ANNA UNIVERSITY, CHENNAI

AFFILIATED INSTITUTIONS

R - 2008

B.TECH. BIOTECHNOLOGY

II – VIII SEMESTERS CURRICULA AND SYLLABI

SEMESTER II

(Common to all B. E. / B. Tech. Degree Programmes except B. E. – Marine Engineering)

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A. CIRCUIT BRANCHES

I Faculty of Electrical Engineering
   1. B.E. Electrical and Electronics Engineering
   2. B.E. Electronics and Instrumentation Engineering
   3. B.E. Instrumentation and Control Engineering

II Faculty of Information and Communication Engineering
   1. B.E. Computer Science and Engineering
   2. B.E. Electronics and Communication Engineering
   3. B.E. Bio Medical Engineering
   4. B.Tech. Information Technology

B. NON – CIRCUIT BRANCHES

I Faculty of Civil Engineering
   1. B.E. Civil Engineering

II Faculty of Mechanical Engineering
   1. B.E. Aeronautical Engineering
   2. B.E. Automobile Engineering
   3. B.E. Marine Engineering
   4. B.E. Mechanical Engineering
   5. B.E. Production Engineering

III Faculty of Technology
   1. B.Tech. Chemical Engineering
   2. B.Tech. Biotechnology
   3. B.Tech. Polymer Technology
   4. B.Tech. Textile Technology
   5. B.Tech. Textile Technology (Fashion Technology)
   7. B.Tech. Plastics Technology
### SEMESTER III
(Applicable to the students admitted from the Academic year 2008 – 2009 onwards)

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### ELECTIVE – VI

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AIM
To encourage students to actively involve in participative learning of English and to help them acquire Communication Skills.

OBJECTIVES
- To help students develop listening skills for academic and professional purposes.
- To help students acquire the ability to speak effectively in English in real-life situations.
- To inculcate reading habit and to develop effective reading skills.
- To help students improve their active and passive vocabulary.
- To familiarize students with different rhetorical functions of scientific English.
- To enable students write letters and reports effectively in formal and business situations.

UNIT I
Technical Vocabulary - meanings in context, sequencing words, Articles- Prepositions, intensive reading & predicting content, Reading and interpretation, extended definitions, Process description

Suggested activities:
1. Exercises on word formation using the prefix ‘self’ - Gap filling with preposition.
2. Exercises - Using sequence words.
3. Reading comprehension exercise with questions based on inference – Reading headings
4. and predicting the content – Reading advertisements and interpretation.
5. Writing extended definitions – Writing descriptions of processes – Writing paragraphs based on discussions – Writing paragraphs describing the future.

UNIT II

Suggested activities:
1. Reading comprehension exercises with questions on overall content – Discussions analyzing stylistic features (creative and factual description) - Reading comprehension exercises with texts including graphic communication - Exercises in interpreting non-verbal communication.
2. Listening comprehension exercises to categorise data in tables.
3. Writing formal letters, quotations, clarification, complaint – Letter seeking permission for Industrial visits – Writing analytical paragraphs on different debatable issues.

UNIT III
Cause and effect expressions – Different grammatical forms of the same word - Speaking – stress and intonation, Group Discussions - Reading – Critical reading - Listening, - Writing – using connectives, report writing – types, structure, data collection, content, form, recommendations.

Suggested activities:
1. Exercises combining sentences using cause and effect expressions – Gap filling exercises using the appropriate tense forms – Making sentences using different grammatical forms of the same word. (Eg: object – verb / object – noun)
2. Speaking exercises involving the use of stress and intonation – Group discussions– analysis of problems and offering solutions.
3. Reading comprehension exercises with critical questions, Multiple choice question.

UNIT IV
Numerical adjectives – Oral instructions – Descriptive writing – Argumentative paragraphs – Letter of application - content, format (CV / Bio-data) - Instructions, imperative forms - Checklists, Yes/No question form – E-mail communication.

Suggested Activities:
1. Rewriting exercises using numerical adjectives.
2. Reading comprehension exercises with analytical questions on content – Evaluation of content.
3. Listening comprehension – entering information in tabular form, intensive listening exercise and completing the steps of a process.
4. Speaking - Role play – group discussions – Activities giving oral instructions.

UNIT V
Speaking - Discussion of Problems and solutions - Creative and critical thinking – Writing an essay, Writing a proposal.

Suggested Activities:
1. Case Studies on problems and solutions
2. Brain storming and discussion
3. Writing Critical essays
4. Writing short proposals of 2 pages for starting a project, solving problems, etc.
5. Writing advertisements.

TOTAL: 60 PERIODS

TEXT BOOK

REFERENCES

Extensive Reading:

Note:
The book listed under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.
UNIT I  ORDINARY DIFFERENTIAL EQUATIONS
Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy’s and Legendre’s linear equations – Simultaneous first order linear equations with constant coefficients.

UNIT II  VECTOR CALCULUS

UNIT III  ANALYTIC FUNCTIONS
Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy – Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping : w= z+c, cz, 1/z, and bilinear transformation.

UNIT IV  COMPLEX INTEGRATION

UNIT V  LAPLACE TRANSFORM

Definition of Inverse Laplace transform as contour integral – Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
UNIT I  CONDUCTING MATERIALS  9

UNIT II  SEMICONDUCTING MATERIALS  9

UNIT III  MAGNETIC AND SUPERCONDUCTING MATERIALS  9
Superconductivity: properties - Types of super conductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV  DIELECTRIC MATERIALS  9

UNIT V  MODERN ENGINEERING MATERIALS  9
Metallic glasses: preparation, properties and applications.
Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, advantages and disadvantages of SMA

TOTAL : 45 PERIODS

TEXT BOOKS
2. Charles P. Poole and Frank J.Ownen, 'Introduction to Nanotechnology', Wiley India(2007) (for Unit V)

REFERENCES
AIM
To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

OBJECTIVES
- The student should be conversant with the principles of electrochemistry, electrochemical cells, emf and applications of emf measurements.
- Principles of corrosion control
- Chemistry of Fuels and combustion
- Industrial importance of Phase rule and alloys
- Analytical techniques and their importance.

UNIT I   ELECTROCHEMISTRY
Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes – Standard Hydrogen electrode - Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox - Fe²⁺ vs dichromate and precipitation – Ag⁺ vs Cl⁻ titrations) and conduct metric titrations (acid-base – HCl vs, NaOH) titrations,

UNIT II  CORROSION AND CORROSION CONTROL

UNIT III  FUELS AND COMBUSTION

UNIT IV  PHASE RULE AND ALLOYS

UNIT V  ANALYTICAL TECHNIQUES

TOTAL: 45 PERIODS
TEXT BOOKS

REFERENCES

ME2151 ENGINEERING MECHANICS

OBJECTIVE
At the end of this course the student should be able to understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in two dimensions and also in three dimensions. Further, he should understand the principle of work and energy. He should be able to comprehend the effect of friction on equilibrium. He should be able to understand the laws of motion, the kinematics of motion and the interrelationship. He should also be able to write the dynamic equilibrium equation. All these should be achieved both conceptually and through solved examples.

UNIT I  BASICS & STATICS OF PARTICLES

UNIT II  EQUILIBRIUM OF RIGID BODIES

UNIT III  PROPERTIES OF SURFACES AND SOLIDS
UNIT IV  DYNAMICS OF PARTICLES  12
Displacements, Velocity and acceleration, their relationship – Relative motion – 
Curvilinear motion – Newton’s law – Work Energy Equation of particles – Impulse and 
Momentum – Impact of elastic bodies.

UNIT V  FRICITION AND ELEMENTS OF RIGID BODY DYNAMICS  12
Frictional force – Laws of Coloumb friction – simple contact friction – Rolling resistance – 
Belt friction.
Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane 
motion.

TEXT BOOK

REFERENCES
UNIT V ANALYSING THREE PHASE CIRCUITS

Three phase balanced / unbalanced voltage sources – analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & unbalanced – phasor diagram of voltages and currents – power and power factor measurements in three phase circuits.

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
UNIT V SPECIAL SEMICONDUCTOR DEVICES (Qualitative Treatment only) 12

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES

GE2151 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING L T P C
(Common to branches under Civil, Mechanical and Technology faculty) 4 0 0 4

UNIT I ELECTRICAL CIRCUITS & MEASUREMENTS 12

Operating Principles of Moving Coil and Moving Iron Instruments (Ammeters and Voltmeters), Dynamometer type Watt meters and Energy meters.

UNIT II ELECTRICAL MECHANICS 12

UNIT III SEMICONDUCTOR DEVICES AND APPLICATIONS 12

UNIT IV  DIGITAL ELECTRONICS  12
Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops – Registers and Counters – A/D and D/A Conversion (single concepts)

UNIT V  FUNDAMENTALS OF COMMUNICATION ENGINEERING 12

Communication Systems: Radio, TV, Fax, Microwave, Satellite and Optical Fibre (Block Diagram Approach only).

TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES

GE2152  BASIC CIVIL & MECHANICAL ENGINEERING  L T P C
(Common to branches under Electrical and I & C Faculty)  4 0 0 4

A – CIVIL ENGINEERING

UNIT I  SURVEYING AND CIVIL ENGINEERING MATERIALS  15


UNIT II  BUILDING COMPONENTS AND STRUCTURES  15
Foundations: Types, Bearing capacity – Requirement of good foundations.


TOTAL: 30 PERIODS
UNIT III POWER PLANT ENGINEERING 10

UNIT IV I C ENGINES 10
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 – Boiler as a power plant.

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 10

TOTAL: 30 PERIODS

REFERENCES:

GE2155 COMPUTER PRACTICE LABORATORY – II

L T P C

0 1 2 2

LIST OF EXPERIMENTS

1. UNIX COMMANDS 15
Study of Unix OS - Basic Shell Commands - Unix Editor

2. SHELL PROGRAMMING 15
Simple Shell program - Conditional Statements - Testing and Loops

3. C PROGRAMMING ON UNIX 15
Dynamic Storage Allocation-Pointers-Functions-File Handling

TOTAL : 45 PERIODS
HARDWARE / SOFTWARE REQUIREMENTS FOR A BATCH OF 30 STUDENTS

Hardware

- 1 UNIX Clone Server
- 33 Nodes (thin client or PCs)
- Printer – 3 Nos.

Software

- OS – UNIX Clone (33 user license or License free Linux)
- Compiler - C

GS2165 PHYSICS LABORATORY – II

LIST OF EXPERIMENTS

1. Determination of Young’s modulus of the material – non uniform bending.
2. Determination of Band Gap of a semiconductor material.
3. Determination of specific resistance of a given coil of wire – Carey Foster Bridge.
5. Spectrometer dispersive power of a prism.
6. Determination of Young’s modulus of the material – uniform bending.

• A minimum of FIVE experiments shall be offered.
• Laboratory classes on alternate weeks for Physics and Chemistry.
• The lab examinations will be held only in the second semester.

GS2165 CHEMISTRY LABORATORY – II

LIST OF EXPERIMENTS

1. Conduct metric titration (Simple acid base)
2. Conduct metric titration (Mixture of weak and strong acids)
3. Conduct metric titration using BaCl\textsubscript{2} vs Na\textsubscript{2} SO\textsubscript{4}
4. Potentiometric Titration (Fe\textsuperscript{2+} / KMnO\textsubscript{4} or K\textsubscript{2} Cr\textsubscript{2} O\textsubscript{7})
5. PH titration (acid & base)
6. Determination of water of crystallization of a crystalline salt (Copper sulphate)
7. Estimation of Ferric iron by spectrophotometry.

• A minimum of FIVE experiments shall be offered.
• Laboratory classes on alternate weeks for Physics and Chemistry.
• The lab examinations will be held only in the second semester.
List of Exercises using software capable of Drafting and Modeling

1. Study of capabilities of software for Drafting and Modeling – Coordinate systems (absolute, relative, polar, etc.) – Creation of simple figures like polygon and general multi-line figures.
2. Drawing of a Title Block with necessary text and projection symbol.
3. Drawing of curves like parabola, spiral, involute using Bspline or cubic spline.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
5. Drawing front view, top view and side view of objects from the given pictorial views (eg. V-block, Base of a mixie, Simple stool, Objects with hole and curves).
6. Drawing of a plan of residential building ( Two bed rooms, kitchen, hall, etc.)
7. Drawing of a simple steel truss.
8. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
10. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

TOTAL: 45 PERIODS

Note: Plotting of drawings must be made for each exercise and attached to the records written by students.

List of Equipments for a batch of 30 students:

1. Pentium IV computer or better hardware, with suitable graphics facility -30 No.
2. Licensed software for Drafting and Modeling. – 30 Licenses
3. Laser Printer or Plotter to print / plot drawings – 2 No.

TOTAL: 45 PERIODS
1. Verification of KVL and KCL
2. Verification of Thevenin and Norton Theorems.
3. Verification of superposition Theorem.
4. Verification of Maximum power transfer and reciprocity theorems.
5. Frequency response of series and parallel resonance circuits.
6. Characteristics of PN and Zener diode
7. Characteristics of CE configuration
8. Characteristics of CB configuration
9. Characteristics of UJT and SCR
10. Characteristics of JFET and MOSFET

TOTAL: 45 PERIODS

ENGLISH LANGUAGE LABORATORY (Optional)   L T P C

1. Listening:
   Listening & answering questions – gap filling – Listening and Note taking- Listening to
telephone conversations 5

2. Speaking:
   Pronouncing words & sentences correctly – word stress – Conversation practice. 5

Classroom Session
   1. Speaking: Introducing oneself, Introducing others, Role play, Debate-
      Presentations: Body language, gestures, postures.
      Group Discussions etc
   2. Goal setting – interviews – stress time management – situational reasons

Evaluation
   (1) Lab Session – 40 marks
      Listening – 10 marks
      Speaking – 10 marks
      Reading – 10 marks
      Writing – 10 marks
   (2) Classroom Session – 60 marks
      Role play activities giving real life context – 30 marks
      Presentation – 30 marks

Note on Evaluation
1. Examples for role play situations:
   a. Marketing engineer convincing a customer to buy his product.
   b. Telephone conversation – Fixing an official appointment / Enquiry on availability of flight or train tickets / placing an order. etc.

2. Presentations could be just a Minute (JAM activity) or an Extempore on simple topics or visuals could be provided and students could be asked to talk about it.

REFERENCES

LAB REQUIREMENTS
1. Teacher – Console and systems for students
2. English Language Lab Software
3. Tape Recorders.

MA2211  TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATION  

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(Common to all branches of BE / B.Tech Programmes)

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

UNIT I  FOURIER SERIES  

9+3

UNIT II  FOURIER TRANSFORMS  

9+3
UNIT III  PARTIAL DIFFERENTIAL EQUATIONS  9+3
Formation of partial differential equations – Lagrange’s linear equation – Solutions of standard types of first order partial differential equations - Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV  APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS  9+3
Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in cartesian coordinates.

UNIT V  Z -TRANSFORMS AND DIFFERENCE EQUATIONS  9+3

L : 45  T : 15  TOTAL : 60 PERIODS

TEXT BOOK

REFERENCES

BT 2204  PRINCIPLES OF CHEMICAL ENGINEERING  L T P C
3 0 0 3

AIM(S) OF THE COURSE
The course aims to develop skills of the Students in the area of Chemical Engineering with emphasis in Thermodynamics fluid mechanics. This will be necessary for certain other course offered in the subsequent semesters and will serve as a prerequisite

UNIT I  OVERVIEW OF PROCESS INDUSTRY  8
Mass and energy conservation; process automation; environment; SI units; conservation factors; applied mathematics for experimental curve fitting; numerical differentiation; integration.

UNIT II  MATERIAL BALANCES  10
Overall and component balances; material balances without and with chemical reactions; degrees of freedom; steady and unsteady state; unit operations; recycle and by pass; humidity calculations.

UNIT III  FIRST AND SECOND LAWS OF THERMODYNAMICS  9
Energy balances; sensible heat, latent heat; vapour pressure; steady and unsteady state calculations.
UNIT IV        FLUID MECHANICS          10
Fluids; fluid statics and applications in chemical engineering; fluid flow; laminar; turbulent
pressure drops; compressible fluid flow concepts; multiphase flow concepts.

UNIT V        FLOW THROUGH PACKED COLUMNS          8
Fluidisation; centrifugal and piston pumps; characteristics; compressors; work.

TEXTS BOOKS

TOTAL: 45 PERIODS

GE 2211     ENVIRONMENTAL SCIENCE AND ENGINEERING            L T P C           3 0 0 3
(Common to EEE, EIE, ICE, Biotech, Chemical, Textile Tech.(Fashion Tech.) / Fashion
Tech., Plastic Tech., Polymer Tech. & Textile Tech.)

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

UNIT I     INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL
            RESOURCES          10
Definition, scope and importance – need for public awareness – forest resources: use
and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and
their ground water, floods, drought, conflicts over water, dams-benefits and problems –
mineral resources: use effects on forests and tribal people – water resources: use and
over-utilization of surface and exploitation, environmental effects of extracting and using
mineral resources, case studies – food resources: world food problems, changes caused
by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide
problems, water logging, salinity, case studies – energy resources: growing energy
needs, renewable and non renewable energy sources, use of alternate energy sources.
Case studies – land resources: land as a resource, land degradation, man induced
landsides, 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 II     ECOSYSTEMS AND BIODIVERSITY          14
Concept of an ecosystem – structure and function of an ecosystem – producers,
consumers and decomposers – energy flow in the ecosystem – ecological succession –
food chains, food webs and ecological pyramids – introduction, types, characteristic
features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c)
desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans,
estuaries) – introduction to biodiversity – definition: genetic, species and ecosystem
diversity – biogeographical classification of India – value of biodiversity: consumptive
use, productive use, social, ethical, aesthetic and option values – biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT III  ENVIRONMENTAL POLLUTION  8
Definition – causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards – solid waste management: causes, effects and control measures of urban and industrial wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – urban / rural / industrial / agricultural

UNIT IV  SOCIAL ISSUES AND THE ENVIRONMENT  7

UNIT V  HUMAN POPULATION AND THE ENVIRONMENT  6

TOTAL : 45 PERIODS

TEXT BOOKS:

REFERENCES:
MAIN AIM(S) OF THE COURSE
The course aims to develop skills of the Students in the area of Cell Biology and Cell Signalling pathways. This will be necessary for studies in course like Microbiology, Molecular course is also a prerequisite for other Biology, etc., This courses offered in the subsequent semesters.

UNIT I CELL STRUCTURE AND FUNCTION OF THE ORGANELLES 9
Eukaryotic and prokaryotic cells, principles of membrane organisation, membrane proteins, cytoskeletal proteins, types of cell division, mitosis & meiosis, extra cellular matrix, cell cycle and molecules that control cell cycle.

UNIT II TRANSPORT ACROSS CELL MEMBRANES 9
Passive & active transport, permeases, sodium potassium pump, Ca2+ ATPase pumps, lysosomal and vacuolar membrane ATP dependent proton pumps, co transport symport, antiprot, transport into prokaryotic cells, endocytosis and exocytosis. Entry of viruses and toxins into cells.

UNIT III RECEPTORS AND MODELS OF EXTRA CELLULAR SIGNALLING 9
Cytosolic, nuclear and membrane bound receptors, examples of receptors, autocrine, paracrine and endocrine models of action, quantitation and characterisation of receptors.

UNIT IV SIGNAL TRANSDUCTION 9
Signal amplification, different models of signal amplifications, cyclic amp, role of inositol phosphates as messengers, biosynthesis of inositol tri phosphates, cyclic GMP and g proteins, role in signal transduction, calcium ion flux and its role in cell signaling, current models of signal amplification, phosphorylation of protein kinases, regulation of protein kinases, serine –threonine kinases, tumor necrosis factor receptor families.

UNIT V CELL CULTURE 9
Techniques for the propagation of eukaryotic and prokaryotic cells. Cell line, generation of cell lines, maintenance of stock cells, characterization of cells, immunochemistry, morphological analysis techniques, in cell culture, ex-plant cultures primary cultures, contamination, differentiation, three dimensional cultures, role of matrix in cell growth.

TOTAL : 45 PERIODS

TEXTS BOOKS

REFERENCES
1. De Robertis & De Robertis, “Cell Biology”.
2. James D.Watson, “Molecular Biology of the Cell”.

24
AIM(S) OF THE COURSE
The course aims to develop skills of Students in the area of Organic Chemistry and its applications in Biology. This will be a prerequisite to courses like Molecular Modelling, Bioseparations etc.

UNIT I  INTRODUCTION TO ENZYMES  9

UNIT II  KINETICS OF ENZYME ACTION  9

UNIT III  ENZYME IMMOBILIZATION & CASE STUDIES OF ENZYME STRUCTURE AND MECHANISM  9
Physical and chemical techniques for enzyme immobilization – adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding etc., - examples, advantages and disadvantages. Case studies include dehydrogenases, proteases – - lysozyme-stability of proteins

UNIT IV  KINETICS OF PROTEIN FOLDING  9
Kinetics of single substrate reactions; estimation of Michaelis – Menten parameters, multi substrate reactions- mechanisms and kinetics; turnover number; types of inhibition & models –substrate, product - folding of peptides.

UNIT V  FOLDING PATHWAYS & ENERGY LANDSCAPES  9
Folding of ci2 – nucleation condensation mechanism – folding of barnase – time resolution – insights from theory – optimization of folding rates – molecular chaperones. Production and purification of crude enzyme extracts from plant, animal and microbial sources; methods of characterization of enzymes; development of enzymatic assays

TOTAL: 45 PERIODS

TEXTS  BOOKS
2. James M. Lee, “Biochemical Engineering”, PHI, USA.

REFERENCES
BT2203  BIOCHEMISTRY - I  L T P C  3 0 0 3

AIM
To enable students learn the basic fundamental of biochemical Processes.

OBJECTIVE
- To ensure students have a strong grounding in structures and reactions of biomolecules.
- To introduce them to metabolic pathway of the major bimolecular and relevance to clinical conductors.
- To correlate biochemical processes with biotechnology applications.

UNIT I  INTRODUCTION TO BIOMOLECULES  5
Basic principles of organic chemistry, types of functional groups, biomolecules, chemical nature, water, pH and biological buffers.

UNIT II  STRUCTURE AND PROPERTIES  15
Structure and properties of Important Biomolecules.
Carbohydrates (mono, di, oligo & polysaccharides) Proteoglycans, glucosaminoglycans. mutarotation, glycosidic bond, reactions of monosaccharides, reducing sugars.
Lipids: fatty acids, glycerol, saponification, iodination, hydrogenation, phospholipids, glycolipids, sphingolipids, cholesterol, steroids, prostaglandins.
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 ,reactions, properties, measurement, nucleoprotein complexes

UNIT III  METABOLISM CONCEPTS  5
Functions of Proteins, Enzymes, introduction to biocatalysts, metabolic pathways, primary and secondary metabolites.

UNIT IV  INTERMEDIARY METABOLISM AND REGULATION  15
Glycolysis, TCA cycle, gluconeogenesis, pentose phosphate shunt, glyoxalate shunt, fatty acid synthesis and oxidation, reactions of amino acids, deamination, transamination and decarboxylation, urea cycle, interconnection of pathways and metabolic regulation. Case study on overproduction of glutamic acid, threonine , lysine, methionine, isoleucine and ethanol.

UNIT V  BIOENERGETICS  5
High energy compounds, electronegative potential of compounds, respiratory chain, ATP cycle, calculation of ATP yield during oxidation of glucose and fatty acids.

TOTAL : 45 PERIODS

TEXT BOOKS
BT2207 BIOCHEMISTRY LABORATORY  L T P C 0 0 4 2

MAIN TOPICS OF STUDY

Demonstration of use of volume and weight measurements devices.
Titration of weak acid-weak base.
Quantitative Test for carbohydrates
Distinguish reducing and nonreducing sugars.
Using ninhydrin for distinguishing Imino and amino acids
Protein estimation by Biuret and Lowry’s methods.
Protein estimation by Bradford colorometric methods.
Extraction of lipids and analysis by TLC.
Estimation of nucleic acids by absorbance at 260nm and hyperchromicity.
Enzymatic assay of phosphates.
Hydrolysis of starch by an enzyme

TOTAL: 60 PERIODS

REFERENCES

LIST OF EQUIPMENTS

Heating Mantles (5) / Water Baths (5) / Bunsen Burners (10)
TLC Plates – Required Numbers
Colorimeter – 2 Nos.
Consumables and Reagents.

BT 2208 BIOORGANIC CHEMISTRY LABORATORY  L T P C 0 0 4 2

AIM(S) OF THE COURSE

The course aims is offering hands on training in the area of Bio Organic Chemistry. This will be a prerequisite for certain lab courses offered in the subsequent semesters and also for the project work.

LIST OF EXPERIMENTS
1. Synthesis of aspirin
2. Hydrolysis of sucrose
3. Preparation of pyruvic acid.
4. Preparation of oleic acid
5. Preparation of alpha D- glucopyranose pentaacetate
6. Preparation of 1,2,5,6 dicyclohexyloine 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

REFERENCE

EQUIPMENTS / APPARATUS REQUIREMENTS

Heating Mantles (Nos. 5) / Water baths (Nos. 5) / Bunsen Burners (Nos. 15)
Round bottom flasks of various volumes (100ml, 500 ml, 250 ml – Nos.5) condensers (Nos. 5), Distillation units (Nos. 2).
Reagents and consumables.

BT 2209 CELL BIOLOGY LABORATORY L T P C
0 0 4 2

AIM(S) OF THE COURSE
The course aims is offering hands on training in the area of Cell culture and Cell identification. This will serve as a prerequisite for post graduate and specialized studies & research.

EXPERIMENTS
1. Introduction to principles of sterile techniques and cell propagation.
2. Principles of microscopy, phase contrast and fluorescent microscopy.
3. Identification of given plant, animal and bacterial cells and their components by microscopy,
4. GRAM’S Staining,
5. Leishman Staining,
6. Thin Layer Chromatography,
7. Giemsa Staining,
8. Separation of Peripheral Blood Mononuclear Cells from blood,
9. Osmosis and Tonicity,
10. Tryphan Blue Assay,
11. Staining for different stages of mitosis in AlliumCepa (Onion).

TOTAL : 60 PERIODS

REFERENCE

EQUIPMENTS / APPARATUS
Microbiological Hood for sterilization with UV lighting (One).
Bunsen Burners – 10 Nos.
Orbital Shaker and Incubator – 2 Nos.
Refrigerator – 1 No.
Reagents and consumables – Required amount.
AIM(S) OF THE COURSE
The course aims to develop skills of the Students in area of Basic Industrial Biotechnology. This will be very effect in understanding courses like Bioprocess technology, genetic engineering. Etc.,

UNIT I INTRODUCTION TO INDUSTRIAL BIOPROCESS 7

UNIT II PRODUCTION OF PRIMARY METABOLITES 10
A brief outline of processes for the production of some commercially important organic acids (e.g. citric acid, lactic acid, acetic acid etc.,); amino acids (glutamic acid, phenylalanine, aspartic acid etc.,) and alcohols (ethanol, butanol etc.,)

UNIT III PRODUCTION OF SECONDARY METABOLITES 10
Study of production processes for various classes of secondary metabolites: antibiotics: beta-lactams (penicillin, cephalosporin etc.), aminoglycosides (streptomycin etc.,) macrolides (erythromycin), vitamins and steroids.

UNIT IV PRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS 8
Production of industrial enzymes such as proteases, amylases, lipases, cellulases etc., Production of biopesticides, biofertilisers, biopreservatives (Nisin), cheese, biopolymers (xanthan gum, PHB etc.,), single cell protein.

UNIT V PRODUCTION MODERN BIOTECHNOLOGY PRODUCTS 10
Production of recombinant proteins having therapeutic and diagnostic applications, production of vaccines. Production of monoclonal antibodies. Products of plant and animal cell culture

TOTAL: 45 PERIODS

TEXT BOOKS
2. Presscott, Dunn, “Industrial Microbiology”, Agrobios (India).

REFERENCES
2. Murrey Moo & Young, “Comprehensive Biotechnology”, Pergamon
OBJECTIVES
At the end of the course, the students would
1. Acquire skills in handling situations involving more than one random variable and functions of random variables.
2. Be introduced to the notion of sampling distributions and have acquired knowledge of statistical techniques useful in making rational decision in management problems.
3. Be exposed to statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.

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

UNIT II TWO DIMENSIONAL RANDOM VARIABLES
Joint distributions - Marginal and conditional distributions – Covariance - Correlation and Regression – function of a random variable-Transformation of random variables - Central limit theorem.

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

UNIT IV DESIGN OF EXPERIMENTS

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

L: 45  T: 15  TOTAL: 60 PERIODS

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

TEXT BOOKS

REFERENCES
AIM(S) OF THE COURSE
The course aims to develop skills of the Students in area of unit operations. This course will be a prerequisite for certain engineering subjects offered in the subsequent semesters.

UNIT I MIXING AND AGITATION 8
Dimensional analysis; power for agitation; agitation of liquids; gas-liquid systems; gas-solid suspensions; agitator scale up.

UNIT II FILTRATION 8
Constant pressure, constant volume batch filtration; continuous filtration; industrial filters; settling and sedimentation; centrifugation.

UNIT III MECHANISM OF HEAT TRANSFER 10
Steady state conduction; combined resistances; unsteady state conduction; lumped heat capacity; extended surfaces; combined conduction and convection.

UNIT IV CONVECTION HEAT TRANSFER 10
Dimensional analysis; forced and natural convection; convection in flow over surfaces through pipes boiling and condensation.

UNIT V HEAT EXCHANGERS 9
Equipments; overall heat transfer coefficients; design of heat exchangers; NTU concept; evaporators; single and multiple effects; mass and enthalpy balances.

TOTAL : 45 PERIODS

TEXT BOOK

REFERENCE
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; v-l-e 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 ANALYSIS OF PROCESSES  9
Concept of lost work; entropy generation; calculation of real irreversible processes; power cycle; liquefaction.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE
UNIT V  SEPARATION METHODS

TOTAL: 45 PERIODS

TEXT BOOKS
1. Instrumental Methods of Analysis; Willard and H. Merrit, Phi, 1999.

BT2255  MICROBIOLOGY  L T P C
3 0 0 3

AIM(S) OF THE COURSE
The course aims to develop skills of the Students in the area of Microbiology particularly to identify microbes, their structure, their metabolism and their industrial applications. This will be a prerequisite for all courses offered in Bioprocess Technology.

UNIT I  INTRODUCTION  6
Basic of microbial existence; history of microbiology, classification and nomenclature of microorganism, 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 a special mention of life history of actinomycetes, yeast, mycoplasma and bacteriophage.

UNIT III  MICROBIAL NUTRITION, GROWTH AND METABOLISM  12
Nutritional requirements of bacteria and different media used for bacterial culture; growth curve and different methods to quantitate 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; antibacterial, 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, vit.b-12; biogas; bioremediation; leaching of ores by microorganisms; bio-fertilizers and bio-pesticides; microorganisms and pollution control; biosensors

TOTAL : 45 PERIODS

TEXT BOOKS
AIM(S) OF THE COURSE
The course aims to develop the skills of students in area of microbiology. Here hands on training is offered for the students to study microbes, their identifications & characterization and their practical uses.

EXPERIMENTS
1. Laboratory safety and sterilization techniques
2. Microscopic methods in the identification of microorganisms
3. Preparation of culture media – nutrient broth and nutrient agar
4. Culturing of microorganisms – in broth and in plates (pour plates, streak plates, isolation and preservation of bacterial cultures)
5. Staining techniques – grams’ and differential
6. Quantitation of microorganisms.
7. Effect of disinfectants on microbial flora
8. Isolation and identification of microorganisms from different sources – soil, water and milk
9. Antibiotic sensitivity assay
11. Effect of different parameters on bacterial growth (ph, temperature & UV irradiation)

TOTAL: 60 PERIODS

REFERENCE

EQUIPMENTS / APPARATUS
Microbiological Hood for sterilization with UV lighting (One).
Bunsen Burners – 15 Nos.
Orbital Shaker and incubator – 2 Nos.
Refrigerator – 1 No.
Reagents and consumables – Required amount.

MAIN AIM(S) OF THE COURSE
To develop skills of students by providing hands on training in using various equipments used in biotechnology. This will be a pre-requisite for certain specialized project work that a student undertakes.

EXPERIMENTS
1. Precision and validity in an experiment using absorption spectroscopy and Validating Lambert-Beer's law using kMn O4
2. Finding the molar absorbtivity and stoichiometry of the Fe (1, 10 phenanthroline) using absorption spectrometry.
3. Finding the pKa of 4-niropsenol using absorption spectroscopy.
4. UV spectra of nucleic acids.
5. Estimation of Sulphate by nephelometry.
6. Estimation of Al⁺⁺⁺ by fluorimetry.
7. Chromatography analysis using TLC and Column chromatography.
8. UV spectra of nucleic acids.
10. Chromatography using column chromatography.
11. Job’s plot for funding stochometer of iron salicylate complex.
12. UV – spectra of proteins.

TOTAL: 60 PERIODS

REFERENCE

LIST OF EQUIPMENTS

1. UV – VIS Spectro photometer, Fluorimeter (optional).
2. TLC chamber (common to biochemistry)
3. Reagents and consumables
4. Measuring cylinders, bathometric flasks of various volumes.

BT2259 CHEMICAL ENGINEERING LAB

1. Flow measurement
2. Pressure drop in pipes and packed columns
3. Fluidization
4. Filtration
5. Heat exchanger
6. Simple and steam distillation
7. Distillation in packed column
8. Liquid-liquid equilibria in extraction
9. Adsorption equilibrium

TOTAL: 60 PERIODS
UNIT I  ENGINEERING ETHICS  9
Senses of ‘Engineering Ethics’ – Variety of moral issues – Types of inquiry – Moral
dilemmas – Moral Autonomy – Kohlberg’s theory – Gilligan’s theory – Consensus and
Controversy – Professions and Professionalism – Professional Ideals and Virtues –
Uses of Ethical Theories.

UNIT II  ENGINEERING AS SOCIAL EXPERIMENTATION  9
Engineering as Experimentation – Engineers as responsible Experimenters – Research
Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The
Challenger Case Study

UNIT III  ENGINEER’S RESPONSIBILITY FOR SAFETY  9
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing
Risk – The Government Regulator’s Approach to Risk – Chernobyl Case Studies and
Bhopal.

UNIT IV  RESPONSIBILITIES AND RIGHTS  9
Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality
– Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights –
Intellectual Property Rights (IPR) - Discrimination

UNIT V  GLOBAL ISSUES  9
Multinational Corporations – Business Ethics - Environmental Ethics – Computer Ethics -
Role in Technological Development – Weapons Development – Engineers as Managers
– Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty –
Moral Leadership – Sample Code of Conduct

TOTAL: 45 PERIODS

TEXT BOOKS
York, 2005.

REFERENCES
3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “Business Ethics – An Indian Perspective”,
Biztantra, New Delhi, 2004.
AIM
This course aims to develop the skills of the students in Bioinformatics. This is a pre-requisite for certain elective courses offered in the subsequent semesters & for project work.

OBJECTIVES
- At the end of this course, the students would have learnt about tools used in Bioinformatics & how to use them. This will facilitate the students to undertake projects in the modern biology.

UNIT I INTRODUCTION

UNIT II DATABASES
Data management – data life cycle – database technology – interfaces and implementation – biological databases and their uses

UNIT III PATTERN MATCHING & MACHINE LEARNING

UNIT IV PHYLOGENY
Introduction; mutations; irrelevant mutations; controls; mutations as a measure of time; distances; reconstruction; distances between species; estimating time intervals from distances.

UNIT V ADVANCED TOPICS IN BIOINFORMATICS

TEXT BOOKS

REFERENCE
AIM
To develop skills of the students in Biochemistry with special emphasis on the metabolizing amino acids, nucleic acids, polysaccharide & lipids and an bio membranes. This may be a pre-requisite for certain-elective courses like Metabolic Engineering; Molecular Modelling & Drug Design etc.

OBJECTIVES
- At the end of the course, the student would have gained an extensive knowledge of Biochemistry particular various metabolic pathways & Biomembranes. This knowledge will be useful for project work.

UNIT I  METABOLISM OF AMINO ACIDS  15
Nitrogen metabolism and urea cycle. Biosynthesis of Gly, Ser and Cys; Biosynthesis of six essential amino acids (Met, Thr, Lys, Ile, Val, Leu) and regulation of branched chain amino acids (concerted inhibition, allostery regulation and enzyme multiplicity, sequential feed back) from oxaloacetate and pyruvate; Biosynthesis of aromatic amino acids. Metabolic disorders associated with branched chain and aromatic amino acid degradation. Important molecules derived from amino acids (auxins, DOPA, Serotonin, porphyrins, T3, T4, Adrenaline, Noradrenaline, histamine, GABA, polyamines etc)

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

UNIT III  METABOLISM OF NUCLEIC ACIDS, POLYSACCHARIDES AND LIPIDS  10
Biosynthesis of nucleotides, denovo and salvage pathways for purines and pyrimidines, regulatory mechanisms: Degradation of nucleic acid by exo and endo nucleases. Biosynthesis and degradation of starch and glycogen, Biosynthesis and degradation of Lipids: Fatty acid synthesis and oxidative degradation, Triacylglycerol and phospholipid biosynthesis and degradation; Cholesterol biosynthesis and regulation and targets and action of cholesterol lowering drugs. Vitamins (fat and water-soluble), Co-enzymes, hormones (steroids like corticoids, amino acids derived like adrenaline and noradrenaline and peptides like insulin and growth hormone).

UNIT IV  STRUCTURAL PROTEINS AND CYTOSKELETON  5
Contractile proteins, Actin, myosin, actin polymerization, acto-myosin complexes, mechanism of myosin ATPase activity, excitation- contraction coupling and relaxation, microtubules, microfilaments and their role in organelle movements

UNIT V  BIOMEMBRANE, TRANSPORT AND ELECTRICAL CONDUCTIVITY  10
Micelles, lipid bi-layer structure of membranes, membrane proteins, passive, career-mediated and active transport, ion-selective channels, trans-membrane potential coupled ATP generation, receptors, acetylcholine receptor as a ligand gated ion-channel, Neuronal sodium channel as voltage-gated ion channel, neurotransmitters and their mechanism of action, action potential, depolarization and nerve conduction. Ion-channel agonists and antagonists as drugs. Ion channel defects (Cystic Fibrosis)

TOTAL : 45 PERIODS
TEXT BOOKS
1. Lehninger's Principles of Biochemistry by David L. Nelson and Michael M Cox, Macmillan Worth Publisher

REFERENCES

BT2303 BIOPROCESS PRINCIPLES L T P C
AIM
To develop skills of the students in the area of Bio process Technology with emphasis an Bioprocess principles. This is a pre-requisite for courses an Bioprocess technology offered in the subsequent semesters.

OBJECTIVES
- At the end of the course, the students would have learnt about fermentation processes, Metabolic stoichiometry, Energetics, Kinetics of microbial growth etc. This will serve as an effective course to understand certain specialized electives in Bioprocess related fields.

UNIT I OVERVIEW OF FERMENTATION PROCESSES 6
Overview of fermentation industry, general requirements of fermentation processes, basic configuration of Fermentor and ancillaries, main parameters to be monitored and controlled in fermentation processes.

UNIT II RAW MATERIALS AND MEDIA DESIGN FOR FERMENTATION PROCESS 8
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 6
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 12
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

TEXT BOOKS

REFERENCES

BT2304  MASS TRANSFER OPERATIONS  L T P C
3 0 0 3

AIM
To develop skills of the students in the area of Mass Transfer operation. This will be a pre-requisite for courses offered in Engineering in the subsequent semesters.

OBJECTIVES
• At the end of the course, the student would have learnt about Mass Transfer, Gas-Liquid, Vapour – liquid & solid – third operations. This will be beneficial to for the study of specialized electives and project work.

UNIT I  DIFFUSION AND MASS TRANSFER  9
Molecular diffusion in fluids and solids; Inter phase 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 & PONCHON-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
Adsorption equilibria – Batch and fixed bed adsorption; Drying-Mechanism-Drying curves-Time of Drying; Batch and continuous dryers.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE

BT2305  MOLECULAR BIOLOGY  L T P C
3 0 0 3

UNIT I  CLASSICAL GENETICS  5
Mendelian genetics, linkage, crossing over, classical experiments – Hershey and Chase, Avery McLeod & McCarty. Bacterial conjugation, transduction and transformation.

UNIT II  STRUCTURE OF NUCLEIC ACIDS AND DNA REPLICATION  15
Conformation of DNA and RNA; replication in prokaryotes, D-loop and rolling circle mode of replication, replication of linear viral DNA. Organisation of eukaryotic chromosome – cot value, replication of telomeres in eukaryotes

UNIT III  TRANSCRIPTION  8
In prokaryotes and eukaryotes, features of promoters and enhancers, transcription factors, nuclear RNA splicing, ribozyme.

UNIT IV  TRANSLATION  3  10
Elucidation of genetic code, mechanism, codon usage, suppressor mutation.

UNIT V  REGULATION OF GENE EXPRESSION  7
Lac and trp phage life cycle, mutation and repair of DNA, operon.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE
AIM
To develop the skills of the students by providing hands-on training practical training in Molecular Biology. This will facilitate the students to take up specialized project in Molecular biology and will be a pre-requisite for research work.

OBJECTIVES
- At the end of this course, the students would have learnt basic techniques used in Molecular Biology and its application. This will be strength for students to undertake research projects in the area of moderation biology.

1. Isolation of bacterial DNA
2. Isolation of plant cell and animal cell genomic DNA
3. Agarose gel electrophoresis
4. Restriction enzyme digestion
5. Competent cells preparation
6. Transformation and screening for recombinants
7. Agarose gel electrophoresis
8. Restriction enzyme digestion
9. Competent cells preparation
10. Blue and white selection for recombinants
11. Plating of Ophage
12. Q phage lysis of liquid cultures

TOTAL : 60 PERIODS

BT2308  BIOINFORMATICS LAB

1. Introduction to UNIX basic commands and UNIX Filters.

2. Perl programming and applications to Bioinformatics.
   - Basic scripting.
   - Regular expressions.
   - File i/o & control statement.
   - Subroutines & functions.
   - Writing scripts for automation.

3. Types of Biological Databases and Using it.
   - Genbank.
   - Protein Data Bank.
   - Uniprot.

4. Sequence Analysis Tools
   - Use of BLAST, FASTA (Nucleic Acids & Proteins).
   - Use of Clustal W.
   - Use of EMBOSS.
5. Phylogenetic Analysis

- Use of Phylip.

6. Molecular Modeling

- Homology Modeling – Swissmodeller.
- Any Open Source Software.

EQUIPMENT

One computer for every 2 students with the software indicated.

TOTAL: 60 PERIODS

GE2321 COMMUNICATION SKILLS LABORATORY L T P C
0 0 4 2
(Fifth / Sixth Semester)

Globalization has brought in numerous opportunities for the teeming millions, with more focus on the students’ overall capability apart from academic competence. Many students, particularly those from non-English medium schools, find that they are not preferred due to their inadequacy of communication skills and soft skills, despite possessing sound knowledge in their subject area along with technical capability. Keeping in view their pre-employment needs and career requirements, this course on Communication Skills Laboratory will prepare students to adapt themselves with ease to the industry environment, thus rendering them as prospective assets to industries. The course will equip the students with the necessary communication skills that would go a long way in helping them in their profession.

OBJECTIVES

- To equip students of engineering and technology with effective speaking and listening skills in English.
- To help them develop their soft skills and interpersonal skills, which will make the transition from college to workplace smoother and help them excel in their job.
- To enhance the performance of students at Placement Interviews, Group Discussions and other recruitment exercises.

<table>
<thead>
<tr>
<th>I. PC based session (Weightage 40%)</th>
<th>24 periods</th>
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</thead>
</table>

A. ENGLISH LANGUAGE LAB (18 Periods)

1. LISTENING COMPREHENSION:
   - Listening and typing – Listening and sequencing of sentences – Filling in the blanks - Listening and answering questions.

2. READING COMPREHENSION:
   - Filling in the blanks - Close exercises – Vocabulary building - Reading and answering questions.
3. SPEAKING

Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

B. DISCUSSION OF AUDIO-VISUAL MATERIALS (6 PERIODS)
(Samples are available to learn and practice)

1. RESUME / REPORT PREPARATION / LETTER WRITING (1)
   Structuring the resume / report - Letter writing / Email Communication - Samples.

2. PRESENTATION SKILLS: (1)
   Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples

3. SOFT SKILLS: (2)
   Time management – Articulateness – Assertiveness – Psychometrics – Innovation and Creativity - Stress Management & Poise - Video Samples

4. GROUP DISCUSSION: (1)
   Why is GD part of selection process ? - Structure of GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD -Video samples

5. INTERVIEW SKILLS: (1)
   Kinds of interviews – Required Key Skills – Corporate culture – Mock interviews- Video samples.

II. Practice Session (Weightage – 60%) 24 periods

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<tbody>
<tr>
<td>1.</td>
<td><strong>Resume / Report Preparation / Letter writing</strong>: Students prepare their own resume and report.</td>
<td>(2)</td>
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<tr>
<td>2.</td>
<td><strong>Presentation Skills</strong>: Students make presentations on given topics.</td>
<td>(8)</td>
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<tr>
<td>3.</td>
<td><strong>Group Discussion</strong>: Students participate in group discussions.</td>
<td>(6)</td>
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<tr>
<td>4.</td>
<td><strong>Interview Skills</strong>: Students participate in Mock Interviews</td>
<td>(8)</td>
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</tbody>
</table>

REFERENCES
LAB REQUIREMENT
1. Teacher console and systems for students.
2. English Language Lab Software
3. Career Lab Software

Guidelines for the course

GE2321 COMMUNICATION SKILLS LABORATORY

A batch of 60 / 120 students is divided into two groups – one group for the PC-based session and the other group for the Classroom session.

The English Lab (2 Periods) will be handled by a faculty member of the English Department. The Career Lab (2 Periods) may be handled by any competent teacher, not necessarily from English Department.

Record Notebook: At the end of each session of English Lab, review exercises are given for the students to answer and the computer evaluated sheets are to be compiled as record notebook. Similar exercises for the career lab are to be compiled in the record notebook.

Internal Assessment: The 15 marks (the other 5 marks for attendance) allotted for the internal assessment will be based on the record notebook compiled by the candidate. 10 marks may be allotted for English Lab component and 5 marks for the Career Lab component.

End semester Examination: The end-semester examination carries 40% weightage for English Lab and 60% weightage for Career Lab.

Each candidate will have separate sets of questions assigned by the teacher using the teacher-console enabling PC-based evaluation for the 40% of marks allotted.

The Career Lab component will be evaluated for a maximum of 60% by a local examiner & an external examiner drafted from other Institutions, similar to any other lab examination conducted by Anna University.

Requirement for a batch of 60 students

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<tr>
<th>Sl.No.</th>
<th>Description of Equipment</th>
<th>Quantity required</th>
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<tbody>
<tr>
<td>1.</td>
<td>Server</td>
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<td>o PiV system</td>
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<td></td>
<td>o 1 GB RAM / 40 GB HDD</td>
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<td></td>
<td>o OS: Win 2000 server</td>
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<td></td>
<td>o Audio card with headphones (with mike)</td>
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<td>o JRE 1.3</td>
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<td>2.</td>
<td>Client Systems</td>
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<td>o PIII or above</td>
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<tr>
<td>1</td>
<td>o 256 or 512 MB RAM / 40 GB HDD</td>
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<td>3.</td>
<td>Handicam Video Camera (with video lights and mic input)</td>
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<td>Television - 29&quot;</td>
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<td>5.</td>
<td>Collar mike</td>
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<td>6.</td>
<td>Cordless mikes</td>
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<td>7.</td>
<td>Audio Mixer</td>
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<tr>
<td>8.</td>
<td>DVD Recorder / Player</td>
<td>1 No.</td>
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</tbody>
</table>

**UNIT I**

**INTRODUCTION**
Overview of Genomes of Bacteria, Archae and Eukaryota.

**UNIT II**

**PHYSICAL MAPPING TECHNIQUES**
Top down and bottom up approach; linking and jumping of clones; genome sequencing: placing small fragments on map; STS assembly; gap closure; pooling strategies; cytogenetic mapping techniques.

**UNIT III**

**FUNCTIONAL GENOMICS**
Gene finding; annotation; ORF and functional predication; Subtractive DNA library screening; differential display and representational difference analysis; SAGE; TOGA.

**UNIT IV**

**PROTEOMICS TECHNIQUES**
Protein level estimation; Edman protein micro sequencing; protein cleavage; 2D gel electrophoresis; metabolic labeling; detection of proteins on SDS gels; pattern analysis; Mass spectrometry – principles of MALDI-TOF; tandem MS-MS; Peptide mass fingerprinting.

**UNIT V**

**STRUCTURE FUNCTION RELATIONSHIP OF PROTEINS**
Post translation modification; protein–protein interactions; glycoprotein analysis; phosphoprotein analysis, NMR and Crystallography of protein of elucidate protein structure, protein structure by modally.

**TOTAL : 45 PERIODS**

**REFERENCES**
AIM
This course aims to develop the skills of the students in the area of chemical reaction engineering. This is a pre-requisite for courses offered in Bioprocess Technology a few electives.

OBJECTIVES
- At the end of the course, the student would have learnt chemical kinetics, various types of reactors, and how they function. This will help the student to take up PG courses in Bioprocess, Biochemical Engg., and also the project work.

UNIT I SCOPE OF CHEMICAL KINETICS & CHEMICAL REACTION ENGINEERING 8
Broad outline of chemical reactors; rate equations; concentration and temperature dependence; development of rate equations for different homogeneous reactions. Industrial scale reactors.

UNIT II IDEAL REACTORS 10
Isothermal batch, flow, semi-batch reactors; performance equations for single reactors; multiple reactor systems; multiple reactions.

UNIT III IDEAL FLOW AND NON IDEAL FLOW 10
RTD in non-ideal flow; non-ideal flow models; reactor performance with non-ideal flow.

UNIT IV GAS-SOLID, GAS-LIQUID REACTIONS 9
Resistances and rate equations; heterogeneous catalysis; reactions steps; resistances and rate equations.

UNIT V FIXED BED AND FLUID BED REACTORS 8
G/l reactions on solid catalysis; trickle bed, slurry reactors; three phase-fluidized beds; reactors for fluid-fluid reactions; tank reactors.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE
AIM
This course aims to develop the skills of the students in the area of Bioprocess Engineering. This will be a pre-requisite for a few elective courses and for project in Bioprocess Technology.

OBJECTIVES
• At the end of the course, the student would have learnt about stirred Tank reactors and configuration of various reaches, and how to model and similar a Bio process. This will help the student to undertake project in the area of Bio process Technology.

UNIT I  ANALYSIS OF STR  8
Stirred tank reactor - non-ideality, RTD and stability analysis, tanks in series and dispersion models – application to design of continuous sterilizer.

UNIT II  ANALYSIS OF OTHER CONFIGURATIONS  8
Packed bed reactor, airlift reactor, fluidized bed reactor bubble column reactors – non-ideality, RTD and stability analysis.

UNIT III  BIOREACTOR SCALE – UP  9
Regime analysis of bioreactor processes, oxygen mass transfer in bioreactors - microbial oxygen demands; methods for the determination of mass transfer coefficients; mass transfer correlations. Scale up criteria for bioreactors based on oxygen transfer, power consumption and impeller tip speed.

UNIT IV  MODELLING AND SIMULATION OF BIOPROCESSES  12
Study of structured models for analysis of various bioprocess – compartmental models, models of cellular energetics and metabolism, single cell models, plasmid replication and plasmid stability model. Dynamic simulation of batch, fed batch, steady and transient culture metabolism.

UNIT V  BIOREACTOR CONSIDERATION IN ENZYME SYSTEMS  8
Analysis of film and pore diffusion effects on kinetics of immobilized enzyme reactions; formulation of dimensionless groups and calculation of effectiveness factors. Design of immobilized enzyme reactors – packed bed, fluidized bed and membrane reactors.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
1. James M. Lee, “Biochemical Engineering”, PHI, USA.
AIM
This course aims to develop the skills of the students in Immunotechnology, Proteomics and genomics etc.

OBJECTIVES
- At the end of the course would have learnt about the mechanisms by which a human body interacts with a pathogenic microbe & how it eliminates it. Students, also familiarize themselves with the pathogenesis of diseases like AIDS, Cancer, TB etc.

UNIT I  INTRODUCTION  9
Cells of immune system; innate and acquired immunity; primary and secondary lymphoid organs; antigens: chemical and molecular nature; haptens; adjuvants; types of immune responses; theory of clonal selection.

UNIT II  CELLULAR RESPONSES  9
Development, maturation, activation and differentiation of T-cells and B-cells; TCR; antibodies: structure and functions; antibodies: genes and generation of diversity; antigen-antibody reactions; monoclonal antibodies: principles and applications; antigen presenting cells; major histocompatibility complex; antigen processing and presentation; regulation of T-cell and B-cell responses.

UNIT III  INFECTION AND IMMUNITY  9
Injury and inflammation; immune responses to infections: immunity to viruses, bacteria, fungi and parasites; cytokines; complement; immunosuppression, tolerance; allergy and hypersensitivity; AIDS and Immunodeficiencies; resistance and immunisation; Vaccines.

UNIT IV  TRANSPLANTATION AND TUMOR IMMUNOLOGY  9
Transplantation: genetics of transplantation; laws of transplantation;; tumor immunology.

UNIT V  AUTOIMMUNITY  9
Autoimmunity, Autoimmune disorders and diagnosis.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE
AIM
To develop skills of the students in the area of genetic Engineering. This will be a pre-
requisite for electives like genomics & proteomics, Immuno technology offered in the
subsequent semesters.

OBJECTIVES
- At the end of the course, the student would learnt about various aspects of genetic
  engineering and its application This will be very useful for the student to undertake
  research /project work in Modern Biology.

UNIT I BASICS OF RECOMBINANT DNA TECHNOLOGY 4
Role of genes within cells, genetic elements that control gene expression, restriction and
modifying enzymes, safety guidelines of recombinant DNA research.

UNIT II CREATION OF RECOMBINANT MOLECULES 10
Restriction mapping, design of linkers and adaptors. Characteristics of plasmid and
phage vectors, prokaryotic and eukaryotic expression vectors. Insect, Yeast and
Mammalian vectors.

UNIT III CONSTRUCTION OF LIBRARIES 15
Construction of cDNA and genomic libraries. Screening of libraries with DNA probes and
with antisera.

UNIT IV POLYMERASE CHAIN REACTION 10
Inverse PCR, Nested PCR, Taqman assay, Molecular beacons, RACE PCR, RAPD, site
directed mutagenesis, methods of nucleic acid sequencing- Sangers method, (Kunkel’s
Method).

UNIT V APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY 6
Cloning in plants, Ti plasmid, and transgenic and knockout animals.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
AIM
To provide hands on training in the Genetic Engineering by the designing simple experiments. This is a pre-requisite for Down-stream processing has offered in later semester.

OBJECTIVES
- At the end of the course, the student would have learnt about the cloning of genes, how to express them for protein production & subsequent purification of protein. This will be needed for any project work in modern biology.
  1. Preparation of plasmid DNA.
  2. Elution of DNA from agarose gels.
  3. Ligation of DNA into expression vectors.
  5. Optimisation of inducer concentration for recombinant protein expression.
  6. Optimisation of time of inducer for recombinant protein expression.
  7. SDS-PAGE, 2 D Gel, ISO – electric Focussing.
  8. Western blotting.
  9. Hybridisation with anti-sera.
  10. PCR.

TOTAL : 60 PERIODS

AIM
This course aims to provide hands a training in the laboratory of Bio process Technology by performing simple experiments.

OBJECTIVES
- At the end of the course, the student would have learnt about Bioreactors & how to use them for practical applications. This will be beneficial to students to undertake project work in this area.
  1. Thermal death kinetics
  2. Batch sterilization design
  4. Batch and Fed batch cultivation, exhaust gas analysis – carbon balancing, gas balancing
  5. Total cell retention cultivation, exhaust gas analysis – carbon balancing, gas balancing
  6. Estimation of kla – sulphite oxidation method
  7. Estimation of kla – power correlation method
  8. Residence time distribution
  9. Estimation of overall heat transfer coefficient
  11. Enzyme kinetics – micheies menton parameters.

TOTAL : 60 PERIODS
UNIT I INTRODUCTION

UNIT II TQM PRINCIPLES
Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDCA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I

UNIT IV TQM TOOLS & TECHNIQUES II

UNIT V QUALITY SYSTEMS

TOTAL : 45 PERIODS

TEXT BOOK

REFERENCES
AIM
This course aims to develop the skills of the students in the area of Downstream processing. This is a pre-requisite for courses in Bioprocess Technology.

OBJECTIVES
• At the end of the course, the student would have learnt about methods to obtain pure proteins, enzymes and in general about product development R & D. This will be handy for projects of Industries.

UNIT I  DOWNSTREAM PROCESSING  8+3
Introduction to downstream processing principles characteristics of biomolecules and bioprocesses. Cell disruption for product release – mechanical, enzymatic and chemical methods. Pretreatment and stabilisation of bioproducts.

UNIT II  PHYSICAL METHODS OF SEPERATION  6+3
Unit operations for solid-liquid separation - filtration and centrifugation.

UNIT III  ISOLATION OF PRODUCTS  12+3
Adsorption, liquid-liquid extraction, aqueous two-phase extraction, membrane separation – ultrafiltration and reverse osmosis, dialysis, precipitation of proteins by different methods.

UNIT IV  PRODUCT PURIFICATION  12+3
Chromatography – principles, instruments and practice, adsorption, reverse phase, ion-exchange, size exclusion, hydrophobic interaction, bioaffinity and pseudo affinity chromatographic techniques.

UNIT V  FINAL PRODUCT FORMULATION AND FINISHING OPERATIONS  7+3
Crystallization, drying and lyophilization in final product formulation.

L : 45 , T : 15 , TOTAL : 60 PERIODS

TEXT BOOKS

REFERENCES
AIM
This course aims to develop the skills of the students in the area of Protein Engineering. This is a pre-requisite for a few elective courses offered in the subsequent semesters.

OBJECTIVES
• At the end of the course, the student would have learnt structure and function of proteins of particular importance, the student will know the production of recombinant insulin & in general how to engineer protein to be used as therapeutics.

UNIT I  BONDS AND ENERGIES IN PROTEIN MAKEUP  5
Covalent, Ionic, Hydrogen, Coordinate, hydrophobic and Vander walls interactions in protein structure. Interaction with electromagnetic radiation (radio, micro, infrared, visible, ultraviolet, X-ray) and elucidation of protein structure.

UNIT II  AMINO ACIDS AND THEIR CHARACTERISTICS  5
Amino acids (the students should be thorough with three and single letter codes) and their molecular properties (size, solubility, charge, pKa). Chemical reactivity in relation to post-translational modification (involving amino, carboxyl, hydroxyl, thiol, imidazole groups) and peptide synthesis.

UNIT III  PROTEIN ARCHITECTURE  12

UNIT IV  STRUCTURE-FUNCTION RELATIONSHIP  15
DNA-binding proteins: prokaryotic transcription factors, Helix-turn-Helix motif in DNA binding, Trp repressor, Eucaryotic transcription factors, Zn fingers, helix-turn helix motifs in homeodomain, Leucine zippers, Membrane proteins: General characteristics, Transmembrane segments, prediction, bacteriorhodopsin and Photosynthetic reaction center, Immunoglobulins: IgG Light chain and heavy chain architecture, abzymes and Enzymes: Serine proteases, understanding catalytic design by engineering trypsin, chymotrypsin and elastase, substrate-assisted catalysis other commercial applications.

UNIT V  PROTEIN ENGINEERING  8
Advantages and purpose, overview of methods, underlying principles with specific examples: thermal stability T4-lysozyme, recombinant insulin to reduce aggregation and inactivation, de novo protein design.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
AIM
To provide hands on training in Down stream processing by through simple experimentation in the laboratory. This will be a pre-requisite for project work.

OBJECTIVES
• At the end of the course, the student has gained the knowledge to perform various techniques used in Down Stream Processing and how to make a finished project.

1. Solid liquid separation – centrifugation, microfiltration
2. Cell disruption techniques – ultrasonication, French pressure cell
3. Cell disruption techniques – dyno mill – batch and continuous
4. Precipitation – ammonium sulphite precipitation
5. Ultra filtration separation
6. Aqueous two phase extraction of biologicals
7. High resolution purification – affinity chromatography
8. High resolution purification – ion exchange chromatography
9. Product polishing – gel filtration chromatography
10. Product polishing spray drying freeze drying

TOTAL : 60 PERIODS

AIM
The develop skills of students in Immunology by performing simple experiments in the laboratory.

OBJECTIVES
• At the end of the course the student would have gained knowledge to perform techniques like blood grouping, ELISA, & identification of T-cell, Immuno fluorescence etc. This will be of help in facilitating the students for project work.

1. Handling of animals, immunization and raising antisera
2. Identification of cells in a blood smear
3. Identification of blood group
4. Immuno diffusion & immuno electrophoresis
5. Testing for typhoid antigens by Widal test
6. Enzyme Linked Immuno Sorbent Assay (ELISA)
7. Isolation of peripheral blood mononuclear cells
8. Isolation of monocytes from blood
9. Immuno fluorescence
10. Identification of t cells by T-cell rosetting using sheep RBC.

TOTAL : 60 PERIODS
UNIT I  INTRODUCTION TO MARINE ENVIRONMENT  9

UNIT II  IMPORTANT MARINE ORGANISMS  9

UNIT II  MARINE ENVIRONMENTAL BIOTECHNOLOGY  9

UNIT IV  MARINE PHARMACOLOGY  9
Medicinal compound from marine flora and fauna – marine toxins , antiviral and antimicrobial agents.

UNIT V  AQUACULTURE TECHNOLOGY  9
Important of coastal aquaculture – marine fishery resources – common fishing crafts and gears – aquafarm design and construction.

TOTAL : 45 PERIODS

TEXT BOOKS

BT2022  PROCESS INSTRUMENTATION DYNAMICS AND CONTROL  L T P C 3 0 0 3

AIM
To introduce control equipments used to control the production process of a chemical factory and to introduce the control mechanism thro’ automation and computers.

OBJECTIVES
- Gains knowledge in designing a control system and identifying the alternative control configuration for a given process plant or entire plant. He will be familiar with the control mechanism before attempting to tackle process control problems.

UNIT I  9
Laplace transformation, transform of standard functions, derivatives and integrals, inversion, theorems in Laplace transformation, application .Open-loop systems, first order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics, transfer function for chemical reactors and dynamics.
UNIT II
Closed loop control systems, development of block diagram for feed-back control systems, servo and regulator problems, Transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transportation lag, transient response of closed-loop control systems and their stability.

UNIT III
Introduction to frequency response of closed-loop systems, control system design by frequency, Bode diagram, stability criterion, Nyquist diagram; Tuning of controller settings.

UNIT IV
Controller mechanism, introduction to advanced control systems, cascade control, feed forward control, control of distillation towers and heat exchangers, introduction to microprocessors and computer control of chemical processes.

UNIT V
Principles of measurements and classification of process control instruments, measurements of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity and consistency, pH, concentration, electrical and thermal conductivity, humidity of gases, composition by physical and chemical properties and spectroscopy.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
AIM
To develop the skills of the students in the area of Molecular Pathogenesis.

OBJECTIVES
- At the end of the course, the students would have learnt about Host Parasite interactions, Host defense mechanisms and molecular mechanisms involved in Pathogenesis of diseases caused by E.Coli and Vibrio. Cholerae.

UNIT I OVERVIEW
Historical perspective - discovery of microscope, Louis Pasteur’s contributions, Robert Koch’s postulates, early discoveries of microbial toxins, toxic assays, vaccines, antibiotics and birth of molecular genetics and modern molecular pathogenesis studies, Various pathogen types and modes of entry.

UNIT II HOST-DEFENSE AGAINST PATHOGENS AND PATHOGENIC STRATEGIES
Attributes & components of microbial pathogenesis, Host defense: skin, mucosa, cilia, secretions, physical movements, limitation of free iron, antimicrobial compounds, mechanism of killing by humoral and cellular defense mechanisms, complements, inflammation process, general disease symptoms, Pathogenic adaptations to overcome the above defenses.

UNIT III MOLECULAR PATHOGENESIS (WITH SPECIFIC EXAMPLES)
Virulence, virulence factors, virulence-associated factors and virulence lifestyle factors, molecular genetics and gene regulation in virulence of pathogens, Vibrio Cholerae: Cholera toxin, co-regulated pili, filamentous phage, survival E.coli pathogens: Enterotoxigenic E.coli (ETEC), labile & stable toxins, Entero- pathogenic E.coli (EPEC), type III secretion, cytoskeletal changes, intimate attachment; Enterohaemorrhagic E.coli (EHEC), mechanism of bloody diarrhoea and Hemolytic Uremic Syndrome, Enteroaggregative E.coli (EAEC). Shigella: Entry, macrophage apoptosis, induction of macropinocytosis, uptake by epithelial cells, intracellular spread, inflammatory response, tissue damage Plasmodium: Life cycle, erythrocyte stages, transport mechanism and processes to support the rapidly growing schizont, parasitiparous vacuoles, and knob protein transport, Antimalarials based on transport processes. Influenza virus: Intracellular stages, Neuraminidase & Haemagglutinin in entry, M1 & M2 proteins in assembly and disassembly, action of amantidine.

UNIT IV EXPERIMENTAL STUDIES ON HOST-PATHOGEN INTERACTIONS
Virulence assays: adherence, invasion, cytopathic, cytotoxic effects. Criteria & tests in identifying virulence factors, attenuated mutants, molecular characterization of virulence factors, signal transduction & host responses

UNIT V MODERN APPROACHES TO CONTROL PATHOGENS
Classical approaches based on serotyping. Modern diagnosis based on highly conserved virulence factors, immuno & DNA-based techniques. New therapeutic strategies based on recent findings on molecular pathogenesis of a variety of pathogens, Vaccines - DNA, subunit and cocktail vaccines.

TOTAL : 45 PERIODS
TEXT BOOKS

REFERENCES

BT2025 PRINCIPLES OF FOOD PROCESSING

AIM
To develop the skills of the students in the area of Food Process Technology and its applications.

OBJECTIVES
- At the end of the course, the student would have gained knowledge in various aspects of Food processing & its importance for industrial applications. This will facilitate the student to take up higher studies in the area.

UNIT I FOOD AND ENERGY
Constituents of food – carbohydrates, lipids, proteins, water, vitamins and minerals, dietary sources, role and functional properties in food, contribution to organoleptic and textural characteristics.

UNIT II FOOD ADDITIVES
Classification, intentional and non-intentional additives, functional role in food processing and preservation; food colourants – natural and artificial; food flavours; enzymes as food processing aids.

UNIT III MICROORGANISMS ASSOCIATED WITH FOOD
Bacteria, yeasts and molds – sources, types and species of importance in food processing and preservation; fermented foods and food chemicals, single cell protein.

UNIT IV FOOD BORNE DISEASES
Classification – food infections – bacterial and other types; food intoxications and poisonings – bacterial and non-bacterial; food spoilage – factors responsible for spoilage, spoilage of vegetable, fruit, meat, poultry, beverage and other food products.

UNIT V FOOD PRESERVATION
Principles involved in the use of sterilization, pasteurization and blanching, thermal death curves of microorganisms, canning; frozen storage-freezing characteristics of foods, microbial activity at low temperatures, factors affecting quality of foods in frozen storage; irradiation preservation of foods.

TOTAL : 45 PERIODS
TEXT BOOKS

REFERENCES

BT2026 BIOCONJUGATE TECHNOLOGY L T P C
3 0 0 3

AIM
To develop the skills of Student in the area of Bio conjugate technology and its industrial applications.

OBJECTIVES
- At the end of the course, the student would have learnt about enzymes, nucleic acids and how to modify them for target specificity. Student also gets familiarized with the industrial applications of this technology.

UNIT I FUNCTIONAL TARGETS

UNIT II CHEMISTRY OF ACIVE GROUPS
Amine reactive chemical reactions – Thiol reactive chemical reactions – carboxylate reactive chemical reactions – hydroxyl reactive chemical reactions – aldehyde and ketone reactive chemical reactions – Photoreactive chemical reactions.

UNIT III BIOCONJUGATE REAGENTS

UNIT IV ENZYME AND NUCLEIC ACID MODIFICATION AND CONJUGATION
Properties of common enzymes – Activated enzymes for conjugation – biotinylated enzymes – chemical modification of nucleic acids – biotin labeling of DNA- enzyme conjugation to DNA – Fluorescent of DNA.

UNIT V BIOCONJUGATE APPLICATIONS

TOTAL : 45 PERIODS

TEXT BOOK
AIM
To develop skills of the students in the area of Cancer Biology.

OBJECTIVES
- At the end of the course, the student would have learnt about pathogenesis of cancer, identifications of cancer through tools developed by biotechnology research & molecules synthesized for cancer therapy. This will be very beneficial for the student to take up projects in Cancer Biology.

UNIT I   FUNDAMENTALS OF CANCER BIOLOGY  9
Regulation of cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, modulation of cell cycle in cancer, different forms of cancers, diet and cancer. Cancer screening and early detection, Detection using biochemical assays, tumor markers, molecular tools for early diagnosis of cancer.

UNIT II   PRINCIPLES OF CARCINOGENESIS  12

UNIT III   PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER  9

UNIT IV   PRINCIPLES OF CANCER METASTASIS  9
Clinical significances of invasion, heterogeneity of metastatic phenotype, metastatic cascade, basement membrane disruption, three step theory of invasion, proteinases and tumour cell invasion.

UNIT V   NEW MOLECULES FOR CANCER THERAPY  6
Different forms of therapy, chemotherapy, radiation therapy, detection of cancers, prediction of aggressiveness of cancer, advances in cancer detection. Use of signal targets towards therapy of cancer; Gene therapy.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE
AIM
To develop the skills of the students in the area of Plant Biotechnology.

OBJECTIVES
- At the end of the course the student would have learnt about the applications of Genetic Engineering in Plant and how to develop Transgenic plants. This will facilitate the student to take up project work in this area.

UNIT I  ORGANIZATION OF GENETIC MATERIAL  9
Genetic material of plant cells – nucleosome structure and its biological significance; junk and repeat sequences; outline of transcription and translation.

UNIT II  CHLOROPLAST & MITOCHONDRIA  9
Structure, function and genetic material; rubisco synthesis and assembly, coordination, regulation and transport of proteins. Mitochondria: Genome, cytoplasmic male sterility and import of proteins.

UNIT III  NITROGEN FIXATION  9
Nitrogenase activity, nod genes, nif genes, bacteroids.

UNIT IV  AGROBACTERIUM & VIRAL VECTORS  9

UNIT V  APPLICATION OF PLANT BIOTECHNOLOGY  9
Outline of plant tissue culture, transgenic plants, herbicide and pest resistant plants, molecular pharming, theraputic products.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCES
AIM
To develop the skills of the students in the area of Biophysics and is a prerequisite for PG studies in biotechnology.

OBJECTIVES
• At the end of the course, the student would have learnt about Molecular structure of biological systems, Cell permeability and conformation of proteins and Nucleic acids.
  This course facilitates the students to take specialization in computation Biology.

UNIT I  MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEMS  9

UNIT II  CONFORMATION OF NUCLEIC ACIDS  9
Primary structure – the bases – sugars and the phosphodiester bonds- double helical structure – the a, b and z forms – properties of circular DNA– topolgy – polymorphism and flexibility of DNA – structure of ribonucleic acids – hydration of nucleic acids.

UNIT III  CONFORMATION OF PROTEINS  9

UNIT IV  CELLULAR PERMEABILITY AND ION – TRANSPORT  9
Ionic conductivity – transport across ion channels – mechanism - ion pumps- proton transfer – nerve conduction – techniques of studying ion transport and models.

UNIT V  ENERGETICS & DYNAMICS OF BIOLOGICAL SYSTEMS  9

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE
AIM
To develop the skills of the students in the area of Biological spectroscopy. Prerequisite for PG studies in Biotechnology.

OBJECTIVES
- At the end of the course, the student would have learnt about various kinds spectroscopic techniques to study biological system. This course is very effective in the area of Drug Design.

UNIT I  OPTICAL ROTATORY DISPERSION  5

UNIT II  NUCLEAR MAGNETIC RESONANCE  10

UNIT III  MASS SPECTROMETRY  10
Ion sources sample introduction – mass analyzers and ion detectors – biomolecule mass spectrometry – peptide and protein analysis – carbohydrates and small molecules – specific applications.

UNIT IV  X-RAY DIFFRACTION  10

UNIT V  SPECIAL TOPICS AND APPLICATIONS  10
Electron microscopy – transmission and scanning electron microscopy – scanning tunneling and atomic force microscopy – combinatorial chemistry and high throughput screening methods.

TOTAL : 45 PERIODS

TEXT BOOKS
UNIT I  HISTORY OF BIOETHICS  9

UNIT II  METHODS OF ETHICS ANALYSIS  9

UNIT III  ETHICS IN CLINICAL SETTING  9
Ethics committee (hospital) – Inner working of an ethics committee – ethics consultation training – skills & roles – Facilitating medical ethics – case studies – ethics consultation in Indian Hospital & US Hospital.

UNIT IV  CULTURAL ASSUMPTION IN BIOETHICS AND BIOETHICAL METHODS  9
Western bioethics on the Navajo reservation – communication through interpreters in healthcare – Aafrica and American perspectives in bioethics – Gender, race and class in delivery of health care – bioethics and human rights in the global ear.

UNIT V  PRACTICE OF BIOETHICS  9

TOTAL : 45 PERIODS

TEXT BOOK

AIM
To develop the skills of the students in the area of animal biotechnology and its applications.

OBJECTIVES
- At the end of the course, the student would have learnt about animal cell culture, molecular diagnostic of animal diseases and Transgenic animal production. This will facilitate the student to undertake project work in this area.

UNIT I  ANIMAL CELL CULTURE  12
Introduction to basic tissue culture techniques; chemically defined and serum free media; animal cell cultures, their maintenance and preservation; various types of cultures- suspension cultures, continuous flow cultures, immobilized cultures; somatic cell fusion; cell cultures as a source of valuable products; organ cultures.
UNIT II ANIMAL DISEASES AND THEIR DIAGNOSIS 10
Bacterial and viral diseases in animals; monoclonal antibodies and their use in diagnosis; molecular diagnostic techniques like PCR, in-situ hybridization; northern and southern blotting; RFLP.

UNIT III THERAPY OF ANIMAL DISEASES 12
Recombinant cytokines and their use in the treatment of animal infections; monoclonal antibodies in therapy; vaccines and their applications in animal infections; gene therapy for animal diseases.

UNIT IV MICROMANIPULATION OF EMBRYO’S 6
What is micromanipulation technology; equipments used in micromanipulation; enrichment of x and y bearing sperms from semen samples of animals; artificial insemination and germ cell manipulations; in vitro fertilization and embryo transfer; micromanipulation technology and breeding of farm animals.

UNIT V TRANSGENIC ANIMALS 5
Concepts of transgenic animal technology; strategies for the production of transgenic animals and their importance in biotechnology; stem cell cultures in the production of transgenic animals.

TOTAL: 45 PERIODS

TEXT BOOKS

REFERENCE

BT2037 PROCESS EQUIPMENTS AND PLANT DESIGN L T P C
3 0 0 3

AIM
To develop the skills of the students in the are of process equipment and Design. This is a pre-requisite for higher PG studies in Biotechnology.

OBJECTIVES
• At the end of the course, the student would have learnt about various types of process equipment, principles involved in their function, and its industrial applications.

UNIT I HEAT EXCHANGERS, CONDENSERS, EVAPORATORS 12
UNIT II  STORAGE VESSEL FOR VOLATILE AND NON VOLATILE FLUIDS, PRESSURE VESSEL STRUCTURE  6
Design of the following equipments as per ASME, ISI codes, drawing according to scale; monoblock and multiplayer vessels, combustion details and supporting structure.

UNIT III  EXTRACTOR, DISTILLATION AND ABSORPTION TOWER  10
Construction details and assembly drawing; Plate and Packed Extraction Towers; Plate and Packed absorption Towers; Plate and Packed Distillation Towers.

UNIT IV  PUMPS, MECHANICAL SEALS, VALVES AND SWITCHES  8
Various types of pumps, Principle of working, construction, usages, advantages and disadvantages; Various types of seals, effectiveness, usages; Pneumatic Seals; Gate, Globe and Butterfly Valves, their material of construction; Pneumatically Controlled Valves.

UNIT V  PIPING, PLANT LAY OUT AND DESIGN  9
Various types of Piping, material of construction, their usage; Pipe lay out; Modern Plant Design and case Studies.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE

BT2040  BIOPHARMACEUTICAL TECHNOLOGY  L T P C
3 0 0 3

AIM
The develop skills of the students in the area of Biopharmaceutical Technology. This course is effective for PG studies in Biotechnology.

OBJECTIVES
• At the end of the course, the students would have learnt about Drug manufacture, Drug action and Drug metabolism and production of Biopharmaceuticals. This will facilitate the students to take up projects work in this area of Biotechnology.

UNIT I  INTRODUCTION  7
Pharmaceutical industry & development of drugs; types of therapeutic agents and their uses; economics and regulatory aspects.

UNIT II  DRUG ACTION, METABOLISM AND PHARMACOKINETICS  9
Mechanism of drug action; physico-chemical principles of drug metabolism; radioactivity; pharmaco kinetics.

UNIT III  MANUFACTURE OF DRUGS, PROCESS AND APPLICATIONS  7
Types of reaction process and special requirements for bulk drug manufacture.
UNIT IV  PRINCIPLES OF DRUG MANUFACTURE  15
Compressed tablets; dry and wet granulation; slugging or direct compression; tablet presses; coating of tablets; capsule preparation; oval liquids – vegetable drugs – topical applications; preservation of drugs; analytical methods and other tests used in drug manufacture; packing techniques; quality management; gmp.

UNIT V  BIOPHARMACEUTICALS  7
Various categories of therapeutics like vitamins, laxatives, analgesics, contraceptives, antibiotics, hormones and biologicals.

TOTAL : 45 PERIODS

TEXT BOOKS

BT2041  MOLECULAR MODELING & DRUG DESIGN  L T P C
3 0 0 3

AIM
To develop skills of students in the area of Molecular modeling. Prerequisite for courses on Drug Design.

OBJECTIVES
• At the end of the course the student would have learnt Classical & Statistical mechanics, and Quantum mechanics and its applications.

UNIT I  INTRODUCTION TO CLASSICAL MECHANICS  9
Newton's laws of motion – time intervals- algorithms

UNIT II  INTRODUCTION TO STATISTICAL MECHANICS  9

UNIT III  QUANTUM MECHANICS  9

UNIT IV  GROMOS, GROMACS, AMBER & DOCK  9

UNIT V  GAUSSIAN 98  9

TOTAL : 45 PERIODS

TEXT BOOKS
2. Quantum Mechanics; D. McQuarrie, Narosa, 1999.

REFERENCE
1. GROMOS Handbook.
AIM
To develop skills of the students in the area of Metabolic Engineering.

OBJECTIVES
- At the end of the course, the student would have learnt about Biosynthesis of primary & secondary metabolites, Bioconversion etc and its relevance to Industrial applications.

UNIT I INTRODUCTION 15
Induction-jacob monod model, catabolite regulation, glucose effect, camp deficiency, feed back regulation, regulation in branched pathways, differential regulation by isoenzymes, concerted feed back regulation, cumulative feed back regulation, amino acid regulation of rna synthesis, energy charge, regulation, amino acid regulation of rna synthesis, energy charge, regulation, premeability control passive diffusion, active transport group transportation.

UNIT II SYNTHESIS OF PRIMARY METABOLITES 7
Alteration of feed back regulation, limiting accumulation of end products, feedback, resistant mutants, alteration of permeability, metabolites.

UNIT III BIOSYNTHESIS OF SECONDARY METABOLITES 9
Precursor effects, prophophase, idiophase relationship, enzyme induction, feedback regulation, catabolite regulation by passing control of secondary metabolism, producers of secondary metabolites.

UNIT IV BIOCONVERSIONS 4
Advantages of bioconversions, specificity, yields, factors important to bioconversion, regulation of enzyme synthesis, mutation, permeability, co-metabolism, avoidance of product inhibition, mixed or seqencial bioconversions, conversion of insoluble substances.

UNIT V REGULATION OF ENZYME PRODUCTION 10
Strain selection, improving fermentation, recognising growth cycle peak, induction, feed back repression, catabolite repression, mutants resistant to repression, gene dosage.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE
UNIT I  STEM CELLS AND CELLULAR PEDIGREES  9

UNIT II  STEM CELL CONCEPT IN PLANTS  9
Stem cell and founder zones in plants – particulary their roots – stem cells of shoot meristems of higher plants.

UNIT III  STEM CELL CONCEPT IN ANIMALS  9
Skeletal muscle stem cell – Mammary stem cells – intestinal stem cells – keratinocyte stem cells of cornea – skin and hair follicles – tumour stem cells - factors influencing proliferation and differentiation of stem cells – hormone role in differentiation.

UNIT IV  HAEMOPOIETIC STEM CELL  9
Biology – growth factors and the regulation of haemopoietic stem cells.

UNIT V  POTENTIAL USES OF STEM CELLS  9

TOTAL : 45 PERIODS

TEXT BOOK

AIM
To develop the skills of the students in the area of Immunotechnology pre-requisite for PG studies in biotechnology & related fields.

OBJECTIVES
• At the end of the course, the student would have learnt various techniques like developing diagnostic tests, characterization of lymphocytes, purification of antigens, Antibody Engineering etc. This knowledge will beneficial for Industrial applications.

UNIT I  ANTIGENS  3
Types of antigens, their structure, preparation of antigens for raising antibodies, handling of animals, adjuvants and their mode of action.

UNIT II  ANTIBODIES & IMMUNODIAGNOSIS  9
Monoclonal and polyclonal antibodies – their production and characterization, western blot analysis, immuno electrophoresis, SDS-PAGE, purification and synthesis of antigens, ELISA-principle and applications, radio immuno assay (RIA) principles and applications, non isotopic methods of detection of antigens-enhanced chem. iluminescence assay.
UNIT III ASSESSMENT OF CELL MEDIATED IMMUNITY 12
Identification of lymphocytes and their subsets in blood. T cell activation parameters, estimation of cytokines, macrophages activation, macrophage activation, macrophage microbicidal assays, in-vitro experimentation-application of the above technology to understand the pathogenesis of infectious diseases.

UNIT IV IMMUNOPATHOLOGY 6
Preparation of storage of tissues, identification of various cell types and antigens in tissues, isolation and characterization of cell types from inflammatory sites and infected tissues, functional studies on isolated cells, immuno cytochemistry – immuno fluorescence, immuno enzymatic and immuno ferritin techniques, immuno electron microscopy.

UNIT V MOLECULAR IMMUNOLOGY 9
Preparation of vaccines, application of recombinant DNA technology for the study of the immune system, production of antidiotypic antibodies, catalytic antibodies, application of PCR technology to produce antibodies and other immunological reagents, immuno therapy with genetically engineered antibodies.

UNIT VI CURRENT TOPICS IN IMMUNOLOGY 6
Trends in Immunology of infectious diseases and tumours, topics as identified from time to time.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE

BT2047 NEUROBIOLOGY AND COGNITIVE SCIENCES L T P C
3 0 0 3

AIM
To develop the skills of students in the area of macrobiology and cognitive sciences.

OBJECTIVES
- At the end of the course, the student would have learnt about the human nervous system, neurophysiology & neuropharmacology. The student also gains knowledge in the mechanisms of neurological behaviour.

UNIT I NEUROANATOMY 9
What are central and peripheral nervous systems; Structure and function of neurons; types of neurons; Synapses; Glial cells; myelination; Blood Brain barrier; Neuronal differentiation; Characterization of neuronal cells; Meninges and Cerebrospinal fluid; Spinal Cord.
UNIT II  NEUROPHYSIOLOGY  9
Resting and action potentials; Mechanism of action potential conduction; Voltage dependent channels; nodes of Ranvier; Chemical and electrical synaptic transmission; information representation and coding by neurons.

UNIT III  NEUROPHARMACOLOGY  9
Synaptic transmission, neurotransmitters and their release; fast and slow neurotransmission; characteristics of neurites; hormones and their effect on neuronal function.

UNIT IV  APPLIED NEUROBIOLOGY  9
Basic mechanisms of sensations like touch, pain, smell and taste; neurological mechanisms of vision and audition; skeletal muscle contraction.

UNIT V  BEHAVIOUR SCIENCE  9
Basic mechanisms associated with motivation; control of feeding, sleep, hearing and memory; Disorders associated with the nervous system.

TOTAL : 45 PERIODS

TEXT BOOK

BT2048  BIOPROCESS ECONOMICS AND PLANT DESIGN  L T P C
3 0 0 3

AIM
To develop skills of the students in the area of Bioprocess Economics and Plant Design.

OBJECTIVES
• At the end of the course, the student would have learnt about Business organizations, project design and development, Economics of plant Design and Quality control requirements.

UNIT I  PROCESS ECONOMICS AND BUSINESS ORGANIZATIONS  10
Definition of Bio Process, Bio Process Economics, Importance of various M-inputs-Globalization concept-Competition by Dumping-It’s effect on Plant size-Status of India with adjoining ASEAN countries (Singapore, Malaysia, Indonesia etc)-Project profile concept-details; Structure and Types of Organizations; Simple Management Principles.

UNIT II  PROJECT DESIGN AND DEVELOPMENT  10
UNIT III  COST ESTIMATION, PROFITABILITY AND ACCOUNTING  10

UNIT IV  PROCESS OPTIMIZATION TECHNIQUES  6
Optimum design-Design Strategy, Economic-Balance, Different unit-Operations with Single and Multiple Variables.

UNIT V  QUALITY AND QUALITY CONTROL  9
Current good manufacturing practices. Concepts of Quality Control in 20th century; Elements of quality control envisaged by ISI since 1947; Emergence of Statistical Process Control (SPC), Simple SPC concept details, Fundamental Concepts of ISO 9000 Quality System and the various requirements for ISO certification.

TOTAL : 45 PERIODS

TEXT BOOKS

REFERENCE