Rajasthan Technical University, Kota

B.Tech.

(Petroleum Engineering)

Scheme

&

Syllabus

Effective from Session 2011-12

Scheme of Teaching and Examination B.Tech. Petroleum Engineering

Second year (3rd Semester)

Theory Papers:

S. No.	Subject Code	Subject	Teaching Hours(Per Week)		Exam Duration (Hours)	Maximum Marks		
			Lecture	Tutorial		IA	Exam	Total
1	3PE1	Mathematics-III	3	1	3	20	80	100
2	3PE2	Basic Petroleum Geology	3		3	20	80	100
3	3PE3	Fundamental of geophysics	3		3	20	80	100
4	3PE4	Drilling fluids and cementing technology	3	1	3	20	80	100
5	3PE5	Drilling technology -I	3	1	3	20	80	100
6	3PE6	Fundamentals of Mechanical Engineering	3		3	20	80	100
Total			18	03		120	480	600

A. Practicals and Sessionals:

S. No.	Subject Code	Subject	Hours (Per Week)	IA 60%	Exam 40%	Maximum Marks
1	3PE7	Drilling Fluids & Cementing Lab	3	45	30	75
2	3PE8	Geology Lab	2	45	30	75
3	3PE9	Humanities & Petroleum Economics	2	30	20	50
4	3PE10	Programming Lab	2	45	30	75
5	3PE11	DBMS Lab	2	45	30	75
6	3PE12	DECA				50
Total			11	210	140	400

*3PE1 Mathematics-III common with 3EC1

Second year (4th Semester)

A. Theory Papers:

S. No.	Subject Code	Subject	Teaching Hours(Per Week)		Exam Duration (Hours)	Maximum Marks		
			Lecture	Tutorial		IA	Exam	Total
1	4PE1	Mathematics -IV	3	1	3	20	80	100
2	4PE2	Fluid Flow Through Porous Media	3	1	3	20	80	100
3	4PE3	Reservoir Engineering Fundamentals	3	1	3	20	80	100
4	4PE4	Surveying	3		3	20	80	100
5	4PE5	Petroleum Exploration and Prospecting (Seismic)	3		3	20	80	100
6	4PE6	Fundamentals of Well Logging Technology	3		3	20	80	100
Total			18	3		120	480	600

B. Practical and Sessionals:

S. No.	Subject Code	Subject	Hours(Per Week)	IA	Exam	Maximum Marks
				60%	40%	
1	4PE7	Numerical &Statistical Methods Lab	2	45	30	75
2	4PE8	Surveying Lab	3	60	40	100
3	4PE9	Petroleum Geology Lab	2	45	30	75
4	4PE10	Reservoir Engg. Lab	3	60	40	100
5	4PE11	DECA	-	-	-	50
Total			10	210	140	400

*4PE1 Mathematics-IV common with 4EC1

3PE1 MATHEMATICS-III

Common with 3EC1

Unit 1

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.

Unit 2

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.

Unit 3

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.

Unit 4

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.

Unit 5

COMPLEX VARIABLES -Taylor's series Laurent's series poles, Residues, Evaluation of simple definite real integrals using the theorem of residues. Simple contour integration.

Suggested Readings

1. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley India New Delhi
2. Mathematics for Engineers, Chandrika Prasad, Prasad Mudranalya, Allahabad
3. Advanced Mathematics for Engineers, Chandrika Prasad, Prasad Mudranalya, Allahabad
4. Higher Engineering Mathematics, B V Ramana, Tata McGraw Hill
5. Introduction to Numerical Analysis, S. S. Sastry

3PE2 BASIC PETROLEUM GEOLOGY

Unit 1

Mineralogy and Petrology: Minerals: General properties, Classification of minerals and properties of common rock forming minerals.
Petrology: Rocks, Classification and description of some common rocks.
Stratigraphy: Principles of stratigraphy, Concepts of paleontology, Fossils, their mode of

preservation and 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.

Unit 2

Structural Geology: Concept of Stress and strain, Folding and Faulting, Mechanism and deformation Patterns, Foliation / Cleavage and Lineation's , Joints and Fractures , Shear Zone, Unconformity , Salt Domes , Plate Tectonics and Basin Formation ,Mapping Techniques.

Unit 3

Sedimentology: Sedimentation Process and Sedimentary, Sedimentary rock textures, Lithification and Diagenesis.
Sedimentary petrology : Clastic , Carbonate , Evaporate , Coal and Oil Shales Heavy mineral studies.
Sedimentary Environments : Fluvial ,Lacustrine , Deltaic , Shorelines ,Carbonate platforms, Deep sea fans and Turbidities environments.

Unit 4

Basic Petroleum Exploration Methods: Geological & Geophysical.
Interpretation of topographic maps; Attitude of planar and linear structures; Effects of topography on outcrops. Unconformities, folds, faults and joints - their nomenclature, classification and recognition. Forms of igneous intrusions - dyke, sill and batholiths. Effects of folds and fractures on strata and their importance in exploration activities.

Unit 5

Nature of Petroleum – composition & properties. Concepts of Petroleum Geology & Basic Rock Properties – source, migration & accumulation of petroleum. Porosity, permeability and rock pressure concepts of rocks.

Suggested Readings

1. Geology of Petroleum, A.I. Levorsen
2. Basic petroleum Geology, Peter K. Link
3. Petroleum Formation and occurrence ,Tissot B.P and Welte D.H, 2nd Edition,
4. Petroleum Geology, North F.K., Allen & Unwin , London ,1985.
5. Geological Techniques for Petroleum, Sahay B, Rai A. and Ghosh M.
6. Structural Geology, Billings M.P.
7. Principles of Sedimentology & Stratigraphy, Mercil P.C. & Sam Boggs Jr.
8. Principles of Stratigraphy, Carl O Dunbar & Rogers
9. Earth (An Introduction to Physical Geology), Tarbuch &Lutigens
10. A First Course in Petroleum Technology, David A.T. Donobue, Karl R. Lang.
11. Physical Geology, Anatole Dolqoff
12. 3-D Structural Geology, Groshong,R.H
13. 14 Seismic Stratigraphy, Payton C.E.

3PE3 FUNDAMENTALS OF GEOPHYSICS

Unit 1

Fundamental of wave theory, cyclicity sedimentation, The fourier transform and spectra, common relationship, data processing, seismic data acquisition principle, seismic and structure, Seismic and stratigraphy, Information from seismic trace.

Unit 2

Seismic tools, stacking, frequency filter, de-convolution, Velocity analysis, seismic trace attribute, data migration, Seismic data inversion.

Unit 3

Gravity: Units of gravity. Gravity measuring instruments. Gravity survey, Gravity anomalies. Gravity data reduction Drift, latitude, Elevation and Free-air correction. Free air & Bouguer anomalies. Gravity response of simple shapes. Interpretation of gravity anomalies. Application of gravity methods.

Unit 4

Geo- magnetism: The geomagnetic field. Magnetic anomalies. Magnetic survey-instruments. Field method of magnetic surveys. Reduction of magnetic data. 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.

Unit 5

Active and passive seismics, Seismic refraction surveys, Geometry of refracted path, planar interface. Birefringence. Two layer case with horizontal interface. 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 shooting and Board side shooting. Interpretation of refraction data. Application of seismic refraction method.

Suggested Readings

1. Seismic Interpretation: The Physical Aspect, Anstey N.A., Boston, IHRDC.
2. Introduction to Geophysical Prospecting, Dobrin M.B., New York, McGraw-Hill, Inc.
3. Basic Exploration Geophysics, Robinson, E.S. and Coruh C., John Willey and sons, New York,1998.
4. Fundamentals of Geophysics, Lowri, W., Cambridge University press. (1997).
5. Applied Geophysics, Telford,W.M. ,Geldart L.P., Sheriff, R.E., Keys, D.A. (1990).
6. The solid Earth , Fowler.

3PE4 DRILLING FLUIDS AND CEMENTING TECHNOLOGY

Unit 1

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: 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.

Unit 2

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. Design of technology specific drilling fluids for, environmentally sensitive areas, horizontal\ERD wells, HP-HT wells and depleted reservoirs

Unit 3

Cements: Cementing, cements & cement slurry: objectives of cementing, oil well cements. Classification of cement, slurry design, slurry additives, factors influencing cement slurry design, Cementing equipment. Factors influencing cement rise behind casing and its bridging with rock and casing.

Unit 4

Testing and performance evaluation of cement and cement additives, Framing of specifications for developed additives, Design of cement slurries for casing cementation, Design of cement slurries for low temperature areas, loss prone areas, depleted reservoirs, quality control of cementing process.

Unit 5

Cementing Methods: Primary cementing, stage cementing, liner cementing, plugging, squeeze cementing techniques in practice. 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.

Suggested Readings

1. Handbook of Drilling Technology, Terms & Phrases ,S.M. Malhotra
2. Drilling and Drilling Fluids (Developments in Petroleum Science) G. V. Chilingarian and P. Vorabutr.
3. 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.
4. Working Guide to Drilling Equipment and Operations, William C. Lyons, Gulf Professional Publishing.
5. Applied Drilling Circulation Systems: Hydraulics, Calculations and Models, Boyun Guo, Gefei Liu, Gulf Professional Publishing.

3PE5 DRILLING TECHNOLOGY –I

Unit 1

Drilling techniques in onshore, shallow, offshore and deep sea environments. Types of wells, vertical, inclined, ERD, cluster and horizontal. Types of rigs: mobile, stationary onland, jack-up offshore and floating offshore. Criteria of selection (technical requirement and technology available).

Unit 2

Anticipatory/precautionary measures, Geo-technical order (GTO), drilling through sub-hydrostatic, hydrostatic and super-hydrostatic zones. Directional drilling, MWD, Steering motors, intelligent bits and real time surface read-outs. DST.

Unit 3

Risk analysis, precursors of blowout. Prevention and safety. Environmental issues. Overbalanced and underbalanced drilling. Thief zone, mud loss calculation. Effect of drilling on formation evaluation, reservoir engineering calculation and well stimulation.

Unit 4

Types of well completion techniques, smart well completion, multi-string, slotted liner, stringer liner, sliding sleeve and bare foot completion. Criteria of selection and limitation. Selective perforation and perforation through tubing.

Unit 5

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. Reservoir perspective of drilling and completion. Cost analysis of drilling and its role in field development plan.

Suggested Readings

1.Horizontal and Directional Drilling (HDD): Utility and Pipeline Applications (Civil Engineering); David Willough.
2. Petroleum Engineering Drilling & Well completion, 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, Dr. Skimmer.
4. Natural Gas Engineering Hand Book, Donlad L. Katz.
5. Standard Handbook of Petroleum and Natural Gas Engineering, Vol.1 William C. Lyons (Ed.)

3PE6 FUNDAMENTALS OF MECHANICAL ENGINEERING

Unit 1

Laws of thermodynamics, Analysis of various thermodynamics processes, P-V and T-S diagrams. Analysis of air standard cycles. Carnot, joules, Otto, Diesel.

Unit 2

Properties of fluids; Classification; Ideal fluid, Newtonian and Non-Newtonian fluids; Newton's law of viscosity**.**

Fluid Statics: fluid pressure and its measurement. Fluid Kinetics: Continuity equation; types of flow.

Unit 3

Fluid dynamics: One dimensional equation of motion; Bernoulli's equation; application; application of Bernoulli's equation; venturimeter Orifice meter, Nozzle. Flow through pipes – Darcy – Weisbach's equation. Head loss in **P**ipes, **P**ipes in series/ **P**arallel.

Unit 4

Classification, basic construction and application of different types of pumps (Centrifugal pump, **axial** pumps, Gear pump, Vane pump, Reciprocation pump and Screw pump)
Classification, basic construction and applications of compressor(Centrifugal, axial, rotary vane type, Reciprocating and Screw compressor)

Unit 5

Classification and performance of internal combustion engines, turbines - Gas, Steam and Hydraulic turbines.

Suggested Readings

1. Engineering Thermodynamics, P K Nag, TMH
2. Engineering Thermodynamics, Rogers and Mathew, Oxford
3. Fluid Mechanics, V. L. Streeter, McGraw Hill
4. Fluid Mechanics by F. M White, McGraw Hill
5. Fluid Mechanics by Cenegel and Cimbala McGraw Hill
6. Mechanics of Fluids, Shames, I.H., McGraw-Hill, Inc.
7. Engineering fluid Mechanics, Kumar KL

3PE7 DRILLING FLUIDS LAB

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 GEOLOGY LAB

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. Interpretation of Geological Map (10 Nos.)
8. Dip & Strike Problems (8 Nos.)

3PE9 Humanities & Petroleum Economics

India: Brief history of Indian Constitution, farming features, fundamental rights, duties, directive principles of state. History of Indian National Movement, socio economic growth after independence. Group discussion.

Society: Social groups- concept and types, socialization- concept and theory, social control: concept, social problem in contemporary India, status and role. Group discussion

The Fundamentals of Economics: meaning, definition and importance of economics, Logic of choice, central economic problems, positive and normative approaches, economic systems socialism and capitalism. Group discussion
Microeconomics: Law of demand supply, utility approach, indifference curves, elasticity of demand and supply and applications, consumer surplus, Law of returns to factors and returns to scale.
Macroeconomics: concepts relating to National product – National income and its measurement, Simple Keynesian theory, simple multiplier, money and banking. Meaning, concept of international trade, determination of exchange rate, Balance of payments.
1. International oil markets, developments of Indian Oil Industry
2. NELP (national exploration licensing policy)
3. Iran – India Gas Pipeline
4. Hydrocarbon and national security

3PE10 PROGRAMMING LAB

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 DBMS LAB

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.

4PE1 MATHEMATICS -IV

Common with 4EC1

Unit 1

NUMERICAL ANALYSIS - Finite differences – Forward, Backward and Central differences.
Newton's forward and backward differences, interpolation formulae. Stirling's formula, Lagrange's interpolation formula.

Unit 2

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

Unit 3

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.

Unit 4

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.

Unit 5

CALCULUS OF VARIATIONS - Functional, strong and weak variations simple variation problems, the Euler's equation.

Suggested Readings

(i) 1. Numerical Method for Engineers:- Canal & Chapra
(ii) 2. Applied Numerical Analysis;- Curits F Gerald
(iii) 3. Introduction to Numerical Analysis:- Sastry SS
(iv) 4. Statistics for Geologists Ed. II by John C. Davis, Pub. John Wiley & Sons
(v) 5. 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

Unit 1

Chemical composition of oil and gas. Physical properties of reservoir fluids. Thermodynamics of reservoir fluids. Gas deviation factor, compressibility and formation volume factor. 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.

Unit 2

Physico-chemical properties of reservoir rocks. Rock compressibility. Rock texture and mineralogy. Darcy's law, its boundary conditions and modification for petroleum system. Absolute and effective permeability, relative permeability. Saturation of reservoir fluids. Wettability of reservoir rocks. Capillary pressure behavior and its effect on different rock and fluid flow properties.

Unit 3

Core analysis, Log interpretation and PVT analysis of reservoir fluids and integrated rock-fluid modeling. Historical account of modeling reservoir permeability.

Unit 4

Darcy's model, Bernoulli's model, Kozeny's model, Kozeny-Carman's model, Hydraulic Flow-Unit approach. Tortuosity & core analysis vs hyper-Darcy flow and its impact on well performance and reservoir stability.

Unit 5

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. Diffusivity equation and fluid front advancement.

Suggested Readings

1. Reservoir Engineering Handbook by Tarek Ahmed, Gulf professional Publication.
2. Well logging and Reservoir Evaluation by O. Serra ISBN-978-2-7108-0881-7
3. Fundamental of Well Log Interpretation - O Serra, Elsevier Science Publishing Co., ISBN 0-444-42132-7

4PE3 RESERVOIR ENGINEERING FUNDAMENTALS

Unit 1

Fundamental of rock properties: Porosity, saturation, testability, surface and interfacial tension, Capillary pressure, permeability, rock compressibility, net pay thickness, reservoir heterogeneity

Unit 2

Reservoir drives: Insitu drive, Gas cap drive, Water drive, Mixed drive.

Unit 3

Material Balance Equation (MBE), its way of working and boundary limits. Determination of IOIP and/or IGIP. Quantification of operating drive indices. Refinement of reservoir model by sensitivity analysis and history match by MBE.

Unit 4

Monitoring fluid flow, pressure, GOR, Water-cut and advancement of fluid front. Mid-course correction scheme design and implementation whenever required. Concept of in-fill drilling and secondary recovery and optimization of development plan. Techno-economic analysis for optimized production and recovery strategy.

Unit 5

Equation of States (EOS), its boundary conditions and functionalities. 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.

Suggested Readings

1. Fundamental of Reservoir Engineering, L.P. Dake.
2. Applied Petroleum Reservoir Engineering, B.C. Craft, M. Hawkim
3. Reservoir Engineering Handbook by Tarek Ahmed, Gulf professional Publication

4PE4 SURVEYING

Unit 1

Introduction to Surveying: Objective of surveying and its importance, Classification, principles of surveying, Application of Surveying in various fields of Engineering.
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.

Unit 2

Angular measurements: Principle and constriction of prismatic compass, bearing of lines, local attraction, magnetic declination and examples.

Unit 3

Theodolite: The essentials of transit theodolite, definition and terms, temporary adjustments, measurement of horizontal and vertical angles, different operations and sources of error, theodolite traversing, Omited Measurements.

Unit 4

Leveling instruments : Definition, different type of leveling instruments, curvatures and refraction corrections, reciprocal leveling, errors in leveling and problem solving.
Contouring : General, Contour Interval, Characteristics, Methods of locating contours, Interpolation etc.

Unit 5

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

Suggested Readings

1. Basic Surveying: Walter S. Whyte, R. E. Paul, Elsevier Science & Technology.
2. GPS for Land Surveyors, Jan Van Sickle, Denver, Colorado, USA, CRC Press, Third Edition.
3. Surveying Vol. I B.C. Punmia
4. Surveying Vol. II B.C. Punmia
5. Surveying by Kanitker

6. Surveying by K.R.Arora.

4PE5 PETROLEUM EXPLORATION AND PROSPECTING (SEISMIC)

Unit 1

Velocity Analysis: Time & Velocity, constant Velocity Stack, Stacking velocities, Check shot well survey, sonic logs, statistical analyses, clastic section,
Seismic trace attribute: Attribute mapping, bright spot, data processing consideration, frequency mapping, Hilbert transform, Instantaneous amplitude, phase and frequency, Interpretation.

Unit 2

Multichannel Operations two dimensional filters: Introduction, signal and noise component, Fourier transform, design, frequency relationship, filter operation, CDP Trace gather filtering, time domain operations,
Automatic migration: General principal, diffraction, Velocity compensation, wave equation migration, K/F Migration.

Unit 3

Envelop of sound wave, P and S wave components. Reflection series, impedance, amplitude. Relation of rocks and fluids on seismic signature. 2D, 3D and 4D seismic analyses. Techniques of data acquisition and processing. Seismic attributes and uses.

Unit 4

Structural analysis through seismics. Time to depth conversion, its limitations and strength. Subjectivity in picking faults through seismics. Coherency cube. Bed thickness vs. seismic response. Tuning thickness and seismic resolution. Statistical enhancement of seismic resolution.

Unit 5

Direct Hydrocarbon Indicators (DHI). Impedance and inversion. Biot-Gassmann Equation, AVO effect. Uncertainties in predicting reservoir parameters through seismic only. Scale and resolution problems of seismics.

Suggested Readings

1. The Nature of Digital Seismic Processing, Roy O. Lindseth, Calgary, Alberta, Canada
2. 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

Unit 1

Methods of gathering formation evaluation data: Mud logging, Coring, MWD, Open hole logging, cased hole logging, Modern logging techniques. Wire line logging operations: Logging truck, cable, tools, borehole environment, choosing a logging suite, log quality control

Unit 2

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. 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.

Unit 3

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 Formation Properties, Formation Density Log, Neutron Logs, Dipmeter Surveys. High tech tools introduction and their utility: FMI, DSI, MDT, LWD, ECS and CMR

Unit 4

Analysis Of Logs And Cores: Compatibly Scaled Overlays, Cross plots, Histograms, Quick look Algorithm, Porosity Estimation From Neutron Density Logs, Sonic Logs Using Various Cross plot And Overlay Techniques, Lithology Identification From Various Cross plots And Other Types Of Plots.

Unit 5

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. Core Analysis: Sample Selection And preparation, Measurement Of Basic Rock Properties, Effect Of Overburden Pressure, Measurement Of Cappilary Pressure, Petrographic And Other Measurements.

Suggested Readings

1. Open Hole Log Analysis and Formation Evaluation by Richard M. Bateman
2. Modern Open Hole Log Interpretation, John. T. Dewan
3. Well Logging Data Acquisition and Application O&L Serra ISBN-978295156125
4. Handbook of Well Log Analysis, S.J. Pirson
5. Log Interpretation Principles and Applications, Schlumberger Educational services.
6. Petroleum Geoscience from Sedimentary Environments to Rock Physics, Knut bjorlykke, Springer Heidelberg Dordrecht London- New York, ISBN 978-3-642-02331-6
7. Petrophysics, Tiab, Djebbar & Donaldson Erle C. Elsevier, Gulf Professional Publishing.

4PE7 NUMERICAL &STATISTICAL METHODS LAB

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.

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

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.

4PE9 PETROLEUM GEOLOGY LAB

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.

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

4PE10 RESERVOIR ENGG. LAB

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.