

COURSE STRUCTURE FOR B.TECH. Third Year

SEMESTER V			B.TECH. Third year										
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	PE-371	Petroleum Process Unit Operations	3	1	0	7	4	30	60	10	--	--	100
2	PE-374	Natural Gas Processing	3	1	0	7	4	30	60	10	--	--	100
3	PE 372	Hydrocarbon based Fertilizer industries	3	1	0	7	4	30	60	10	--	--	100
4	PE-319	Industrial Orientation	0	0	6	3	6	--	--	--	80	20	100
5	PE-373P	Product Application Lab	0	0	2	1	2	--	--	--	25	25	50
7	PE 320	Group Assignment and Presentation	0	0	4	2	4	--	--	--	80	20	100
8	CH 306	Transport Phenomena	3	1	0	7	4	30	60	10	--	--	100
9	MAXXX/ PE XXX	Elective-1	2	0	0	4	2	30	60	10	--	--	100
Total			14	4	12	38	30						750

MS = Mid Semester, ES = End Semester;

LW = Laboratory work; LE = Laboratory Exam

Elective 1: MA XXX Time Series Analysis (2-0-0)

4 PE352 ; Enhanced Oil Recovery (200)4

IA = Internal assessment (like quiz, assignments etc)

PE 371 Petroleum Process Unit Operations										
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: Distillation and Gas Absorption Hours: 12 Flash Distillation, Continuous Distillation with Reflux-Material Balances in plate columns / Mc. Thiele Method, Batch Distillation and Distillation Equipment.</p> <p>Unit 2:- Hours: 10 Gas Absorption Principles of Absorption, Packed Tower Design, Material Balances, Calculation of Tower Height, Desorption or Stripping</p> <p>Unit – 3: Adsorption Hours: 10 Adsorption Processes, Principles of Adsorption, Basic Equations of Adsorption, Adsorption Equipment, Ion Exchange</p> <p>Unit – 4: Membrane Separation Processes Hours: 10 Separation of Gases, Separation of Liquids</p> <p style="text-align: right;">Total Hours: 42</p>										
<p>Texts and References:</p> <ol style="list-style-type: none"> 1. Warren L.Mc Cabe, Unit Operations of Chemical Engineering. 2. Robert E. Trybal , Mass Transfer Operations. 3. R.D. Noble , Membrane Separation Technology, Principles and Application 4. Anil K. Pabby, Syed S.H. Rizvi , Hand Book of Membrane Separations 										

PE 373 Natural Gas Processing										
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: Introduction Hours: 12 Composition, properties, fields & reserves in India and energy scenario; major NG producing industries of India and their contribution to Indian economy; techniques of utilization</p> <p>Unit - 2: Gas Processing: Hours: 10 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. CBM, NG hydrates & in-situ coal gasification, conversion of gas to liquid (GTL)</p> <p>Unit - 3: Transportation of NG: Hours: 10 Compression calculations; gas stations & transmission; city gas distribution system; gas flow measurement; compressor sizing</p> <p>Unit – 4: Marketing, retailing and gas trading: Hours: 10 CBM, NG hydrates & in-situ coal gasification, conversion of gas to liquid (GTL)</p> <p style="text-align: right;">Total Hours: 42</p> <p>Texts and References:</p> <ol style="list-style-type: none"> 1. Bradly H. B.; Petroleum Production Handbook. 2. Skimmer, D. R. Introduction to Petroleum Production Volume 1 & 2. 3. Speight, Janes A; Gas Processing. 4. Katz: D. L., Natural Gas Engineering-Production and Storage, McGraw-Hill Publishing Company, New York. 5. Kumar, Sanjay; Gas production Engineering. 										

PE 372 Hydrocarbon based Fertilizer Industries

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

Unit1:- **Hours: 10**
 Introduction to Fertilizer Industry, Definition, Types, Consumption, uses, Role of Hydrocarbon in Fertilizer industry, Natural gas demand, Petrochemicals requirement. Reaction of natural gas in making fertilizer, Different types of process and hydrocarbon involved in making fertilizer, Air reforming Process, Partial Oxidation process, Total Recycle CO2 Stripping Urea process.

Unit2:- **Hours: 10**
 Different Unit involved in fertilizer process, Fluidised catalytic cracking unit, Cyclone , Catalyst transfer line, Slide valves(fccu), Process furnaces, Heaters, Boilers, Crude stills etc., Incinerators, Air / vacuum heaters. Hoods feedlines, Coal gasifiers, Ammonia units secondary reformers, Fractionators towers & columns, Sulphur recovery units. Raw Material & Feed Stock, (Naphtha, Fuel Oil, Natural Gas, Coal), Nitrogen, Ammonia, Urea, Phosphorous acid, Potassium, Common product.

Unit3:- **Hours: 11**
 Key Fertilizer Product and process involved in making including multi nutrient fertilizer, Anhydrous ammonia, Aqua ammonia, Urea, Urea ammonium nitrate solutions, Ammonium nitrate, Ammonium sulphate, Calcium nitrate, Ammoniated phosphates, Potassium chloride, Potassium sulphate., Mono potassium phosphate ,Potassium magnesium sulphate, Potassium nitrate.

Unit 4:- **Hours: 11**
 Challenges faced by fertilizer Industry, Different types of challenges faced by fertilizer industry likes natural gas demand , natural gas pricing , environmental impact, New fertilizer practices, Technological and R&D issues relating to Fertilizer Industry, India in fertilizer sector, Kind of fertilizer used in India, future prospect and demand of fertilizer in India, Natural Gas Supply for Fertilizer industry

Total Hours: 42

Text and reference Books

1. Katja, India's Fertilizer Industry: Productivity and Energy Efficiency
2. Schumacher and Jayant Sathaye Hand book of fertilizer manufacturing process.
3. Report of the working group on fertilizer industry for the twelfth plan (2012-13 to 2016-2017)
4. Industry notes in key fertilizer product resources

PE 319 Industrial Orientation										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Report writing			V/V		Total
0	0	6	3	3	80			20		100
Aim: To Familiarization of students in Upstream, Midstream and Downstream Hydrocarbon industry.										

PE 373P Product Application 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
Laboratory Courses: Practical classes shall be based on theory course content of the corresponding courses.										
Aim: To test the chemical properties such as fire point, flash point, drop point, smoke point etc of petroleum and petroleum related products.										

PE 320 Group Assignment and Presentation										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Report writing			V/V		Total
0	0	4	2	3	80			20		100
Aim: To train students in developing inter and intra personal skills in professional world.										

CH 306 Transport Phenomenon

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: Momentum Transport

Hours: 12

Viscosity and the mechanisms of momentum transport, Shell Momentum Balances and velocity distributions in laminar flow, equations of change for isothermal systems, velocity distribution with more than one independent variable, velocity distribution in turbulent flow, interphase transport in isothermal systems, macroscopic balances for isothermal flow systems, polymeric liquids

Unit – 2: Energy Transport

Hours: 10

Thermal conductivity and the mechanics of energy transport, Shell energy balances and temperature distribution in solids and laminar flow, equation of change for non-isothermal system, temperature distribution with more than one independent variable, temperature distributions in turbulent flow, Interphase transport nonisothermal systems, macroscopic balances for nonisothermal systems, energy transport by radiation

Unit – 3: Mass Transport

Hours: 10

Diffusion in gases: Fick's law, determination and estimation of diffusion coefficient; diffusion through stagnant gas and equimolecular counter-diffusion. Diffusion in liquids: Mass transfer across phase boundaries, two-film theory and mass transfer coefficient.

Unit 4:- Distillation

Hours: 10

Gas Absorption, adsorption, and Distillation (flash and differential): Basic principles, laws, and calculations. Equilibrium, co-current and counter-current operations. Ideal stage concept and calculation of number of ideal stages. Efficiency. Packed bed and tray columns

Total Hours: 42

Texts and References:

1. Bird, R. B; Stewart, W. E. and Lightfoot, E. N. (2007) Transport Phenomena, John Willy
2. Warren L. McCabe, Julian C. Smith, Unit Operations of Chemical Engineering, McGraw Hill.
3. Donald Q. Kern, Process heat transfer, Tata-McGraw-Hill.

PE 352 E Enhanced Oil Recovery (Elective)										
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					7 Hrs					
Flow of immiscible fluids through porous media. Reservoir Geophysics and Fracture mapping, continuity equation, equation of motion, solution methods.										
Unit: 2					7 Hrs					
Water flooding, Fractional flow equation, Frontal advance theory. Concept of pattern flooding, recovery efficiency, permeability heterogeneity. Polymer flooding.										
Unit: 3					7 Hrs					
Flow of miscible fluids. Conditions of miscibility, Miscible displacement processes. Carbon dioxide flooding. Surfactant flooding. Mobilization of residual oil. Adsorption on solid and liquid interface, micelles and micro-emulsion, Micellar flooding.										
Unit: 4					7 Hrs					
Thermal flooding processes: Hot water flooding, Steam flooding, Insitu combustion. Profile modification. Microbial EOR.										
										Total 28 Hrs
Text Book and references										
<ol style="list-style-type: none"> 1. Lake, L. W. (1989) Enhanced Oil Recovery, Prentice Hall 2. Latil, M. (1980) Enhanced Oil Recovery, Technip Publication 3. Donaldson, E. C.; Chilingarian, G. V. and Yen, T. F. (1985) enhanced oil recovery –I Fundamentals and Analysis, Elsevier. 										

MAL312 Time Series Analysis (Elective)

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

Definition of Time series analysis, Moving Average and smoothing techniques, Auto Regressive Method, Moving Average Method, Auto Regressive Moving Average Method, Single Moving Average and Centered Moving Average,

Unit-2

Exponential Forecasting, Single Exponential Smoothing, Double Exponential Smoothing, Triple Exponential smoothing, Triple Exponential smoothing, Univariate Time series model, Seasonality and Stationarity, Box-Jenkins model identification, Estimation and Validation, MultiVariate Time Series Analysis

Unit-3

Identification of Pattern in Time series data, Trend analysis, Auto correlation, Cross correlation, Convolution , Semblance, Parameter estimation, Indices of lack of fit, single spectrum analysis, cross spectrum analysis, squared coherency, Gain and Phase shift

Unit-4

Frequency and Period, Periodogram, Problem of Leakage, padding the Time Series, Tapering, analysis of result when no periodicity exists in data, Fast Fourier Transform (FFT), Computation of FFT in time series analysis, Decomposition of data, Data analysis , modeling and forecasting of events from petroleum field where periodicity and non-periodicity exists.

Total 28 Hrs

Books and References

1. Box, G. E. P, Jenkins G M and Reinsel, G. C., 2009, Time Series Analysis: Forecasting and Control, Wiley Publication
2. Madsen, H (2008) Time series analysis, Chapman and hall,
3. Hamilton, J. D. (1994) The time series Analysis, Princeton University Press