishing Marginal Utility.
14. Demand Analysis – Meaning & type; Law of Demand – features; Exceptions; Market Demand Schedule & Curve; Elasticity of Demand – Price elasticity, cross elasticity & income elasticity
15. Indifference Curve approach and its properties.
16. Supply – its law, elasticity & curve.
17. Types of markets; Pricing under various market conditions – Perfect competition, imperfect competition & monopolistic competition.
18. Profit & Profit measurement.
19. Inflation – meaning; Demand-pull, cost-push inflation; Inflationary gap; Causes and steps to control inflation.
20. National Income – Concepts & methods of measurement; Difficulties in measuring national income.

Text Book References-

1. Managerial Economics by William F. Samuelson and Stephen G. Marks
2. Managerial Economics: Theory, Applications, and Cases by W. Bruce Allen, Keith Weigelt, Neil Doherty and Edwin Mansfield
3. Managerial Economics by Christopher Thomas and S. Charles Maurice
4. Managerial Economics by William F. Samuelson and Stephen G. Marks
5. Managerial Economics: Theory, Applications, and Cases by W. Bruce Allen, Keith Weigelt, Neil Doherty and Edwin Mansfield
6. Managerial Economics by Christopher Thomas and S. Charles Maurice

SUBJECT: PRODUCTION ENGINEERING –II

PE-1502

2L-1T-0P: 03 Credits

1. Well Performance: Productivity Index (PI), Specific Productivity Index, Importance of Inflow Performance Relationship (IPR), Vertical Lift Performance, Bean Performance, Multiphase Flow in tubing and flow lines, Coning, Production Optimization– Nodal System analysis, Production Logging.
2. Sand Control: Sand Control Techniques, use of Screens, Gravel Packing, Formation Sand size analysis, optimum Gravel-Sand Ratio, Gravel Pack Thickness, Gravel Selection, Gravel Packing Fluid, Gravel Placement Techniques, Chemical Method of Sand Control.
3. Oil and Gas Processing: Introduction to Oil & Gas Separation, Flash & Differential Separation, Stage Separation, Fluid Level and Pressure Control System, FWKO, Two Phase Separator, Three Phase Separator; Horizontal, Vertical, Spherical and Centrifugal Separator, Scrubber, Treater, Wash Tank, Design of Oil & Gas Separator, Safety Feature in separators, Sand Removal, Desalting, Gas Dehydration, Gas Sweetening, formation of Gas Hydrates.
4. Crude Oil Storage Tank: Types & Features of Storage Tanks, Tank Accessories, Tank Batteries, Metering of Oil & Gas, Sampling of Crude Oil, Gauging Equipment and Methods, Vapor Recovery System.
5. **Application of AI and ML in Production Engineering and Well Completion:** Role of Machine Learning in Production Engineering; Production Optimization; Well's Potential; Production Rates for Gas-lift Wells; Poor Well Performance; Critical Oil Rate.

Text Book References:

1. Principles of Oil Well Production- T. E. W. Nind.
2. Introduction to Petroleum Production, Volume I- D. R. Skinner.
3. Introduction to Petroleum Production, Volume-II- D. R. Skinner.
4. Gas-Liquid and Liquid-Liquid Separators- Maurice Stewart and Ken Arnold.
5. Oilfield Processing, Volume Two: Crude Oil- Francis S. Manning and Richard E. Thompson.
6. Petroleum and Gas Field Processing- H. K. Abdel-Aal, Mohamed Aggour and M. A. Fahim.
7. Petroleum Engineering Handbook-Howard B. Bradley.
8. Introduction to Oil and Gas Production, Vocational Training Series- American Petroleum Institute.

SUBJECT: RESERVOIR ENGINEERING-II

PE-1503

3L-0T-0P: 03 Credits

- Unit I:** Flow of Fluids through Porous Media: Darcy's law, assumptions and applications, single and multiphase flow, Types of fluid- compressible fluid, incompressible and slightly compressible fluid; radial and spherical flow, steady state and unsteady state flow.
- Unit II:** Productivity Index, Injectivity Index, Formation Damage, Skin Effect, GOR, WOR equations, principles of fluid flow for steady state, semi steady state and unsteady state conditions.
- Unit III:** Water influx in reservoir, different water influx models.
- Unit IV:** Water and gas coning; Immiscible displacement process, Buckley and Leverett treatment of fractional flow and frontal advance equations.
- Unit V:** Reservoir Management: Concepts of Reservoir Management and its Application
- Unit VI:** **Application of AI and ML in Reservoir Engineering:** Role of Machine Learning in Reservoir Engineering; EOR; Well Testing; Decline Curve Analysis; Equations and Descriptions.

Text/Reference Books -

1. Reservoir Engineering Handbook- Tarek Ahmed
2. Advanced Reservoir Engineering- Tarek Ahmed, Paul D. Mcinney
3. Fundamental of Reservoir Engineering- L. P. Dake
4. Applied Petroleum Reservoir Engineering- Craft and Hawkins
9. Basics of Reservoir Engineering- R Cosse

SUBJECT: RESERVOIR MODELING AND SIMULATION

PE-1504

3L-0T-0P: 03 Credits

Reservoir Modeling:

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.

Reservoir Simulation:

1. Overview: Introduction, Historical background, application of simulator, various types of models.
2. Flow Conditions: Single phase flow equations for one, two and three dimension models.
3. Special Concept: Explicit and implicit, grid system, finite difference & finite element method, matrix solution, stability criteria.
4. Data Preparation
5. Pesudofunctions
6. Reservoir model Solution Techniques: Implicit Pressure and Explicit Saturation (IMPES)
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 evaluation
11. Introduction to streamline simulation & comparison of conventional/Streamline simulation.

Text Book References-

1. Principles of Applied Reservoir Simulation, by John R. Fanchi
2. Advanced Petroleum Reservoir Simulation by Rafiq Islam, S.H. Moussavizadegan, Shabbir Mustafiz and Jamal H. Abou-Kassem
3. Practical Enhanced Reservoir Engineering: Assisted with Simulation Software by Abdus Satter, Ghulam M. Iqbal and James L. Buchwalter
4. Practical Reservoir Simulation by M. R. Carlson
5. Modern Reservoir Engineering: A Simulation Approach by Henry B. Crichlow

SUBJECT: DESIGNS OF DRILLING ENGINEERING

PE-CEIv.-1505-1

2L-1T-0P:03 Credits

A. Drilling Fluids and its design:

1. Overview of Drilling Fluids: Clay chemistry and its application to drilling fluids, Types of clays, hydration, flocculation, aggregation and dispersion.
2. Classification, Types and applications of Drilling Fluids: Water based, oil based, emulsion based, polymer based, Surfactant based, Foam based and Aerated drilling fluids.
3. Drilling Fluid Characteristics: Basic functions, properties, maintenance and treatments of drilling fluids.
4. Drilling fluid design and casing design.

B. Cements:

1. Cementing, Cements & cement slurry: Objectives of cementing, oil well cements, Classification of cement, Slurry additives, Factors influencing cement slurry and its design, Cementing equipment.
2. Cementing Methods: Primary cementing, Stage cementing, Liner cementing, Plugging, Squeeze Cementing techniques in practice. Characteristics of good quality cementation.
3. Cement slurry design and volume calculations

SUBJECT: WELL CONTROL SYSTEMS

PE-CEIv.-1505-2

2L-1T-0P: 03 Credits

1. Basic terms, BHP and leak off test.

Kick, Blow Out, Primary, Secondary & Tertiary Well Control, Bottom Hole pressure, Normal & Abnormal Formation pressure, Causes of abnormal pressure, U tube concept, swab and Surge effects, Equivalent Circulating Density.

2. Kick Indications & Shut-In Procedure

Causes of Kick, Early warning signs, positive kick signs, Shut-in procedures, Type of Influx and behaviour, Gas influx behaviour.

3. Well Killing Methods

Drillers method, wait & weight Method, Volumetric Method, Comparison of methods and calculations, Stripping and Snubbing.

4. Blow Out Preventer Equipment

Annular preventer and packing Elements, Pipe ram, Blind ram and variable Bore ram Preventer, Koomey unit, Choke & kill Manifold, Diverters, Trip tank, Mud gas separator, Vaccum degasser, Pit volume recorder, Mud flow indicators, BOP drill.

Core Elective-II

SUBJECT: ENHANCED OIL RECOVERY

PE-OELv.-1506 (1)

3L-0T-0P: 03

Credits

- Unit I:** Introduction to EOR, Basic principles and mechanism of EOR, Mobility ratio concepts, Screening of EOR processes.
- Unit II:** Chemical Flooding: Polymer flooding, Surfactant flooding, Caustic flooding; ASP flooding – Principles and applications.
- Unit III:** Miscible Flooding: First contact miscibility, Multiple Contact Miscibility-Condensing Gas Drive, Vaporizing Gas Drive, Principles and applications of CO₂ flooding.
- Unit IV:** Thermal Recovery Techniques - Steam stimulation, hot water flooding, steam flooding and in-situ combustion process.
- Unit V:** Microbial EOR - Principles and Applications. Introduction to Nano-technology based EOR.aspects

Text/Reference Books -

1. Principles of Petroleum Reservoir Engineering- Gian Luigi Chierici
2. Enhanced Oil Recovery Textbook Vol-6- Don W. Green G. Paul Willhite
3. The Reservoir Engineering Aspects of Water flooding- Forrest F. Craig, Jr.
4. The Design Engineering Aspects of Water flooding- Stephen C. Rose, John F. Buckwalter and Robert J. Woodhall
5. Improved Recovery, Oil and Gas Production- Nicholas J. Const
6. Improved Oil Recovery by Surfactant and Polymer Flooding- D. O. Shah, R. S. Schechter

SUBJECTY: FLOW ASSURANCE

PE-CElv.-1506(2)

3L-0T-0P:03Credits

Unit I:

Definition of Flow assurance, Typical Production System, Criteria of flow assurance, Resistances to the flow, various issues encountered for flow assurance in the industry, Importance of velocity profiles, temperature profiles and concentration profiles in prediction flow assurance issues. Importance of Pressure drop calculations in flow assurance industry

Unit II:

Definition of Slugging, Terminology used in slugging, Flow Pattern Maps and its utilization, Definition and criteria for terrain slugging and severe slugging, Remedies of slugging, terrain slugging and sever slugging, Liquid Loading definition, symptoms of liquid loading, Models used to predict liquid loading, Mitigation of Liquid Loadings

Unit III

Wax Deposition definition, Wax deposition Criteria, Models used to predict Wax deposition remedies and mitigation techniques for wax deposition, Definition of Gas Hydrates, Criteria for formation of Gas hydrates, Models utilized for prediction of gas hydrates, remedies and mitigation techniques of gas hydrates

Unit IV

Scale Deposition definition, Scale deposition Criteria, Models used to predict Scale deposition remedies and mitigation techniques for Scale deposition , Definition of Asphaltenes, Criteria for formation of Asphaltenes, Models utilized for prediction of Asphaltenes, remedies and mitigation techniques of Asphaltenes

TEXT / REFERENCE BOOKS:

1. Mechanistic Modeling of Gas-Liquid Two-Phase Flow in Pipes. Ovadia Shoham: 2006: 408 pp.; Softcover: ISBN: 978-1-55563-107-9: Society of Petroleum Engineers
2. Organic Deposits in Oil and Gas production, Wayne Frenier, Murtuza Ziauddin, Ramachandran Venkatesan, 2010, Softcover: ISBN: 978-1-55563-291-5, Society of Petroleum Engineers
3. Formation, Removal, and Inhibition of Inorganic Scale in the Oilfield Environment,, Wayne Frenier, Murtuza Ziauddin, 2008, Softcover: ISBN: 978-1- 61399-279-1, Society of Petroleum Engineers

4. Practical Aspects of Flow Assurance in the Petroleum Industry, by Jitendra Sangwai and Abhijit Dandekar. CRC Press, 2022

SUBJECT: PETROCHEMICALS

PE-CElv.-1507-1

3L-0T-0P: 03 Credits

Unit1:

Petrochemicals

- a. History and growth of petrochemical industry.
- b. Petrochemical industries in India
- c. Trends in Petrochemical Industries
- d. Petrochemicals from Natural Gas: Methane, ethane, propane and butane based Petrochemicals.

Unit-2:

Raw materials

- a. Crude oil and natural gas as raw materials for petrochemical industries, Individual hydrocarbons and Petroleum cuts as feed stock for petrochemical manufacture.
- b. Manufacture of petrochemical feedstock, such as ethylene, propylene, BTX and synthesis gas for manufacture of ammonia and methanol.
- c. Separation process used for purification of product gases of a gas cracker.
- d. Petrochemical Feed Stocks: Aromatics, un-saturates and saturates (linear and cyclic).

Unit-3:

Polymerization

- a. Basic concept of polymer chemistry, the type and structure of the macromolecular products, Physical and mechanical properties of high molecular mass compounds.
- b. Classification of polymers according to the Gas Cracker Products.

Unit-4:

Oxidation

- a. Basic reactions and mechanisms in the oxidation of hydrocarbons.
- b. Process for oxidation of light olefins, production of ethylene oxide, acetaldehyde, acrylonitrile etc.

Unit-5:

Manufacture of petrochemicals

- a. Hydration of Olefins, basic concepts concerning hydration of olefins.
- b. Direct and indirect ways of olefins hydration.
- c. Manufacture of low molecular weight alcohols from olefins.

d. Processes used in sulfuric acid as a means of obtaining a under molecular weight range of alcohols.

Unit-6:

Processes for Petrochemical Manufacture

- a. Ammonia and methanol synthesis, OXO synthesis.
- b. Manufacture of some important commercial polymer products.

Unit-7:

Petroleum Product safety & Transportation

- a. Product Handling & Safety: Loss Prevention, underground storage, Product Blending.
- b. Transport and distribution, Fire Prevention & safety devices.

Text/Reference Books -

1. Petrochemical Processes- A.Chuvel, G. Lefebure
2. Petrochemicals- Djebbar Tiab, Erle C, Donaldson
3. Petrochemical Technology Assessment- John Wiley
4. Petrochemicals – B. K. Bhaskar Rao

SUBJECT: UNIT OPERATIONS

PE-CElv.-1507-1

3L-0T-0P: 03 Credits

Unit-1:

Definitions and Principles

Physical quantities, Gas constants, Engineering units, Conversion of units, Units and equations, Equation of states (EOS).

Unit-2:

Compressible and incompressible fluid flow

Basics of laminar and turbulent flow, Reynold number, flow of compressible and incompressible fluid in conduits, laminar flow in pipes, Bernaulis equation, Navier Stoke's equation, turbulent flow in pipes and closed conduits, incompressible fluid flow in closed channels, Compressible fluid flow through variable-area conduits, Adiabatic and isothermal fluid flow, Fluidization, Motion of particles through fluids.

Unit-3:

Transporting and Metering of Fluids

Different fluid moving machinery, Pipes, tubes, fittings and valves, Positive displacement machinery, Centrifugal pumps and compression principles, Hydrostatic equilibrium equation, Barometric equation, Principles of U-Tube Manometer, Inclined manometer, Insertion meter, Full bore meter.

Unit-4:

Heat Transfer in fluid flow

Energy balance, Mode of heat transfer, Steady and Un steady state heat transfer, Rate of heat transfer, Heat transfer by forced convection in laminar/turbulent flow, Heat transfer in transition region between laminar and turbulent flow, Prandtl number, Nusselt number, Overall heat transfer coefficient.

Unit-5:

Gas absorption and adsorption

Principles of gas absorption and adsorption, Equilibrium adsorption isotherms, Basic equation for absorption and adsorption, Mass transfer equations, Absorber/adsorber design, Design of Packed tower, Raschig rings, Mass Transfer Correlations, Plate column, Absorption with chemical reactions.

SUBJECT: PRODUCTION ENGINEERING LABORATORY

PE-L-1501

0L-0T-1P: 01 Credits

1. To Identify and study of Casing, Float Collar, Casing Shoe, Casing Head Spool, Casing Valve, Gauge Cutter.
2. To Identify and study of Packer, Cross over Sub, Side Pocket Mandrel, Sliding Valve.
3. To Identify and study of Scraper, Fishing Tool, Shock Sub, Change over Sub, Centralizer, Slick Line, Wire Rope, Piano Wire.
4. To Identify and study of Tubing Hanger, Hanger Flange, Elevator, Sleeve, Ring Seal, Coupling, Dognut.
5. To Identify and study of Bean Housing, Gate Valve, Casing Valve, Standing Valve, Needle Valve, Bean Nozzle, Bean Wrench, Pressure Gauge.

SUBJECT: DRILLING FLUID LABORATORY

PE-L-1502

0L-0T-1P: 01Credits

1. Determination of Density/Specific Gravity of drilling fluid sample.
2. Determination of Funnel Viscosity of drilling fluid.
3. Determination of rheological properties such as plastic viscosity, gel strength etc. of drilling fluid
4. Determination of filtration /fluid loss of a given drilling fluid.

SUBJECT: CHEMISTRY OF PETROLEUM LAB

PE-L-1503

0L-0T-1P: 01Credits

List of Experiment

1. To determine the strength of a given CH_3COOH solution by titrating against a standard NaOH solution by conductometric titration.
2. To determine the amount of chloride ions in the given KCl solution by precipitation titration.
3. To determine the strength of an unknown solution of HCl by titrating it with NaOH solution by using pH meter.
4. To determine average molecular weight of polyvinyl acetate by viscosity measurement.
5. To learn the basic principles of UV-visible spectrophotometry and to measure concentration by a UV-visible spectrophotometer.
6. To learn the instrumentation of IR spectroscopy and to analysis IR spectra of three organic molecules.

SUBJECT: CONSTITUTION OF INDIA (AUDIT COURSE)

MC-502

0L-0T-0P: 0Credits

1. The History of the Making of Indian Constitution.
2. Preamble and the Basic Structures.
3. Fundamental Rights and Duties.
4. Directive Principles of State Policy.
5. Legislature, Executive and Judiciary.

6. Emergency Powers.
7. Special Provisions for Jammu and Kashmir, Nagaland and Other Regions.
8. Amendments.

Text/Reference Books –

1. D D Basu, Introduction to the Constitution of India, 20th Edn., Lexisnexis Butterworths, 2012.
2. Rajeev Bhargava (ed), Ethics and Politics of the Indian Constitution, Oxford University Press, New Delhi, 2008.
3. Granville Austin, The Indian Constitution: Cornerstone of a Nation, Oxford University Press, Oxford, 1966.
4. Zoya Hassan, E. Sridharan and R. Sudarshan (eds), India's Living Constitution: Ideas, Practices, Controversies, Permanent Black, New Delhi, 2002.
5. Subhash C. Kashyap, Our Constitution, National Book Trust, New Delhi, 2011.

COURSE CONTENT

6TH SEMESTER

SUBJECT: PRINCIPLES OF WATER FLOODING (OPEN ELECTIVE-II)

PE-OElv.-1602

3L-0T-0P:03Credits

1. Introduction to Water flooding: Formation Energy, Pressure Maintenance, Importance of Water flooding, Optimum Time to Water flood, Effect of Trapped Gas on Water flood Recovery, Factors affecting Water flood Performance, Displacement Efficiency, Sweep Efficiency, Recovery Efficiency, Infill Drilling, Cutler's Law, Reservoir Heterogeneity, Methods used to characterize Vertical Permeability Stratifications, Mobility & Mobility Ratio.

2. Water flood Patterns: Importance of Pattern Water flooding, Types of Flood Patterns.

3. Fractional Flow Curve: Importance of Fractional Flow Equation, Fractional Flow Curve, Types of Fractional Flow Curves, Effects of Wettability, Viscosity, Dip Angle, Capillary Pressure etc. on Fractional Flow Curve.

4. Frontal Advance Equation: Importance of Frontal Advance Equation, Stabilized and Non stabilized Zone, Shock Front, Water Breakthrough, Water Saturation Profile, Oil Recovery Calculation.

5. Injection Water Treatment: Treatment Objectives, Injectivity Problems, Sources of Injection Water, Desired Characteristics of Injection Water, Design consideration for Water Handling and Injection System.

6. Oil & Gas Field Development: Development of Oil & Gas Fields, Rate and Order of drilling well, well spacing & pattern.

Text Book References:

1. Reservoir Engineering Handbook- Tarek Ahmed.
2. The Reservoir Engineering Aspects of Waterflooding- Forrest F. Craig, Jr.
3. The Design Engineering Aspects of Waterflooding- Stephen C. Rose, John F. Buckwalter and Robert J. Woodhall.
4. Waterflooding- James T. Smith and William M. Cobb.

SUBJECT: OIL AND GAS WELL TESTING

PE-CElv.-1603

3L-0T-0P: 03Credits

Unit I: Introduction to Oil and Gas Well Testing, Steady State and Unsteady Flow Tests, Diffusivity Equation, its derivation and Solution, Reservoir Pressure Measurements and Significance: Techniques of pressure measurement, Wellbore storage effects, Radius of investigation, Principle of Superposition.

Unit II: Oil Well Testing: Pressure Transient Tests: Draw-down and Buildup test analysis, Horner's approximation.

Unit III: Gas Well Testing: Flow after flow testing, Isochronal testing, Modified Isochronal testing

Unit IV: Injection well testing, Multiple well testing, Interference testing, Pulse Testing, Pressure fall-off test in injection wells, Multilayer reservoirs.

Unit V: Type curves and its uses, well test analysis by use of Type curves, Drill Stem Testing: Equipment, DST chart observation and preliminary interpretation, Pressure derivative curve.

Text/Reference Books -

1. Pressure Transient Test- SPE
2. Well Testing- John Lee
3. Pressure Buildup and Flow Tests in Wells – C. S. Matthews and D. G. Russell
4. Advances in Well Test Analysis – Robert C. Earlougher

SUBJECT: PETROLEUM EXPLORATION - I

PE-CEIv.-1604-1

3L-0T-0P: 03Credits

1. Surface indications of subsurface oil and gas accumulations.
2. Oil accumulation parameters.
3. Time of accumulation vis-avis time of oil generation.
4. Exploration Philosophy and Principles. Stages and norms of exploration.
5. Geological techniques and procedures of petroleum exploration. Geological mapping
6. Geochemical methods of prospecting: Soil geochemical surveys; Hydro-geochemistry as a tool for oil exploration.
7. Source rock types, Kerogen types, maturation & significance, Source rock characterization: Rock Eval Pyrolysis, Vitrinite Reflectance, Thermal Alteration Index (TAI), Total Organic Carbon (TOC), Carbon Ratio Method
8. Development Geology
9. Role of plate tectonics in Hydrocarbon accumulation onshore and offshore.
10. Application of AI and ML in Geosciences

TEXT/REFERENCE BOOKS:

1. Theoretical Principles of Exploration and Development of Oil & Gas Accumulation by Bakirov, A.D
2. Handbook for Prospectors by Richard M. Peaut
3. Petroleum Exploration Handbook by Moody, G.B.
4. Development and Exploration of Oil and Gas Fields by Peace Publishers, Moscow
5. New technologies for Exploration & Development of Oil and Gas Resources by Graham & Trotman
6. Petroleum Exploration and Exploitation Practices by Bhagwan Sahay
7. Petroleum Source Rocks by Barry Katz
8. New Technologies for the Exploration and Exploitation of Oil and Gas resources by Miller, Joulia Asselt & Angyris

SUBJECT: MICROPALAEONTOLOGY IN FOSSIL FUEL INDUSTRY

PE-CEIv.-1604-2

3L-0T-0P: 03Credits

1. Introduction to micropalaeontology, classification of microfossils
2. Introduction to different microfossils such as - foraminifera, calcareous nannofossils, palynomorphs, siliceous microfossils - radiolaria and diatoms.
3. Morphology, classification, evolution and geological distribution of important microfossil groups. Stratigraphic significance of different microfossils with special reference to India, Important Microfossils from NE India.
4. Concept of biostratigraphy, Concept of palynofacies and its application in paleoenvironment interpretation and fossil fuel industry.
5. Application of micropalaeontology to hydrocarbon exploration, appraisal and field development studies, assessment of reservoir trap evaluation and source rock evaluation

TEXT/REFERENCE BOOKS:

1. Micropalaeontology (2016). Pratul Kumar Sarawati & M. S. Srinivasan.

2. Introduction to Marine Micropaleontology. B.U. Haq, and A. Boersma, (eds.). 1978.. Elsevier, New York. 376 pp.
3. Micropalaeontology in Petroleum Exploration: Robert Wynn Jones, Oxford Science Publication
4. Palaeontology – An Introduction: E. W. Nield and V. C. T. Tucker, Pergamon Press
5. Applied Micropalaeontology: Ed. David Graham Jenkins, Kluwer Academic publishers

SUBJECT: ADVANCED DRILLING ENGINEERING

PE-1605

3L-0T-0P: 03Credits

1. Directional Drilling: Objectives, Types of deflection tools, tool orientation, Directional well profiles.
2. Well Monitoring: Well path deflection & correction. Down the hole surveying methods, Surveying Analysis Methods and Calculations of Three Dimensional well coordinates.
3. Surveying Tools: Single shot and multi shot survey tool, MWD & LWD tools, Telemetry system.
4. Down Hole Motors: Positive displacement motors and Turbo-drills - motor description, Power calculation and applications. Rotary Steerable system, Geo-steering tools.
5. Horizontal Well Drilling: Horizontal well objectives and selection, Different profiles, Drilling techniques etc.
6. Special Methods of Directional Drilling: Extended reach drilling, Multilateral drilling, coil tubing drilling, UBD, MPD.
7. Hole cleaning in high angled wells.
8. Application of AI and ML in On-shore drilling operations.

SUBJECT: NATURAL GAS ENGINEERING AND HYDROGEN ENERGY

PE-1606

3L-0T-0P: 03Credits

1. Gas from condensate and oilfields. Scope of Natural gas industry. Basic thermodynamic and system energy concepts in Natural Gas Engineering.
2. Physical properties of natural gas and hydrocarbon liquids associated with Natural gas. Reservoir aspects of natural gas.

3. Flow of fluids. Compression calculations. Heat Transfer and Mass Transfer principles and applications in Natural Gas Engineering.
4. Gas flow measurement. Process control and instrumentation in natural gas processing plants.
5. Natural Gas Processing. Field separation and oil absorption process. Refrigeration and low temperature processing. Liquefaction Process. Dehydration of Natural Gas sweetening of Natural gas and sulphur recovery, Processing for LPG, LNG, CBG, CNG, system.
6. Transmission of Natural Gas. Specifications. Utilization of Natural Gas. Underground storage and conservation of Natural Gas.
7. Unconventional gas: Coal Bed Methane, Natural Gas Hydrate. Insitu Coal Gasification.
8. Conversion of gas to liquid.
9. Hydrogen Energy
 - a. Basics of hydrogen properties and its energy
 - b. Hydrogen as a renewable energy source
 - c. Introduction to fuel cell
 - d. Hydrogen as green fuel
 - e. Hydrogen energy to fuel cell
 - f. Hydrogen economy
 - g. Hydrogen storage

Text/Reference Books –

1. Natural Gas: A Basic Handbook by J. G. Speight
2. Handbook of Natural Gas Transmission and Processing by Saeid Mokhatab, William A. Poe and James G. Speight
3. Natural Gas Engineering Handbook by Boyun Guo and Ali Ghalambor
4. Advanced Natural Gas Engineering by Michael Economides and Xiuli Wang
5. Standard Handbook of Petroleum and Natural Gas Engineering: Volume 1 & 2, (by William C. Lyons Ph.D. P.E
6. Working Guide to Petroleum and Natural Gas Production Engineering by William C. Lyons.

SUBJECT: PIPELINE ENGINEERING

PE-1607

2L-1T-0P: 03Credits

1. Transportation of petroleum & petroleum products.
2. Basics of pipeline construction, operation and protection.
3. Pump and compressor stations. Instrumentation and control.
4. Metering and measurements of oil and gas.
5. Traffic management, Fire and safety rules.
6. Indian and Global supply scenario of petroleum and petroleum products.
7. Storage of petroleum products in fixed installations. Standards and regulations.
8. Role of International oil companies and OPEC pricing mechanism.

Pipeline engineering

1. Objective and scope of pipeline as a means of fluid transportation with special reference to crude oil/gas/refined products, Economics of Pipeline transportation.
2. Design of Pipeline
3. Theory and different formulae of the flow of fluids in oil/gas pipelines; basic equations for the flow of fluids through pipes; different flow equations for laminar and turbulent flow of compressible and incompressible fluids (Newtonian); Introduction to the flow of Non-Newtonian fluids through pipes; multiphase flow and loop pipelines.
4. Construction of pipelines; materials; general equipment specifications (Pipes, valves and fittings); Pigging, Pigging Technology: pig launcher and receiver, types of pigs.
5. Corrosion protection and control; Design of cathodic protection system, Pipeline automation.
6. Offshore Pipeline: Description of stinger; and Riser, construction of offshore pipeline, Method of underwater welding.
7. Hydrates, wax & scale - formation and prevention. Crude conditioning and use of additives to improve flow conditions.

Text Book References-

1. Petroleum marketing practices and problems by William H. Day
2. Petroleum Transportation Handbook, By: Harold Sill Bell
3. The economics of petroleum, Author: Joseph Ezekiel Pogue
4. Fundamentals of Pipeline Engineering By Jacques Vincent-Genod
5. Pipeline engineering by Henry Liu
6. Petroleum Engineering Handbook, Vol. 3

SUBJECT: EOR LAB

PE-L-1601

0L-0T-1P:01Credits

1. To determine the Interfacial Tension of a given fluid.
2. To determine the Capillary Pressure of a given fluid.
3. To determine the Liquid Permeability of a given fluid in a given core sample.
4. To determine the Relative Permeability of Oil-Water system in a given core sample.
5. To determine the saturation of a given fluid in a given core sample.

**COURSE CONTENT
7TH SEMESTER**

SUBJECT: PETROLEUM EXPLORATION – II

PE-OEIV.-1701

3L-0T-0P: 03Credits

1. An overview of Exploration Geophysics: Geophysics as an exploration tool, brief accounts of different geophysical exploration methods
2. Gravity Survey Method: Salient features of Earth's gravitational field in relation to gravity exploration, Units of gravity, Gravity measuring instruments, Gravity anomalies, Gravity data reduction, Drift, Latitude, Elevation and Free-air correction. Bouguer anomalies, Concept of isostasy, Gravity anomaly maps. Gravity response of simple geometric shapes, Airborne gravity survey, Interpretation of gravity anomalies and application of gravity methods.
3. Magnetic Survey Method: The geomagnetic field, Types of magnetism, Magnetic anomalies. Magnetic survey instruments, Field method of magnetic surveys. Reduction of magnetic data, diurnal and geomagnetic correction, Magnetic response from buried magnetic bodies, Airborne magnetic survey, Interpretation of magnetic anomalies, Application of magnetic survey.

3. Basic concepts of Seismic Methods: Types of seismic waves, Properties of seismic waves, Effects of the medium on wave propagation, Field surveys arrangements. Seismic recording instruments and energy source. Types of seismic noise.

4. Different aspects of reflection and refraction seismic survey, Importance of seismic reflection survey over seismic refraction survey technique. Types of Spread , Selection of field parameters, Basics of 2D, 3D and 4D seismic data acquisition, seismic data processing, Vertical Seismic Profiling (VSP), Applications of seismic method in oil exploration.

References:

1. Geophysical Prospecting by Dobrin MiltonB.
2. Handbook for Prospectors by Richard M.Peaut
3. Petroleum Exploration Handbook by Moody,GB.
4. Handbook of Subsurface Geology by Moore,C.A
5. Electrical methods in Geophysical Prospecting by George V.Keller
6. New Technology in Exploration Geophysics, by H. Roices NelsonJr.
7. Outlines of Geophysical prospecting by Ramechandra Rao

SUBJECT: CORE ANALYSIS

PE-CEIv.-1702-1

3L-0T-0P: 03Credits

1. Coring Program: Objectives, Coring Tool, Core Types.
2. Core Sampling and Core Preparation: Introduction, Core Cutting, Core Plugging, End Facing, Core Cleaning, Core Drying, Core Preservations.
3. Core Analysis: Importance of Core Analysis, Conventional Core Analysis, Special Core Analysis.
4. Core Flooding: Importance of Core Flooding, Core Flooding methods, determination of Connate Water Saturation, Original Oil In Place (OOIP), Oil Recovery Efficiency, Residual Oil Saturation, Relative Permeability Curve.

Text Book References:

1. Recommended Practices for Core Analysis: Recommended Practice 40- American Petroleum Institute.
2. Core Analysis- Technica Petroleum Services Limited.
3. Experimental Reservoir Engineering Laboratory Workbook-O. Torsaeter and M. Abtahi

SUBJECT: ADVANCED PRODUCTION ENGINEERING AND MANAGEMENT

PE-CEIv.-1702-2

3L-0T-0P: 03Credits

Unit I: Production Enhancement: An overview of various production enhancement techniques, Well Analysis and Remedial Measures, Low Productivity – Stimulation, Excessive Production of unwanted fluid, Water Control, Sand Control, Production Optimization.

Unit-II: Stimulation: Concept of Formation damage, Type & description of Stimulation Techniques to mitigate formation damage problem and address issues of low productivity, Design of Matrix Acidization and Acid Fracturing. Design of Hydraulic Fracturing, Multistage Fracturing.

Unit III: Control of Excessive Production of fluids and solids: Reasons for excessive production of oil and gas, causes and hazards of excessive sand production, Water Control Techniques, Sand Control Techniques.

Unit IV: Production Optimization: Modelling, Monitoring and Control, optimization processes.

TEXT / REFERENCE BOOKS:

1. Dr. Guo Boyun, Computer-Aided Petroleum Production Engineering
2. H Dale Begg, Production Optimization, OGCI Publication, Tulsa.
3. Petroleum Engineering Handbook-Howard B. Bradley.

SUBJECT: OFFSHORE OPERATIONS

PE-1703

3L-0T-0P: 03Credits

UNIT I

Introduction to offshore oil and gas operations. Sea States and Weather: Meteorology, oceanography, ice, sea bed soil. Analyses of Sea environment: Wind, waves and current forces- Characteristics, analysis and force evaluation. Buoyancy and stability, Offshore platforms & their stability, Buoyant force calculation.

UNIT II

Offshore Fixed Platforms: Types, description, operations and installation, Bracing & framing patterns in offshore structures.

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, Corrosion in offshore structures and its protection.

UNIT VI

Application of AI and ML in Off-shore drilling operations.

BOOKS:

1. Handbook of offshore engineering, S. K. Chakrabarti, Volume 1 & 2, Elsevier, 2005.
2. Handbook of Offshore Oil and Gas Operations, James G. Speight, Gulf Professional Publishing, 2014.
3. Offshore Petroleum Drilling and Production, Sukumar Laik, CRC Press, Taylor & Francis Group,

4. Hydrodynamics of offshore structures, S. K. Chakrabarthy, WIT Press.
5. Matrix methods of structural analysis, P. N. Godbole, R. S. Sonparote, S. U. Dhote, PHI Learning Private Limited, 2014.

SUBJECT: PETROLEUM FORMATION AND EVALUATION

PE-1704

2L-0T-0P: 02Credits

1. Petrophysical measurements to sub-surface engineering.
2. Indirect Methods: SP and resistivity logs, radioactive logs, acoustic logs (principles, types of tools, limitation and applications). Evaluation of CBL/ VDL, USIT, SFT, RFT.
3. Production Logging: Introduction, type of tools, principles, limitations and applications.
4. Special Type of Logging Tools: Casing inspection tools (principles, application and limitation), Formation micro scanner (FMS), DSI, NMR logging principles. Logging in high-angle wells.
5. Log Interpretation and Analysis Techniques.
 - a) Standard log interpretation methods.
 - b) Cross-plotting methods: neutron-density, sonic-density and sonic-neutron etc.
 - c) Clean sand interpretation
 - d) Concepts of invasion – RXO, Tornado charts.
 - e) Shale sand interpretation.

Text Book References-

1. Well Logging II. Electric and Acoustic Logging- James R. Joeden, Frank L. Compbell
2. Encyclopedia of Well Logging- Robert Desbrandes
3. Geophysical Well Logging- J. P. Vaish

COURSE CONTENTS

8TH SEMESTER

SUBJECT: ENERGY ECONOMICS

PE-OElv.-1801-1

3L-0T-0P: 03Credits

1. Introduction to Energy, Primary and Secondary Energy Resources, Commercial and Non-Commercial Energy, Commercial Energy Production, Renewable and Non-Renewable Energy, Importance, limitations to primary sources.
2. Major Primary Energy Sources in India (Coal, Oil, and Natural Gas), nuclear energy, thermal energy, Commercial Energy and Non Commercial Energy, Primary Energy supply and Present Consumption Trend in India.
3. Energy Needs of Growing Economy, Long Term Energy Scenario (Future prospects of Gas Hydrates, CBM & Shale Gas etc in India), Energy Pricing in India.
4. Energy and Environment: Air Pollution, Climate Change, the Greenhouse Effect.
5. Energy Security, Energy Conservation and its Importance, Energy Strategy for the Future, Energy Conservation Act-2001 and its Features.
6. Statutory guidelines in Indian Energy Sector: Various statutory bodies of Indian Government involved with the entire energy sector in India such as DGH, OISD.

References:

1. Online Energy Journals/Publications
2. Government Guidelines
3. Published Papers
4. Energy Economics (2nd Edition), By Peter M. Schwarz
5. Handbook on the Economics of Renewable Energy by Pablo del Río and Mario Ragwitz
6. Energy Economics: Concepts, Issues, Markets and Governance Hardcover – by Subhes C. Bhattacharyya

SUBJECT: COMPUTATIONAL FLUID MECHANICS

PE-OELv.-1801-2

3L-0T-0P: 03Credits

Unit – I

Governing equations of fluid dynamics:

Substantial derivative, Divergence of velocity, continuity, momentum, energy equations. Physical boundary conditions. Forms of governing equation suited for CFD- shock fitting and shock capturing approach. Mathematical behavior of Partial difference equations- hyperbolic, parabolic and elliptic equations.

Discretization:

Finite difference method- Central, Forward, Backward difference for a uniform grid – Central difference expressions for a non-uniform grid - Numerical error - Accuracy of solution. Explicit and implicit approach. Errors and Stability analysis.

Grid Transformation:

Direct and In-direct transformation, Metric and Jacobians. Stretched grids, boundary fitted grids. Structured and unstructured grids.

Heat transfer:

Conduction Heat Transfer- Applications of Heat conduction - Steady and Unsteady conduction – numerical solutions of one and two dimensional steady and unsteady state problems.

Some simple CFD techniques:

Numerical solution of the incompressible Navier-Stokes equations: Stream function-vorticity formulation; Primitive variable formulation; Pressure correction techniques like SIMPLE, SIMPLER.

Texts/References:

1. Muralidhar, K., and Sundararajan, T., “Computational Fluid flow and Heat Transfer”, Narosa Publishing House.
2. Ghoshdasdar, P.S., “Computer simulation of flow and heat transfer”, Tata McGraw – Hill, New Delhi.
3. Anderson, D. A., Tannehill, J. L, and Pletcher, R.H., “Computational fluid mechanics and Heat Transfer”, Hemisphere Publishing Corporation.

4. John David Anderson, "Computational Fluid Dynamics: The Basics with Applications", McGraw Hill, New York

SUBJECT: OCCUPATIONAL HEALTH AND SAFETY

PE-1802

3L-0T-0P:03Credits

Unit-I : Health Hazards in Petroleum Production Refining and Utilization

1. Introduction to national and international safety and environment management.
2. 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.
3. Effect of corrosive atmosphere and additives during acidizing, sand control and fracturing jobs etc.

Unit –II: Safety System

1. Introduction to API grades and standards related to Petroleum Industry.
2. Hazards analysis, developing a safe process, failure mode analysis, safety analysis (API-14C) safety analysis function evaluation chart (synergic approach).
3. Manual & atmospheric shut down system, blow down systems.
4. Gas detection system
5. Fire detection and suppression systems.
6. Personal protection systems & measures.
7. HSE Policies, standards & specifications
8. Disaster & crisis management.
9. Qualitative and quantitative risk analysis techniques, safety practices in drilling, production and design of installation.
10. Safety regulation -mines act, oil mines regulation, petroleum rule, petroleum act, atomic ERB rules, explosive act, explosive rule, occupational health hazards in hydrocarbon industries.

Unit-III: Environment

1. Environment concepts, impact on eco-system, air, water and soil.
2. The impact of drilling & production operations on environment, Environmental transport of petroleum wastes.
3. Offshore environmental studies, offshore oil spill and oil spill control.
4. Oil mines regulations and other environmental legislations.
5. Environmental impact assessment.
6. Waste treatment methods, waste disposal method, remediation of contaminated sites.
7. Air & noise pollution.
8. Biodiversity.
9. **Application of AI and ML in Health, Safety, Security and Environment:** Role of AI and ML in Health, Safety, Security and Environment; Latest concerns HSSE; Improvement of outcomes using AI and ML.

Text/Reference Books -

1. Occupational Safety and Health for Technologists, Engineers, and Managers (7th Edition) (Alternative Etext Formats) by David L. Goetsch
2. Safety and Health for Engineers by Roger L. Brauer and Roger Brauer
3. Elements of Industrial Hazards: Health, Safety, Environment and Loss Prevention by Ratan Tatiya
4. Process Technology: Safety, Health, and Environment by Charles E. Thoma

SUBJECT: UNCONVENTIONAL ENERGY

PE-CEIv.-1803-1

3L-0T-0P: 03Credits

1. Introduction and present status of coal bed methane and shale gas- Global and Indian Scenario
2. Properties of coal bed methane: Generation of coal bed methane gas and its properties, Coal gas origin, Coal rank, Ultimate and Proximate analyses, Cleats etc.
3. Measurement of Coal bed Gas content: Direct methods, Lost gas, Residual gas etc.
4. Sorption of gases: Sorption isotherms, Langmuir's equation, under saturation.
5. Overview of Drilling and Production systems, well completion techniques, etc.s

SUBJECT: HEAT AND MASS TRANSFER

PE-CEIv.-1803-2

3L-0T-0P:03CREDITS

UNIT 1

Heat Transfer: Conduction: Steady-state and transient flow through various geometries, Convection: LMTD and NTU, overall heat transfer coefficient; Application of dimensional analysis to convection. Heat transfer rate and Heat transfer coefficient calculations. Double pipe parallel and counter-flow heat exchangers, natural and forced convection through tubes and outside tubes, Shell and tube heat exchanger, and finned tube heat exchanger; Boiling of liquids and condensation of vapours.

UNIT 2

Radiation: Radiation from black and real surfaces, radiation transfer between black and grey surfaces, view factor, radiation shield, and multi-sided enclosures., Thermal insulation, Economic and critical thickness of lagging.

UNIT 3

Mass Transfer: Diffusion in gases: Fick's law, determination and estimation of diffusion coefficient; diffusion through stagnant gas and equimolecular counter-diffusion. Diffusion in liquids: Mass transfer across phase boundaries, two-film theory and mass transfer coefficient.

UNIT 4

Gas Absorption, adsorption, Extraction and Distillation (flash and differential): Basic principles, laws, and calculations; Equilibrium, co-current and counter-current operations. Ideal stage concept and calculation of number of ideal stages; Efficiency; Packed bed and tray columns.

TEXT/REFERENCE BOOKS:

1. Coulson and Richardson's Chemical Engineering Vol-1, 6th Ed, Elsevier (Butterworth and Heinemann).
2. Warren L. McCabe, Julian C. Smith, Unit Operations of Chemical Engineering, McGraw Hill.
3. Donald Q. Kern, Process heat transfer, Tata-McGraw-Hill.
4. Badger and Banchero, Introduction to Chemical Engineering, McGraw-Hill