

**COURSE STRUCTURE FOR M.TECH.  
SEMESTER I (Petroleum Engineering) w.e.f. 2015-2016**

Sr. No	Course Code	Course Name	Teaching Scheme					Exam Scheme					Total Marks
			L	T	P	C	Hrs/wk	Theory			Practical		
								MS	ES	IA	LW	LE/Viva	
1	MPE101T	Advanced Numerical methods and computer programming	3	0	0	3	3	30	60	10	--	--	100
2	MPE102T	Advanced Drilling Engineering	3	1	0	4	4	30	60	10	--	--	100
3	MPE103T	Advanced Natural Gas Engineering*	3	1	0	4	4	30	60	10	--	--	100
4	MPE104T	Hydrocarbon Exploration Techniques	3	1	0	4	4	30	60	10			100
5	MPE105T	Advanced Reservoir Engineering	3	1	0	4	4	30	60	10	--	--	100
6	MPE101P	Advanced Numerical methods and computer programming LAB	0	0	4	2	4	--	--	--	25	25	50
7	MPE106P	Petroleum Engineering Lab-I	0	0	2	1	2	--	--	--	25	25	50
8	MPE107P	Drilling Fluid Lab	0	0	2	1	2				25	25	50
		Total	<b>15</b>	<b>4</b>	<b>8</b>	<b>23</b>	<b>27</b>						<b>650</b>

MS = Mid Semester, ES = End Semester;

IA = Internal assessment (like quiz, assignments etc)

LW = Laboratory work; LE = Laboratory Exam

\*FOET Elective - I

**MPE 101T: 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	0	0	3	3	30	60	10	--	--	100

**Unit1: 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: 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 : 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 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<sup>nd</sup> 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

**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

MPE 102T: 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	30	60	10	--	--	100

**Unit-1** :Types of drillings application and selection; Drilling rigs – Mechanical, hydraulic and electrical; Rig components; Design of derrick, drawworks; Drill string components and design; Casings and cementing; Drill bit types and design features. Mud pumps; Drilling economics; Parameters influencing drilling; Safety in drilling.

**Unit-2:** Control, operation and data acquisition; well hydraulics; Rate of penetration; Measurement of mud properties; Mud additives; Contamination of a drilling mud; Liquid and solids content, Rotary drilling subsystems, drilling fluids, drilling fluid hydraulics, drill bit hydraulics, cuttings transport, well control mechanics, overview of well planning.

**Unit-3:** Drilling problems & their remedies: pipes sticking, sloughing shales, lost circulation, blowout prevention and well control (minimum three case studies of major disasters in drilling)

**Unit-4** : Directional Drilling and Deviation Control, Drilling Problems; Drill string Mechanics and Well Planning, MWD, SHE issues related to drilling.

**Texts and References:**

- 1) Adam T. Bourgoyne Jr., Martin E. Chenevert, Keith K. Millheim and F.S. Young Jr., Applied Drilling Engineering, Society of Petroleum Engineers, Richardson, TX, 1991.
- 2) Advanced Drilling and Well Technology, B.S. Aadnoy, I Cooper, S.Z.Miska, R F. Mitchell & M.L. Payne, SPE 2009(TB)
- 3) High Technology in Drilling and Exploration, C.P.Chugh, Oxford & IBH High Technology co. Pvt. Ltd 1998.
- 4) Horizontal Well Technology, S.D. Joshi., Pennwell Books 1991
- 5) Well control problem solutions, N J Adam
- 6) Applied Drilling Engineering, A.T. Bourgrove jr., K.K.Millehim, SPE 2005
- 7) Drilling fluids Optimization, J.L. Lummus and J.J Azar, Pennwell Books 2007

- 8) Formulas and Calculation for Drilling, N.J. Lapeyrouse, Gulf Professional Publishing 2002
- 9) Blowout Prevention, Goins WC jr.
- 10) Horizontal Wells, R Aguilera et. Al.
- 11) Oil, Well Drilling Technology, Mc Gray & Cole
- 12) Well Completion & Servicing, Perrins D, Editions Technip,
- 13) Advanced Drilling Solutions Vol-I & II, Y.A. Gelfgat, & Y.S. Lopatin, Pennwell Books 2003.**

**MPE 103T: Advanced Natural Gas 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	30	60	10	--	--	100

**Unit-1: Introduction:** Composition, properties, fields & reserves in India and energy scenario; major NG producing industries of India and their contribution to Indian economy; techniques of utilization

**Unit-2: Reservoir Aspects:** flow of gas in reservoir; gas in the wellbores; deliverability aspects, OFP, production forecasting & decline curves etc., gas gathering systems, **Transportation of NG:** compression calculation; gas stations & transmission; city gas distribution system; gas flow measurement, compressor sizing

**Unit-3: N G Processing:** conventional and advanced separation techniques; sulphur recovery; LPG, LNG & CNG systems; specifications of NG for transportation in pipelines

**NG Utilization:** uses, underground storage, conservation & concept of peak shaving etc.

**Unit-4: Unconventional Gas:** CBM, NG hydrates & in-situ coal gasification, conversion of gas to liquid (GTL)

**Texts and References:**

- 1) Petroleum Production Handbook:- Bradly HB.
- 2) Introduction to Petroleum Production Volume 1 & 2:- Dr. Skimmer
- 3) Gas Processing:- Janes A Speight.
- 4) Kelkar, M., Notes on Natural Gas Engineering, 2005.
- 5) Lee, W.J., Wattenbarger, R.A., Gas Reservoir Engineering, 1996.
- 6) Katz: D.L., Natural Gas Engineering Prodcution and Storage, McGraw-Hill Publishing Company, New York, 1990.

**MPE 104T: Hydrocarbon Exploration Techniques**

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	30	60	10	--	--	100

**Unit-1:** Petroleum Geology: Source rock, Primary and Secondary Migration, Trapping Mechanism and Traps, Top and fault Seal, Petroleum Systems Analysis.

**Unit-2:** Geology exploration and Mapping techniques: Surface and sub-surface mapping techniques, Structure contour Maps, Cross sections, Isopach Maps, Lithofacies maps.

Remote sensing & GIS

**Unit-3 :** Geophysical Techniques: Seismic, Magnetic, Electrical and Gravity Methods

Geochemical techniques: Rock Eval Pyrolysis with TOC and LECO method, Fluid Inclusion studies.

**Unit-4:** Integration of different Exploration techniques in Oil field development. Resource and Reserve estimation.

**Texts and References:**

- 1) AAPG Treatise on Petroleum Exploration, Memoir 26
- 2) Telford, W.M, Geldart L.P., Sherif R.E., Keys D.A. Applied Geophysics
- 3) Brown A.R.: Interpretation of Three-Dimensional Seismic Data, AAPG Memoir 42.

**MPE 105T: Advanced Reservoir 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	30	60	10	--	--	100

**Unit-1** Fluid Flow Through Porous Media. Single Phase and Multiphase Flow Equations, Linear and Radial flow in Reservoir: Derivation of Diffusivity Equation, PVT Analysis for Oil: Hydrocarbon Phase Behavior, Determination of the PVT Parameters.

**Unit-2:** Gas Reservoir Engineering, Condensate Reservoirs, Reserve estimation Methods: Volumetric and Material Balance Equation. Reservoir Simulation.

**Unit-3:** Reservoir Drive Mechanisms, Natural Water Influx Reservoir, Pressure Maintenance water Flooding Performance Calculations for Stratified Reservoirs.

**Unit-4:** Productivity Index, IPR. Water and Gas Coning, Decline Curve Analysis

**Texts and References:**

- 1) Petroleum Reservoir Engineering Physical Properties James W. Amyx, Daniel M. Bass and Robert L. Whiting
- 2) Oil Reservoir Engineering S.J. Pirson
- 3) Applied Petroleum Reservoir Engineering B.C Craft, M. Hawkins, and Ronald E. Terry.
- 4) Integrated Petroleum Reservoir Management: A. satter, G. Thakur.
- 5) Gas Reservoir Engineering: John W. Lee and R.A. Wattenbarger.
- 6) Towler, B. Fundamental Principles of Reservoir Engineering
- 7) Dake, L.P; Fundamentals of reservoir Engineering

MPE 101P: Advanced Numerical methods and computer programming LAB										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
0	0	4	2	4				25	25	50
<b>Practical Hours: 2 per week</b> The computer programming of numerical methods shall be done using MATLAB										

MPE 106P: Petroleum Engineering Lab-I										
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				25	25	50
<b>Practical Hours: 2 per week</b> Experiments on Drilling Fluids, Cements and Reservoir Engineering										

MPE 107P: Drilling Fluid Lab										
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				25	25	50