

**CURRICULUM
OF
PETROLEUM ENGINEERING
FOR
B.E./B.Sc. & M.E./M.Sc.**



(Revised 2003)

**HIGHER EDUCATION COMMISSION
H-9, ISLAMABAD**

CURRICULUM DIVISION

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*Composed by **Ghafoor Ahmad**, HEC, Regional Centre, Lahore*

TABLE OF CONTENTS

<u>S.No.</u>	<u>Detail</u>	<u>Page No.</u>
1.	INTRODUCTION	6
2.	SCHEME OF STUDIES FOR B.E./B.Sc.	8
3.	DETAIL OF COURSES FOR B.E./B.Sc.	11
4.	SCHEME OF STUDIES FOR M.E./M.Sc.	35
5.	DETAIL OF COURSE FOR M.E./M.Sc.	36
6.	RECOMMENDATIONS	39

PREFACE

Curriculum of a subject is said to be the throbbing pulse of a nation. By looking at the curriculum of a subject, one can judge the state of intellectual development and the state of progress of a nation. The world has turned into a global village, new ideas and information are pouring in a constant stream. It is, therefore, imperative to update our curricula by introducing the recent developments in the relevant fields of knowledge.

In exercise of the powers conferred by Sub-section (1) of section 3 of the Federal Supervision of Curricula Textbooks and Maintenance of Standards of Education Act 1976, the Federal Government vide Notification No.D773/76-JEA (Cur.), dated December 4, 1976, appointed Higher Education Commission as the Competent Authority to look after the Curriculum Revision Work beyond Class XII at Bachelor level and onwards to all Degrees, Certificates and Diplomas awarded by Degree Colleges, Universities and other Institutions of higher education.

In pursuance of the above decisions and directives, the Commission is continually performing curriculum revision in collaboration with the Universities. According to the decision of the special meeting of Vice-Chancellors' Committee, curriculum of a subject must be reviewed after every 3 years. For the purpose, various Committees are constituted at the national level comprising senior teachers nominated by the Universities. Teachers from local degree colleges and experts from user organizations, where required, are also included in these Committees.

The National Curriculum Revision Committee on **Petroleum Engineering** in its meeting held in July 15-17, 2003 at the Higher Education Commission, Regional Centre, Lahore finalized the draft curriculum after due consideration of the comments and suggestions received from the Universities and Colleges where the subject under consideration is taught.

The Final draft prepared by the Curriculum Revision Committee duly approved by competent authority is being circulated for implementation by the Universities.

(PROF. DR. ALTAF ALI G. SHAIKH)
DIRECTOR GENERAL (CURRICULUM)

July, 2003

INTRODUCTION

The final meeting of National Curriculum Revision Committee in Petroleum Engineering was held from 15-17 July, 2003 at Higher Education Commission, Regional Centre, Lahore to revise and update the draft curriculum developed in the first meeting held from 29-31st October, 2002. The Following attended the meeting:

1. Engr. Dr. Obed-ur-Rehman Paracha, Convener
Manager Reservoir Engineering,
Oil & Gas Training Institute, Plot No.136-137,
Street No.16, Sector I-9, Islamabad.
2. Engr. Javaid Afzal, Member
Associate Professor,
Department of Petroleum Engineering,
University of Engg. & Technology,
Lahore.
4. Engr. Shahzad Ali Baladi, Member
Professor,
Institute of Petroleum & Natural Gas Engg.,
Mehran University of Engg. & Tech., Jamshoro.
5. Engr. Muhammad Inamullah, Member
Assistant Professor,
Department of Petroleum Engineering,
University of Engg. & Technology, Lahore.
6. Engr. Azam Khan, Member
Assistant Professor,
Department of Petroleum Engineering,
University of Engg. & Technology,
Lahore.
7. Mr. Zahid Khan Member
Reservoir Engineer
Pakistan Petroleum Limited
3rd floor PIDC Building
Ziaud din Ahmad Road, Karachi.

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| 8. | Engr. Amanat Ali Bhatti,
Associate Professor,
(Attended 1 st Meeting)
Department of Petroleum Engineering,
University of Engg. & Technology, Lahore. | Member |
| 9. | Engr. Mehboob Ahmad Malik,
Engineering Department,
(Attended 1 st Meeting)
Oil & Gas Development Company, Islamabad. | Member |
| 10. | Prof. Dr. Rafique Akhtar Kazi,
Professor,
(Attended 1 st Meeting)
Institute of Petroleum & Natural Gas Engg.,
Mehran University of Engg. & Tech., Jamshoro. | Member |
| 11. | Dr. Hafeez ur Rehman Memon,
Professor,
Institute of Petroleum & Natural Gas Engg.,
Mehran University of Engg. & Tech., Jamshoro. | Secretary |

The meeting started with the recitation from the Holy Quran by Mr. Bashir Ahmad, Admin. Officer, Higher Education Commission, Regional Centre, Lahore.

Mr. Bashir Ahmad welcomed the participants on behalf of the Director HEC, Regional Centre, Lahore.

Mr. Muhammad Tahir Ali Shah, Assistant Director, HEC, Islamabad explained the objectives and emphasized the importance of the meeting. The committee, before taking up the regular agenda, elected Dr. Obed-ur-Rahman Paracha as its Convener and Prof. Dr. Hafeez ur Rehman Memon as Secretary. The Committee appreciated the participation of the representatives of the industries in the meeting and the valuable feed back provided by them. The Committee expressed satisfaction on the draft curriculum prepared in its previous meeting on October 29-31, 2002, however substantial changes were incorporated to meet the current academic and industrial requirements.

**SCHEME OF STUDIES
FOR
B.E./B.Sc**

1ST TERM

Serial No.	Course Title	Work Load	
		Credit Hours	
		Theory	Practical
1	Elements of Petroleum Engineering	3	1
2	Communication Skills	2	0
3	Applied Geology	3	1
4	Applied Chemistry	3	1
5	Engineering Drawing & Graphics	2	1
TOTAL		13	4

2ND TERM

Serial No.	Course Title	Work Load	
		Credit Hours	
		Theory	Practical
1	Applied Mathematics-I	3	0
2	Applied Physics	3	1
3	Workshop Practice	0	1
4	Statigraphy and Structural Geology	3	1
5	Islamic/Pakistan Studies-I	0	0
TOTAL		11	3

3RD TERM

Serial No.	Course Title	Work Load	
		Credit Hours	
		Theory	Practical
1	Petroleum Geology & Exploration	3	1
2	Applied Mathematics-II	3	0
3	Computer Programming & Application Software	3	1
4	Fluid Mechanics	3	1
5	Islamic/Pakistan Studies-II	2	0
TOTAL		14	3

4TH TERM

Serial No.	Course Title	Work Load	
		Credit Hours	
		Theory	Practical
1	Strength of Material	3	0
2	Chemical Engineering Thermodynamics	3	1
3	Petrophysics	3	0
4	Applied Electricity	3	1
5	Applied Statistics	3	0
TOTAL		15	2

5TH TERM

Serial No.	Course Title	Work Load	
		Credit Hours	
		Theory	Practical
1	Drilling Engineering-I	3	1
2	Well Logging	3	0
3	Applied Mathematics-III	3	0
4	Properties of Reservoir Fluid	3	1
5	Instrumentation & Control	3	1
TOTAL		15	3

6TH TERM

Serial No.	Course Title	Work Load	
		Credit Hours	
		Theory	Practical
1	Corrosion Principles and Control in Petroleum	3	1
2	Production Engineering-I	3	1
3	Reservoir Engineering-I	3	1
4	Drilling Engineering-II	3	1
5	Applied Numerical Methods	3	0
TOTAL		15	4

7TH TERM

Serial No.	Course Title	Work Load	
		Credit Hours	
		Theory	Practical
1	Gas Engineering	3	1
2	Petroleum Economics	3	0
3	Reservoir Engineering-II	3	1
4	Environment and Safety	3	0
5	Production Engineering-II	3	1
TOTAL		15	3

8TH TERM

Serial No.	Course Title	Work Load	
		Credit Hours	
		Theory	Practical
1	Gas Reservoir Engineering	3	1
2	Principles of Reservoir Simulation	3	1
3	Principles of Enhanced Oil Recovery	3	1
4	Well Testing	3	1
5	Project	0	4
TOTAL		12	8

DETAIL OF COURSE FOR B.E./B.Sc

FIRST TERM

ELEMENTS OF PETROLEUM ENGINEERING

National and International energy requirements. Sources of energy. Role of Petroleum as energy source. Brief history of International Petroleum industry. Influence of Petroleum on International Politics.

Overview of Petroleum Engineering including geological, geochemical and geophysical prospecting. Drilling mechanisms, formation evaluation, reservoir engineering, production engineering, processing, transportation, refining and petrochemicals. Utilization of products Highlights of local Petroleum industry. Job Scope of Petroleum engineering graduate.

Recommended Books:

1. Petroleum Engineering Drilling & Well completion by Carel Gatlin.
2. A First Course in Petroleum Technology by David A.T. Donobue, Karl R. Lang.
3. Introduction to Petroleum production Vol.I, II, III by Dr. Skinner.
4. Natural Gas Engineering (Hand Book) by Donlad L. Katz.

COMMUNICATION SKILLS

Speaking Skills

Active listening skills, Eliciting views and comments, Agreeing and disagreeing techniques, Persuasions and counter argument, Clarifying and checking skills, Interrupting skills, Signalling devices, Body language, meetings, presentation.

Pronunciation

Problematic individual sounds, Elements of connected speech, Intonation and pitch.

Reading

Skimming and scanning, Identifying main ideas, Understanding gist.

Listening

Listening for gist and specific information, Note taking, Prediction.

Writing

Understanding purpose, planning and Organization, Style and register, changing conventions of electronic media.

Structure and Vocabulary

Overview of tense system, Principles of word grammar, Common idiomatic language, Common transfer errors, Modifying techniques, Hypothesis and likelihood.

APPLIED GEOLOGY

Introduction to various branches of Geology. Origin of the earth and its place in Universe. Interior of the earth and chemical composition of the earth's crust. Mountain building and valley formation. Drainage pattern and their types. Agents of weathering and erosion. Theories of plate tectonics. Earth quakes and volcanism. Brief study of the formation of rocks and minerals. Occurrence of economical mineral deposits of Pakistan.

Books Recommended

1. Anatole Dolqoff. 1996. Physical Geology
2. Tarbuch and Lutgens, 1999. Earth (A introduction of Physical Geology)

APPLIED CHEMISTRY

1. Periodic classification of elements on of the structure of atoms. Physical Principles involved in the study of the properties of metals and non metals.
2. Solution. Solubility, Raoult's Law, Azeo-tropic solution, vapour pressure and distillation of partially-miscible and miscible liquids. Diffusion, Osmosis, Theory of dilute solutions. Molecular weight of substances, relation with vapour pressure.
3. Electrochemistry Electrolysis. Electrolytic conductance, transport number and transport phenomena determination of transport number, ionic equilibria, Activity co-efficient Electrolyte, determinations. Debye Huckel theory strong electrolytes. Solubility Products, Galvanic cells, Potentiometric titrations, pH. Buffer solution, Acid base indicators.
4. Molecular Properties. Surface tension, interfacial tensions, Surface films Surface-active agents.

5. Free Energy and Equilibrium. Chemical Equilibrium Surface phenomena and catalysis.
6. Organic Chemistry. Electron displacement; Resonance and its applications; Mechanism and methods of determining; Stereo Chemistry; organic reaction; Electrophilic substitution in aromatic system; Addition to carbon-carbon and carbon-oxygen double bond; Elimination reactions; Interconversion of functional group; organic Nitrogen compounds and heterocyclic system; Aromatic series.
7. Analytical Chemistry. To familiarise students with the concept of accuracy of analysis, separation techniques and Gas Chromatography.
8. Geochemistry. Geo-chemical classification of elements, chemical weathering geo-chemical description, geo-chemical prospecting, significance and techniques.

ENGINEERING DRAWING AND GRAPHICS

Part-I

Introduction. Types of lines, lettering, dimensioning, and drawing instruments. Projection, Types of projection, orthographic projection. Plan of projection, four quadrants.

Traces of a line, true length of line, inclination to both the planes, projection of planes.

Loci of Points. Loci of points and straight line, loci of crank mechanism.

Curves Used in Engineering Practice. Cycloid, Trochoid, epicycloid, Ptochoid, hypotrochoid (superior and inferior). Involute, evolute, archimedean, spiral.

Development of solids. Types of solids, polyhedra, solids of revolution, construction, of polygon, prism, pyramid, cylinder, cones sphere, (development of all solids with passing cutting plane).

Intersection of Surfaces. Intersection of cylinder and cylinder, cone and cylinder. Cone and cone, cone and prism.

Axonometric Projection. Types isometric projection of solids, planes and typical examples.

Projection of Auxiliary Planes. Auxiliary planes and views, Projection of points, plane, true length of line.

Projection of solids. True shape of section on auxiliary plane of various solids.

Part-II (Laboratory Work)

1. Introduction to the subject use of instruments.
2. Planning of a drawing sheet, the projector of simple solids simple position, and the oblique and auxiliary planes.
3. Lettering and dimensioning the principal requirement of a working drawing.
4. Isometric and pictorial projection of solid figures, making of freehand sketches from solid objects and from orthographic projection.
5. Section of solids, riveted joints.
6. Screw thread systems, nut and bolts, keys and cotter, coupling and simple bearings.
7. Pipe connections, engine detail.

Short columns, combined bending and direct stresses. Euler's theory of buckling for long column-Empirical formula.

Mechanical properties of metals and timber in tension and compression respectively. Principles of testing machines. Impact Loads. Hardness.

Recommended Books

1. Fundamentals of Engineering Drawing by Warren J. Luzjader
2. Elementary Engineering by N.D. butt
3. Elements of Solid Geometry by M.K. Guna
4. A first year Engineering Drawing by A.C. Parkinso
5. Auto CAD, Release Ver. 30 for Practical Purpose.

SECOND TERM

APPLIED MATHEMATICS-I

Complex Numbers and Hyperbolic Functions. Basic concepts, Argand diagram, Exponential and Polar forms, De Moivre's theorem, Roots of complex numbers Hyperbolic and inverse hyperbolic functions.

Matrices and Determinants. Algebra of matrices. Inverse of a Matrix Determinants, Properties of determinants Solution of systems of linear equations, Eigenvalues and Eigenvectors.

Application of Differentiation. Velocity and acceleration, Tangents and normals, Maclaurin's and Taylor's series, Maxima and Minima of a function of one variable, Curvature and radius of curvature.

Integration and Its Application. Methods for evaluating indefinite integrals, Definite integrals, Simple Properties of definite integrals, Plan Areas, Length of an arc, Surface area and volumes of solids of revolution, Moments and Centroids of plan areas, Moment of inertia of plane areas, Theorem of Pappus.

Partial Differentiation. Function of two or more variables, Partial derivative, higher order partial derivatives, Total differentials and their applications of small errors, Differential of implicit functions, Chain rules. Maxima and Minima of a function of two variables, Taylor's and Maclaurin's series for a function of two variables.

Ordinary Differential Equations. Basic concepts, Formulation of differential equations, First order differential equations, Second and higher order differential equations with constant coefficients, systems of ordinary differential equations, Application to the relevant Engineering Problems.

Vector Algebra with Applications. Scalars and Vectors, vector algebra, Scalar and Vector products, Triple products, Vector functions, differentiation and integration of vector, application to line plane and sphere.

Polar Coordinates and Polar curves.

Recommended Books

1. Brief Calculus & its applications by Doniel D. Benice.
2. Applied Calculus by Raymond A. Barnett.
3. Calculus by Gerald L. Bradley.

APPLIED PHYSICS

Electricity. Electric field & electrical forces, Electric field calculations, Gauss's Law, Applications of Gauss's Law, Charges on conductors, Electrical Potential, Energy, Potential, Calculate of Potentials, Potential gradient, Cathode-ray tube.

Sources of Magnetic Field. Magnetic field of a moving charge, Magnetic field of a current element. Ampere's Law, Magnetic field of a long straight conductor, Force between parallel conductors, Magnetic field of circular loops solenoid.

Magnetism. Magnetic field and displacement current, Magnetic properties of materials.

Electromagnetic Induction. Induction phenomena, Motional electromotive force, Faraday's law Induced electric fields, lenz's Law, Eddy currents, Maxwell's equations.

Electromagnetic Waves. Introduction, speed of and electromagnetic wave, Energy in electromagnetic waves, Electromagnetic Waves in matter, Sinusoidal Waves, Standing.

Interference & Diffraction. Waves and Oscillations. Sound Waves. Resultant of simple Harmonic Motions Resonance and Beats. Units and Measurement of Sound Waves. Reflector, Refraction of sound. Interference, Diffraction grating, Interference in Thin film X-ray Diffraction of sound waves.

Atomic Physics. Structure of atom, Line spectra, Energy levels, Atomic spectra, The laser, continuous spectra, X-ray production and scattering.

Nuclear Physics. The nuclear atom, properties of nuclear. Nuclear stability, Radioactive transformations, Nuclear reactions, Nuclear fission, Nuclear fusion, reaction, Neutron thermalization, Radiation Detectors.

Natural radioactivity, Artificial radioactivity, Three distinct types of radiation's Radioactive series, Laws of radioactive disintegration, decay constant. Half period and mean constant, Interaction of rays with matter.

Practical for Petroleum Engineers

1. Ionization Potential of Mercury.
2. To study the state Characteristics of a transistor
3. To find the value of H by tangent galvanometer

4. To find the E/M of electron by deflection methods
5. To draw B-H curve of a given material
6. To find the velocity of sound waves in different media
7. To find the surface tension of a given liquid
8. C.R.O. demonstration.

Workshop Practice

Machine Shop, Fitting shop, Electrical Shop, Carpentry and Pattern Shop, smithy and Foundry Shop, Welding and Plumbing.

STRATIGRAPHY AND STRUCTURAL GEOLOGY

Principles of Stratigraphy: Concepts of geological time and its scale. Correlation techniques, isostasy and continental drift. Stratigraphy of Pakistan with special emphasis on salt range. Introduction to structural geology and its objectives. Primary and secondary structures of sedimentary rocks and the determination of dip, strike and thickness of beds. Completion of out crops and construction of cross sections.

Modes of Deformation of Rocks: Parts, varieties and classification of Folds, faults, joints and unconformities. Expression of the above features on geological field maps and construction of cross sections. Geological mapping and the application photogrammetry.

Recommended Books

1. Carl, O. Dunbar & John Rodgers. Principles of Stratigraphy, John Willey & Sons.
2. Sam Boggs. Jr. Principles of Sedimentology and Stratigraphy Mersil P.C.
3. M.P. Billings. Structural Geology. Prentice Hall of India

ISLAMIC/PAKISTAN STUDIES-I

As recommended by HEC

THIRD TERM

PETROLEUM GEOLOGY & EXPLORATION

Geological history of Petroleum. The origin, migration and accumulation of petroleum, Reservoirs with abnormal pressure and temperature. Geological distribution of petroleum in the world. Geological basins of Pakistan. Geology of existing oil and gas fields in Pakistan. Surface geological methods for petroleum exploration. Use of topography and surface features for oil prospecting.

Geophysical exploration methods with emphasis on seismic methods. History of exploration in Pakistan.

Recommended Books

1. Geology of Petroleum, A.I. Levorsen
2. Basic petroleum Geology, Peter K. Link
3. Petroleum Geology of Pakistan, Iqbal B. Kadri.

APPLIED MATHEMATICS-II

Laplace Transformation. Laplace transforms of elementary functions. Unit step function, Dirac's delta function, Periodic functions, Inverse Laplace transforms, Convolution.

Applications. Ordinary differential equations, system of differential equations, physical problems.

Fourier Series. Periodic functions, Fourier series for the function of period 2π , even and odd functions. Fourier series for functions having arbitrary period, Half range expansions, complex form of Fourier series, Application to physical problems.

Double Integrals and its Applications. Double Integrals, Geometrical interpretation. Their applications in determining areas, volumes, centroids and moments of inertia, Double integrals in polar coordinates.

Series solution of Differential Equations & Special Functions. Beta and Gamma Functions, Power series, Method of Frobenius, Legendre's differential equation, Legendre polynomials, Generating function, Recurrence formulas, Orthogonality, Bessel's differential equation, Bessel functions of first and second kind, Generating functions, Recurrence formulas, Orthogonality, Modified Bessel functions.

Partial differential Equations (PDEs). Basic concepts, Derivation (modeling) of I-D equations, solution using method of separation of variables, D' Alembert solution of the wave equation, Classification of linear second order P.D. equations, Two dimensional partial differential equations (wave, heat and Laplace), General solutions, Laplace equation in Polar coordinates, Laplace equation in cylindrical and spherical polar coordinates.

Recommended Books:

1. Advanced Engineering Mathematics, H.K. Dass
2. Advanced Engineering Mathematics, Dr. B.S. Grawall
3. Advanced Engineering Mathematics, Erwin Crayzig
4. Laplace Transform, Schaum Series.

COMPUTER PROGRAMMING AND APPLICATION SOFTWARE

Introduction to Digital computer Set up. Programming Languages and Compilers Introduction to Operating systems. Dos and WINDOWS. File Editing commands. Problem analysis and Flow charts.

Elements of Programming. Assignment Statement Control Statements. Repetitive Statements. Input and Output Statements. Subprogrammes. Debugging Techniques. Programming Examples and Exercises using FORTRAN, C++ & Visual Basic language.

Introduction to Word Processors, spread sheets, databases presentation slides preparation tools and Internet.

Recommended Books:

1. Turbo C++, Robert Lafore
2. How to Programming with C++, Deiliet & Delite.

FLUID MECHANICS

Fluid Properties. Properties of fluids, Determination of viscosity and its application to lubricated bearings.

Fluid Statics. Pressure intensity and pressure head, and their measurements. Hydrostatic forces on a submerged surface. Buoyancy and flotation.

Fluid Kinematics. Classifications of fluid flow. Equation of continuity Bernoulli's equation. Fluid mass under acceleration. Forced vortex.

Flow Measurement. Venturimeter, orifices, mouthpieces, nozzles, pitot tube and sharp crested weirs/notches. Steady flow through pipes. Darcy Weisbach equation. Losses in pipelines, Hydraulic and energy gradient. Transmission of Energy.

Uniform flow in open Channels. Chezy's and Manning's Equations. Economical rectangular and trapezoidal cross-sections.

Compressible fluids. Isothermal and adiabatic flow. Continuity and energy equations, Steady Flow of gases through venturimeter and pipes.

Recommended Books

1. Fluid Mechanics for Petroleum Engineers, Elsevier Publisher.
2. Fluid Mechanics, Walther Kaufman
3. Fluid Mechanics with Engineering Application, Daugherty and Franzini.
4. Engineering fluid Mechanics, K.L. Kumarr.

ISLAMIC/PAKISTAN STUDIES-II

As recommended by HEC.

FOURTH TERM

STRENGTH OF MATERIALS

Types of stresses and strains. Load extension diagrams. Hooke's Law. Temperature stresses.

Geometrical properties of plane areas. (Centroid, Moment of Inertia & Product of Inertia) Shearing Force and Bending Moments for simply supported beams, Cantilever and overhanging beams.

Theory of simple Bending and Shearing Stresses in beams. Theory of Torsion in circular shafts (solid and hollow).

Recommended Books

1. Strength of Materials by Tamo Shungo Young.

CHEMICAL ENGINEERING THERMODYNAMICS

Fundamental. The system, working substance, heat and work, ideal gas, pure substance, properties and state, ideal gas, kinetic theory of gases including discussion of the specific heat of gases. Phase process, cycle, temperature scales. Definition and Units of basic system parameters. Following topics with emphasis on hydrocarbon fluids:

First Law of thermodynamics. Internal energy, enthalpy, phase rule, heat capacity.

Volumetric Properties of Pure Fluids, PVT Behaviour of pure substances, equation of state and correlation. Heat Effects with and without Phase Change.

Second Law of Thermodynamics. Heat engine, entropy. Volumetric Properties of Multicomponent Fluids: PVT. Behaviour of pure substances, equation of state and correlations. Heat effects with and without Phase change. Thermodynamics of flow Processes: Flow in pipes, expansion and compression processes. Conversion of Heat into work: Steam power plant – Internal combustion engines, auto and diesel engine.

Heat Exchangers. Types, the overall heat transfer co-efficient, log mean temperature difference, Parallel flow and counter flow heat exchanger, Multiphase and cross-flow heat exchanger, the effective NTU relations.

Boiling and Condensation. Boiling curve for pool boiling, condensation over vertical plates, empirical correlations.

Recommended Books

1. Applied Thermodynamics, A.Mc Conkey, T.D, EASTOP.
2. Process Heat Transfer, D.Q. Kern.
3. Surface Production Operation Volume-I, Ken Arnold & Manrice Stewart.

PETROPHYSICS

Petrophysics. Introduction to formation evaluation, core analysis. Fundamental properties of fluid permeated rocks; porosity, Permeability, fluid saturations, compressibility, surface kinetics. Core-sampling and preservation. Measurement of basic rock properties. Interpretation of basic core analysis data. Special rock properties; electrical, acoustic, thermal.

Application of core analysis data. Example calculations of petrophysical properties with the help of computers.

Recommended Books

1. Applied Petroleum Reservoir Engg., B.C. Craft & M.F. Hawkins
2. Fundamental of Reservoir Engg., L.P. Dake
3. Petroleum Reservoir Engg. Physical Properties, James W. Amyx.

APPLIED ELECTRICITY

Nature of Electricity: Electric circuit electromagnetism, systems of units. Alternating currents, alternating current circuits electrical resonance. Principles of electronics, measuring instruments, principles of measuring physical quantities by electrical methods. Single-Phase transformer, introduction to alternator. The induction motor. The direct current machine. Principles of house wiring and industrial wiring.

Storage Batteries: Lead and nickel iron cells. Charge and discharge. Quantity and energy efficiencies.

Recommended Books

1. Electrical Technology, by B.L. Theraja
2. Electrical Technology, by E.D. Hughes
3. Electrical Technology, by V.K. Mehta.

WELL LOGGING

Basic Concepts. Logging environment, porosity, permeability, fluid saturations, formation density, resistivity, invasion process and resistivity profiles.

Electrical Logs. SP logs, conventional, normal, lateral and micro devices.

Nuclear Logs. Gamma ray, neutron and formation density logs Sonic or acoustic log. Cross plots of various logs.

Quantitative Analysis. Formation water resistivity and saturation determination. Lithology and porosity determination.

Recommended Books

1. Applied Openhole Well Analysis, Brock.
2. Well Logging I & II, J.R. Jordan & F.L. Campbell.

3. Fundamental of Well Log Interpretations (The Intr. Of Logging data), O.Serra.

FIFTH TERM

DRILLING ENGINEERING-I

Purpose of drilling, planning the well. Rotary drilling its introduction and basic operations. Basic rig components and brief introduction to their function mud pumps rating and capacities. Rotary drilling bits. Bits types, standard classification of bits. Bit selection and evaluation. Development in drilling system. Introductions to drill fluids, function general nature and composition. Different types of drilling mud Drilling mud additives. Drilling hazards and their remedies. Drilling mud calculations. Air, natural gas, and aerated mud used as drilling fluids. Calculation of air and horsepower requirements.

Pressure relations in the earth and bore hole. The hydrostatic heads of liquids, the hydrostatic heads of mud and cement slurries. Total overburden pressure, formation pressures. Pressure relations in bore holes.

Casing Design, standardization of casing, API casing performance properties, casing design criteria, special design consideration. Casing landing.

Recommended Books:

1. Applied Drilling Engineering, A.T Bourgrove jr., K.K. Millehim.
2. Drilling fluids Optimization, J.L. Lummus and J.J. Azar]
3. Formulas and Calculation for Drilling, NJ. Lapeyrouse
4. horizontal Well Technology, S.D. Joshi.

APPLIED STATISTICS

Measures of central tendency. Measures of dispersion. Frequency distributions Normal, Chi-square, student's-t, and F-distributions, Estimations and hypothesis testing, confidence intervals Analysis of variance.

Regression Analysis. Linear – simple and multiple Polynomial – power, orthogonal, non-linear, step – wise.

Correlation. Auto and Cross correlation. Time trend analysis, filtering, moving averages data smoothing.

APPLIED MATHEMATICS-III

Complex Variables. Functions, Limits and Continuity, Derivatives, Analytic functions, Cauchy-Reimann equations, Elementary complex functions (Exponential, Trigonometric, Hyperbolic, Logarithmic etc), simply multiply connected regions, complex integration, Cauchy's theorem, Cauchy's integral formula, Convergence and Radius of Convergence of Power Series, Taylor's and Laurent's series, Zeros and singularities, poles, Residues, The residue theorem, Contour integration, Conformal mapping.

Advanced Vector Analysis. Scalar and vector point functions, Gradient and its geometrical interpretation, Directional derivative, Divergence and Curl and their physical interpretations, Vector identities, Line integrals, Conditions for a line integral to be independent of path, surface and volume integrals, Green's theorem in the plane, Gauss' divergence theorem and Stockes theorem.

Cartesian Tensors. Summation convention, Kronecker delta, Alternating symbol, Relation between alternating symbol and Kronecker delta, Tensor of first, second and tensors, Differentiation of tensors, Application to vector analysis, Eigenvalues and Eigenvectors of a tensor.

Recommended Books

1. Advanced Engineering Mathematics, H.K. Dass.
2. Advanced Engineering Mathematics, Dr. B.s. Grawall.
3. Advanced Engineering Mathematics, Erwin Crayzig.

PROPERTIES OF RESERVOIR FLUID

Chemistry of petroleum and review of thermodynamic concepts. Basic concept of phase behaviour; single, binary, and multi-component systems. Equations of State for real fluids. Calculation of phase equilibria for reservoir fluids, their sampling procedures. Determination of reservoir fluid properties by:

1. Field data
2. Laboratory Analysis
3. Correlation's
4. Equations of state

Preparation of fluid analysis data for use in reservoir and production engineering calculations.

Properties of oil field waters. Hydrates. Use of existing/available software for phase behaviour calculations.

Recommended Book

1. Properties of Petroleum Fluids by McCain.

INSTRUMENTATION AND CONTROL

Review of laplace transform control system (introduction) first and higher order systems and their dynamic linearization overall transfer function testability theoretical and practical controllers final control elements introduction to frequency response techniques measuring instruments for temperature, pressure, and level control of heat exchangers and distillation columns.

Recommended Books

1. Process Systems Analysis & Control, Donald R. Coughanowr
2. Modern Control Engineering, Ogatta, K. (3rd Edition-Latest).
3. Process Control Instrumentation Technology, Curtis, D. Johnson (5th Edition).

SIX TERM

GAS RESERVOIR ENGINEERING

Basics of Gas Reservoir Engineering, reservoir gas volume factor, densities and gas gradient. Calculation of static bottom hole pressure.

Gas Reservoir. Estimation of gas Reserves, gas in place by volumetric methods Unit Recovery and recovery from volumetric and water drive gas reservoir Material balance equation method. Assumptions, derivation and application.

Reserve calculations and Reservoir performance. Volumetric estimates, material balance estimates, pressure decline curve P/Z method, material balance equation straight line method. Reservoir size, calculation of water influx. Gas equivalent of produced condensate and water.

Bas Condensate Reservoirs. Reservoir types defined with reference to phase diagrams Calculation of original gas and condensate in place for volumetric reservoirs Wet Gas.

Reservoirs. Compositional analysis with and without the composition available Well Testing and sampling. Performance of volumetric retrograde gas condensate reservoir. Use of M.B. with retrograde reservoir.

Gas Well Testing. Deliverability Testing of gas wells. Fundamental equation in deliverability testing, flow after flow test, isochronal testing and modified isochronal testing. Use of pseudo pressure in deliverability testing. Real gas pseudo pressure analysis, Transient testing. Pressure.

Build up and pressure draw down test. Gas gathering systems; guide lines for gas well testing. Problems in gas well testing liquid loading. Hydrate formation, wet gas stream. Irregular flow and Sour (1125) gas. Use of computer in Gas Reserves estimation and well test analysis.

Recommended Books

1. Gas Reservoir Engineering, John W. Lee.
2. Over Pressurize Gas Reserves, Stween W. Postan, R.R. Berg.
3. Gas Production Engineering, Sanjav Kumar.

PRODUCTION ENGINEERING-I

Definition and scope of production engineering. Review of casing design concepts.

Well Completions. Various completion designs, reservoir and mechanical consideration. Perforation, production packers, tubing strings, liners, subsurface completion and production control equipment, completion fluids. Sand control procedures. Wellheads Components-running/installation.

Surface Production Facilities. Piping systems, valves, chokes, fittings. Separators, stock tanks, Gathering systems and individual well flow rate allocation. SCADA. Introduction to Petroleum production system analysis and design for single phase and multiphase fluid flow Performance Relationship. Tubing & Flow line Behaviour: Tubing size, maximum possible flow rate. Flow line size.

Fluid Separators. Separator components, types, factors influencing Separators capacity.

Recommended Books

1. Introduction to Petroleum Production-I & II, Dr. Skimmer.
2. Surface Operation in Petroleum Production, G.V. Chillingarian, J.O. Roberts and S. Kumar.
3. Production Optimization Nodal Analysis, SPE series.

RESERVOIR ENGINEERING-I

Fundamental reservoirs engineering, classification of reservoir flows system, geometry of the reservoir steady state and unsteady state flow, Darcy's law of fluid flow through porous media. Dimensional analysis of Darcy's law. Basic flow equations, Pressure distribution and pressure gradient for linear, radial, compressible, slightly compressible and incompressible steady state flow conditions. Average permeability calculations for beds in series and beds in parallel for linear and radial reservoir geometry. Determination of average pressure in radial flow system. Readjustment time, productivity index, specific productivity index and injectivity index. Relationship between well-bore radius and flowrate in radial flow system. Continuity equation and its derivation. Diffusivity equation and its different forms. Volumetric evaluation of oil in place and empirical reserve estimates. Different type of oil drives of reservoir.

Recommended Books

1. Fundamental of Reservoir Engineering, L.P. Dake.
2. Applied Petroleum Reservoir Engineering, B.C. Craft, M. Hawkim
3. Applied Reservoir Vol. I & II, C.R. Smith G.W. Tracy.

DRILLING ENGINEERING-II

Factors affecting penetration rate. Directional drilling and deviation control Definitions and reasons for directional drilling. Planning the directional well trajectory, Planning the kick off and trajectory change, Deflection tools, Deviation Control Brief introduction to Horizontal drilling. General coring methods and equipment Routine core analysis. Practical use of core analysis data Formation damage causes and prevention of formation damage.

Drill stem testing general procedure and general considerations. Test tool components and their arrangement. Analysis of test data. Oil well cementing Primary oil well cementing. Techniques, Types of cement, cement additives

Factors considered for the selection of cement type. Cementing volumes. Squeeze cementing. Stage cementing.

Drilling economics-equipment cost, slim hole drilling. Air gas drilling, methods of reducing drilling casts. Payment of drilling charges. Brief introduction to offshore drilling technology.

Recommended Books

1. Applied Drilling Engineering, A.T Bourgrove jr., K.K. Millehim.
2. Drilling fluids Optimization, J.L. Lummus and J.J. Azar]
3. Formulas and Calculation for Drilling, NJ. Lapeyrouse
4. Horizontal Well Technology, S.D. Joshi.

APPLIED NUMERICAL METHODS

Error. Its types and sources, propagation and estimation. Loss of significance.

Systems of Linear Equations. Direct elimination methods, LU decomposition, Band types systems. Interactive methods. Accuracy and convergence, successive over-relaxation.

Nonlinear Equations. Bisection method. Fixed point iteration, Linear Iteration method Secant method. Method of False Position. Polynomial method. Newton-Raphson method System of Nonlinear Equations. Comparison of methods. Convergence Criteria and Rates of Convergence.

Interpolation. Binary Search, Difference Operators and Tables. Interpolating Polynomials based on Differences. Lagrangian form of Interpolating Polynomial Errors in Polynomial Interpolation. Inverse and multidimensional interpolation.

Numerical Differentiation and Integration. Formulas for Derivatives Round-off Errors and Accuracy of Derivatives. Newton-Cotes Integration Formulae Trapezoidal Rule, Romberg Algorithm, Simpson's Rules. Integration for multiple and improper integrals.

Curve Fitting and Approximation. Polynomial Approximation by method of Least Squares and Orthogonal Polynomials. Approximation with Trigonometric Functions, Chebysheve Polynomials, Rational Functions, and Spline Functions.

Ordinary differential Equations. Taylor-Series method. Euler and Modified Euler methods. Runge-Kutta methods. Simple Predictor-Corrector methods. Error Estimates.

Stochastic Simulation. Random Numbers. Monte Carlo Technique. Simulation. Computer Application.

Linear Programming. Formulation, Graphical Solutions. Simplex Method computer Applications using LP package.

Recommended Books

1. Numerical methods for Engineers, Canal and Chapra.
2. Applied Numerical analysis, Curits F. Gerald.

SEVENTH TERM

GAS ENGINEERING

Introduction to natural gas industry, natural gas properties, flow and compression calculation, gas transmission, sweetening and dehydration of crude gases, distribution of gas in the city, gas stations, pipe line welding techniques, testing and welding defects, gas appliances and their design, gas flow measurements.

Recommended Books

1. Gas Conditioning and Processing, Campbell.
2. Gas Process, Janes G. Speight.

PETROLEUM ECONOMICS

Introduction. Definition and some of basic concepts; Evaluation nomenclature, time value of money, basic interest equation, present and net present value, ABC transaction, payout and payback time, rate of return.

Engineering Economics. Factors and their uses. Evaluation of alternatives. Depreciation, depletion and corporation taxes. Cash flow and risk analysis.

Economics of Petroleum Industry. The need of economic analysis in petroleum industry. World supply and demand. Application of the principles of engineering economics to Exploration and drilling, estimation and evaluation of oil properties, production operations, oil transportation and crude oil processing.

Recommended Books

1. Petroleum Production Economics, Lector Charles Uran.
2. World wide Petroleum Economics, Richard D. Seba.

RESERVOIR ENGINEERING-II

Derivation of Material Balance Equation. M.B. Equation as an equation of a straight line. K_g/K_o determination from field data and discussion of some empirical correlation's.

Performance Calculation for Depletion Drive reservoirs. Empirical Prediction technique or immiscible processes. Method for Extrapolation of cut vs recovery curves. Performance of water drive reservoirs using Frontal Advance Rate theory of Buckley and Leveret.

Water and Gas Fingering. Water/gas Coning in homogeneous reservoirs. Musket Arthur method, Meyer and Gardner and Pirson's method, Craft and Hawkins method. Method Sobocinsky and Cornelius method. Water/Gas coning in Fractured reservoirs.

Recommended Books

1. Fundamental of Reservoir Engineering, L.P. Dake.
2. Applied Petroleum Reservoir Engineering, B.C. Craft, M. Hawkim
3. Applied Reservoir Vol. I & II, C.R. Simth G.W. Tracy.

ENVIRONMENT AND SAFTY MANAGEMENT

Environment impact assessment of oil and gas field, risk securing techniques, concept of air and water pollution in petroleum industry, flaming impact, oil spill control, solid waste and sludge control, impact for drilling activity, emissions during drilling, production, storage and LPG plant operation, noise pollution in oil exploring and exploiting prevention and control. Safety and awareness, management commitment to safety, employee commitment, development and safety assessment, design procedure for operation, maintenance, modification and emergencies, safety by contractor, accident and incident reporting, investigation and follow-up, monitoring and auditing, and reappraisal of the system.

Recommended Books

1. Environmental management in Petroleum Industry, S.K. Wahri, Tech, A.K. Agnihotri, J.S. Sharma.
2. Managing Drilling Operations, Kraser, Ken.
3. Carbonate Depositional Environment, Skolle, Peter A.

PRODUCTION ENGINEERING-II

Causes of low well productivity. Reservoir dominated factors, well bore dominated factors, mechanical failures.

Well Diagnostics. Production Test, deliverability tests, Transient tests (PLT), Near wellbore damage characterization. Problem well analysis. Well Performance Prediction: Decline curve analysis, Material balance method, and reservoir simulators.

Remedies.

Well services and work over jobs. Squeeze jobs, reperformation, well cleaning.

Stimulation Techniques.

Hydraulic Fracturing. Introduction, inducing, productivity ratio, fracture area, fracturing fluid coefficients, fractures efficiency, fracturing hydraulics, fracture design and calculation.

Acidizing. Introduction, types of treatment, acid-fracturing design.

Gas Lift. Introduction, Application, valve mechanics. Design of continuous-flow gas lift system. Design of intermittent gas lift system, Accumulation chambers.

Recommended Books

1. Introduction to Petroleum Production-I & II, Dr. Skimmer.
2. Surface Operation in Petroleum Production, G.V. Chillingarian, J.O. Robertsin and S. Kumar.
3. Production Optimization Nodal Analysis, SPE series.

EIGHTH TERM

**CORROSION PRINCIPLES AND CONTROL
IN PETROLEUM INDUSTRY**

Corrosion Principles: Corrosion mechanism causes of corrosion cells, polarization and factors of polarization, high temperature corrosion, stress corrosion cracking (sulfide stress corrosion cracking, chloride stress corrosion cracking, caustic stress corrosion cracking, environmentally induced cracking), hydrogen damages, corrosion losses.

Corrosion Control: Corrosion detection methods (corrosion coupons, corrosion resistance probes, caliper measurement, ETT, sonic testing, casing potential profil tool), corrosion control methods (material selection environment modification, inhibitor treatment), evaluation of inhibitor treatment program, cathodic protection, properties of galvanic anodes, design of impressed current, G/B, Criteria of CP, interference, anodic protection.

Recommended Books

1. Mars G. Fontana and Norbert D. Greene, Corrosion Engineering. McGraw Hill Book Company.
2. A.W.Peahody. Control of Pipeline Corrosion. National Association of Corrosion Engineers. Corrosion Control Handbook. (A guide to corrosion control in oil and gas production pipelining, distribution and petro-chemical compiled for articles in petroleum Engineer, pipeline and gas journals and pitro-chemical engineers).

PRINCIPLES OF RESERVOIR SIMULATION

Introduction to the concept of reservoir simulation, its advantage and limitations. Developing a model for single phase, slightly compressible for infinite reservoir conditions. Selection of a reservoir simulator and computer aided design. Theory: formulation of partial differential equations governing single phase and multiphase flow in porous media. Finite difference methods and solutions of linear equations applicable to the reservoir. Direct and iterative methods. Practice: use of a black oil simulator. Input data and data file preparation. Fine tubing for history matching. Performance prediction.

Recommended Books

1. Modern Reservoir Engineering, Hennerly Crick Low.
2. Principle of Applied Reservoir Simulation, John R. Fanchin
3. Applied Numerical method, Donald L. Katz.
4. Fundamental of Numerical Reservoir Simulation, D.W. Peaceman
5. SPE Monograph Series Reservoir Simulation, Calvin, C. Matlay.

PRINCIPLES OF ENHANCED OIL RECOVERY

Factors Common to all Enhanced Recovery methods. Principles influence on the efficiency of enhanced recovery. Linear displacement. Two and three-dimensional displacement. Injection well location. Areal sweep efficiency for pattern floods.

Water Flooding. Selection of water injection as an EOR method. Displacement mechanics and performance calculations. Practical considerations in water injection Projects.

Immiscible Displacement by Gas Injection. Preliminary studies and field evaluation of injection efficiency. Injection and production well completions. Surface installations, compression and treatment methods. Special applications of gas injection.

Miscible Drive. Miscible slug flooding, thermodynamic miscibility, ternary diagram. Basic methods of miscible drive. Improved methods of miscible drive. Gas Recycling in Gas-Condensate Reservoirs: Thermodynamics of gas recycling. Sweep efficiency, well locations, production control, production equipment, and determination of operating conditions.

Thermal Recovery methods. Data required for the study of thermal recovery methods. Hot fluid displacement. In situ combustion.

Other methods of Enhanced Recovery. Use of polymers. Foam injection. Use of surfactant solutions and Micro-emulsions. Carbon dioxide flooding.

Calculations. Solution of EOR problems; development of computer algorithms and example calculations.

Recommended Books

1. Fundamental of Enhanced Oil Recovery, by M. D. Donaldson.
2. Enhanced Oil Recovery by V. Poolen.

WELL TESTING

Analytical solutions of the diffusivity equation for constant Rate and constant pressure under transient and pseudo Steady State flow regimes. Skin effect due to well damage and storage. Analytical/Numerical solution of diffusivity equation including damage and storage presented in the graphical form and its use as a diagnostic plot.

Principle of superposition and Homer's approximation. Pressure Build-up Analysis-Ideal build Up test and actual Build-up test. Determination of reservoir permeability, Skin, Factor, Flow, Efficiency etc. Pseudo skin Analysis of hydraulically fractured reservoirs. Determination of static drainage Area Pressure by P and Musket Methods. Distance to fault and arial extent determination.

Modification of Liquid Equation for gases and for Multiphase Flow Transient equation for gases including well bore damage, storage and Turbulent Factor D. Pseudo Pressure and Pseudo time determination and calculation K, S and D by conventional and modern methods. Two phase flow testing using pseudo pressure function Draw Down Analysis of Oil and Gas wells. Multinate Testing Multiwell Testing. Use of type curves and Derivative Curves specialized plotting for different flow regimes. Discussion of Ramey's, Griagarten's, and Bourdet's Type curves.

Recommended Books

1. Well Test Analysis, by M.A. Babet.
2. Advances in Well Test Analysis, Robert C. Earlongher Jr.

PROJECT

Every student will be required to submit a comprehensive report on an assigned problem.

**SCHEME OF STUDIES
FOR
M.E./M.Sc**

CORE COURSES (GROUP-A)

Course No.	Courses Title	Marks		Contact Hours	
		Part-I	Part-II	Part-I	Part-II
Pet-E-1	Enhanced Oil Recovery	100	100	2	2
Pet-E-2	Advanced Well Testing	100	100	2	2
Pet-E-3	Advanced production Engg.	100	100	2	2
Pet-E-4	Advanced Drilling Engg.	100	100	2	2
Pet-E-5	Advanced Reservoir Engg.	100	100	2	2
Pet-E-6	Reservoir Simulation-I	100	100	2	2

ELECTIVE COURSES (GROUP-B)

Pet-E-7	Flow Through Porous Media	100	100	2	2
Pet-E-8	Well Log Interpretation	100	100	2	2
Pet-E-9	Technology of Artificial Lift	100	100	2	2
Pet-E-10	Reservoir Simulation-II	100	100	2	2
Pet-E-11	Petroleum Economics	100	100	2	2

RESEARCH THESIS

Pet. E-500	Thesis				
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NOTE:

Part-II marks comprise of 70% for Sessional work and 30% for viva voces

**DETAIL OF COURSES
FOR
M.E./M.Sc.**

PET-E-1: ENHANCED OIL RECOVERY

Enhanced oil Recovery Processes: General review of process description, recovery efficiency. The Oil Resource for EOR Processes: Waterflooded reservoirs, heavy oil reservoirs. Miscible Displacement, dispersion, diffusion, fingering. Mechanics for Mobilization and Displacement of Residual Oil, Miscible processes, immiscible processes. Chemical Flooding Processes. Carbon Dioxide Miscible Recovery Process. Thermal Recovery Processes.

PET-E-2: ADVANCED WELL TESTING

1. Pressure draw Down, Pressure Build-up, Average Pressure determination, Two Rate Testing, Multirate Tests.

2. Multiwell Testing – Interference Test Analysis, Pulse Testing of the Hydraulically Fractured Wells. Testing of the heterogeneous reservoir-Linear discontinuity, faults and barriers, permeability anisotropy, Composite systems, layered reservoirs (with cross flow). Naturally fractured reservoirs.

3. Use of type curves in all types of well testing techniques. Pressure derivative approach.

PET-E-3: ADVANCED PRODUCTION ENGINEERING

Inflow performance, multiphase flow correlations, tubing – flowline intake, and choke bean performance. Comprehensive study of well completion design, subsurface control equipment, perforation of oil and gas wells, completion and workover fluids, squeeze cementing, production logging, sand control, introduction to stimulation methods.

PET-E-4: ADVANCED DRILLING ENGINEERING

Drilling assemblies, rotary drilling bits, the theory of elasticity in drilling operation. Fatigue and failure of drill pipes, directional drilling, hydraulics and casing design, optimization of drilling hydraulics and casing design, optimization of drilling parameters and related problems, well control, novel techniques in drilling.

PET-E-5: ADVANCED RESERVOIR ENGINEERING

Classification of reservoirs and evaluation of their performance. Application of material balance equation and its limitations. Water and Coning problems and their solutions.

PET-E-6: RESERVOIR SIMULATION-I

A review of basic mathematics and reservoir engineering concepts in reservoir simulation. Formulation of reservoir simulation equations. Setting up the finite difference model. Solution of the finite difference model (explicit or implicit in pressure/saturation). Solving the matrix of simultaneous equations. Examples. Uses and misuses of reservoir simulation. Selection of a proper reservoir simulator. Application of finite element technique to reservoir simulation.

PET-E-7: FLOW THROUGH POROUS MEDIA

Physical properties of porous media with emphasis on transport phenomena in porous media, geometrical and mechanical properties, single-phase flow and (miscible and immiscible) multiphase fluid flow through porous media, and heat transfer in porous media.

Reserve calculations for volumetric, water drive, and geopressured gas reservoirs. Decline curve analysis, Gas wells deliverability tests. Static and flowing buttonhole pressure.

The goal of this course is to develop the techniques for the solution of a wide variety of single-phase flow problems in porous media for compressible and incompressible and incompressible flow. Two-dimensional flow will be considered for the greater part. Selection mathematical techniques will be developed for specific problems.

PET-E-8: WELL LOG INTERPRETATION

Open hole logging: review of petrophysical parameters, rapid initial interpretation, log interpretation in complex lithology computer processed interpretation, cased hole logging: review of porosity tool principles, thermal decay time log, cement bond logging, production logs, Cross plotting techniques

PET-E-9: TECHNOLOGY OF ARTIFICIAL LIFT

Theory and application of gas lift. Gas lift installation design and analysis. Compressor system, submersible sucker rod, and other type of pumping systems cost analysis of various installations, production optimization techniques including Nodal Analysis.

PET-E-10: RESERVOIR SIMULATION-II

The principle objective of this course is the development of reservoir simulation theory to the level required for the construction of a three-phase, three-dimensional reservoir simulator. In addition to providing practice in developing a simulator, the course will also require the use of available reservoir simulators to do simulation study for a number of fields. A simulation project will include data preparation, selection of model, input file preparation, restart procedures, history matching, prediction and optimization. Field examples on well testing, coning problems and improved recovery techniques will be used.

PET-E-11: PETROLEUM ECONOMICS

Principles of economics, estimation of costs, evaluation of costs, evaluation of oil and gas reservoir, oil operations, optimization, cost and risk analysis, study of various scenarios, profitability analysis and pay out time, Monte Carlo simulation, linear programming theory of forecasts, pipelines, tankers, decision tree methods. OPEC cartel, review of annual forecasts from various multinational companies. Oil prices policy. Gas pricing policy. Petroleum concession agreement for Pakistan, its uses and limitations. Petroleum policy 1994.

PET-E-500: THESIS

RECOMMENDATIONS

The Committee emphasized that in order to take full advantage of the new curriculum, efforts should be made to increase the effectiveness of teaching – learning process. For that purpose, the following recommendations are made:

1. Training of teachers in teaching methodology, increase teacher – industry interaction and regular participation of teachers in relevant conferences must be ensured. Universities should take necessary steps and provide financial resources for that purpose.
2. The improvement in examination system to ensure that students understand basic concepts and are able to apply these concepts independently.
3. Teaching aids such as white boards, overhead projectors and multi-media projectors must be provided in all classes.
4. The Committee recommends that video libraries should be established at all universities to illustrate engineering processes and techniques that are difficult to understand through books above. The HEC should act as a resource centre for the universities by obtaining and making available technical videos from various sources, such as SPE, NAIT, SAIT etc.
5. Credit hours for a four years BE/BSc (Petroleum Engineering) be 140 Credits. The universities may get approval from their respective bodies.
6. The term is spread over 16 working weeks. Three hours per week of class-room instructions for sixteen weeks of the term will be considered as three credit hours whereas three hours per week of laboratory work over a term will be of one credit hour.
7. For the postgraduate studies, the minimum requirements are as follows:
 - a) At least two qualified instructors having Ph.D. Degree in Petroleum Engineering to be included in the faculty.

b) At least 30 credit hours that includes 4 credit hours of thesis.

c) The student has to maintain a minimum GPA of 3.0 out of 4

-sd-

Engr. Dr. Obed-ur-Rehman Paracha
Convener

-sd-

Dr. Hafeez ur Rehman Memon
Secretary