

St. PETER'S UNIVERSITY

Chennai – 600 054.

B.TECH. CHEMICAL ENGINEERING 3 & 4 SEMESTERS CURRICULUM AND SYLLABI

Regulations – 2008

SEMESTER III

(Applicable to the students admitted from the Academic year 2008–2009 onwards)

Code No.	Course Title	Credit	L	T	P	Marks		
						CA	EA	Total
Theory								
308CHT01	Transforms and Partial Differential Equations	3	3	1	0	25	75	100
308CHT02	Electrical Drives and Controls	3	3	0	0	25	75	100
308CHT03	Organic Chemistry	2	3	0	0	25	75	100
308CHT04	Mechanics of Solids	2	3	0	0	25	75	100
308CHT05	Fluid Mechanics	2	3	0	0	25	75	100
308CHT06	Environmental Science and Engineering	3	3	0	0	25	75	100
Practical								
308CHP01	Organic Chemistry Lab.	1	0	0	3	25	75	100
308CHP02	Basic Electrical Electronics Engineering Lab.	1	0	0	3	25	75	100
308CHP03	Fluid Mechanics Lab	1	0	0	3	25	75	100
Total		18	18	1	9	225	675	900

SEMESTER IV

(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

Code No.	Course Title	Credit	L	T	P	Marks		
						CA	EA	Total
Theory								
408CHT01	Probability and Statistics	3	3	1	0	25	75	100
408CHT02	Physical Chemistry	3	3	0	0	25	75	100
408CHT03	Instrumental Methods of Analysis	2	3	0	0	25	75	100
408CHT04	Chemical Process Industries I	2	3	0	0	25	75	100
408CHT05	Chemical Process Calculations	2	3	0	0	25	75	100
408CHT06	Mechanical Operation	3	3	0	0	25	75	100
Practical								
408CHP01	Chemical Analysis Lab	1	0	0	3	25	75	100
408CHP02	Physical Chemistry Lab	1	0	0	3	25	75	100
408CHP03	Mechanical Operations Lab	1	0	0	3	25	75	100
Total		18	18	1	9	225	675	900

308CHT01 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS 3 1 0 4
(Common to all branches of BE / B.Tech Programmes)

OBJECTIVES

The course objective is to develop the skills of the students in the areas of Transforms and Partial Differential Equations. This will be necessary for their effective studies in a large number of engineering subjects like heat conduction, communication systems, electro-optics and electromagnetic theory. The course will also serve as a prerequisite for post graduate and specialized studies and research.

UNIT I FOURIER SERIES 9 + 3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORMS 9 + 3

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9 + 3

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

UNIT V Z-TRANSFORMS AND DIFFERENCE EQUATIONS 9 + 3

Z-transforms - Elementary properties – Inverse Z-transform – Convolution theorem - Formation of difference equations – Solution of difference equations using Z-transform.

Lectures : 45

Tutorials : 15

Total : 60

TEXT BOOKS

1. Grewal, B.S, "*Higher Engineering Mathematic*", 40th Edition, Khanna publishers, Delhi, (2007)

REFERENCES

1. Bali.N.P and Manish Goyal, "*A Textbook of Engineering Mathematic*", 7th Edition, Laxmi Publications(P) Ltd. (2007)
2. Ramana.B.V., "*Higher Engineering Mathematics*", Tata Mc-GrawHill Publishing Company limited, New Delhi (2007).
3. Glyn James, "*Advanced Modern Engineering Mathematics*", 3rd Edition, Pearson Education (2007).
4. Erwin Kreyszig, "*Advanced Engineering Mathematics*", 8th edition, Wiley India (2007).

OBJECTIVE

- To understand the basic concepts of different types of electrical machines and their performance.
- To study the different methods of starting D.C motors and induction motors.
- To study the conventional and solid-state drives.

1. INTRODUCTION 8

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors

2. DRIVE MOTOR CHARACTERISTICS 9

Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.

3. STARTING METHODS 8

Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

4. CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES 10

Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers –applications.

5. CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES 10

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.

TOTAL : 45 PERIODS

TEXT BOOKS

1. VEDAM SUBRAHMANIAM, “Electric Drives (concepts and applications)”, Tata McGraw-Hill, 2001
2. NAGRATH.I.J. & KOTHARI.D.P, “Electrical Machines”, Tata McGraw-Hill, 1998

REFERENCES

1. PILLAI.S.K “A first course on Electric drives”, Wiley Eastern Limited, 1998
2. M.D.SINGH, K.B.KHANCHANDANI, “Power Electronics”, Tata McGraw-Hill, 1998
3. H.Partab, “Art and Science and Utilisation of electrical energy”, Dhanpat Rai and Sons, 1994.

AIM

To study the type of components in which organic reaction are taking place and also to know the preparation of the essential organic compounds.

OBJECTIVES

At the end of the course students are in a position to have knowledge on various reaction, Mechanism, preparation of organic compounds classification of the compounds. This will be a pre cursor for the study on Chemical Reaction Engineering.

UNIT I UNIT PROCESS**9**

Definitions – reagents- mechanism – catalyst – illustrations of the following unit process – nitration – halogenation – oxidation & reduction – esterification.

UNIT II ORGANIC REACTIONS MECHANISM AND ESTIMATION**9**

Electrophilic reaction - Friedel craft reaction, Riemer Timenn Reaction; Nucleophilic reactions - Aldol condensation, Benzion condensation; Free radical reaction - Halogenation of Alkane, Addition HBR on Alkene in presence of peroxide

UNIT III**9**

Alylic halogenation using N-Bromo succinamide (NBS); Thermal halogenation of Alkane ($\text{CH}_3\text{-CH=CH}$); condensation and polymerization reaction – oxidation and reduction reactions; estimation of some organic compounds – phenol – aniline – acetone - glucose

UNIT IV SYNTHETIC CHEMISTRY**9**

synthesis of different types of compounds like alcohol, aldehyde, acid, amine and synthesis of dicarboylic acids and unsaturated acids.

Synthesis of azodyes –methyl orange and congo dye.

Synthesis of triphenyl methane dyes – alizarin-melachite green

UNIT V AMINO ACIDS AND PROTEINS**9**

Amino acids and proteins- classification - synthesis of amino acids - reactions of carboxyl group and amino group - peptide linkage - end group analysis - colour reaction of proteins- denaturation.

TOTAL: 45**TEXT BOOK**

1. Tiwari K.S. Vishnoi N.K. and Marhotra S.N., A text book of Organic Chemistry, II Edition , Vikas Publishing House Pvt.Ltd., (1998), New Delhi.

REFERENCE BOOK

1. P. H. Groggins Unit processes in organic synthesis. (Third Edition). McGraw-Hill, New York, 1947.

AIM

To give them knowledge on structural, Mechanical properties of Beams, columns.

OBJECTIVES

The students will be able to design the support column, beams, pipelines, storage tanks and reaction columns and tanks after undergoing this course. This is precursor for the study on process equipment design and drawing.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid bodies and deformable solids – forces on solids and supports – equilibrium and stability – strength and stiffness – tension, compression and shear stresses – Hooke's law and simple problems – compound bars – thermal stresses – elastic constants and poisson's ratio – welded joints – design.

UNIT II TRANSVERSE LOADING ON BEAMS 9

Beams – support conditions – types of Beams – transverse loading on beams – shear force and bending moment in beams – analysis of cantilevers, simply – supported beams and over hanging beams – relationships between loading, S.F. and B.M. In beams and their applications – S.F.& B.M. diagrams.

UNIT III DEFLECTIONS OF BEAMS 9

Double integration method – Macaulay's method – Area – moment theorems for computation of slopes and deflections in beams – conjugate beam method

UNIT IV STRESSES IN BEAMS 9

Theory of simple bending – assumptions and derivation of bending equation ($M/I = F/Y = E/R$) – analysis of stresses in beams – loads carrying capacity of beams – proportioning beam sections – leaf springs – flitched beams – shear stress distribution in beams – determination of shear stress in flanged beams.

UNIT V TORSION 9

Torsion of circular shafts – derivation of torsion equation ($T/J = C/R = G\theta/L$) – stress and deformation in circular and hollow shafts – stresses and deformation in circular and hollow shafts – stepped shafts – shafts fixed at both ends – stresses in helical springs – deflection of springs – spring constant

UNIT VI COLUMNS

Axially loaded short columns – columns of unsymmetrical sections – Euler's theory of long columns – critical loads for prismatic columns with different end conditions – effect of eccentricity.

TOTAL : 45**TEXT BOOKS**

1. Junarkar, S.B., Mechanics of Structure Vol. 1, 21st Edition, Character Publishing House, Anand, Indian, (1995)
2. William A.Nash, Theory and Problems of Strength of Materials, Schaum's Outline Series. McGraw Hill International Editions, Third Edition, 1994.

REFERENCES

1. Elangovan, A., Thinma Visai Iyal (Mechanics of Solids in Tamil), Anna University, Madras, 1995.

AIM

To have a general idea about the Mechanism of fluid, fluid flow and flow measuring devices thro' basic concepts.

OBJECTIVES

The subject will help the students to have a knowledge on the fluid properties, their characteristics while abstatic, during flow thro' ducts, pipes and other channels. Knowledge on several machineries used to transport the fluid and their performance are assessed.

UNIT I INTRODUCTION**9**

Nature of fluids - laws of dimensional homogeneity – Physical properties of fluids – Types of fluids-Newtonian and Non Newtonian fluids- viscosity and other secondary properties – Compressible and incompressible fluids-hydrostatic pressure distributions-laws of buoyancy Pressure measurements manometers

UNIT II KINEMATICS OF FLUID FLOW**9**

Velocity potential, concept of boundary layer, form drag, skin drag-Drag coefficient-Continuity, momentum and mechanical energy equations; Laminar and turbulent flow through closed conduits, velocity profiles and friction factor for smooth and rough pipes

UNIT III DIMENSIONAL ANALYSIS AND MEASUREMENT OF FLUID FLOW**9**

The principle of dimensional homogeneity - the Pi-theorem - relationship between dimensional analysis and similitude - use of dimensional analysis for scale up studies-Orifice meter, Venturimeter, Pitot tube, Rota meter, Weirs and notches- Principles and applications of Doppler effect in flow measurement

UNIT IV VISCOUS FLOW IN DUCTS AND BOUNDARY LAYER FLOW**9**

Reynolds's number regimes, internal versus external viscous flow, flow in circular pipe - head loss, minor losses in pipe systems and multiple-pipe systems - functions and pressure drag - flow through packed and fluidized beds.

UNIT V FLOW MEASUREMENT AND TUBRO MACHINERY**9**

Fluid moving machinery performance - selection and specification; Air lift and diaphragm pump – positive displacement pump – reciprocating and rotary pumps – centrifugal pump; pump characteristics. Fans, blowers and compressors – steam jet ejector.

TOTAL : 45**TEXT BOOKS**

1. McCabe, W.L, Smith J.C and Harriot .P., "Unit Operations in Chemical Engineering", Mc-Graw-Hill, Sixth Edition, 2000.
2. Noel de Nevers, "Fluid Mechanics for Chemical Engineers", Second Edition, McGraw-Hill, 1991.

REFERENCES

1. Coulson J.M. and Richardson J.E., Chemical Engineering, Vol. 1 (3rd Edition) Pergamon Press.
2. Shames, I.H., "Mechanics of Fluids", Third Edition, McGraw-Hill Inc., 1992.
3. White, F.M., "Fluid Mechanics", 4th Edition, McGraw-Hill Inc., 1999.
4. Daugherty, R.L., Franzini, J.B and Finnemore, E.J., "Fluid Mechanics with Engineering Applications", SI metric Edn., McGraw-Hill Book Company, 1989.
5. Darby, R. Chemical Engineering Fluid Mechanics, Marcel Dekker, 1998.
6. Vennarol, J.K., Street, R.L. Elementary Fluid Mechanics. 6th Edition John Wiley & Sons. 1982.

OBJECTIVES

- To create an awareness on the various environmental pollution aspects and issues.
- To give a comprehensive insight into natural resources, ecosystem and biodiversity.
- To educate the ways and means to protect the environment from various types of pollution.
- To impart some fundamental knowledge on human welfare measures.

1. INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES**10**

Definition, scope and importance – need for public awareness – forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their ground water, floods, drought, conflicts over water, dams-benefits and problems – mineral resources: use effects on forests and tribal people – water resources: use and over-utilization of surface and exploitation, environmental effects of extracting and using mineral resources, case studies – food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies – land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

2. ECOSYSTEMS AND BIODIVERSITY**14**

Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – introduction to biodiversity – definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds

Field study of simple ecosystems – pond, river, hill slopes, etc.

3. ENVIRONMENTAL POLLUTION**8**

Definition – causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards – solid waste management: causes, effects and control measures of urban and industrial wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.

Field study of local polluted site – urban / rural / industrial / agricultural

4. SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – environmental ethics: issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – air (prevention and control of pollution) act – water (prevention and control of pollution) act – wildlife protection act – forest conservation act – issues involved in enforcement of environmental legislation – public awareness.

5. HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – hiv / aids – women and child welfare – role of information technology in environment and human health – case studies.

TOTAL : 45

TEXT BOOKS

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. Jr., "Environmental Science", Wadsworth Publishing Co.

REFERENCES

1. Bharucha Erach, "The Biodiversity of India", Mapin Publishing Pvt. Ltd., Ahmedabad India.
2. Townsend C., Harper J and Michael Begon, "Essentials of Ecology", Blackwell Science.
3. Trivedi R.K. and P.K. Goel, "Introduction to Air Pollution", Techno-Science Publications.
4. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
5. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
6. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.

OBJECTIVE

To learn basic principles involved in analysis and synthesis of different organic derivatives.

1. Analysis of nature of organic compounds – To identify aliphatic / aromatic, saturated / unsaturated compounds.
2. Identification and Characterization of various functional groups by their characteristic reactions: a). alcohol, b) aldehyde, c) ketone, d) carboxylic acid, e) phenol, f) ester, g) primary, secondary and tertiary amines h) amide i) nitro compounds.
3. Analysis of an unknown organic compound and preparation of suitable solid derivatives.
4. Analysis of Proteins.
5. Methodology of filtrations and recrystallization.
6. Introduction to organic Synthetic procedures:
 - i. Acetylation – Preparation of acetanilide from aniline.
 - ii. Hydrolysis – Preparation of salicylic acid from methyl salicylate.
 - iii. Substitution – Conversion of acetone to iodoform.
 - iv. Nitration – Preparation of m-dinitrobenzene from nitrobenzene.
 - v. Oxidation – Preparation of benzoic acid from benzaldehyde / benzylalcohol.

TOTAL : 45 PERIODS

REFERENCE BOOKS:

1. Vogel's Text Book of Practical Organic Chemistry, Fifth Edition, Longman Singapore Publishers Pte. Ltd., Singapore (1989).
2. Organic Chemistry Lab Manual, Chemistry Division, Chemical Engineering Departemnt, A.C. Tech, Anna University (2007).

AIM

The laboratory course aims to provide a basic understanding of operation and characteristics of Electrical machines and Electronic devices

OBJECTIVE

Gain knowledge on characteristics of Electrical machines and Electronic Devices

List of Experiments:

1. Open circuit and load test on shunt generators
2. Load test of D.C. shunt motor
3. Load test or single phase induction motor
4. Equivalent circuit of a transformer
5. Swinturn's test
6. Load test or 3- phase squirrel cage induction motor
7. Load test or 3 –phase slip ring induction motor
8. Diode characteristics
9. Transistor amplifier
10. SCR application
11. Frequency Response Analysis
12. Characteristics of Transducers

TOTAL: 45

List of Equipments

1. Shunt Generators
2. Shunt DC motors
3. Single phase Induction motor
4. Single phase transformer
5. Three phase Squirrel Cage induction Motors
6. Diodes and Amplifiers
7. Oscilloscope
8. Transducers

AIM

To determine experimentally the flow characteristics of fluids and also to determine the efficiency of the flow measuring devices and fluid transport machineries.

OBJECTIVES: To gain practical knowledge on the measurement of Fluid Flow and their characteristics at different operating conditions.

LIST OF EXPERIMENTS*

1. Calibration of constant and variable Head meters
2. Calibration of Weirs
3. Drag reduction studies
4. Flow through straight pipe
5. Pressure drop studies in packed column
6. Pressure drop studies in Fluidized bed
7. Flow through fittings / valves
8. Open drum orifice and draining time
9. Flow through helical and spiral Coil
10. Characteristic curves of centrifugal pump
11. Characteristic curves of Gear pump
12. Characteristic curves of Reciprocating pump
13. Viscosity measurement of non Newtonian fluids
14. Flow through annular pipe of horizontal concentric pipe

TOTAL: 45**LIST OF EQUIPMENTS REQUIRED**

1. Orifice Meter with U tube manometer
2. Venturi meter with U tube Manometer
3. V-notch and circular Notch weirs.
4. Straight pipes with U tube Manometers
5. Packed column with U tube manometer.
6. Fluidized column with U tube manometer.
7. Flow loops for pipes, fittings and valves.
8. Open drum orifice.
9. Helical coil of different diameter.
10. Centrifugal pump with sump and pressure gauge (Vertical discharge & horizontal discharge).
11. Reciprocating pump with sump and pressure gauge (Vertical discharge & horizontal discharge).
12. Gear pump with sump and pressure gauge (Vertical discharge & horizontal discharge).
13. Horizontal double pipe (concentric pipes) with U tube Manometer

***Minimum 10 experiments shall be offered**

SEMESTER IV

408CHT01

PROBABILITY AND STATISTICS

3 1 0 4

(Common to Biotech, Chemical, Fashion, Petroleum, Polymer, Plastic)

OBJECTIVES

At the end of the course, the students would

1. Acquire skills in handling situations involving more than one random variable and functions of random variables.
2. Be introduced to the notion of sampling distributions and have acquired knowledge of statistical techniques useful in making rational decision in management problems.
3. Be exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.

1. RANDOM VARIABLES 9 + 3

Discrete and continuous random variables - Properties- Moments - Moment generating functions and their properties. Binomial, Poisson, Geometric, Negative binomial, Uniform, Exponential, Gamma, and Weibull distributions.

2. TWO DIMENSIONAL RANDOM VARIABLES 9 + 3

Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression – function of a random variable-Transformation of random variables - Central limit theorem.

3. TESTING OF HYPOTHESIS 9 + 3

Sampling distributions – Testing of hypothesis for mean, variance, proportions and differences using Normal, t, Chi-square and F distributions - Tests for independence of attributes and Goodness of fit.

4. DESIGN OF EXPERIMENTS 9 + 3

Analysis of variance – One way classification – CRD - Two – way classification – RBD - Latin square.

5. RELIABILITY AND QUALITY CONTROL 9 + 3

Concepts of reliability-hazard functions-Reliability of series and parallel systems- control charts for measurements (x and R charts) – control charts for attributes (p, c and np charts)

LECTURES: 45 TUTORIALS: 15 TOTAL: 15

Note : Use of approved statistical table is permitted in the examination.

TOTAL : 60

TEXT BOOKS

1. J. S. Milton and J.C. Arnold, "Introduction to Probability and Statistics", Tata McGraw Hill, 4th edition, 2007. (For units 1 and 2)
2. R.A. Johnson and C.B. Gupta, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, (2007)

REFERENCES

1. Walpole, R. E., Myers, R. H. Myers R. S. L. and Ye. K, "Probability and Statistics for Engineers and Scientists", Seventh Edition, Pearsons Education, Delhi, 2002.
2. Navidi, W, "Statistics for Engineers and Scientists", Special Indian Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3. Spiegel, M.R, Schiller, J and Alu Srinivasan, R, "Schaum's Outlines Probability and Statistics", Tata McGraw-Hill Publishing Company Ltd. New Delhi, 2007.

AIM

To know the basic concepts of physical chemistry aspects of chemical compounds and their behaviour at different processing conditions.

OBJECTIVES

The students get knowledge on the reactors mechanism. Use of catalyst and also the reactions stages involved in a particular process operations.

UNIT I CHEMICAL KINETICS 9

Rate equations – order of reaction – I order – II order – III order – zero order – pseudo order reactions – effect of temperature on reaction rate – concept of activation energy- chain reactions – branched chain reactions – reactions in solutions – influence of ionic strength in rates of reactions.

UNIT II ELECTROCHEMISTRY 9

Electrolytic conductance – specific conductance – equivalent conductance – molar conductance-variation with dilution – Kohlrausch's law- applications of Kohlrausch's law - molar ionic conductance - conductometric titrations – Ostwald dilution law – Debye – Huckel theory of mean ionic activity coefficient.

UNIT III PHASE RULE AND DISTRIBUTION LAW 9

Definition of terms- one component system – water – sulphur – two component system – simple eutectic system – reduced phase rule. Distribution-chemical combinations-applications-applications of distribution law-Raoult's law-Henry's law-ideal and non-ideal solutions-vapour pressure & boiling point

UNIT IV SURFACE CHEMISTRY 9**ADSORPTION**

Definition – types – isotherms – theories of adsorption – BET method – applications.

CATALYSIS

Homogeneous catalysis – acid –base – enzyme catalysis autocatalysis mechanism and kinetics – Michaelis-Menten equation - Heterogeneous catalysis – kinetics – effect of temperature on surface reactions

UNIT V MACRO MOLECULES 9**COLLOIDS**

Classification – preparations – coagulation – flocculation – determination of size of particles- surfactants – emulsions – emulsifiers –gels – applications.

POLYMERS

Classification – polymerization reactions – molar masses of reactions – determination of molar masses- kinetic study.

TEXT BOOKS

1. Puri B.H and Sharma L.R. Principles of Physical Chemistry, S. Nagin Chand and Company, Delhi (1994)
2. P.L.Soni , O.P. Dharmarha & U.N. Dash, Textbook of Physical Chemistry , Sultan Chand & Sons.

REFERENCES:

1. Kund and Jain, Physical Chemistry, S.Chand and Company, Delhi (1996)
2. Kuriakose, J.C. and Rajaram J, Chemistry in Engineering and Technology Vol. I, Tata McGraw-Hills.1984.

AIM

To impart knowledge on various analytical instruments and methods for accurate chemical analysis.

OBJECTIVES

Several chemical reaction have to be analysed for composition of raw materials, materials in progress and also the final products. Several sophisticated instruments on the basic principles involving operation and interpretation of data thro' the instruments are obtained by the students.

Unit 1 : FUNDAMENTALS OF SPECTRAL ANALYSIS**9**

ELECTROMAGNETIC RADIATION: Regions and properties, Various energy levels, Interaction of photons with matter, absorbance, & transmittance and their relationship, Permitted energy levels for the electrons of an atom and simple molecules, classification of instrumental methods based on physical properties.;VISIBLE SPECTROSCOPY AND COLORIMETRY: Beer-Lambert's Law, Limitations, Deviations (Real, Chemical and Instrumental deviations) Nesslerimetry, Duboscq colorimetry, Estimation of inorganic ions such as Fe, Ni and Nitrite using Beer-Lambert's Law. UV-VISIBLE AND IR SPECTROSCOPY: Instrumentation (Source, Optical parts and Detectors) - Various electronic transitions in organic and inorganic compounds effected by UV, Visible and infra red radiations. Woodward-Fischer rules for the calculation of absorption maxima (dienes and carbonyl compounds). Effects of auxochromes and effects of conjugation on the absorption maxima, Multicomponent analysis - Photometric titration

Unit 2 : ELECTROMETRIC METHODS**9**

Conductometric Titrations: Instrumentation-Types-Advantages-Application; Potentiometric Titrations: Instrumentation-Types-Advantages-Application; Measurement of pH: Instrumentation-Applications; Ion selective electrodes: Electrode setup-Applications.; Amperometric titrations: Principle-instrumentation- Application

Unit 3: X-RAY DIFFRACTION & THERMAL ANALYSIS METHODS**9**

XRD: Introduction, Mosley's law, Different emission and diffraction methods, various X-ray detectors.

Thermogravimetric Analysis (TGA): Instrumentation, factors affecting the shapes of thermograms, applications, thermograms of some important compounds (CuSO_4 , $5\text{H}_2\text{O}$, $\text{CaC}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$ etc).

Differential thermal analysis (DTA) & Differential Scanning Calorimetry (DSC): Principle, Instrumentation and applications of DSC and DTA, differences between DSC and DTA.

Unit 4: IMPORTANT SPECTROSCOPIC METHODS OF ANALYSIS**9**

Atomic Absorption Spectroscopy (AAS): Principle, Instrumentation, Interference and Applications.

Flame Photometry and Inductively coupled Plasma Atomic Emission spectroscopy(ICP-AES):

Principle, Instrumentation and Applications. Polarimetry: Principle, Instrumentation and Applications.

Refractometry: Principle, Instrumentation and Applications. Nephelometry/Turbidimetry: Principle, Instrumentation and Applications.

Unit 5 : CHROMATOGRAPHIC METHODS**9**

Chromatographic methods - Types (column, Thin layer, paper, Gas, High performance liquid Chromatographic methods) – principle- separation technique - separation of organic compounds by column and thin layer, Amino acids and mixture of Cu, Co & Ni by Paper, estimation of organic compounds by GC and HPLC.

TOTAL: 45**TEXTS PRESCRIBED :**

1. Skoog D.A. and West D.M., " Fundamentals of Analytical Chemistry ", Saunders-college Publishing, 1982.
2. Willard, H.H., Merritt. I.I., Dean J.a., and Settle, F.A., " Instrumental methods of analysis ", Sixth edition, CBS publishers, 1986.

REFERENCES :

1. A.I.Vogel., "Qualitative Inorganic analysis ", V.Edition, Prentice-Hall of India (P) Ltd., New Delhi, 1991.
2. S harma, B.K., " Instrumental Methods of Analysis ", Goel publishing House, 1995.
3. Parikh V.M., " Absorption spectroscopy of organic molecules ", Addison - Wesley Publishing Company, 1974.

AIM

To integrate various courses such as chemistry, unit operations, mechanical operation, stoichiometry etc., and to give the young chemical engineers some comprehension on various fields of production into which he will enter or with which he will be affiliated during the course of study or after completion of the study.

OBJECTIVES

To gain knowledge on various aspects of production engineering and understand the practical methods of production in a chemical factory.

UNIT I INTRODUCTION AND CHLORO- ALKALI INDUSTRIES 9

The role of a chemical engineers in process industries, Introduction to common devices used in manufacturing processes, block diagrams, flow charts and standard symbols used for devices, industrial safety and pollution, outline of plant and equipment design. Manufacture of Soda ash and sodium bicarbonate, chlorine and caustic soda; bleaching powder and related bleaching agents, Sodium chloride, By-products of common salt industry. .

UNIT II SULPHUR AND SULPHURIC ACID INDUSTRIES 9

Mining and manufacture of sulphur, recovery of sulphur from polluting gases, sulphur trioxide and sulphuric acid, hydrochloric acid, sodium sulphate, sodium thiosulphate.

UNIT III SILICATE INDUSTRIES 9

Types and manufacture of Portland cement, Manufacture of glasses and special glasses, Ceramics and refractories

UNIT IV NITROGEN AND PHOSPORUS INDUSTRIES 9

Synthetic ammonia, Nitric acid, Urea, Phosphate rock beneficiation and phosphoric acid

UNIT V FERTILIZER INDUSTRIES 9

Growth elements, functions, ammonium sulphate, ammonium nitrate, ammonium phosphate, potassium chloride, potassium sulphate, single, triple super phosphate introduction to pesticides, herbicides and bio-fertilizers.

TOTAL : 45**TEXT BOOKS**

1. Austin, G.T., Shreve's Chemical Process Industries, Fifth Edition, McGraw-Hill International Book Co, Singapore, 1984
2. Dryden, C.E., Outlines of Chemicals Technology, Edited and Revised by Gopala Rao, M. and M.Sittig, Second Edition, Affiliated East-West press, 1993.

REFERENCES

1. Shukla and G.N. Pandey "Text book on Chemical Technology", Vikas publishing company 1997
2. Kirk and othmer , "Encyclopedia of Chemical Technology", III Edition.

AIM

Every chemical reaction involves consumption of Materials and energy. The reactions are to be balanced with correct quantity of materials and energy to achieve good percentage of conversion for products. The aim of this course is to give fundamental knowledge on such material and energy balances.

OBJECTIVES

To make them understand different types of laws of chemistry of materials and also prepare the students to accurately calculate the Stoichiometric relations between the materials involved in a physical and chemical reaction.

UNIT I UNITS AND DIMENSIONS**5**

Basic and derived units, use of model units in calculations, Methods of expression, compositions of mixture and solutions.

UNIT II GAS CALCULATIONS**7**

Ideal and real gas laws - Gas constant - calculations of pressure, volume and temperature using ideal gas law. Use of partial pressure and pure component volume in gas calculations, applications of real gas relationship in gas calculation.

UNIT III MATERIAL BALANCE**7**

Stoichiometric principles, Application of material balance to unit operations like distillation, evaporation, crystallisation, drying etc., - Material balance with chemical reaction - Limiting and excess reactants - recycle - bypass and purging - Unsteady state material balances.

UNIT IV HUMIDITY AND SATURATION**7**

Calculation of absolute humidity, molal humidity, relative humidity and percentage humidity - Use of humidity in condensation and drying - Humidity chart, dew point.

UNIT V FUELS AND COMBUSTION**6**

Determination of Composition by Orsat analysis of products of combustion of solid, liquid and gas fuels - Calculation of excess air from orsat technique, problems on sulphur and sulphur burning compounds.

UNIT VI THERMO PHYSICS**6**

Heat capacity of solids, liquids, gases and solutions, use of mean heat capacity in heat calculations, problems involving sensible heat and latent heats, evaluation of enthalpy.

UNIT VII THERMOCHEMISTRY**7**

Standard heat of reaction, heats of formation, combustion, solution, mixing etc., calculation of standard heat of reaction - Effect of pressure and temperature on heat of reaction - Energy balance for systems with and without chemical reaction. - Unsteady state energy balances.

TOTAL: 45**TEXT BOOKS**

1. Bhatt, B.L., Vora, S.M., "Stoichiometry", Tata McGraw-Hill, 1976.
2. Himmelblau, D.M., "Basic Principles and Calculations in Chemical Engineering", EEE Sixth Edition, Prentice Hall Inc., 2003 (with CD containing programmes and problems).

REFERENCES

1. Process Calculation for Chemical Engineering, Second Revised Edition, Chemical Engineering Education Development Centre, I.I.T., Madras, 1981.
2. Process Calculations, Venkataramani, V and Anantharaman, N, Prentice Hall of India Pvt. Ltd., 2003.

AIM

To impart knowledge in separating solids from solids, solids from liquids, reduction of size, and mixing of solid, solid, liquid – liquid components

OBJECTIVES

The students will be in a position to understand that the industrial processes contain a coordinated series of separation operations and they will be in a position to decide the best process needed for a particular process industry.

UNIT I PARTICLE CHARACTERISTICS AND SIZE ANALYSIS 7

General characteristics of solids, their behaviour under different external forces, agglomeration, techniques for size analysis.

UNIT II SIZE REDUCTION 8

Laws of size reduction, classification of equipment, methods of size reduction, disintegration, preparation of colloids.

UNIT III MECHANICAL SEPARATIONS 9

Screening and Screening equipment, effectiveness of screens, gravity settling, sedimentation, thickening, centrifugal separation, impingement methods, industrial dust removing equipment with special reference to electrostatic and magnetic separators, heavy media separations, floatation.

UNIT IV FILTRATION 7

Theory of filtration, Batch and continuous filters, centrifuges, membrane and ultra filtration.

UNIT V MIXING AND AGITATION 7

Equipment for blending and kneading, dispersion, power for agitation, correlations.

UNIT VI STORAGE AND CONVEYING OF SOLIDS 7

Conveyors, Elevators, Pneumatic conveying, Different methods for storage of solids.

TOTAL: 45

TEXT BOOKS

1. McCabe, W.L, Smith J.C and Harriot, P., "Unit Operations in Chemical Engineering", McGraw-Hill, Fourth Edition, 1984.
2. Coulson, J.M., Richardson, J.F., "Chemical Engineering", Volume 2, Third Edition, Pergamon Press, 1977.

OBJECTIVE

To learn basic principles involved in estimation and characterization of industrially important materials.

I. Soap Analysis

- a. Estimation of total fatty acid.
- b. Estimation of percentage alkali content.

II. Oil Analysis

- a. Estimation of free acid
- b. Determination of Saponification value
- c. Determination of iodine value

III. Cement Analysis

- a. Estimation of Silica content
- b. Estimation of mixed oxide content
- c. Estimation calcium oxide content
- d. Estimation of calcium oxide by rapid method

IV. Coal Analysis

- a. Estimation of Sulphur present in coal
- b. Ultimate analysis of coal
- c. Proximate analysis of coal

V. Analysis of Bleaching Power

- a. Estimation of Available Chlorine

VI. Analysis of Glycerol

- a. Estimation of purity of glycerol

VII. Analysis of fuels

- a. Flash point
- b. Fire point
- c. Cloud point
- d. Pour point
- e. Aniline point

TOTAL : 45 PERIODS**REFERENCES**

1. Technical Analysis Manual, Chemistry Division, Chemical Engineering Department, A.C. Tech. Anna University (2007).
2. Hand book of Chemical Analysis by Griffin.

AIM

To determine experimentally various properties of the chemical compounds and to determine and estimate kinetics values, and other properties of chemicals.

OBJECTIVES : To improve the practical knowledge on the properties and characteristics of solvents and mixtures.

LIST OF EXPERIMENTS

1. Determination of molecular weight of a polymer by viscosity method.
2. Determination of partition co-efficient of iodine between two immiscible solvents
3. Determination of partition co-efficient of benzoic acid between two immiscible solvents
4. Determination of K_a of the weak acid
5. Conductometric experiments- Verification of Oswald's Dilution Law
6. Titration of Strong Acid Vs Strong Base
7. Titration of mixture of Strong Acid Weak Acid Vs Strong Base
8. Titration of Weak Acid Vs Weak Base
9. Determination of Rate Constant (K)
10. Determination of Activation Energy (ΔE)
11. Estimation of Ferrous ion concentration by Potentiometric Titration
12. Determination of standard electrode potential (Zn, Cu, Ag)
13. Adsorption studies
14. To study the adsorption of Acetic acid on charcoal and construct the isotherm.
15. Determination of pH metric titration of Strong Acid Vs Strong Base
16. Enzyme catalytic reaction by varying pH.
17. Application of Phase Rule to Phenol-Water system
18. To study the inversion of cane sugar by polarimeter.
 - a. Polarimeter-Inversion of cane sugar
 - b. Refractometer

TOTAL: 45**REFERENCE BOOK :**

1. Physical Chemistry experiments by Alexander Findley, McGraw-Hill IV Edition, (1976).

LIST OF EQUIPMENTS

1. Micro Calorimeter
2. Beckman Thermometers. Glasswares,
3. Thermometers 0 to 110 – 0°. Bottle Shakers .pH meters
4. Pressure Glass bottles. Standard Cells. Multimeters
5. Viscometers-Ostwald Cannon Ubbelohde. Voltage Stabiliser
6. Stalalometer
7. Surface Tension Meter .Tape Heaters
8. Mantle Heaters
9. DC Power Supply. Thermostat. Cyrostats

AIM

To impart practical knowledge and have on experience on various separation techniques.

LIST OF EXPERIMENTS

1. Study of crushing strength of solid materials using jaw crusher
2. Study of crushing strength of solid materials using crushing rolls
3. Study of crushing strength of solid materials using ball mill
4. Taylor sieves
5. Layer sieves
6. Study of characterization of filtration using to Filter Press.
7. Study of characterization of solid materials using leaf Filter.
8. Study of separation of fine particles using cyclone separator.
9. Study of separation of fine particles using sedimentation
10. Study of separation of fine particles using Elutriator.
11. Study of separation of solid particles using drum Filter.
12. Study of separation of fine particles using screens and determination of effectiveness of factor.

LIST OF EQUIPMENTS

1. Jaw crusher
2. Crushing rolls
3. Ball mill
4. Taylor sieving
5. Layer sieving
6. Filter press
7. Leaf filter
8. Cyclone separator
9. 2 liter and one liter Glass Jars, Stop Clock.
10. Elutriator
11. Rotary Drum filter
12. Screens of various mesh sizes.

*** Minimum experiments shall be offered.**

TOTAL: 45