RAJASTHAN TECHNICAL UNIVERSITY

B.Tech. Petroleum Engineering

3PE1 FUNDAMENTALS OF MECHANICAL ENGINEERING

B.Tech. (Petroleum) 3rd semester **Max. Marks: 80**
3L **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Laws of thermodynamics:** Analysis of various thermodynamics processes, P-V and T-S diagrams.	4
	Analysis of air standard cycles. Carnot, joules, Otto, Diesel.	3
II	**Properties of fluids;** Classification; Ideal fluid, Newtonian and Non-Newtonian fluids; Newton's law of viscosity**.**	4
	Fluid Statics: fluid pressure and its measurement. Fluid Kinetics: Continuity equation; types of flow	4
III	**Fluid dynamics**: One dimensional equation of motion; Bernoulli's equation; application; application of Bernoulli's equation; venturimeter Orifice meter, Nozzle.	4
	Flow through pipes – Darcy – Weisbach's equation. Head loss in **P**ipes, **P**ipes in series**/ P**arallel	4
IV	**Classification of pump**: basic construction and application of different types of pumps (Centrifugal pump, **axial** pumps, Gear pump, Vane pump, Reciprocation pump and Screw pump)	5
	Classification, basic construction and applications of compressor(Centrifugal, axial, rotary vane type, Reciprocating and Screw compressor)	4
V	**Classification of I C Engine :** and performance of internal combustion engines,	4
	Turbines turbines - Gas, Steam and Hydraulic turbines	4
	TOTAL	**40**

TEXT BOOKS

1. Engineering Thermodynamics, P K Nag, Tata Mc Graw Hill.

REFERENCE BOOKS

1. Engineering Thermodynamics, Rogers and Mathew, Oxford
2. Fluid Mechanics by Cenegel and Cimbala McGraw Hill
3. Mechanics of Fluids, Shames, I.H., McGraw-Hill, Inc.

3PE2 BASIC PETROLEUM GEOLOGY

B.Tech. (Petroleum) 3rd semester **Max. Marks: 80**
3L **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Mineralogy and Petrology:** General properties of minerals and their classification, properties of common rock forming minerals; Petrology: classifications and descriptions of some common rocks.	4
	Stratigraphy: principles of stratigraphy; introduction to paleontology, fossils and their mode of preservation, significance as indices of age and climate; concept of index fossils, broad stratigraphic subdivisions and associated rock types of important coal belts and oil fields of India.	4
II	**Sedimentology:** sedimentary processes and sedimentary rocks, textures, lithification and diagenesis.	3
	Sedimentary Petrology: clastic and carbonate rocks, evaporites, coal and oil shales, heavy mineral studies.	3
	Sedimentary Environments: fluvial, lacustrine, deltaic, shorelines, carbonate platforms, deep sea fans and turbidites environments	3
III	**Structural Geology:** concept of stress and strain, deformation mechanism folding and faulting, their nomenclature, classification and recognition, joints and fractures, foliation / cleavage and lineations	5
	Shear zone; unconformity, salt domes, plate tectonics and basin formation, effects of folds, faults and fractures on strata and their importance in exploration activities, mapping techniques, forms of igneous intrusions - dyke, sill and batholiths,	4
IV	**Nature of petroleum and natural gas** – composition & properties; Origin and occurrence of hydrocarbons and their deposition: source, migration and accumulation of oil and gas; trapping mechanisms; reservoir characteristics: porosity, permeability, saturation	6
	Concept of pressures in the rocks; petroleum provinces in India	2
V	**Geological Exploration Methods:** – surface indications and surveys; regional structural settings, geochemical surveys; basin analysis	3
	Interpretation of topographic maps; Attitude of planar and linear structures; Effects of topography on outcrops.	3
	TOTAL	40

TEXT BOOKS

1. Geology of Petroleum, A.I. Levorsen, CBS Publisher, 2nd Edition, 2006.

REFERENCE BOOKS

1. Basic Petroleum Geology, Peter K. Link, 3rd Edition, 1987. OGCI, TULSA.
2. Petroleum Formation and occurrence ,Tissot B.P and Welte D.H, 2nd Edition,

3. Petroleum Geology, North F.K., Allen & Unwin , London ,1985.
4. Geological Techniques for Petroleum, Sahay B, Rai A. and Ghosh M.

3PE3 FUNDAMENTALS OF GEOPHYSICS

B.Tech. (Petroleum) 3rd semester **Max. Marks: 80**
3L **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Reflection Seismics:** Fundamental of wave theory. The fourier transform and spectra, common relationship, data processing, seismic data acquisition principle	5
	Information from seismic trace. Frequency filter, de-convolution.	4
II	**Seismic Data Analysis and Intrepretation:** Seismic tools, stacking, Velocity analysis, seismic trace attribute, data migration, Seismic data inversion.	6
	Cyclicity sedimentation, Seismic and stratigraphy, seismic and structure	3
III	**Gravity**: Units of gravity. Gravity measuring instruments. Gravity survey, Gravity anomalies. Gravity data reduction Drift, latitude, Elevation and Free-air correction.	4
	Free air & Bouguer anomalies. Gravity response of simple shapes. Interpretation of gravity anomalies. Application of gravity methods.	3
IV	**Geo- magnetism**: The geomagnetic field. Magnetic anomalies. Magnetic survey-instruments. Field method of magnetic surveys. Reduction of magnetic data.	4
	Diurnal correction and geomagnetic correction. Interpretation of magnetic anomaly. Response of magnetic method for different type of bodies and geological structure. Application of magnetic survey. .	3
V	**Refraction Surveys:** Active and passive seismics, Seismic refraction surveys, Geometry of refracted path, planar interface. Birefringence. Two layer case with horizontal interface.	4
	Methodology of refraction profiling. Field surveys arrangements. Recording instruments & energy sources. Corrections applied to refraction data. Role of Vp and Vs components. Other methods of refraction shooting such as Fan shoot and Board side shooting. Interpretation of refraction data. Application of seismic refraction method	4

	TOTAL	**40**

TEXT BOOKS

1. Fundamentals of Geophysics, Lowri, W., Cambridge University Press. (1997).

REFERENCE BOOKS

1. Introduction to Geophysical Prospecting, Dobrin M.B., New York, McGraw-Hill, Inc.
2. Basic Exploration Geophysics, Robinson, E.S. and Coruh C., John Willey and sons, New York,1998.
3. Applied Geophysics, Telford,W.M. ,Geldart L.P., Sheriff, R.E., Keys, D.A. (1990).
4. The solid Earth , Fowler.
5. Seismic Interpretation: The Physical Aspect, Anstey N.A., Boston, IHRDC.

3PE4 DRILLING FLUIDS AND CEMENTING TECHNOLOGY

B.Tech. (Petroleum) 3rd semester **Max. Marks: 80**
3L **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Drilling Fluids**: Overview of drilling fluids, clay chemistry and its application to drilling fluids, types of clays, hydration, flocculation, aggregation and dispersion. Classification, types and applications of drilling fluids:	**5**
	Water based, oil based, emulsion based, polymer based, surfactant based, foam based and aerated drilling fluids. Criteria of selection of drilling fluid additives and salinity of drilling fluids. .	**4**
II	**Drilling Fluid Characteristics**: Basic functions, properties, maintenance and treatments of drilling fluids. Drilling fluid requirement calculations. Role of formation pressure, mineralogy & petrology in designing drilling fluid. Rock texture and its relation with drilling fluids.	**5**
	Design of technology specific drilling fluids for, environmentally sensitive areas, horizontal\ERD wells, HP-HT wells and depleted reservoirs	**4**
III	**Cementing:** Cements: Cementing, cements & cement slurry: objectives of cementing, oil well cements. Classification of cement, slurry design, slurry additives, factors influencing cement slurry design.	**5**
	Cementing equipment. Factors influencing cement rise behind casing and its bridging with rock and casing	**3**
IV	**Cement formulation and testing:** Testing and performance evaluation of cement and cement additives, Framing of specifications for developed additives, Design of cement	**4**

	slurries for casing cementation	
	Formulation/Design of cement slurries for low temperature areas, loss prone areas, depleted reservoirs, quality control of cementing process	**3**
V	**Cementing Methods** Cementing Methods: Primary cementing, stage cementing, liner cementing, plugging, squeeze cementing techniques in practice.	**3**
	Deep well cementing, squeeze jobs, prevention of gas channeling , HT-HP environments, analysis and techniques of evaluation of cement job. Characteristics of good quality cementation. Cementing calculations	**4**
	TOTAL	**40**

TEXT BOOKS

1. Well Engineering and Construction, H. Rabia

REFERENCE BOOKS

1. Drilling and Drilling Fluids (Developments in Petroleum Science) G. V. Chilingarian and P. Vorabutr.

2. Advanced Drilling and Well Technology, Edited by Bernt Aadnoy, Iain Cooper, Stefan Miska, Robert F. Mitchell, and Michael L. Payne, 2009, ISBN:9781555631451, Society of Petroleum Engineers.

3. Well Cementing- Erik B.Nelson, Developments in Petroleum Sciences, Schlumberger.

4. Handbook of Drilling Technology, Terms & Phrases , S.M. Malhotra

3PE5 DRILLING TECHNOLOGY –I

B.Tech. (Petroleum) 3rd semester **Max. Marks: 80**
3L +1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction to Drilling:** Drilling techniques in onshore, shallow, offshore and deep sea environments. Types of wells, vertical, inclined, ERD, cluster and horizontal.	3
	Types of rigs: mobile, stationary on land, jack-up offshore and floating offshore. Criteria of selection (technical requirement and technology available).	3
	Drill bits: Drill bit types and criterion of selection	2
II	**Geological considerations in Drilling:** Anticipatory/precautionary measures, Geo-technical order (GTO), drilling through sub-hydrostatic, hydrostatic and super-hydrostatic zones. DST.	4
	Advanced Techniques in Drilling: Directional drilling, MWD, Steering motors, intelligent bits and real time surface read-outs.	4
III	**Risks and its Prevention:** Risk analysis, precursors of blowout. Prevention and safety. Environmental issues. Overbalanced and underbalanced drilling. Thief zone, mud loss calculation.	5
	Drilling Effects on Reservoir Effect of drilling on formation evaluation, reservoir engineering calculation and well stimulation	3
IV	**Casing and Well Completion** Casing types and design, Types of well completion techniques, smart well completion, multi-string, slotted liner, stringer liner, sliding sleeve and bare foot completion.	5
	Criteria of selection and limitation. Selective perforation and perforation through tubing.	4
V	**Other Considerations While Drilling** Mid-course correction, dog-legs, window cutting, side tracking and coring. Advantages and disadvantages in maintenance repair and reservoir studies in different types of wells.	4

	Reservoir perspective of drilling and completion. Cost analysis of drilling and its role in field development plan.	**3**
	TOTAL	**40**

TEXT BOOKS

1.Horizontal and Directional Drilling (HDD): Utility and Pipeline Applications (Civil Engineering); David Willough. Mc Graw Hill.

REFERENCE BOOKS

1. Petroleum Engineering Drilling & Well completion, Carel Gatlin. Prentice Hall.
2. Introduction to Petroleum Production Vol.I, II, III, Dr. Skimmer.

3PE6 ADVANCED ENGINEERING MATHEMATICS-I

COMMON WITH 3PCE1

B.Tech. (Petroleum) 3rd semester **Max. Marks: 80**
Hours per week: 3L +1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**LAPLACE TRANSFORM -** Laplace transform with its simple properties, applications to the solution of ordinary and partial differential equations having constant coefficients with special reference to the wave and diffusion equations.	**10**
II	**FOURIER SERIES & Z TRANSFORM –** Expansion of simple functions in Fourier series. Half range series, Change of intervals, Harmonic analysis. Z TRANSFORM **-** Introduction, Properties, Inverse Z Transform.	**7**
III	**FOURIER TRANSFORM -** Complex form of Fourier Transform and its inverse, Fourier sine and cosine transform and their inversion. Applications of Fourier Transform to solution of partial differential equations having constant co-efficient with special reference to heat equation and wave equation	**8**
IV	**COMPLEX VARIABLES -** Analytic functions, Cauchy-Riemann equations, Elementary conformal mapping with simple applications, Line integral in complex domain, Cauchy's theorem. Cauchy's integral formula. .	**8**
V	**COMPLEX VARIABLES -**Taylor's series Laurent's series poles, Residues, Evaluation of simple definite real integrals using the theorem of residues. Simple contour integration	**7**
	TOTAL	**40**

TEXT BOOKS

1. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley India, New Delhi

REFERENCE BOOKS

1. Mathematics for Engineers, Chandrika Prasad, Prasad Mudranalya, Allahabad
2. Advanced Mathematics for Engineers, Chandrika Prasad, Prasad Mudranalya, Allahabad
3. Higher Engineering Mathematics, B V Ramana, Tata McGraw Hill

List of experiments for III Semester Labs

3PE7 Drilling Fluids and Cementing lab

B. Tech. (Petroleum Engineering) Max. Marks: 100
Hours per Week:3

1. Measurement of mud weight
2. Measurement of mud density.
3. Measurement of mud plastic viscosity.
4. Measurement of gel strength.
5. Determination of filtration loss
6. Determination of Sand content
7. Determination of consistency of cement slurry.
8. Determination of the setting points of the cement based slurries.

3PE8 DBMS LAB

B. Tech. (Petroleum Engineering) Max. Marks: 100
Hours per Week:2

Objectives: At the end of the semester, the students should have clearly understood and implemented the following:
1. Stating a database design & application problem.

2. Preparing ER diagram
3. Finding the data fields to be used in the database.
4. Selecting fields for keys.
5. Normalizing the database including analysis of functional dependencies.
6. Installing and configuring the database server and the front end tools.
7. Designing database and writing applications for manipulation of data for a standalone and shared data base including concepts like concurrency control, transaction roll back, logging, report generation etc.
8. Get acquainted with SQL.

In order to achieve the above objectives, it is expected that each students will chose one problem. The implementation shall being with the statement of the objectives to be achieved, preparing ER diagram, designing of database, normalization and finally manipulation of the database including generation of reports, views etc. The problem may first be implemented for a standalone system to be used by a single user. All the above steps may then be followed for development of a database application to be used by multiple users in a client server environment with access control. The application shall NOT use web techniques. One exercise may be assigned on creation of table, manipulation of data and report generation using SQL.

Suggested Tools:

For standalone environment, Visual FoxPro or any similar database having both the database and manipulation language may be used.

For multi-user application, MYSql is suggested. However, any other database may also be used. For front end, VB.Net, Java, VB Script or any other convenient but currently used by industry may be chosen.

Indicative List of exercises:

1. Student information system for your college.
2. Student grievance registration and redressal system.
3. A video library management system for a shop.
4. Inventory management system for a hardware/ sanitary item shop.
5. Inventory management system for your college.
6. Guarantee management system for the equipments in your college.

3PE9 Energy and Geopolitics

B. Tech. (Petroleum Engineering) Max. Marks: 75

Hours per Week:2

1. Basic concepts of demand, supply and pricing; price and output determination under perfect competition, derivation of the supply function, price and output determination under monopoly, oligopoly, and monopolistic competition
2. Energy and society: Social, economic, political and environmental dimensions of energy
3. Major types and sources of energy at the global and at the national level
4. Reserves and resources of petroleum, coal and nuclear minerals: Globally and in India
5. Other resources of energy: Hydroelectric power, solar energy, wind, wave, and biomass based energy
6. Energy sources and power generation: Thermal, nuclear, hydroelectric, solar, wind and wave; relative merits and demerits including conversion efficiency, generation cost and environmental impact, clean coal initiatives
7. Power transmission and distribution
8. Carbon sequestration, coal gasification, CBM, Shale gas, gas hydrates: current status and future prospects

9. Solar energy, hydrogen energy, and fuel cells: current status and future prospects
10. Carbon credits and its impact on hydrocarbon business
11. International oil markets, developments of Indian oil industry
12. NELP (New Exploration Licensing Policy), Mines rules and regulations
13. Pipelines: Current status and future prospects
14. LNG, CNG and other forms of natural gas: global and Indian scenario
15. Global energy politics

3PE10 Programming Lab

B. Tech. (Petroleum Engineering) Max. Marks: 75
Hours per Week:2

Programming in C++

1. To write a simple program for understanding of C++ program structure without any CLASS declaration. Program may be based on simple input output, understanding of keyword using.
2. Write a C++ program to demonstrate concept of declaration of class with public & private member, constructors, object creation using constructors, access restrictions, defining member functions within and outside a class. Scope resolution operators, accessing an object's data members and functions through different type of object handle name of object, reference to object, pointer to object, assigning class objects to each other.
3. Program involving multiple classes (without inheritance) to accomplish a task. Demonstrate composition of class.
4. Demonstration Friend function friend classes and this pointer.
5. Demonstration dynamic memory management using new & delete & static class members.
6. Demonstration of restrictions an operator overloading, operator functions as member function and/ or friend function, overloading stream insertion and stream extraction, operators, overloading operators etc.
7. Demonstrator use of protected members, public & private protected classes, multilevel inheritance etc.
8. Demonstrating multiple inheritance, virtual functions, virtual base classes, abstract classes

3PE11 DECA

4PE1 Advanced Engineering Mathematics-II

COMMON WITH 4PCE1

B.Tech. (Petroleum) 4th semester **Max. Marks: 80**
3L+1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**NUMERICAL ANALYSIS** - Finite differences – Forward, Backward and Central differences. Newton's forward and backward differences, interpolation formulae. Stirling's formula, Lagrange's interpolation formula.	8
II	**NUMERICAL ANALYSIS**- Integration-Trapezoidal rule, Simpson's one third and three-eighth rules. Numerical solution of ordinary differential equations of first order - Picard's mathod, Euler's and modified Euler's methods, Miline's method and Runga-Kutta fourth order method.,Differentiation	8
III	**SPECIAL FUNCTIONS** – Bessel's functions of first and second kind, simple recurrence relations, orthogonal property of Bessel's , Transformation, Generating functions, Legendre's function of first kind. Simple recurrence relations, Orthogonal property, Generating function	7
IV	**STATISTICS AND PROBABILITY** - Elementary theory of probability, Baye's theorem with simple applications, Expected value, theoretical probability distributions-Binomial, Poisson and Normal distributions. Lines of regression, co-relation and rank correlation	9
V	**CALCULUS OF VARIATIONS** - Functional, strong and weak variations simple variation problems, the Euler's equation	8
	TOTAL	40

TEXT BOOKS

1. Numerical Method for Engineers:- Canal & Chapra, Mc Graw Hill.

REFERENCE BOOKS

1. Introduction to Numerical Analysis:- Sastry SS
2. Statistics for Geologists Ed. II by John C. Davis, Pub. John Wiley & Sons
3. Statistics for Petroleum Engineers and Geoscientists, by Jerry.J., Larry W. Lake, Patrick W.M., Corbett and David J. Goggin, Elsevier.

4PE2 FLUID FLOW THROUGH POROUS MEDIA

B.Tech. (Petroleum) 4th semester **Max. Marks: 80**
3L+1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Properties of Reservoir Fluids:** Chemical composition of oil and gas. Physical properties of reservoir fluids. Thermodynamics of reservoir fluids. Gas deviation factor, compressibility and formation volume factor.	**4**
	Density and viscosity of reservoir fluids under changing temperature and pressure. Dew point, saturation pressure, bubble point pressure. Concept of pseudo- temperature and pseudo-pressure.	**4**
	PVT analysis of reservoir fluids.	**2**
II	**Introduction to Reservoir rocks and Geology** Physico-chemical properties of reservoir rocks. Rock compressibility. Rock texture and mineralogy. Absolute and effective permeability, relative permeability. Core analysis, Log interpretation	**6**
III	**Static to Dynamic Model of Reservoir** Saturation of reservoir fluids. Wettability of reservoir rocks. Capillary pressure behavior and its effect on different rock and fluid flow properties.	**4**
	Integrated rock-fluid modeling. Historical account of modeling reservoir permeability.	**3**
IV	**Modelling of flow:** Darcy's law, its boundary conditions and modification for petroleum system. Darcy's model, Bernoulli's model, Kozeny's model, Kozeny-Carman's model, Hydraulic Flow-Unit approach.	**4**
	Tortuosity & core analysis vs hyper-Darcy flow and its impact on well performance and reservoir stability.	**4**
V	**Reservoir Flow Behaviour** Dynamic and static flow regimes of fluids in proximal part of wellbore and in distal parts of reservoir. Selective and fractional flow of reservoir fluids in porous media.	**6**
	Diffusivity equation and fluid front advancement.	**3**
	TOTAL	**40**

TEXT BOOKS

1. Reservoir Engineering Handbook by Tarek Ahmed, Gulf Professional Publication.

REFERENCE BOOKS

1. Well logging and Reservoir Evaluation by O. Serra ISBN-978-2-7108-0881-7. TECHNIP
2. Fundamental of Well Log Interpretation - O Serra, Elsevier Science Publishing Co., ISBN 0-444-42132-7.TECHNIP.

4PE3 RESERVOIR ENGINEERING FUNDAMENTALS (L – 3)

B.Tech. (Petroleum) 4th semester **Max. Marks: 80**
3L+1T **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Rock Properties** Fundamental of rock properties: Porosity, saturation, testability, surface and interfacial tension	3
	Capillary pressure, permeability, rock compressibility, net pay thickness, reservoir heterogeneity	3
II	**Phase behavior** Equation of States (EOS), its boundary conditions and functionalities.	3
	In case gas reservoirs, ways to determine whether it is retrograde condensation reservoir or normal. Processing of thermodynamic data to carry out P/Z analysis. Ways to probe if gas is associated with oil lag and/or with aquifer water	5
III	**Material Balance Equation** Material Balance Equation (MBE), its way of working and boundary limits. Determination of IOIP and/or IGIP. Quantification of operating drive indices.	6
	Refinement of reservoir model by sensitivity analysis and history match by MBE. Buckley Leverette theory.	4
IV	**Reservoir drives**: Insitu drive, Gas cap drive, Water drive, Mixed drive.	6
	Decline curve analysis.	2
V	**Reservoir Surveillance** Monitoring fluid flow, pressure, GOR, Water-cut and advancement of fluid front. Mid-course correction scheme design and implementation whenever required.	4

	Concept of in-fill drilling and secondary recovery and optimization of development plan. Techno-economic analysis for optimized production and recovery strategy.	**4**
	TOTAL	**40**

TEXT BOOKS

1. Fundamental of Reservoir Engineering, L.P. Dake, Elsevier, 1978.

REFERENCE BOOKS

1. Applied Petroleum Reservoir Engineering, B.C. Craft, M. Hawkim, Prentice Hall, 1991.
2. Reservoir Engineering Handbook by Tarek Ahmed, Gulf professional Publication
3. Reservoir Engineering Manual- F W Cole, gulf Publication Co. 1961.

4PE4 SURVEYING (L-3)

B.Tech. (Petroleum) 4th semester **Max. Marks: 80**
Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	Introduction to Surveying: Objective of surveying and its importance, Classification, principles of surveying, Application of Surveying in various fields of Engineering.	**4**
	Linear measurements : Conventional Instruments for measuring distances, ranging and chaining out of survey lines, Obstacle in chaining and errors in chaining, corrections Principles, offsets, booking field notes, problems.	**4**
II	Angular measurements: Principle and constriction of prismatic compass	**5**
	Bearing of lines, local attraction, magnetic declination and examples	**3**
III	Theodolite: The essentials of transit theodolite, definition and terms, temporary adjustments, measurement of horizontal and vertical angles,	**4**
	Different operations and sources of error, theodolite traversing, Omited Measurements.	**4**
IV	Leveling instruments : Definition, different type of leveling instruments, curvatures and refraction corrections, reciprocal leveling, errors in leveling and problem solving.	**4**
	Contouring : General, Contour Interval, Characteristics, Methods of locating contours, Interpolation etc	**4**

V	Linear measurements (EDMs): Theory and characteristics of electromagnetic waves, radio waves, infra red, laser waves, principle of distance measurement with EDMs	**4**
	Total Station : Principle, working and construction. Corrections to be applied. Global Positioning System (GPS) : Theory, principles and applications	**4**
	TOTAL	**40**

TEXT BOOKS

1.Basic Surveying: Walter S. Whyte, R. E. Paul, Elsevier Science & Technology

.

REFERENCE BOOKS

1. GPS for Land Surveyors, Jan Van Sickle, Denver, Colorado, USA, CRC Press, Third Edition.
2. Surveying Vol. I B.C. Punmia
3. Surveying Vol. II B.C. Punmia

4PE5 PETROLEUM EXPLORATION AND PROSPECTING (SEISMIC) (L-3)

B.Tech. (Petroleum) 4th semester **Max. Marks: 80**

Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Fundamentals of Seismic data processing** Sound wave- P and S wave components, reflectivity series, impedance, amplitude and synthetic seismograms	**4**
	Multichannel Operations two dimensional filters: Introduction, signal and noise component, Fourier transform, design, frequency relationship, filter operation, CDP Trace gather filtering, time domain operations	**4**
	Velocity Analysis: NMO, Interval velocity, RMS velocity, constant Velocity Stack, Stacking velocities, Check shot well survey, sonic logs.	**3**
II	**Seismic migration** Migration: General principal, diffraction, Velocity compensation, wave equation migration, K/F Migration	**3**

	Attribute analysis Seismic trace attribute: Attribute mapping, bright spot, data processing consideration, frequency mapping, Hilbert transform, Instantaneous amplitude, phase and frequency, Interpretation.	**4**
III	**Seismic data interpretation** Structural analysis through seismics. Time to depth conversion, its limitations and strength. Subjectivity in picking faults through seismics.	**4**
	Coherency cube. Bed thickness vs. seismic response. Tuning thickness and seismic resolution. Statistical enhancement of seismic resolution	**3**
IV	**Effects of fluid on seismic** Direct Hydrocarbon Indicators (DHI). Impedance and inversion. Relation of rocks and fluids on seismic signature: Biot-Gassmann Equation, AVO effect.	**6**
	Uncertainties in predicting reservoir parameters through seismic only. Scale and resolution problems of seismics.	**4**
V	**Seismic in reservoir monitoring** 2D, 3D and 4D seismic analyses. Techniques of data acquisition and processing. Seismic attributes and uses	**5**
	TOTAL	**40**

TEXT BOOKS

1.The Nature of Digital Seismic Processing, Roy O. Lindseth, Calgary, Alberta, Canada

REFERENCE BOOKS

1. Seismic Stratigraphy, Basin Analysis and Reservoir Characterization, (Handbook of Geophysical Exploration: Seismic Exploration, vol. 37) Paul C.H. Veeken; Elsevier

4PE6 FUNDAMENTALS OF WELL LOGGING TECHNOLOGY (L- 3)

B.Tech. (Petroleum) 4th semester **Max. Marks: 80**
Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction to Well Logging** Methods of gathering formation evaluation data: Mud logging, Coring, MWD, Open hole logging, cased hole logging, Modern logging techniques.	**5**

	Wire line logging operations: Logging truck, cable, tools, borehole environment, choosing a logging suite, log quality control	**3**
II	**Rock Properties** Methods of analysis and application of results: The genesis of Reservoir Rocks, Fluid Distribution in the Reservoir, Relative Permeability, Measurement of Porosity, Measurements of Permeability, Measurements of Saturation.	**4**
	Basic concepts of Log Analysis: Lithology, Porosity, Water Saturation, Hydrocarbon Type, Pay counting, Permeability. Reserve Estimation: Oil and Gas-In-Place Estimates, Reserve estimates, Factors, Formation Volume Factors, Reservoir Volumes.	**4**
III	**Open hole Logging Measurements**: The SP Log, The Gamma Ray Log, Resistivity Measurements, Induction Logging, Latero log, Micro resistivity Log, Dielectric Logs, Sonic (Acoustic) Logging And Elastic	**5**
	Formation Properties, Formation Density Log, Neutron Logs, Dipmeter Surveys. High tech tools introduction and their utility: FMI, DSI, MDT, LWD, ECS and CMR	**3**
IV	**Analysis Of Logs And Cores:** Compatibly Scaled Overlays, Cross plots, Histograms, Quick look Algorithm, Porosity Estimation From Neutron	**4**
	Cross Plots: Density Logs, Sonic Logs Using Various Cross plot And Overlay Techniques, Lithology Identification From Various Cross plots And Other Types Of Plots.	**4**
V	**Water Saturation and Archie Equation:** Rw Determination Using SP Log, Ratio Techniques, Crossplots, F Overlay Techniques and from chemical analysis. Water Saturation: Basic Archie's Equation, Saturation Exponent-n And Formation Factor-m For Clean Formation.	**4**
	Core Analysis: Sample Selection And preparation, Measurement Of Basic Rock Properties, Effect Of Overburden Pressure, Measurement Of Capillary Pressure, Petrographic And Other Measurements.	**4**
	TOTAL	**40**

TEXT BOOKS

1.Open Hole Log Analysis and Formation Evaluation by Richard M. Bateman

REFERENCE BOOKS

1. Modern Open Hole Log Interpretation, John. T. Dewan

2. Well Logging Data Acquisition and Application O&L Serra ISBN-978295156125, TECHNIP.
3. Handbook of Well Log Analysis, S.J. Pirson
4. Log Interpretation Principles and Applications, Schlumberger Educational services.

List of Experiments for Labs of IV Semester

4PE7 NUMERICAL &STATISTICAL METHODS LAB

B. Tech. (Petroleum Engineering) IV th semester Max. Marks: 75
Hours per Week:2

A. Numerical Methods:
1. Numerical solution of non-linear algebraic and transcendental equation by bisection, iteration, false position, secant and Newton Raphson methods.
2. Numerical solution of system of linear simultaneous equations by Gauss elimination and Gausss Seidel methods.
3. Interpolation by Lagrange's interpolation formula. R.T..

4. Numerical evaluation of definite integral by Trapezoidal, Simpson's 1/3rd, Simpson's 3/8th, Weddle and Gaussian quadrature formulae.
5. Numerical solution of first order ordinary differential equation by Euler's,
Modified Euler's, second and fourth order Runge-Kutta, Adams-Moulton and Milne's methods.
B. Scope of practice sessions:
Computation of raw moments, central moments, coefficient of variation, coefficients of skewness and kurtosis; Fitting of straight line, second degree polynomial (parabola), power curve and exponential curve; Computation of product moment correlation, multiple and partial correlation coefficients; Regression coefficients and regression lines, plane and regression. Application of tests of significance based on numerical data.

4PE8 SURVEYING LAB

B. Tech. (Petroleum Engineering) IV th semester Max. Marks: 100
Hours per Week:3

1. Ranging and Fixing of Survey Station.
2. Plotting Building Block by offset with the help of cross staff.
3. To determine the magnetic bearing of a line
a. Using surveyor's compass b. Using prismatic compass
4. Measurement and adjustment of included angles of traverse using prismatic compass.
5. To determine the reduced levels using Tilting Level.
6. To determine the reduce levels in closed circuit using Dumpy Level.
7. Prepare contour map by levelling.
8. Measurement of horizontal angle.
a. By method of repetition.
b. By method of Reiteration.
9 Use and application of GPS for surveying.
10. Use and applications of Total Station.

4PE9 PETROLEUM GEOLOGY LAB

B. Tech. (Petroleum Engineering) IV th semester Max. Marks: 75
Hours per Week:2

1. Identification of Materials by Visual Inspection
2. Physical Properties of Minerals
3. Physical Properties of Rocks
4. Identification of Minerals in Hand Specimen
5. Identification of Rocks in Hand Specimen
6. Identification of Geological features through wooden Models

a) Structural Geological Diagrams
b) Petro logical Diagrams
c) Engineering Geological Diagrams

7. Structural Geology: Plotting of Dip-Strike data: Three point problems in toposheets: contour maps and profiling: Geological maps of folded, faulted and fractured regions, Cross section preparation.

8. Dip & Strike Problems (8 Nos.)

9. Field visits for sediment logical and sedimentary basin and analysis practices.

4PE10 RESERVOIR ENGG. LAB

B. Tech. (Petroleum Engineering) IV th semester Max. Marks: 100
Hours per Week:3

1. Determination of porosity of rock samples by helium porosimeter
2. Determination of porosity of rock samples by Ruska porosimeter.
3. Determination of permeability (using both gas and liquid).
4. Determination of surface tension of various Petroleum fractions.
5. Ternary phase diagram with oil fraction/water/alcohol.
6. Log-simulator.
7. Using production vs. time data and decline curve analysis method, computation of :
8. Amount of initial gas in place and gas reserves, if R.F. is 70%
9. Total gas reserve
10. Using chart scanner and a recorded bottom hole, built-up chart and production data before shut down compute permeability and skin.

4PE11 DECA

Third Year B. Tech. (V th Semester) Petroleum engineering

5PE1 Renewable Energy Resources

B.Tech. (Petroleum) 5th semester **Max. Marks: 80**

L3 **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Solar Energy** Introduction to renewable energy and its importance in context of global warming.	**5**
	Solar radiation, solar thermal energy systems: active and passive systems, concentrating collectors, solar flat plate collector, solar thermal energy storage, photovoltaic cells and their arrangements.	**3**
II	**Biomass Energy** Energy from biomass and solid wastes: thermal route-pyrolysis and gasification, biochemical route-ethanol production, refuse derived fuel.	**3**
	Biofuels, Jatropha, Bio-diesel, Biogas production and storage. Examples of failures and successes of biofuels, say with case studies of Brazil and USA.	**5**
III	**Wind Energy** Wind energy: types of turbines and principles of operation, OTEC, Wave and tidal energy,	**4**
	Geo-thermal energy, hydrothermal energy. Case Studies of India and Netherlands	**4**
IV	**Fuel Cells** Fuel cells, basic design, types Hydrogen Energy, Economics of hydrogen production methods and storage and transportation. Applications	**8**
V	**Environmental Aspects** Environmental consequences of various renewable energy resources. Energy management: Energy efficiency, Energy audit, Energy conservation.	**4**
	Energy policy. Examples of Electric vehicles as part of energy and transportation policy of California and Brazil	**4**
	TOTAL	**40**

TEXT BOOKS

1.Principles of Solar Engineering, Kreith, F. and Kreider, J.F., McGraw-Hill, 1978

REFERENCE BOOKS

1. Solar Energy Handbook, Kreider, J.F. and Kreith, F., McGraw-Hill 1981.
2. Alternative Energy Sources, T.N. Veziroglu, Vol 5 and 6, McGraw-Hill, 1978.
3.Non-conventional Energy Resources, Khan, B.H., Tata McGraw Hill, New Delhi, 2008.
4. Solar Energy: Principles of Thermal Collection and Storage", Sukhatme, S.P., Tata McGraw-Hill, NewDelhi, 1984.
5. Solar Engineering of Thermal Processes, Duffie, J. A. and Beckman, W. A., John Wiley
6. "Renewable Energy, Sorensen, B., Academic press, New York, 2/e, 2000.

5PE2 Health Safety and Environment

Common with 5PCE6

B.Tech. (Petroleum) 5th semester **Max. Marks: 80**
L3 **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Importance of Safety** Industrial safety and loss trends, safety and environmental concerns, development of industrial safety and loss prevention approaches – loss prevention, total loss control, quality assurance	5
	Total quality management, concept of hazard system, the characterization of hazards, hazard sources and their realization	3
II	**Safety Hazards** Major process hazards: self heating, flame propagation, limits of flammability, explosion, detonation and deflagration, toxic materials, dosage, acute and chronic effects, threshold limits, fire, explosion and toxic release, effects of hazards	4
	Building a Safe Environment Parameters determining probability and consequence of hazards, occupational health and hygiene, personal safety, personnel protection equipment, classification of fires, explosion limits, fire fighting methods, work permit, material safety data sheet	4
III	**Hazard identification**: use of hazard indices, hazard and operability studies	5
	Hazard Control Major hazard control, legislation and laws, case studies of major hazard events.	3
IV	**Impact on Air** Air pollution: major pollutants, meteorology, lapse rate, dispersion, engineering control of air pollution. Safety aspects of H_2S leakage from	4

	oil and gas fields.	
	Air pollution causes, remedies in fertilizer plants, petrochemical plants etc.	**4**
V	**Impact on Water** Water pollution: physical, chemical and biological water quality parameters, pollution by oil spills. Ground water pollution near oil dispensing stations.	**5**
	Pollution Control Remediation of the environment, engineered systems for water purification, sludge treatment and disposal. Water pollution causes and remedies in oil production sites, refiners and in production of petrochemicals	**3**
	TOTAL	**40**

TEXT BOOKS

1 Loss Prevention in the Process Industries, Less, F. P., 2nd ed. Butterworth Heinemann, UK.

REFERENCE BOOKS

1 Environmental Engineering; Peavy, H. S., Rowe, D. R. and Tchobanoglous, G., McGraw Hill.
2 Chemical Process Safety, Sanders, R. E., Butterworth Heinemann,UK
3 Fundamentals of Process Safety, Marchell, V. and Ruchemann, S., Institution of Chemical Engineers, Warwickshire, UK
4 Critical Aspects of Safety and Loss Prevention, Kletz, T. A., Butterworth Heinemann,

5PE3 Petroleum Production Engineering

B.Tech. (Petroleum) 5th semester **Max. Marks: 80**
L3 **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Different Types of Production** Components of the petroleum systems. Well productivity engineering. Production from under saturated oil reservoirs. Production from two-phase reservoirs.	**4**
	Production from gas reservoirs. Pseudo critical properties of natural gases. Gas well deliverability for non – Darcy flow. Inflow performance relationships.	**4**

II	**Near Well Processes** The near-well bore condition and damage characterization, the effect of perforation conditions on well performance. Well bore flow performance. Well deliverability. Well head surface gathering systems.	**5**
	Artificial lift systems. Horizontal well production. System analysis. Production Chemistry Basics (Wax, Scale, Corrosion, Emulsions).	**4**
III	**Surface equipment and operations**. Flow control and well heads. Gathering systems; service and cleaning systems; design and testing of flow lines.	**4**
	Separation and separators; separator components, stage separation; design and construction of separators. Meeting - Oil and gas metering techniques	**3**
IV	**Challenges in Production Systems** Flow measurement system; liquid level controllers. Emulsion problems; oil emulsions; emulsifying agents and de-emulsifiers, choice and dosage of de-emulsifiers, heat treatment, heat theaters, desalting, oil storage and tank farms. Gauging, sampling and quality control. Underground storage – caverns etc.	**5**
	Water disposal, corrosion. Water injection systems. Subsurface equipment**.**	**3**
V	**Well and Completion Design** Well completion techniques and equipment, drill stem test (DST) flowing well performance, vertical lift performance, optimum size tubing and chokes, production forecast for a pool.	**4**
	Design and analysis of artificial methods of petroleum production. Work over and sand exclusion technique**..**	**4**
	TOTAL	**40**

TEXT BOOKS

1.Gas Production Engineering – S.Kumar-Gulf publishing Co., 1987.

REFERENCE BOOKS

1.Principles of well Production, Nind; 2nd Edition.Mc.Graw Hill
2.Production operations; T.O. Allen and A.P. Roberts, PetroSkills , 4-th ed., vol. 2.

5PE4 Drilling Technology II

B.Tech. (Petroleum) 5th semester **Max. Marks: 80**
L3 **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Directional Drilling :** Objectives, Types of deflection tools, tool orientation, Directional well profiles,	**4**
	Well path deflection & correction.	**3**
II	**Down Hole Motors :** Positive displacement motors and Turbo-drills – motor description, Power calculation and applications.	**4**
	Auto-track and verti-track system. Rotary Steerable motors, Geo-steering tools.	**4**
III	**Horizontal Well Drilling :** Horizontal well objectives and selection, Different profiles, Drilling techniques, Mud requirements & characteristics, casing and drill string requirements and completion programs.	**5**
	Slant Hole Drilling : Objectives and selections, Well profiles and applications.	**4**
IV	**Down the Hole Well Surveying** : Well surveying objectives, surveying methods, Surveying Analysis methods and calculations for well coordinates.	**5**
	Measurements While Drilling : Objectives of MWD/ LWD, MWD tools, Telemetry system and data interpretation. Directional Drilling Problems and Their Remedies.	**4**
V	**Special Methods of Drilling :** Aerated drilling, Under-balanced drilling, Overbalanced drilling, HPHT Drilling, Variable pressure regime, Plasma drilling, Electrical Drilling, Top drive drilling,	**4**
	Re-entry drilling, Jet Drilling, Extended reach drilling, Multilateral drilling, Slim hole drilling, coil tubing drilling.	**3**
	TOTAL	**40**

TEXT BOOKS

1. Drilling & Casing Operations, Jim Short, J.A., Penwell Publishing Company, Oklahoma

REFERENCE BOOKS

1. Well Design Drilling & Production, Craft B.C., Prentice Hall 1962
2. Applied Drilling Engineering, Bourgoyne A.T, Millheim K K, Chenevert M E and Young F. S., SPE textbook series, 1991
3. Horizontal and Directional Drilling, Carden, R. S., Petroskills, 2007,
4. Working Guide to Drilling Equipment and Operations, Lyons W,
Gulf Professional Publishing, 2010,
5. Well Engineering and Construction, Rabia, H., Gulf Publishing,

5PE5 Applied Thermodynamics

Common with 5PCE3

B.Tech. (Petroleum) 5th semester **Max. Marks: 80**
L3, T1 **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction and First law:** The scope of thermodynamics, dimensions and units, measures of amount or size, force, temperature, pressure, work, energy and heat.	2
	The first law of thermodynamics and other basic concepts, Joules' experiment, internal energy.	2
	The first law of thermodynamics, energy balance for closed systems, thermodynamic state and state functions, equilibrium, the phase rule,	2
	The reversible process, constant volume and constant pressure process, enthalpy, heat capacity.	2
II	**The second law of thermodynamics:** statements of the second law, heat engines, thermodynamic temperature scales, entropy.	2
	Entropy changes of an ideal gas, mathematical statement of the second law, entropy balance for open systems,	2
	Calculation of ideal work, the third law of thermodynamics. Classification and performance of internal combustion engines.	4
III	**Refrigeration and Liquefaction:** the Carnot refrigerator-V and T-S diagrams. Analysis of air standard cycles. Carnot cycle,	2
	The vapour –compression cycle, the choice of refrigerant, absorption refrigeration, the heat pump, liquefaction process.	2
	Vapour- Liquid Equilibrium: The nature of equilibrium, the phase rule VLE – Quantitative behaviour, VLE by modified Raoult's Law, VLE from k-value correlations.	4
IV	**Solution thermodynamics**: theory, fundamental property relation, the chemical potential and phase equilibria, partial properties.	4
	Ideal-gas mixtures, fugacity and fugacity coefficients, pure species, species in solution, generalized correlations for the fugacity	

	coefficient, the ideal solution, excess properties.	
	Application ; liquid phase properties from VLE data, models for the excess Gibb's energy,	**2**
	Property changes of mixing, heat effects of mixing processes	**2**
V	**Chemical Reaction Equilibria:** The reaction coordinate, application of equilibrium criteria to chemical reactions, the standard Gibbs. Energy change and the equilibrium constant,	**4**
	Effect of temperature on the equilibrium constants, relation of equilibrium constants to composition.	**2**
	Equilibrium conversions for single reactions, phase rule and Duhem's theorem for reacting systems.	**2**
	TOTAL	**40**

TEXT BOOKS

1. Introduction to Chemical Engineering Thermodynamics, Smith, J. M. and Van Ness H. C., McGraw-Hill, 6/e 2003.

REFERENCE BOOKS

1. Thermodynamics of Hydrocarbon Reservoirs, Abbas Firodabadi, McGraw-Hill Publishing, 1999.
2. Rao, Y.V.C. "Chemical Engineering Thermodynamics", Universities Press, India 2/e, 2001.
3. 2.. Kyle; B.G., "Chemical and Process Thermodynamics"; Prentice Hall, New York, 3/e, 1999
4. 3. K V Narayanan Chemical Engineering Thermodynamics, PHI Learning, 2004.

5PE6 Unit Operation for Petroleum Industry

B.Tech. (Petroleum) 5th semester **Max. Marks: 80**
L3, T1 **Exam Hours: 3**

UNIT	CONTENTS	CONTACT HOURS
I	**Conduction** Introduction to unit operation and its application in petroleum engineering. Heat Transfer and its application, Modes of heat transfer one dimensional and two dimensional, heat rate equations,	**4**
	Theory of insulation, critical radius calculations, types of insulation material, conduction through slab, cylinder and sphere.	**3**

II	**Convection** Convective heat transfer, natural and forced convection, co/counter/cross current contacting for heat transfer, individual and overall heat transfer coefficient,	**4**
	Fouling factor. Heat transfer with and without phase change conditions**.**	**4**
III	**Heat Exchange equipment**: Introduction to double pipe, shell and tube exchangers, condensers, extended surface equipments,	**4**
	Evaporation Evaporation- Type of evaporators and their applications single and multiple effect evaporators, operation of forward– backward and mixed feed operations,	**4**
IV	**Mass transfer and its application**. Analogies in transfer process, basic concept of diffusion and interphase mass transfer. Mass transfer theory film theory Penetration and surface renewal theory,	**4**
	Distillation distillation, Rectification, reflux ratio, calculation of numbers of plates by McCabe Thiele method, optimum reflux ratio,	**3**
	Basic introduction to absorption, liquid liquid extraction, leaching	**2**
V	**Drying:** Equilibrium mechanism theory of drying, drying rate curve.	**5**
	Introduction to filtration Sedimentation and settling.	**3**
	TOTAL	**40**

TEXT BOOKS

1. Process Heat Transfer, Kern, D. Q. McGraw Hill USA

REFERENCE BOOKS

1.Unit Operation of chemical engineering, Mc Cabe, W.L. Smith, J C and Harriot, P., Mc Graw hill 1993

2. Mass transfer operation. Treybal, R.E. Kogakusha, McGraw Hill 1980.
3. Transport Process and Separation Processes Principles (Includes Unit Operations) 4th Ed, Geankopis, C. J., Prentice Hall

4 Principles of Unit Operations, Foust, A.S., Wenzel, L.A., Clump, C.W., Naus, L

List of Experiments for Labs of Vth Semester

5PE7 Petroleum Production Engineering Lab

B. Tech. (Petroleum Engineering) Max. Marks: 100
Hours per Week:3

1. Measuring the density.
2. Measuring the specific gravity and API gravity.
3. Measuring the viscosity using Brookfield Viscometer
4. Measuring the viscosity using U – tube Viscometer
5. Determination of the water in crude oil by distillation
6. Determination of the water in crude oil by the centrifuge.
7. Determination of the total salts content of crude oil by conductivity method.
8. Determination of natural gas composition using GC chromatography.

5PE8 Petroleum Product Testing Lab

B. Tech. (Petroleum Engineering) Max. Marks: 100
Hours per Week:3

1. Measurement of fire point- Flash point
2. Measurement of Cloud point
3. Measurement of pour point.
4. Measurement of Aniline point & Bromine number
5. Measurement of Reid Vapour Pressure
6. Measurement of Sulphur Content
7. Measurement of Carbon Residue.
8. Distillation of Petroleum and Petroleum products.
9. Measurement of surface tension by Tensiometer.
10. Measurement of surface tension by Platinum ring method.
11. Ternary phase diagram.

5PE9 Health Safety and Environment lab

B. Tech. (Petroleum Engineering) Max. Marks: 100
Hours per Week:3

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

Safety System:
1. Hazards analysis, developing a safe process, failure mode analysis, safety analysis (API-14C) safety analysis function evaluation chart (synergic approach).
2. Manual & atmospheric shut down system, blow down systems.

3. Gas detection system
4. Fire detection and suppression systems.
5. Personal protection systems & measures.
6. HSE Policies, standards & specifications
7. Disaster & crisis management.

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.

5PE10 Heat Transfer Lab

B. Tech. (Petroleum Engineering) Max. Marks: 50
Hours per Week:2

1. To Measure the thermal Conductivity of Liquid and solid.
2. To measure the thermal conductivity of liquid and solid (linear model).
3. To measure the transfer conductivity measurements in linear and radial method.
4. To Measure the Emissivity of the Test plate Surface.
5. To Determine Stefan Boltzmann Constant of Radiation Heat Transfer.
6. To Determine the Surface Heat Transfer Coefficient for Heated Vertical Cylinder in Natural Convection.
7. Determination of Heat Transfer Coefficient in Drop Wise & Film Wise condensation.
8. To Study Performance of Simple Heat Pipes
9. To Study and Compare LMTD and Effectiveness in Parallel and Counter Flow Heat Exchangers.
10. To determine the total thermal conductivity and thermal resistance of the given compound resistance in series.
11. Testing and performance of different heat insulators.
12. To understand the importance and validity of Engineering assumptions through the lumped heat capacity method.

5PE11 DECA

6 PE1 Petroleum Production System Design

B.Tech. (Petroleum) 6th semester Max. Marks: 80

L3, T1 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction** Review of various geological, reservoir engineering and petroleum production principles and methods with reference to oil and gas field development.	**5**
	Drainage of oil and gas reservoirs by wells. Theoretical fundamentals of oil field development. Necessity and scope of development plan. Various stages in the life of oil and gas field development	**4**
II	**Data Requirement for Field** Requirement of data sources. Various field data sample collection. Well surveys. Laboratory analysis. Creation of integrated approach for statistical, technical and cost database.	**4**
	Production system Design for Primary Recovery Planning for field exploitation under natural mechanism. Well spacing and location. Well Performance. Field production performance evaluation. Need of additional energy for pressure maintenance of a reservoir. Descriptions of artificial lift methods	**4**
III	**Production System Design for Secondary and tertiary Recovery** Field development with application of secondary and tertiary recovery.	**4**
	Application of mathematical modeling and computer simulation for optimum field development	**3**
IV	**Economics** Economics of field development. Consideration of downstream utilization and consumption.	**5**
	Special consideration for gas field developments. Development of marginal fields. Indian Scenario.	**4**
V	**Surface Facilities** Planning of various surface installations. Surface storage system for oil and gas. Pipe Line System for Oil and Gas	**4**
	Transport Pumping & Compressor Stations in Trunk Line .	**4**
	TOTAL	**40**

TEXT BOOKS

1. Surface production operations: Design of oil Handling system and Facilities (Vol I & II) Maurice Stewart, Ken Arnold

REFERENCE BOOKS

1 API Gas Lift Manual: American Petroleum Institute, Third Edition 1994

2. Technology of Artificial Lift: Brown K,Penwell Publishing Co Tulsa 1984
3. Production Operations Vol 1 & 2, Allen & Roberts.

6 PE2 Artificial Lift Technique

B.Tech. (Petroleum) 6th semester — Max. Marks: 80
L3 — Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Different types of Artificial lift** Introduction, definition and purpose of artificial lift. Inflow performance principles and descriptions of Artificial lift methods:	**4**
	Gaslift – continuous and intermittent; Chamber lift, Electrical submersible pumping; Sucker rod pumping; Progressive cavity pump; Plunger lift; Hydraulic pump – piston & jet type.	**4**
II	**Reservoir Aspect of Artificial Lift** Skin, permeability determination, IPR curves, absolute open flow potential (AOFP) of well. Stimulation and workover jobs and optimization of fluid flow.	**5**
	Manipulation of sweep efficiency, mobility ratio, GOR and water cut. Selection of suitable artificial lift method	**3**
III	**Gas lift design** Continuous Gas Lift, Intermittent Gas Lift, Type of Installations, Gas Lift valve Mechanics, other common valve types, selection of Gas Lift valve, Reverse flow check valve, merits and demerits of different categories of gas lift valves,	**4**
	Gas Lift Mandral, Surface equipment, Pack –off Gas Lift Installation, Gas Lift Design, Advances in Gas lift, plunger lift, plunger lift operation, Chamber lift.	**3**
IV	**Sucker Rod pump Design** Sucker rod pumping system, pumping units, sub-surface pump, sucker rod string, gas and tubing anchors, skinner bar.	**4**
	Well Head Equipment .Selection of SRP installations. Hydraulic pumping – piston & jet	**4**

V	**ESP Design** Centrifugal electric submersible pumping system (ESP). Surface and sub-surface component of ESP, Downhole components, ESPs design,	**5**
	Application, surface components, standard performance curves. Total Dynamic Head. Recent advances in Electrical Submersible Pumping.	4
	TOTAL	**40**

TEXT BOOKS

1 Principles of Artificial Lift; Niadri Kumar Mitra and Adesh Kumar; Allied Publishers Pvt.Ltd.

REFERENCE BOOKS

1. High Rate Artificial Lift, Clegg, J. D., SPE 1988
2. Well Performance, Golan, M & Whitson, C. H., (IHRDC, Boston)
3. Surface Operations in Petroleum Production, Chilingarian GV
4. Petroleum Fluid Flow Systems, Boyd, O.W.
5. Well Design Drilling and Production, Craft, Holden and Graves
6. The Technology of Artificial Lift Methods, Brown, K E., SPE

6 PE3 Surface Facilities

B.Tech. (Petroleum) 6th semester Max. Marks: 80
L3 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Oil Surface Production Facilities**: Well Equipments, Pigging System, Separator,	**5**
	Gas Scrubber, Gas Dehydrator	**3**
II	**Gas Surface Processing Facilities**, Gas Sweetening, Heat Exchanger, Fractionation, Liquefaction,	**5**
	Refrigeration System, Compressors.	**3**
III	**Pumps:** Centrifugal, Reciprocating, Diaphragm. Pump: Basic Theory, Conservation of Mass, Specific Velocity, Pump Performance, Cavitations, Pump Specification,	**4**
	Flow Capacity, Fluid Properties, Head, Net Positive Heads, Rotation determination and Pump Types, Viscous Fluid Correction, Material Selection, Prime Movers Selection.	**4**
IV	**Field Processing of Oil & Gas**. Metering, storage and transport of oil and gas.	**4**

	Surface treatment of oil & gas.	**4**
V	**Surface facility for oil pumping station**, gas pumping station, water injection, gas injection and EOR processes.	**4**
	Equipment to plug wells, Equipment to demolish and remove installations, Equipment to restore it.	**4**
	TOTAL	**40**

TEXT BOOKS

1. Surface Production Operations, Volume 2, Second Edition: KenArnold; Maurice Stewart, Gulf Professional Publishing; Edition-1999,

REFERENCE BOOKS

1. Gas Production Engineering; Sanjay Kumar, Gulf Publishing

6 PE4 Workover & Well Stimulation

B.Tech. (Petroleum) 6th semester Max. Marks: 80

L3, T1 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Introducton** Differentiate between reservoir problem v/s workover problem**,** Analyse what type of workover is required**.**	**4**
	Work-over operations, types of workover	**4**
II	**Work Over Operations** Work over fluids. Scraping, well circulation, Shut-off, Squeeze cementing. Handling water and gas coning.	**4**
	Evaluation of workover jobs	**4**
III	**Packers** Production packers, Packers calculation, Well activation. Repair of wells, Paraffin and scale removal.	**5**
	Corrosion, Bacteria & Scale control. Sand-control, Screens, Gravel packs.	**3**
IV	**Well treatment**; acidizing of oil & gas wells.	**4**
	Hydro-perforation. Hydraulic fracturing	**4**

V	**Stimulation Designing** Stimulation designing, Proppants and their placement. Thermal stimulation techniques. Down-hole heaters.	**5**
	Horizontal well related development on the subject. Well kicks & control	**3**
	TOTAL	**40**

TEXT BOOKS

1. Well Design Drilling and Production, Craft, Holden and Graves, Prentice Hall, 1962.

REFERENCE BOOKS

1. Well Control Problem Solutions, N J Adams
2. Petroleum Production Handbook, Thomas C Frick
3. Workover Well Control, Neal Adams
4. Petroleum Production Systems:- Michael J Economides (Daniel Hill)
5. Hydraulic Fracturing, Faust, G. C., SPE

6PE5 Well Test Analysis & Enhanced Oil Recovery

B.Tech. (Petroleum) 6th semester Max. Marks: 80
L3, T1 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Principles of Fluid Flow** Principles of Fluid Flow for steady state, semi steady state & non steady state conditions. Steady State Flow Tests (Indicator Diagram) and Gas Well Tests.	**5**
	Diffusivity Equation. Derivation & Constant Terminal Rate Solution	**3**
II	**Pressure Transient Tests**: Analysis and Pressure Draw-down Tests, Pressure buildup tes.,reservoir limit test (RLT)etc. for oil and gas both.	**5**
	Multirate testing, average reservoir pressure, Type curves & its uses.	**4**
III	**Introduction to EOR**. Reservoir engineering aspects of enhanced recovery methods. Water flooding concepts, Well spacing for fluid injection.	**4**
	Buckley Leverett Principle for immiscible flooding. Mobility ratio concepts. Polymer flooding, Surfactant flooding, Caustic flooding; ASP flooding – Principles and applications.	**4**

IV	**Miscible Flooding**: Principles and applications of CO2 flooding Dry and enriched gas flooding. Inert gas flooding.	**4**
	Thermal Recovery Techniques – Steam stimulation, hot water flooding, steam flooding & in-situ combustion process	**3**
V	**Microbial EOR** – Principles & applications. Profile modification – Monomer and polymer based gel systems	**7**
	TOTAL	**40**

TEXT BOOKS

1. Enhanced Oil Recovery, Lake, L.W., Prentice Hall

REFERENCE BOOKS

1. Advances in Well Test Analysis, Earlougher, Jr., R.C., SPE
2. Pressure Build Up and Flow Tests in Wells, Mathews, C.S. & Russell, D. G., SPE
3. Modern Well Test Analysis, Horne, R.N., Petroway
4. Well Testing, Lee, J., SPE

6PE 6.1 Offshore Structure Design

B.Tech. (Petroleum) 6th semester Max. Marks: 80

L3 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Offshore field developments**, Analysis of offshore structures, Offshore platforms & their stability, Buoyant force calculation, Bracing & framing patterns in offshore structures,	**5**
	Welding of offshore structures, layouts of jacketed offshore platforms. .	**4**
II	**Analyses of Sea environment** : Wind, waves and current forces.- Characteristics, analysis and force evaluation, Sea soil & sea bed, Offshore piles and their foundation.	**4**
	Tubular/ rectangular joints – Types, design, protection and failures. Corrosion in offshore structures and its protection, Buckling & bending in offshore structures and in offshore pipe lines, Risk factors and risk analysis	**4**

III	**Offshore mobile rigs**: Types, load and stress analysis, Fatigue calculation and safety factors,	**5**
	Marine risers and tensioners.	**3**
IV	**Fixed platform design** : Steel templates & concrete tower type platforms – construction, fabrication and installation	**7**
V	**Structural analyses** : Stress analysis & calculation, Skewed and finite plates; Fillets and grooves design,	**5**
	Offshore static and dynamic structural analysis.	**3**
	TOTAL	**40**

TEXT BOOKS

1. Introduction to Offshore Structures, Design, Fabrication and Installation, W. J. Graff, Gulf Publications, 1981.

REFERENCE BOOKS

1. Dynamics of offshore Structures, James F Wilson
2. Floating Drilling Equipment and its Use, Riley Sheffield
3. Offshore Handbook (5 vols.), Gulf Publishers
4. Offshore Pipeline Design, Analysis & Methods, Moussel, A.H.
5. Technology of Developing Marginal Offshore Oilfields, Fea, D.A. & Dea, J.O.
6. Deepwater Petroleum Exploration: A Non technical Guide (2nd ed).Leffers, William L., Richard, P. and Sterling, Penn Well Corporation.

.

6 PE6.2 Transportation & Marketing of Petroleum and Its Products

B.Tech. (Petroleum) 6rd semester Max. Marks: 80

L3 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Transportation of petroleum & petroleum products**. Basics of	**4**
	Pipeline construction, operation and protection.	**4**
II	**Pump and compressor stations.** Instrumentation and Control	**4**
	Metering and measurements of oil and gas.	**3**
III	**Traffic management**, Fire and safety rules. Indian and Global supply scenario of petroleum and petroleum products.	**5**

	Product quality control.	**3**
IV	**Bulk distribution and handling**-domestic, commercial and industrial.Storage of petroleum products in fixed installations.	**4**
	Standards and regulations.	**4**
V	**Role of International oil c**ompanies and OPEC pricing mechanism. Administered andmarket determined pricing mechanism in India.	**4**
	Conservation of petroleum & its products. Spot and other market control mechanism.	**3**
	TOTAL	**38**

TEXT BOOKS

1 Offshore Pipeline Design, Analysis and Methods, Mouselli, A. H. Pennwell Books, Tulsa, Oklahoma

REFERENCE BOOKS

1. Surface Production Operations, Arnold, Ken and Stewart, Maurice Volume I and II, Gulf Publishing Company, London.
2. Modeling of Oil Product and Gas Pipeline Transport, Lurie Mikhail, Wiley, 2008
3. Subsea Pipelines and Risers, Young Bai and Quang Bai, Elsevier Publishing, 2005
4. Production and Transport of Oil and Gas, Szilas, A. P, Part B: Gathering and Transport, Development in Petroleum Series, 18 B, Elsevier, 1986,

6PE6.3 Petroleum Refinery Engineering

Common with 6PCE1

B.Tech. (Petroleum) 6rd semester Max. Marks: 80

L3 Exam hours-3

UNIT	CONTENTS	CONTACT HOURS
I	**Cracking Process:** Atmospheric and Vaccum Distillation. Thermal conversion processes.	**4**
	conventional thermal cracking process. Visbreaking, Coking – Fluid coking, flexicoking, delayed coking etc.	**4**
II	**Reforming:** Catalytic conversion processes – fluid catalytic cracking,	**3**
	Hydrocracking, hydrogen production, Reforming.	**4**

III	**Purification process** Alkylation, Polymerization process of crude oil.	**4**
	Isomerisation and Hydrotreating processes crude oil.	**4**
IV	**Crude oil Evalution :** Evaluation of crude oil for LOBS (Lube oil base Stock).	**4**
	Steps in preparation of LOBS, deasphalting.	**4**
V	**Solvent Extraction**: Types of solvents available and their comparison, dewaxing.	**3**
	Hydro finishing of LOBS Hydrogenation processes for LOBS production.	**4**
	TOTAL	**38**

TEXT BOOKS

1. Petroleum Refinery Engineering, Nelson N.L., McGraw Hill Book Co., 1985

REFERENCE BOOKS

1. Petroleum Refining Technology and Economics', James H. G. and Glenn E. H. 4 ed., Marcel Dekker, Inc., 2001
2. Petroleum Refining, Waquier, J.P., Vol .I and II, 2 ed., Technip, 1995
3. Petroleum Processing Handbook, Mcketta S.S., Marcel Dekker, Inc., 1992
4. Modern Petroleum Refining Processes, B.K.Bhaskara Rao, 5 ed.Oxford and IBH Publishing Co. Pvt. Ltd., 2007

List of Experiments for Labs of VI Semester

6PE7 Mass Transfer Lab

B. Tech. (Petroleum Engineering) Max. Marks: 100
Hours per Week:3

1. To determine diffusion coefficient of liquid vapour in air.
2. To study the mass transfer characteristics of a wetted wall column.
3. Liquid-liquid extraction in a packed column for co current and counter current flow of binary systems.
4. To study the absorption of a gas in a packed column and calculation of NTU and HTU.
5. Studies on solid-liquid extraction column. Studies on the sieve plate distillation unit.
6. Design of distillation Tower.
7. Air fuel ratio in a gas burner.
8. Pyrolysis and characterization of pyrolysis products.

6PE8 Exploration and Prospecting Lab

B. Tech. (Petroleum Engineering) Max. Marks: 100
Hours per Week:3

Seismic data analysis related to:

1. Horizon picking

2. Map building

3. Seismic well log tie.

4. Well log analysis

6PE9 Advanced Reservoir Engineering Lab

B. Tech. (Petroleum Engineering) Max. Marks: 100
Hours per Week:3

Study and practicals related to the following

- Special Core Analyses (degree of moisture, capillary pressure, electrical abilities and relative permeability)
- Petrophysical measurements (capillary pressure curves, resistivity measurements and compressibility)
- Simulation and interpretation of experiments
- Experiments for improved recovery

1.Core and plug preparation: Introduction to the machines for the various steps of core preparation including core slabbing, core pluging and trimming. Also sand/shale analysis and depth matching through the use of core gamma logger will be introduced.

2. Cleaning and saturation determination. The available instruments for core cleaning as well as saturation determination will be introduced. This includes extraction/distillation method for core cleaning (Dean Stark), drying and heating for saturation determination (Retort Oven) and
core saturator for saturation of core before other experiments.

3.Porosity. An introduction to core porosity and various methods of its measurements. Describing Hg porometer and KeyPhi instruments for porosity measurements.

4. Resistivity. Introduction for the rock conductivity measurements at surface for
pressure and at overburden pressure.

5. Surface and interfacial tension. An introduction to various methods of measurements.
6. Capillary pressure. Introduction to capillary measurement methods under drainage and

40mbibitions
processes. Description of CAPRI instrument for measuring capillary pressures.

7. Permeability. An introduction to rock permeability. Description of instruments for absolute permeability measurements for gas/liquid absolute and relative permeabilities.

8. Rock Mechanical Properties. An introduction on how to measure the rock properties like Young's modulus and Poisson's ratio.

6PE 10 Professional Ethics and Human Values

B. Tech. (Petroleum Engineering) Max. Marks: 50
Hours per Week:2

Human Values
Morals, Values and Ethics – Integrity – Work Ethic – Service Learning – Civic Virtue – Respect for Others – Living Peacefully – caring – Sharing – Honesty – Courage – Valuing Time – Co-operation – Commitment – Empathy – Self-Confidence – Character – Spirituality.
Engineering Ethics
Senses of 'Engineering Ethics' - variety of moral issued - types of inquiry - moral dilemmas - moral autonomy - Kohlberg's theory - Gilligan's theory - consensus and controversy – Models of Professional Roles - theories about right action – Self interest - customs and religion - uses of ethical theories.

Engineering as a Social Experimentation
Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - the challenger case study.

The Three Mile Island, Fukoshima and Chernobyl case studies.

Safety, Responsibilities and Rights
Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk -.
Collegiality and loyalty - respect for authority - collective bargaining - confidentiality - conflicts of interest - occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination.
Global Issues
Multinational corporations - Environmental ethics - computer ethics .Engineers as managers-consulting engineers-engineers as expert witnesses and
advisors -moral leadership-sample code of Ethics.

Suggested Readings

1. Ethics in engineering, Mike Martin and Roland Schinzinger, McGraw-Hill, New York1996.
2, Engineering Ethics, Govindarajan M., Natarajan S., Senthil Kumar V. S., Prentice Hall, New Delhi, 2004.

3. Engineering Ethics, Fleddermann, Charles D., Pearson Education
4. Engineering Ethics- Concepts and Cases, Harris, Charles E., Protchard, Michael S. and Rabins, Michael, J., Wadsworth Thompson Learning, 2000
5. Ethics and the Conduct of Business, Boatright, John, R., Pearson Education, New Delhi, 2003.

6PE11 DECA

7PE1 Offshore Drilling and Production Operations

B.Tech. (Petroleum) 7th semester Max. Marks: 80
L3 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Physical Environment** Overview of physical ocean environment, geotechnical aspect - sea floor marine soils, composition and properties of sea water, seawater corrosion, offshore rigs, floating drilling vessels.	5
	Fixed offshore structures, wind, wave, current and other forces acting on offshore structures.	3
II	**Field Operations**: Station keeping, conventional mooring system, spread mooring system, design considerations, operations, equipment and functions, Dynamic positioning system, components, working.	3
	Floater well control, shut in procedures, well kill operations, subsea well head, BOP Stack.	4
III	**Deepwater Drilling:** Deepwater well construction problems and solutions, deepwater cementation, high temp- high pressure wells, casing and mud policy. Drilling logs, gas hydrate problems. Deepwater drilling operations,	5
	Riser system, components, riser tensioners, heave compensator, emergency disconnect and hang off. Wellbore stability and rock mechanics, mud window for vertical, horizontal deep water drilling. ROV	5

IV	**Offshore structures**: Fixed steel structures, Concrete Gravity Base Structures, TLPs, Semi -submersible and Floating Production systems, SPM, SPAR Application. Depths and design limitations.	**4**
	Installation of offshore platforms, Typical Platform Layout, Process flow diagram, Static and Rotary Equipment. Safety systems.	**3**
V	**Development and Production Operations:** Risers for Production operations, deepwater completion, Subsea completion, planning,	**4**
	production monitoring and control system.	**3**
	TOTAL	**40**

TEXT BOOKS

1. Construction of Marine and offshore structures, Benc Gerwick Jr. IDT ONGC Dehradun, Drilling operations manual.

REFERENCE BOOKS

1. Handbook of offshore engineering volume I and II, Chakraborty S.K, Elsevier, 2006, 1213 pp.
2. IADC deepwater control guidelines.
3. Exxon Mobil, Floating Drilling School, Deepwater, 2002, 992 pp.

7PE2 Reservoir Modelling & Simulation

B.Tech. (Petroleum) 7th semester Max. Marks: 80
L3,T1 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction to General Modelling:** Introduction to concept geological modeling.	**3**
	Types of model and designing of various models depending on reservoir complexities, rock properties, fluid properties – concept of back oil model, compositional model.	**5**

	.	
II	**Overview:** Geological model and flow model and transition Introduction, Historical background, application of simulator, various types of models.	**4**
	Flow Conditions: Single phase, two phase and multiphase flow equations for one, two and three dimension models, Mass balance equations.	**4**
III	**Discretization and solution of Equations** Special Concept**:** Explicit and implicit, grid system, finite difference & finite element method, matrix solution, iterative method, stability	**5**
	Reservoir model Solution Techniques: Implicit Pressure and Explicit Saturation, Pseudo-functions. Implicit pressure and implicit saturation (IMPIS). Preview of numerical solution methods**:** Direct process, iterative process.	**3**
IV	**History matching** History matching, data preparation, Mechanics and parameters of match	**4**
	Streamline simulation Introduction to streamline simulation & comparison of conventional/Streamline simulation	**4**
V	**Integration with Economics** Special Concept on Coning and Compositional Models simulation. Optimization using Economic and Techno-economic evaluation.	**4**
	Computation of economic indices viz. Different variants base on technical and economic consideration.	**4**
	TOTAL	**40**

TEXT BOOKS

1. Aziz, K. Settari, A. Petroleum Reservoir Simulation, Applied Science Publisher, 1983.

REFERENCE BOOKS

1. Thomas, G.W., Principles of Hydrocarbon Reservoir Simulation, Int. Human Res. Dev. Co., BOSTON, 1981

2. Chrichlow, H.B., Modern Reservoir Engineering - A Simulation Approach, Prentice-Hall, Inc., Englewood Cliffs, NJ, 1977.
3. Chavent, G., Jaffre, J., Mathematical Models and finite Elements for Reservoir Simulation, North-Holland, 1986.
4. Helmeg, R., Multiphase Flow and Transport Processes in the Subsurface, Springer-Verlag, 1997.
5. Thompson, E.G., an Introduction to the Finite Element Method, John Wiley & Sons, Inc.,

7PE3 Advanced Reservoir Engineering and Management

B.Tech. (Petroleum) 7th semester — Max. Marks: 80
L3, T1 — Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction** Multi phase flow: Relative permeability: fractional flow. Well performance – inflow performance, tubing performance.	5
	Reserve estimation, Fluid phase behaviour	3
II	**History matching and forecasting** Performance prediction and history matching for various types of reservoir drives: Depletion drive, Gas Cap Drive,	5
	Water Drive, Combination Drive.	3
III	**Well Testing Techniques** Reservoir testing and performance analysis: well test – drill stem tests (DST); production tests, pressure tests on gas wells; formation interval testing and other well testing techniques.	5
	Differential equations for radial flow in a porous medium. Pressure draw down and build up analysis	3
IV	**Gas condensate reservoir engineering**, fluid phase behaviour development – options	6
V	**Other Well testing and reserve estimation** – Basic well testing theory – oil well testing: gas well testing – Practical well testing –	5

	Gas field reservoir engineering. – Gas in place volumes and recovery estimations. **Reservoir management**– reservoir data acquisition. Mathematical basis of bottom hole analysis;	**5**
	TOTAL	**40**

TEXT BOOKS

1. Advance Reservoir Engineering by T. Ahmed, P. D. McKinney, Elsevier.

REFERENCE BOOKS

1 Fundamental of Reservoir Engg by L.P Dake
2 Petroleum Reservoir Engg by Amyx, McGraw Hill 1998 .
3 Applied Petroleum Reservoir Engineering ,Craft B.C and Hawkins M.F , Prentice Hall Engle wood cliffs, N J1991

7 PE4 Pipeline Engineering

B.Tech. (Petroleum) 7th semester Max. Marks: 80
L3 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Objective and scope of pipeline** :as a means of fluid transportation with special reference to crude oil/gas/refined products. Design of Pipeline: Factors influencing oil, gas and refined products as pipeline design;	**5**
	Hydraulic surge and water hammer; specific heat of liquids; river crossing; pipe size and station spacing etc.	**3**
II	**Theory and different formulae of the flow of fluids** : 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;	**4**
	Introduction to the flow of Non- newtonian fluids through pipes; multiphase flow and loop pipelines.	**4**
III	**Construction of pipelines**; materials; project specifications; general equipment specifications (Pipes, valves and fittings); Installation of expansion loops and thermodymetric tapping plant.	**5**

	Pigging: pigging technology, pig launcher and receiver, intelligent pigging, types of pigs.	**3**
IV	**Offshore Pipeline**: design and control of Sag and Over bend; description of stinger and riser, articulated stinger,	**5**
	construction of offshore pipeline; method of underwater welding	**3**
V	Prevention of hydrates, wax & scales. Crude conditioning and use of additives to improve flow conditions.	**4**
	Corrosion: protection and control; design of cathodic protection system, pipeline automation. City distribution network of oil/gas. Lease and custody transfer.	**4**
	TOTAL	**40**

TEXT BOOKS

1.Piping Design Handbook: Macetta. John, M Dekar1992, CRC Press.

REFERENCE BOOKS

1. Pipline and Risers : Young Boi ,Elsevier Ocean Engineering Book series 2001Volume 3
2. Pipe Line Corrosion, Cathodic Protection: Parker M E and Peattie E G , Elsevier USA 2001

7PE5 OIL & GAS FIELD DEVELOPMENT

B.Tech. (Petroleum) 7th semester Max. Marks: 80
L3 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Types of reserves** – Proved, proved subeconomic and inferred reserves. Classification of reserves – Proved: Categories A, B, C1; Proved subeconomic – Category Z; and inferred:	**4**
	Category C2. SPE/WPC definitions and classification of reserves – Proved, unproved, probable and possible reserves.	**4**
II	**Classification of simulations** based on type of reservoir –gas reservoir simulations, black oil reservoir simulators and compositional reservoir simulations. Input data for black oil simulation	**4**

	General data of the reservoir, rock and fluid data, grid data, production / injection and well data. History matching – Verification of input initial data, pressure matching and saturation matching.	**4**
III	**Field Development**: Criteria for field development – Basic geological data for development planning. Data collection from initial wells. Discovery well – Delineation of the field limits	**5**
	Volumetric estimation of in place reserves – Planning development wells based on the reservoir parameters and economic criteria – Well spacing - Final development plan – Rate of production – Oil recovery factor – Water injection – Pressure maintenance – Abandoning the field – Abandonment pressure.	**3**
IV	**Bottom Hole Studies:** Collection of reservoir samples, performance of routine reservoir tests like productivity index, build-up test, draw down test, interference test, back pressure test, and isochronal test.	**4**
	Calculation of reservoir parameters like, K, Kh, Skin, flow efficiency, P.I. etc. and other PVT parameters. Significance of pressure and temperature data in hydrocarbon exploration and exploitation	**4**
V	**Identification and Treatment of Sick Wells** Definition of a sick well, criteria for identification of sick well. Sickness due to leakage – Detection of leakage, temperature survey, temperature anomaly,	**4**
	Radioactive isotope (tracer) survey, Activated oxygen log, isolation by packers. Reperforation and activation.	**4**
	TOTAL	**40**

TEXT BOOKS

1. Cole, F.W. 1961, Reservoir Engineering Manual, 2nd Edn.Gulf Eng Co, Huston, Texas.

REFERENCE BOOKS

1.Advance Reservoir Engineering by T. Ahmed, P. D. McKinney, Elsevier.
2.Craft, B.C. and Hawkins, F.W. 1959. Petroleum Applied Reservoir Engineering practice Hall, New Jersey
3.Oil and Gas Pipeline Fundamentals:- Kennedy
4.Oil and Gas Field Development – Sant Kumar

7PE6.1 PETROCHEMICAL PRODUCTION TECHNOLOGY

B.Tech. (Petroleum) 7th semester Max. Marks: 80
L3 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Petrochemical feedstock;** Manufacture of acetic anhydride,	4
	Manufacture of acetone, Manufacturing of acetic acid.	4
II	**Adipic acid and aniline**; Manufacture of benzoic acid,	4
	benzyl chloride, butyl acetate.	4
III	**Manufacturing Process** Manufacture of Maleic anhydride,	4
	methyl ethyl ketone, chlorobenzene	4
IV	**Propelene and vinyl acetate;** Transportation of dangerous goods; ,	4
	phthalic anhydride, Polyvinyl chloride	4
V	**Fertilizer** Nitrogenous Industries, Ammonia and Nitric acid, Nitrogenous Fertilizer, mixed fertilizers, N-P-K Fertilizers and micronutrients**,**	5
	Health and safety in petrochemical industries	3
	TOTAL	**40**

TEXT BOOKS

1. M. Wells, Handbook of Petrochemicals and Processes, Ashgate, 1999.

REFERENCE BOOKS

1.D.L. Burdick and Leffler, Petrochemicals in non-technical language, Penn Well, 2001
2.Dryden C.E., M. Gopala Rao; Outlines Of Chemical Technology. Affiliated East-West Press
3.Pandey G.N.; Chemical Technology Volume- I; Lion Press, Kanpur

7PE6.2 Process Dynamics & Control

B.Tech. (Petroleum) 7th semester Max. Marks: 80
L3 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**First Order system** Linear Open-Loop Systems: First–order Systems: Transfer Function, Transient response (step response, impulse response, sinusoidal response) examples of first – order systems, response of first order systems in series :	**5**
	Non-interacting systems and interacting systems. Second – order systems: transfer function, step response, impulse response, k sinusoidal response, transportation lag. .	**4**
II	**Linear closed-loop Systems**: Control System: components of a control system block diagram,	**4**
	negative feedback and positive feedback, servo problem and regulator problem	**3**
III	**Controller and final control element:** Mechanism of control valve and controller	**4**
	transfer functions of control valve and controllers (P, PI, PD, PID). Example of a chemical reactor control system	**4**
IV	. **Closed-Loop Transfer functions**: Overall transfer function for single-loop systems, overall transfer function for set-point change and load change, multi-loop control systems.	**4**
	Transient Response of simple control systems: P and PI control for set- point change and for load change.	**4**
V	**Stability:** Concept of Stability, Stability criteria, Routh test for stability, Root Locus. Frequency Response: Introduction to Frequency	**4**
	Response, Bode Diagrams for First and second order systems, Bode stability Criteria, Ziegler-Nichols and Cohen-coon Tuning rules	**4**
	TOTAL	**40**

TEXT BOOKS

1.Process Systems Analysis and control, Coughanowr, D.R., McGraw –Hill, 1991.

REFERENCE BOOKS

1.Chemical Process Control, Stephanopoulos, G., PHI,
2.Process Modeling, Simulation and Control for Chemical Engineers, Luyben, W.L, McGraw Hill,

7PE6.3 Petrochemical Engineering – I

B.Tech. (Petroleum) 7th semester Max. Marks: 80
L3 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction** History and importance of Petrochemical industry, growth in India, Classification of Petrochemicals,	**5**
	Preparation of Olefinic feedstocks.	**3**
II	**Aromatics**: Preparation of Aromatic feedstock and Synthesis gas	**8**
III	**Small chain hydrocarbons :** Production of some commercially important petrochemicals from syngas and C1 like Methanol,	**5**
	Formaldehyde, Chloromethane, etc	**3**
IV	**Small chain hydrocarbons:** Production of some commercially important petrochemicals from C2 like Ethylene oxide,	**4**
	chlorides and glycols; Vinyl acetate, acetaldehydes, etc.	**4**
V	**Rubber and resins:**Thermosetting and Engineering Resins,	**4**
	Synthetic Fibers, Synthetic Rubber.	**4**
	TOTAL	**40**

TEXT BOOKS

1. Chauvel, A. and Lefebvre, G., "Petrochemical Processes", Gulf Publishing Company, Houston, 1989.

REFERENCE BOOKS

1. Matar, S., "Chemistry of Petrochemical Processes", Gulf Publishing Company, 2/e, 2000
2. Waddams, A.L.,Chemicals from Petroleum, Gulf Publishing Company, London, 4/e, 1980.
3. Mall, I.D., Petrochemical Process Technology, Macmillan India Limited, Delhi, 2007.
4. Meyers, R.A. (ed.), Handbook of Petrochemicals Production Processes, McGraw Hill, New York, 2005.

List of experiments for VII Semester Labs

7PE7 Process Dynamics and Control Lab

B. Tech. (Petroleum Engineering) Max. Marks: 100
Hours per Week:3

Study and practical related to the following:

1. To determine the time constant of a given thermometer and thermocouple
2. To study the open loop,three mode PID and two mode PD control
3. To study the working principal and clibration procedure of capacitance type level transmitter.
4. To obtain the step response of a single tank liquid level system to a step change in input flow and compare it with the theoretical response.
5. To study the inherent characteristics of control valve.
6. To study the theoretical time constant and damping coefficient of the manometer.
7. To study the interacting and non interacting mode of system.
8. To study the behaviour of an PID controller.
9. To study the tuning of controller using the Zeigler Nichols Method.
10. To study the stability of the system using the Bode Plot.

Suggested Readings

1. William C. Dunn, Fundamental of Industrial Instrumentation and Process Control, McGraw-Hill, New York, 2005.
2. D.P. Eckman, Process Instrumentation, Wiley Eastern Ltd., New Delhi
3. B.C. Nakra, KK Chaudhury, Instrumentation Measurements and Analysis, Tata McGraw Hill, 1985.
4. G.C. Barney, Intelligent Instrumentation, Prentice Hall of India Pvt. Ltd., 1992.

7PE8 Pipeline Design

B. Tech. (Petroleum Engineering) Max. Marks: 100
Hours per Week:3

Study of the following:

A: Onshore Pipeline Engineering

1. Introduction and over view of piping,

2. Piping basics, piping shape

3. Piping material, Pipeline materials selection, Steels used for line pipe, Compositional limitations, mechanical properties, grades Fabrication of line pipe – seamless, longitudinal

welded, ERW, spiral Toughness and weld ability, Improving corrosion resistance Solid corrosion-resistant alloy pipe Internally clad pipe, New materials.

4. Pipeline design- Legislation and regulations, Development of pipeline design codes Design process, Detailed design: product categorization, locating pipelines, design pressures, factors, and stressing, Pipeline crossings, Pipeline valves, Other pipeline design considerations Surges/overpressures, Bends, Piping flexibility, Pipe protection, Fracture control Fluids and hydraulics.

5. Basics of welding, Types of welding process, Effects on line pipe of the welding process, Welding procedures, Inspection of welds

7. Piping components & types, Piping isometric, Selection of code & standards, Piping supports & hangers, P&ID, PFD diagrams, Piping insulation.

B: Offshore Pipeline Engineering

1. Subsea Field Components, Subsea structures, Subsea pipelines, rigid risers

2. Field Layout and pipeline route selection, Development options, Field architecture Geotechnical and geophysical survey, Seabed feature and obstructions, Route selection
3. Pipeline systems (e.g. single pipe, piggybacked pipe, bundle and etc.) what pipeline system to use (pros and cons) Rigid riser systems, what riser system to use (pros and cons)
4. Safety classifications 500m zone, Protection requirements , Trenching and back filling
5. Overview of design codes for subsea pipeline design
DNV-OS-F-101, PD8010-2, API 1111, DNV-OS-F101 stain limits and ECA requirements DNV-RP-F112 hydrogen induced stress cracking (HISC)
6. Spanning Assessment (based on DNV- RP-F105) Freespan concept, Freespan response free span parameters, screening criteria and detailed assessment approaches Static response, In-line and cross-flow VIV, Direct wave fatigue, Combine VIV fatigue.
7. On-bottom Stability (based on DNV-RP-F109), Hydrodynamics of current and wave. On-bottom stability concept, Stability assessment approaches (DNV-OS-F109). Absolute stability method (DNV-OS-F109). How to stabilize an unstable pipeline/tie-in spool.
8. Expansion and tie-in spools, Expansion phenomenon, Expansion in single pipes, piggybacked pipes and pipe-in pipes, why do we need tie-in spools. What is the optimum size and layout of a tie-in spool.

9. Lateral and Upheaval buckling and Crossing Design, Buckling phenomena Soil-pipe interaction, Lateral and axial friction Modeling of upheaval resistance of cohesive (clay) and granular (sand) soils Lateral buckling analysis (Hobbs approach and Finite Element Analysis) Upheaval buckling analysis
10. High Pressure - High Temperature (HP/HT) systems, HP/HT Pipeline systems, Challenges of design for HP/HT
11. Installation methods, S-lay installation method J-lay installation method, Floating Stress limits of over bend and sag bend (DNV-OS-F101)
12. Pre-commissioning, Pre-commissioning activities (hydrotest, cleaning, dewatering, conditioning and drying) Liquid/Gas pipelines, Pre-commissioning pigging.

7PE9 Project –I

B. Tech. (Petroleum Engineering) Max. Marks: 50
Hours per Week:2

7PE 10 Training and Industrial Visit

B. Tech. (Petroleum Engineering) Max. Marks: 100
Hours per Week: 2

7PE11 DECA

8PE1 Natural Gas Engineering

B.Tech. (Petroleum) 8th semester Max. Marks: 80
L3 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Properties and Measurement of Natural Gas**: Introduction to Natural Gas, origin of natural gas, other sources of gaseous fluids. Phase behaviour fundamentals, qualitative and quantitative phase behaviour, vapour liquid equilibrium.	**5**
	Equation of state: critical pressure and temperature determination. Gas compressibility, viscosity and thermal conductivity, formation volume factor.	**3**
II	**Gas Reservoir Performance and Gas flow measurement**: Fundamentals of gas flow in conduits, fundamentals of fluid flow in porous media, inflow performance curves, outflow performance.	**5**
	Gas flow measurement: fundamentals, Methods of measurements, Orifice meters equation, turbine meters.	**3**
III	**Flow of Gas in Production Tubing:** Introduction, gas flow fundamentals, vertical and inclined single phase flow of gas, Calculating flow and static bottom hole pressure,	**5**
	gas flow through restrictions. Temperatures profiling in flowing gas systems.	**3**
IV	**Natural gas Processing**: Gas liquid separations, dehydration processes, absorption and adsorption by gas permeation.	**4**

	Desulfurization processes: solid bed sweetening process, physical and chemical absorption processes, Acid gas removal. Integrating natural gas processing.	**4**
V	**Gas Compression:** Introduction, types of compressors, Selection, Thermodynamics of compressors, Design fundamentals for reciprocating, centrifugal and rotary compressors (single and multistage).	**4**
	Gas Gathering and Transport Gas gathering system, steady state flow in simple pipeline system, steady state and non steady state flow in pipelines, solution for transient flow. Installation, operation and trouble shooting of natural gas pipelines.	**4**
	TOTAL	**40**

TEXT BOOKS

1.Beggs, D, H, Gas Production Operations. Edition Technip. 1984

REFERENCE BOOKS

1. Ikoku, Chi, "Natural Gas Production Engineering", John Wiley and Sons, 1984.
2. Kumar Sanjay, "Gas Production Engineering", Gulf Publishing Company, TX, USA, 1987.
3. "Gas Processes Suppliers Handbook", USA, 1980.
4. Lee, J, Wattenbarger, R. A., "Gas Reservoir Engineering", Society of Petroleum Engineers, TX, USA, 1996

8PE2 Petroleum Economics & Risk Analysis

B.Tech. (Petroleum) 8th semester Max. Marks: 80
L3 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Introduction to upstream economic analysis,** energy overview of India. Time Value of Money, cash flow analysis, capital budgeting techniques,	**5**
	general probability, elements of oil and gas project cash flows.	**3**
II	**Reserves classification methods**: quantification, assessment of geosciences and reservoir engineering uncertainties.	**4**
	Assessment of reserves: production and demand in international market. Reserves auditing. Accounting systems for oil and gas. Valuation of petroleum properties.	**4**
III	**Inflation and cost escalation:** oil market and OPEC, share of non OPEC countries in oil production, International oil and gas pricing mechanism.	**4**
	Function of spot markets and marker crudes; Oil price uncertainty; market for gas; Gas sales contract; gas pricing; Exchange rate variation and influence on project economics; Risk associated with borrowing money; Partners – risks associated with partnerships. Geopolitics.	**4**
IV	**Sources of uncertainty and risk:** Geology - concept of exploration success; Facilities – problems encountered in subsurface and surface;	**4**
	Environmental issues: pertaining to oilfield development; Human failure; Government – imposition of changes to project; taxation, Concept and implications of demand elasticity; NELP	**4**
V	**Risk Management:** Sources of information to reduce uncertainty; Transferring risk – financial instruments and commodity trading;	**5**
	Diversification: Joint ventures; Scenario planning; relevant information in the context of decision-making; Simple Decision Methods; Sensitivity analysis. Decision analysis.	**3**
	TOTAL	**40**

TEXT BOOKS

1. Petroleum Economics and Engineering, Abdel-Aal, H. K. Bakr, A. B. Al-Sahlawi, M. A,

Dekrer Publication, 1992.

REFERENCE BOOKS

1. Estimation and Classification of Reserves of Crude Oil, Natural Gas, and Condensate, .Cronquist, C., SPE (2001)
2. International Exploration Economics, Risk, and Contract Analysis, Johnston, D, Pennwell

8PE3 Unconventional Hydrocarbon Resources

B.Tech. (Petroleum) 8th semester Max. Marks: 80
L3 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	Non conventional oil: Heavy oil, extra heavy oil and bituminous, oil shales. Introduction, geology of non conventional oil, origin and occurrence worldwide.	5
	Reservoir rock and fluid properties. Exploration and evaluation.	3
II	Non conventional Gas: Introduction to shale gas and basin centred gas, coal bed methane, tight reservoirs. Formation and properties of coal bed methane.	4
	Thermodynamics of coal bed methane. Introduction, importance of shale gas, shale gas geology, important occurrences in India, Properties of shale gas, petro physical properties. Introduction and present status of gas hydrates. Formation and properties of gas hydrates	4
III	**Coal and Gas conversions to oil:** Introduction, classification and principles, pyrolysis, theoretical aspect of processes involved in conversion.	5
	Coal Gasification : Technological development of direct conversion and indirect processes and sustainability of conversions. Coal gasification and liquefaction. Fisher Tropsch synthesis.	3
IV	Development and Production of Non conventional oil like Shale oil, heavy oil**:**	4
	Non conventional oil production, thermal and non thermal methods of oil recovery.	4
V	Development and Production of Non conventional gas: Nature of CBM reservoirs, Hydro-fracturing of coal seam. Well operation and production equipment. Treating and disposing produced water.	4

	CBM Testing of coal bed methane wells. Development of shale gas, design of hydro fracturing job, horizontal wells, production profiles, Drilling and completion of gas hydrate wells. Prevention and control of gas hydrates. Gas hydrates accumulation in porous medium. Gas extraction from gas hydrates.	**4**
	TOTAL	**40**

TEXT BOOKS

1. Carrol John, Natural Gas Hydrates: A guide for engineers, Gulf Publications, 2003.

REFERENCE BOOKS

1. Farooqi Ali, S M, Jones S A and Meldau R F, Practical Heavy Oil Recovery, SPE, 1997, 434 pp.
2. James T. Bart is, Frank Camm, David S. Ortiz, Producing liquid fuels from coal: Prospects and policy issues. NETL, DOE, USA, 2008, 198 pp
3. Marlan W. Downey, William Andrew Morgan, and Jack C. Threet, Petroleum Provinces of

8PE4.1 Industrial Engineering Management

B.Tech. (Petroleum) 8th semester Max. Marks: 80
L3 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Basic functions of Management** – Planning, organizing, staffing, directing and controlling.	**4**
	Introduction to Industrial Engineering techniques.	**4**
II	**Productivity**: definition, measurement. Work study and its role in improving productivity of an organization.	**4**
	Types of production systems.	**4**
III	Introduction to production planning and control	**8**
IV	Concepts of Human Resource Management – Selection,	**4**
	Training & Development.	**4**
V	**Finance Management** – Capital Budgeting Techniques. Pay-back period, ARR, NPV, IRR, PI; Sources of capital; Cost concepts and Break-even analysis. Project Management:	**4**
	Introduction, Network construction & identification of critical activities in CPM & PERT	**4**

	TOTAL	**40**

TEXT BOOKS

1.Varshney, R.L. and Maheswari, K.L. 2006. Managerial Economics, 19th Edn., Sultan Chand & Sons., New Delhi.

REFERENCE BOOKS

1. Koontz, H. and Weihrich, H. 2007. Essentials of management, 7th Edn., Tata McGraw Hill, New Delhi.
2. Prasad, L.M. 2006. Organisational behaviour, 4th Edn., Sultan Chand & Sons, New Delhi.
3. Luthans, F. 2005. Organisational behaviour, 10th Edn., Mc-Graw Hill International Edn., Singapore.
4. Keat, P.G. and Young, P.K.Y. 2004. Managerial Economic, pears education Inc.

8PE4.2 Oil and Gas Processing Plant Design

B.Tech. (Petroleum) 8th semester Max. Marks: 80

L3 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Oil desalting**: Operation, variables, Heater treater design. Crude & Condensate Stabilization: LTX Stabilization. Oil & Gas Treatment :	**4**
	Oil desalter, emulsion treatment theory and practice, Emulsifiers & Demulsifiers, Gravity Separation, coalescence, coalescing media, electrostatic coalescers.	**4**
II	**Treating Equipment**: pressure vessels - Vertical, horizontal, Electrostatic. Process heat duty, sensible heat of natural gas, water,	**5**
	heat transfer from fire-tube. Heat exchangers types, fluid placement, sizing, number of tubes.	**3**
III	**Natural Gas Dehydration**: (a) Glycol Process: operation, effect of variables, dew point depression, stage calculation.NTU - graphical and analytical methods, Absorber sizing.	**4**
	Lean oil absorption. (b) Solid bed process: design & operation, effect of process variables, Regeneration and cooling calculations. Hydrocarbon recovery. (c) Hydrate formation & inhibition.	**4**

IV	**Natural Gas Sweetening:** Acid gases, Toxicity, Pipeline specification. Solid-bed Process :	**4**
	Design, operation & effect of variables. Adsorbent selection.	**4**
V	Multistage Separation, Hengsteback's Flash calculation, stabilizer design. Amine and other absorptive process details	**8**
	TOTAL	**40**

TEXT BOOKS

1. Gas Production Engineering – S. Kumar-Gulf publishing Co., 1987.
Production operations, T. O. Allen and A. P. Roberts, SPE – Vol - I 4-th edition.

8PE4.3 Petrochemical Engineering-II

B.Tech. (Petroleum) 8th semester Max. Marks: 80

L3 Exam Hours: 3

UNIT	CONTENTS	CONTACT HOURS
I	**Production of some commercially important petrochemicals** C3 and higher like Chlorobutane,	**4**
	Isoprene, MTBE, Acrylonitrile, Cummene, Isopropanol, etc.	**4**
II	**Production of aromatics** some commercially important petrochemicals from aromatics. like TNT,	**4**
	Benzoic acid, DMT/TPA, Styrene, linear alkyl benzenes.	**4**
III	**Production of Polymer** commercially important commodity polymers like polyethylene,	**5**
	polypropylene, polystyrene, PVC etc	**3**
IV	**Production of fiber** commercially important engineering polymers and fibres like ABS plastic,	**4**
	polyester, nylon-6, resin, rubber, etc.	**4**
V	**Production polycarbonates**, poly sulphones,	**4**
	polyketones and aramid fibres	**4**
	TOTAL	**40**

TEXT BOOKS

1. Chauvel, A. and Lefebvre, G., "Petrochemical Processes", Gulf Publishing Company, Houston, 1989.

REFERENCE BOOKS

1. Matar, S., "Chemistry of Petrochemical Processes", Gulf Publishing Company, Houston, 2/e, 2000
2. Waddams, A.L., "Chemicals from Petroleum", Gulf Publishing Company, London, 4/e, 1980.
3. Mall, I.D., "Petrochemical Process Technology", Macmillan India Limited, Delhi, 2007.

8PE5 Seminar

B. Tech. (Petroleum Engineering) Max. Marks: 100
Hours per Week:2

8PE6 Reservoir Simulation lab

B. Tech. (Petroleum Engineering) Max. Marks: 100
Hours per Week:2

Practicals and exercises related to application of oil field Simulator

8PE7 Gas Testing Lab

B. Tech. (Petroleum Engineering) Max. Marks: 100
Hours per Week:2

Practicals:

1. Determination of compositions of Gas with Gas Chromatography.
2. Determination of Reid Vapour Pressure.
3. Determination of % reserve of gas.
4. Determination of Gas gravity.
5. CO_2 detection.

8PE8 Comprehensive Petroleum Engineering

B. Tech. (Petroleum Engineering) Max. Marks: 100
Hours per Week:2

Exercises and presentation based on comprehensive understanding of various subjects of the curriculum.

8PE9 Project II

B. Tech. (Petroleum Engineering) Max. Marks: 200
Hours per Week:3

8PE10 DECA