

COURSE STRUCTURE FOR B.TECH. Fourth year (7th Sem)

SEMESTER VII			B.TECH. Fourth 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-409 T	Safety Health and Environment	3	0	0	6	3	30	60	10	--	--	100
	PE-409P		0	0	2	1	2	--	--	--	25	25	50
2	PE-402	Petrochemicals Engineering - II	3	1	0	7	4	30	60	10	--	--	100
3	PE-403	LNG Value Chain	3	0	0	6	3	30	60	10	--	--	100
4	PE-404	Chemical Reaction Engineering	3	1	0	7	4	30	60	10	--	--	100
5	PE-417	Industrial Training and Viva-Voce	0	3	6	6	9	--	--	--	80	20	100
6	PE-406	Pre Project Dissertation and Seminar	0	0	8	4	8	--	--	--	80	20	100
7	PE -407	Transport and Marketing of Petroleum and its Products	3	1	0	7	3	30	60	10	--	--	100
Total			15	6	14	43	35						750

MS = Mid Semester, ES = End Semester;
LW = Laboratory work; LE = Laboratory Exam

IA = Internal assessment (like quiz, assignments etc)

PE 402 Petrochemicals Engineering-II

Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	LE/Viva	
3	0	--	6	3	30	60	10	--	--	100

UNIT I: Hours: 12

Chemistry and technology for the production of Phenol, Maleic anhydride, Phthalic anhydride, styrene.

UNIT II: Hours: 10

Chemistry and technology for the production of DMT, Terephthalic acid, Acrylic acid, Methyl methacrylate.

UNIT III: Hours: 10

Properties, applications and production technologies of the following commodity polymers – polyethylene, LLDPE, HDPE, polypropylene, polystyrene, PVC.

UNIT IV: Hours: 10

Properties, applications and production technologies of the following engineering and thermosetting polymers: ABS plastic, nylon-6, polycarbonate, epoxy resin, unsaturated polyester resin, rubber.

Total Hours: 42

Text Books and References

1. Waddams, A.L., 'Chemicals from Petroleum', 4th edition, Gulf Publishing Company, London, 1980.
2. Lewis F. Hatch & S Matar, From Hydrocarbon to Petrochemicals
3. B.K. BhaskaraRao, A Text on Petrochemicals, 2/e, Khanna Publishers, Delhi, 1998.
4. Mall, I.D., "Petrochemical Process Technology", Macmillan India Limited, Delhi, 2007.
5. F.A. Lowenheim and M. K. Moran; Industrial Chemicals, John Wiley & Son Inc., USA

PE 403 LNG Value Chain										
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: 12					
Introduction to LNG Global Gas Production and gas Trading Constituents of International Gas Trading- Pipelines ; LNG; CNG LNG value Chain										
Unit 2:-					Hours: 10					
Gas Producing Acreage, proven reserves, minimum Reserves for LNG plant Gas Treatment- Suitable for LNG preparation LNG Liquefaction Process (APCI, BHP, Black and Wealtch, Cascade) LNG Storage										
Unit 3:-					Hours: 10					
Marine facilities LNG Transportation/ shipping LNG Regas terminal Regas Send Out Facilities LNG by tanker Concept										
Unit 4:-					Hours: 10					
LNG –Indian Scenario (History, Present status, upcoming terminal, possibility of composite plant(Combined Liquefaction and gasification Plant); M&As in LNG Business Economic of LNG plants- Sizing(Train size, Plant size, shipping Capacity) Economics of Regas Plant- Use of Cold energy										
Total Hours: 42										
Reference Book:										
1. Negi BS, LNG an Indian Scenario, Published by Technology Publication Dehradun 2. Negi BS, LNG an Emerging Global Trade, Published by Technology Publication Dehradun.										

PE 404 Chemical Reaction Engineering										
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 12 Hrs

Rate equations of elementary and non-elementary reactions. Analysis of batch reactor data: Reversible and irreversible single reactions; Homogeneous catalytic reactions; Chain reactions; Series, parallel and series – parallel reactions; Enzymatic reactions.

Unit 2 12 Hrs

Behaviour of ideal flow reactors; Design of mixed flow reactors; Plug flow reactors and their combinations for single and multiple reactions (series, parallel and series – parallel); Recycle reactors; Yield and selectivity in multiple reactions. Non-isothermal operation of reactors: Optimum temperature progression; Adiabatic and nonadiabatic batch, mixed flow and plug flow reactors; Exothermic reactions in mixed flow reactors; Multiple reactions: Yield and selectivity.

Unit 3 12 Hrs

Unsteady state operation of reactors: Start-up of a mixed flow reactor; Semi-batch reactor; Nonisothermal batch, mixed flow and plug flow reactors. Reaction with separation; Reactive distillation. Non-ideal flow; Residence time distribution; Dispersion and tank in series models; Multi-parameter models; Mixing of fluids; Degree of segregation; Laminar flow reactor; Conversion in segregated flow; Early and late mixing; Mixing of two fluids - Product distribution in multiple reactions.

Unit 4 6 Hrs

Catalyst characterization: Surface area and pore size distribution; Introduction to other characterization techniques (XRD, electron microscopy, electron spectroscopy, thermal analysis, desorption spectroscopy.)

TOTAL HOURS = 42

Books:

1. Levenspiel. O, "Chemical Reaction Engineering", John Wiley & Sons.
2. Smith. J.M., "Chemical Engineering Kinetics", McGraw-Hill book Co.
3. Fogler, H.C., "Elements of Chemical Reaction Engineering", Prentice-Hall, Inc.

PE 409T Safety Health and Environment										
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: 12

Physical Hazards Noise, Heat, Vibration, Illumination, Radiation, extreme climatic conditions etc, Chemical Hazards Hydrogen sulfide gas, Hydrocarbons, Ammonia, Chlorine, Formaldehyde, Hydrochloric Acid, Methanol, Sulphur, Sulphuric acid, Sodium Hydroxide, etc. Biological Hazards, Psychological Hazards, Ergonomic Hazards, Injuries, Burns etc Prevention & Remedial controls of Occupational Hazards In Oil & Gas Industry for each type of Hazards Engineering Control, Administrative Control, Medical Control, Use of Personal Protective Equipment (PPE) Understanding Fire: Fire triangle/tetrahedron, Stages of development of fire Flammability, Concept of flash / Fire point, volatility, Flammable Limits, Fire Detection; Fire signature, Smoke, Heat, Flame, Combustible Gas Detection Fire Prevention, Fire suppression , Process Safety: Safety Analysis Table, Safety Analysis Checklist & SAFE Chart(ref API 14 C)

Unit – 2: Hazard & Risk Analysis,

Hours: 12

Risk Matrix, HAZID, HAZOP, QRA (API 14 J, OISD) ,Safe Work Practices :PTW, MOC, SIMOPS etc (ref API RP 75,OISD, OMR) , Electrical Safety;, Classification of Hazardous locations, use of electricity I Hazardous area (Ref IER, OISD, OMR, API RP 500 & 14 F) Accident Investigations:Study of major accidents like Piper Alpha, Flixborough, Bhopal etc., Investigation techniques Emergency Response planning Audits & Inspection. Audit methodology, protocol, typical check lists for Drilling rigs, Work over activities, logging, etc (ref OISD Standards)

Unit – 3: HSE Management system: Hours: 6

OISD, API RP 75, ISO 14000, ISO 9000, OSHAS 18000 Standards

Unit – 4: Environment

Hours: 12

Environment Concepts:- Effect on eco-system; Air, Water, & Soil of HC"s. Impact of Exploration & Exploitation of Hydrocarbon on Environment Environmental studies (Off shore & On Shore) - Environmental Impact Assessment Oil Spills Control and their management. State, Government of India and international Maritime Environmental Rules & Regulations. Drilling / Oil Storage / Effluent water / waste (solid & sludge) treatments their disposal and remediation of soil etc

Upstream safety.- Implementing Agency OISD(for on-land blocks) directorate of Mine Safety(for Off Shore Blocks),Safety in Rig operation; Safety in Exploration and Production

Downstream Safety: Implementing Agency PNGRB; Safety Regulations(Technical Standard, Specification and Safety Standards T4S), Emergencies, Mutual Aida; Emergency Response and Disaster Management Plan ERDMP)

Total Hours: 42

Texts and References:

1. Less, F. P., Loss Prevention in the Process Industries, 2nd ed., Butterworth Heinemann, UK.
2. Peavy, H. S., Rowe, D. R. and Tchobanoglous, G., Environmental Engineering, McGraw Hill, New York.
3. Sanders, R. E., Chemical Process Safety, Butterworth Heinemann, UK, Year.
4. NFPA, API 14 G & OISD Standards.
5. Marchell, V. and Ruchemann, S., Fundamentals of Process Safety, Institution of Chemical Engineers, Warwickshire, UK.

PE 409PSafety Health and Environment lab							
Teaching Scheme					Examination Scheme		
L	T	P	C	Hrs/Week	LW	LE/Viva	Total
0	0	2	1	2	25	25	50

Aim: To get exposure on day- to-day Safety, Health and Environmental activities of various segments of hydrocarbon industries.

PE 417 Industrial Training and Viva-Voce							
Teaching Scheme					Examination Scheme		
L	T	P	C	Hrs/Week	Report writing	V/V	Total
0	3	6	6	0	80	20	100

Aim: To get exposure on day- to-day activities of various segments of hydrocarbon industries.

PE 406 Pre Project Dissertation & Seminar							
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 address specific industry and research related problems.

Unit 1: Problem Identification

Unit 2: Literature survey and Methodology

Unit 3: Framing of Experimentation set up and Preliminary data collection

Unit 4: Future Deliverables & Expected Outcome

Text Books&RecommendedSoftware:

1. Kothari, C. R. (2008) Research Methodology: Methods and techniques,
2. Murray, R (2002) How to write a thesis, McGrawal Hill Publication
3. Recent ENDDNOTE Software for referencing
4. JABREF for Referencing.

PE 407 Transportation and Marketing of Petroleum and its Products

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: (2Hrs)
Introduction to Transportation of petroleum and petroleum products - different means, Classification of petroleum as per “Indian Petroleum Rules – 1977” and NPRA

Unit-2: (8Hrs)
Basics of pipeline construction, operation and protection. Product pipeline traffic management, Batching of different products, their receipt and accounting at storage depots. Product quality control, Metering and measurements of products.

Unit- 3: (10Hrs)
Layout of petroleum product storage premises, Storage of petroleum products, Concept of storage depots, terminals and intermediate receiving & distributing depots, Packed oil storage, Distribution of products, Calibration of road tankers and tank wagons, Concept of cleaning and repair of tanks and drums

Unit- 4: (10 Hrs)
Operations at road and rail tank wagons/cars, loading and unloading racks., Filling methods, Precautions of Class I & II petroleum, Precautions with Class III and unclassified petroleum

Unit 5 (6Hrs)
Traffic Management, Fire and safety rules (& OISD), Role of international oil companies.

Unit 6: (6Hrs)
OPEC pricing mechanism. Spot marketing and other control mechanisms. Conservation of petroleum and its products.

TOTAL HOURS= 42 Hrs

TEXT BOOK AND REFERENCES

- 1) Hughes, J. R. (revised by Swindles, N. S) The Storage & Handling of petroleum liquids, Charles Griffin & Co. Ltd. London
- 2) Mohitpur, M. (1994) Energy supply and pipeline transportation Challenges and Opportunities, ASME press.
- 3) Masseron, J.(1990) Petroleum Economics, Technip Publications
- 4) Petroleum Storage Principles: Alex Marks
- 5) Petroleum Production Handbook (vol-3): LC UREN
- 6) Oil Industry Safety Directorate (2012) Storage And Handling Of Petroleum Productsat Depots And Terminals Prepared by functioning committee (<http://oisd.nic.in/PDF/OISDSTDDraft244.pdf>).