ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
REGULATIONS 2017
B. TECH. BIOTECHNOLOGY AND BIOCHEMICAL ENGINEERING
CHOICE BASED CREDIT SYSTEM (CBCS)

CURRICULUM AND SYLLABI (I – IV SEMESTERS)

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*Course from the curriculum of other UG programme
## SEMESTER VIII

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**TOTAL NUMBER OF CREDITS : 177**

## PROFESSIONAL ELECTIVES COURSES (PEC)

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OBJECTIVES:
- To develop the basic reading and writing skills of first year engineering and technology students.
- To help learners develop their listening skills, which will, enable them listen to lectures and comprehend them by asking questions; seeking clarifications.
- To help learners develop their speaking skills and speak fluently in real contexts.
- To help learners develop vocabulary of a general kind by developing their reading skills.

UNIT I        SHARING INFORMATION RELATED TO ONESELF/FAMILY& FRIENDS            12

UNIT II        GENERAL READING AND FREE WRITING                          12
Reading - comprehension-pre-reading-post reading- comprehension questions (multiple choice questions and /or short questions/ open-ended questions)-inductive reading- short narratives and descriptions from newspapers including dialogues and conversations (also used as short Listening texts)- register- Writing – paragraph writing- topic sentence- main ideas- free writing, short narrative descriptions using some suggested vocabulary and structures –Listening- telephonic conversations. Speaking – sharing information of a personal kind—greeting – taking leave- Language development – prepositions, conjunctions Vocabulary development- guessing meanings of words in context.

UNIT III        GRAMMAR AND LANGUAGE DEVELOPMENT                                   12
Reading- short texts and longer passages (close reading) Writing- understanding text structure-use of reference words and discourse markers-coherence-jumbled sentences Listening – listening to longer texts and filling up the table- product description- narratives from different sources. Speaking- asking about routine actions and expressing opinions. Language development- degrees of comparison- pronouns- direct vs indirect questions- Vocabulary development – single word substitutes- adverbs.

UNIT IV        READING AND LANGUAGE DEVELOPMENT                         12
Reading- comprehension-reading longer texts- reading different types of texts- magazines Writing- letter writing, informal or personal letters-e-mails-conventions of personal email-Listening- listening to dialogues or conversations and completing exercises based on them. Speaking- speaking about oneself- speaking about one’s friend- Language development- Tenses- simple present-simple past- present continuous and past continuous- Vocabulary development- synonyms-antonyms- phrasal verbs

UNIT V        EXTENDED WRITING                             12
Reading- longer texts- close reading –Writing- brainstorming -writing short essays – developing an outline- identifying main and subordinate ideas- dialogue writing-Listening – listening to talks-conversations- Speaking – participating in conversations- short group conversations-Language
development-modal verbs- present/ past perfect tense - Vocabulary development-collocations-fixed and semi-fixed expressions

TOTAL : 60 PERIODS

OUTCOMES:
At the end of the course, learners will be able to:
- Read articles of a general kind in magazines and newspapers.
- Participate effectively in informal conversations; introduce themselves and their friends and express opinions in English.
- Comprehend conversations and short talks delivered in English
- Write short essays of a general kind and personal letters and emails in English.

TEXT BOOKS:

REFERENCES

MA8151 ENGINEERING MATHEMATICS – I

OBJECTIVES:
- The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

UNIT I DIFFERENTIAL CALCULUS 12
Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 12
Partial differentiation – Homogeneous functions and Euler’s theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor’s series for functions
of two variables – Maxima and minima of functions of two variables – Lagrange’s method of undetermined multipliers.

UNIT III INTEGRAL CALCULUS 12
Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS 12

UNIT V DIFFERENTIAL EQUATIONS 12

TOTAL : 60 PERIODS

OUTCOMES:
After completing this course, students should demonstrate competency in the following skills:

• Use both the limit definition and rules of differentiation to differentiate functions.
• Apply differentiation to solve maxima and minima problems.
• Evaluate integrals both by using Riemann sums and by using the Fundamental Theorem of Calculus.
• Apply integration to compute multiple integrals, area, volume, integrals in polar coordinates, in addition to change of order and change of variables.
• Evaluate integrals using techniques of integration, such as substitution, partial fractions and integration by parts.
• Determine convergence/divergence of improper integrals and evaluate convergent improper integrals.
• Apply various techniques in solving differential equations.

TEXT BOOKS:
2. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015. [For Units I & III - Sections 1.1, 2.2, 2.3, 2.5, 2.7(Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1(Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES:
PH8151 ENGINEERING PHYSICS

OBJECTIVES:
- To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology.

UNIT I PROPERTIES OF MATTER

UNIT II WAVES AND FIBER OPTICS

UNIT III THERMAL PHYSICS

UNIT IV QUANTUM PHYSICS

UNIT V CRYSTAL PHYSICS
Single crystalline, polycrystalline and amorphous materials – single crystals: unit cell, crystal systems, Bravais lattices, directions and planes in a crystal, Miller indices – inter-planar distances - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - crystal imperfections: point defects, line defects – Burger vectors, stacking faults – role of imperfections in plastic deformation - growth of single crystals: solution and melt growth techniques.

OUTCOMES:
Upon completion of this course,
- the students will gain knowledge on the basics of properties of matter and its applications,
- the students will acquire knowledge on the concepts of waves and optical devices and their applications in fibre optics,
• the students will have adequate knowledge on the concepts of thermal properties of materials and their applications in expansion joints and heat exchangers,
• the students will get knowledge on advanced physics concepts of quantum theory and its applications in tunneling microscopes, and
• the students will understand the basics of crystals, their structures and different crystal growth techniques.

TEXT BOOKS:

REFERENCES:

CY8151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

OBJECTIVES:
• To make the students conversant with boiler feed water requirements, related problems and water treatment techniques.
• To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems and appreciate the purpose and significance of alloys.
• Preparation, properties and applications of engineering materials.
• Types of fuels, calorific value calculations, manufacture of solid, liquid and gaseous fuels.
• Principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.

UNIT I WATER AND ITS TREATMENT 9

UNIT II SURFACE CHEMISTRY AND CATALYSIS 9
UNIT III   ALLOYS AND PHASE RULE  

UNIT IV   FUELS AND COMBUSTION  

UNIT V   ENERGY SOURCES AND STORAGE DEVICES  
Nuclear fission - controlled nuclear fission - nuclear fusion - differences between nuclear fission and fusion - nuclear chain reactions - nuclear energy - light water nuclear power plant - breeder reactor - solar energy conversion - solar cells - wind energy. Batteries, fuel cells and supercapacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H₂-O₂ fuel cell.

TOTAL: 45 PERIODS

OUTCOMES:
• The knowledge gained on engineering materials, fuels, energy sources and water treatment techniques will facilitate better understanding of engineering processes and applications for further learning.

TEXT BOOKS:

REFERENCES:
OBJECTIVES:
- To know the basics of algorithmic problem solving
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops.
- To define Python functions and call them.
- To use Python data structures — lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT I ALGORITHMIC PROBLEM SOLVING
Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA, EXPRESSIONS, STATEMENTS
Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS
Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES
Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

UNIT V FILES, MODULES, PACKAGES
Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

OUTCOMES:
Upon completion of the course, students will be able to
- Develop algorithmic solutions to simple computational problems
- Read, write, execute by hand simple Python programs.
- Structure simple Python programs for solving problems.
- Decompose a Python program into functions.
• Represent compound data using Python lists, tuples, dictionaries.
• Read and write data from/to files in Python Programs.

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:

GE8152 ENGINEERING GRAPHICS L T P C
2 0 4 4

OBJECTIVES:
• To develop in students, graphic skills for communication of concepts, ideas and design of Engineering products.
• To expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (Not for Examination)
Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

UNIT I PLANE CURVES AND FREEHAND SKETCHING 7+12
Basic Geometrical constructions, Curves used in engineering practices: Conics – Construction of ellipse, parabola and hyperbola by eccentricity method – Construction of cycloid – construction of involutes of square and circle – Drawing of tangents and normal to the above curves.
Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects
UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACE 6+12
Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 5+12
Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 5+12
Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12
Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

TOTAL: 90 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
• familiarize with the fundamentals and standards of Engineering graphics
• perform freehand sketching of basic geometrical constructions and multiple views of objects.
• project orthographic projections of lines and plane surfaces.
• draw projections and solids and development of surfaces.
• visualize and to project isometric and perspective sections of simple solids.

TEXT BOOK:

REFERENCES:

Publication of Bureau of Indian Standards:

Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

GE8161 PROBLEM SOLVING AND PYTHON PROGRAMMING
LABORATORY

OBJECTIVES:
- To write, test, and debug simple Python programs.
- To implement Python programs with conditionals and loops.
- Use functions for structuring Python programs.
- Represent compound data using Python lists, tuples, dictionaries.
- Read and write data from/to files in Python.

LIST OF PROGRAMS
1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton’s method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame
PLATFORM NEEDED
Python 3 interpreter for Windows/Linux

OUTCOMES:
Upon completion of the course, students will be able to
- Write, test, and debug simple Python programs.
- Implement Python programs with conditionals and loops.
- Develop Python programs step-wise by defining functions and calling them.
- Use Python lists, tuples, dictionaries for representing compound data.
- Read and write data from/to files in Python.

TOTAL :60 PERIODS

BS8161 PHYSICS AND CHEMISTRY LABORATORY
(Common to all branches of B.E. / B.Tech Programmes)
L T P C
0 0 4 2

OBJECTIVES:
- To introduce different experiments to test basic understanding of physics concepts applied in optics, thermal physics, properties of matter and liquids.

LIST OF EXPERIMENTS: PHYSICS LABORATORY (Any 5 Experiments)
1. Determination of rigidity modulus – Torsion pendulum
2. Determination of Young’s modulus by non-uniform bending method
3. (a) Determination of wavelength, and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
5. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
6. Determination of wavelength of mercury spectrum – spectrometer grating
7. Determination of band gap of a semiconductor
8. Determination of thickness of a thin wire – Air wedge method

TOTAL: 30 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
- apply principles of elasticity, optics and thermal properties for engineering applications.

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

OBJECTIVES:
- To make the student to acquire practical skills in the determination of water quality parameters through volumetric and instrumental analysis.
- To acquaint the students with the determination of molecular weight of a polymer by viscometry.
1. Estimation of HCl using Na₂CO₃ as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler’s method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline / thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
12. Pseudo first order kinetics-ester hydrolysis.
14. Determination of CMC.
15. Phase change in a solid.
16. Conductometric titration of strong acid vs strong base.

OUTCOMES:
- The students will be outfitted with hands-on knowledge in the quantitative chemical analysis of water quality related parameters.

TOTAL: 30 PERIODS

TEXTBOOKS:
UNIT II READING AND STUDY SKILLS


UNIT III TECHNICAL WRITING AND GRAMMAR


UNIT IV REPORT WRITING


UNIT V GROUP DISCUSSION AND JOB APPLICATIONS


OUTCOMES: At the end of the course learners will be able to:

- Read technical texts and write area specific texts effortlessly.
- Listen and comprehend lectures and talks in their area of specialisation successfully.
- Speak appropriately and effectively in varied formal and informal contexts.
- Write reports and winning job applications.

TEXT BOOKS:

REFERENCES

Students can be asked to read Tagore, Chetan Bhagat and for supplementary reading.
OBJECTIVES:

- This course is designed to cover topics such as Matrix Algebra, Vector Calculus, Complex Analysis, and Laplace Transform. Matrix Algebra is one of the powerful tools to handle practical problems arising in the field of engineering. Vector calculus can be widely used for modelling the various laws of physics. The various methods of complex analysis and Laplace transforms can be used for efficiently solving the problems that occur in various branches of engineering disciplines.

UNIT I MATRICES 12

UNIT II VECTOR CALCULUS 12

UNIT III ANALYTIC FUNCTIONS 12
Analytic functions – Necessary and sufficient conditions for analyticity in Cartesian and polar coordinates – Properties – Harmonic conjugates – Construction of analytic function – Conformal mapping – Mapping by functions $w = z + c, cz, \frac{1}{z}, z^2$ - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

UNIT V LAPLACE TRANSFORMS 12

TOTAL: 60 PERIODS

OUTCOMES:

After successfully completing the course, the student will have a good understanding of the following topics and their applications:

- Eigenvalues and eigenvectors, diagonalization of a matrix, Symmetric matrices, Positive definite matrices and similar matrices.

- Gradient, divergence and curl of a vector point function and related identities.
- Evaluation of line, surface and volume integrals using Gauss, Stokes and Green's theorems and their verification.
- Analytic functions, conformal mapping and complex integration.
- Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.

TEXT BOOKS:

REFERENCES:

PH8254 PHYSICS OF MATERIALS
(Common to courses offered in Faculty of Technology except Fashion Technology)

OBJECTIVES:
- To introduce the physics of various materials relevant to different branches of technology

UNIT I PREPARATION OF MATERIALS

UNIT II CONDUCTING MATERIALS
UNIT III SEMICONDUCTING MATERIALS
Elemental Semiconductors - Compound semiconductors - Origin of band gap in solids (qualitative)

UNIT IV DIELECTRIC AND MAGNETIC MATERIALS

UNIT V NEW MATERIALS AND APPLICATIONS

TOTAL: 45 PERIODS

OUTCOMES:
At the end of the course, the students will able to
- gain knowledge on phase diagrams and various material processing methods,
- acquire knowledge on basics of conducting materials, superconductors and their applications
- get knowledge on the functioning of semiconducting materials and their applications in LED and solar cells,
- understand the functioning of various dielectric and magnetic materials,
- have the necessary understanding on various advanced materials.

TEXT BOOKS:

REFERENCES
OBJECTIVES:

- To impart basic knowledge on Civil and Mechanical Engineering.
- To familiarize the materials and measurements used in Civil Engineering.
- To provide the exposure on the fundamental elements of civil engineering structures.
- To enable the students to distinguish the components and working principle of power plant units, IC engines, and R & AC system.

A – OVER VIEW

UNIT I SCOPE OF CIVIL AND MECHANICAL ENGINEERING 10
Overview of Civil Engineering - Civil Engineering contributions to the welfare of Society – Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering


B – CIVIL ENGINEERING

UNIT II SURVEYING AND CIVIL ENGINEERING MATERIALS 10


UNIT III BUILDING COMPONENTS AND STRUCTURES 15


C – MECHANICAL ENGINEERING

UNIT IV INTERNAL COMBUSTION ENGINES AND POWER PLANTS 15
Classification of Power Plants - Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Working principle of steam, Gas, Diesel, Hydro - electric and Nuclear Power plants — working principle of Boilers, Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps
UNIT V  REFRIGERATION AND AIR CONDITIONING SYSTEM

OUTCOMES:
On successful completion of this course, the student will be able to
  • appreciate the Civil and Mechanical Engineering components of Projects.
  • explain the usage of construction material and proper selection of construction materials.
  • measure distances and area by surveying
  • identify the components used in power plant cycle.
  • demonstrate working principles of petrol and diesel engine.
  • elaborate the components of refrigeration and Air conditioning cycle.

TOTAL: 60PERIODS

TEXTBOOKS:

REFERENCES:

BT8291  MICROBIOLOGY  L T P C
3  0  0  3

OBJECTIVES
• To introduce students to the principles of Microbiology to emphasize structure and biochemical aspects of various microbes.
• To solve the problems in microbial infection and their control.

UNIT I  INTRODUCTION  6
Basics of microbial existence; history of microbiology, classification and nomenclature of microorganisms, microscopic examination of microorganisms, light and electron microscopy; principles of different staining techniques like gram staining, acid fast, capsular staining, flagellar staining.

UNIT II  MICROBES- STRUCTURE AND MULTIPLICATION  12
Structural organization and multiplication of bacteria, viruses, algae and fungi, with special mention of life history of actinomycetes, yeast, mycoplasma and bacteriophages.
UNIT III MICROBIAL NUTRITION, GROWTH AND METABOLISM 12
Nutritional requirements of bacteria; different media used for bacterial culture; growth curve and different methods to quantify bacterial growth; aerobic and anaerobic bioenergetics and utilization of energy for biosynthesis of important molecules.

UNIT IV CONTROL OF MICROORGANISMS 6
Physical and chemical control of microorganisms; host-microbe interactions; anti-bacterial, anti-fungal and anti-viral agents; mode of action and resistance to antibiotics; clinically important microorganisms.

UNIT V INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY 9
Primary metabolites; secondary metabolites and their applications; preservation of food; production of penicillin, alcohol, vitamin B-12; biogas; bioremediation; leaching of ores by microorganisms; biofertilizers and biopesticides; microorganisms and pollution control; biosensors

TOTAL: 45 PERIODS

TEXT BOOKS

BT8251 BIOCHEMISTRY

OBJECTIVE
• To enable students learn the fundamentals of Biochemical Processes and Biomolecules.

UNIT I INTRODUCTION TO BIOMOLECULES - CARBOHYDRATES 8

UNIT II STRUCTURE AND PROPERTIES OF OTHER BIOMOLECULES 12
Structure and properties of Important Biomolecules.
Lipids: fatty acids, glycerol, saponification, iodination, hydrogenation, phospholipids, glycolipids, sphingolipids, cholesterol, steroids, prostaglandins.
Protein: Amino Acids, Peptides, Proteins, measurement, structures, hierarchy of organization primary, secondary, tertiary and quaternary structures, glycoproteins, lipoproteins. Determine of primary structure.
**Nucleic acids:** purines, pyrimidines, nucleoside, nucleotide, RNA, DNA-Watson-Crick structure of DNA, reactions, properties, measurement, nucleoprotein complexes

**UNIT III:** METABOLISM CONCEPTS AND CARBOHYDRATE METABOLISM 8

**UNIT IV:** INTERMEDIARY METABOLISM AND REGULATION 12
Fatty acid synthesis and oxidation, reactions of amino acids, deamination, transamination and decarboxylation, urea cycle, Bioenergetics - High energy compounds, electronegative potential of compounds, respiratory chain, ATP cycle, calculation of ATP yield during oxidation of glucose and fatty acids.

**UNIT V:** PROTEIN TRANSPORT AND DEGRADATION 5
Protein targeting, signal sequence, secretion; Folding, Chaperone and targeting of organelle proteins, Protein degradation, receptor-mediated endocytosis, turnover.

**TOTAL: 45 PERIODS**

**OUTCOMES**
- To ensure students have a strong foundation in the structure and reactions of Biomolecules.
- To introduce them to metabolic pathways of the major biomolecules and relevance to clinical conditions.
- To correlate Biochemical processes with Biotechnology applications.

**TEXT BOOKS**

**REFERENCES**
OBJECTIVES:
To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP A (CIVIL & MECHANICAL)

I  CIVIL ENGINEERING PRACTICE  13

Buildings:
- (a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:
(a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
(b) Study of pipe connections requirements for pumps and turbines.
(c) Preparation of plumbing line sketches for water supply and sewage works.
(d) Hands-on-exercise:
  Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
(e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Power Tools only:
(a) Study of the joints in roofs, doors, windows and furniture.
(b) Hands-on-exercise:
  Wood work, joints by sawing, planing and cutting.

II  MECHANICAL ENGINEERING PRACTICE  18

Welding:
(a) Preparation of butt joints, lap joints and T- joints by Shielded metal arc welding.
(b) Gas welding practice

Basic Machining:
(a) Simple Turning and Taper turning
(b) Drilling Practice

Sheet Metal Work:
(a) Forming & Bending:
(b) Model making – Trays and funnels.
(c) Different type of joints.

Machine assembly practice:
(a) Study of centrifugal pump
(b) Study of air conditioner

Demonstration on:
(a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
(b) Foundry operations like mould preparation for gear and step cone pulley.
(c) Fitting – Exercises – Preparation of square fitting and V – fitting models.
GROUP B (ELECTRICAL & ELECTRONICS)

III ELECTRICAL ENGINEERING PRACTICE

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring.
3. Stair case wiring
5. Measurement of energy using single phase energy meter.

IV ELECTRONICS ENGINEERING PRACTICE

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.
2. Study of logic gates AND, OR, EX-OR and NOT.
4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.
5. Measurement of ripple factor of HWR and FWR.

TOTAL: 60 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
- fabricate carpentry components and pipe connections including plumbing works.
- use welding equipments to join the structures.
- Carry out the basic machining operations
- Make the models using sheet metal works
- Illustrate on centrifugal pump, Air conditioner, operations of smithy, foundary and fittings
- Carry out basic home electrical works and appliances
- Measure the electrical quantities
- Elaborate on the components, gates, soldering practices.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

CIVIL

1. Assorted components for plumbing consisting of metallic pipes, plastic pipes, flexible pipes, couplings, unions, elbows, plugs and other fittings. 15 Sets.
2. Carpentry vice (fitted to work bench) 15 Nos.
4. Models of industrial trusses, door joints, furniture joints 5 each
5. Power Tools: (a) Rotary Hammer 2 Nos
   (b) Demolition Hammer 2 Nos
   (c) Circular Saw 2 Nos
   (d) Planer 2 Nos
   (e) Hand Drilling Machine 2 Nos
   (f) Jigsaw 2 Nos

TOTAL: 60 PERIODS
MECHANICAL
1. Arc welding transformer with cables and holders 5 Nos.
2. Welding booth with exhaust facility 5 Nos.
3. Welding accessories like welding shield, chipping hammer, wire brush, etc. 5 Sets.
4. Oxygen and acetylene gas cylinders, blow pipe and other welding outfit. 2 Nos.
5. Centre lathe 2 Nos.
6. Hearth furnace, anvil and smithy tools 2 Sets.
7. Moulding table, foundry tools 2 Sets.
9. Study-purpose items: centrifugal pump, air-conditioner One each.

ELECTRICAL
1. Assorted electrical components for house wiring 15 Sets
2. Electrical measuring instruments 10 Sets
3. Study purpose items: Iron box, fan and regulator, emergency lamp 1 each
4. Megger (250V/500V) 1 No.
5. Power Tools: (a) Range Finder 2 Nos
   (b) Digital Live-wire detector 2 Nos

ELECTRONICS
1. Soldering guns 10 Nos.
2. Assorted electronic components for making circuits 50 Nos.
3. Small PCBs 10 Nos.
5. Study purpose items: Telephone, FM radio, low-voltage power supply

BT8261 BIOCHEMISTRY LABORATORY
AIM
• To learn and understand the principles behind the qualitative and quantitative estimation of biomolecules (proteins, carbohydrates, lipids, metabolites etc.,) and laboratory analysis of the same in the body fluids.

EXPERIMENTS
1. General guidelines for working in biochemistry lab (theory)
2. Units of volume, weight, density and concentration measurements and their range in biological measurements. Demonstration of proper use of volume and weight measurement devices.
3. Accuracy, precision, sensitivity and specificity (theory)
4. Preparation of buffer –titration of a weak acid and a weak base.
5. Qualitative tests for carbohydrates – distinguishing reducing from non-reducing sugars and keto from aldo sugars.
7. Protein estimation by Biuret and Lowry's methods.
8. Protein estimation by Bradford and spectroscopic methods.
9. Extraction of lipids and analysis by TLC.
10. Estimation of nucleic acids by absorbance at 260 nm and hyperchromic effect (demo).

Equipment Needed for 20 Students
Autocalve 1
Hot Air Oven 1
Incubators 2
Light Microscopes 4
Incubator Shaker 1
Colorimeter 2
Laminar Flow Chamber 2
Glassware, Chemicals, Media as required

TOTAL: 60 PERIODS

TEXT BOOKS
1. Practical Biochemistry by R.C. Gupta and S. Bhargavan.
2. Introduction of Practical Biochemistry by David T. Phummer. (II Edition)

REFERENCES

MA8353 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

OBJECTIVE:
- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.
UNIT I  PARTIAL DIFFERENTIAL EQUATIONS 12
Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange’s linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II  FOURIER SERIES 12

UNIT III  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12
Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV  FOURIER TRANSFORMS 12

UNIT V  Z - TRANSFORMS AND DIFFERENCE EQUATIONS 12

TOTAL: 60 PERIODS

OUTCOMES:
Upon successful completion of the course, students should be able to:
- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS:

REFERENCES:

BT8302          APPLIED THERMODYNAMICS FOR BIOTECHNOLOGISTS         L T P C
                                    3  0  0  3

OBJECTIVE:

- To enable the students to learn about basic concepts of classical and statistical thermodynamics

UNIT I        THERMODYNAMIC LAW AND PROPERTIES OF FLUIDS         9
First Law of thermodynamics, a generalized balance equation and conserved quantities, Volumetric properties of fluids exhibiting non ideal behavior; residual properties; estimation of thermodynamic properties using equations of state; calculations involving actual property exchanges; Maxwell’s relations and applications.

UNIT II       SOLUTION THERMODYNAMICS         9
Partial molar properties; concepts of chemical potential and fugacity; ideal and non-ideal solutions; concepts and applications of excess properties of mixtures; activity coefficient; composition models; Gibbs Duhem equation.

UNIT III      PHASE EQUILIBRIA         9
Criteria for phase equilibria; VLE calculations for binary and multi component systems; liquid-liquid equilibria and solid-solid equilibria.

UNIT IV       CHEMICAL REACTION EQUILIBRIA         9
Equilibrium criteria for homogeneous chemical reactions; evaluation of equilibrium constant; effect of temperature and pressure on equilibrium constant; calculation of equilibrium conversion and yields for single and multiple reactions.

UNIT V        THERMODYNAMIC DESCRIPTION OF MICROBIAL GROWTH AND PRODUCT FORMATION         9
Thermodynamics of microbial growth stoichiometry thermodynamics of maintenance, Calculation of the Operational Stoichiometry of a growth process at Different growth rates, Including Heat using the Herbert –Pirt Relation for Electron Donor, thermodynamics and stoichiometry of Product Formation

TOTAL: 45 PERIODS
OUTCOMES:
At the end of this course, the student would have the ability

- To explain the theoretical concepts of thermodynamics and how it applies to energy conversion in technological applications and biological systems.
- To demonstrate the capability to analyze the energy conversion performance in a variety of modern applications in biological systems.
- To design and carry out bioprocess engineering experiments, and analyze and interpret fundamental data to do the design and operation of bioprocesses.
- To describe the criteria when two phases coexist in equilibrium and the vapour liquid equilibrium calculations microbial growth and product formation.

TEXT BOOKS:

REFERENCE:

BI8301 BASICS OF FLUID AND SOLIDS OPERATIONS
L T P C
3 0 0 3

COURSE OBJECTIVES
To enable the students to

- learn the basics mechanics of fluid particles
- learn the properties and handling behaviour of particulate solids
- understand the principle and working of size reduction equipment
- understand the working mechanism of the size separation equipment
- learn the basic concepts of fluid particles

UNIT I FLUID-PARTICLE MECHANICS
9

Motion of particles in a fluid, effect of particle shape, influence of boundaries on terminal velocity,
Motion of particles through fluids, drag coefficient, Fluidization: Minimum fluidization velocity,
relevant particle properties types and application of fluidization.

UNIT II PROPERTIES AND HANDLING PARTICULATE SOLIDS
9

Characterization of solid particles, properties of masses of particles, storage and handling of solids,
mixing of solids, equipment used for mixing of solids, liquid-solid and gas-solid systems.
UNIT III SIZE REDUCTION

Crushing laws, classification of the size reduction equipment, principles, construction, working and application of the size reduction equipment like crushers, grinders, ultra-fine grinders and cutters.

UNIT IV MECHANICAL SEPARATIONS

Screening and classification, ideal and actual screens, capacity and effectiveness of screen, study of the filtration techniques, types of filters, filter aids, filter media, sedimentation and thickening, centrifugal sedimentation process, principle of other separation methods like flotation, jigging, electrostatic and magnetic separation, tabling

UNIT V PARTICLE SIZE ENLARGEMENT

Inter-particle forces, comparison and interaction between forces, nucleation and growth of particles, granulation equipment, Transport of fluid-solid systems: Hydraulic and pneumatic transport, flow regimes, rheological models, dilute and dense phase, Colloids and nanoparticles: surface forces, suspension rheology and application

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, students would know about:

CO1: The basic concepts of fluid mechanics and its properties
CO2: The working principles and mechanism of size reduction and size separation equipments
CO3: The concepts related to fluid particles and its rheology

TEXT BOOKS

1. Martin J Rhodes; Introduction to Particle Technology, 2nd Edn., John Wiley & Sons Ltd. 2013

REFERENCES

3. Introduction to Particle Technology by Rhodes, Martin, John Wiley & Sons, 1999
OBJECTIVES:
- To provide knowledge on the fundamentals of cell biology
- To help students understand the signalling mechanisms

UNIT I  CELL STRUCTURE AND FUNCTION OF THE ORGANELLES  9

UNIT II  CELL DIVISION, CANCER, APOPTOSIS AND IMMORTALIZATION OF CELLS  9
Cell cycle – Mitosis, Meiosis, Molecules controlling cell cycle, cancer, role of Ras and Raf in oncogenesis and apoptosis. Stem cells, Cell culture and immortalization of cells and its applications.

UNIT III  TRANSPORT ACROSS CELL MEMBRANE  9
Passive and Active Transport, Permeases, Ion channels, ATP pumps, Na+ / K+ / Ca2+ pumps, uniport, symport antiporter system. Ligand gated / voltage gated channels, Agonistsand Antagonists.

UNIT IV  SIGNAL TRANSDUCTION  9
Receptors – extracellular signaling, Cell surface / cytosolic receptors and examples, Different classes of receptors antocrine / paracrine / endocrine models, Secondary messengers molecules.

UNIT V  TECHNIQUES USED TO STUDY CELLS  9

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course, the students
- Would have deeper understanding of cell at structural and functional level.
- Would have broad knowledge on the molecular interaction between cells.
- Would demonstrate a clear understanding of the signal transduction, secondary messengers.
- Would develop skill on working principles of microscopy and identification of cell types.

TEXT BOOKS:
REFERENCES:

BT8301 STOICHIOMETRY L T P C
3 2 0 4

OBJECTIVES:
- The course aims to develop skills of the students in the area of Chemical Engineering with emphasis in process calculations and fluid mechanics.
- This will enable the students to perform calculations pertaining to processes and operations.

UNIT I BASIC CHEMICAL CALCULATIONS (9 + 6)
Dimension – Systems of units esp. engineering FPS, Engineering MKS & SI systems – Conversion from one system to the other – composition of mixtures and solutions – mass fraction, mass %, mole fraction, mole %, mass ratios, molarity, molality, normality, ppm, composition by density.

UNIT II IDEAL AND ACTUAL GAS EQUATIONS (9 + 6)

UNIT III MATERIAL BALANCE (9 + 6)
Material balance concept – overall & component – material balance applications for evaporator, gas absorber without reaction, Distillation (Binary system), Liquid extraction, solid-liquid extraction, drying, crystallization, Humidification, Reverse Osmosis separation and Mixing Recycle and Bypass illustration

UNIT IV ENERGY BALANCE (9 + 6)
General energy balance equation for open systems, closed system sensible heat calculation, Heat required for phase change thermo chemistry, application of steam tables, Saturated and superheated steam application in bioprocess

UNIT V CHEMICAL REACTION (9 + 6)

TOTAL: 75 PERIODS

OUTCOMES:
Upon success completion of this course, the students will be able to:
• Solve problems related to units and conversions and fit the given data using the methodologies
• Solve problems related to material and energy balance concepts & design reactors for biochemical processes
• Apply their knowledge in the field of biochemical engineering from the principles of thermodynamics

TEXT BOOKS:

REFERENCES:

BT8304 BIOORGANIC CHEMISTRY L T P C
3 0 0 3

OBJECTIVES:
To enable the students
• To know in detail about the elements of atom, charges and their bonding rule.
• To understand the various kinetic properties and types of reaction mechanisms
• To understand the possible bio-organic reactions involved in biosynthesis

UNIT I BONDING AND STEREOCHEMISTRY 9
Atoms Electrons and orbitals - Covalent Bonds - Octet rule - Polar covalant Bonds - Electronegativity- formal charge - Resonance Acids and Bases - Arrhenius and Bronsted Lowry Theories - Acid Base equilibria - SP3 hybridization - Conformations analysis ethane, butane and cyclohexane - Cis- trans isomerism. Stereochem activity around the tetrahedral carbon – optical activity - Conformation of the peptide bond.

UNIT II MECHANISMS OF SUBSTITUTION AND ADDITION REACTIONS 9
SN1 and SN2 reactions on tetrahedral carbon- nucleophiles- mechanism steric effects – nucleophilic addition on Acetals and ketalts -Aldehyde and ketone groups – reactions of carbonyl group with amines- acid catalyzed ester hydrolysis – Saponification of an ester- hydrolysis of amides. Ester enolates - claisen .condensation – Michael condensation.

UNIT III KINETICS AND MECHANISM 9
Kinetic method – Rate law and mechanism – Transition states- Intermediates – Trapping of intermediates – Microscopic reversibility – Kinetic and thermodynamic reversibility – Isotopes for
detecting intermediates. Primary and secondary isotopes – the Arrhenius equation Eyring equation - \( \Delta G, \Delta S, \Delta H \), Thermodynamics of coupled reactions.

**UNIT IV CATALYSIS** 9
Reactivity – Coenzymes – Proton transfer – metal ions – Intra molecular reactions – Covalent catalysis – Catalysis by organized aggregates and phases. Inclusion complexation

**UNIT V BIOORGANIC REACTIONS** 9
Timing of Bond formation and fission – Acyl group transfer – C-C bond formation and fission – Catalysis of proton transfer reactions – Transfer of hydride ion – Alkyl group. Transfer – Terpene biosynthesis – Merrifield state peptide synthesis – Sanger method for peptide and DNA sequencing

**OUTCOME:**
- On completion of this course, the students will learn the basics principles of chemical Bonding, Stereochemistry of Bio-organic molecules and their kinetics, mechanisms of reactions and catalysis.

**TEXT BOOKS:**

**REFERENCE:**

**BI8311 BIOORGANIC CHEMISTRY LABORATORY**

**COURSE OBJECTIVES**
To enable the students to
- gain knowledge on the various kinetic properties and types of reaction mechanisms
- understand the possible bio-organic reactions involved in biosynthesis

**LIST OF EXPERIMENTS**
1. Synthesis of aspirin
2. Hydrolysis of sucrose
3. Preparation of pyruvic acid from tartaric acid
4. Preparation of oleic acid from tartaric acid
5. Preparation of alpha D-glucopyranose pentaacetate
6. Preparation of 1,2,5,6 dicyclohexylnoine alpha d glucofuranose
7. Isolation of lycopene from tomato paste
8. Preparation of L-proline
9. Preparation of L-cysteine from hair
10. Preparation of S-ethyl hydroxybutonate from ethyl acetoacetate using yeast

TOTAL : 60 PERIODS

COURSE OUTCOMES

On successful completion of the course, the students will be able to
CO1 : Identify various kinetic properties and the types of reaction mechanisms in bio-organic molecules
CO2 : Understand their kinetics and mechanisms of the reactions.

BI8312 CELL BIOLOGY AND MICROBIOLOGY LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES

- To establish an understanding about the basic techniques (concept of aseptic work, cultivation and identification) in microbiology
- To describe the different aspects of microbial nutrition and growth
- To describe the microbial interactions and their significance in environment
- To describe the microbial interactions and their significance in agriculture, food and pharmaceuticals

LIST OF EXPERIMENTS

1. Microscopy principle & identification of given plant, animal and bacterial cells
2. Gram’s Staining, Leishman Staining & Giemsa Staining
3. Thin Layer Chromatography
4. Separation of Peripheral Blood Mononuclear Cells
5. Osmosis and Tonicity
6. Trypan Blue Assay
7. Staining for different stages of cell division
8. Preparation of culture media using nutrient broth and nutrient agar
9. Isolation of microorganisms from different sources (Soil and water) using Serial Dilution Technique
10. Culturing of microorganisms – Broth and Plates (Pour plates, Streak plates, Spread plate)
11. Growth curve observation on bacteria
12. Acid Fast Staining, Capsular Staining and Endospore Staining
14. Biochemical Analysis 2 - IMVIC Test
16. Antibiotic sensitivity assay

TOTAL : 60 PERIODS

COURSE OUTCOMES

On successful completion of the course, the students will be able to
CO1 Identify the microbiological techniques, the defining characteristics of the major group of microorganisms and apply the concepts to study microbial phylogeny.
CO2 Classify the methods to measure microbial growth
CO3 Evaluate the interaction of the microorganisms with the environment in beneficial or detrimental ways
CO4 Identify the industrially important microbes
CO5 Apply the scientific method by stating a question; researching the topic; determining appropriate tests; performing tests; collecting, analysing, and presenting data.

HS8381 INTERPERSONAL SKILLS/LISTENING AND SPEAKING

OBJECTIVES: The Course will enable learners to:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations.

UNIT I
Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II
Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III
Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail
UNIT IV
Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

UNIT V
Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

TOTAL : 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:
- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:

REFERENCES:

MA8391 PROBABILITY AND STATISTICS

OBJECTIVE:
- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I  PROBABILITY AND RANDOM VARIABLES  

UNIT II  TWO - DIMENSIONAL RANDOM VARIABLES  
Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

UNIT III  TESTING OF HYPOTHESIS  
Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means - Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV  DESIGN OF EXPERIMENTS  
One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design - $2^2$ factorial design.

UNIT V  STATISTICAL QUALITY CONTROL  
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL: 60 PERIODS

OUTCOMES: 
Upon successful completion of the course, students will be able to:

• Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
• Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.
• Apply the concept of testing of hypothesis for small and large samples in real life problems.
• Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
• Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS:

REFERENCES:

GE8291 ENVIRONMENTAL SCIENCE AND ENGINEERING

OBJECTIVES:
- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth’s interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14
Definition, scope and importance of environment – need for public awareness - 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.

UNIT II 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 municipal solid 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.
UNIT III NATURAL RESOURCES
Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use 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.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

TOTAL: 45 PERIODS

OUTCOMES:
- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS:

REFERENCES:

BT8404 BIOPROCESS PRINCIPLES

OBJECTIVES:
- To impart knowledge on design and operation of fermentation processes with all its prerequisites.
- To endow the students with the basics of microbial kinetics, metabolic stoichiometry and energetics.

UNIT I OVERVIEW OF FERMENTATION PROCESSES
Overview of fermentation industry, general requirements of fermentation processes, basic configuration of fermentor (CSTR) and ancillaries, main parameters to be monitored and controlled in fermentation processes.

UNIT II RAW MATERIALS AND MEDIA DESIGN FOR FERMENTATION PROCESS
Criteria for good medium, medium requirements for fermentation processes, carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, medium formulation of optimal growth and product formation, examples of simple and complex media, design of various commercial media for industrial fermentations – medium optimization methods

UNIT III STERILIZATION KINETICS
Thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid media, air sterilization and design of sterilization equipment - batch and continuous.

UNIT IV METABOLIC STOICHIOMETRY AND ENERGETICS
Stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients energetic analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

UNIT V KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course in Bioprocess Principles graduates will be able to
- Apply engineering principles to systems containing biological catalysts to meet the needs of the society.
• Convert the promises of molecular biology and genetic engineering into new processes to make bio-products in economically feasible way.

TEXT BOOKS:

REFERENCES:
4. Harvey W. Blanch, Douglas S. Clark, Biochemical Engineering, Marcel Dekker, Inc.

BI8401 HEAT TRANSFER OPERATIONS

COURSE OBJECTIVES
To enable the students to
• understand the fundamental concepts of conduction and its evaluation in different criterias
• understand the fundamental concepts of convection.
• understand the basic concepts of radiation and the laws governing it.
• understand the phenomenon of boiling and condensation.
• have knowledge on the concepts of heat transfer in different heat exchangers

UNIT I CONDUCTION
Basic Concepts: Modes of heat transfer, conduction, convection and radiation, analogy between heat flow and electrical flow. Conduction: One dimensional steady state heat conduction, the Fourier heat conduction equation, conduction through plane wall, conduction through cylindrical wall, spherical wall, conduction through composite slab, cylinder and sphere, critical radius of insulation, Extended surfaces: heat transfer from a fin, fin effectiveness and efficiency, Introduction to unsteady state heat conduction.

UNIT II CONVECTION
Natural and forced convection, the convective heat transfer coefficient. Forced Convection: Correlation equations for heat transfer in laminar and turbulent flows in a Circular tube and duct, Reynolds and Colburn analogies between momentum and heat transfer, heat transfer to liquid metals and heat transfer to tubes in cross flow. Natural Convection: Natural convection from vertical and horizontal surfaces.

UNIT III RADIATION
Basic Concepts of radiation from surface: black body radiation, Planks law, Wien's displacement law, Stefan Boltzmann's law, Kirchhoff's law, grey body, Radiation intensity of black body, View factor, emissivity, radiation between black surfaces and grey surfaces. Solar radiations, combined heat transfer coefficients by convection and radiation.
UNIT IV        BOILING AND CONDENSATION
Pool boiling, pool boiling curve for water, maximum and minimum heat fluxes, correlations for
nucleate and film pool boiling, drop wise and film wise condensation, Nusselt analysis for laminar
film wise condensation on a vertical plate, film wise condensation on a horizontal tube, effect of
non-condensable gases on rate of condensation. Evaporation: Types of evaporators, boiling point
elevation and Duhring’s rule, material and energy balances for single effect evaporator, multiple
effect evaporators: forward, mixed and backward feeds, capacity and economy of evaporators.

UNIT V        HEAT EXCHANGERS
Introduction, Industrial use, Types of heat exchangers, Co-current, Counter-current & Cross-
current, Principal Components of a Concentric tube & Shell-and Tube Heat Exchanger, Baffles,
Tubes and Tube Distribution, Tubes to Tube sheets Joint, Heat Exchangers with Multiple Shell &
tube Passes, Fixed-Tube sheet and Removable-Bundle Heat Exchangers, log-mean temperature
difference, overall heat transfer coefficient, fouling factors, Design of double pipe and shell and
tube heat exchangers.

COURSE OUTCOMES
On successful completion of the course, the students would

CO1: Understand the concept and solve problems related to heat transfer by conduction in solids
for steady state and transient conditions
CO2: Understand the concept and solve heat transfer problems in forced and natural convection.
CO3: Have the ability to discuss and solve heat transfer problems related to radiation.
CO4: Understand the mechanism of heat transfer in boiling, condensation and apply the concepts
in evaporators.
CO5: Be able to apply the concepts of heat transfer in heat exchangers.

TEXT BOOKS

REFERENCES
2. McCabe, W.L., Smith, J.C., and Harriot, P., Unit Operations in Chemical EngineeringII, 6th
   Ltd., India, 1998
OBJECTIVES:
To enable the students
- To have a fundamental knowledge about the Light spectrum, Absorption, Fluorescence, NMR, Mass spectroscopy
- To acquire knowledge on the different chromatographic methods for separation of biological products.

UNIT I  INTRODUCTION TO SPECTROMETRY 9

UNIT II  MOLECULAR SPECTROSCOPY 9

UNIT III  MAGNETIC RESONANCE SPECTROSCOPY AND MASS SPECTROMETRY 9

UNIT IV  SEPARATION METHODS 9

UNIT V  ELECTRO ANALYSIS AND SURFACE MICROSCOPY 9

TOTAL: 45 PERIODS

OUTCOME:
- On completion of the course, students will have a better understanding of spectroscopy and the separation techniques used for biological products.

TEXT BOOKS:

REFERENCES:

BT8501 MASS TRANSFER OPERATIONS

OBJECTIVES:
- To define the principles of adsorption, absorption, leaching and drying extraction, distillation crystallization operations.
- To begin the concept of membrane separation process and develop skills of the students in the area of mass transfer operations with emphasis on separation and purification of products.

UNIT I DIFFUSION AND MASS TRANSFER 9
Molecular diffusion in fluids and solids; Interphase Mass Transfer; Mass Transfer coefficients; Analogies in Transport Phenomenon.

UNIT II GAS LIQUID OPERATIONS 9
Principles of gas absorption; Single and Multi component absorption; Absorption with Chemical Reaction; Design principles of absorbers; Industrial absorbers; HTU, NTU concepts.

UNIT III VAPOUR LIQUID OPERATIONS 9
V-L Equilibria; Simple, Steam and Flash Distillation; Continuous distillation; McCabe-Thiele & Onchon-Savarit Principles; Industrial distillation equipments, HETP, HTU and NTU concepts.

UNIT IV EXTRACTION OPERATIONS 9
L-L equilibria, Staged and continuous extraction, Solid-liquid equilibria, Leaching Principles.

UNIT V SOLID FLUID OPERATIONS 9
Adsorption equilibria – Batch and fixed bed adsorption; Drying-Mechanism-Drying curves- Time of Drying; Batch and continuous dryers.

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of this course the students will be able
- To demonstrate about gas -liquid, vapour- liquid and solid- liquid and liquid–liquid equilibrium.
- To classify and use the accurate engineering correlations of diffusion and mass transfer coefficients to model a separation process.
- To investigate a multi-stage equilibrium separation processes, simultaneous phase equilibrium and mass balances in continuous separation processes (absorbers, strippers, and distillation columns) and sizing continuous separation units.
• To design and construction with operating principles of process economics of separating equipments

TEXT BOOKS:

REFERENCE:

BT8512 ANALYTICAL METHODS AND INSTRUMENTATION LABORATORY L T P C 0 0 4 2

OBJECTIVES:
To train the students
• To have a practical hands on experience on Absoprtion Spectroscopic methods
• To acquire experience in the purification by performing chromatography
• To validate and analysis using spectrometric and microscopic techniques

LIST OF EXPERIMENTS
1. Precision and validity in an experiment using absorption spectroscopy .
2. Validating Lambert-Beer’s law using KMnO4
3. Finding the molar absorbtivity and stoichometry of the Fe (1,10 phenanthroline)3 using absorption spectrometry.
4. Finding the pKa of 4-nitrophenol using absorption spectroscopy.
5. UV spectra of nucleic acids.
6. Chemical actinometry using potassium ferrioxolate.
7. Estimation of SO4-- by nephelometry.
8. Estimation of Al3+ by Flourimetry.
10. Chromatography analysis using TLC.
11. Chromatography analysis using column chromatography.

TOTAL: 60 PERIODS

OUTCOME:
• The students would visualize and interpret the theory of spectroscopic methods by hands on experiments.

REFERENCES:
Equipment Needed for 20 Students
Colorimeter  2
Glassware, Chemicals, Media as required

BI8411 CHEMICAL ENGINEERING LABORATORY I L T P C 0 0 4 2

COURSE OBJECTIVES
To provide practical experience on
- operating the equipments,
- calibration of flow meters,
- determining pressure loss in fluid flow

LIST OF EXPERIMENTS
1. Flow measurement a) Orifice meter b) Venturimeter, c) Rotameter
2. Determination of separation efficiency of centrifugal separator
3. Determination of energy requirement in size reduction and reduction ratio using the ball mill and hammer mill.
4. Determination of particle size of granular foods by sieve analysis.
5. Stokes law: To study \( C_d \) vs \( N_{Re} \) graph of the steel ball in different fluids
6. Determination of efficiency of liquid solid separation by filtration
7. Batch filtration studies using a Plate and Frame Filter press
8. Characteristics of batch Sedimentation
9. Reduction ratio in Jaw Crusher
10. Sampling methods: To study different sampling method to determine the average diameter of the particle.
11. Reduction ratio of Roll Crusher
12. Reduction ratio of Drop weight crusher
13. Size separation using Sub-Sieving

TOTAL 60 PERIODS

COURSE OUTCOMES
On successful completion of the course, the student will be able to operate the equipments and determine the parameter related to flow measurements

HS8461 ADVANCED READING AND WRITING L T P C 0 0 2 1

OBJECTIVES:
- Strengthen the reading skills of students of engineering.
- Enhance their writing skills with specific reference to technical writing.
- Develop students' critical thinking skills.
- Provide more opportunities to develop their project and proposal writing skills.
UNIT I
Reading - Strategies for effective reading- Use glosses and footnotes to aid reading comprehension- Read and recognize different text types- Predicting content using photos and title
Writing - Plan before writing - Develop a paragraph: topic sentence, supporting sentences, concluding sentence – Write a descriptive paragraph

UNIT II
Reading - Read for details- Use of graphic organizers to review and aid comprehension Writing - State reasons and examples to support ideas in writing- Write a paragraph with reasons and examples- Write an opinion paragraph

UNIT III
Reading - Understanding pronoun reference and use of connectors in a passage- Speed reading techniques Writing - Elements of a good essay- Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

UNIT IV
Reading - Genre and Organization of Ideas- Writing - Email writing- visumes – Job application- project writing-writing convincing proposals.

UNIT V
Reading - Critical reading and thinking- understanding how the text positions the reader- identify Writing - Statement of Purpose- letter of recommendation- Vision statement

TOTAL: 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:
- Write different types of essays.
- Write winning job applications.
- Read and evaluate texts critically.
- Display critical thinking in various professional contexts.

TEXT BOOKS:

REFERENCES: