17BPE221 - Numerical Methods										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	--	--	100

Unit I **Hours:10**

Numerical solution of Algebraic & Transcendental equations

Introduction, Descarte's Sign rule, Bisection Method, Method of false position, Secant method, Iteration method, Extended method of iteration, Newton-Raphson method, it's applications, Solution of nonlinear simultaneous equations, Newton-Raphson method for multiple roots, Horner's method, Lin-Bairstow's method or Method for Complex Root, Graeffe's root squaring method, Comparison of various methods.

Unit II **Hours:10**

Finite Differences

Introduction, Finite differences, Operators: Forward Difference, Backward Difference, Central Difference, Shift Operator, Averaging Operator. Relation between operators, Factorial Notation, Synthetic Division, and Missing term Technique. **Interpolation:** Newton Gregory Forward Interpolation Formula, Newton Gregory Backward Interpolation Formula, Gauss's Forward and Backward Interpolation Formula, Stirling's Central Difference Formula, Lagrange's Interpolation Formula for unevenly spaced Formula, Inverse Interpolation, Divided Differences, Properties of Divided Differences, Newton's Divided Difference Formula, Relation between Divided Differences and Ordinary Differences.

Unit III **Hours:10**

Numerical Differentiation

Introduction, Formulae for Derivatives .; **Numerical integration** : Introduction, Newton-Cotes's Quadrature Formula, Trapezoidal rule, Simpson's one-third rule, Simpson's Three-Eighth rule, Weddle's rule, Romberg's method, Double Integration. **Solution of Simultaneous Algebraic Equations:** Direct methods, Iterative methods: Gauss-Jacobi's method, Gauss-Seidal method, Relaxation method. **Numerical Solution of Ordinary Differential Equation:** Taylor's method, Euler's method, Rung- Kutta method, Modified Euler's method, Predictor Corrector method: Adam's method & Milne's method. **Numerical Solution of Partial Differential Equation:** Difference Quotients, Graphical representation, Classification of PDE's of 2^{nd} order, Elliptic equations, Solutions of Laplace equation by Liebmann's iteration method, Poisson's equation, Parabolic equation(One dimension heat equation), Bender-Schmidt method Crank- Nicholson method.

Unit IV **Hours: 09**

Introduction to Finite Elements Methods

Introduction to Finite Element Methods, Functionals, Base Functions. Methods of Approximation: The Rayleigh-Ritz Method, The Galerkin Method. The FEM for one dimensional problems and applications to two dimensional problems.

Total Hours: 39

Texts and References:

1. Numerical Methods in Engineering and Science with Programs in C & C++ by B.S. Grewal, Khanna Publisher.
2. Introductory Methods for Numerical Analysis by S.S. Sastry, Fourth edition, Prentice Hall of India.
3. Numerical Methods for Scientific and Engineering Computation by M.K. Jain, S.R.K. Iyenger and R.K. Jain, 5^{th} edition, New Age International .
4. An introduction to Finite Element Method By J N Reddy, Mc Graw Hill.
5. Advanced Engineering Mathematics by R.K. Jain & S.R.K. Iyenger, 3^{rd} edition, Narosa .
6. Numerical Methods for Engineers by S C Chapra , Raymond P. Canale, Tata McGraw Hill Pub. Co. Ltd.

17BPE222 - Drilling Engineering - I										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	3	3	25	50	25	--	--	100

Unit I **Hours : 14**

Basic Drilling Practices

Well Planning, Drilling Rig: Components, Selection and Operating systems - Hoisting, Circulation and Rotary systems, Power transmission, Rig control system. Wire lines and service life evaluation, Drilling Fluids – Basics, Functions, Classification, Properties and Nature. Drilling fluids equipment related to pressure and separation. Formulations of drilling fluid, Mud systems like Pneumatic, Synthetic oil based, Inhibitive and Non-inhibitive Rheology models of drilling fluids Mud Hydraulics and Mud weight and Pressure loss calculations in round trip circulation cycle Water and Oil based drilling fluid testing procedures. Latest advances and emerging trends in drilling fluid like use of NDDF. Advanced mud Technology, Balanced/Underbalanced drilling. Pore Pressure prediction, Fracture pressure, abnormal pressure. Well Planning, GeoTechnical Order (GTO)

Unit II **Hours : 12**

Drill string, Casing and Bit Design

Drill String - Components, functions and design, Casing Practices – Configuration, operation, properties, types and design, casing setting depth and hole sizes, liner design, casing handling practices Drill Bits – Types, Performance and Criteria for design.

Unit III **Hours : 07**

Cementation Techniques

Cementing, Cements & cement slurry: Objectives of cementing, oil well cements, Classification of cement, Slurry design, Slurry additives, Factors influencing cement slurry design, Cementing equipments. Cementing Methods -Primary cementing, Stage cementing, Liner cementing, Plugging, Squeeze Cementing techniques in practice. Deep well cementing, Characteristics of good quality cementation. Cementing calculations.

Unit IV **Hours : 06**

Drilling Problems and Remedies

Pipe sticking and failure, Lost circulation, Hole Deviation, Sloughing shale, Formation damage, Bore hole instability. Drill string fatigue failure. Bit failure, wire line failure etc. Fishing and coring operations. Well kick and Blow outs: Problem, symptoms and controlling measures, Hole Cleaning. General equipment and Personnel. Safety and Environmental Impact of Drilling fluid. Waste management, classification of drilling waste, approaches of drilling waste minimization

Total Hours: 39

Text and References:

1. Carl Gatlin (1960), Petroleum Engineering: Drilling and Well Completion, Prentice Hall; 1st Ed.
2. Bourgoyne , Adam T. Jr., Martin E. Chenevert, Keith K. Millheim and F.S. Young Jr.,

Richardson, TX (1991), Applied Drilling Engineering, Society of Petroleum Engineers.
3. Neal J.Adams (1985), Drilling Engineering: A Complete Well Planning and approach, PennWell Books
4. H Rabia (1986), Oil Well Drilling Engineering Principles and Practices, Kluwer Law International
5. Gray and Darley (1988), Composition and properties of drilling and completion fluids, Gulf Professional publishing.
6. ASME Shale Shaker Committee (2004), Drilling fluids processing handbook, Gulf Professional publishing
7. James L. Lummus (1986), Drilling fluids optimization: a practical field approach, PennWell Books

17BPE223 - Reservoir Engineering										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	-	-	100

Unit - I **Hours - 10**

Introduction to reservoir media –porous and fracture medium, concept of porosity fluid saturation, wettability, capillary pressure and relative permeability for understanding multiphase flow behavior in reservoir system, Salient features of Gas-Oil and Water-Oil relative permeability Curves, Factors affecting relative permeability, Three phase relative permeability, basic laboratory core data analysis for understanding petrophysical parameters.

Unit- II **Hours - 10**

Fundamentals of flow in porous media, Classification of flow system in porous media, Single phase and multiphase fluid flow in different state (steady and unsteady) and different system (linear, radial) considering compressible, slightly compressible and incompressible fluid, Diffusivity equation and its application for reservoir flow system

Unit – III **Hours – 10**

Reservoir Field operation data acquisition, Basic data of reservoir engineering; PVT data, Core data, Well logging and transient well testing information. Reservoir Drive Mechanism, Application of reservoir engineering principles: volumetrics, material balance and decline curve analysis.

Unit – IV **Hours - 9**

Reservoir Engineering activities and management, Reservoir performance analysis, Preparation of development schemes, IOR/EOR and workover jobs for reservoir management, Concept of Reservoir simulation

Total Hours - 39

Texts and References:

1. Fundamentals of Reservoir Engineering – L. P. Dake – Elsevier, 17th Edition, 1998
2. Applied Petroleum Reservoir Engineering (Second Edition)- B. C. Craft and M. F. Hawkins Revised by Ronald E. Terry – Prentice Hall.
3. Worldwide Practical Petroleum Reservoir Engineering Methods – H. C. “Slip” Slider – Pennwell Publishing Company.
4. Advance Reservoir Engineering- Tarek Ahmed and Paul D. McKinney - Gulf Professional Publishing – Elsevier -2005
5. Applied Reservoir Engineering (Vol – I & II)– C. R. Smith, G. W. Tracy, R. L. Farrar – OGCI Publications -1992.
6. Petroleum Reservoir Rock and Fluid Properties – Abhijit Y. Dandekar- Taylor and Francis-2006.

17BPE224 - Transport Phenomena										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	1	0	4	4	25	50	25	0	0	100

Unit – I **Hours : 9**

Momentum Transport

Viscosity, temperature effect on viscosity of gases and liquids, Newton's law, mechanism of momentum transport, shell balance method, pressure and velocity distributions in falling film, circular tube, annulus, slit.

Unit – II **Hours : 10**

Equations of Change and Turbulent Flow

Equation of continuity, motion, mechanical energy, use of equations of change to solve flow problems, dimensional analysis of equations of change, comparison of laminar and turbulent flows, time-smoothed equation of change, empirical expressions.

Unit – III **Hours : 10**

Energy Transport

Thermal conductivity, temperature and pressure effect on thermal conductivity of gases and liquids, Fourier's law, mechanism of energy transport, shell energy balance, temperature distribution in solids and laminar flow with electrical, nuclear, viscous, chemical heat source, heat conduction through composite walls, cylinders, spheres, fins, slits.

Unit – IV **Hours : 10**

Mass Transport, Equations Of Change For Multicomponent Systems And Concentration Distribution In Turbulent Flows :

Diffusivity, temperature and pressure effect, Fick's law, mechanism of mass transport, theory of diffusion in gases and liquids, shell mass balances, concentration distribution in solids and in laminar flow : stagnant gas film, heterogeneous and homogeneous chemical reaction systems, falling film, porous catalyst. The equation of continuity, summary of equations of change and fluxes, use of equations of change, dimensional analysis, time smoothed equations of change, empirical expressions for turbulent mass flux.

Total Hours -39

TEXT BOOKS

1. R.B. Bird, W.E. Stewart and E.W. Lightfoot, "Transport Phenomena", John Wiley, II Edition 2006.
2. Robert, S Brodkey, Harry C. Hershey, "Transport Phenomena A Unified Approach", Brodkey Publishing 2003.

REFERENCES

1. L.S.Sissom, and D.R.Pitts, "Elements of Transport Phenomena", McGraw-Hill, New York, 1972.
2. R.W.Fahien, "Elementary Transport Phenomena", McGraw-Hill, New York, 1983.

3. J.R. Welty, R.W. Wilson, and C.W.Wicks, Rorer G.E, Wilson R.W. “Fundamentals of Momentum Heat and Mass Transfer”, V Edn. John Wiley, New York, 2007

17BPE225 - Programming Languages											
Teaching Scheme					Examination Scheme						
L	T	P	C	Hrs/Week	Theory			Practical			Total Marks
					MS	ES	IA	LW	LE/Viva		
0	0	2	1	2	--	--	--	50	50		100

Unit I

Introduction to Python: The basic elements of Python, Branching programs, Strings and Input, Iteration **Functions, Scoping and Abstraction:** Functions and Scoping, Specifications, Recursion, Global variables, Modules, Files **Testing and Debugging:** Testing, Debugging

Unit II

Structured Types, Mutability and Higher-order Functions: Tuples, Lists and Mutability, Functions as Objects, Strings, Tuples and Lists, Dictionaries **Exceptions and assertions:** Handling exceptions, Exceptions as a control flow mechanism, Assertions

Unit III

Classes and Object-oriented Programming: Abstract Data Types and Classes, Inheritance, Encapsulation and information hiding,**Some Simple Algorithms and Data Structures:** Search Algorithms, Sorting Algorithms, Hashtables

Unit IV

Plotting and more about Classes: Plotting using PyLab, Plotting mortgages and extended examples

Dynamic Programming: Fibonacci sequence revisited, Dynamic programming and the 0/1 Knapsack algorithm, Dynamic programming and divide and conquer

Texts and References

1. Introduction to C Programming, ReemaThareja, Oxford, 1st Edition
2. Let Us C, YashavantKanetkar, BPB Publication,9th Edition
3. Object Oriented Programming with C++, E. Balaguruswami, TMH, 3rd Edition
4. C: The Complete Reference, Herbert Schildt

17BPE227 - Numerical Methods Practical										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory		IA	Practical		Total Marks
					MS	ES		LW	LE/ Viva	
0	0	2	1	2	--	--	--	50	50	100

Unit I **Hours : 7**

Data representation, error analysis, introduction to MATLAB, Applied MATLAB programming.

Numerical Solution of Algebraic & Transcendental equations: Bisection Method, Method of false position, Secant method, Iteration method, Extended method of iteration, Newton-Raphson method, Newton-Raphson method for multiple roots. Comparison of various methods.

Unit II **Hours : 10**

Interpolation: Newton Gregory Forward Interpolation Formula, Newton Gregory Backward Interpolation Formula, Gauss's Forward and Backward Interpolation Formula, Stirling'sCentral Difference Formula, Lagrange's Interpolation Formula for unevenly spaced Formula, Inverse Interpolation, Divided Differences, Newton's Divided Difference Formula.

Unit III **Hours : 8**

Numerical Integration: Trapezoidal rule, Simpson's one-third rule, Simpson's Three-Eighth rule, Weddle's rule, Romberg's method, Double Integration.

Solution of Simultaneous Algebraic Equations: Gauss-Jacobi's method, Gauss-Seidal method.

Numerical Solution of Ordinary Differential Equation: Taylor's method, Euler's method, Runge – Kuttamethod, Modified Euler's method, Predictor Corrector method: Adam's method& Milne's method.

Unit IV **Hours : 4**

Numerical Solution of Partial Differential Equation: Bender-Schmidt method Crank- Nicholson method.

Texts and References

7. B.S. Grewal, Numerical Methods in Engineering and Science with Programs in C & C++,Khanna Publishers2010.
8. S.S. Sastry, Introductory Methods for Numerical Analysis, 4th Ed., Prentice Hall of India (2009).
9. M.K. Jain, S.R.K. Iyenger and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 5th Ed., New Age International (2007).
10. J N Reddy, An Introduction to Finite Element Method,McGraw Hill.
11. R.K. Jain & S.R.K. Iyenger, Advanced Engineering Mathematics, 3rd Ed., Narosa (2002).
12. S C Chapra, Raymond P. Canale,Numerical Methods for Engineers, Tata McGraw Hill Pub. Co. Ltd.

17BPE226 - Drilling Engineering Practical										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	2	1	2	--	--	--	50	50	100

List of Experiments:

1. Preparation of WBM and OBM including determination of pH of drilling fluid using pH meter.
2. To calibrate the mud balance and determine the specific gravity / density of the mud.
3. To measure the viscosity of drilling fluid using Marsh funnel viscometer.
4. To determine the Rheology of the drilling fluid using Rheometer.
5. To determine the volumes of Water, Oil and Solids in Drilling Fluid using Retort kit.
6. To determine the Fluid loss using Low-temperature/low-pressure API filtration apparatus.
7. To determine the Sand content in drilling fluid using sand content kit.
8. To determine the alkalinity in Drilling fluid and in filtrate of drilling fluid by titration method.
9. To determine the Total hardness in drilling fluid by titration method. Field procedure to determining the total hardness in mud filtrate.
10. To determine the Calcium and Magnesium in drilling fluid by titration method. Field procedure to determining the Ca in mud filtrate.
11. Field procedure for determining cation exchange capacity.
12. To determine the Emulsion stability using Emulsion stability (ES) meter.
13. To measure the gel or shear strength of drilling fluid using Shearometer.
14. To determine the Resistivity of drilling fluid and mud cake using Analog Resistivity meter.
15. Prepare homogeneous cement slurry with the help of Constant Speed Mixer.
16. To measure the absolute density of cement slurry using pressurized mud balance.
17. To determine the thickening time of cement slurries under simulated wellbore conditions using HPHT Consistometer
18. To condition cement slurry to test temperature to enable further testing using Atmospheric Consistometer.
19. To estimate the volume of filtrate lost to the formation using HPHT Filter Press.
20. To determine the rheological properties and graphical behavior of cement slurries using automated computerized viscometer.
21. To determine the stability of Cement Slurry under static Conditions using free water test.

17BPE228 - Geological and Hydrocarbon Exploration Field Work										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	10	5	--	--	--	--	50	50	100

Laboratory Courses: Practical classes/Field trips shall be based on theory course content of Earth science, Sedimentary geology, Petroleum Geology and Petroleum Exploration courses

Aim : Field familiarization of exploration in sedimentary basin and petroleum System

Text and Reference Books

1. Coe, A. L. (2011) Geological field techniques, Wiley Blackwell Publication,
2. Compton, R. R. (1962) Manual of Field Geology