Course Contents

Category	Title	Course	Credits-4C			Theory
DC (E) 1 Elective I	Petroleum Processing Technology	CM 701 (A)	L	T	P	Max.Marks-100
			3	1	0	Min.Marks-35
						Duration-3hrs.

Unit I Origin and occurrence of petroleum crude, status of petroleum refining in India; composition of petroleum, classification and physical properties of petroleum.; evolution of crude oil and petroleum products, future refining trends.

Unit II Crude oil distillation process, pretreatment of crude, atmospheric and vacuum distillation process; secondary conversion processes; catalytic reforming, catalytic cracking and deep catalytic cracking.

Unit III Heavy residue up-gradation technologies; hydro-cracking, hydro-treating, vis-breaking and delayed coking alkylation, isomerisation, dehydrogenation processes, polymerization.

Unit IV Lubricating oil, grease and bitumen: de-waxing and de-oiling, de-asphalting, lube hydro-finishing, bitumen air blowing, sweetening and desulphurization; hydro-desulphurisation of petroleum products.

Unit V Refinery products, refinery gas utilization, LPG, propylene and hydrogen recovery, reformulated gasoline; present and future requirements.

References:

1. Nelson WL; Petroleum refinery engineering ; Mc. Graw hill
2. Hobson GD; Modern petroleum technology Part I & II; John Wiely & sons.

Course Contents

Category	Title	Course	Credits-4C			Theory
DC (E) 1 Elective I	Safety Engg and Hazard Management	CM 701 (B)	L	T	P	Max.Marks-100
			3	1	0	Min.Marks-35
						Duration-3hrs.

Unit I Origin of process hazards, Laws Codes, Standards, Case Histories, Properties of Chemical, Health, hazards of industrial substances.

Unit II Toxicology: Toxic materials and their properties, effect of dose and exposure time, relationship and predictive models for response, Threshold value and its definitions, material safety data sheets, industrial hygiene evaluation.

Unit III Fire & Explosion: Fire and explosion hazards, causes of fire and preventive methods. Flammability, characteristics of chemical, fire and explosion hazard, rating of process plant., Propagation of fire and effect of environmental factors, ventilation, dispersion, purifying, and sprinkling, safety and relief valves.

Unit IV Other Energy Hazards: Electrical hazards, noise hazards, radiation hazard in process operations, hazards communication to employees, plant management and maintenance to reduce energy hazards.

Unit V Risk Analysis: Component and plant reliability, event probability and failure, plant reliability, risk analysis, HAZOP and HAZON, event and consequence analysis (vapor cloud modeling) Designing for safety, measurement and calculation of risk analysis.

Unit VI Hazard Assessment: Failure distribution, failure data analysis, modeling for safety, safety training, emergency planning and disaster management, case studies.

References:

1. Crawl DA and Louvar J. A.; Chemical process safety fundamentals with applications- PHI
2. Wentz, Charles A; Safety, health and environmental protection – Tata McGraw Hill
3. Smith B.D.; Design of equilibrium state process ; Mc Graw Hill,
4. Van Winkle – Distillation – Mc Graw Hill, Book Co.

Course Contents

Category	Title	Course	Credits-4C			Theory
DC (E) 1 Elective I	Pharmaceutical Technology	CM 701 (C)	L	T	P	Max.Marks-100
			3	1	0	Min.Marks-35
						Duration-3hrs.

Unit I Practice of the following unit operation in pharmaceutical industries: Heat transfer, evaporation, distillation, drying, mixing, size reduction, crystallization, filtration, size separation, conveying, humidification, air conditioning and refrigeration.

Unit II Formulation, development of sterile dosage forms. Production facilities, environmental control and personnel in the production of sterile dosage form, compounding, processing, filtration, sealing, sterilization, packing and labeling of sterile dosage forms. Quality control tests like sterility, pyrogen, clarify, safety and leakage testing.

Unit III Types of tablets. Manufacturing of tablets by wet granulation, dry granulation and direct compression. Tablet processing problems and defects, tablet standardization: hard-ness, friability, weights variation, disintegration, dissolution and content uniformity tests.

Unit IV Capsules: Hard gelatin capsule, capsule size, formulation and preparation of filled hard gelatin capsules, soft gelatin capsule, soft gel - manufacturing procedures; quality control of capsules.

Unit V Cosmetics and Toiletries: Introduction, factors to be considered in the formulation of facial cosmetics, dentifrices, deodorant, antiperspirants, shampoos, hairdressing and hair removers.

Unit VI Pharmaceutical packing: packing components, types of packing containers and closures, materials used for and their pharmaceutical specification, method of evaluation, stability aspects of packaging materials.

References:

1. Leon lachman, Lieberman; Theory & practice of industrial pharmacy; Verghese P, Mumbai
2. Ganderto; Unit process in pharmacy.
3. HersheyD; Chemical engineering in medicine and biology - Plenum press, new york.
4. Chemical engineering in medicine - chern. Engg. Progrer syrnp series no. C 66, vol 62.

Course Contents

Category	Title	Course	Credits-4C			Theory
DC (E) 2 Elective II	Transport Phenomenon	CM 702 (A)	L	T	P	Max.Marks-100
			3	1	0	Min.Marks-35 Duration-3hrs.

Unit-I Similarity in momentum, heat and mass-transport - Newton's laws of viscosity, Fouriers laws of conduction and Fick's laws of diffusion, Flux-transport property relationships, Estimation of transport properties measurement and correlations, velocity distribution in Laminar flow of falling film. Flow over an inclined plane, a circular tube an annulus and between two parallel plates.

Unit-II Shell balance approach for developing equations of change for momentum, heat and mass transport, Equations of change and their approximations for transport in one dimension.

Unit –III Transport equations in turbulent flow and equations for turbulent fluxes, velocity, temperature and concentration profiles for laminar and turbulent flow conditions, temperature and concentration profiles for conductive and convective transport in solids and fluids.

Unit-IV Macroscopic momentum and heat balance equations, Kinetic energy calculations. Constant area and variable area flow problems. Flow through bends, time determination for emptying of vessels.

References:

1. Bird R.B., Stewart W.E. and Lightfoot EW; Transport phenomena; Wiley tappon
2. Brodkey RS and Hershey -Transport phenomena a unified approach; TMH
3. Geancoplis; Transport processes & separation process principles; PHI learning.

Course Contents

Category	Title	Course	Credits-4C			Theory
DC (E) 2 Elective II	Polymer Technology	CM 702 (B)	L	T	P	Max.Marks-100
			3	1	0	Min.Marks-35
						Duration-3hrs.

Unit I Polymerization Chemistry: Chain, step and miscellaneous polymerization reactions and polymerization technique. Polymerization kinetics: Free radical, cationic and anionic polymerization, poly-condensation and polymerization.

Unit-II Polymerization Processes: Bulk solution, emulsion and suspension polymerization, thermoplastic composites, fiber reinforcement fillers, surface treatment reinforced thermo-set composites resins, fillers, additives.

Unit-III Polymer reactions: Hydrolysis, acidolysis, aminolysis, hydrogenation, addition and substitution reactions, reactions of various specific groups, cyclyzation and cross linking reactions, reactions leading to graft and block copolymer

Unit IV Manufacturing processes of important polymers: Plastics- polyethylene, polypropylene polyvinyl chloride & copolymer, polystyrene; Phenol-formaldehyde, epoxides, urethane, Teflon, elastomers, robbers, polymeric oils - silicon fibers - cellulosic (Rayon), polyamides (6:6 Nylon), Polyesters (Dacron). Acrylic-olefin.

Unit - V Composite materials - Ceramic and other fiber reinforced plastics, Polymer degradation - Thermal, Mechanical, Ultrasonic, Photo, High energy radiation, Ecology and environmental aspects of polymer industries. Rheological Sciences Equations, Uni-coelastic models - Maxwell.

References:

1. Rodringuez; Principles of polymer systems; TMH
2. Billmayer Jr, Fred W.; Textbook of polymer science; Wiley tappon
3. David J Williams; Polymer science & engineering; PHI
4. Mc. Keley, JH; Polymer processing; John Wiley

Course Contents

Category	Title	Course	Credits-4C			Theory
DC (E) 2 Elective II	Novel Separation Techniques	CM 702 (C)	L	T	P	Max.Marks-100
			3	1	0	Min.Marks-35 Duration-3hrs.

Unit I Limitations of common separation techniques- sedimentation, screening, filtration, evaporation, distillation, absorption, liquid - liquid and solid -liquid extraction.

Unit II Principles of membrane separation process classification, characterization and preparation of membrane, Analysis and modeling of membrane separation, Membrane modules and application.

Unit III Reverse Osmosis and ultra filtration, membrane characteristics and applications, Ion selective membranes and their application in electrolysis. Per vaporization and gas separation using membranes, Liquid membrane, Industrial applications.

Unit IV Foam and bubble separation, principle, classification, foam and surfactants, Separation techniques, Column Separations:

Unit V Zone melting and Zone refining, electrophoresis, desalting by freezing, centrifugation.

Unit VI Parametric pumping, thermal parametric pumping, batch, continuous and semi-continuous pumping, multi component separation, ph-parametric pumping, heatless parametric pumping,

References:

1. Mccabe Wl and smith IC; Unit operation of chemical engineerin; TMH
2. King J.; Separation process; TMH
3. Kaup EC; Design factors in reverse osmosis - chemical engineering
4. Arden TV; Water purification by ion exchange; Butterworth, London.

Course Contents

Category	Title	Course	Credits-6C			Theory
DC 21	Process Equipment Design	CM 703	L	T	P	Max.Marks-100
			3	1	2	Min.Marks-35
						Duration-3hrs.

Unit I Scale up criteria and scale up of process equipment. Process design calculations for heat exchanges equipment shell and tube heat exchangers general description, heat transfer coefficients and pressure drop by Kerm's & Bells methods rating on existing unit.

Unit II Design of a new system having one or more units in series: single effect evaporation, multiple effect evaporator with boiling point elevation.

Unit III Process design calculations for mass exchange equipment plate and packed column for distribution hand adsorption including column diameter and height.

Unit IV Detailed process and mechanical design, Flash drum , Kettle reloerler, condenser, cooling tower rotary drier.

References:

1. Perry, Robert etal; Perry's Chemical Engg. Handbook; TMH
2. Ludwig E; Applied process design in chemical petrochemical plants; Gulf publishing co.
3. Mahajani V V, Umarji SB; Process Eqipment Design; MacMillan Pub.
4. Kern D; Process Heat Transfer; TMH
5. Smith B. D; Design of equilibrium stages.
4. Coulson JM. Richardson JF; Chemical engg. Vol ;. Pergaman process

List of Experiments (Please expand it):

Each student should design a complete chemical process plant with mechanical design details of at least three major equipments.

Course Contents

Category	Title	Course	Credits-6C			Theory
DC 22	Chemical Reaction Engineering II	CM 704	L	T	P	Max.Marks-100
			3	1	2	Min.Marks-35
						Duration-3hrs.

Unit-I Heterogeneous processes: Catalysis and adsorption; Classification of catalysts, Preparation of catalysts, Promoters and Inhibitors, General mechanism of catalytic reactions surface area and pore size distribution Rate equation of fluid solid catalytic reactions, Hougen - Watson & Poinule law models, Procurement and analysis of kinetic data, kinetics of catalyst deactivation.

Unit -II External transport processes and their effects on heterogeneous reactions yield and selectivity Reaction and diffusion in porous catalysts, Isothermal and non-isothermal effectiveness factors, Effect of intra-phase transport on yield, selectivity & poisoning, Global reaction rate.

Unit -III Design of catalytic reactors, Isothermal & adiabatic fixed bad reactor staged adiabatic reactors, Non isothermal, non adiabatic fixed bed reactors, Fluidized bed reactors, Slurry reactors, Trickle bed reactors.

Unit-IV Models for fluid - solid non-catalytic reactions, controlling mechanisms, Diffusion through gas film controls.
Diffusion through ash layer controls, Chemical reaction controls, fluidized bed reactors with and without elutriation.

Unit – V Gas-liquid reactions and liquid-liquid reaction, Rate equation based on film theory, Reaction design for instantaneous reactions and slow reactions, Aerobic Fermentation, Application to Design Tools for Fast Reactions.

References:
1. Smiili J.M; Chemical engg. Kinetics; TMH
2. Denbig K.G & Turner KG; Chemical theory - an introduction to reactors; United press
3. Cooper G. & Jeffery JVJ; Chemical kinetics and reactor engg.; PHI
4. Rajaram J, Kuriacose JC; Kinetics and mech. of Chemical Transformations; MacMillan
5. Levenspiel O; Chemical reaction engg; Wiley Eastern Singapore.
6. Hougen, watson & Ragatz; Chemical process principles part 3
7. Fogler, HS; Elements of chemical reaction engg.; PHI

List of Experiments (Please expand it):
Experiments based on above theory

Course Contents

Category	Title	Course	Credits-6C			Theory
DC 23	Environmental Engineering	CM 705	L	T	P	Max.Marks-100
			3	1	2	Min.Marks-35
						Duration-3hrs.

Unit I Environmental Management: Nature of environment, major component of life support system industrial development and environmental degradation, environmental impact assessment, national environmental policies, environmental guidelines for process industries, environmental pollution control through planned industrial development; environmental pollution and its effect on human beings, animal and vegetation system.

Unit - II Air Pollution: Sources and effect of air pollution, classification of air pollutants, emission standard of air pollution. Meteorological condition influencing air pollution, Chemical inversion, principle, working and design of control equipment for particulate emission and gaseous pollutants like cyclone separator, gravity settling chamber, multi-tray settling chamber, bag filter, scrubber, E.S.P.

Unit -III Water Pollution: Sources and effect of water pollution, water born diseases, classification of water pollutants, physical, chemical and bacteriological analysis of water; pollution laws and limits, effluent standards;, design of waste water and industrial effluent treatment plants (physio-chemical and biological), advanced treatment methods, modern trends in sedimentation and filtration.

Unit - IV Pollution due to Solid Waste and Noise: Nature of domestic, municipal, agricultural, industrial, Hospital, Nuclear Wastes; collection, treatment and disposal of solids waste; waste recovery system, solid waste management; noise pollution, sources, noise measurement and control; noise mitigation measures.

Unit - V Case study with respect to air, water and solid waste: Fertilizer industry, refinery and petrochemical industries, pulp and paper industries, training industry, sugar and alcohol industries, alkali industries, cement and steel industries.

References:

1. Rao C S; Environmental Pollution Control Engineering; New Age India Ltd.
2. Mahajan S P; Pollution Control in Process Industries
3. Canter Lary; Environmental Impact Assessment; TMG
4. Keily; Environmental Engineering; TMG
5. Miller GT Jr; Environmental sciences-working with earth; Cegage Pub

List of Experiments(Please Expand it):

1. To determine the BOD of a given water Sample.
2. To determine the D O of a given water Sample.
3. To determine the COD of a given water Sample.
4. To determine the ph value of a given water Sample.
5. To determine the Chlorides in a given water Sample.
6. To determine the Acidity in a given water Sample.
7. To determine the Alkalinity in a given water Sample.
8. To determine the Total Hardness in a given water Sample.
9. To determine the Turbidity of a given water Sample.
10. To determine the Aerobic Microbial colony count.
11. To determine the Total dissolve solid of a given sample.

Course Contents

Category	Title	Code	Credits 4C			Practical
DC (P) 2	Minor Project	ME 706	L	T	P	Max. Marks-50
			0	0	4	Min. Marks-25-

Provision of Minor project is made as preparation phase-I for major project or to take it as an independent small project. For details of project see ME-805- Major project

Course Contents

Category	Title	Code	Credits 2C			Practical
DC (P) 3	Industrial Training	ME 707	L	T	P	Max. Marks-30
			0	0	2	Min. Marks-15

Objective of Industrial Training

The objective of undertaking industrial training is to provide work experience so that student's engineering knowledge is enhanced and employment prospects are improved. The student should take this course as a window to the real World and should try to learn as much as possible from real life experiences by involving and interacting with industry staff. Industrial training also provides an opportunity to students to select an engineering problem and possibly an industry guide for their Major Project in final semester.

Scheme of Studies:

Duration: Minimum 2 weeks in summer break after VI semester, assessment to be done in VII semester

Scheme of Examination:

For the assessment of industrial training undertaken by the students, following components are considered with their weightage.

(a) Term Work in Industry	**Marks Allotted**
Attendance and General Discipline	5
Daily diary Maintenance	5
Initiative and participative attitude during training	10
Assessment of training by Industrial Supervisor	10
Total	30*

(b)	**Practical/Oral Examination (Viva-Voce) in Institution**	**Marks Allotted**
1.	Training Report	15
2.	Seminar and cross questioning (defense)	15
Total		30

* - Marks of various components in industry should be awarded by the I/c of training in Industry but in special circumstances if not awarded by the industry then faculty in charge /T.P.O. will give the marks.

During training students will prepare a first draft of training report in consultation with section in charge. After training they will prepare final draft with the help of T.P.O. /Faculty of the Institute. Then they will present a seminar on their training and they will face viva-voce on training in the Institute.

Learning through Industrial Training

During industrial training students must observe following to enrich their learning:

- Industrial environment and work culture.
- Organisational structure and inter personal communication.
- Machines/equipment/instrument-their working and specifications.
- Product development procedure and phases.
- Project Planning, monitoring and control.
- Quality control and assurance.
- Maintenance system
- Costing system
- Stores and purchase systems.
- Layout of Computer/EDP/MIS centers.
- Roles and responsibilities of different categories of personnel.
- Customer services.
- Problems related to various areas of work etc.

Students are supposed to acquire the knowledge on above by-

- Direct Observations without disturbing personnel at work.
- Interaction with officials at the workplace in free/ tea time
- Study of Literature at the workplace (e.g. User Manual, standards, processes, schedules, etc.)
- "Hand's on" experience
- Undertaking/assisting project work.
- Solving problems at the work place.
- Presenting a seminar
- Participating in group meeting/discussion.
- Gathering primary and secondary data/information through various sources, storage, retrieval and analysis of the gathered data.
- Assisting official and managers in their working
- Undertaking a short action research work.
- Consulting current technical journals and periodicals in the library.
- Discussion with peers.

Daily Diary- Industrial Training

Name of the Trainee…… College ……..
Industry / work place …… Week No……..
Department /Section …… Date ……

Dates Brief of observations made, work done, problem/project undertaken, discussion held, literature consulted etc.

Signature of Supervisor (TPO/Faculty) | Signature of Trainee | Signature of Official in charge for Trg. In Indutry.

Supervision of Industrial Training

Faculty and TPO are supposed to plan industrial training in such a manner that students get exposure on most of the above area in the field.
One faculty member or TPO will plan industrial training of students in consultation with training manager of the industry (work place) as per the predefined objectives of training.
Monitoring visits will be made by training and placement officer/faculty in-charge for the group of students, of the college during training.

Guidance to the faculty / TPO for Planning and implementing the Industrial Training

Keeping in view the need of the contents, the industrial training program, which is spread to minimum 2 weeks duration, has to be designed in consultation with the authorities of the work place; Following are some of the salient points:

- Spelling out the objectives of the industrial training in behavioral terms and same is informed in advance to the 1) students, 2) authorities of the work place and 3) supervising faculty members.
- Discussing and preparing students for the training for which meetings with the students has to be planned.
- Meeting with industrial personnel and orienting them regarding the objective of the training and the expectations of the program.
- Correspondence with the authorities of the work place.
- Orientation classes for students on how to make the training most beneficial-monitoring daily diary, writing weekly reports, how to interact with various categories of industrial personnel, how to behave and undertake responsibilities, how to gather information form the workplace, ethics etc.
- Guiding students to make individual plans (week wise/ day wise) to undertake industrial training.,
- Developing a system of maintaining training records, by teachers for every batch of students for convenient retrieval.
- Inviting industrial personnel to deliver lectures on some aspects of training.

Action plan for planning stages at the Institutional Level

S.No.	Activity	Commencing Week	Finishing week	Remark
1.	Meeting with Principal			
2.	Meeting with colleagues			
3.	Correspondence with work place(Industry concerned)			
4.	Meeting with authorities of work place			
5.	Orientation of students for industry training			
6.	Scrutinizing individual training plan of students.			
7.	Commencement of individual training			
8.	First monitoring of industrial training			
9.	Second monitoring of industrial training			
10.	Finalization of Training report			
11.	Evaluation of performance at industry level			
12.	Evaluation of Industry Program in the Institutions.			