B.TECH VIII SEMESTER CHEMICAL ENGG.							
COURSE CONTENTS (UEC SCHEME)							
CM-830	Process Plant Development Economics	L	T	P	C	Max. Marks	Min. Marks
Duration	3 Hours	3	0	0	3	70	22

COURSE OBJECTIVE

Large number of activities is observed during the production of different types of chemicals along with the use of latest technology, process control and quality products .In all these work requires step wise procedure and rules to maintain smooth operation and to avoid the chances of accidents and fire. Therefore the basic knowledge of different aspects of safety and the procedures of maintaining smooth operation in the industry, the course has been designed.

Unit-I

General design considerations; Chemical Engineering plant design, Overall design consideration, Practical considerations in design, engineering ethics in design.
Health and Safety hazards, Loss prevention, Environmental Protection, Plant Location, Plant Layout, Plant Operation and Control.

Unit- II

Process Design Development: Development of design database, Process creation, Process design criteria, Process flow diagram (PFD), Equipment design specifications. Flow sheet synthesis and development: General procedure, Process information, Functions diagram, Flow sheet synthesis, Software use in process design, Optimum design and design strategy.

Unit-III

Product Cost Analysis:
Analysis of Cost Estimation: Cash flow for industrial operations, Factors affecting investment and production costs, Capital investments, Fixed capital and working capital, Estimation of capital investment, Cost indices, Estimation of total cost, Gross profit, Net profit and cash flow, Cost scaling factors, Net present value analysis.

Unit-IV

Interest and Depreciation: Interest, Simple interest, Compound interest, Nominal and effective interest rates, Continuous interest, Costs of capital, Time value of money, Annuity, Cash flow patterns, Income taxes, Present worth, Future worth, Taxes and Insurance. Depreciation: Depreciable investments, Methods for calculating Depreciation.

Unit-V

Profitability Analysis: Profitability standards, Costs of capital, Minimum acceptable rate of return, Methods of calculating profitability, Rate of return on investment, Payback period, Net return, discounted cash flow rate of return, Net present worth, Payout period, Alternative investments, Replacements.

BE VIII Semester ***CHEMICAL ENGINEERING***							
COURSE CONTENTS (UEC SCHEME)							
CM-8001	***Process Piping Engineering***	***L***	***T***	***P***	***C***	***Max. Marks***	***Min. Marks***
Duration	*3 Hours*	*3*	*1*	*0*	*4*	*70*	*22*

Unit I

Classification of Pipes and Tubes:

IS & BS codes for pipes used in chemical process industries and utilities. Pipes of circular and non-circular cross section-velocity distribution, average velocity and volumetric rate of flow. Flow through curved pipes (Variable cross sections). Pressure drop for flow of Newtonian fluids through pipes. Resistance to flow and pressure drop. Effect of Reynolds and apparent Reynolds number. Recommended design methods.

Unit II

Non-Newtonian Time Independent/Dependent Fluid Flow:

Flow through process pipes, Shear stress, Shear rates behavior, apparent viscosity and its shear dependence, Power law index, Yield stress in fluids. Recommended design methods.

Time dependant behavior, Mechanical analogues, velocity pressure relationships for fluids, line. Recommended design methods.

Unit III

Pipe Line Design and Power Losses in Vertical Flow:

Flow of gas-liquid , liquid –liquid, gas-solid and liquid-solid mixtures in pipes, flow pattern, holdup, pressure gradients and empirical overall correlations, bubble flow pattern, slug flow pattern, annular mist flow pattern Recommended design methods.

Unit IV

Pipe Line Design and Power Losses in Horizontal Flow:

Flow of gas-liquid, liquid –liquid, gas-solid and liquid-solid mixtures in pipes, flow pattern, holdup, pressure gradients and empirical overall correlations, bubble flow pattern, stratified flow pattern, slug flow pattern, annular mist flow pattern, Lockhart Martinelli relations, Flow pattern regimes. Recommended design methods, Case studies.

Unit V

Introduction to software (Casesuse-II, Caepipe), Case studies in real problems from industries

Suggested Readings:

1. Govier, G.W. and Aziz K. - THE FLOW OF COMPLEX MIXTURES IN PIPE- Krieger Publication, Florida, 1982.
2. McKetta .John .J ,Piping Design Hand Book, Marcel Drekker
3. Mohinder L Nayyar, Piping Hand Book, McGraw Hill Book Co.
4. Rip Weaver ,Process Piping Design Vol.1, Gulf Publishing Co.

5. Coulson JM and Richardson *J.F.* - CHEMICAL ENGINEERING - Vol I,VI Edition, Butterworth Heinemann, British Library, Publications, Oxford, 1999.

Course Outcomes:

CO1: To understand the major concepts of piping system in chemical process industries, flow and pressure drop through pipes and tubes.
CO2: To understand behavior of non-Newtonian fluid flow and shear rate through process pipes.
CO3: To analyze flow pattern and pressure drop of liquid-gas, liquid-liquid and liquid-solid mixture flow through vertical pipes.
CO4: To analyze flow pattern and pressure drop of liquid-gas, liquid-liquid and liquid-solid mixture flow through horizontal pipes.
CO5: To analyze case studies from industries with the help of software

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	-	2	2	1	2	2	2	2
CO2	3	3	3	1	-	-	-	-	2	-	2	2
CO3	3	3	2	1	-	2	2	-	1	2	2	2
CO4	3	3	2	1	-	2	2	-	1	2	2	2
CO5	2	2	2	2	3	3	3	3	3	3	2	2

Course	PSO1	PSO2	PSO3
CM-8001.1	3	1	1
CM-8001.2	3	2	1
CM-8001.3	3	2	1
CM-8001.4	3	2	-
CM-8001.5	3	1	-

BE VIII Semester ***CHEMICAL ENGINEERING***							
COURSE CONTENTS (UEC SCHEME)							
CM-8043	***Pharmaceutical Technology***	***L***	***T***	***P***	***C***	***Max. Marks***	***Min. Marks***
Duration	*3 Hours*	*3*	*1*	*0*	*4*	*70*	*22*

Unit I

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

Production, Formulation and Quality control:

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: hard- ness, 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 capsule.

Unit IV

Cosmetics and Toiletries:

Introduction, factors to be considered in the formulation of facial cosmetics, dentifrice's, 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.

Suggested Readings:

1. Leon Lachman, H.A. Lieberman, J.L.K. - THE THEORY AND PRACTICE OF INDUSTRIAL PHARMACY - Verghese Publishing House, Hind Rajasthan Building Dadar, Mumbai,400014.
2. Ganderton - UNIT PROCESS IN PHARMACY.
3. D. Hershey, Ed. - CHEMICAL ENGINEERING IN MEDICINE AND BODOGY - Plenum Press, New York.
4. CHEMICAL ENGINEERING IN MEDICINE - Chern. Engg. Progrer Syrnp Series No. c 66, Vol 62.

Course Outcomes

CO1: Study of various mass transfer operation and size reduction processes.
CO2: Familiarization of the process conditions, process parameter along with process technology and various aspect of quality control.
CO3: Study of various techniques like oral and non-oral formulation techniques, dose estimation and quality control.
CO4: Preparation, properties, application of natural and artificial products used in cosmetics, deodorant etc. along with quality aspects.
CO5: Study of different types of packing material, process along with machine, quality and stability aspects of packing materials.

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	2	2	2	2
CO2	3	2	-	2	1	2	2	2	1	3	3	2
CO3	3	3	3	2	2	2	2	2	2	3	1	2
CO4	3	1	2	1	-	2	2	3	2	3	2	2
CO5	3	-	2	2	1	2	-	2	1	2	2	2

Course	PSO1	PSO2	PSO3
CM-8043.1	2	-	-
CM-8043.2	2	2	1
CM-8043.3	3	3	-
CM-8043.4	3	1	-
CM-8043.5	2	1	-

B.TECH VIII SEMESTER CHEMICAL ENGG.							
CM-836) COURSE CONTENTS (UEC SCHEME)							
CM-8051	Novel Separation Techniques	L	T	P	C	Max. Marks	Min. Marks
Duration	3 Hours	3	1	2	6	70	22

Objectives : Students will be able to design piping system for a chemical process industry

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.

Course Outcomes:

1. To able to select pipe of proper size
2. To able to select piping system components
3. To able to design piping for a given system

Suggested Readings:

1. King, C.J., "Separation Processes", Tata McGraw-Hill.
2. Sourirajan, S. and Matsura, T., "Reverse Osmosis and Ultrafiltration - Process Principles," NR Publications, 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.
6. McHugh, M. A. and Krukonis, V. J., 'Supercritical Fluid Extraction", Butterworths, Boston, 1985.

CM-8362

B.TECH VIII SEMESTER CHEMICAL ENGG.							
COURSE CONTENTS (UEC SCHEME)							
CM-8053	Food Technology	L	T	P	C	Max. Marks	Min. Marks
Duration	3 Hours	3	1	2	6	70	22

Course Objectives:

To impart knowledge to the students about food processing and various unit operations involved in it, packaging, storing and preservation, food poisoning, food related hazards and safety, and transportation.

Unit I

Introduction:

Introduction to food processing technology including calculations of processing parameters, unit operations involved with thermal technologies and non thermal technologies (Pulsed Electric fields)
Types of Food Processing: canning, freezing, Pasteurization and sterilization, fermentation, irradiation, packaging.

Unit II

Mathematical concepts:

Algebra, interpolation of data in tables, Graphs and curve fitting, calculus, problem solving on gases and vapors, mass balances, energy balances, fluid mechanics and heat transfer.
Physical properties of food and food processing system: Units and dimensions: Density and specific gravity, fluids viscosity, rheology and texture, surface, properties, thermodynamics of food, heat changes, diffusion and mass transfer

Unit III

Food Dehydration:

Factory organization, Preparation of plant, dryers and their classification, dehydration of potato products dehydration of vegetables, dehydration of fruits, spray dried products, dehydration of meat, soup, selection and storage of dehydrated products, quality control and economics of dehydration.

Unit IV

Separation Processes:

An overview, supercritical fluid extraction, Pressure activated membrane processes, Ultra-filtration, Ion exchange & innovative separation methods, Fractionation in fat, and solid separation processes.

Unit V

Quality Optimization and Assessment:

Quality optimization and minimal processing of foods, methodologies to optimize thermal processing conditions, process assessment of high pressure processing of fluid, high pressure treatment of fruit, meat and cheese product, equipments, quality and safety aspects of novel minimal processing technologies.

Course Outcome:

- Understanding the various causes of food deterioration and food poisoning.
- Identification of appropriate processing, preservation, and packaging method.
- Analyze product quality and effect of processing technique on it.
- Identify important species of pathogenic microbes and describe factors that affect their growth in various types of food.
- Analysis of food related hazards and HACCP method.

Suggested Readings:

1. Richardson, P., "Thermal Technologies in Food Processing," April 2001
2. Fellows, R.P., "FOOD PROCESSING TECHNOLOGIES, PRINCIPLES AND PRACTICES," 2nd ed.
3. Hartel, R.W. Howell,T.A, and Hyslop, D.B., "MATHEMATICS FOR FOOD ENGINEERING," University of Wisconsin USA.
4. Lewis, M.J., "PHYSICAL PROPERTIES OF FOOD AND FOOD PROCESSING SYSTEMS"
5. M.Gransmits, Gunness Peat group & APV, "PRACTICAL DEHYDRATION," 2nd ed. *Syllabus-page 82 of 147*
6. Randison, A.S.G. and Lewis M.J., "SEPARATION PROCESSES IN THE FOOD AND BIO TECHNOLOGY INDUSTRIES".
7. F.A.R. Oliveria, J.C. Olivenia, "PROCESSING FOODS QUALITY OPTIMIZATION AND PROCESS ASSESSMENT".