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Credit Based Grading System

Chemical Engineering, VII-Semester

CM-7001 Process Equipment Design-II

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

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

Unit III Process design calculations for mass exchange equipment plate and packed column for distillation and absorption including column diameter and height.

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

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Credit Based Grading System

Chemical Engineering, VII-Semester

CM-7002 Chemical Reaction Engineering-II

Unit-I Heterogeneous processes: Catalysis and adsorption; Classification of catalysts, 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

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Credit Based Grading System

Chemical Engineering, VII-Semester

CM-7003 Environmental Engineering

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, concept of sustainable development.

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 principle 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;, working principle of waste water and industrial effluent treatment plants (physiochemical and biological), introduction to advanced treatment methods, modern trends in sedimentation and filtration.

Unit - IV Pollution due to solid waste and Noise
Sources and effects of solid waste and Nature of domestic, municipal, agricultural, industrial, Hospital, Nuclear Wastes; collection, treatment and disposal of solids waste; waste recovery system, solid waste management; sources and effects of noise pollution noise pollution, 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, tanning 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.

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Credit Based Grading System

Chemical Engineering, VII-Semester

Elective-III CM-7004 (1) Petroleum Processing Technology

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.

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Credit Based Grading System

Chemical Engineering, VII-Semester

Elective-III CM-7004 (2) Pharmaceutical Technology

Unit I Unit Operation in Pharmaceutical Industries: working principle of evaporation, distillation, drying, mixing, size reduction, crystallization, filtration, size separation, conveying, humidification, air conditioning and refrigeration equipments

Unit II Introduction to pharmaceutical laws and regulation

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 Tablets and Capsules

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

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 IV Cosmetics and Toiletries:

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

Unit V 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.

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Credit Based Grading System

Chemical Engineering, VII-Semester

Elective-III CM-7004 (3) Process Intensification

UNIT I

Introduction: Techniques of process Intensification (PI) Applications, The philosophy and opportunities of process Intensification, Main benefits from process intensification, Process-Intensifying Equipment, Process intensification toolbox, Techniques for PI application.

UNITII

Process Intensification through micro reaction technology: Effect of miniaturization on unit operations and reactions, Implementation of Microreaction technology, from basic properties to Technical Design Rules, Inherent Process Restrictions in Miniaturized Devices and Their Potential Solutions, Microfabrication of Reaction and unit operation Devices-Wet and Dry Etching Processes.

UNITIII

Scales of mixing, Flow patterns in reactors, mixing in stirred tanks: Scale up of mixing, Heat transfer, Mixing in intensified equipment, Chemical processing in High-Gravity Fields Atomizer Ultrasound Atomization, Nebulizers, High intensity inline MIXERS reactors Static mixers, Ejectors, Tee mixers, Impinging jets, Rotor stator mixers, Design Principles of static Mixers Applications of static mixers, Higee reactors. Combined chemical reactor heat exchangers and reactor separators: Principles of Operation; Applications, Reactive absorption, Reactive distillation, Applications of RD Processes, Fundamentals of Process Modeling, Reactive Extraction Case Studies: Absorption of NOx Coke Gas Purification.

UNITIV

Compact heat exchangers: Classification of compact heat exchangers, Plate heat exchangers, Spiral heat exchangers, Flow pattern, Heat transfer and pressure drop, Flat tube-and-fin heat exchangers, Microchannel heat exchangers, Phase-change haet changer, selection of heat exchanger technology, Feed/effluent heat exchangers, Integrated heat exchangers in separation processes, Design of compact heat exchanger-example.

UNITV

Enhanced fields: Energy based intensifications, Sono-chemistry, Basics of cavitation, Cavitation Reactors, Flow over a rotating surface, Hydrodynamic cavitation applications, Cavitation reactor

design, Nusselt –flow model and mass transfer, The rotating Electrolytic Cell, Microwaves, Electrostatic fields, Sonocrystallization, Reactive separations, Superctrical fluids.

References

1. Stankiewicz, A. and Moulijn, (Eds.) Reengineering the chemical Process Plants, Process Intensification, Marcel Dekker, 2003.
2. Reay D., Ramshaw C., Harvey A., Process Intensification Butterworth Heinemann, 2008.

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Chemical Engineering, VII-Semester

Elective-IV CM-7005 (1) Transport Phenomena

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.

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Credit Based Grading System

Chemical Engineering, VII-Semester

Elective-IV CM-7005 (2) Polymer Technology

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, cyclization 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

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Credit Based Grading System

Chemical Engineering, VII-Semester

Elective-IV CM-7005 (3) Novel Separation Techniques

Unit I Introduction :
Introduction to Separation process in chemical and Biochemical Industries, Categorization of Separation Processes, equilibrium and rate governed processes. Introduction to various new Separation techniques e.g. Membrane Separation, Ion-exchange foam Separation , supercritical extraction, liquid membrane permeation, PSA & Freeze drying.

Unit II Membrane Separation: Introduction :
Membrane based Separation Techniques, Historical background, physical and chemical properties of membranes, Techniques of membrane preparation, membrane characterization, various types of membranes and modules.

Unit III Membrane Operation and Design :
Osmosis and osmotic pressure. Working principle, operation and design of Reverse osmosis, Ultra filtration, Micro filtration, Electro dialysis and Pervaporation. Gaseous separation by membranes.

Unit IV Ion Exchange:
Ion Exchange History, basic principle and mechanism of separation, Ion exchange resins, regeneration and exchange capacity. Exchange equilibrium, affinity, selectivity and kinetics of ion exchange. Design of ion exchange systems and their uses in removal of ionic impurities from effluents.

Unit V New Techniques in Separation :
Introduction to foam separation, micellar separation, supercritical fluid extraction, liquid membrane permeation and chromatographic separation, Reactive separation and Hybrid separation.

References:

1. King, C.j., “Separation Process”, Tata Mcgraw-Hill.
2. Sourirajan, S. and Matsura, T., “ Reverse Osmosis and Ultrafiltration – Process Principles,” NR Publication,Ottawa, 1985.
3. Porter, M.C.,”Handbook of Industrial Membrane Technology,” Noyes Publication, New Jersey, 1990.
4. Henry, J.D. and Li, N.N., “ New Separation Techniques”, AICHE Today Series, AICHE(1975).
5. Hatton, T.A., Scamehorn, J.F. and Harvell, J.H., “Surfactant Based Separation Processes”, Vol.23, Surfactant Science Series, Marcel Dekker Inc., New York 1989.

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Credit Based Grading System

Chemical Engineering, VII-Semester

CM-7006 Project-I

- All Experimental Projects should contain : Introduction, Literature Review, and setup Preparation

- All plant Design Projects should contain : Introduction, Literature Review, Process selection and Material and Energy Balances.

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Credit Based Grading System

Chemical Engineering, VII-Semester

CM-7007 Industrial Training

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

Learning through Industrial Training

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

- Industrial environment and work culture.
- Organizational 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.