17MPE111 : Advanced Numerical methods and computer programming										
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 1: **Hrs : 10**

Errors and approximations: Accuracy of numbers, Different types of errors, **Finite Differences:** Different operators, Factorial polynomial, Synthetic Division. **Interpolation:** Newton's Forward interpolation Formula, Newton's backward interpolation Formula. Gauss forward interpolation Formula,Gauss backward interpolation Formula, Stirling's Formula, Lagrange's interpolation formula, Dividend differences & Newton's formula, Calculation of Error terms for different interpolation formulas. (Self Study) ,**Spline Interpolation**: Linear, Quadratic, Cubic

Unit 2: **Hrs : 9**

Numerical Differentiation: Derivatives using forward difference formula, Derivates using backward difference formula, Numerical Integration: Newton-Cotes Quadrature Formula, Trapezoidal Rule, Simpson's 1/3 rule, Weddle's rule, Simpson's 3/8 rule, Romberg's integration Formula, Double integration (Self Study), Gaussian integration (Self Study)

Unit:3 : **Hrs : 10**

Solving algebraic & transcendental equations: Bisection method, False position (Regula Falsi) method, Method of simple iteration/Successive approximation, Extended method of iteration, Newton- Raphson method, Find qth root, Square root, reciprocal, Solution of non linear simultaneous equations (Self Study), Newton-Raphson method for multiple roots, Secant method, Ralston-Rabinwitz method, Descarte's Sign rule, Horner's method, Graffe's root squaring method

Unit:4 **Hrs : 10**

Numerical methods for solving Ordinary Differential Equation: Picard's method, Taylor's method, Euler's method, Runge – Kutta method, Modified Euler's method, Predictor Corrector method,Adam's method, Milne's method, **Curve Fitting:** Least square approximation method: Linear curve, Quadratic curve, Exponential curve, Formation of Normal equations for differential curves.**Solutions to Simultaneous Linear Equations**: Direct methods (Self Study), Iterative methods: Gauss-Jacobi's method, Gauss-Seidal method, Relaxation method (Self Study), **Partial Differential Equations(PDE's)**: Differential 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

Total Hrs : 39

Texts and References:

1) Numerical Methods for Engineers, Tata McGraw-Hill Publishing Company Limited, Steven C.Chapra and Raymond P. Canale

2) Numerical Methods by M K Jain, Iyengar & R K Jain, New Age International Publishers

3) Numerical Methods by E.Balaguruswamy

4) Numerical Methods for Mathematics, Science & Engineering by John H. Mathews

5) Applied Numerical Analysis by Curtis F Gerald & Patrick O. Wheatley

6) Computer Oriented Numerical Methods by V.Rajaraman

17MPE112 : Advanced 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 - 1: **Hrs- 10**

Introduction to reservoir and reservoir engineering. Petroleum reservoir:type, drive mechanism, geometry, flow system and pattern, Single phase and multiphase fluid flow in different state (steady and unsteady) and different system (linear, radial, spherical) considering compressible, slightly compressible and incompressible fluid, Diffusivity equation and its application for reservoir flow system

Unit-2: **Hrs- 10**

Reservoir Data: type and acquisition. Bottom hole operation for pressure and temperature measurement, Reservoir fluid data: sampling, PVT studies and PVT parameters. Reservoir rock and fluid data: Core study, well log information, Transient well testing and interpretation information. Classification of flow system in porous media,

Unit – 3: **Hrs – 10**

Reservoir engineering principles and activities, Volumetric evaluation of petroleum reserves, Material balance equation and its application, Water Influx calculation, Decline curve analyses method and its application. Reservoir performance analysis by volumetric, material balance and decline curve methods with few case studies.

Unit – 4: **Hrs -9**

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

Total Hrs - 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.

17MPE113 : Advanced Drilling 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-1: **Hours: 13**

Design

Design of Drill string design, Casing design, Bit Selection, BOP design, Wellbore Hydraulics

Unit 2 : **Hours:13**

Directional Drilling

Directional Drilling Technology, Objectives of Directional Drilling. Tools for deflection & orientation. Directional well profiles and well path – deflection & corrections Motor Types: PD motors and Turbodrills; their description, power calculations and applications, Horizontal Well Drilling, Introduction of Horizontal well drilling: Objectives & selection, Drilling techniques and different well profiles, Special mud requirements and their characteristics. Well Surveying: Objectives & methods. Surveying analysis & calculations for well coordinates Directional drilling problems & their remedies Auto and Verti-track systems: Rotary steerable motors and geo-steering tools.

Unit 3 : **Hours : 07**

Drilling Problems

Pipe sticking, Lost circulation, Sloughing shale, formation damage, fatigue failure of drill string, Bit failure, wire line failure etc. Well control and hydrodynamic pressure, well control techniques

Unit 4: **Hours : 06**

Non-conventional drilling methods

Special Drilling Methods: Foam, under balanced, overbalanced, plasma, electrical, top drive, re-entry, extended reach, jet, multilateral, slim-hole and coil tubing drilling methods; Drilling HPHT wells, Drilling fluids for HPHT environment, Case study of HPHT drilling

Total Hrs -39

Texts and References:

1. Malcom Rider, Second Edition, 2002: The Geological Interpretation of well logs, Rider-French Consulting limited
2. Oeberto Serra & Lorenzo Serra, 2004 : Well logging - data acquisition and applications, Edition Serralog, France
3. Jorden J R and Campbell F. L., , SPE, New York, 1986: Well Logging Vol. 1 and 2
4. Ellis, D. V. and Singer, J. M. 2nd edition, 2007: Well logging for Earth Scientist, Springer
5. Toby Darling, Well logging and Formation Evaluation, Gulf Professional Publishing, Elsevier Science

17MPE114 : Petroleum Formation Evaluation										
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-1: **Hours: 9**

Fundamentals

Formation evaluation basics, Borehole environment, Invasion, Log acquisition, representation of log data on different tracks,Basic working principle of various logging tools, Coring and Core analysis, data collected on Mud logs. Temperature logs, Closed hole environment

Unit 2 : **Hours:12**

Routine Logging

Lithology logs (SP, Caliper, and Gamma); Porosity Logs (Density, neutron and Sonic), Resistivity, Induction logs.
Quick look analysis :-Overlay, (Logarathmic movable oil plot, Neutron density, density sonic, dielectric-porosity overlay) Cross Plots (Trend analysis and Grouping, Extrapolation, frequency plots, Z Plots. Sandy shale interpretation Fracture detection, Porosity from Resistivity

Unit 3 : **Hours : 10**

Special Logging Technique

Nuclear magnetic resonance logging, Dip meter, image logging, gyroscopic log, geochemical log, vertical seismic profiling, Cement bond log, variable density log, Logging while drilling and Measurement while drilling, Production Logging

Unit 4: **Hours : 8**

Integrating and Interpreting data

Synthetic seismogram preparation using seismic and well log, dual mineral interpretation, multi mineral interpretation, static model interpretation using well log and seismic, reservoir property evaluation for reserve estimation (gross sand, net sand, gross pay and net pay), Rw calculation and use of the same in Sw, Understanding Sw and Swi and its effect in reserve estimation, thin resistive sand interpretation in facies classification and reservoir property evaluation

Total Hrs -39

Texts and References:

1. Malcom Rider, Second Edition, 2002: The Geological Interpretation of well logs, Rider-French Consulting limited
2. Oeberto Serra & Lorenzo Serra, 2004 : Well logging - data acquisition and applications, Edition Serralog, France

3. Jorden J R and Campbell F. L., , SPE, New York, 1986: Well Logging Vol. 1 and 2
4. Ellis, D. V. and Singer, J. M. 2nd edition, 2007: Well logging for Earth Scientist, Springer
5. Toby Darling, Well logging and Formation Evaluation, Gulf Professional Publishing, Elsevier Science
6. Schlumberger Interpretation Handbook, 2009
7. Whitteker, Collins Fundamentals of Produciton Logging, 2013, Schlumberger

17MPE115 : Advanced Production Engineering										
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 1: **Hours : 9**

Conventional Onshore Well Completion

Concept of Well Completion, Casing string types- Drive Pipe, Surface casing, Conductor casing, Intermediate casing, Production liner, Tubing; Casing Head, Casing Hanger, Casing Spool, Well Head integrity- Effect of leakage in A , B and C section, Mono Bore completion.

Unit 2: **Hours: 10**

Advanced (Offshore) Completion System

Introduction – Concept of Offshore well completion, Well Head and Christmas tree(Dry and Wet Type) , Tubing and Packer Completion, Single and Dual string Completion, Material Selection, Completion equipment; Intelligent and Smart completion; Hi-Tech Well Completion: Completion of Horizontal Wells, ERD and Multi Lateral wells, Downhole equipment requirements.

Unit 3: **Hours: 10**

Onshore Production System

Well head fitting & piping, Process flow diagram (PFD) for oil gas, Process control, separation of oil, gas,& water , types of separator, Separation mechanism. De- emulsifications & Desalination of crude. Indirect bath heater and Heater- treater. Produced water treatment. Storage of oil and gas, Liquefied Petroleum Gases (LPG& LNG), Transportation of oil& gas and metering systems.

Unit 4: **Hours: 10**

Offshore Production System

Elements of offshore production system--- Wells (Dry/Wet), well platforms/well servicing rigs, feeder subsea pipeline, process platforms, export pipelines for oil & gas, tankers for evacuation of oil, types of offshore platform - essential personnel, unmanned platform, process control and monitoring—RTU and SCADA system, well automation and optimization, processing of oil, gas and produced water, water injection, Utilities.

Total Hours: 39

Texts and References:

7) Dr. Guo Boyun , Computer Aided Petroleum Production Engineering
8) Deep water Petroleum Exploration & Production-By Willium Leffler, Richard Pattardozzi, Gordon Sterling
3. Shippen, M and Scott(2004) offshore multiphase production operation, Pennwell books.
4. Robinson,T(1992) - an introduction to offshore technology and terminology .
5. Floating Production System- By N.K. Mitra.

17MPE116 : Hydrocarbon Exploration Techniques										
Teaching Scheme					Exam 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 1: **Hours: 10**

Gravity and Magnetic Survey

Description of various types of gravimeter. Borehole gravimeter. Air borne gravimeter. Zero Spring length. Various types of Magnetometer. Bore hole and Air borne magnetometer. Unipolar gravity and Bipolar Magnetic. Poisson relation in relating to gravity and magnetic. Data Acquisition and Processing of gravity and magnetic data. Corrections applied to gravity and magnetic data. Paleomagnetic analysis. Field generated by magnetic forces. Monopole and dipole. Analysis of quadrapole. Derivation to understand Earth's magnetic field acting as a dipole field. Potential and simple surface distribution. Potential due to horizontal ribbon. Potential at an Exterior point for an arbitrary 3D body. Vertical and Gravity Anomaly due to fault. Gravity anomaly for a sphere, horizontal and vertical cylinder. Contouring of Bouguer Gravity Data and Separation of regional and residual. First order and second order gravity data. Zero contour of a second order gravity data. Downward and upward continuation of gravity data. Layered stripping of gravity and magnetic data. Sediment and Basement analysis using integrated gravity and magnetic data.

Unit 2: **Hours:10**

Electrical, Electromagnetic and Magnetotelluric method

Various configuration of acquiring data for apparent resistivity calculation. Derivation for Schlumberger Array, Werner Array, Pole Dipole Array, Dipole-Dipole Array. Evaluating anisotropy using two layer, three layer and multilayer base curve. Type curve analysis: A Type, Q Type, K Type, H Type. Understanding isotropic and anisotropic layers using transverse resistance and longitudinal conductance. Use of principle of equivalence. Self-potential methods. Self-potential equipment. Interpretation of self-potential data. Telluric and Magnetotelluric methods, origin and characteristics of Magnetotelluric fields and electric currents. Field equipment and operations. Mapping 3D anomalies. Measuring overburden depth and resistivity.

Unit 3: **Hours: 10**

Seismic Acquisition and Processing

Refraction, Reflection, Field methods and equipment. Fluid crew organization. Field Layouts and Equipments. Marine Equipments and methods. Measurement of velocity and density. Field processing of the raw data along with broute strap preparation. Software for initial processing and velocity estimation, average velocity, interval velocity, instantaneous velocity, stacking velocity, route mean square velocity, time-distance curve for refraction and refraction (two layers, three layers and multi layers). Acoustic impedance contrast. Stickogram preparation. SEGD and SEGY sections, various seismic processing steps. Static and Residual static correction. Automatic Gain control (AGC). Muting. Horizontal velocity analysis.

Tomogram preparation. Normal and Dip Move out. Final Stack. Migration.

Unit 4: **Hours:9**

Structural and Stratigraphic Seismic Interpretation

2D and 3D interpretation. Understanding time-lapse interpretation. Loop time and two way time map preparation. Advance velocity analysis. Gridding methodology and placement of faults. Depth – Map preparation. Isochron preparation. Isochrono-pach preparation.2D interpretation and preparation of 3D volumes from 2D data (pseudo 3D preparation).

Amplitude variation with Offset. Amplitude variation with Angle. Classes of Sand. Bright Spot, Dim Spot and Flat Spot. Understanding sequence stratigraphy from seismic interpretation. Mapping of transgressive sequences. Canyons. Dumps. Unconformity. Barrier Parts. Cheniers. Wedge-Out and Pinch out interpretation. 2D and 3D seismic attributes. Analysis of amplitude, frequency and sweetness, derived attributes. Use of attributes in understanding tuning thickness and Fresnel zone (vertical and horizontal resolution).

Total Hours: 39

Text Books and References:

1. Bhattacharya, P. *Direct current geoelectric sounding: Principles and interpretation*. Vol. 9. Elsevier, 2012.
2. Telford, William Murray, Lloyd P. Geldart, and Robert E. Sheriff. *Applied geophysics*. Vol. 1. Cambridge university press, 1990.
3. Dobrin, Milton B. *Introduction to geophysical prospecting*. International student edition,(McGraw-Hill Book Company, Inc.).
4. Telford, William Murray, Lloyd P. Geldart, and Robert E. Sheriff. *Applied geophysics*. Vol. 1. Cambridge university press, 1990.
5. Paul Weimer and Thomas L. Davis. Application of 3D Seismic Data to Exploration and Production, SEG Geophysical Developments, Series, No. 5.
6. Alsadi, Hamid N. "Seismic Hydrocarbon Exploration."

17MPE117 : 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.