BE V SEMESTER CHEMICAL ENGG.							
COURSE CONTENTS (UEC SCHEME)							
CM-5001	Organic Process Technology	**L**	**T**	**P**	**C**	**Max. Marks**	**Min. Marks**
Duration	3 Hours	3	1	0	4	70	22

Study of organic process industries involving process technology, raw material availability, production pattern, Engg. Problems involving material of construction, Environment pollution, waste utilization and disposal, energy consumption and conservation Equation.

Unit I

Industrial Microbial Processes and Edible Oils:

Fermentation processes for the production of ethyl alcohol, alcohol derivatives like acetic acid, acetic anhydride, vinyl acetate, ethylene glycol, pyridine, citric acid and antibiotics, Refining of edible oils and fats, fatty acids, Soaps and detergents.

Unit II

Cellulosic Processes:

Pulp and paper, pulping process chemical recovery pulp preparation and paper making.

Unit III

Petrochemicals:

Intermediates for petrochemical from petroleum based stocks, phenol, methanol, ethylene, propylene, benzene, toluene and xylene, acrylonitrile, styrene, butadiene.

Unit IV

Fine Chemicals and Fibers:

Dyes and Dye intermediates, carbohydrates and sugar, man made fibers; rayon, polyester, polyamides and acrylics, cellulose acetate, insecticides and pesticides,

Unit V

Unit Processes:

Nitration: nitrating agents, equipments for nitration, mixed acid preparation, sulfonation and sulfation agents

Suggested Readings:

1. V.B. Gupta & V. K . Kathari – MANUFACTURING FIBRE TECHNOLOGY – Chapman Hall, Newyork I Edition 1997
2. V.K. Kathari- PROGRESS IN TEXTILE, SCIENCES TECHNOLOGY, VOL I & II – IAFL Publications, S-351 Greater Kailash part I New Delhi – 48 I Ed.
3. Austin, G.T. SHREEVES CHEMICAL PROGRESS INDUSTRIES – 5th Ed. Mc. Graw Hill New York 1984
4. Dryden C.E. –OUTLINES OF CHEMICAL TECHNOLOGY – 3rd Ed. Affilicted. East West press, New Delhi, 1997

BE V SEMESTER CHEMICAL ENGG.							
COURSE CONTENTS (UEC SCHEME)							
CM-5002	Computational Methods in Chemical Engineering	**L**	**T**	**P**	**C**	**Max. Marks**	**Min. Marks**
Duration	3 Hours	3	1	2	6	70	22

Unit I

Treatment of Engineering Data:

Graphical representation. Empirical equations, Interpolation, Newton's formula, Lagrange's Interpolation formula, extrapolation, Integration, graphical Integration, Graphical Construction of Integral curves, Numerical Integration.

Unit II

Interpretation of Engineering Data:

Significant figure, Classification of Measurements, Propagation of Errors, Variation and Distribution of Random Errors, Properties of Variance, Confidence limits for small samples.

Unit III

Ordinary Differential Equations:

Formulation, Application of Law of Conservation of Mass – Mixing in flow process. Classification of ordinary Differential Equations and its applications to common Chemical Engineering problems.

Unit IV

Numerical Solutions of Ordinary Differential Equations:

Linear Second – order Equations with variable coefficients, Numerical solution by Runge Kutta Method. Its application to higher – order equations.

Unit V

Formulation of Partial Differential Equations:

Finite difference, linear finite difference equations, non – linear difference equations. Optimization, types of methods, its application relating to chemical processes.

List of Experiments:

1. Data representation and treatment by Graphical methods, Pressure- Volume-Temperature and concentration relationships for gases and their mixtures.
2. Integrated methods of data processing. Integral functions and their graphical representation.
3. Estimation of properties from empirical correlations (Nokay)
4. Estimation of critical properties from group contribution method.
5. Redlich-Kwong equation of state and other Virial equations to estimate thermodynamic properties like compressibility factor, molar volume and P-V-T relationships.
6. To study the effect of liquid viscosity and dissolved gases on pump efficiency, reciprocating pump performance.
7. Measurement errors their propagation and minimization of random errors. Selection of confidence limits.
8. Mass balance problems using continuity equation applied to a dynamic system. Formation of differential equations (component balance) and their solution & examples – CSTR and flow through pipes.
9. Numerical Solutions of batch reactor problems. Euler Algorithm
10. Runge-Kutta algorithm and its application in chemical Engineering. Implicit and explicit calculations. Problems related to effect design, optimum liquid concentration.
11. Transient flow of fluid unsteady temperature and varying concentration problems and use of partial differential equation to solve them.

Note: Each student should perform at least eight experiments from the above list. Suggested Readings:

1. Mickley, H. S. Sherwood, T. S. Reed – APPLIED MATHEMATICS IN CHEMICAL ENGINEERING- Tata McGraw Hill pub.
2. Jenson & Jeffrey's – MATHEMATICAL METHODS IN CHEMICAL ENGINEERING.

BE V SEMESTER CHEMICAL ENGG.							
COURSE CONTENTS (UEC SCHEME)							
CM-5003	Mass Transfer - I	**L**	**T**	**P**	**C**	**Max. Marks**	**Min. Marks**
Duration	3 Hours	3	1	3	7	70	22

Unit I

Fundamentals of Mass Transfer: Individual and film coefficients, overall mass transfer coefficient and their inter relationships; Analogies in transfer processes, determination of mass transfer co-efficient; two phase flow in packed beds, co-current and counter current processes flooding loading, column internals: types of trays / plates and packing, point and plate efficiency.

Unit II

Diffusion Phenomena: Molecular and eddy diffusion in gases, liquids and solids, interface mass transfer, Mass transfer theories: film theory Penetration theory and surface renewal theory

Unit III

Distillation: Vapour liquid Equillibria, Boiling point diagram, Relative volatility, flash and, Batch distillation. Differential instillation for two component mixture, steam distillation, azeotropic distillation, extractive distillation.

Unit IV

Continuous and Differential contact Distillation: Rectification, reflux ratio, calculation of numbers of plates by NTU, optimum reflux ratio, open steam, multiple feed and multiple product calculations, Enthalpy concentration diagram, Panchon-Savarit method for calculation of number of theoretical plates. Approximate equation; Fensky Undeinrood equation for minimum numbers of plate calculation. Polarison Gilliland method for actual numbers of plate calculation.

Unit V

Absorption: Theory of gas absorption, Design of absorption towers, Concept of Equilibrium and operating lines. Mass Transfer Equipments- Batch and continuous Stage wise contactors and Differential contactors, Concept of HTU and NTU, Tower packings and packing characteristics.

Suggested Readings:

1. Mc-Cabe W.L, Smith J.M.; Unit Operation In Chemical Engineering; Tat Mc-GrawHill.
2. Coulson J. M. Richardson; Chemical Engineering – Vol 2; Butserworth Heinmann, Oxford, Delhi
3. Treybal R.E; Mass Transfer Operations; Mc. Graw Hill.
4. Sherwood, T.K. Pigford R.L. and Wilke, C.R.; Mass Transfer; Mc. Graw Hill.

List of Experiment

1. To study the flooding and loading of packed columns using different types of packing.
2. To study different types of plates and packing.
3. To prepare the vapor-liquid equilibrium and Boiling point diagram for a binary liquid mixture.
4. Determination of relative volatility of a given system of acetic acid water.
5. To verify Rayleigh equation for differential distillation of binary system.
6. To carry out the steam distillation.
7. To study batch distillation.
8. To study continuous distillation.
9. Studies on packed tower distillation unit.
10. Studies on the sieve plate distillation unit.
11. Studies on bubble cap distillation column.
12. To study the absorption of a gas in a packed column and calculation of NTU and HTU.

Note: Each student should perform at least eight experiments out of the above list.

BE V SEMESTER CHEMICAL ENGG.							
COURSE CONTENTS (UEC SCHEME)							
CM-5004	Chemical Reaction Engineering - I	**L**	**T**	**P**	**C**	**Max. Marks**	**Min. Marks**
Duration	3 Hours	3	1	3	7	70	22

Unit I

Classification of Reactions: Definition of reaction rate, Variables affecting the rate, concept of reaction equilibria, order of reaction and its determination, theoretical study of reaction rates, collision and activated complex theory, Mechanism of reaction series, Parallel and consecutive reaction autocatalytic reactions, chain reaction polymerization reaction. Interpretation of kinetic data, Integral and differential method of analysis, variable volume reactions, total pressure method of kinetic analysis.

Unit II

Classification of Reactors: Concept of ideality, Development of design equations for batch, semi batch, tubular and stirred tank reactor, CSTR, PER, Combination of reactors, Reactors with recycle, yield and selectivity , reactor choice for single reaction.

Unit III

Multiple Reactions: Multiple Reactions in Batch, continuous stirred tank and Plug flow reactors uniqueness of steady state in continuous stirred tank reactor, optimum temperature progression, thermal characteristics of reactors. analysis of product distribution and determination of reactor size for different types of ideal reactors, selectivity and yield factors, Denbigh reactions, reactor choice for multiple reactions.

Unit IV

Residence Time Distribution: Non ideal reaction, RTD dispersion model, Tank and series model, recycle model, segregated flow in mixed models, evaluation of RTD characteristics. , role of RTD in determining reactor behaviour, age distribution (E) of fluid, experimental methods for finding E, relationship between E and F curve;

Unit V

Design of Reactors: Non-isothermal design of ideal reactors, hot spot in tubular reactor, auto-thermal process, steady state multiplicity and effect of operating variables on the stability of CSTR, optimal temperature progression for first order reversible reaction, and discussion of optimal policy for the operation of reactors with inter stage coolers.

List of Experiments:

1. To determine velocity rate constant of the hydrolysis of ethyl acetate by sodium hydroxide.
2. To study the rate constant of hydrolysis of an ester-catalyzed by acid.
3. Determine the rate constant and order of reaction between Potassium per sulphate and Potassium iodide.
4. To study temperature dependency of rate constant, evaluation of activation energy and verification of Arrhenious law.
5. To study a consecutive reaction system(hydraulic model)
6. To study a parallel reaction system (hydraulic model)
7. To study a homogeneous reaction in a semi-batch reactor under isothermal conditions.
8. Study of non catalytic homogeneous saponification reaction in CSTR.
9. To study a non-catalytic homogeneous reaction in a plug flow reactor.
10. To study the residence time distribution
11. Behavior of a back mix reactor.
12. To study the RTD behavior of a tubular reactor.
13. To study the RTD behavior of a packed bed reactor.
14. To study the behavior of a continuous flow reactor system-three reactor in series.
15. To study the kinetics of thermal decomposition of calcium carbonate.
16. To study a homogeneous catalytic reaction in a batch reactor under adiabatic conditions.
17. Study of non catalytic saponification reaction in a tubular flow reactor.

Note: Each student should perform at least eight experiments out of the above list.

Suggested Readings:

1. J.M. Smith – CHEMICAL ENGINEERING KINETICS – 3rd Ed. Mc Graw Hill.
2. K.G. Denbigh & K.G. Turner – CHEMICAL REACTION THEORY AN INTRODUCTION – 2nd Ed. United Press and ELBS 1972
3. G. Copper & GVJ Jeffery's – CHEMICAL KINETICS AND REACTOR ENGINEERING – Prentice Hall 1972
4. O. Levenspiel – CHEMICAL REACTION ENGG. – 2nd Ed. Willey Eastern, Singapore.
5. Houghen Watson & Ragatz – CHEMICAL PROCESS PRINCIPLES PART III – (Kinetics & Catalysis) 2nd Ed. Asian Publishing House Bombay.
6. Fogler, H.S. – ELEMENTS OF CHEMICAL REACTION ENGINEERING – 2nd Ed. Prentice Hall of India Pvt. Ltd. New Delhi. -1999

BE V SEMESTER CHEMICAL ENGG.							
COURSE CONTENTS (UEC SCHEME)							
CM-5005	Principals & Practices of Management	**L**	**T**	**P**	**C**	**Max. Marks**	**Min. Marks**
Duration	3 Hours	3	1	0	4	70	22

Unit I

Nature and Functions of Organizations:
Aim of organizations, legal establishment of organizations, Functions of organization viz., Purchasing, Operations, Marketing and Sales, Finance, Product Development, Quality, Personnel etc., Case studies.

Unit II

Production and Operation Management:
Need analysis, Product life cycle, Product development Process, Intellectual property rights, Production planning and control, Materials Management,

Unit III

Quality Management:
Inspection and test, Quality assurance and ISO 9000, Requirements of ISO 9001 for operational and for quality system, Total quality management, Quality management tools and techniques.

Unit IV

Project Planning and Management:
Defining the project, Implications of the project, Constraints, Planning the project, Milestones and targets, Gantt charts, Critical path analysis, Project control.

Unit V

Personnel Management:
Organization Structure, Recruitment, Induction process, Motivation, Leadership, Appraisal of employees, Training and development, Job design.

Suggested Readings:

1. Towler G. and Sinnott R. K., “Chemical Engineering Design:
2. Principles, Practice and Economics of Plant and Process Design”, Butterworth-Heinemann.

BE V SEMESTER CHEMICAL ENGG.							
COURSE CONTENTS (UEC SCHEME)							
CM-5006	Chemical Process Plant Simulation - I	**L**	**T**	**P**	**C**	**Max. Marks**	**Min. Marks**
Duration	3 Hours	0	0	4	4	60	19

COURSE CONTENTS

Operations on following software's

- ChemCad Part –I
- Pro-simulator Part –I