Bansilal Ramnath Agarwal Charitable Trust’s
Vishwakarma Institute of Technology
(An Autonomous Institute affiliated to University of Pune)

Structure & Syllabus of
B.Tech. (Chemical Engineering)
Pattern ‘A14’

Effective from Academic Year 2013-14

Prepared by: - Board of Studies in Chemical Engineering
Approved by: - Academic Board, Vishwakarma Institute of Technology, Pune

Signed by,

Chairman – BOS   Chairman – Academic Board
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CH 20101: PROCESS CALCULATIONS

Credits: 03  
Teaching Scheme: 3 Hours / Week

Unit I: Basic Chemical Calculations  (8 Hrs)
A. Dimensions and Units, chemical calculations including mole, equivalent weight, solids, liquids, solutions and their properties, properties of gases.
B. Significance Unit conversions of mass, energy and pressure

Unit II: Material Balances Without Chemical Reactions  (8 Hrs)
A. Process flow sheet, Concept, Material balance calculations, recycling and bypassing operations, material balance of unsteady state processes.
B. Material balance of unit operations such as distillation, crystallization

Unit III: Material Balances Involving Chemical Reactions  (8 Hrs)
A. Mass balance with chemical reactions, single, multiple reactions, excess and limiting reactants, conversion, yield and selectivity. Material balance with recycle, bypass and purge operation.
Material balance of unsteady state processes with chemical reaction.
B. Material balance of metallurgical applications.

Unit IV: Energy Balance  (8 Hrs)
A. Specific heat of gases, liquids and solids, latent heat of phase change, heat of reaction, energy balance of unit process, combustion of fuels and combustion calculations.
B. Heat of solutions.

Unit V: Complex Chemical Calculations  (8 Hrs)
A. Psychometric calculations, Non ideal calculations for gaseous and liquid mixtures, calculations for n number of reactions, simultaneous material and energy balance, adiabatic flame temperature calculations.
B. Applications of spreadsheet software in process calculations.

Text Books

Reference Books

Course outcomes
Student will be able to-
1. Determine the quantities of chemicals in different mode i.e. moles and equivalent mass and able to convert various physical quantities in different unit systems.
2. Formulate analyse and solve steady state and unsteady state material balances for unit operations and unit processes
3. Make material balances for recycling, by-passing and purging operations.
4. Perform energy balances for unit operations and unit processes and simultaneous material and energy balances
5. Perform Psychrometric calculations, non ideal calculations for gaseous and liquid mixtures, combustion calculations and solve complex chemical problems.
CH 20103 :: FLUID FLOW OPERATIONS

Credits: 04                  Teaching Scheme: 03 Hours / Week

Unit 1: Fundamentals of Fluid Flow Operation (08 Hours)
Part A: Fluids and properties of fluids, Newton’s law of viscosity pressure and temperature dependence, introduction to rheology of fluids, types of flow, lines to describe the flow, The basic equation of fluid statics, pressure-depth relationship, pressure forces on surfaces, pressure measurements

Part B: Engineering applications of fluid flow operations, pressure measuring devices, rheological classification of fluids

Unit 2: Momentum and Energy Balance Equations (08 Hours)
Part A: Mass and energy balance equations, Bernoulli’s equation; variable head and variable area meters.

Part B: Flow measuring devices

Unit 3: Dimensional Analysis and Boundary Layer Theory (08 Hours)
Part A: Fundamental dimension of quantities, dimensional homogeneity, Reyleigh’s method and Buckingham’s π method, concept of hydrodynamic boundary layer, growth over a flat plate, change in nature of boundary layer, and different thicknesses of boundary layer, drag on flat plate, coefficient of drag and its variation

Part B: Physical significance of dimensionless numbers, hydrodynamic, thermal and concentration boundary layers

Unit 4: Flow through Conduits (08 Hours)
Part A: Shell balance based solutions for laminar flow through circular tube (Hagen Poiseuille equation), on inclined plane, through annular space, Concept of Reynolds number; transition and turbulent flow in pipes, Darcy-Weisbach equation, friction factor chart.

Part B: Different pipe fittings and valves.

Unit 5: Transportation of Fluids (08 Hours)
Part A: Minor losses and major losses in pipes, concept of equivalent pipe, series and parallel pipe systems, cavitation and water hammer, transportation of fluids, centrifugal pump.

Part B: Compressors, fans and blowers.

Text Books: (As per IEEE format)

Reference Books: (As per IEEE format)

Course Outcomes:
The student will be able to –
1. Determine various properties and flow behaviours.
2. Solve fluid flow problems by using conservation equations of mass, momentum, and energy.
3. Develop correlations using dimensional analysis.
4. Design the pipe size and flow meters requirements under laminar and turbulent flow conditions.
5. Determine the power requirements of pumping and transportation of fluids.
CH 20105 :: PHYSICAL AND INORGANIC CHEMISTRY

Credits: 3  
Teaching Scheme: 3 Hours / Week

Unit 1: Kinetics and Molecule in Motion  (8 Hours)

Part A: The kinetic model of gases, Molecular motion in gases & liquids, diffusion. The rates of chemical reactions- experimental techniques, the rates of reactions, integrated rate laws, the temperature dependence of reaction rates. Numerical on reaction rates.

Part B: Numericals on kinetics and diffusion.

Unit 2: Surface Chemistry and Enzyme Catalysis  (8 Hours)


Unit 3: Transition elements and their complexes  (8 Hours)

Part A: Nature of covalent bond and shapes of molecules. Transition elements, study of Ist transition series w.r.t. oxidation states, magnetic behavior, color, ability to form complexes and catalytic behavior. Co-ordination compounds-different terms-C.N., ligands, EAN etc. Nature of metal ligand bonding- VBT and CFT- Formation and above properties of tetrahedral square planar and octahedral complexes of Ist transition series on the basis of VBT and CFT.

Part B: Calculation of CFSE, General principles of catalysis

Unit 4: Thermodynamics  (8 Hours)


Part B: Carnot cycle, entropy, mathematical statement of 2nd law of thermodynamics, application of second law, statement of 3rd law. Refrigeration cycle

Unit 5: Volumetric Properties of Pure Fluids  (8 Hours)

Part A: The PVT behavior of pure substance, the viral equation, Compressibility factor, the ideal gas, the constant volume, constant pressure, adiabatic, polytrophic processes, real gas, applications of Viral equation, critical properties, Vander Wall equation.

Part B: Benedict - Webb – Rubin equation, Redlich –Kwong equation, Peng Robinson Equation.

Text Books:

Structure & Syllabus of B.Tech., Chemical Engineering – Pattern A14, rev01/06/15

Reference Books:

Course Outcomes:
The student will be able to –
1. Find out the rate of chemical reaction and different kinetic parameters e.g. order or reaction, michaelis menten kinetics etc.
2. Find out different thermodynamic parameters of chemical reactions e.g. Helmholtz and Gibbs energies, Cp and Cv.
3. Find out the structure of simple chemical compounds and complex co-ordination compounds.
4. Get adsorption isotherms and its study e.g. surface area determination etc.
5. Get volumetric parameters for any system.
CH 21101 :: CHEMICAL ENGINEERING MATERIALS

Credits: 03  
Teaching Scheme: - Theory 3 Hrs/Week

Unit I: Structure of crystalline solids  
(8 Hrs)
Part A. Introduction to materials and their principle properties, Structure of crystalline solids: Unit cells, crystal systems, crystallographic directions, crystallographic planes.  
Metallic crystal structures  
Imperfections in solids  
Phase diagrams: Basic concepts. Unary and binary phase diagrams.

B] Crystalline and non-crystalline materials.

Unit II: Mechanical Properties of Metals  
(8 Hrs)

Part B. Failure of metals: fracture, fatigue and creep.

Unit III: Iron-Carbon system and Ferrous alloys  
(8 Hrs)
Part A. Iron-Carbon system.  
Ferrous alloys.

Part B. Cast irons

Unit IV: Non-ferrous alloys and Polymeric materials  
(8 Hrs)
Part A. Non-ferrous alloys.  

Part B. Methods of fabrication of metals

Unit V: Ceramic Materials and Corrosion  
(8 Hrs)
Part A. Ceramics: Mechanical properties – brittle fracture, stress-strain behaviour. Various types of ceramics: glass, cement etc.  

Text Books

Reference Books

Course outcomes
The students will be able to –
1. Describe basic fundamentals of Science behind materials on atomic scale and in bulk materials.
2. Explain mechanical properties of metal and various Imperfections in solids.
3. Recognized different types of material and their properties to select suitable materials for process equipment.
4. Explain phase diagram of alloy systems and correlation between microstructure and mechanical properties.
5. Explain structure, mechanical properties and application of polymer and ceramics.
CH 21103: STRENGTH OF MATERIALS

Credits: 02
Teaching Scheme: Theory 2 Hours / Week

Unit 1: Stress and Strain
Part A:
Types of Actions: (axial loading, bending moment, shear force, torsion, combined axial loading-bending and torsion), Types of Stresses (Normal, shearing, bearing, bending), Normal stress and strain under axial loading, Hooke’s law, modules of elasticity and rigidity, design considerations viz ultimate strength of material, allowable stress, factor of safety.
Deformation of members under axial loading, axial force diagram, Poisson’s ratio, generalized Hooke’s law, bulk modules
Part B:
Stress-strain diagram for ductile and brittle material, inter-reaction between elastic constants, selection of an appropriate factor of safety, axial deformation in indeterminate members.

Unit 2: Shear Force and Bending Moment
Part A:
Shear force and bending moment diagram of determinate beams due to concentrated loads, uniformly distributed loads, uniformly varying loads and couples, concept of pure bending, relations among distributed load, shear force and bending moment
Part B:
Construction, of loading diagram from shear force diagram and/or bending moment diagram.

Unit 3: Moment of Inertia of Areas
Part A:
Use of parallel and perpendicular axis theorem, polar moment of inertia, radius of gyration moment of inertia of composite areas.
Bending Stresses in Beams: Application of flexural formula Bending stress distribution diagrams.
Shearing Stresses in Beams: Application of shear stress formula, shear stress distribution diagrams.
Part B:
Assumptions in pure bending, Derivation of flexural formula and shear stress distribution in beams.

Unit 4: Slope and Deflection in Beams
Part A:
Slope and deflection of determinate beams using Macaulay’s method
Axially Loaded Columns: Buckling of column, concept of actual length and equivalent length for various end conditions. Applications of Euler’s and Rankine’s formula.
Part B:
Derivation of formulae for slope and deflection for standard cases of simply supported and cantilever beams. Derivations of Euler’s formula for buckling load of column with hinged ends Derivations of Rankine’s formula for column.

Unit 5: Transformation of Stress and Strain
Part A:
Derivation of transformation of plane stress, principal stresses and maximum shearing stress and their locations of planes, Mohr’s circle for plane stress.
Part B:
Derivation of principal stresses, maximum shearing stress and their location of planes, derivation of Mohr’s circle of plane stress.
Text Books:
2. Gere and Timoshenko; Mechanics of materials; Second Edition; C.B.S Publishers and distributors, New Delhi

Reference Books:

Course Outcomes:
The student will be able to –
1. Apply the concept of stress and strain and behavior of element under external load
2. Apply concept of shear force and bending moment to real world problems
3. Determine the bending stress and shear stress in the component subject to external loading conditions
4. Determine slope and deflections in the beams and buckling in the columns
5. Apply the concept of various stresses including principal stresses and Mohr’s circle of plane stress
CH 20201 :: PROCESS CALCULATIONS (Tutorial)

Credits: 01

Teaching Scheme: - Tutorial 1 Hr/Week

List of Contents

TERM-WORK

1. Solve problems based on units and conversions
2. Solve problems based on material balance without chemical reaction.
3. Solve problem of recycle without chemical reaction
4. Solve problem of bypass and purge
5. Solve problems based on material balance with chemical reaction
6. Solve problems based on energy balance
7. Solve problems based on unit operations

Text Books


Reference Books


Course outcomes

Student will be able to-
1) Determine the quantities of chemicals in different mode i.e. moles and equivalent mass and able to convert various physical quantities in different unit systems.
2) Formulate analyse and solve steady state and unsteady state material balances for unit operations and unit processes
3) Make material balances for recycling, by-passing and purging operations.
4) Perform energy balances for unit operations, unit processes and simultaneous material and energy balances
5) Perform psychrometric calculations, non ideal calculations for gaseous and liquid mixtures and combustion calculations and solve complex chemical problems
CH 20203 :: FLUID FLOW OPERATIONS (Tutorial)

Credits: ---  
Teaching Scheme: 01 Hours / Week

List of Tutorials:

1. Examples based on calculations of viscosity and pressure.
2. Examples based on continuity equation and energy balance equation.
3. Examples based on and flow meters
4. Examples based on dimensional analysis
5. Examples based on drag on flat surfaces
6. Examples based on laminar flow through conduits
7. Examples based on major and minor losses in pipes
8. Examples based on pipes in series and parallel

Text Books: (As per IEEE format)

Reference Books: (As per IEEE format)

Course Outcomes:
The student will be able to –
1. Solve the fluid problems to calculate fluid properties.
2. Solve the examples based on continuity and Bernoulli equation.
3. Determine the power required for transportation of fluids
4. Develop correlations using dimensional analysis.
5. Determine the boundary layer thickness and the drag force.
CH 20303 :: FLUID FLOW OPERATIONS LABORATORY

Credits: 02     Teaching Scheme: 02 Hours / Week

List of Practicals:

1. Determination of viscosity of liquids
2. Pressure measurements by manometers
3. Reynolds experiment
4. Verification of Bernoulli principle
5. Calibration of venturimeter
6. Calibration of orificemeter
7. Calibration of rotameter
8. Friction in flow through pipes
9. Characteristics of centrifugal pump
10. Minor losses in pipes

Text Books: (As per IEEE format)

Reference Books: (As per IEEE format)

Course Outcomes:
The student will be able to –
1. Determine pressure in fluids by using manometer
2. Determine the viscosity of liquids by using viscometer
3. Determine the type of flow and major and minor energy losses in pipes
4. Use orificemeter, venturimeter and Rotameter to measure flow rates.
5. Determine the operating characteristics of centrifugal pump.
CH 20307:: PHYSICAL AND INORGANIC CHEMISTRY LABORATORY

Credits: 2
Teaching Scheme: 2 Hours / Week

List of Practical:

1. Study of adsorption of acetic acid on activated charcoal from solution.
3. To standardize Na$_2$S$_2$O$_3$ solution by preparing K$_2$Cr$_2$O$_7$ and to estimate percentage of Cu from brass.
4. Preparation of potassium trioxalato aluminate.
5. Preparation of potash alum.
7. Separation and identification of components from a given sample using Gas Chromatography.
8. Determination of concentration of copper from brass iodometrically.
10. Determination of amount of Ni gravimetrically as Ni-DMG.
11. Determination of reaction rate constant of acid catalyzed hydrolysis of ester/saponification of ethyl acetate and determination of order of the reaction.
12. Determination of partition coefficient and molecular condition of benzoic acid between benzene and water.
13. Preparation and characterization of colloidal solution (sol).

Text Books:
1. A.M. Mounir; Experimental inorganic and physical chemistry: An investigative, integrated approach to practical project work; Woodhead Publishing, 1999.

Reference Books:

Course Outcomes:
The student will be able to –
1. Draw adsorption isotherms and get the value of constants.
2. Get HPLC and GC data, spectrophotometric data of chemicals, its characterization and study.
3. To get quantitative analysis of metal ion solution volumetrically.
4. Synthesize complex inorganic compounds e.g. potassium trioxalato aluminate, potash alum.
5. Get pH metric analysis, rate constant of reactions, partition coefficient and determine viscosity of different solutions.
CH 21301 :: CHEMICAL ENGINEERING MATERIALS LABORATORY

Credits: 01
Teaching Scheme: - Laboratory 2 Hrs/Week

List of Practicals:

Minimum 8 experiments to be performed based on but not restricted to the following topics:

1. Microstructure observation and study of metals and alloys. (Minimum five) low carbon steel, medium carbon steel, high carbon Steel, tin, bronze, brass, phosphor bronze.
2. Study of properties of polymeric materials; impact test and polymeric tests.
3. Corrosion testing (salt spray test for different samples such as plain carbon steel, chrome plate steel, galvanized steel.)
4. Different types of hardness test on metals. i.e. Rockwell hardness test, Brinell hardness test, Shore scleroscope tests.
5. Izod and Charpy impact test on mild steel, copper, brass and aluminum.
6. Chemical analysis of metals and alloys (Any one element to be analyzed e.g. molybdenum from stainless steel, carbon from steel, copper from brass etc.)
7. Macrostructure observation: (flow lines observation in forging by macro etching sulphur printing of steel.)

Textbooks:

References:

Course Outcomes
Students will be able to –
1. Determine hardness of given specimen.
2. Determine presence of surface crack.
3. Explain microscopic structure of various metals and alloys.
4. Describe corrosion process and its type.
5. Explain phase diagram of alloy systems and correlation between microstructure and mechanical properties.
Skill Development Courses (SD3/SD4), S.Y. B.TECH. Chemical Engineering

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CH 24301 :: COMPUTING IN MS EXCEL
Credits: 01
Teaching Scheme: - Laboratory 2 Hrs/Week

List of Practical (any 8)

1. Introduction to Ms Excel & basic commands.
2. Introduction to higher level commands.
4. To study material balance problems with excel.
5. To study energy balance problems with excel.
6. Import & Export of data.
7. Solving Heat transfer problem with excel
8. Solving Process Calculation problem with excel
9. Different operation on Matrix with excel
10. Solving different numerical methods.
11. To study preparation of mass balance.
12. Interfacing of excel with Mat lab.

Text Books

Reference Books

Course Outcomes:
The student will be able to –
1. solve various problems with the use of a spreadsheet for technical computations
2. to use the numerical routines provided in MS Excel to carry out computational tasks..
3. solve different Chemical engineering problems with numerical methods.
4. calculate mass balance around single equipment.
5. link data between different spreadsheet.
CH 24302 :: CHEMICAL SYNTHESIS

Credits: 01
Teaching Scheme: - Laboratory 2 Hrs/Week

List of Practical
1. Synthesis of Aspirin- different route of synthesis, explanation, and analysis of product.
2. Halogenation of cyclo alkanes- Theory explanation, and analysis of product.
5. Alizarin - Theory explanation, and analysis of product.
7. Sudan-I- Theory explanation, and analysis of product.
8. Cinnamic acid (Perkin's reaction) – Theory explanation, and analysis of product.
9. Benzoylacetone (Claisen's reaction) – Theory explanation, and analysis of product.

Text Books

Reference Books

Course Outcomes:
The student will be able to –
1. Synthesize organic compounds by oxidation reactions and multiple step synthesis reactions.
2. Analyze qualitative analysis of organic compounds.
4. Synthesize artificial chemical dyes.
5. Analyze and perform electrophillic aromatic substitution reactions.
CH 24303: PIPE STRESS ANALYSIS USING CAESAR-II

Credits: 01  
Teaching Scheme: Laboratory 2 Hrs/Week

List of Practical
Around Two Practical per unit on the topic mentioned below:

1. Given a line sketch isometric - Input pipe run data into CAESAR-II
2. select pipe supports as given and Entering vendor data into CAESAR-II and learn stress calculation; changes for various nations.
3. Static pipe stress analysis. Use XYZ coordinates and pipe connection basics as given data and re-do layout and stress analysis simulation. Learn to save costs.
4. Static pipe stress analysis. Solve Tutorial. Linear dynamic analysis. Given pipe network flow simulation data and design constraints that cavitation can occur under certain constraints add static and linear dynamic stress analysis to clear the design to lie much below the maximum allowable stress.
5. Linear dynamic analysis. A Tutorial. Changes in pressure and temperature rating for header (main) and branch pipes modular design (simulation results) and safe piping system design.
6. Pipe network simulation and safety rules as per codes. Re-design piping system to include static and linear dynamic stress analysis. Piping class components and static and linear dynamic stress analysis.
7. Preparation of specification sheets as per ASME Codes and industry job skill
8. Specifications.

Text Books:

Reference Books:
1. Mohinder Nayyar; Piping Data Handbook; 1st edition; McGraw-Hill Professional

Course Outcomes:
The student will be able to –

1. To learn basic concept of pipe stress analysis
2. To analyze for stress analysis of critical lines on CAESAR-II or similar software
3. To learn to select pipe supports for piping system.
4. To be able to select material of construction.
5. To learn to design as per ASME codes and prepare specification sheets.
CH 24304 :: WATER TREATMENT (LABORATORY-PD)

Credits: 01    Teaching Scheme: Laboratory- 02 Hours / Week

List of Practicals:

1. Waste water sample preparation for testing (2 Experiments each)
2. Study physical properties of waste water (2 Experiments each)
3. Study of chemical properties of waste water (3 Experiments each)
4. Study of biological properties of waste water (2 Experiments each)
5. Study of advance treatment methods for waste water (1 Experiments each)
6. Water and waste water treatment plants industrial visit.

Text Books: (As per IEEE format)

1. S. P. Mahajan; Industrial waste water treatment;

Reference Books: (As per IEEE format)


2. “Water Treatment Unit Processes: Physical and Chemical (Civil and Environmental Engineering)” by David W. Hendricks.

Course Outcomes:
The student will be able to –

1. Collect and prepare the water and waste water samples for analysis.
2. Perform the analysis of waste water sample to identify the level of contaminants.
3. Carry out the experimentation for analysis of physical properties of water samples
4. Carry out the experimentation for analysis of Chemical properties of water samples
5. Carry out the advanced waste water treatment experimentation for water treatment.
CH 24305 :: HTRI-BASED HEAT EXCHANGER SIMULATION

Credits: 01  Teaching Scheme: - Laboratory  2 Hrs/Week

Prerequisites: Nil

Objectives:
1. To use HTRI software to design heat exchangers.
2. To learn to use TEMA codes for design of heat exchangers.
3. Mapping with PEOs : 4,5 (c, d, e)

List of Practical
Around Two Practical per unit on the topic mentioned below:
2. TEMA codes and applications in heat exchanger design, various types of industrial specification for design; correlation equation used in heat exchanger design.
3. Shell and tube heat Exchanger; double pipe heat exchanger; exchanger internals and design of heat exchangers; engineering drawings used in industrial practice.
4. Condenser, types of condenser and design; use of TEMA codes.
5. Evaporators, multi- effect evaporator; use of design; specifications used in design.
6. Air cooled heat exchanger; industrial applications and design; chiller design.

Text Books
A) “Process heat transfer” by D.Q.kern.

Reference Books
2. Coulson & Richardson's Chemical Engineering, vol 2.

Course Outcomes:
The student will be able to –
1. To learn basic concept of heat exchanger design.
2. To learn how to select TEMA construction codes based on design and selection factors.
3. To learn to select exchanger internals for a design problem.
4. To be able to select property data from various standard resources.
5. To learn about TEMA vibration test for clearing heat exchanger design.
CH 24306 : INDUSTRIAL VISITS

Credits: 01
Teaching Scheme: Laboratory 2 Hrs/Week

List of Practical

Students will visit minimum three of the industries such as below mentioned chemical process industries in and around Pune. They will study the whole process before visiting the industry. Also they will make detailed report of the visit immediately after visiting an industry.

1. Inorganic chemical industries.
2. Natural product industries.
3. Synthetic organic chemical industries.
4. Polymerization industries.
5. Metallurgical industries
6. Pollution control & toxic chemicals industries

Text Books
1. M. Gopala Rao, Marshall Sittig; Dryden’s Outlines of Chemical Technology- For the 21st Century; Third Edition; Affiliated East-West Press Pvt Ltd; New Delhi

Reference Books
1. Austin, George T.; Shreve's Chemical Process Industries; Fifth Edition; McGraw-Hill

Course Outcomes:
The student will be able to –
1. Visualize and understand the various processes in the chemical process industry
2. Visualize and understand the various processing equipment used in the chemical process industry
3. Understand auxiliary equipment and utility lines in the process plant
4. Learn the process plant layout and equipment layout basics
5. Learn the preliminary idea on process flow, testing, inspection and quality check standards of the process industry
List of Practicals

Minimum 6 practicals out of the following:
1) Preparation of a spreadsheet using sample data and Statistical tools.
2) Determination of unknown concentration from the given solution using UV-Vis Spectroscopy
3) Separation of one component sample using HPLC
4) Separation of multi component sample using HPLC
5) Separation of one component sample using GC
6) Separation of multi component sample using GC
7) Separation of a sample using Ion Chromatography
8) Volumetric exercise using pH metry.
9) Volumetric exercise using Conductometry.
10) Determination of structural features using refractometry.

Text Books


Reference Books


Course outcomes:
Students will be able to –
1. Identify the technique to be employed for the characterization of a given sample
2. Develop suitable extraction technique for sample preparation
3. Calculate unknown concentration of the target analyte selectively in a given sample
4. Test the samples for the qualitative and quantitative analysis of the analytes
5. Develop methods for the separation and quantification of samples using chromatography
Credits: 01

Teaching Scheme: - Laboratory 2 Hrs/Week

Prerequisites: Nil

List of Practical (any 6 to 8)
1. Scilab Basics, Scilab Environment
2. The Workspace and Working Directory
3. Matrix Operations
5. Plotting graph
6. Functions in Scilab.
7. Miscellaneous Commands.
8. Fluid flow problems
9. Problems will be taken from the areas of material and energy balances, kinetics, data fitting and analysis of experimental data.

Text Books

Reference Books

Course outcomes

Student will be able to-

1. Recognize the importance of numerical methods in mathematical modeling.
2. Perform basic algebraic and arithmetic computations in the Scilab environment.
3. Write and interpret programs in Scilab programming language.
4. Solve simple numerical problems using interactive Scilab commands.
5. Solve moderately complicated numerical problems by writing Scilab programs.