FUNDAMENTALS OF MECHANICAL ENGINEERING

CODE **PE 201**

L	T	P
2	2	-

RATIONALE

The aim of this subject is to impart to the students knowledge on fluid properties, fluid statics, dynamic characteristics for through pipes and porous medium, flow measurement and fluid machineries. Students will learn PVT behaviour of fluids, laws of thermodynamics, thermodynamic property relations and their application to fluid flow, power generation and refrigeration processes.

COURSE OUTCOME

On completion of this course, the students will have knowledge on

1. Engineering thermo dynamics and understand the practical implications of thermo dynamic law in engineering design.
2. Several machineries used to transport the fluid and their performance.
3. Fluid properties, their characteristics while static and during flow through ducts, pipes and porous medium.
4. Correlation between thermodynamics and fluid flow.
5. Laws of thermodynamics, thermodynamic property relations, PVT diagrams etc.

CONTENTS

L

1. Laws of thermodynamics: 12

1.1 Analysis of various thermodynamics processes,
1.2 P-V and T-S diagrams
1.3 Analysis of air standard cycles
- 1.3.1 Carnot cycle
- 1.3.2 Joules cycle
- 1.3.3 Otto cycle
- 1.3.4 Diesel cycle

2. Engines : 4

2.1 Classification of I C Engine
2.2 Performance of internal combustion engines

3. Properties of fluids: 10

3.1 Classification
- 3.1.1 Ideal fluid
- 3.1.2 Newtonian
- 3.1.3 Non-Newtonian fluids

4. Fluid dynamics: 14

4.1 One dimensional equation of motion
- 4.1.1 Bernoulli's equation
- 4.1.2 Application of Bernoulli's equation
- 4.1.3 Venturimeter
- 4.1.4 Orifice meter
- 4.1.5 Nozzle

4.2 Flow through pipes
- 4.2.1 Darcy – Weisbach's equation
- 4.2.2 Head loss in Pipes
- 4.2.3 Pipes in series/ Parallel

5. Classification of pumps: 14

5.1 Basic construction and application of different types of pumps
- 5.1.1 Centrifugal pump
- 5.1.2 Axialpumps
- 5.1.3 Gear pump
- 5.1.4 Vane pump
- 5.1.5 Reciprocation pump
- 5.1.6 Screw pump

5.2 Classification, basic construction and applications of different types of compressor
- 5.2.1 Centrifugal Compressor
- 5.2.2 AxialCompressor
- 5.2.3 Rotary Vane type Compressor
- 5.2.4 Screw pump Compressor

6. Turbines: 6

6.1 Gas
6.2 Steam
6.3 Hydraulic turbines

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.

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BASIC PETROLEUM GEOLOGY

CODE **PE 202**

L	T	P
2	-	2

RATIONALE

The aim of this subject is to impart knowledge on the Earth as a planet and its internal structure, particularly different kind of rocks in earth's crust. Several kinds of minerals are trapped in crust between different layers of rocks. This subject would cover properties of these rocks and fossils as well as of natural gas. Different geological exploration methods which are required in major exploration industries will be covered in this subject.

COURSE OUTCOME

On completion of this course, the students will have knowledge on

1. General properties of minerals and their classification.
2. Various mapping techniques, forms of igneous intrusions - dyke, sill and batholiths.
3. Nature of petroleum and natural gas, their origin and occurrence, trapping mechanism.
4. Regional structural settings, geochemical surveys.
5. Basin Analysis Interpretation of topographic maps.
6. Present petroleum provinces in India and future opportunities .

CONTENTS

L

1. Mineralogy and Petrology: 15

1.1 General properties of minerals and their classification ,

1.1.1 Properties of common rock forming minerals and clay minerals.

1.2 Petrology: Texture, Structures, classifications and descriptions of Igneous and metamorphic rocks.

2. Sedimentology: 20

2.1 Mode of formation of sedimentary rock,

2.1.1 Texture and its types, grain size, grain shape, sorting & composition.

2.1.2 Mechanically and chemically formed Structures.

2.1.3 Classification of sedimentary rocks and their characteristics

2.1.4 Descriptions of sedimentary rocks.

2.2 Characteristic of sedimentary rock,

2.2.1 Detailed study of clastic, carbonate rocks, evaporites, coal and oil shales.

2.2.2 Sedimentary Environments:- Concept of sedimentary environments.

2.2.3 Environmental parameters and their control.

2.2.4 Classification of environments. Continental Environments**:** Fluvial, lacustrine**,** Paluda**,** Eolian & Glacial**.**

2.2.5 Transitional to Shallow Marine Environments: Deltas, Beaches and Barrier Islands, Clastic shelf, carbonate shelves and platforms,

2.2.6 Deep Marine: Pelagic & Turbidites**.**

2.2.7 Concept of tectonics and sedimentation.

2.2.8 Role of environmental analysis in petroleum exploration.

3. Structural Geology : 15

3.1.1 Deformation mechanism of folds and faults

3.1.2 Nomenclature, Classification and recognition, joints
3.1.3 Unconformity, salt domes, plate tectonics and basin formation,
3.1.4 Effects of folds, faults and fractures on strata and their importance in Exploration activities

4. Stratigraphy : 10

4.1 Earth's history in rock record,
4.1.1 introduction of stratigraphic principles – lithostratigraphy, cyclostratigraphy, chronostratigraphy, event stratigraphy.
4.1.2 Indian Geological time-scale,
4.1.3 Introduction to paleontology, fossils & microfossils and their mode of preservation, significance of microfossils in petroleum exploration,
4.1.4 Broad stratigraphic subdivisions and associated rock types of important coal basins and oil basins of India.
4.1.5 Geology of prospective basins of India.

5. Petroleum Geochemistry : 15

5.1 Introduction to Petroleum Geochemistry,
5.2 Theories of origin of petroleum,
5.3 Biomass composition,
5.4 Sedimentary organic matter,
5.5 Transformation of sedimentary organic matter into kerogen,
5.6 Transformation of kerogen into oil and gas.
5.7 Migration of oil and gas: mechanism, pattern and barriers.
5.8 Reservoir rocks and cap rocks. Entrapment of oil- types and mechanism.
5.9 Accumulation of oil and gas.
5.10 Composition and classification of petroleum,
5.11 Laboratory analysis equipment and methods,
5.12 Biomarkers,
5.13 Stable isotopes,
5.14 Source rock characterisation and evaluation in terms of quantity, quality and maturation of organic matter –
5.15 Analytical techniques,
5.16 Oil to oil and oil to source correlation,
5.17 Gas to gas and gas to source correlation.

PRACTICALS

1. Study of physical properties of the minerals
2. Study of physical properties of the rocks
3. Identification of minerals in hand specimen
4. Identification of rocks (Igneous) in hand specimen.
5. Identification of rocks (Sedimentary) in hand specimen.
6. Identification of rocks (Metamorphic) in hand specimen.
7. Study of thin section of important minerals & rocks.
8. Study of topographical features from Geological maps
9. Interpretation of geological structures from surface geological maps.
10. Interpretation of subsurface geological structures from borehole data
11. Preparation of subsurface structural contours map.
12. Identification of Geological features through wooden Models

Field visits for Geological structures & stratigraphy exposures.

REFERENCE BOOKS

1. Geology of Petroleum — A.I. Lavorsen
2. Elements of Petroleum Geology — Richard C.Selley and Stephen A.Sonnenberg
3. Basic Petroleum Geology — Peter.K.Link

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P.E.

DRILLING FLUIDS AND CEMENTING TECHNOLOGY

CODE **PE 203**

L	T	P
2	-	2

RATIONALE

This subject is designed to introduce the basic functions and properties of drilling fluids and cement slurries. Also Compositions and related properties of drilling fluids and cement slurries. Different types of drilling and cementing techniques required in onshore as well as offshore operations will be covered through this subject.

COURSE OUTCOME

On completion of this course, the students will have knowledge on

1. General properties of drilling fluids and their classification.
2. Concepts and applications of drilling fluids.
3. Equipments involved in the cementing operations.
4. Rheology of drilling fluids ,Pressure loss calculations and Rig hydraulics.
5. Designing and Factors influencing cement slurry design.

CONTENTS

		L
1.	**Overview of Drilling Fluids:**	**15**
1.1	Clay chemistry and its application to drilling fluids	
1.2	Types of clays	
1.3	Hydration, Flocculation, Aggregation and Dispersion	
2.	**Classification,Types and applications of drilling fluids:**	**8**
2.1	Water based, Oil based, Emulsion based, Polymer based	
2.2	Surfactant based, Foam based and Aerated drilling fluids	
3.	**Drilling Fluid Characteristics:**	**10**
3.1	Basic functions, properties	
3.2	Maintenance and treatments of drilling fluids	
4.	**Calculations :**	**10**
4.1	Drilling fluid calculations	
5.	**RotaryDrilling Hydraulics**	**8**
5.1	Rheology of drilling fluids	
5.2	Pressure loss calculations and Rig hydraulics	
5.3	Mud logging	

6. Cementing, Cements & cement slurry: 10

6.1 Objectives of cementing
6.2 Oil well cements
6.3 Classification of cement
6.4 Slurry design, Slurry additives, Factors influencing cement slurry design
6.5 Cementing equipments

7. Cementing Methods: **7**

7.1 Primary cementing, Stage cementing, Liner cementing
7.2 Plugging, Squeeze Cementing techniques in practice
7.3 Deep well cementing,
7.4 Characteristics of good quality cementation.

PRACTICALS

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.

REFERENCE BOOKS

1. Drilling Engineering — J.J. Azar and G. Robbello Samuel
2. Well Cementing Operations — Ron Sweatman

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DRILLING TECHNOLOGY-I

CODE **PE 204**

L	T	P
2	1	-

RATIONALE

The aim drilling technology subject is to provide the knowledge of to develop an awareness of the equipment terminology and operations associated with the drilling process in surface mines. It updates the students about the classification of drilling methods,principle of rock tool interaction in drilling.

COURSE OUTCOME

After completion of this course, the students will be able to:

1. Understand the concepts and techniques used in well drilling.
2. They will learn the design requirements of well planning and construction .
3. Learn Drilling Process and Drilling Equipments.
4. Optimize the design of a drilling program.
5. Understand and analyse impact of drilling and production discharge.
6. Understand and apply problems related to drilling and well planning.

CONTENTS

		L
1.	**Well Planning:**	**8**
	1.1 Introduction to oil well drilling	
	1.2 Drilling planning approaches	
2.	**Rotary Drilling Method:**	**6**
	2.1 Rig parts	
	2.2 Selection and general layout	
3.	**Drilling Operations & Practices:**	**10**
	3.1 Hoisting, circulation, Rotation	
	3.2 Power plants and Power transmission	
	3.3 Rig wire line system handling & storage	
4.	**Casing Design:**	**12**
	4.1 Design of casing string, Liner design and setting	
	4.2 Casing landing practices, Casing while drilling	
	4.3 Buckling criteria and Calculation of well head loads.	

5. Drill String: **8**

5.1 Parts function
5.2 Design

6. Drill Bits: **8**

6.1 Classification of drag, rotary, roller, diamond and PDC bits.
6.2 Design criteriaof drag, rotary, roller, diamond and PDC bits

7. Coring: **8**

7.1 Different methods of core drilling

REFERENCE BOOKS

1. Horizontal and Directional Drilling (HDD): Utility and Pipeline Applications (Civil Engineering); David Willough. Mc Graw Hill.
2. Petroleum Engineering Drilling & Well completion, Carel Gatlin. Prentice Hall.
3. Introduction to Petroleum Production Vol.I, II, III, Dr. Skimmer

REFERENCE BOOKS

1. Drilling Technology Steve Deveroux
2. Drilling Engineering J.J. Azar and G. Robbello Samuel

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PETROLEUM PRODUCTION OPERATION – I

CODE **PE 205**

L	T	P
2	--	2

RATIONALE

The aim of this subject is to provide knowledge of production operations in the oil and gas wells such as artificial lifts and subsurface equipments. Basics of oil and gas production engineering techniques will be covered in this subject.

COURSE OUTCOME

After completion of this course, the students will be able to:

1. Demonstrate working principle and design of separators.
2. Illustrate various equipment and processes for the treatment on produced emulsion.
3. Understand mechanism and factors of oil field corrosion and methods for prevention.
4. Understand and apply production logging operations.
5. Do problem well analysis and apply new techniques to sustain production rates.
6. Comprehend emerging and peripheral technologies for lifelong learning.

CONTENTS

L

1. Well Equipment: 10

1.1 Well Head Equipments
- 1.1.1 Christmas tree, valves, hangers
- 1.1.2 Flow control devices
- 1.1.3 Packers
- 1.1.4 Tubular and flow lines

2. Well Completion Design: 12

2.1 Perforating Oil & Gas Wells
- 2.1.1 Conventional and Unconventional techniques viz. through tubing
- 2.1.2 Tubing conveyed underbalanced perforating techniques
- 2.1.3 Type size and orientation of perforation holes

2.2 Well activation
- 2.2.1 Use of compressed air & liquid Nitrogen

2.3 Down-hole equipment selection
- 2.3.1 Servicing, installation & testing

2.4 Smart wells- intelligent completions

3. Production System Analysis & Optimization: 14

3.1 Self flow wells - PI & IPR of self flowing and artificial lift wells

3.2 Production testing - back pressure test, flow after flow test & isochronal test, surface layout
3.3 Design & analysis of test data
3.4 Production characteristics of Horizontal and multilateral wells
3.4.1 Coning, IPR & skin factor
3.4.2 Multiphase flow in tubing and flow-lines
3.5 Sizing, selection and performance of Tubing, chokes and surface pipes.

4. Well Production Problems and mitigation 6

4.1 Scale formation
4.2 Paraffin deposition
4.3 Formation damage

5. Designin Gravel Pack for Sand Control 8

5.1 Sand Control Techniques
5.2 Formation Sand Size Analysis
5.2.1 Optimum gravel - sand ratio
5.2.2 Gravel pack thickness
5.2.3 Gravel selection
5.3 Gravel packing fluid & gravel pack techniques

6. Well Servicing & Workover: 10

6.1 Workover system
6.2 Workover rigs and selection
6.3 Rig less workover including Endless/ Coiled tubing unit
6.4 Minor & major workover jobs-diagnosis & remedial measures
6.4.1 Water shut off and gas shut off- Chemical treatment and conformance control
6.5 Workover & completion fluids - types & selection
6.6 Formation damage, Workover planning & economics, asphaltine wax

PRACTICALS

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

REFERENCE BOOKS

1. Surface Production Operations Ken Arnold
2. Petroleum Production systems Michalle J. Economides,A. Denniel Hill Christine Ehlig-Economides and Ding Zhu
3. Petroleum Production Operations Lewis W. Hall and Jodie Leecraft

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RESERVOIR ENGINEERING

CODE **PE 206**

L	T	P
2	-	2

RATIONALE

This subject will enable the student to interpret cross plots, well characteristics, classification of crude and its physicochemical properties. In includes Reservoir Rock Properties, Reservoir estimation and Phase behavior of hydrocarbon system, ideal & non-ideal system necessary for reserve management.

COURSE OUTCOME

After completion of this course, the students will be able to :

1. Understand characteristics and classification of crude and its physicochemical properties.
2. Understand the reservoir concepts such as reservoir simulation, rock characteristics and reservoir management.
3. Different correlations and laboratory measurements, data reduction, evaluation and application.
4. Determination of porosity of rock surface tension of various petroleum fractions.
5. Analyse different reserve estimation techniques.

CONTENTS

		L
1.	**Introduction:**	**6**
1.1	Introduction to reservoir engineering	
1.2	Characteristics of crude oil and natural gas	
1.3	Classification of crude and its physicochemical properties	
2.	**Reservoir Rock Properties:**	**8**
2.1	Porosity and permeability determination	
2.2	Combination of permeability in parallel & series beds	
2.3	Porosity permeability relationship	
2.4	Fluid saturation determination and significance	
2.5	Effective and relative permeability	
2.6	Wettability, capillary pressure characteristics, measurements and uses	
2.7	Coring and Core Analysis	
3.	**Reservoir Fluids:**	**10**
3.1	Phase behavior of hydrocarbon system, ideal & non ideal system	
3.1.1	Equilibrium ratios	
3.2	Reservoir fluid sampling	
3.3	PVT properties determination	
3.4	Different correlations and laboratory measurements, data reduction, evaluation and application.	

4. Flow of Fluids through Porous Media: 10

4.1 Darcy's law
4.2 Single and multiphase flow
4.3 Linear, radial & spherical flow
4.4 Steady state & unsteady state flow
4.5 GOR, WOR equations

5. Reservoir Pressure , Drives and estimation : 10

5.1 Reservoir Pressure Measurements: Techniques of pressure measurement
5.2 Reservoir Drives :Reservoir drive mechanics and recovery factors
5.3 Reserve estimation: resource & reserve concept
5.4 Different reserve estimation techniques:
5.4.1 Volumetric, MBE, decline curve analysis
5.5 Latest SPE/ WPC/ IS classification

6. Multi phase flow: **6**

6.1 Relative permeability-fractional flow
6.2 Well performance – inflow performance,tubing performance

PRACTICALS

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/alcohol1. Log-simulator.
6. Using production vs. time data and decline curve analysis method, computation of :
7. Amount of initial gas in place and gas reserves, if R.F. is 70%.
8. Study of total gas reserve.
9. Using chart scanner and a recorded bottom hole, built-up chart and production data before shut down compute permeability and skin.

REFERENCE BOOKS

1. "Petroleum reservoir engineering" – Mc.Graw-hill-1998. Amyx.J.W. et al
2. "Petroleum engineering principles and practice", kluwer 1990 Archer.J.s and Wall C.C.

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PETROLEUM REFINING AND PETROCHEMICALS

CODE **PE 207**

L	T	P
2	1	--

RATIONALE

This subject will enable the student to interpret the fundamental and methodologies in the petroleum refining processes,concepts of petrochemicals, polymerization and the unit operations involved in it.Student will learn unit process involved in the petroleum refining process and polymerization.

COURSE OUTCOME

At the end of this course, the student will be able to:

1. Establish the link between the upstream and downstream petroleum industry.
2. Know the composition of crude oil, along with its properties and characterization methods.
3. Understand the purification and fractionation process of crude oil.
4. Get conversant the conversion processes of the various products from distillation.
5. Select a good grade of lubricating oil and bitumen.
6. Address the issues related to pollution from refineries.

CONTENTS

		L
1.	**Introduction:**	**14**
1.1	Origin, exploration and production of Petroleum	
1.2	Types of crudes, composition, characteristics,Products Pattern, Indigenous and imported crudes	
1.3	Crude heating, primary distillation principles	
1.4	Separation of cuts, gaps / overlaps, stripping.	
1.5	Vacuum distillation	
1.6	Types of trays, drawoffs, intermediate product, quality control	
2.	**Solvant Treatment and Extraction :**	**14**
2.1	Lube oil and wax processing	
2.2	Solvent extraction, dewaxing desilting	
2.3	Deasphalting, clay contacting	
2.3.1	Principles	
2.3.2	Operating parameters	
2.3.3	Feed and product equalities and yields	
2.4	Types and functions of secondary processing	
2.5	Cracking, thermal cracking and visbreaking, different feed stocks, products, yields and qualities	
3.	**Catalytic cracking and reforming :**	**12**
3.1	Fluid catalytic feed stocks and product yields and qualities	

3.1.1 Catalyst and operating parameters

3.2 Steam Reforming, Hydrogen, Synthesis gas

3.3 Cracking of gaseous and liquid feed stocks, olefins, Diolofins, Acetylene and Aromatics and their separation

4. Unit Processes : 10

4.1 Alkylation, oxidation, dehydrogenation,

4.2 Nitration,chlorination, sulphonation and isomerisation

5. Polymerisation : 10

5.1 Models and Techniquies

5.2 Production of polyethylene, PVC, Polypropylene, SAN, ABS, SBR,

5.3 Polyacrylonitrile, Polycarbonates, Polyurethanes, Nylon, PET

REFERENCE BOOKS

1. Modern Petroleum Refining Processes" Edition 3, B.K. Bhaskara Rao
2. Unit Processing in Organic Synthesis" Edition 5, Tata McGraw Hill Groggins
3. Petroleum Refinery Engineering", McGraw Hill Nelson W.L.
4. Petroleum Refinery Distillation, second edition Watkins, R.N.

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Chemistry of Hydrocarbons

CODE **PE 208**

L	T	P
2	1	--

RATIONALE

The aim of incorporating the subject Chemistry of Hydrocarbons is to make the students familiar with the Origin and formation of Petroleum.The students will be imparted the knowledge of Charactersisation and properties of Crued oil and Gaseous fuels.

COURSE OUTCOME

At the end of the course the students will be having:
1.Information about the Reserves and deposites of Hydrocarbon in India.
2.Characterstics and Classification of Crude oil.
3.Chemical Reactions of Hydrocarbons
4.Varrious tyoes and characterstics of Gaseous fuels.
5.Properties of Crude Oil.

CONTENTS

L

1 Origin and formation of Petroleum:
- 1.1 Reserves and deposits of Hydrocarbon in India
- 1.2 Indian Petroleum Industry.
- 1.3 Composition of crude Oils, ultimate and chemical composition,
- 1.4 Hydrocarbons in petroleum, Asphltenes and Resins,
- 1.5 classification of petroleum, evaluation of crude oil,
- 1.6 Bench mark crudes.

2 **Characterization of crude oils:**
- 2.1 TBP and ASTM distillation,
- 2.2 Classification by chemical composition,
- 2.3 Correlation Index. Density, API gravity, Viscosity, UOP characterization factor, etc.
- 2.4 Physical & Thermal properties of petroleum
- 2.5 ASTM, TBP, EFV distillation curves.

3 **Properties of crude oil:**
- 3.1 Properties of crude oil octane no. etc
- 3.2 Pre-treatment, Electric desalting.
- 3.3 Atmospheric and vacuum distillation,
- 3.4 Petroleum products and their quality control tests.

4 **Value addition of petrochemicals:**
- 4.1 From feedstock to consumer end products
- 4.2 Chemical reactions of hydrocarbons
  - 4.2.1 Decomposition (Thermal & Catalytic)
  - 4.2.2 Halogenations
  - 4.2.3 Isomerisation
  - 4.2.4 Hydrogenation
  - 4.2.5 Alkylation
  - 4.2.6 Nitration
  - 4.2.7 Sulfonation, etc. with chemistry and reaction mechanism.

5 **Gaseous fuels:**

5.1 Natural gas,

5.2 Synthetic gases, their composition & properties.

5.3 Producer gas, Water gas, Coal Gas, LPG, CNG, and Hydrogen as fuel.

REFERENCE BOOKS

1. Bhaskar Rao,., "Modern Petroleum Refining Processes", Oxford & IBH Co. Pvt. Ltd., New Delhi, 4/e,2002, Reference Books 1. Speight, J.C.; "The Chemistry and Technology of Petroleum", Marcel Dekkar, New York, 3/e1999.
2. Lucas, A.G. (ed.), "Modern Petroleum Technology", Vol. 2, Downstream, John Wiley & Sons Limited, New York, 6/e, 2000.
3. Hobson, G.D., "Modern Petroleum Technology" Vol I & II, John Wiley & Sons, New York, 5/e, 1984 4. Prasad, R., "Petroleum Refining Technology", Khanna Publishers, New Delhi, 2000

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FUNDAMENTALS OF WELL LOGGING TECHNOLOGY

CODE **PE 209**

L	T	P
2	1	-

RATIONALE

The aim of this subject is to introduce various well logging techniques and their uses. Student will become familier with aims and objectives of well logging. Reservoir formations. Borehole conditions. Fundamental concepts in borehole geophysics physical properties of reservoir rocks. Formation parameters and their relationships will be covered in this subject.

COURSE OUTCOME

At the end of this course, the student will be able to :

1. Understand the concept of formation evaluation and well logging and techniques involved in it.
2. Methods of gathering formation evaluation data from logging techniques.
3. Methods of analysis and application of results
4. Understand the physical principles of the tools used in logging.
5. Characterize the formation based on interpretation of well logs.
6. Recording, transmission and processing of log data.

CONTENTS

L

1. Introduction to Well Logging : 10

1.1 Methods of gathering formation evaluation data
- 1.1.1 Mud logging, Coring, MWD
- 1.1.2 Open hole logging
- 1.1.3 Cased hole logging
- 1.1.4 Modern logging techniques

2. Rock Properties : 16

2.1 Methods of analysis and application of results
- 2.1.1 The genesis of Reservoir Rocks
- 2.1.2 Fluid Distribution in the Reservoir
- 2.1.3 Relative Permeability, Measurement of Porosity
- 2.1.4 Measurements of Permeability, Measurements of Saturation

2.2 Basic concepts of Log Analysis
- 2.2.1 Lithology, Porosity, Water Saturation, Hydrocarbon Type
- 2.2.2 Pay counting
- 2.2.3 Permeability

2.3 Reserve Estimation
- 2.3.1 Oil and Gas-In-Place Estimates
- 2.3.2 Reserve estimates, Factors
- 2.3.3 Formation Volume Factors, Reservoir Volumes

3. Open hole Logging Measurements : 12

3.1 The SP Log, The Gamma Ray Log
3.2 Resistivity Measurements
3.3 Induction Logging, Latero log, Micro resistivity Log, Dielectric Logs, Sonic (Acoustic)Logging and Elastic

4. Analysis Of Logs And Cores: 14

4.1 Compatibly Scaled Overlays,Cross plots, Histograms
4.2 Quick look Algorithm, Porosity Estimation From Neutron
4.3 Cross Plots:
- 4.3.1 Density Logs, Sonic Logs Using Various Cross plot And Overlay Techniques
- 4.3.2 Lithology Identification From Various Cross plots And Other Types Of Plots

5. Water Saturation and Archie Equation: 8

5.1 Rw Determination Using SP Log, Ratio Techniques, Crossplots,
5.2 F Overlay Techniques and from chemical analysis
5.3 Water Saturation: Basic Archie's Equation, Saturation Exponent-n And FormationFactor-m For Clean Formation.

REFERENCE BOOKS

1. Modern Open Hole Log Interpretation, John. T. Dewan
2. Well Logging Data Acquisition and Application O&L Serra TECHNIP.
3. Handbook of Well Log Analysis, S.J. Pirson
4. Log Interpretation Principles and Applications, Schlumberger Educational services.

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C' PROGRAMMING

CODE PE210 L T P

Common to all branches branches except AR/CC/CE/CS/ EE /IT 2 -- 2

RATIONALE

'C' is computer programming language and also structured programming language. In 'C' programming language we consider various syntax used in programming. By having good knowledge of 'C', students can write modular application and system programs. 'C' can be used in the engineering applications. By acquiring a sound knowledge of 'C' students will be able to understand the concept of all the application areas. This course is specially designed for engineering students of all diploma streams.

CONTENTS

1. Introduction:

1.1 Scope of 'C' Language
1.2 Distinction and similarities with other HLLs
1.3 Special features and Application areas

2. Elements of 'C' :

2.1 Character set
2.2 Key words
2.3 Data types
2.4 Constants and Variables
2.5 Operators: unary, binary, ternary
2.6 Operator precedence

3. Console Input-Output:

3.1 Types of I-O
3.2 Console I-O
3.3 Unformatted console I-O: getchar(),putchar(), gets(), puts(), getch(),getche()
3.4 Formatted I-O: scanf(), printf()

4. Control Flow :

4.1 Statements and blocks
4.2 if
4.3 switch
4.4 Loops: for, while, do-while
4.5 goto and labels
4.6 break, continue, exit
4.7 Nesting control statements

5. Arrays :

5.1 Basic concepts
5.2 Memory representation

5.3 One dimensional array
5.4 Two dimensional array

6. Functions :

6.1 Basic concepts
6.2 Declaration and prototypes
6.3 Calling
6.4 Arguments
6.5 Scope rules
6.6 Recursion
6.7 Storage classes types
6.8 Library of functions: math, string, system

7. Pointers :

7.1 Basic concepts
7.2 &, * operator
7.3 Pointer expression: assignment, arithmetic, comparison
7.4 Dynamic memory allocation
7.5 Pointer v/s Arrays

8. Structure and Enumerated Data Types :

8.1 Basic concepts
8.2 Declaration and memory map
8.3 Elements of structures
8.4 Enumerated data types : typedef, enum
8.5 Union

PRACTICALS

1. Problems based on arithmetic expression, fixed mode arithmetic.
2. Problems based on conditional statements and control structures.
3. Problems based on arrays (1-D, 2-D), functions and pointers.
4. Problems based on engineering applications.

REFERENCE BOOKS

1. 'C' Programming — Stephen Kochan
2. Programming with 'C' — Schaum's Series
3. 'C' Programming — V.Balguru Swami
4. 'C' Programming — Kernighan & Ritchie
5. Let us 'C' — Yashwant Kanetkar

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