

PE 380 Petroleum Refining Engineering

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	30	60	10	--	--	100

Unit I

Hours: 10

Origin–Exploration and production of petroleum–Types of crudes, crude composition–Characteristics and classification–Crude oil properties. IS 1448: Standard –Testing of Petroleum crude–Products: Specifications and their Significance.

Unit II

Hours: 12

Pre-treatment of crude for Refining–Dehydration and desalting–Atmospheric distillation, Vacuum distillation of residue products–Treatment techniques for vacuum distillates with different processes like solvent extraction –Deasphalting, dewaxing, hydro fining, catalytic dewaxing and clay contact process–Production of lubricating oils. Hydro cracking, principles, process requirements, product yields and qualities and resid-cracking –Hydro treating –Sulphur removal, hydro finishing.

Unit III

Hours: 10

Thermal cracking – Processes, operating parameters, feed stock selection and product yields, Advantages – Types and functions of secondary processing – Visbreaking – Processes, operating parameters and advantages –Coking –Operating parameters and advantages. Fluid catalytic cracking –processes, operating parameters, feed stock selection and product yields –Advantages.

Unit IV

Hours: 10

Reforming –Principles, processes, operating parameters – Isomerisation –Processes, operating parameters, and advantages –Alkylation –Processes, operating parameters, advantages –Polymerization –Processes, operating parameters, and advantages. Asphalt manufacture, Air blowing technology, Bitumen Types and their properties, Acid gas removal and sulphur removal techniques.

Total Hours: 42

Texts and References:

1. Dr. B.K. Bhaskara Rao, Modern Petroleum Refining Processes (5th Edition)
2. Dr. B.K. Bhaskara Rao, A Text Book on Petrochemicals.
3. Marshall Sittig, Dryden's Outlines of Chemical Technology.

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	0	0	3	3	30	60	10	--	--	100

Unit I

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.

Unit II

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 feed lines, 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.

Unit III

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 IV

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

Texts and References :

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 381 Fluid Mechanics

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: 6

Introduction – Types Methods of analysis and description – fluid as a continuum – velocity and stress field – Newtonian and Non-Newtonian fluid – Classification of fluid motion.

Unit II

Hours: 12

Fluid statics – basic equation – equilibrium of fluid element – pressure variation in a static fluid – application to manometer – differential analysis of fluid motion – continuity, Euler’s and Bernoulli equation.

Unit III

Hours: 12

The principle of dimensional homogeneity – dimensional analysis, the Pi-theorem – non dimensional action of the basic equations – similitude – relationship between dimensional analysis and similitude – use of dimensional analysis for scale up studies. Types of Flow meters and its co-efficient.

Unit IV

Hours: 12

Reynolds number regimes, internal flow – flow through pipes – pressure drop under laminar and turbulent flow conditions – major and minor losses; line sizing; External flows – boundary layer concepts, boundary layer thickness under laminar and turbulent flow conditions – flow over a sphere – friction and pressure drag – flow through fixed bed and fluidized beds.

Total Hours: 42

Texts and References:

1. Noel de Nevers, “Fluid Mechanics for Chemical Engineers “, Second Edition, McGraw-Hill, (1991).
2. Munson, B.R., Yound, D.F., Okiishi, T.H. “Fundamentals of Fluid Mechanics”, 5th Edition”. John Wiley, 2006.
3. White, F.M., “Fluid Mechanics”, IV Edition, McGraw-Hill Inc., 1999. McCabe W.L, Smith, J C and Harriot. P “Unit Operations in Chemical Engineering”. McGraw Hill, 5th Edition, 2001.
4. Dr. R.K. Bansal., “A Text book of Fluid Mechanics and Fluid Machinery”, 9th Edition. Lakshmi Publication.

PE 306 Heat and Mass Transfer										
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 : Heat Transfer										Hours: 12
Conduction: Steady-state and transient flow through various geometries, Convection: LMTD and NTU, overall heat transfer coefficient. Application of dimensional analysis to convection. Heat transfer rate and Heat transfer coefficient calculations. Double pipe parallel and counter -flow heat exchangers, natural and forced convection through tubes and outside tubes, Shell and tube heat exchanger, and finned tube heat exchanger. Boiling of liquids and condensation of vapours.										
Unit II : Radiation										Hours: 10
Radiation from black and real surfaces, radiation transfer between black and grey surfaces, view factor, radiation shield, and multi-sided enclosures., Thermal insulation, Economic and critical thickness of lagging.										
Unit III : Mass Transfer										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 IV										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:										
<ol style="list-style-type: none"> 1. Coulson and Richardson's Chemical Engineering Vol-1, 6th Ed, Elsevier (Butterworth and Heinemann). 2. Warren L. McCabe, Julian C. Smith, Unit Operations of Chemical Engineering, McGraw Hill. 3. Donald Q. Kern, Process heat transfer, Tata-McGraw-Hill. 4. Badger and Banchero, Introduction to Chemical Engineering, McGraw-Hill. 										

PE 322 Contracts in Hydrocarbon Industry

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

Unit I **Hours: 5**

Historical background of the Oil and Gas trading, , Geopolitical history of Hydrocarbon exploration and trading, Life cycle of Petroleum Project, Fiscal System in hydrocarbon industry, Basic elements of Contracts, Basic terminologies of contract and legal. Basics of Upstream and Downstream regulatory Laws and Policies.

Unit II **Hours: 12**

Contracts in E & P Industry, Classification of contracts, Concession style, Sharing contracts- Production Sharing Contract, Terminologies, Attributes of PSC, Different PSC Models (Indonesian, Indian, Nigerian, Chinese, Equatorial New Guinea, etc). Risk Sharing Contracts, Joint Operating Agreements, JOA attributes, JOA Models, Farm out Agreements, Rig procurement contracts-Design and Fabrication aspects

Unit III **Hours: 5**

Elements of Transportation, Hydrocarbons transport, Contracts related to bougers, ship and pipeline, Tarrif mechanism- national and International, LNG contracts, LNG taxation and charges. Oil Tanker

Unit IV **Hours: 6**

Hydrocarbon trading-Oil trading, Physical and Paper; Crude oil Markets- Spot, Barter, Future and forward. Oil Pricing mechanism, short term and long term, Level playing and swaping. Hydrocarbon Strategic storage, Contract Arbitration and dispute settlement.

Total Hours: 28

Texts and References:

1. Shippey, K. C. (2009) A short course on international Contracts, 4th Ed. World Trace press.
2. Tordo, S (2007) Fiscal System in Hydrocarbons: design issues. The World Bank
3. Ministry of P & G (Government of India) Model Production Sharing Contracts
4. Johnston, D (1994) International petroleum fiscal system and Production sharing contracts, Penn Well books.

PE 382 Enhanced Oil Recovery

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

Unit I

Hours: 7

Flow of immiscible fluids through porous media. Reservoir Geophysics and Fracture mapping, continuity equation, equation of motion, solution methods.

Unit II

Hours: 7

Water flooding, Fractional flow equation, Frontal advance theory. Concept of pattern flooding with special reference to five spot and seven spot, recovery efficiency, understanding mobility and mobility ratio, permeability heterogeneity. Polymer flooding. Buckley Leverett equation

Unit III

Hours: 7

Flow of immiscible and 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 IV

Hours: 7

Thermal flooding processes: Hot water flooding, Steam flooding, Insitu combustion. Profile modification. Microbial EOR.

Total Hours: 28

Text and References:

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.

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	4	80	20	100	
Aim: To train students in developing inter and intra personal skills in professional world.								

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

PE 373P Product Application 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 test the chemical properties such as fire point, flash point, drop point, smoke point etc of petroleum and petroleum related products.										