MA 201T Mathematics - III

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 I **Hours:12**

Complex Variable: Function of a Complex variable, Cauchy-Riemann equations, Analytic function, Conformal mapping, Some standard & special conformal mappings, Definition of a Complex line integral, Cauchy's integral theorem, Cauchy's Integral formula, Residue theorem, Calculation of residues, Evaluation of real definite integrals.

Unit II **Hours: 10**

Special Functions: Power series method to solve the equation, Frobenius method for solution near regular singular points, Legendre's equation, Legendre polynomials, Rodrigue's formula, Bessel's equation.

Unit III **Hours: 10**

Partial Differential Equations and its Applications: Classification of partial differential equations, solutions of one dimensional wave equation, one dimensional unsteady heat flow equation.

Unit IV **Hours: 10**

Two dimensional steady heat flow equation in Cartesian and polar coordinates by variable separable method with reference to Fourier trigonometric series and by Laplace transform technique.

Total Hours: 42

Texts and References:

1. Murray Spiegel, Complex Variables with an introduction to Conformal mapping and its applications, McGraw Hill Publication.
2. S. Arumugam, Complex Analysis, Scitech Publication.
3. M.D. Raisinghania, Ordinary and Partial Differential Equations, S. Chand Publication.
4. K. Sankara Rao, Introduction to Partial Differential Equations, Prentice-Hall India.

PE 201 Sedimentary & Petroleum Geology

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 I: Sedimentary Basics **Hours: 10**

Sedimentary Geology Basic, Sedimentary Processes & Characterization (clastic, non clastic, carbonate and evaporites): Transport of sediments, Flow regimes, Diagensis, Textural Properties Sedimentary Structures: Physical, Biological and Chemical

Unit II: Depositional Environment **Hours: 10**

Depositional Environment; Continental Environment: Fluvial, Lake, Aeolian, Alluvial Fan etc., Marginal marine: Estuarine, etc., Shallow Marine: Tidal Flats, Beach, Deltaic., Shelf Environment., Deep and Ultra Deep Marine environment, Reservoir geometry and sedimentology for clastic and non-clastic

Unit III : Origin, Occurrences and Ingredients of Petroleum System **Hours: 10**

Inorganic and organic theory, Transformation of organic matter into petroleum, Composition of oil and gas. Mode of occurrences of petroleum. Source, Trap, Seal, Reservoir, Migration (Primary, Secondary and Tertiary), Classification of Traps

Unit IV : Petroleum Reservoirs & Basin Analysis **Hours: 10**

Sedimentary controls on porosity, permeability, and saturation, Reservoir geometry and exploration strategies and examples Control on Porosity, permeability and other basic properties of reservoir, Reservoir geometries and exploration strategies and examples, Basin classification, Quantifying uncertainty, minimizing risk and making decisions

Total Hours: 40

Texts and References:

1. Reineck & Singh Depositional Sedimentary Environment
2. Tucker & Wright Carbonate Sedimentology
3. Boggs S Principles of Sedimentology & Stratigraphy
4. Slatt, M. Reservoir Sedimentology
5. Petroliferous basins of India Vol 1, 2 & 3
6. AAPG Treatise on Petroleum Geology, 1999
7. AAPG, Development Geology Reference Manual, 1992
8. F. J. Pettijohn, Sedimentary Rocks
9. Leverson, Geology of Petroleum, CBS Publishers & Distributors
10. Warren, J. (2006) Evaporites: Sediment, resources and Hydrocarbon, Springer Publicaiton
11. Ahr, W. M. (2008) Geology of Carbonate reservoir, John Willey and Sons.
12. Philip A. Alen & John R. Alen, Basin Analysis-Principles and Applications.

PE 201P Sedimentary & Petroleum Geology Laboratory

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

Laboratory Courses: Practical classes shall be based on theory course content of the corresponding courses.

Aim: Hand specimen and Thin section of Clastic, carbonate, Evaporite rocks; Sedimentary Structure identification (hand specimen); Study of Cores; Delineation of depositional environment, Reservoir geometry.

PE 203 Thermodynamics of Reservoir Fluids

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 I : Thermodynamic Behavior **Hours: 12**

Thermodynamic behavior of naturally occurring hydrocarbon mixtures; evaluation and correlation.

Unit II **Hours: 10**

Physical properties of petroleum reservoir fluids including laboratory and empirical methods.

Unit III **Hours: 10**

Theoretical and experimental analysis of the mechanics and thermodynamics of flowing fluids

Unit IV : State Equation and Water Properties **Hours: 10**

Use of various equations of state, Calculation of compressibility factor and experimental analysis (compositional analysis, constant composition expansion, flash and differential liberation for oil and gas condensate) of reservoir fluids using PVT cell , Water Properties- Water from petroleum reservoirs, water production, water analysis at atmosphere pressure

Total Hours: 42

Texts and References:

1. Thermodynamics of Hydrocarbon Reservoirs, Abbas Firoozabadi, McGraw-Hill.
2. PVT and Phase behavior of Petroleum Reservoir Fluids, Ali Danesh, Elsevier, 1998.
3. Properties of Petroleum Rocks and Fluids, Abhijeet Dandekar.

PE-204 T Earth Science

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 I : Earth, Mineralogy and Crystallography **Hours: 8**

Origin of Earth , Age of Earth, Internal Structure and Constitution of Earth, Mineralogy, Crystallography of Minerals; Physical, Optical and Chemical properties of minerals; origin and occurrence of minerals

Unit II : Petrology and Physical Geology **Hours: 10**

Petrology: Igneous, Sedimentary and metamorphic rocks with respect to their origin mode of occurrence texture and structures. Classification of rocks, Physical Geology: Weathering and erosion, transporting agents, geological work of wind, river, subsurface water, lakes, volcanoes, glaciers, earthquakes, ocean and seas. Depositional environments, Concepts of Isostacy

Unit III : Structural Geology **Hours: 12**

Structural Geology-Bedding plane, dip and strike, folds, faults, joints and fracture-classification

Unit IV : Paleontology, Stratigraphy and Plate Tectonics **Hours: 12**

Paleontology – Mode of preservation of fossils, uses of fossils, standard geological time scale, Startigraphy - Startigraphic sequences of major petroliferous basins of India Plate Tectonics: formation of continents, convergent and divergent plate boundaries, Island Arc system, Ring of Fire

Total Hours: 42

Texts and References:

1. P. K. Mukherjee, A Text Book of Geology, The World Press Pvt Ltd., Kolkata,
2. Rutley, A Text Book of Mineralogy
3. Supriya Mohan Sengupta, An Introduction to Sedimentary Geology
4. Anthony R. Philpotts and Jay J. Ague, Principles of Igneous and Metamorphic Petrology, Cambridge University Press.
5. Thornbury, Principles of Geomorphology

PE 204P Earth Science Laboratory

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

Laboratory Courses: Practical classes shall be based on theory course content of the corresponding courses.

Aim: To understand the basic properties of rocks and minerals to understand and identify them in hand specimen and under microscope.

PE 211 Energy Resources

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 I **Hours : 12**

Introduction to Energy Resources: Defining Energy ; various forms of Energy; Energy Resources Classification- Fossil Fuels(Conventional and Non-conventional Resources); Renewable and Non Renewable energy Resources; Primary Energy(Tradable and Non tradable); Commercial Energy; Non-Commercial Energy; Energy Outlook- Global versus India, Renewable and Non Renewable Energy Resources- Differentiate and option

Unit II **Hours : 12**

Study Of Various Energy Resources (Conventional Exploration & Production and Non-Conventional Exploration & Production of Fossil Fuels- Crude Oil, Natural Gas, Coal, Shale Gas, Gas Hydrates , CBM and CMM, CBM – formation; Resource potential mapping; Seismic analysis and other methods for assessing the potential; Award procedure for CBM block in India ; status of CBM bidding round; Current CBM Production; Future prospects; Players in India; Global Scenario; Shale Gas- Introducing Shale Gas; Shale Rock formation; History of Shale Gas; US success Story; Replication possibilities US experience in India; Shale gas Global Potential ; Shale Gas initiatives in Europe and Asia; Shale Gas Potential in India; Technological Advancements in Shale Gas Exploitation; Gas Hydrates- The concept of gas in hydrates; possible location of gas hydrates; Global versus Indian experience; potential of estimated gas from hydrates; artificial Hydrate concept; application of artificial Gas hydrate for gas transportation Insitu gasification of Coal and lignite

Unit III **Hours : 10**

Renewable and new Energy Resources, Hydro-Energy- Power from Potential and Kinetic Energy of water; Principle of Hydro power; Location advantage; construction of dam, pen stock, turbine and Generator; Problem related to displacement of population, Mitigating the consequences; Example of Bhkhra- Nangal dam, Tehri Dam, Narmada dam and Ramganga Dam

Solar Energy- Solar Radiation and its measurement; Solar Energy Collectors; Solar Energy Storage ; Application of Solar Energy Wind Energy-Basic Principles; Nature of the wind; Power in the wind; Wind Energy Conversion System (WES) the Wind Mills; Electrical Generation System from wind Mills, Energy storage and transmission; Safety System; Environmental aspects, Incentives in India for Wind Energy Bio Energy- Energy from Biomass; Biomass Conversion techniques(Wet process, Dry Process); Photo Synthesis; Biogas generation; Types of Bio Gas plants; Community Biogas plants; Biomass as Source of energy; Methods for obtaining energy from Biomass; thermal Gassification of biomass; Pyrolysis (Destructive distillation)

Unit IV **Hours : 8**

Geothermal Energy- Introduction; Estimation of Geothermal Power; Geothermal Sources; Hydrothermal (Convective) Resources; Geo-pressure Resources; Hot- Dry Rock Resources; Prime Movers for Geothermal Energy Conversion; Application of Geothermal Energy Energy from Oceans- Ocean Thermal Electric Conversion(OTEC); Energy from Tides(Tidal energy; Ocean Waves (Energy and Power from the waves; Wave energy conversion devices; Nuclear Energy-Nuclear fusion and Fission, Nuclear Fuels; Process of power generation from Nuclear plants Hydrogen Energy- Principle; Hydrogen generation process; Hydrogen Storage and Transportation;

Total Hours : 42

Texts and References:

1. GD Rai, Energy Resources.
2. United Nations Framework Classification for Fossil Energy and Mineral Resources
3. Twindle, J and Weir, A. D. (2006) Energy Resources, 2nd Publication, Taylor and Francis Ltd.
4. Zou, C et al (2013) Unconventional Petroleum Geology, Elsevier
5. Max, M. D. (2003) Natural Gas Hydrate in Oceanic and Permafrost Environments, Kluwer Academic Publication
6. Nash, K. M. (2010) Shale gas Development, Nova Science Publishers, Incorporated
7. Rogers, R. (1994) Coal bed methane: principles and Practices, PTR Prentice Hall

PE 200 Introduction to Petroleum 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 I **Hours : 10**

Nature of Petroleum- composition & properties; Overview of Petroleum geology & basic rock properties: Source, migration and accumulation of petroleum, Seal and trap; Overview of Petro physical properties of rock and fluid; Brief study of fluid flow through porous media.

Unit II **Hours : 12**

Fundamentals of reservoir engineering; classification of reservoir flow systems; Darcy's law of fluid flow; Pressure distribution and pressure gradient for linear, radial, compressible, steady state flow; Average permeability calculations for beds in series and beds in parallel for linear and radial reservoir geometry; Overview of drilling operation: Rig Components, Drill String, Casing policy, Drilling fluid and Cementing; Concept of oil production, gathering, treatment & storage and transportation.

Unit III **Hours : 12**

Thermal and Physical properties of crude; Crude characterization techniques; Overview of Refining operations; Introduction to each unit of refinery – Distillation, Sweetening, Cracking, Reforming, Isomerisation, Alkylation, Polymerization; Major equipments used in refinery; Various catalysts used in refining units;

Unit IV **Hours : 8**

Introduction to gas processing, Pre-treatment of gas – Merox Process, Sulphur Removal, Dehydration; General processes concerning gas Processing; Overview of LNG Value Chain; Introduction to Gas Distribution

Total Hours: 42

Texts and References:

1. Leverson, *'Geology of Petroleum'* CBS Publishers and Distributors
2. O Serra, *'Fundamentals of Well Log Interpretation'* Elsevier
3. Carl Gatlin, *'Petroleum Engineering'*, Prentice Hall Inc.
4. Kermit Brown, 'Technology of Artificial Lift Methods', Pennwell Publishing Company
5. Dr. B.K. Bhaskara Rao, Modern Petroleum refining Processes (5^{th} Edition)

PE 209 Drilling and Well Completion

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 I : Well Planning **Hours: 12**

Drilling rig components and selection. Drilling rig operating systems: Hoisting, Circulation and Rotary systems, Power transmission, Rig control system. Wire lines and service life evaluation.

Unit II : Equipments **Hours: 10**

Casing String and Drill string: configuration, operations, properties and design. Well head equipments
Drill bits and bit performance. Balanced/ underbalanced pressure drilling

Unit III : Drilling Problems **Hours: 10**

Basic Drilling problems and remedies: Pipe sticking, Lost circulation, Sloughing shale, formation damage, fatigue failure of drill string, Bit failure, wire line failure etc. Well kick and Blow outs: Problem, symptoms and controlling measures.

Unit IV : Fishing and Hydraulics **Hours: 10**

Fishing and coring operations Factors affecting penetration rate and drilling economics, Mud Hydraulics and Pressure loss calculations in round trip circulation cycle.

Total Hours: 42

Texts and References:

1. Carl Gatlin , Petroleum Engineering: Drilling and Well Completion:
2. Adams T Bourgoyane , Applied Drilling Engineering:
3. Neal J.Adams ,Drilling Engineering: A complete Well Planning and approach.
4. H Rabia , Oil Well Drilling