

COURSE STRUCTURE FOR B.TECH. SECOND YEAR

SEMESTER III			B.TECH. Second year										
Sr · N o	Course Code	Course Name	Teaching Scheme					Exam Scheme					Total Mark s
			L	T	P	C	Hrs/wk	Theory			Practical		
								MS	ES	IA	LW	LE/Viva	
1	MA-201T	Mathematics-III	3	1	0	7	4	30	60	10	--	--	100
2	PE-201	Petroleum Geology	3	0	0	6	3	30	60	10	--	--	100
3	PE-203	Thermodynamics of Reservoir Fluids	3	1	0	7	4	30	60	10	--	--	100
4	PE-204T	Earth Science	3	0	0	6	3	30	60	10	--	--	100
	PE-204P		0	0	2	1	2				25	25	50
5	PE- 211	Energy Resources	3	0	0	6	3	30	60	10	--	--	100
6	EE-213T	Basics of Measurement and Control	2	1	0	5	3	30	60	10	--	--	100
7	PE-226T	Sedimentary Geology	3	0	0	6	3	30	60	10	--	--	100
	PE-226P		0	0	2	1	2	--	--	--	25	25	50
8	SC-204T	Petroleum Chemistry	2	0	0	4	2	30	60	10	--	--	100
	SC-204P		0	0	2	1	2	--	--	--	25	25	50
Total			22	3	6	50	31						950

MS = Mid Semester, ES = End Semester; IA = Internal assessment (like quiz, assignments etc)

LW= Laboratory Work LE = laboratory Exam

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	7	4	30	60	10	--	--	100

Unit 1

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 2

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 3

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 4

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 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	6	3	30	60	10	--	--	100
Unit – 1:					Hours:- 8					
Origin and Occurrences of Petroleum										
Inorganic and organic theory, Transformation of organic matter into petroleum: Bacterial action, evolution of hydrogen and release of oil from sedimentary rocks, Role of heat and pressure, Composition of oil and gas. Mode of occurrences of petroleum.										
Unit 2:					Hours:- 12					
Source Migration and Trap										
Source, Source characterization, Source quantification, Oil and gas Window, Migration, Primary and Secondary migration, Mechanism of Migration, Migration quantification, Migration pathways, Traps, Classification of traps, Traps classification based on GWC and OWC, Trapping Mechanism, Seal, Seal integrity study, Seal style.										
Unit – 3:					Hours:- 10					
Petroleum Reservoirs										
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.										
Unit- 4					Hours:- 12					
Petroleum System and Basin Analysis										
Introduction to the petroleum system and Petroleum system criticals, Geochemical fundamentals of basin formation, Burial history curve, Tectonic subsidence analysis, Geothermics: steady state and rifting, Organic geochemistry: Quantity, quality and maturity, , Reservoir-Traps-Seals and analogs, Basin classification, Quantifying uncertainty, minimizing risk and making decisions										
Hours:- 42					Total					
Texts and References:										
<ol style="list-style-type: none"> 1. AAPG Treatise on Petroleum Geology, 1999 2. AAPG, Development Geology Reference Manual, 1992 3. F. J. Pettijohn, Sedimentary Rocks 4. Levenson, Geology of Petroleum, CBS Publishers & Distributors 5. Warren, J. (2006) Evaporites: Sediment, resources and Hydrocarbon, Springer Publication 6. Ahr, W. M. (2008) Geology of Carbonate reservoir, John Willey and Sons. 7. Philip A. Alen & John R. Alen, Basin Analysis-Principles and Applications. 										

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	--	7	4	30	60	10	--	--	100
<p>Unit-1 Thermodynamic Behavior Hours:- 12 Thermodynamic behavior of naturally occurring hydrocarbon mixtures; evaluation and correlation.</p>										
<p>Unit 2 Hours:- 10 Physical properties of petroleum reservoir fluids including laboratory and empirical methods.</p>										
<p>Unit 3 Hours:- 10 Theoretical and experimental analysis of the mechanics and thermodynamics of flowing fluids</p>										
<p>Unit-4 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</p>										
Total Hours:- 42										
<p>Texts and References:</p> <ol style="list-style-type: none"> 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	4	2	30	60	10	--	--	100
<p>Unit 1:- Earth, Mineralogy and Crystallography Hours:- 8</p> <p>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</p> <p>Unit-2 :- Petrology and Physical Geology Hours:- 10</p> <p>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 Isostasy</p> <p>Unit-3:- Structural Geology Hours- 12 Structural Geology-Bedding plane, dip and strike, folds, faults, joints and fracture-classification</p> <p>Unit-4:- 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</p> <p style="text-align: right;">Hours-42</p>										
<p><u>Texts and References:</u></p> <ol style="list-style-type: none"> 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 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
<p>Laboratory Courses: Practical classes shall be based on theory course content of the corresponding courses.</p> <p>Aim: To understand the basic properties of rocks and minerals to understand and identify them in hand specimen and under microscope.</p>										

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	6	3	30	60	10	--	--	100
Unit 1:- 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					Hours:- 12					
Unit 2:- 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					Hours:- 10					
Unit 3:- 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)					Hours:- 10					
Unit 4:- 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; Utilization of Hydrogen Gas, Hydrogen as alternative fuel for Motor Vehicles Chemical Energy- Fuel Cells(Design, Classification, Types, conversion efficiency ; Batteries(advantage for bulk energy storage, Invertors); Mini and Micro Hydel- Small Hydro Development concept; Classification of small Hydro power plants; Turbine and generators for small Hydro plants; Advantage and limitation of small hydro plants;					Hours:- 10					
Total Hours:- 42										
Texts and References: <ol style="list-style-type: none"> 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. 										

PE-226T Sedimentary Geology										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	0	6	3	30	60	10	--	--	100
Unit 1:- Significance of Sedimentary in Petroleum Industry., Sedimentary Geology Basic, Sedimentary Processes (clastic and non clastic): Transport of sediments, Flow regimes, Diagenesis, Textural Properties Sedimentary Structures: Physical, Biological and Chemical					Hours:- 14					
Unit 2:- Characterization and Classification of Clastic, Carbonate and Evaporite, rocks,					Hours:- 6					
Unit 3:- Depositional Environment; Continental Environment: Fluvial, Lake, Aeolian, Alluvial Fan etc., Marginal marine: Esturine, etc., Shallow Marine: Tidal Flats, Beach, Deltaic., Shelf Environment., Deep and Ultra Deep Marine environment					Hours:- 14					
Unit 4:- Reservoir Sedimentology, Reservoir geometry, Sandstone reservoir, Carbonate reservoir Examples of Indian and Global Classical sedimentary basins.					Hours:- 8					
Total Hours:- 42										
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										

PE 226P Sedimentary Geology										
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.										

SC-204T Petroleum Chemistry										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	0	0	4	2	30	60	10	--	--	100
Unit 1:- Hours:- 4 Properties and General Characteristics of Hydrocarbon, Composition, Molecular types in Petroleum.										
Unit 2:- Hours:- 8 Characterization and Analytical Techniques for Crude Oil: Physical properties, Thermal properties, Electrical properties, Optical properties, Chromatographic techniques, Spectroscopic methods (Principles and Applications of UV Visible, IR, and NMR Spectroscopy), Characterization of formation water. SARA Separation methods, Metals and Heteroatoms in Heavy crude oil.										
Unit 3:- Hours:-10 Processing and Refining of crude oil: Processing and Refining of crude oil: Distillation, Sweetening and Cracking (basic concepts), Reforming, Isomerization, Alkylation processes, Polymerization processes, Solvent process, Knocking, Octane number and Cetane number, Additives to improve the quality of Diesel and Petrol, Catalysis and Applications of Catalysts (like Zeolite and other catalysts) in separation processes and also in petroleum industries.										
Unit 4:- Hours:- 6 Instability and incompatibility of petroleum products										
Total Hours:- 28										
Texts and References: 1. Speight, James (1998) Petroleum Chemistry and Refining, Taylor and Francis 2. Simanzhenkov, V and Idem, R. (2003) Crude oil Chemistry, Marcel Dekker Inc.										

SC-204P Petroleum Chemistry										
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 evaluate and characterize different types of crude oil samples with the help of modern analytical techniques.										

EE -213T Basics of Measurement and Control

Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
2	1	0	5	3	30	60	10	--	--	100

Unit 1:-

Hours: 7

Introduction

Definition of basic measurable parameters-

Defining terminology used- Accuracy; Precision; Repeatability; Least Count; Zero Error; Sensitivity;

Unit 2:-

Hours: 7

Analog Measurement; Digital measurements; Primary measurement; Secondary Measurement

Measuring Instruments- Pressure Measurement; Temperature Measurement ; Volume Measurement;

Length Measurement; Thickness Measurement ; Flow Measurement; Velocity Measurement;

Acceleration Measurement; Energy Measurement;

Basics of Process Controls (Level, Pressure, Temperature etc.)

Unit 3:-

Hours: 7

Control Systems- Open loop control; Close loop Control; Feedback Control; Surge control; PLC Based

Control System; DIDC Based Control System; Telemetry; CSADA ; system; Remote Transmitting

Units (RTU);

Unit 4:-

Hours: 7

Seismic DATA(2D and 3D) acquisition and interpretation; Magnetic flux measurement system; Virtual

Drilling; Controlling Well Drilling operation; Controlling Horizontal Directional Drilling (HDD);

Remote sensing Application of SCADA and Computer based control in Exploration and Production of Energy Resources

Total Hours: 28

Texts and References:

1. I.J. Nagrath and M.Gopal, "Control system Engineering", New age International (P) Limited, Publishers, New Delhi .
2. Ernest O. Doebelin, "Measurement Systems - Application and Design", 5th edition, McGraw Hill.
3. E. A. Parr, "Programmable Controllers", 3rd edition, Newnes, Reed Educational and Professional Publishing Ltd.
4. [R K Jain](#), Mechanical and Industrial Measurements ,Process Instrumentation and Control, Khanna publishers.
5. David Bailey, Edwin Wright, "Practical SCADA for Industry", Elsevier and Newnes publication.