SHIVAJI UNIVERSITY, KOLHAPUR

SYLLIBUS/ STRUCTURE (REVISED from June- 2015)

T.E. Chemical Engineering -I (Sem. – V)

Sr. No.	Name of the Subject	Teaching Scheme(Hrs)				Examination Scheme (Marks)			
		L	T	P	Total	Theory	TW	POE/ OE	Total
1	Process Instrumentation and Instrumental Methods of Analysis	3	--	2	5	100	25	25	150
2	Computational Techniques in Chemical Engg.	3	--	2	5	100	50	-	150
3	Mass Transfer-I	4	1	2	7	100	25	25	150
4	Chemical Engg. Thermodynamics-II	3	1	--	4	100	25	--	125
5	Chemical Equipment Design-I	4	--	2	6	100	50	25	175
6	Mini Project	1	--	2	3	--	50	--	50
	Total	18	02	10	30	500	225	75	800

T.E. Chemical Engineering -II (Sem. – VI)

Sr. No.	Name of the Subject	Teaching Scheme(Hrs)				Examination Scheme (Marks)			
		L	T	P	Total	Theory	TW	POE/ OE	Total
1	Industrial Economics Management and Entrepreneurship	3	--	--	3	100	25	--	125
2	Plant Utility and Pollution Control	3	--	--	3	100	25	--	125
3	Mass Transfer-II	3	1	2	6	100	25	25	150
4	Process Dynamics & Control	4	--	2	6	100	25	25	150
5	Chemical Reaction Engg.-I	3	1	2	6	100	25	25	150
6	Process Simulation Lab.	2	--	2	4	--	50	--	50
7.	Industrial Practices & Case Studies	1	--	2	3	--	50	--	50
	Total	18	02	10	30	500	225	75	800

SHIVAJI UNIVERSITY, KOLHAPUR

Equivalences of T.E. Chemical Engineering for repeater students

T.E.CHEMICAL ENGINEERING SEM.-V

Sr.No.	Pre-Revised	Revised	Remarks
1	Process Instrumentation and Instrumental Methods of Analysis	Process Instrumentation and Instrumental Methods of Analysis	--
2	Computer techniques in Chemical Engg	Computational techniques in Chemical Engg.	--
3	Mass Transfer-I	Mass Transfer-I	--
4	Chemical Engg. Thermodynamics-II	Chemical Engg. Thermodynamics-II	--
5	Chemical Equipment Design-I	Chemical Equipment Design-I	--
6	Soft Skill-I	Mini Project	-----------

T.E.CHEMICAL ENGINEERINGSEM.-VI

Sr.No.	Pre-Revised	Revised	Remarks
1	Industrial Economics , Management and Entrepreneurship	Industrial Economics , Management and Entrepreneurship	
2	Plant Utilities & Pollution Control	Plant Utilities & Pollution Control	
3	Mass Transfer-II	Mass Transfer-II	
4	Process Dynamics & Control	Process Dynamics & Control	
5	Chemical Reaction Engg.-I	Chemical Reaction Engg.-I	
6	Computer Applications	Process Simulation Lab	
7	Industrial Practices & Case Studies	Industrial Practices & Case Studies	

THIRD YEAR CHEMICAL ENGINEERING SEM.-V

1. PROCESS INSTRUMENTATION AND INSTRUMENTAL METHODS OF ANALYSIS

Lectures: 3 hrs per week
Practical: 2 hrs per week

Examination:
Theory: 100marks
Practical:
Term work: 25 marks
External: 25 marks

OBJECTIVES

1) To understand basic principle behind measurements and their applicability in chemical processes.
2) To understand differences between various analytical methods.
3) To understand correct analytical method for sample analysis.

OUTCOMES

On completion of the modules students should be able to

1) Select appropriate instruments for a given chemical parameter.
2) Calibrate instruments
3) Use various analytical methods for analysis of various industrial samples.

SECTION – I:

PROCESS INSTRUMENTATION

Unit 1.

Introduction: Basic Concepts and characteristics of measurement system, various elements of instrument, performance characteristics.

Pressure Measurement: Introduction, methods of pressure measurement by manometers, elastic pressure transducer, force balance pressure gauges, electrical pressure transducers and vacuum measurement. Pressure switches, calibration. Repairs and maintenance of pressure measuring instruments, trouble shooting.

Unit 2

Temperature measurement: Introduction, methods of temperature measurement by expansion thermometers, filled system thermometers, electrical temperature instruments, pyrometers. Calibration of Thermometers

Flow measurements: Introduction, methods of flow measurements by inertial flowmeters, quantity flow meters, and mass flow meters.

Unit 3

Liquid level measurement: Introduction, Methods of liquid level measurements by direct methods, indirect methods, electrical methods. Servicing of liquid level measuring instruments.

Data analysis and PLC

Text Books:

1. S.K.Singh, “Industrial Instrumentation & Control”, Tata McGraw Hill publishing company ltd, New Delhi, 2000
2. D. Pastranabis, “Principals of industrial instrumentation”, 2nd edition, Tata McGraw 4
Hill publishing company ltd, New Delhi, 2003

Reference Books:

1.Eckman D.P. “Industrial Instrumentation”, Willey Eastern Ltd, New Delhi, 1984.
2. A.C. Shrivastav “Techniques in Instrumentation”, New Delhi, 1984.
3. W.Boltan, “Instrumentation and Process Measurement”, Orient Longman Ltd,
Hyderabad, 1st Edition, 1993.

4. Ray Choudhuri and Ray Choudhuri "Process Instrumentation, Dynamics and control for Engineers", 1st Edition, Asian Books Pvt Ltd, New Delhi, 2003.

SECTION – II:

INSTRUMENTAL METHODS OF ANALYSIS

Unit 4.

Introduction to instrumental methods of analysis: General Introduction , classification of instrumental methods, spectroscopy, properties of electromagnetic radiation, electromagnetic spectrum, different types of molecular energies, interaction of electromagnetic radiations with matter , origin of spectrum, examples.

Visible Spectrophotometry & Colorimetry: Deviation from Beer's law, instrumentation applications. Molar compositions of complexes, examples.

Unit 5

Conductometry: Introduction, laws, conductance, measurements, types of conductometric titrations, applications, advantages and disadvantages.

Nephelometry and Turbidimetry: Introduction, theory, comparison with spectrophotometry, instrumentation, applications.

Refractometry: Introduction, Abbe refractometer, instrumentation, applications, optical exaltation, numericals.

Unit 6

Flame Photometry: Introduction, principles of flame photometry, instrumentation, interferences in flame photometry, limitations, and applications.

Chromatography: Introduction, types, theoretical principles, theories of chromatography, development of chromatography, qualitative and quantitative analysis, applications and numerical.

Gas Chromatography: Introduction, principles of gas chromatography, gas liquid chromatography, instrumentation, evaluation, retention volume, resolution. Branches of gas chromatography, applications and numericals.

High Performance (Pressure) Liquid Chromatography: Introduction, principles, instrumentation, apparatus & materials, column efficiency and selectivity, applications.

Reference Books:

1. Willard H.H, "Instrumental methods of analysis", 6th Edition, CBS Publication New Delhi 1986
2. Galen W. Ewing, "Instrumental Methods of Chemical Analysis", 5th Edition, McGraw Hill Book Company, Singapore, 1990
3. D. A. Skoog, "Principal of Instrumental Analysis", Southern Collage Publication, Japan 1984
4. G. R. Chatwal, S.K. Anand, "Instrumental method of chemical analysis", 5th Edition, Himalaya Publishing House, Mumbai 2002.

TERM WORK : (Any 10)

1. Calibration of pressure gauge.
2. Thermocouple calibration.
3. Liquid level measurement.
4. Flow measurement.
5. Acid–base titration with help of conductometer.
6. Experiment based on Nephelo turbidity meter.
7. Study of spectrophotometer.
8. Study of flame photometer.
9. Demonstration of GLC.
10. Demonstration of HPLC.
11. Measurements of RI of different liquid samples with Refractometer.
12. Determination of percentage composition with help of RI measurement.
13.Estimation Of total solids ,volatile solids , suspended solids and dissolved solids.
14. Industrial waste water analysis.

THIRD YEAR CHEMICAL ENGINEERING SEM.-V

2. COMPUTATIONAL TECHNIQUES IN CHEMICAL ENGINEERING

Teaching Scheme: **Exam:** Theory 100 Marks

Lectures: 3 hours/ week **Term Work:** 50 marks

Practicals: 2 hrs per week

OBJECTIVE:

Computational techniques use computers to solve problems by step-wise, repeated and iterative solution methods, which would otherwise be tedious or unsolvable by hand-calculations.
This course is designed to give an overview of computational techniques of interest to process engineer.However, the focus being on the techniques themselves, rather than specific applications.

OUTCOMES:

Understanding of fundamental mathematics and to solve problems of algebraic and differential equations, simultaneous equation, partial differential equations
Ability to convert problem solving strategies to procedural algorithms and to write computer based program structures
Ability to solve engineering problems using computational techniques
Ability to assess reasonableness of solutions, and select appropriate levels of solution sophistication

SECTION -1

Unit 1

Introduction of Numerical methods and error Introduction, Motivation and applications. Computation and Error Analysis- Introduction, Accuracy of Number. Error,Accuracy and precision; Truncation and round-off errors; Binary Number System; Error propagation.

Unit 2

Linear Systems and Equations

Matrix representation; Cramer's rule; Gauss Elimination; Matrix Inversion; LU Decomposition; Iterative Methods; Relaxation Methods; Eigen Values- Faddeev-Leverrier's Method, Power Method, Hosuseholder's and givens method

Unit 3

Algebraic Equations

Introduction, Bracketing methods: Bisection, Reguli-Falsi; Open methods: Secant, Fixed point iteration, Newton-Raphson; Multivariate Newton's method.

SECTION-II

Unit 4

Regression and Curve Fitting

Linear regression; Least squares; Total Least Squares; Interpolation; Newton's Difference Formulae; Cubic Splines. Pade Approximations, Richardson and Gaunt Technique.

Unit 5

Numerical Differentiation

Numerical differentiation; higher order formulae.Integration and Integral Equations-
Trapezoidal rules; Simpson's rules; Quadrature.

Unit 6

ODEs: Initial Value Problems

Euler's methods; Runge-Kutta methods; Predictor-corrector methods; Adaptive step size; Stiff ODEs.

ODEs: Boundary Value Problems

Shooting method; Finite differences; Over/Under Relaxation (SOR).

PDEs

Introduction to Partial Differential Equations.

Reference Books:

1. Gupta S.K. (1995) Numerical Methods for Engineers, New Age International.
2. Chapra S.C. and Canale R.P. (2006) Numerical Methods for Engineers, 5th Ed; McGraw Hill.
3. B. S. Grewal (2002) Khanna Publishers.
4. Davis. M.E., "Numerical Methods and Modeling for Chemical Engineers", Wiley 1984.
5. Alan. L,.Myers and Warren. D Seider., "Introduction to Chemical Engineering and Computer Calculations", Prentice Hall, Engle Wood Cliffs (N.J), 1976.
6. Jaan Kiusalaas "Numerical Methods in Engineering with MATLAB",Cambridge University Press, 2005

Term Work (Any 10)

Several Examples from Chemical Engineering fields to be solved using standard self-developed programmers by using computer-based exercises practical implementation. Using MATLAB/SCILAB/Fortran/C/C++ package.

1. Bisection Method
2. Regula-Falsi Method
3. Newton Raphson Method
4. Muller's Method
5. Multiplication of matrices
6. Gauss elimination method
7. Gauss Jordan Method
8. Factorization method
9. Power Method
10. Method of least square
11. Trapezoidal Rule
12. Euler's Method
13. Range-Kutta Method
14. Solution of heat equation
15. Solution of wave equation.

THIRD YEAR CHEMICAL ENGINEERING SEM.-V

3. MASS TRANSFER –I

Lectures: 4 hrs per week	**Examination:**
Tutorials- 1 hr per week	Theory : 100 marks
Practicals: 2 hrs per week	**Practical /Oral:**
	Term work: 25 marks
	External: 25 marks

OBJECTIVES:

The student completing this course are excepted to understand mass transfer operation with the concept of molecular diffusion, flux rate, theories of mass transfer, mass transfer coefficient, designed for equipment in which two phases are contacted. Application of Navier-Stoke equation in unsteady state convective mass transfer and mass transfer analogy. It gives details about method of conducting mass transfer operation, concepts of driving force, operating line, designing of stages for operations like adsorption, absorption, distillation, extraction, leaching, drying. Also it helps in process design and study of equipment for above mentioned operations. They will understand implication through laboratory experiments performed.

OUTCOME:

- To able to design equipment for mass transfer operations, the rate equations are important which can be utilized for optimization concept.
- Concept of steady state & unsteady state diffusional operations studied for controlling parameters in actual industrial process.
- Student can able and to understand the trouble shooting problem in actual operation
- To implement the knowledge of various unit operations in the real plants.

SECTION –I

Unit I

Introduction to mass transfer operations, Classification & Applications, Molecular diffusion in fluids, Concept of diffusivity ,Flux transfer equations for gas and liquid phase based on steady and unsteady state equation, empirical equations used to determine diffusivity through gas and liquid phase, equation of continuity and its application in the form of Navier -Stoke equation.

Diffusion In Solids: Steady State Diffusion, Unsteady State Diffusion, Diffusion in Polymers & Crystals.

Unit II

Mass transfer coefficients: Determination Of mass transfer coefficient through contacting equipment. Eddy diffusion, film theory, penetration theory, surface renewal theory, analogy of mass transfer, heat Transfer and its significance, mass transfer coefficient in laminar flow and turbulent flow, Simultaneous mass & heat transfer.

Interphase mass transfer:

Equilibrium, Study of Raults law, Daltons law, henrys law, Two Film Theory - Concept Of individual and overall mass transfer coefficient, operating line, driving force line. Cascades –cross current, Counter Current stages. Solved examples on stages and driving force lines with interfacial compositions.

Unit III

Equipment for gas –liquid operations:

a) Gas dispersed: Multistage absorption tray towers, Type of trays, flow arrangements on tray, Tray efficiency, Sparged vessels. Gas hold up – concept of sleep velocity.

b) Liquid dispersed:

Ventury Scrubber, Wetted wall tower, Spray tower, Spray chamber, Packed tower, Mass Transfer coefficients for packed tower, Random & Stacked packing, End effects and axial mixing, Tray tower Verses packed tower .Liquid hold up – determination of interfacial area based on hold up and Mass Transfer Coefficients.

SECTION –II

Unit IV

Gas absorption: Choice of solvent, Material balance on cross current and countercurrent absorption or stripping ,Absorption factor and stripping factor, Tray efficiency ,design equation for packed tower ,HETP,NTU,HTU calculation for packed tower.

Unit V

Adsorption: adsorption isotherm, Types of adsorbents, Adsorption equipment, Adsorption hysteresis, Heat of adsorption, break through curves, Single and multistage adsorption operation calculations, Principle of Ion Exchange, Principles & Techniques of Ion Exchange.

Unit VI

Mass transfer with chemical reactions: Theory of simultaneous mass transfer and chemical reaction, Theory of simultaneous mass transfer with reaction ,Mass transfer reaction operations considering heterogeneous and homogeneous slow reaction ,fast reaction.

Text Book:

1. Robert E. Treybal, “Mass Transfer Operations”, Third Edition, McGraw Hill, 1980.

References:

1. Thomas-K-Sherwood, Robert L. Pigford, Chorles R. Wilke, “Mass transfer”International Student Edition, McGraw Hill, Kogakusha Ltd., 1975.

2. McCabe and Smith, “Unit Operation of Chemical Engineering”, 5th Edition McGrawHill, Kogakusha Ltd., 1998.

3. Foust etal, “Principles of Unit Operations”,2nd Edition, John Wiley and Sons, 1979.

4. Richardson & Coulson, “Chemical Engineering”, Vol. 2 ,Pergamon Press, 1970.

5. G. Astalita Elsevier, “Mass Transfer with Chemical Reaction”, Publication.

6. C. J Geankolis, Transport Processes and unit operations, 3rd Edition, Prentice hall, India, 1993.

7. B.K Datta, Principles of mass transfer & separation process.

TERM WORK

1. Diffusivity of acetone in air.
2. Mass transfer through packed bed
3. Wetted wall tower.
4. Liquid –liquid diffusion.
5. Vapour – liquid equilibrium.
6. Surface evaporation.
7. Liquid hold up in packed column.
8. Batch adsorption.
9. Humidification & dehumidification.
10. Cooling Tower.

THIRD YEAR CHEMICAL ENGINEERING SEM.-V

4. CHEMICAL ENGINEERING THERMODYNAMICS- II

Teaching Scheme:

Lectures: 3 hours/ week

Tutorial: 1 hour/ week

Exam: Theory 100 Marks

Term Work: 25 marks

Course Objectives:

1) Students should be able to describe the terminologies associated with engineering thermodynamics.
2) Students should be able to calculate properties of ideal & real mixtures based on thermodynamics principles.
3) Students should be able to explain underlying principles of phase equilibrium in bi-component & multicomponent systems.
4) Students should be able to communicate effectively, both orally & in writing, regarding scientific & engineering principles and thermodynamics aspects of engineering design.
5) Students should be able to apply knowledge of problem solving to thermodynamics.
6) Students should be should be able to recognize the need for life-long learning in order to remain effective as scientist or an engineer.

Outcomes:

The learning outcomes are assessed through graded homework exercises, Assignments, mid semesters and a final exam. Science the course is a prerequisite for other course in the curriculum, there are additional opportunities to evaluate the extent to which course objective are achieved from the feed backs of the faculty teaching professional course such as process design and equipment design that have increased emphasis on application of basic principles, including control mass and volume

The acquired knowledge of vapour liquid equilibrium can be applied to various unit operation such as distillation, absorption etc. with the thorough knowledge of thermodynanmics purity of products and feasibility can be analyzed.

SECTION – I

UNIT 1 - VAPOR / LIQUID EQUILIBRIUM:

The nature of equilibrium, The phase rule &Duhem'sTherom, VLE: Qualitative Behavior, Simple models for Vapor / Liquid Equilibrium Raoults law, Dew point and bubble point calculations with Raoults law, Henry's law, VLE by modified Raoults law, VLE from k- value correlations, problems.

UNIT 2 - SOLUTION THERMODYAMICS: THEORY I

Fundamental Property Relation ,Chemical Potential & Phase Equilibria , Partial Properties, Equations relating molar & partial molar Properties,Partial Properties in Binary Solutions, Relations among partial Properties, Problems ,Ideal Gas Mixtures.

UNIT 3 - SOLUTION THERMODYAMICS: THEORY II

Fugacity & Fugacity Coefficient, pure Species & Species in Solution, the Fundamental Residual Property relation , the ideal Solution, The Lewis Randall Rule, Excess properties, The excess Gibbs Energy and the Activity Coefficient

SECTION –II

UNIT 4 - SOLUTION THERMODYNAMICS: APPLICATIONS

Liquid Phase Properties from VLE Data, fugacity ,Activity Coefficient, Excess Gibbs Energy, Data Reduction, Thermodynamic consistency, Models for Excess Gibbs Energy, Property Changes Of Mixing.

UNIT 5 - CHEMICAL REACTION EQUILIBRIA:

The Reaction Coordinate, Application of Equilibrium Criteria to Chemical reactions, The Standard Gibbs Energy change & the Equilibrium Constant, Effect of Temperature On the equilibrium Constant, Evaluation of Equilibrium Constants. Relation Of Equilibrium Constants to Compositions .Equilibrium Conversions For Single Reactions, Phase Rule & Duhem'sTherom For Reacting Systems.

UNIT 6 - THE PHASE EQUILIBRIA & THERMODYNAMIC ANALYSIS

Criteria of Phase equilibrium, Criterion of Stability .Phase Equilibrium in Single Component System, Non ideal Solutions. Liquid – Liquid Equilibrium (LLE), Solid – Liquid Equilibrium (SLE), Solid – Vapor Equilibrium (SVE), Work and free energy, availability, analysis of mixing and separation processes, Heat exchange and lost work calculations.

Text Books:

1. J.M.Smith, H.C.Vanness," Introduction to Chemical Engineering Thermodynamics" 7 th Edition, Tata McGraw Hill Publishing Co.
2. Thomas E Daubert, "Chemical Engineering Thermodynamics "McGraw Hill International Edition.

References:

1. K.V. Narayanan "Chemical Engineering Thermodynamics", Prentice Hall, India
2. B.F.Dodge "Chemical Engineering Thermodynamics, International Student Edition, McGraw Hill Publication.
3. O.A.Hougen, K.M.Watson& R.A. Rogatz "Chemical Process Principles", Vol –II, Asia Publishing House.
4. Kenneth Denbigh, the Principles of Chemical Equilibrium", Cambridge University Press.
5. S. I. Sandler "Chemical Engineering Thermodynamics" – Wiley - @nd Edition.
6. Koretsky M.D. "Engineering& Chemical Thermodynamics" – John Wiley & Sons – 2004.

THIRD YEAR CHEMICAL ENGINEERING SEM.-V

5. CHEMICAL EQUIPMENT DESIGN – I

Lectures: 4 hrs per week
Practical: 2 hrs per week

Examination:
Theory: 100 marks
Practical /Oral:
Internal: 50 marks
(Term work: 25, Demo Model: 25)
External: 25 marks

Objectives:

To introduce the students the Basic concept in design, different types of stresses involved, various types of joints, Design of various types of equipments like pressure vessel, storage vessel, vessel supports, heat exchangers, evaporators, agitator and reaction vessels

Outcomes:

On completion of the module students should be able to design individual pieces of equipment.

SECTION –I

Unit 1.

Design preliminaries.

Design codes, Maximum working pressure, Design pressure, Design temperature, Design stress & factor of safety, Weld joint efficiency factor, Corrosion allowance, Design wall thickness, minimum actual wall thickness, Design loadings, Moment of inertia, Radius of gyration, Section modulus

Unit 2.

Pressure vessels:

Classification of pressure vessels, Codes and Standards for pressure vessels. Design of pressure vessels under internal and external pressures .Design of thick walled high pressure vessels, Design of Gasket, Flanges, Nozzle, Design of spherical vessels.(Use ASME Sec A Div I and IS 2825 for above design procedure)

Storage vessels:

Storage of fluids, Different types of storage vessels, Design of cylindrical storage vessels with roof.

Unit 3.

Design of tall vessels.

Determination of longitudinal stresses, Period of vibration, Determination of resultant longitudinal stress

Design of Support for process vessels.

Design of Bracket Support, Lug Support, Skirt Support & Saddle support.

SECTION –II

Unit 4.

Mechanical design of heat exchanger.

Types of heat exchangers, Special type of heat exchangers, Design of Shell & Tube Heat Exchanger.(Use IS 4503 for above design procedure)

Mechanical design of evaporator.

Types of evaporators, Entrainment Separators, Design of Standard Short Tube Vertical Evaporator.

Unit 5.

Mechanical design of Reaction vessel.

Classification of reaction vessel, Heating systems, Design consideration

Mechanical design of Agitator.

Types of agitators, Baffling, Power requirements for agitation, Design of agitation system components

Unit 6.

Equipment testing methods.

Hydrostatic Pressure test, Pneumatic pressure test, Dye penetrant test, Magnetic test, Ultrasonic test, Freon test, Radiography test.

Process Hazards & Safety

Hazards in Process Industry, Analysis of Hazards, Safety Measures, Safety measures in Equipment Design, Pressure Relief Devices

Text Books:

1. B. C. Bhattacharya, "Introduction to chemical equipment design" (Mechanical accepts) 1985.
2. M. V. Joshi, "Process equipment design" McMillan India Ltd. 1981.Coulson J. M. and Richardson J. F., "Chemical Engg." Vol. 2 & 6, Pergaman Press, 1970.
3. Dr. S.D. Dawande, "Process Design of Equipment", Central Techno Publication, 1st Edition 1999.

References:

1. L. E. Brownel and E. H. Young "Process equipment design", Wiley Eastern Ltd.1977.

TERM WORK

1. Design of pressure vessels with heads ,flanges and gaskets.
2. Design of atmospheric storage vessels.
3. Design of head and closures
4. Design of tall vertical vessels
5. Design of supports.
6. Design of heat exchangers.
7. Design of reaction vessel.
8. Design of evaporator.
9. Design of agitation system

Note:

- Due prototype model containing all parts should be submitted by a group of 4-6 students. Demonstrated models of all components of vessels.
- Minimum 8 sheets needed to be drawn out of which 3 should be drawn with the help of software AutoCAD.

6. MINI PROJECT

Lectures: 1 hrs per week
Practical: 2 hrs per week

Examination:
Theory: NIL-
Practical /Oral:
Term work: 50 marks

Objectives:

- Development of ability to define and design the problem and lead to its accomplishment with proper
- Planning Learn the behavioral science by working in a group
- To develop student's abilities to transmit technical information clearly and test the same by delivery of Seminar based on the Mini Project.
- To understand the importance of document design by compiling Technical Report on the Mini Project work carried out

Outcomes:

After successfully completing this course, the student shall be able to:

- Understand, plan and execute a Mini Project with team.
- Implement basic engineering knowledge.
- Prepare a technical report based on the Mini project.
- Deliver technical seminar based on the Mini Project work carried out.

The project can be taken by group of 4 students and mini project can be carried out in the dept. under a guide or outside the department/institute/ company under a guide from the dept. and co guide from the outside department/institute/ company.

Evaluation procedure:

1	Report	Abstract, Introduction, Literature survey, And parameters planned to study
2	PPT Presentation	Evaluation by the committee

THIRD YEAR CHEMICAL ENGINEERING SEM.-VI

1. INDUSTRIAL ECONOMICS , MANAGEMENT AND ENTREPRENERSHIP

Lectures: 3hrs per week

Examination:
Theory: 100 marks
Practical /Oral:
Term work: 25 marks

OBJECTIVES:

1) To understand economical aspects in chemical industry.
2) To understand and introduce general common terms related to economics, management and entrepreneurship.
3) To make students to develop skills required for entrepreneurship development and leadership.

OUTCOMES:

Upon completion of the course students should:1) Understand basic models of the behavior of firms and industrial organization and how they can be applied to policy issues.
2) Be able to manipulate these models and be able to solve analytically problems relating to industrial economics.
3) Be able to apply the models to important policy areas while being aware of the limitations of the theory.

Section – I

Unit 1

Economic problem :

Law of Demand, Equilibrium between demand and supply, concepts of costs, cost curves and revenue curves of a firm, equilibrium of a firm under perfect competition,break-even analysis, break-even point.

National income: Concept of national income, estimation of national income,difficulties in measurement of national income, uses of national income figures.

Unit 2

Inflation:

Meaning, types of inflation, causes, effects, control of inflation, value of money, index numbers, construction, utility, limitations, business cycles, phases of business cycles.

Industrialisation:

Need, capital requirement, raising of finanace, cottege and small scale industries, role in the Indian economy, problems of small scale industries, remedies.

Unit 3

Entrepreneurship :

Need of entrepreneurship, Various Assistance Programmes for Small Scale and large Scale Industries through agencies, like IDBI,IFC,NSIC SFC,SIDCO and DIC

SECTION – II

Unit 4

Principles of management :

Definition ,nature ,levels of management ,functions of management .

a) **Planning** : nature ,importance ,types of plans ,planning process ,decision making.
b) **Organising** : Principles of organization ,process of organising ,organizational structure.
c) **Directing** : Theories of motivation ,communication ,process and barriers , leadership styles
d) **Controlling** : Control techniques .

Unit 5

Production management :

Selection of site , plant layout ,its type ,function of P.P.C. Materials management : purchase ,inventory control ,production and quality control.

Finanace management :

Scope and importance , capital structure planning ,working capital management , sources of funds ,financial institutions of India.

Unit 6

Marketing management :

Marketing concepts ,physical distribution ,advertising and sales promotion , marketing research ,sales management.

References :

1. Stonier , A.W. and Hague ,D.C. A Text Book of Economic Theory ,Longman.
2. Bach ,George Lealand , “ Economics Analysis ,Decision Making and policy”,Prentice Hall Inc .Engiewood Cliffs N.J.
3. Benham ,F. “ Economics “ ,Sir Issac Pitman and sons Ltd ., London.
4. Jhingan,M.L.“Advanced Economics Theory” ,Vikas publishing House Pvt .Ltd ,New Delhi .
5. Seth , M.L . “ Principles of Economics ,Lakshmi Narain Agarwal,Agra.
6. Agarwal , A.N. “ Indian Economy” ,Vikas Publishing House Pvt .Ltd ,New Delhi .
7. Datta R and Sundharam , K.P.M “ Indian Economy” S.Chand & Co.Ltd ,New Delhi .
8. Peter F .Drucker “ The Practice of Management” ,Allied publishers pvt. Ltd ,Bombay.

THIRD YEAR CHEMICAL ENGINEERING SEM.-VI

2. PLANT UTILITIES AND POLLUTION CONTROL

Lectures: 3 hrs per week

Examination:
Theory: 100 marks
Term work: 25 marks

Objectives

The main objective of this subject is to provide the opportunity to understand the principles of plant utilities and pollution control in modern society. The subject develops an understanding of air, water, steam, insulation as utilities and water, air, solid pollution control technologies, as well as better product or process design to mitigate the problems of utilities and pollution both in the chemical industry and other process industries. It also begins to tackle the problems of water, air, solid and hazardous waste minimization, generation, treatment and disposal. Topics include utilities and waste characterization, generation and composition analysis, development of optimum collection routing networks, transfer stations, design, operation and maintenance of sanitary landfills, and related social and environmental issues. Other topics include: Boiler, insulation and control of the generation of specific pollutants from the projects such as wastewater treatment works and waste management disposal sites.

Outcomes:

Upon successful completion of this course students students are be able to:

Apply the principles of utilities and waste minimization, source reduction, material use and recovery in the design of utilities and pollution control and develop technical knowledge and apply design skills related to utilities and pollution control in chemical industries, generator and waste treatment.

SECTION-I

Unit 1
Purification of Water : Methods of Purification of Water, Treatment of Boiler Feed Water,Color Codes of water ,Air and Process Streams etc.
Unit 2
Steam : Steam generators ,Classification ,Indian act of Boiler ,Mountings and accessories ,Types Of Steam ,Types of Steam, Superheaters ,Injectors ,Condencers ,Performance of Boilers & Boiler Calculations .[More Weight age should be given to Boiler Calculations.
Unit 3.
Air Fluids: Introduction, Compressed Air ,Blower Air ,fan air ,Types Of Compressor ,Instrumental Air . Fire & Industrial Safety

Section – II

Unit 4

Air pollution control:

Sources and effects .air pollution monitoring system, theory ,design and operating principles of the air pollution control equipments, dry collectors ,wet collectors ,electrostatic precipitators ,thermal combustion techniques ,control of air pollution in industry viz. Iron and Steel industries ,paper and pulp industries ,cement industries. Thermal power plants.

Stream and river pollutions:

Causes and parameters to be measured ,pollution control legislation measure, Maharashtra pollution control board norms(MPCB norms), Iso norms for Environmental quality assessment.

Unit 5

Primary and Secondary waste water treatment :

Theories and practices of equalization, neutralization , screens ,grit removal, floatation, settling & Coagulation. Trickling filters , activated sludge process and its modification and anaerobic sludge treatment, low cost waste treatment methods such as stabilization ponds ,Oxidation & aerate lagoons, roots zone technologies etc.

Solid Waste Disposal:

Sources and effects ,Characterisation, resources consumption and recovery, treatment and disposal method ,Sludge handling and disposal.

Unit 6

Advanced Oxidation processes:

Photo catalytic treatment.
Treatment with H2O2 and ozone.
Wet Oxidation Process.
Supercritical Oxidation.

Removal of oxides of nitrogen :

Introduction , Analysis Of Nox ,Control Measures .

Pollution Control aspects of fertilizer industries:

Introduction, ammonia plant effluents, ammonia sulfate plant, Phosphoric acid plant, complex fertilizer plant.

Text Books:

Ashutosh Pande, Plant Utilities, Vipul Prakashan, Mumbai.
,D.B.Dhone , " Plant Utilities ", NiraliPrakashan ,Pune.
B.I.Bhatt ,S.M. Vora, "Stoichiometry",Tata McGraw Hill Publisning Company Ltd.
S. P. Mahajan, "Pollution Control in Process Industries", Tata McGraw hill, 1985.
Matcalf and Eddy, "Waste Water Engineering Treatment", Tata
C. S. Rao "Environmental pollution control engineering" Wiley Eastern, Ltd 1994.

References:

1. WarenViessman and Mark J. Hammer, "Water supply and pollution control", Harper & Row, New York, 1985.
2. M.V. Rao and A. K. Datta : "Waste Water Treatment".
3. U. N. Mahida, "Water Pollution and disposal of Waste Water on land".
4. Soli Arceivala, "Waste Water Treatment for Pollution Control".
5. "Chem. Tech. I". Chemical Engg.Edu.Development Centre, I. I. T., Madras, 1975.
Lund H. F,"Industrial Pollution Control", Hand Book , McGraw Hill, 1971.
H. C. Perkins, "Air Pollution", McGraw Hill 1974.
D. J. Hagertyet. al. "Solid Waste Management", Van Nostrand Reinhold 1973.
L. D. Benffield and C. W. Randall, "Biological Process Design for Waste Water treatment", Prentice Hall, 1980.

C. P. Gaady Jr. and H. C. Lim “Bio-logical Waste Water Treatment”, 1980.
Degrenont, “Water Treatment” Hand Book Wiley, 1979.
M. J. Hammer, “Water & waste water Technology”, Wiley, 1975.
Artur L. Kohi and Fred C. Reisenfled, “Gas Purification”, Gulf Publishing Co.1979.
Arcadio P. Sincero, Gregoria A. Sincero, “Environmental engineering” (Design approach), Prentice Hall of India Pvt. Ltd, New Delhi, 1999.
G.D.Ulrich,”A Guide to Chemical Engineering Process Design and Economics”,John Wiley and Sons 1934.

THIRD YEAR CHEMICAL ENGINEERING SEM.-VI

3. MASS TRANSFER – II

Lectures: 3 hrs. per week	**Examination:**
Tutorial: 1 hr. per week	Theory :100 marks
Practicals: 2 hrs. per week	**Practical /Oral:**
	Term work: 25 marks
	External:25 marks

OBJECTIVES:

The student completing this course are excepted to understand mass transfer operation with the concept of molecular diffusion, flux rate, theories of mass transfer, mass transfer coefficient, designed for equipment in which two phases are contacted. Application of Navier-Stoke equation in unsteady state convective mass transfer and mass transfer analogy. It gives details about method of conducting mass transfer operation, concepts of driving force, operating line, designing of stages for operations like adsorption, absorption, distillation, extraction, leaching, drying. Also it helps in process design and study of equipment for above mentioned operations. They will understand implication through laboratory experiments performed.

OUTCOME:

- To able to design equipment for mass transfer operations, the rate equations are important which can be utilized for optimization concept.
- Concept of steady state & unsteady state diffusional operations studied for controlling parameters in actual industrial process.
- Student can able and to understand the trouble shooting problem in actual operation
- To implement the knowledge of various unit operations in the real plants.

SECTION –I

Unit I

Distillation: Vapor Liquid Equilibrium, Ideal Solutions, Relative volatility, Azeotropic mixtures, Methods Of distillation: Flash, Differential, Steam, Vacuum, molecular, Continuous, Multicomponent system, batch rectification, Introduction to reactive distillation. Analysis and determination of stages: Material balance, Analysis of Fractionating column by McCabe Thiele method, Ponchon Savarit method, Lewis –Sorrel method, Lewis Matheson, Transfer unit Concept in Packed Column Design.

Unit II

Liquid–Liquid Extraction: Liquid Equilibrium, coordinate systems, cross and counter current operation and its calculation, selection of extractors, Extraction Equipment.

Unit III

Leaching: Leaching Principles, Various Types of Leaching Operations with application, Method of Calculations, Leaching equipment.

SECTION –II

Unit IV

Humidification:

Application of Humidification, Study of Adiabatic Saturation Curve, Humidifier height calculations, definition of wet bulb ,dry bulb and equation for wet bulb depression, water cooling tower, Spray chamber, Evaporative Cooler.

Unit V

Drying: Theory and Mechanism of Drying, Steady and Unsteady Drying, Definition of moisture content, total time of drying, length of continuous dryer, Characteristics, Classification and selection of Industrial dryers.

Unit VI

Crystallization: Nucleation, Crystal Growth, Methods of super saturation, Overall and Individual Growth coefficient, material and enthalpy balance of crystallizer, The Law of Crystal Growth Crystallization Equipment.

Text Book:

1.Robert E. Treybal, “Mass Transfer Operations”, Third Edition, McGraw Hill, 1980.

References:

1. Thomas-K-Sherwood, Robert L. Pigford, Chorles R. Wilke, “Mass transfer”International Student Edition, McGraw Hill, Kogakusha Ltd., 1975.
2. McCabe and Smith, “Unit Operation of Chemical Engineering”, 5th Edition McGrawHill, Kogakusha Ltd., 1998.
3. Foust et.al, “Principles of Unit Operations”, 2nd Edition, John Wiley and Sons, 1979.
4. Richardson & Coulson, “Chemical Engineering”, Vol. 2, Pergamon Press, 1970.
5. G. Astalita Elsevier, “Mass Transfer with Chemical Reaction”, Publication.
6. C. J Geankolis, Transport Processes and unit operations, 3rd Edition, Prentice hall, India, 1993.
7. B.K Datta, Principles of mass transfer & separation process.
8. K. D Patil, Mass Transfer Operation Vol. I & II.

TERM WORK (Any 10)

1. Simple Distillation.
2. Packed column distillation
3. Steam distillation.
4. Tray dryer
5. Vacuum dryer
6. Rotary dryer.
7. Cross current leaching.
8. Counter current leaching.
9. Binodal curve.
10. Single stage and multistage extraction.
11. Packed column extraction.
12. Batch crystallization.
13. Demonstration of batch rectification column.

THIRD YEAR CHEMICAL ENGINEERING SEM.-VI

4. PROCESS DYNAMICS & CONTROL

Teaching Scheme	Examination Scheme
Lectures: 4 hours / week	Theory: 100 marks
Practical: 2 hrs/week	Term Work: 25 Marks
	Practical / Oral: 25Marks

OBJECTIVES

The students completing this course are expected to understand the basic principles and problems involved in process control. They are expected to understand dynamic behavior of different order systems with examples and response to various forcing functions. They are able to understand design aspects of process control system, block diagram preparation, various types of controllers and there selection for particular application. To evaluate and analyze the transfer functions for various elements of the various control systems and processes. The students are expected to quantify and acquire knowledge of different stability methods such as standard algebraic method, Root locus method, frequency response. Application of control system to unit operations such as heat exchangers, Absorption column, jacketed kettle, Distillation tower. The students have to perform experiments based on theory to acquire practical knowledge. So that they can understand how the chemical engineering parameters are controlled.

OUTCOMES

The learning outcomes are assessed through graded hour assignment, mid-semester and final exam. The students are performing the experiments to gain the knowledge relative theory. The students are able to design the controllers, optimize the parameters by controlling them to optimum to achieve more profit with minimum operating cost. They have increased emphasis on application of basic principles of control system related to chemical engineering operations.

Section-I

Unit 1-

Review of Laplace Transform & Basic Principles & problems involved in process control: (5 lectures)

Definition of transform, properties of Laplace transform, initial & final value theorem, examples, Need of process control, Principals involved in process control, agitated heating tank control system, steady state and transient design, step input, P control, PI control ,Block diagram.

Unit 2-

Dynamic behavior Of First order & Higher order: Second order System (8 lectures)

First order system, Mercury in glass thermometer, Transfer Function, Time constant, Transient response of First order system, Single liquid level system, Mixing process, heating process, Linearization of non linear system, Response of first order system in series**,** Non interacting system, Interacting system, examples, second order systems, U tube manometer, Damped vibrator, step response for second order systems, terms used to describe second order under damped system, Transportation lag, examples

Unit 3

Control System (10 lectures)

Introduction, control system for CSTR, Block diagram, Development of block diagram, negative versus positive feedback control system, servo & regulator problem, Introduction to feedback control, concept, Types of Feedback Controllers like P,PI,PD,PID with transfer function and application, motivation for addition of integral and derivative modes of control, final control element, control valves with transfer function, block diagram for chemical reactor control system, Introduction to MATLAB software, examples

Section-II

Unit 4

Overall transfer function & Transient response of simple control system (5 lectures)

Overall transfer function single loop system, Overall transfer function for change in set point & load, Overall transfer function multiple loop system, offset, P controller for change in set point & load point, PI controller for change in set point & load point, examples.

Unit 5

Stability Analysis of Feedback Systems (8 lectures)

Concept of Stability, definition, Stability criterion, The Characteristic Equation, Routh-Hurwitz Criterion for Stability with theorems and limitations, examples, Root-Locus Analysis, concept, plotting root locus diagram, rules for negative feedback system, examples.

Unit 6

Frequency Response Analysis of Linear Processes (8 lectures)

Substitution rule, The Response of a First-Order System to a. Sinusoidal input, Bode diagrams,Rules, Bode plot for a) first order system ,b) second order system, c) Transportation lag, d) Bode plot for P,.PI,.PD controller, Bode stability criterion, gain & phase margin,

Text Books:

1. Le Blanc & Coughanowr, "Process system analysis and C-ontrol", McGraw Hill, Third edition
2. Coughanowr Koppel, "Process System Analysis and Control", McGraw Hill, New York.
3. Donald K. Coughanowr, "Process system analysis and control", McGraw Hill, Second edition, New York, 1991

References:

1. Peter Harriott, "Process Control", Tata McGraw Hill, New Delhi, 1977.
2. Coulson and Richardson, "Chemical Engineering" Volume – III, Second Edition, Pergmon Press, (UK), 1985
3. Stephanopoulos G ,"Chemical Process Control and introduction to theory and practice

TERM - WORK: (Any10)

1. Time Constant of Thermometer.
2. Time Constant of Manometer.
3. Liquid Level Control System.
4. Two Tank Interacting System.
5. Two Tank non-interacting System.
6. Study of Control Valve Characteristics.
7. Control of Flow System.
8. Control of level System.
9. Control of Pressure System.

10. Control of temp control System.
11. PID control of Shell and tube heat exchanger.
12. Transient Response of U Tube Manometer.

THIRD YEAR CHEMICAL ENGINEERING SEM.-VI

5. CHEMICAL REACTION ENGINEERING –I

Lectures: 3 hrs. per week
Tutorial: 1 hrs. per week
Practical: 2 hrs. per week

Examination:
Theory: 100 marks
Practical /Oral:
Term work: 25 marks
External: 25 marks

Objectives:

1. Write a rate law and define reaction order and activation energy
2. Demonstrate the ability to quantitatively predict the performance of common chemical reactors using simplified engineering models
3. Demonstrate the ability to regress the experimental data from which they determine the kinetic model of a multi-reaction system and use this information to design a commercial reactor.

Outcomes:

1. Ability to size batch reactors, semi batch reactors, CSTRs, PFRs, for isothermal operation given the rate law and feed conditions.
2. Ability to define and develop rate equations for homogeneous reactions
3. Ability to derive design equations for different types of reactors based on mole and energy balance.
4. Ability to relate rate of reaction with design equation for reactor sizing.

SECTION –I

Unit 1.

Introduction with Kinetics of homogeneous reactions :

Chemical kinetics and thermodynamics of reaction; Classification of reactions – Homogeneous and Heterogeneous reactions. Rate of reaction- broad definition for homogeneous and heterogeneous reactions. Irreversible and reversible reactions ,Equilibrium ,Order and molecularity of reaction .Elementary and non elementary reactions , Stoichiometry ,Fractional conversion .Rate of reaction based on all components of the reaction and their inter relation .Law of mass action ,Rate Constant Based on thermodynamic activity, partial pressure, mole fraction and concentration of the reaction components and their interrelation Temperature dependency of rate Constant , Arrhenius law ,Transition state theory and collision theory.

Unit 2.

Interpretation of batch reactor data:

Batch reactor concept, Constant volume batch reactor system; Design equation for zero ,first, Second and third order irreversible and reversible reactions ,graphical interpretation of these equations and their limitations ,Variable volume Batch reactors .Design equation for zero , first and second order irreversible and reversible reactions ,graphical interpretation of their limitations, Introduction to catalytic and auto catalytic reactions ,Rate equation concept for these reactions .Multiple reactions-stoichiometry and Rate equations for series and parallel reactions; Non elementary single reactions Development of rate expression; chain reactions development of rate expressions.

Unit 3.

Ideal flow reactors:

Concept of ideality. Types of flow reactors and their differences, Space-time and space velocity. Design equation for plug flow reactor and CSTR; Design equations for first and second order reversible and irreversible constant volume and variable volume reactor. Graphical interpretation of these equations; mean holding time; Development of rate expression for mean holding time for a plug flow reactor.

SECTION –II

Unit 4.

Single and multiple reactor system :

Size comparison of single reactors ;Optimum size determination ;Staging of reactors , reactors in series and parallel; Performance of infinite number of back mix reactors in series ,Back mix and plug flow reactors of different sizes in series and their optimum way of staging ; Recycle reactors ,Optimum recycle ratio for auto –catalytic (recycle)reactors.

Unit 5.

Design for multiple reactions :

Yield and selectivity, Parallel reactions Requirements for high yield. Best operating condition for mixed & plug flow reactors, Series reactions Maximization of desired product rate in a plug flow reactor and back mixed reactor.

Unit 6.

Temperature effects in homogeneous reactions:

Equilibrium Conversion, Optimum temperature progression, Adiabatic and non adiabatic operations, Rate, Temperature and conversion profiles for exothermic and endothermic reactions, Stable operating condition in reactors.

References:

1. Octave Levenspeil, “Chemical Reaction Engineering”, 2nd Edition, John Wiley, London.
2. S.H. Fogler,” Elements of Chemical Reaction Engineering”, PHI, 4 th Edition.
3. S. M. Walas, “Reaction Kinetics for Chemical Engineers” McGraw Hill, New York.
4. J. M. Smith, “Chemical Engineering Kinetics”, McGraw Hill, New York.
5. J. Rajaram and J. C. Kuriacose, “Kinetics and Mechanics of Chemical Transformation”, McMillan India Ltd., 1993.

TERM WORK(Any 10)

1. To calculate value of rate constant “K” for the saponification of ethyl acetate with NaOH in batch reactor-I (where M=1)
2. To calculate value of rate constant “K” for the saponification of ethyl acetate with NaOH in batch reactor-II (where M=2)
3. To calculate value of rate constant “K” for the saponification of ethyl acetate with NaOH in straight tube reactor.
4. To calculate value of rate constant “K” for the saponification of ethyl acetate with NaOH in bend tube reactor.

5. To calculate value of rate constant “K” for the saponification of ethyl acetate with NaOH in helical coil reactor.
6. To calculate value of rate constant “K” for the saponification of ethyl acetate with NaOH in spiral coil reactor.
7. To calculate value of rate constant “K” for the saponification of ethyl acetate with NaOH in packed bed reactor.
8. To calculate value of rate constant “K” for the saponification of ethyl acetate with NaOH in mixed flow reactor.
9. To calculate value of rate constant “K” for the saponification of ethyl acetate with NaOH in mixed flow reactors in series.
10. Verification of Arrhenius law.
11. To calculate rate of reaction of auto catalytic reaction in recycle reactor.

Note: Experimental calculations & graphs by using software’s like Polymath, Excel etc.

THIRD YEAR CHEMICAL ENGINEERING SEM.-VI

6.PROCESS SIMULATION LAB

Lectures: 2 hrs. per week
Practical: 2 hrs. per week

Examination:
Theory : Nil
Practical /Oral:
Term work: 50 marks
External : ------------

Objectives:

To introduce basic concepts of computer applications to solve chemical engineering problems.
To make use of computer oriented methods for solving problems.
To develop computer programming skills for solving problems related to fluid mechanics, heat transfer, mass transfer and reaction engineering.

OUTCOMES:
After successfully completing this course, the student shall be able to:
- Understand, plan and execute a chemical Processes
- Implement basic engineering knowledge.
- Prepare a computer based technical report.

THEORY:

1. **Material balances for mixing of multiple streams:** Recycling of a multi component Stream without chemical reactions; Curve fitting examples; Specific heats, Vapor pressure, PVT Equations.

2. **Estimation of Pipe diameter by Trial and Error:** Optimum Pipe Diameter, Determination of flow rates in branched Sections, Determination of Average velocity from velocity profiles.

3. **Optimum Insulation thickness:** Optimum outlet temperature for Heat exchangers, Optimum diameter of Heat exchanger tubes, design of multiple effect evaporators.

4. **Determination of Optimum Reflux:** Product compositions / Temperatures / Flow Rates / Pressures in Multi component flash Distillation, Number of Theoretical stages by McCabe Thiele and other methods.

References:

1. Robert E. Treybal, “Mass Transfer Operations”, Third Edition, McGraw Hill, 1980.
2. Octave Levenspeil, “Chemical Reaction Engineering”, 2nd Edition, John Wiley, London.

3. S. M. Walas, “Reaction Kinetics for Chemical Engineers” McGraw Hill, New York.

4. Peter Harriott, “Process Control”, Tata McGraw Hill, New Delhi, 1977.

5. B. C. Bhattacharya, “Introduction to chemical equipment design” 1985.

6.Bansal A.K. ,Goel .M.K. ,Sharma ,”MATLAB and its application in engineering “,Person education ,2012.

TERM -WORK :

Note -Practical’s are to be performed using Scilab/Matlab.

1. Write and execute computer program to find specific heat and vapor pressure.
2. Write and execute computer program to find optimum diameter of pipe.
3. Write and execute computer program to determine flow rates and average velocity.
4. Write and execute computer program to find optimum insulation and optimum temperature for heat exchanger.
5. Write and execute computer program to design a heat exchanger.
6. Write and execute computer program to design multi effect evaporator.
7. Write and execute computer program to find optimum reflux, product composition in distillation.
8. Write and execute computer program to find number of theoretical stages by any method.
9. Write and execute computer program to find mass balance in continuous stirred tank reactor.
10. Write and execute computer program to find the length of a packed bed heat exchanger

THIRD YEAR CHEMICAL ENGINEERING SEM.-VI

7. INDUSTRIAL PRACTICES & CASE STUDIES

Lectures: 1hrs. per week
Practical: 2 hrs. per week

Examination:
Theory : Nil
Practical /Oral:
Term work: 50marks
External: ------------

OBJECTIVES:

The objectives of this course are to

- Bridge the gap between lecture room explanations and real life experiences
- Expose students to various organizations in the chemical industry chain from production, research, to processing and consumption.
- Expose students to opportunities for self-employment in the chemical sector after graduation
- Introduce students to organization of chemical industry and allied orgaisations

OUTCOMES:

Upon successful completion of this course, the student will be able to; (Knowledge based)

- Acquire basic information of sources of raw materials for chemical industries as well as their products and by- products of such activities and what uses they could be put to.
- Understand how industrial establishments are administered.

The Concerned staff member should take the students of a batch consisting of 15 – 20 once a week to an industry , Before taking them to an industry ,the staff member has to give complete details of the particular industry in the theory class .In a semester ,they have to visit a minimum of 5 industries and submit brief reports.

The term work mark shall be given on

1. No. of industrial visits
2. Reports
3. Orals and /or
4. Written examination.

Report shall consist of:

1. History.
2. Raw materials.
3. Process flow chart.
4. Equipment details.
5. Pollution control aspects.

6. Production process details.
7. Quality control aspects.
8. Cost of Production and profits.
9. Suggestions for improvement.
10. Safety aspects.
11. Process hazards and safety measures in chemical process industries: Safety in industries ,chemical process industries , Potential Hazards, Physical job safety analysis. High Pressure High temp operation ,Dangerous and toxic chemicals, Highly explosive and inflammable chemicals , Highly radioactive materials ,Safe handling & operation of materials .Planning & layout, industrial accidents and remedial measures ,effective steps to implement safety procedures, periodic inspection, study of plant layout and constant maintenance, Periodic advice and checking to follow safety procedures ,Proper selection and replacement of handling equipment, Personal protective equipment.
12. P & I Diagram at least for any one plant which they have visited should be drawn.
13. Final Year Project Topics & Guide should be finalized & minimum five page literature survey should be submitted in the term work.

Reference:

1) Hand Book of Cane Sugar Engineering by Hugot E - Elsevier Applied Science Publication
2) Hand Book of Cane Sugar by Cane.J.C.P.- John Wiley & Sons.
3) Milk & Milk Products by Eckles.C.H. - Tata McGraw hill Publication
4) Dairy of an Frank by Nigudkar M - Mehta Publication
5) Principles of Distillation by Pandharipande.S. - Central Techno Publication
6) Distillation Engineering by Billet.R. - Chemical Publishing
7) Pulp & Paper by Casely.J.P. - John Wiley & Sons
8) Shreves Chemical Process Industries by Austin.G.T. – McGraw hill Book Co.
9) Handbook of Analysis & Quality for fruit & Vegetable products by Ranganna.S. - Tata McGraw hill Publication
10) Petrochemicals by Wiseman.P. - John Wiley & Sons.
11) Applied Process Design for Chemical & Petrochemical Plants by Ludwig.E.E. - Gulf Publication
12) Journal of Chemical Engineering World
13) Chemical Industry Digest
14) Indian Journal of Chemical Technology

SHIVAJI UNUVERSITY, KOLHAPUR

Structure of B. E. (Chemical. Engg.) Semesters VII & VIII

Semester –VII

Sr. No.	Name of the Subject	Teaching Scheme(Hrs)				Examination Scheme (Marks)				
		L	T	P	Total	Theory	TW	POE	OE	Total
1	Chemical Reaction Engg.-II	4	--	2	6	100	25	25	--	150
2	Chemical Process & Synthesis.	3	--	--	3	100	--	--	--	100
3	Chemical Process Design	4	--	2	6	100	25	---	25	150
4	Modeling & Simulation in Chemical Engineering	4	--	2	6	100	25	25	--	150
5	Elective-I	3	--	--	3	100	--	--	--	100
6	Seminar	--	--	2	2	--	25	--	--	25
7	Comprehensive tests On all subjects from S.E to B.E-I	--	--	2	2	--	50	--	--	50
8	Industrial Training (At the end of VI Semester -- 4 weeks)	--	--	--	--	--	25	--	--	25
9	Project Work	--	--	4	4	--	50	--	--	50
	Total	**18**	**--**	**14**	**32**	**500**	**225**	**50**	**25**	**800**

[Note: - Examination scheme and term work marks strictly as per above structure]

Semester –VIII

Sr. No.	Name of the Subject	Teaching Scheme(Hrs)				Examination Scheme (Marks)				
		L	T	P	Total	Theory	TW	POE	OE	Total
1	**Chemical Process & Green Technology**	4	--	2	6	100	25	25	--	150
2	**Transport Phenomena**	3	1	--	4	100	25	--	--	125
3	**PEPE**	4	--	--	4	100	25	--	--	125
4	**Elective – II**	4	--	--	4	100	--	--	--	100
5	**Elective—III**	4	--	--	4	100	--	--	--	100
6	**Advanced separation processes**	1	--	2	3	--	25	25	--	50
7	**Project Work**	--	--	6	6	--	50	--	100	150
	Total	**20**	**01**	**10**	**31**	**500**	**150**	**50**	**100**	**800**

[Note: - Examination scheme and term work marks strictly as per above structure]