### Course Structure

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| Total | 24 | 15 | 56 |

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2007-2008

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD

B.TECH. BIO-TECHNOLOGY

1 YEAR COURSE STRUCTURE
# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
## HYDERABAD
### B.TECH. BIO-TECHNOLOGY
#### II YEAR I SEMESTER
##### COURSE STRUCTURE

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# JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
## HYDERABAD
### B.TECH. BIO-TECHNOLOGY

#### III YEAR I SEMESTER

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# Jawaharlal Nehru Technological University

## B.Tech. Bio-Technology

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD
I Year B. Tech BT  

C PROGRAMMING AND DATA STRUCTURES

UNIT - I
Algorithm / pseudo code, flowchart, program development steps, structure of C program, A Simple C program, identifiers, basic data types and sizes, Constants, variables, arithmetic, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators, expressions, type conversions, conditional expressions, precedence and order of evaluation.

Input-output statements, statements and blocks, if and switch statements, loops- while, do-while and for statements, break, continue, goto and labels, programming examples.

UNIT - II
Designing structured programs, Functions, basics, parameter passing, storage classes- extern, auto, register, static, scope rules, block structure, user defined functions, standard library functions, recursive functions, header files, C preprocessor, example c programs.

UNIT - III
Arrays- concepts, declaration, definition, accessing elements, storing elements, arrays and functions, two-dimensional and multi-dimensional arrays, applications of arrays, pointers- concepts, initialization of pointer variables, pointers and function arguments, address arithmetic, Character pointers and functions, pointers to pointers, pointers and multidimensional arrays, dynamic memory managements functions, command line arguments, c program examples.

UNIT - IV
Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bitfields, C program examples.

UNIT - V
Input and output – concept of a file, text files and binary files, streams, standard i/o, Formatted i/o, file i/o operations, error handling, C program examples.

UNIT - VI
Searching – Linear and binary search methods, sorting – Bubble sort, selection sort, Insertion sort, Quick sort, merge sort.

UNIT – VII
Introduction to data structures, singly linked lists, doubly linked lists, circular list, representing stacks and queues in C using arrays and linked lists, infix to post fix conversion, postfix expression evaluation.

UNIT - VIII
Trees- Binary tress, terminology, representation, traversals, graphs- terminology, representation, graph traversals (dfs & bfs)

TEXT BOOKS:

REFERENCES:
2. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education
1. INTRODUCTION:
In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire communicative competence, the syllabus has been designed to develop linguistic and communicative competence of Engineering students. The prescribed books and the exercises are meant to serve broadly as students' handbooks.

In the English classes, the focus should be on the skills of reading, writing, listening and speaking and for this the teachers should use the text prescribed for detailed study. For example, the students should be encouraged to read the texts/selected paragraphs silently. The teachers can ask comprehension questions to stimulate discussion and based on the discussions students can be made to write short paragraphs/essays etc.

The text for non-detailed study is for extensive reading/reading for pleasure by the students. Hence, it is suggested that they read it on their own with topics selected for discussion in the class. The time should be utilized for working out the exercises given after each section, as also for supplementing the exercises with authentic materials of a similar kind for example, from newspaper articles, advertisements, promotional material etc. However, the stress in this syllabus is on skill development and practice of language skills.

2. OBJECTIVES:
   a. To improve the language proficiency of the students in English with emphasis on LSRW skills.
   b. To equip the students to study academic subjects with greater facility through the theoretical and practical components of the English syllabus.
   c. To develop the study skills and communication skills in formal and informal situations.

3. SYLLABUS:
   **Listening Skills:**
   Objectives
   1. To enable students to develop their listening skill so that they may appreciate its role in the LSRW skills approach to language and improve their pronunciation
   2. To equip students with necessary training in listening so that can comprehend the speech of people of different backgrounds and regions
   
   Students should be given practice in listening to the sounds of the language to be able to recognise them, to distinguish between them to mark stress and recognise and use the right intonation in sentences.
   • Listening for general content
   • Listening to fill up information
   • Intensive listening
   • Listening for specific information

   **Speaking Skills:**
   Objectives
   1. To make students aware of the role of speaking in English and its contribution to their success.
   2. To enable students to express themselves fluently and appropriately in social and professional contexts.

   • Oral practice
   • Describing objects/situations/people
   • Role play – Individual/Group activities (Using exercises from all the nine units of the prescribed text: Learning English: A Communicative Approach.)
   • Just A Minute(JAM) Sessions.

   **Reading Skills:**
   Objectives
   1. To develop an awareness in the students about the significance of silent reading and comprehension.
2. To develop the ability of students to guess the meanings of words from context and grasp the overall message of the text, draw inferences etc.

- Skimming the text
- Understanding the gist of an argument
- Identifying the topic sentence
- Inferring lexical and contextual meaning
- Understanding discourse features
- Recognizing coherence/sequencing of sentences

**NOTE:** The students will be trained in reading skills using the prescribed text for detailed study. They will be examined in reading and answering questions using 'unseen' passages which may be taken from the non-detailed text or other authentic texts, such as magazines/newspaper articles.

**Writing Skills:**

**Objectives**

1. To develop an awareness in the students about writing as an exact and formal skill
2. To equip them with the components of different forms of writing, beginning with the lower order ones.

- Writing sentences
- Use of appropriate vocabulary
- Paragraph writing
- Coherence and cohesiveness
- Narration/description
- Note Making
- Formal and informal letter writing
- Editing a passage

**4. TEXTBOOKS PRESCRIBED:**

In order to improve the proficiency of the student in the acquisition of the four skills mentioned above, the following texts and course content, divided into **Eight Units**, are prescribed:

**For Detailed study**


**For Non-detailed study**


**A. STUDY MATERIAL:**

**Unit –I**


**Unit –II**


**Unit –III**


**Unit –IV**


Unit – V


Unit – VI


* Exercises from the lessons not prescribed shall also be used for classroom tasks.

Unit – VII

Exercises on
- Reading and Writing Skills
- Reading Comprehension
- Situational dialogues
- Letter writing
- Essay writing

Unit – VIII

Practice Exercises on Remedial Grammar covering
- Common errors in English, Subject-Verb agreement, Use of Articles and Prepositions, Tense and aspect

Vocabulary development covering
- Synonyms & Antonyms, one-word substitutes, prefixes & suffixes, Idioms & phrases, words often confused.

REFERENCES:

1. Strengthen Your English, Bhaskaran & Horsburgh, Oxford University Press
3. Murphy's English Grammar with CD, Murphy, Cambridge University Press
4. English Skills for Technical Students by Orient Longman
8. Developing Communication Skills by Krishna Mohan & Meera Benerji (Macmillan)
10. The Oxford Guide to Writing and Speaking, John Seely, Oxford
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD
I Year B . Tech BT

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

UNIT I ELECTRICAL CIRCUITS
Ohms Law -Kirchofs Laws - steady state solution of D C Circuits - Introduction to AC circuits - Waveforms and RMS value - power and power factor, single phase and three phase balanced circuits.

UNIT II ELECTRICAL MACHINES
Principles of operation and characteristics of D C machines, Transformers (single phase and three phase) - Synchronous Machines - three Phase and single phase induction motors - (op. Principles).

UNIT III MEASUREMENTS
Moving coil and moving iron instruments (Ammeter and voltmeter). Dynamometer type watt meters and energy meters (op. Principles).

UNIT IV SEMICONDUCTOR DEVICES & RECTIFIERS
Classification of solids based on energy hand theory - Intrinsic semiconductors - Extrinsic semiconductors - P type and N type - P-N junction - V I characteristic of PN junction diode - Zener diode - Zener diode characteristics - Half wave and full wave rectifiers - Voltage regulation, SCR, Diac, Triac, Characteristics and simple applications.

UNIT V TRANSISTORS
Bipolar junction transistor - CB, CE, CC - Configurations and characteristics – Biasing circuits - Field Effect Transistor - Configurations and characteristics - FET amplifier - UJT - characteristics and simple applications - switching transistors - concept of feed back - negative feed back - application in temperature and motor speed control.

UNIT VI AMPLIFIERS
Elementary treatment of voltage amplifier - Class A, B and C power amplifiers - principles of Tuned amplifiers.

UNIT VII SIGNAL GENERATORS AND LINEAR IC’S
Sinusoidal oscillators - positive feed back - RC phase shift, Hartley, Colpit’s, Wien bridge Oscillators - multivibrators - operational amplifier - adder, multiplier, integrator and differentiators -Integrated circuits.

UNIT VIII DIGITAL ELECTRONICS

TEXT BOOKS:

REFERENCES
UNIT I: INTRODUCTION TO MICROORGANISMS

UNIT II: PLANT BIOLOGY
Classification of Plant Kingdom. Concepts of Growth, Meristems. Development of different plant organs; Plant growth regulators; Economic Importance of Plants, Biology of Pests in relation to Rice, Cotton, Sugarcane and Groundnut.

UNIT III: ANIMAL BIOLOGY
Classification of Animal Kingdom, Functions, morphology, growth and Reproduction, economic importance. Phylogeny of Invertebrate & Vertebrate Phyla, Concepts of Species & Ecosystem. Protozoan Parasites – two important forms in man (Plasmodium, Entamoeba histolytica), Helminthes (Fasciotopsis buski, Taenia solium, Ascaris, Wucharia bancrarti)

UNIT IV: BASIC MOLECULAR BIOLOGY
Genetics: DNA as genetic material, Structure of DNA, DNA replication, Transcription, Translation, Genes to proteins to protein function, Gene expression and regulation, Recombinant DNA technology.

UNIT V: HUMAN BIOLOGY I
Introduction of body as a whole, Cells and Tissue Organization, Electrolytes and Body fluids. Physiology of Blood. Digestive system, Respiratory system and Endocrine system.

UNIT VI: HUMAN BIOLOGY II
Human Physiology: Biological axons and neurons, Neuromuscular and synaptic junctions, Sensory systems - hearing, taste, smell and visual receptors.

UNIT VII: PHOTOSYNTHESIS
Bacterial & Plant photosynthesis; oxygenic and anoxygenic photosynthesis; chlorophyll as trapper of solar energy, photosynthetic reaction centres, Hill reaction, PS I & PS II, Photophosphorylation - cyclic & non-cyclic; Dark reaction & CO2 fixation.

UNIT VIII: APPLICATIONS OF BIOTECHNOLOGY: BASIC CONCEPTS
Drugs and Chemicals from Plants & Animals, Definition and importance (in general) of Biofuels, Iofertilizers, Biopesticides, Bioindicators and Biosensors, Microbial Enzymes, Single Cell Protein (SCP), Monoclonal Antibodies, Introduction to Transgenic Plants & Animals.

TEXT BOOKS:
1. H.G. Rehen and G.Reed, biotechnology Volume I & 2
3. Anatomy and Physiology In Health and Disease, K. J.W. Wilson and A. Waugh, Churchill & Livingston

REFERENCES
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD

I Year B. Tech BT

MATHEMATICS – I

UNIT – I

UNIT – II
Non-homogeneous linear differential equations of second and higher order with constant coefficients with RHS term of the type e^{ax}, Sin ax, cos ax, polynomials in x, e^{ax}V(x), xV(x), method of variation of parameters.

UNIT – III
Rolle’s Theorem – Lagrange’s Mean Value Theorem – Cauchy’s mean value Theorem – Generalized Mean Value theorem (all theorems without proof) Functions of several variables – Functional dependence- Jacobian- Maxima and Minima of functions of two variables with constraints and without constraints

UNIT – IV
Radius, Centre and Circle of Curvature – Evolutes and Envelopes Curve tracing – Cartesian, polar and Parametric curves.

UNIT – V
Applications of integration to lengths, volumes and surface areas in Cartesian and polar coordinates multiple integrals - double and triple integrals – change of variables – change of order of integration.

UNIT – VI
Sequences – series – Convergences and divergence – Ratio test – Comparison test – Integral test – Cauchy’s root test – Raabe’s test – Absolute and conditional convergence

UNIT – VII

UNIT – VIII

Text Books:

References:
JAWAHRLAL NEHRU TECHNOLOGICAL UNIVERSITY
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PROCESS ENGINEERING PRINCIPLES

UNIT-I
Application of Engineering principles in biotech Industries-Introduction to unit operations and unit processes--application of transport phenomenon principles (momentum, mass and heat transfer) in bioprocessing.

UNIT-II
Units and dimensions, basic quantities and derived units. Conversion of units. Concept of mass and force, definition of gc and its utility. Various equations of state including ideal gas law to evaluate P-V-T data, their application in process calculations by solving basics numerical problems.

UNIT-III
Fluid mechanics- Properties of fluids, fluid statics, energy balance in fluid flow through pipes and condunits, Bernoulli’s equation and its application, calculation of power required for pumping fluids. Examples from bioprocessing systems.

UNIT-IV

UNIT-V
Flow through pipes, average velocity, flow regimes, boundary layer concept. Laminar and turbulent flow –characterization by Reynold’s number, pressure drop due to skin friction and form friction, friction factor chart, Hagen -Poiseuille equation. Brief introduction to flow of compressible fluids.

UNIT-VI
Flow past immersed bodies: Definition of drag and drag coefficient. Friction in flow through beds of solids, derivation of friction factor equations and pressure drop expressions. Introduction of the concept of packed beds. Motion of particles through fluids, terminal velocity.

UNIT-VII
Flow measuring and monitoring systems- valves, bends, elbows, prevention of leaks, mechanical seals, stuffing box. Flow measuring devices-manometers, orifice meter, venture meter and rotameter.

UNIT-VIII
Fluid transportation machinery: Different types of pumps, positive displacement pumps, reciprocating pumps, diaphragm pumps, peristaltic pumps. Calculation of pump horse power.

TEXT BOOKS:
1. Introduction to Biochemical Engineering, D.G.Rao, Tata Mc Hill (2005)

REFERENCES:
ENGINEERING DRAWING

UNIT – I
Introduction to engineering graphics – construction of ellipse, parabola and hyperbola – cylindrical curves.

UNIT – II
Orthographic projections of points, lines and planes – axis inclined to one planes and inclined to both the planes.

UNIT – III
Orthographic projections of solids:
Cylinder, cone, prism, pyramid and sphere positions and axis inclined to both the planes.

UNIT – IV
Isomeric projections of lines, planes and simple solids

UNIT – V
Conversion of orthographic views into isometric views and vice-versa.

TEXT BOOKS:
1. Engineering drawings By N.D.Bhatt
2. Engineering graphics By K.L. Narayana & P.Kannayya

REFERENCES:
1. Engineering drawing and graphics: Venugopal/ New age
2. Engineering drawing : Johle / TMH
ENGINEERING WORK SHOP PRACTICE

1. TRADES FOR EXERCISES:
1. Carpentry
2. Fitting
3. Tin-Smithy and Development of jobs carried out and soldering.
4. Black Smithy
5. House-wiring
6. Foundry
7. IT Workshop-I: Computer hard ware, identification of parts, Disassembly, Assembly of computer to working condition, Simple diagnostic exercises.
8. IT workshop-II: Installation of Operating system windows and Linux, simple diagnostic exercises.

II TRADES FOR DEMONSTRATION & EXPOSURE:
1. Plumbing
2. Welding
3. Machine Shop
4. Power tools in construction, Wood working, Electrical Engg & Mechanical Engg
5. Metal Cutting (water plasma)

COMPUTER PROGRAMMING LAB

Objectives:
- To make the student learn a programming language.
- To teach the student to write programs in C solve the problems.
- To introduce the student to simple linear and non-linear data structures such as lists, stacks, queues, trees, and graphs.

Recommended Systems/Software Requirements:
- Intel based desktop PC
- ANSI C Compiler with Supporting Editors

Week 1.
- **a)** Write a C program to find the sum of individual digits of a positive integer.
- **b)** A Fibonacci Sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.
- **c)** Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

Week 2.
- **a)** Write a C program to calculate the following Sum:
  \[ \text{Sum} = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \frac{x^8}{8!} - \frac{x^{10}}{10!} \]
- **b)** Write a C program to find the roots of a quadratic equation.

Week 3.
- **a)** Write C programs that use both recursive and non-recursive functions
  i) To find the factorial of a given integer.
  ii) To find the GCD (greatest common divisor) of two given integers.
  iii) To solve Towers of Hanoi problem.

Week 4.
- **a)** The total distance travelled by vehicle in 't' seconds is given by distance \( = ut + \frac{1}{2}at^2 \) where 'u' and 'a' are the initial velocity (m/sec.) and acceleration (m/sec²). Write C program to find the distance travelled at regular intervals of time given the values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'.
- **b)** Write a C program, which takes two integer operands and one operator form the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use Switch Statement)

Week 5.
- **a)** Write a C program to find both the largest and smallest number in a list of integers.
- **b)** Write a C program that uses functions to perform the following:
  i) Addition of Two Matrices
  ii) Multiplication of Two Matrices

Week 6.
- **a)** Write a C program that uses functions to perform the following operations:
  i) To insert a sub-string in to given main string from a given position.
  ii) To delete n characters from a given position in a given string.
- **b)** Write a C program to determine if the given string is a palindrome or not

Week 7.
- **a)** Write a C program that displays the position or index in the string S where the string T begins, or -1 if S doesn't contain T.
- **b)** Write a C program to count the lines, words, and characters in a given text.
Week 8
a) Write a C program to generate Pascal's triangle.
b) Write a C program to construct a pyramid of numbers.

Week 9
Write a C program to read in two numbers, \( x \) and \( n \), and then compute the sum of this geometric progression:
\[
1 + x + x^2 + x^3 + \ldots + x^n
\]
For example: if \( n \) is 3 and \( x \) is 5, then the program computes \( 1 + 5 + 25 + 125 \).
Print \( x \), \( n \), the sum
Perform error checking. For example, the formula does not make sense for negative exponents – if \( n \) is less than 0. Have your program print an error message if \( n < 0 \), then go back and read in the next pair of numbers without computing the sum. Are any values of \( x \) also illegal? If so, test for them too.

Week 10
a) 2's complement of a number is obtained by scanning it from right to left and complementing all the bits after the first appearance of a 1. Thus 2's complement of 11100 is 00100. Write a C program to find the 2's complement of a binary number.
b) Write a C program to convert a Roman numeral to its decimal equivalent.

Week 11
Write a C program that uses functions to perform the following operations:
   i) Reading a complex number
   ii) Writing a complex number
   iii) Addition of two complex numbers
   iv) Multiplication of two complex numbers
(Note: represent complex number using a structure.)

Week 12
a) Write a C program which copies one file to another.
b) Write a C program to reverse the first \( n \) characters in a file.
(Note: The file name and \( n \) are specified on the command line.)

Week 13
Write a C program that uses functions to perform the following operations on singly linked list:
   i) Creation  ii) Insertion  iii) Deletion  iv) Traversal

Week 14
Write a C program that uses functions to perform the following operations on doubly linked list:
   i) Creation ii) Insertion iii) Deletion iv) Traversal in both ways

Week 15
Write C programs that implement stack (its operations) using
   i) Arrays  ii) Pointers

Week 16
Write C programs that implement Queue (its operations) using
   i) Arrays  ii) Pointers

Week 17
Write a C program that uses Stack operations to perform the following:
   i) Converting infix expression into postfix expression
   ii) Evaluating the postfix expression

Week 18
Write a C program that uses functions to perform the following:
   i) Creating a Binary Tree of integers
   ii) Traversing the above binary tree in preorder, inorder and postorder.
Week 19
Write C programs that use both recursive and non recursive functions to perform the following searching operations for a Key value in a given list of integers:
   i) Linear search   ii) Binary search

Week 20
Write C programs that implement the following sorting methods to sort a given list of integers in ascending order:
   i) Bubble sort   ii) Quick sort

Week 21
Write C programs that implement the following sorting methods to sort a given list of integers in ascending order:
   i) Insertion sort   ii) Merge sort

Week 22
Write C programs to implement the Lagrange interpolation and Newton- Gregory forward interpolation.

Week 23
Write C programs to implement the linear regression and polynomial regression algorithms.

Week 24
Write C programs to implement Trapezoidal and Simpson methods.

Text Books
1) Power measurement in 3 phase systems using two-wattmeter method (star connected)

2) Verification of kirchoff's laws

3) Measurement of choke coil parameters using 3 voltmeter & 3 ammeter method.

4) Magnetization characteristics of a dc shunt machine, determination of critical field resistance and critical speed.

5) Open circuit and Shortest Circuit on any 1 phase transformer.

6) Load test on 1-phase transformer.

7) Regulation of 3 phase synchronous generator using OC and SC test.

8) Brake test on 3 phase squirrel cage induction motor.

9) Calibration and testing of single phase energy meter.

10) Calibration of dynamometer type power factor meter.

11) Calibration of PMMC ammeter and voltmete crompton DC potentio meter.

12) PN junction diode characteristics  
    a) forward bias  
    b) reverse bias

13) Zener diode characteristics

14) Transistor CE characteristics (Input and Output)

15) Rectifier without filters (Full wave & Half wave)

16) UJT characteristics

17) FET characteristics

18) Study of CRO

19) CE amplifier

20) Class A Amplifier

21) RC Phase shift Oscillator

22) Study of logic gates using ICS.
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HYDERABAD

I Year B.Tech BT

ENGLISH LANGUAGE COMMUNICATION SKILLS LAB

The Language Lab focuses on the production and practice of sounds of language and familiarises the students with the use of English in everyday situations and contexts.

Objectives:

1. To expose the students to a variety of self-instructional, learner-friendly modes of language learning.
2. To help the students cultivate the habit of reading passages from the computer monitor, thus providing them with the required facility to face computer-based competitive exams such GRE, TOEFL, GMAT etc.
3. To enable them to learn better pronunciation through stress on word accent, intonation, and rhythm.
4. To train them to use language effectively to face interviews, group discussions, public speaking.
5. To initiate them into greater use of the computer in resume preparation, report writing, format-making etc.

SYLLABUS:
The following course content is prescribed for the English Language Laboratory sessions:
1. Introduction to the Sounds of English- Vowels, Diphthongs & Consonants.
2. Introduction to Stress and Intonation.
3. Situational Dialogues / Role Play.
5. ‘Just A Minute’ Sessions (JAM).
6. Describing Objects / Situations / People.
7. Information Transfer
8. Debate
10. Giving Directions.

Minimum Requirement:
The English Language Lab shall have two parts:

i) The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self-study by learners.

ii) The Communication Skills Lab with movable chairs and audio-visual aids with a P.A System, a T.V., a digital stereo –audio & video system and camcorder etc.

System Requirement (Hardware component):
Computer network with Lan with minimum 60 multimedia systems with the following specifications:

i) P – IV Processor
   a) Speed – 2.8 GHZ
   b) RAM – 512 MB Minimum
   c) Hard Disk – 80 GB

ii) Headphones of High quality

Suggested Software:
- Cambridge Advanced Learners' English Dictionary with CD.
- The Rosetta Stone English Library
- Clarity Pronunciation Power – Part I
- Mastering English in Vocabulary, Grammar, Spellings, Composition
- Dorling Kindersley series of Grammar, Punctuation, Composition etc.
- Language in Use, Foundation Books Pvt Ltd with CD.

- Oxford Advanced Learner’s Compass, 7th Edition
- Learning to Speak English - 4 CDs
- Microsoft Encarta with CD
- Murphy’s English Grammar, Cambridge with CD
  - English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge

Books Suggested for English Language Lab Library (to be located within the lab in addition to the CDs of the text book which are loaded on the systems):

1. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.
4. **English Language Communication : A Reader cum Lab Manual** Dr A Ramakrishna Rao, Dr G Natanam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai
5. **Speaking English Effectively** by Krishna Mohan & NP Singh (Macmillan)
7. **A text book of English Phonetics for Indian Students** by T.Balasubramanian (Macmillan)
8. **English Skills for Technical Students**, WBSCTE with British Council, OL

**DISTRIBUTION AND WEIGHTAGE OF MARKS**

**English Language Laboratory Practical Paper:**
1. The practical examinations for the English Language Laboratory shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the Language lab sessions, there shall be a continuous evaluation during the year for 25 sessional marks and 50 year-end Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The year-end Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.
UNIT I: CARBOHYDRATE STRUCTURE & FUNCTION
Structure and properties of Mono, Di, Oligo & polysaccharides, complex carbohydrates, Confirmation of pyranose & furanose ring, glycosidic bond, Glycogen, starch & dextran; as mobilizable stores of glucose. cellulose, glycoproteins, glycosaminoglycans & lectins; structure and function.

UNIT II: BASIC CONCEPTS OF ENZYMES
Introduction to Enzymes, Nomenclature, Functions, Mechanism of action and control, Michaelis – Menten Enzymes and Allosteric Enzymes

UNIT III: CARBOHYDRATE METABOLISM
Glycolysis, Glucogenesis, Glycogenolysis, Gluconeogenesis, ED Pathway, Pentoses phosphate shunt & TCA cycle

UNIT IV: BIOENERGETICS
Respiratory chain, Aerobic and anaerobic respiration.

UNIT V: PROTEINS & AMINO ACIDS METABOLISM -I

UNIT VI: PROTEINS & AMINO ACIDS METABOLISM -II
Synthesis of amino acids - Glutamate pathway; Serine pathway; shikimate pathway for the production of aromatic amino acids.

UNIT VII: LIPIDS & THEIR METABOLISM
Classifications, Structures and roles of fatty acids; fatty acid breakdown; fatty acid synthesis; synthesis and metabolism of triglycerols, cholesterol structure and function. Lipoproteins – classification & function.

UNIT VIII: INTERMEDIARY METABOLISM
Interconnection of pathways & metabolic regulation

NUCLEIC ACIDS AND THEIR METABOLISM
Structure and Properties of purines, pyrimidines, Nucleosides and Nucleotides. Biosynthesis and degradation of nucleic acids

TEXT BOOKS:
2. Fundamentals of Biochemistry J.L. Jain S. Chand Publishers

REFERENCES:
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD
II Year B.Tech BT  I-Sem

THERMODYNAMICS FOR BIOTECHNOLOGISTS

UNIT I: BASIC CONCEPTS IN ENGINEERING THERMODYNAMICS
First and Second law of thermodynamics; Calculation of Work, energy and property changes in reversible processes, Thermodynamics of flow processes; Power cycles and refrigeration cycles, Residual properties

UNIT II: MATERIAL BALANCE
Steady state and equilibrium, types of material balances, stoichiometry of growth and product formation, Electron balance, Theoretical oxygen demand

UNIT III: ENERGY BALANCES
Basic Energy concepts, Intensive and Extensive properties, general energy balance equations, Enthalpy calculations, State properties-reactive and non-reactive systems, Heat of solutions, Heat of combustion, Heat of reaction in non-standard condition; Energy balance equation for cell culture with basic numerical calculations.

Unit IV: UNSTEADY-STATE MATERIAL AND ENERGY BALANCES
Unsteady state material balance and energy balance equations; Solving unsteady equations for biological systems in CSTR, fed-batch and plug flow reactors.

Unit V: THERMODYNAMIC PROPERTIES OF FLUIDS
Estimation of thermodynamic properties using equations of state; Maxwell relationships and their applications; Calculation of flow processes based on actual property changes

UNIT VI: SOLUTION THERMODYNAMICS
Partial molar properties; concepts of chemical potential and fugacity Ideal non ideal solutions; Gibbs Duhem equation; Excess properties of mixtures; Activity Coefficient - corm position models

UNIT VII: PHASE EQUILIBRIA
Criteria for phase equilibrium; Vapour-liquid equilibrium calculations for binary mixtures, liquid -Liquid equilibrium and Solid-liquid equilibrium

UNIT VIII: CHEMICAL REACTION EQUILIBRIA
Equilibrium criteria for homogeneous chemical reactions; Evaluation of equilibrium constant and effect of pressure and temperature on equilibrium constant; Calculation of equilibrium conversions and yields for single and multiple chemical reactions.

TEXT BOOKS :

REFERENCES:
M.D.Koretsky, Engineering and Chemical Thermodynamics, John Wiley and sons, 2004
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II Year B.Tech BT I-Sem

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CELL BIOLOGY

UNIT I: CELL STRUCTURE AND FUNCTION
Discovery of cells; Basic properties of cells; Cell theory; Cell complexity – Cell size & shape; Different classes of cells; Prokaryotic & Eukaryotic cells;

UNIT II: CHEMISTRY OF THE CELL
Importance of carbon and water; Plasma membrane- structure and function; Cytoplasm ; Cytoskeleton - Microtubules, microfilaments & intermediate filaments, cell motility – cilia & flagella

UNIT III: INTRACELLULAR COMPARTMENTS

UNIT IV: TRANSPORT ACROSS CELL MEMBRANES
Passive and Active Transport, Uniport, Symport, Antiport, Permeases, P-Type & V-Type Pumps, Na+/K+ ATPase, Lysosomal & Vacuolar membrane ATP dependent Proton Pumps, Endocytosis and Exocytosis, Transport into Prokaryotic Cells

UNIT V: CELL DIVISION

UNIT VI: CELL DIFFERENTIATION
General Characteristics of Cell Differentiation, Differentiation in Unicellular & Multicellular Organism, Cytoplasmic determinants, Nucleoplasmic Interactions; Embryonic and adult stem cells and its Biological Importance.

UNIT VII: CELL SIGNALING - BASIC CONCEPTS
Intracellular signaling, types of signal receptors - Cytosolic, Nuclear & Membrane bound receptors, Chemo receptors of Bacteria (Attractants & Repellents), Signal Transduction by hormones - Steroid / Peptide hormones; Concept of Secondary messengers, cAMP, cGMP, Protein Kinases, G Proteins; Receptors & Non - receptors associated tyrosine kinases.

UNIT VIII: CANCER BIOLOGY - BASIC CONCEPTS
Characteristics of Cancer Cells, Types of Tumors, Molecular Basis of Cancer – Proto oncogene, Tumor Suppressor gene, telomerase, apoptosis, angiogenesis and metastasis, chemical carcinogens, cancer therapy.

TEXT BOOKS:
1) The Cell by Cooper.

References:
1) Cell & Molecular Biology by Gerald Karp (2nd Ed.) Wiley publishers.
3) Molecular Biology of the cell by Bruce Alberts.
6) Cell & Molecular Biology by Phillip Sheeler and Donald E.Blanchi 3rd edition John Wiley &sons
UNIT – I

UNIT – II

UNIT-III

UNIT –IV

UNIT-V
Formation of partial differential equations by elimination of arbitrary constants and arbitrary functions – solutions of first order linear (Lagrange) equation and nonlinear (standard type) equations.

UNIT – VI
Method of separation of variables – Classification of second order linear Partial Differential Equations, solutions of one dimensional heat equation, wave equation and two-dimensional Laplace’s equation under initial and boundary conditions.

UNIT – VII

UNIT – VIII

TEXT BOOKS:


REFERENCES:

UNIT I: PHYSICAL BASIS OF HEREDITY
Basic laws of inheritance mono-hybrid, dihybrid and tri-hybrid ratios, Modification of Mendel’s ratios due to gene interaction. Multiple factors of inheritance. Genes and environment, identification of the genetic materials - classical experiments. Hershey Chase, Avery McLeod etc.

UNIT II: ORGANIZATION OF GENETIC MATERIAL
Packing of DNA, organization of genetic material in prokaryotes, Eukaryotes, Euchromatin and Heterochromatin organization of Nucleosomes.

UNIT III: LINKAGE & RECOMBINATION

UNIT IV: MAPPING
Two point and three point testcrosses and gene mapping. Mapping of genes by tetrad analysis by mitotic crossing over.

UNIT V: CHROMOSOME STRUCTURE, ORGANIZATION & ABERRATIONS
Chromosome morphology, classification, karyotyping. Special chromosome, chromosome aberrations, origins, types and cytogenetic effects.

UNIT VI: SEX DETERMINATION IN PROKARYOTES AND EUKARYOTES
Mechanism of sex determination in insect (Fruit fly) and plants (Melandrium), Sex factors in bacteria, F and HFr transfer, mechanism of transfer.

UNIT VII: SEX DETERMINATION IN HUMANS
Sex differentiation and developments in humans, Dosage compensation, Maryleons hypothesis, Sex linked disorders in human beings – Haemophilia, Fragile-x syndrome, Down’s syndrome

UNIT VIII: EXTRA CHROMOSOMAL INHERITANCE
Introduction to extra chromosomal inheritance, examples of extra chromosomal inheritance. Petite phenotypes in yeast. Uniparental inheritance in algae.

TEXT BOOKS

REFERENCES:
2. Genetics by Griffith.
4. Essentials of Genetics (In genomics prospective), Hartwell, 2003
UNIT I: INTRODUCTION TO MICROBIOLOGY
1. Discovery of microorganisms; Theory of spontaneous generation, Germ theory of diseases; Major contribution and events in the field of Microbiology. Scope and relevance of microbiology.
2. Identification of Microorganisms - A general account. Microdiversity

UNIT II: MAJOR GROUPS OF MICROORGANISMS.
2. Classification systems - Phylogenetic, Phenetic, Taxonomic ranks, Major characteristics used in Taxonomy - Morphological, Physiological, ecological, Biochemical, Immunological, Genetical and Molecular.

UNIT III: INTRODUCTION TO VIRUSES
Virus properties, Structure of Viruses; Animal Virology; Plant Virology; Viruses of Arthropods, bacteria and other lower organisms; and classification of viruses (Bacterial, plant and animal replication with 1 example each) and Applications of Virology in Biotech Industry.

UNIT IV: REPLICATION OF VIRUSES
Viral Replication, Bacterial, plant and animal replication with 1 example each (in case of animal viruses the teaching should include the examples of DNA and RNA viral replication and also of those that replicate in the cytoplasm and nucleus).

UNIT V: IDENTIFICATION, CULTURING AND ASSAY OF VIRUSES
Identification and in vitro cultivation of viruses. Assay of viruses (Both Bacterial and animal viruses)

UNIT VI: NUTRITION AND CULTIVATION
2. Cultivation of microorganisms; Culture media, synthetic, complex media, solidifying agents, types of media -selective, differential and enrichment and enriched media, pure culture methods - spread plate, pour plate and streak plate, special techniques for cultivation of anaerobes.

UNIT VII : IDENTIFICATION AND PRESERVATION OF MICROBES
1. Preservation of Microorganisms: working and primary stock cultures – agarslants, agar stabs, spore preparation, use of sterile soil, cryopreservation, lyophilisation, Application and limitations of various methods.
2. Influence of environmental factors or growth – solutes, water activity, pH, temperature, oxygen, osmotic pressure, radiation.
3. Colony characteristics, staining techniques; Fixation, Principle dyes, simple standing, differential staining spore staining, flageller straining.
4. Biochemical tests – Sugar fermentations, IMVIC tests, Catalase production etc.

UNIT VIII : MEDICAL BIOTECHNOLOGY
Disease causing microorganisms, Molecular Basis of pathogeneity and identification methods (for at least 6 important bacterial and viral infections)

TEXT BOOKS:
REFERENCES:
BIOCHEMISTRY LAB

1. Units, Volume & Weight measurements. Concentration units, pH Measurement. Preparation of buffers,
2. Qualitative tests for carbohydrates. Estimation of Reducing sugars by the Benedict’s method.
3. Qualitative tests for Amino Acids. Quantitative method for Amino Acids, Ninhydrin method
4. Protein estimation by Biuret / Folin’s / Bradford method.
5. Extraction of lipids. Saponification of Fats.
8. Estimation of Nucleic Acids, Precipitation by sodium sulphate, Test for ribose and deoxyribose sugar.
9. Extraction of Caffeine from tea leaves.

TEXT BOOK:

 Equipments;
1. Refrigerator
2. Centrifuge.
3. Boiling water both.
4. Calorimeter.
5. pH Meter.
CELL BIOLOGY AND MICROBIOLOGY LAB

2. Identification of Animal, Plant & Bacterial cells.
3. Micrometry.
5. Sterilization techniques (lecture/demonstrations)
6. Preparation of culture media (a) Broth type of media (b) Solid media
7. Culturing of microorganisms: (a) Broth (b) Pure culture techniques: Streak plate, pour plate.
8. Isolation and preservation of bacterial culture.
9. Identification of microorganisms (a) Staining technique (b) Biochemical testing.
10. Antibiotic test - Disc diffusion method, minimum inhibitory concentration.
11. Microbiological examination of water.
12. Biochemical tests
IMVIC test
Catalase test
Coagulase test
Gelatinase test
Oxidase test.
14. Factors effecting the bacterial growth – effects of temperature of pH.

TEXT BOOKS:
2. Laboratory manual in microbiology by P. Gunasekharan, Newage international Publishers.

REFERENCES:

EQUIPMENTS:
1. Bright field microscope.
2. Ocular micrometer.
3. Stage micrometer.
4. Hot air oven.
5. Autoclave.
6. Antibiotic disc.
7. Laminar air flow chamber.
8. Bunsen burner.
10. Incubator and shaker.
11. pH Meter.
12. Compound microscope.
UNIT I: INTRODUCTION TO MASS TRANSFER AND DIFFUSION
Introduction to Mass Transfer Operations; Fick’s Law of Diffusion, Gas diffusion and Liquid diffusion (one component transferring to non-transferring component and equimolar counter diffusion.) Diffusivity estimation (Stefan’s experiment); permeability, distribution of gas and liquid components through solid, diffusion of biological solutes in liquids, diffusion in biological gels.

UNIT II: MASS TRANSFER CO-EFFICIENT
Definition of $k_L$, F-type, K-type coefficients, Dimensionless numbers, Sherwood number, Stanton number, Schmidt number; estimation of MTC for the case where mass is diffusing from solid wall to bulk liquid. (Flat plates, cylindrical tubes) and flow past single solids, Application of $k_L$ in Biological Systems.

UNIT III:
Interface mass transfer, gas phase controlling, and liquid phase controlling operations.

UNIT IV: GAS LIQUID OPERATION - I
Absorption: Definition, Solubilities of gases in liquids, single stage (one component transferring) operation.

UNIT V: GAS LIQUID OPERATION - II
Distillation: VLE, single stage equilibrium distillation, simple distillation and steam distillation operation; continuous distillation (McCabe Thiele method only).

UNIT VI: LIQUID – LIQUID AND SOLID – LIQUID OPERATIONS - I
Liquid-Liquid extraction: LLE, types of equilibrium system, Singe stage extraction, Multi stage cross and counter current operations. Solid liquid operation: Leaching, SLE, Single stage leaching.

UNIT VII: LIQUID – LIQUID AND SOLID – LIQUID OPERATIONS - II
Adsorption: Physical adsorption, Chemisorption, Adsorption hysteresis, adsorption isotherm, Single stage operation, Fixed bed adsorption,Case Studies with immobilized cell/enzyme systems

UNIT VIII: MEMBRANE SEPARATION PROCESSES
Dialysis; Hemodialysis; Gas permeation process, introduction to types of flow in gas permeation; hollow – fiber separation assembly, reverse osmosis, application of reverse osmosis, introduction of ultra filtration processes and micro filtration processes.

TEXT BOOKS:

REFERENCES:
UNIT - I
**Multidisciplinary nature of Environmental Studies**: Definition, Scope and Importance – Need for Public Awareness.

UNIT - II
**Natural Resources**: Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. - Energy resources: Growing energy needs, renewable and non-renewable energy sources use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT - III
**Ecosystems**: 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 following ecosystem:

- a. Forest ecosystem
- b. Grassland ecosystem
- c. Desert ecosystem
- d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT - IV

UNIT - V
**Environmental Pollution**: Definition, Cause, 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.

UNIT - VI

UNIT - VII

UNIT - VIII
Field work: Visit to a local area to document environmental assets River / forest grassland / hill / mountain - Visit to a local polluted site - Urban / Rural / industrial / Agricultural Study of common plants, insects, birds. - Study of simple ecosystems pond, river, hill slopes, etc.

TEXT BOOK:
1. Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.
2. Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE:
1 Textbook of Environmental Sciences and Technology by M. Anji Reddy, BS Publication.
UNIT I: INTRODUCTION

UNIT II: MICROSCOPY
Bright field, Dark field, Fluorescent, Phase contrast, confocal microscopy, SEM & TEM Microscopy, Flow Cytometry.

UNIT III: CENTRIFUGATION
General Principals, Ultra Centrifugation, velocity Sedimentation & measurements, Equilibrium Ultracentrifugation – Density Gradient centrifugation

UNIT IV: SPECTROSCOPY - I

UNIT V: SPECTROSCOPY-II
Infra Red Spectroscopy. Mass spectroscopy-Introduction, analysis, applications in biology ESR principles - instrumentation-applications

UNIT VI: ONLINE MONITORING AND CONTROL DEVICES
pH, temperature, dissolved oxygen, agitation, sensors and their operation.

UNIT VII: X RAY DIFFRACTION AND CRYSTALLOGRAPHY
Principle, Mode of Operation and Applications

UNIT VIII: SEPARATION EQUIPMENTS – PRINCIPLES AND OPERATION:
HPLC, Gas chromatography, Ion – exchange Chromatography, Gel – filtration Chromatography, Affinity Chromatography, Membrane separations, Ultrafiltration , Reverse Osmosis

UNIT VIII: NMR
High resolution NMR –Chemical shift-Spin-spin coupling Frequency lock- double resonance-applications of proton NMR-quantitative analysis-qualitative analysis, application of NMR in biology and study of macromolecules

TEXT BOOKS:

REFERENCES:
2. Ewing, Instrumental Methods of Analysis, 1992
MOLECULAR BIOLOGY

UNIT I: STRUCTURE OF DNA
Detailed structure of DNA, variation from Watson & Crick model, Z - DNA, A & B DNA, Denaturation & melting curves.

UNIT II: DNA REPLICATION - I
Models of DNA replication: semi conservative Mechanism of DNA replication in *E.coli* (bi- directional). Mitochondrial (D-loop), Viral DNA (Rolling circle), Single stranded- DNA phages (M13, Ø174).

UNIT - III : DNA REPLICATION- II
Eukaryotic telomeres and its replication Inhibitors of DNA Replication. Enzymes involved in replication, step by step process.

UNIT IV: RNA STRUCTURE AND BIOSYNTHESIS
m-RNA, r-RNA, t-RNA structures, Transcription apparatus, RNA polymerases and proteins involved in transcription (initiation, elongation and termination steps)

UNIT V: POST TRANSCRIPTIONAL PROCESSING
Post transcriptional processing of RNA ’s t-RNA, r-RNA, m- RNA splicing. Inhibitors of transcription.

UNIT VI: PROTEIN BIOSYNTHESIS
The genetic code and Wobble Hypothesis, Codon usage, Protein synthesis In Prokaryotes.

UNIT VII : PROTEIN SYNTHESIS IN EUKARYOTES
Eukaryotic Protein synthesis, differences between prokaryotic and eukaryotic protein synthesis, Post translational modifications. Inhibitors of protein synthesis .

UNIT VIII : MUTAGENESIS
Mutations, spontaneous, induced, lethal, mutagens their types and actions, classification of mutations and their applications. Site - directed mutagenesis and reverse genetics. DNA damage and repair mechanisms. Mutagenicity testing using microbial systems, Ames TEST.

TEXT BOOKS

REFERENCES:
ENGINEERING PHYSICS

UNIT I
OPTICS: Interference - Superposition of waves - Young's double slit experiment - Coherence - Interference in thin films by reflection - Newton's rings - Diffraction - Fresnel and Fraunhofer diffractions - Fraunhofer diffraction at a single slit - Double slit - Diffraction grating - Grating spectrum - Resolving power of a grating - Rayleigh's criterion for resolving power - Polarization - Types of Polarization - Double refraction - Nicol prism.

UNIT II

ACoustics of Buildings: Basic requirement of acoustically good hall - Reverberation and time of reverberation - Sabine's formula for reverberation time - Measurement of absorption coefficient of a material - Factors affecting the architectural acoustics and their remedy.

UNIT III

SUPERCONDUCTIVITY: General properties - Meissner effect - Penetration depth - Type I and Type II superconductors - Flux quantization - DC and AC Josephson effect - BCS Theory - Applications of superconductors.

UNIT IV

UNIT V

UNIT VI

UNIT VII


UNIT VIII
TEXT BOOKS:

REFERENCES:
1. Nanotechnology by Mark Ratner and Daniel Ratner, Pearson Education.
2. Introduction to solid state physics by C. Kittel; Wiley Eastern Ltd.
3. Materials Science and Engineering by V. Raghavan; Prentice-Hall India.
4. Engineering Physics by Dr. M. Arumugam; Anuradha Agencies.
UNIT I: INTRODUCTION TO BIOPROCESSES
An overview of traditional and modern applications of biotechnology industry, outline of an integrated bioprocess and the various (upstream and down stream) unit operations involved in bioprocesses, generalized process flow sheets.

UNIT II: FERMENTATION PROCESSES-I
General requirements of fermentation processes, Basic design and construction of fermentor and ancillaries, Main parameters to be monitored and controlled in fermentation processes;

UNIT III: FERMENTATION PROCESSES-II
An overview of aerobic and anaerobic fermentation processes and their application in the biotechnology industry, solid-substrate, slurry fermentation and its applications, whole cell immobilization, behaviour of microbes in different reactors (air lift, fluidized, batch, continuous fed batch condition).

UNIT IV: MEDIA DESIGN
Medium requirements for fermentation processes, carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, medium formulation for optimal growth and product formation, examples of simple and complex media, design and usage of various commercial media for industrial fermentations

UNIT V: METABOLIC STOICHIOMETRY
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.

UNIT VI: ENERGETICS
Energetic analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

UNIT VII: KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION

UNIT VIII: ENZYME PROCESSES
Production of enzymes in submerged and solid-state processes, extraction and purification of enzymes, methods of characterization, specific activity and activity definitions.

All relevant units will have basic numerical problems.

TEXT BOOKS
1. ENZYME ISOLATION AND ASSAY OF ENZYMATIC ACTIVITY
Extraction of commercially important enzymes from natural sources. Development of enzyme assays; quantification of enzyme activity and specific activity.

2. ENZYME KINETICS

3. IMMOBILIZED ENZYME REACTIONS
Techniques of enzyme immobilization - matrix entrapment, ionic and cross linking; column packing; analysis of mass transfer effects on kinetics of immobilized enzyme reactions; bioconversion studies with immobilized enzyme packed - bed reactors.

4. MICROBIAL CULTURE STUDIES:
Growth of microorganisms, estimation of Monod's parameters.

5. SCREENING OF PROCESS VARIABLES
Plackett-Burman design practice

6. DEMONSTRATION OF REACTOR STUDIES
Batch, fed-batch, and continuous flow reactor analysis and residence time distribution.

EQUIPMENTS
1. Autoclave.
2. pH Meter.
3. Laminar air flow chamber.
5. Compound microscope.
7. Packed-bed reactor.
8. Shaker-incubator.
9. Lyophilizer.
10. Spectrophotometer.
12. Hot air oven.
13. Incubator.
15. Micropipettes.
16. Bioreactor
INSTRUMENTAL METHODS OF ANALYSIS LAB

1. Demonstration of viable cells using phase contrast microscopy.
2. Verification of Lambert – Beers Law by UV – VIS spectrophotometer, scanning.
3. Estimation of different macromolecules by visible spectrophotometer.
4. Estimation of turbidity using UV-VIS spectrophotometer.
5. Emission spectra of Anthracene using Spectrofluorimeter.
7. Separation of different macromolecules by Paper, Thin layer & HPLC chromatography.
8. Membrane separation-dialysis and ultrafiltration.

REFERENCES


Equipments

1. U.V. Visible spectrophotometer
2. Spectrofluorimeter.
3. HPLC
4. Chromatographic chamber.
5. Microscope
7. Magnetic stirrer with magnetic beads
TRANSPORT PHENOMENA IN BIOPROCESSES

Unit I: Momentum Transport-I
Mechanism of Momentum Transport: Newton’s Law of Viscosity, Non-Newtonian fluids, theory of viscosity of liquids, time dependant viscosity, viscosity measurement (cone-and-plate viscometer, coaxial cylinder rotary viscometer, impeller viscometer), use of viscometers with biological reaction fluids, rheological properties of fermentation broth, factors affecting broth viscosity (cell concentration, cell morphology, osmotic pressure, product and substrate concentration), Velocity distribution in laminar flow and turbulent flow

Unit II: Momentum Transport-II
Equation of change for isothermal system (equation of continuity, equation of motion, equation of mechanical energy), interphase transport in isothermal systems (friction factors for flow in tubes and in packed columns) mixing, mixing mechanism, power requirements in ungassed Newtonian and Non Newtonian fluids, gassed fluids, interaction between cell and turbulent Eddies, operating conditions for turbulent shear damage. Macroscopic Balances - mass, momentum and mechanical energy balances.

Unit III: Energy Transport-I
Thermal conductivity and the mechanisms of energy transport - measurement of thermal conductivity, Fourier’s law, steady state conduction, analogy between heat and momentum transfer

Unit IV: Energy Transport-II
Temperature distribution with more than one independent variables - heating in a semi infinite and finite slab, temperature distribution in turbulent flow - reference to stirred tank reactor, relationship between heat transfer, cell concentrations and stirring conditions

Unit V: Mass Transport I
Diffusivity, theory of diffusion, analogy between mass heat and momentum transfer, role of diffusion in bioprocessing, film theory, concentration distribution with more than one independent variable - unsteady diffusion, boundary layer theory, concentration distribution in turbulent flow - Corrsin equation

Unit VI: Mass Transport II
Definition of binary mass transfer coefficients, transfer coefficients at high mass transfer rates - boundary layer theory, penetration theory

Unit VII: Mass Transport III
Convective mass transfer, Liquid -solid mass transfer, liquid-liquid mass transfer, gas-liquid mass transfer

Unit VIII: Oxygen Transport
Oxygen uptake in cell cultures, Factors affecting cellular oxygen demand, oxygen transfer from gas bubbles to aerobic culture, oxygen transfer in fermentors- bubbles, factors affecting oxygen transport - sparging, stirring, medium properties, antifoam agents, temperature, mass transfer correlations, measurements of $k_{La}$ - oxygen balance method, dynamic method.

Note: In all units relevant basic numerical problems should be practiced

TEXT BOOKS
2 P.M.Doran, Bioprocess Principles, Academic Press, 1995
3 Harvey W. Blanch, Douglas S. Clark Biochemical Engineering, Marcel, Dekker, 2007.

REFERENCE BOOK
UNIT I: Fundamentals of reaction engineering

Concept of order, molecularity of a reaction, searching a mechanism for a reaction, evaluation of rate constants, factors affecting reaction rates - pH, temperature using Arrhenius equation.

UNIT II: Reactions involving cells-I

Growth Kinetics - batch, fed-batch and continuous mode of operation in reaction system, evaluation of kinetic parameters Monod’s equation - parameters, death rate of cell-batch and continuous sterilization.

UNIT III: Reactions involving cells-II


UNIT IV: Reactions involving cells-III

Stoichiometry of cell growth and product formation - elemental and available electron balances, degrees of reduction, maintenance coefficient, online data analysis for measurement of biochemical parameters, state and parameter estimation technique.

UNIT V: Multiple Reactions

Parallel series, series – parallel reactions, calculation of yield and selectivity, role of thermodynamic parameters, metabolic flux analysis, basic concepts of structured model and introduction to cybernetic models, Design principles - non isothermal reactions and pressure effects, concepts of residence time distribution, micromixing and macromixing

UNIT VI: Mechanisms and Kinetics of Enzyme Action

Mechanisms of Enzyme Action; Concept of active site and energetics of enzyme Kinetics, substrate complex formation; Specificity of enzyme action; Kinetics of single substrate reactions; turnover number; estimation of Michaelis-Menten parameters. Importance of \( K_M \), Multi-substrate reaction mechanisms and kinetics. Types of Inhibition - kinetic models; Substrate and Product Inhibition; Allosteric regulation of enzymes; Deactivation kinetics.

UNIT VII: Enzyme Immobilization

Physical and Chemical techniques for enzyme Immobilization - adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding - examples; Advantages and disadvantages of different Immobilization techniques. overview of applications of immobilized enzyme systems, effect of pH, temperature on immobilized reaction kinetics.

UNIT VIII: Mass Transfer Effects In Immobilized Enzyme Systems and Design of Enzyme Reactors

Analysis of Film and Pore Diffusion Effects on kinetics of Immobilized Enzyme Reactions; Formulation of dimensionless groups and calculation of Effectiveness Factors, Thiele modulus

Note: In all units relevant basic numerical problems should be practiced.
TEXT BOOKS:

REFERENCES:
Unit I: Production of Primary Metabolites
A brief outline of processes for the production of some commercially important Organic acids (e.g. citric acid, lactic acid, acetic acid, gluconic acid); Amino acids (Glutamic acid, lysine, aspartic acid & Phenylalanine); and Alcohols (ethanol, 2,3- butanediol)

UNIT II: Secondary Metabolites:
Study of production processes for various classes of low molecular weight secondary metabolites: Antibiotics-beta-lactams (Penicillins), semi synthetic Pencillins and Cephalosporins amino-glycosides (streptomycin), macrolids (erythromycin), quinines, and aromatics. Vitamin (B12) and Steroids, dual or multiple fermentation.

Unit III: Production of Commercially Important Enzymes
Proteases, Amylases Lipases, Cellulases, Pectinases, Isomerases and other commercially important. Enzymes for the food pharmaceutical industries;

UNIT IV: Recombinant Proteins
Production of recombinant proteins (Insulin, Interleukin & Interferon’s) having therapeutic and diagnostic applications; production of vaccines.

Unit V: Bio Products and other Processes
Natural Biopreservatives (Nisin), and Biopolymers (Xanthan Gum and PHB); Single Cell Protein, Racemically-pure Drug Intermediates, Steroid Bioconversions; High-Fructose Corn syrup; Bioconversion of Vegetable Oils, Bioleaching.

Unit VI: Biological treatment of waste Water – Aerobic and Anaerobic Systems
Biological processes for domestic and industrial waste water treatments; Aerobic systems - activated sludge process, trickling filters, biological filters, rotating biological contractors (RBC), Fluidized bed reactor (FBR), expanded bed reactor, Inverse fluidized bed biofilm reactor (IFBBR) packed bed reactors air- sparged reactors ; Anaerobic Systems - contact digesters, packed column reactors, UASB.

Unit VII: Bioremediation
Introduction, constraints and priorities of Bioremediation, Bioaugmentation, in situ, ex situ, intrinsic & engineered bioremediation, Solid phase bioremediation - land farming, prepared beds, soil piles, Phytoremediation. Composting, Bioventing & Biosparging; Liquid phase bioremediation - suspended bioreactors, fixed biofilm reactors.

Unit VIII: Hazardous Waste Management
Introduction - Xenobiotic compounds, recalcitrance. hazardous wastes - biodegradation of Xenobiotics. Biological detoxification - hazardous waste management with at least 3 – 4 Examples.

TEXT BOOKS:
Industrial Microbiology; - J. E. Casida;
3 Environmental Biotechnology by S. K. Agarwal

REFERENCES:
1. Microbiology - Prescott and Dunn.
8. Environmental Biotechnology by A.K. Chatterjee
9. Environmental Biotechnology by S.N. Jogdand Himalaya Publishing
GENETIC ENGINEERING

Unit I: Gene Regulation and Expression in Prokaryotes
Lactose, Arabinose and Tryptophan operons, Repressors and activator, Sigma switch in *Bacillus subtilis*.

Unit II: Gene Regulation in Eukaryotic system
Gene regulation in Eukaryotic system, Repetitive DNA, Gene rearrangement, Promoters, enhancer elements, gene amplification.

Unit III: Plasmids, Transposons / Vectors for Gene Transfers
Plasmids: Definition, types, Identification, classification and purifications and transfer of Plasmids. Host restriction in transfer. Transposable elements: Definition, detection of transposition in bacteria, types of bacterial transposons, mechanisms of transposition and excision, applications of transposons. Retrotransposons.

UNIT IV: DNA Technology
Purification of genomic DNA from living cells, Manipulation of purified DNA; construction of prototype vector (pBR 322), different types of cloning vectors (plasmid – pUC 19, ? phage, cosmid, M13). Enzymes involved in genetic engineering; cloning strategies, Introduction of DNA into living cells. Methods of Gene transfer, Restriction mapping.

UNIT – V Expression and Detection of clones
Detection of clones and its expression: Expression of cloned genes in yeast & *E. coli*. Blot analysis - Southern, Northern & Western blot; dot and slot blot. Immunological techniques. DNA methylation, DNA hybridization. Genomic and cDNA library construction and application. DNA sequencing.

Unit VI: PCR and its application
Principles, designing of primers, PCR methodology, RT - PCR, multiplex PCR, identification of PCR product, application of PCR technology.

Unit VII: Molecular markers
Molecular markers: RFLP, RAPD, AFLP, 16s r-RNA typing, gene chip and micro array; applications in disease profile

Unit VIII: Applications of *r*-DNA Technology
Gene cloning in medicine (Insulin, Blood clotting factor VIII) High level expression of proteins in different host systems (*E. coli*, yeast, Insect, mammalian cells) Limitation and advantages and novel technologies- for generation of transgenic animals. Introduction to Gene therapy (Ex vivo & In vivo), case study of ADA as an example. Advantages and limitations of Gene therapy.

TEXT BOOKS:
2. T.A. Brown, Gene Cloning.

REFERENCES:
UNIT I TISSUE CULTURE
Introduction to cell and tissue culture; Tissue culture media (composition, preparation); Initiation and maintenance of callus and cell suspension culture, Somatic embryogenesis, organogenesis; Protoplast isolation culture and fusion;

UNIT II TISSUE CULTURE APPLICATIONS I
Production of haploids, Somaclonal variations, Germplasm conservation (Cryopreservation);

UNIT III TISSUE CULTURE APPLICATIONS II
Production of secondary metabolites from plant cell cultures; Processes for enhancing the production of secondary metabolites. Technology of plant cell culture for production of chemicals; Bioreactors systems and models for mass cultivation of plant cells;

UNIT IV PLANT TRANSFORMATION TECHNOLOGY
Agrobacterium mediated gene transfer; Agrobacterium based vectors, viral vectors and their application. Direct gene transfer methods; chemical methods, electroporation, microinjection, particle bombardment.

UNIT V PLANT GENETIC ENGINEERING FOR PRODUCTIVITY AND PERFORMANCE I (BIOTIC STRESS)
Herbicide resistance, Insect resistance, Disease resistance, virus resistance,

UNIT VI PLANT GENETIC ENGINEERING FOR PRODUCTIVITY AND PERFORMANCE II (ABIOTIC STRESS)
Abiotic stress tolerance :Drought, temperature, salt .

UNIT VII MOLECULAR FARMING & INDUSTRIAL PRODUCTS
Application of Plant biotechnology for the production of quality oil, Industrial enzymes, Therapeutic Proteins , Antigens (edible vaccine) and plantibodies.

UNIT VIII METABOLIC ENGINEERING
Metabolic engineering for plant primary metabolites and secondary metabolites.

TEXT BOOKS:

REFERENCES:
Unit I Introduction to Managerial Economics:


Unit II Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting (survey methods, statistical methods, expert opinion method, test marketing, controlled experiments, judgmental approach to demand forecasting)


Unit IV Introduction to Markets & Pricing Policies:


Unit VI Capital and Capital Budgeting: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising finance. Nature and scope of capital budgeting, features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method (simple problems)


Unit VIII Financial Analysis through ratios: Computation, Analysis and Interpretation of Liquidity Ratios (Current Ratio and quick ratio), Activity Ratios (Inventory turnover ratio and Debtor Turnover ratio), Capital structure Ratios (Debt- Equity ratio, Interest Coverage ratio), and Profitability ratios (Gross Profit Ratio, Net Profit ratio, Operating Ratio, P/E Ratio and EPS).

TEXT BOOKS:

REFERENCES:

3. Suma Damodaran, Managerial Economics, Oxford University Press.
MOLECULAR BIOLOGY AND GENETIC ENGINEERING LAB

1. Isolation of Plant and Bacterial Genomic DNA and Plasmid DNA.
2. Agarose Gel Electrophoresis.
3. Restriction Enzyme digestion.
4. Demonstration Chemical mutagenesis.
5. Isolation and visualization of plasmid on Agarose gel.
6. Restriction mapping and ligation.
7. Transformation, screening for recombinants.
11. Cloning of DNA into plasmid vector.

REFERENCES:

Current protocols in Molecular Biology by Maniatis.

EQUIPMENTS:

Autoclave.
Laminar air flow chamber.
Water bath
Balance.
Microfuge.
Micropipettes
Submarine gel electrophoresis unit with power pack.
U.V.Transilluminator.
Vertical slab gel electrophoresis equipment.
ADVANCED ENGLISH COMMUNICATION SKILLS LAB

1. Introduction
The introduction of the English Language Lab is considered essential at 3rd year level. At this stage the students need to prepare themselves for their careers which may require them to listen to, read, speak and write in English both for their professional and interpersonal communication in the globalised context.

The proposed course should be an integrated theory and lab course to enable students to use ‘good’ English and perform the following:
- Gather ideas and information, to organise ideas relevantly and coherently.
- Engage in debates.
- Participate in group discussions.
- Face interviews.
- Write project/research reports/technical reports.
- Make oral presentations.
- Write formal letters.
- Transfer information from non-verbal to verbal texts and vice versa.
- To take part in social and professional communication.

2. Objectives:
This Lab focuses on using computer-aided multimedia instruction for language development to meet the following targets:
- To improve the students’ fluency in English, through a well-developed vocabulary and enable them to listen to English spoken at normal conversational speed by educated English speakers and respond appropriately in different socio-cultural and professional contexts.
- Further, they would be required to communicate their ideas relevantly and coherently in writing.

3. Syllabus:
The following course content is prescribed for the Advanced Communication Skills Lab:
- Functional English - starting a conversation – responding appropriately and relevantly – using the right body language – role play in different situations.
- Vocabulary building - synonyms and antonyms, word roots, one-word substitutes, prefixes and suffixes, study of word origin, analogy, idioms and phrases.
- Group Discussion – dynamics of group discussion, intervention, summarizing, modulation of voice, body language, relevance, fluency and coherence.
- Interview Skills – concept and process, pre-interview planning, opening strategies, answering strategies, interview through tele and video-conferencing.
- Resume’ writing – structure and presentation, planning, defining the career objective, projecting ones strengths and skill-sets, summary, formats and styles, letter-writing.
- Reading comprehension – reading for facts, guessing meanings from context, scanning, skimming, inferring meaning, critical reading.

4. Minimum Requirement:
The English Language Lab shall have two parts:

i) The Computer aided Language Lab for 60 students with 60 systems, one master console, LAN facility and English language software for self-study by learners.

ii) The Communication Skills Lab with movable chairs and audio-visual aids with a P.A System, a T. V., a digital stereo –audio & video system and camcorder etc.

System Requirement (Hardware component):

Computer network with Lan with minimum 60 multimedia systems with the following specifications:

iii) P – IV Processor
   a) Speed – 2.8 GHZ
   b) RAM – 512 MB Minimum
   c) Hard Disk – 80 GB

iv) Headphones of High quality
5. **Suggested Software:**

   The software consisting of the prescribed topics elaborated above should be procured and used.

   **Suggested Software:**
   - Clarity Pronunciation Power – part II
   - Oxford Advanced Learner’s Compass, 7th Edition
   - DELTA’s key to the Next Generation TOEFL Test: Advanced Skill Practice.
   - Lingua TOEFL CBT Insider, by Dreamtech
   - TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS)
   - The following software from ‘train2success.com’
     - Preparing for being Interviewed,
     - Positive Thinking,
     - Interviewing Skills,
     - Telephone Skills,
     - Time Management
     - Team Building,
     - Decision making
   - English in Mind, Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge

6. **Books Recommended:**

   5. **English Language Communication: A Reader cum Lab Manual** Dr A Ramakrishna Rao, Dr G Natnam & Prof SA Sankaranarayanan, Anuradha Publications, Chennai
   8. Books on TOEFL/GRE/GMAT/CAT by Barron’s/cup
   9. IELTS series with CDs by Cambridge University Press.
   15. **Technical Communication** by Meenakshi Raman & Sangeeta Sharma, Oxford University Press.

**DISTRIBUTION AND WEIGHTAGE OF MARKS:**

**Advanced Communication Skills Lab Practicals:**

1. The practical examinations for the English Language Laboratory practice shall be conducted as per the University norms prescribed for the core engineering practical sessions.
2. For the English Language lab sessions, there shall be a continuous evaluation during the year for 25 sessional marks and 50 End Examination marks. Of the 25 marks, 15 marks shall be awarded for day-to-day work and 10 marks to be awarded by conducting Internal Lab Test(s). The End Examination shall be conducted by the teacher concerned with the help of another member of the staff of the same department of the same institution.
UNIT I: INTRODUCTION TO COMPUTATIONAL MOLECULAR BIOLOGY
Introduction to active areas of research in Computational Molecular Biology, Functional Genomics, Comparative Genomics, Dynamic Programming, Graphical representation of biochemical systems, S-systems equations, steady state analysis, Model refinements.

UNIT II: GENOMICS

UNIT III: MICRO ARRAYS
Basics of Micro array.

UNIT IV: PROTEOMICS I

UNIT V: PROTEOMICS II
Protein homology modeling, Protein threading. Protein ab initio structure prediction. Protein design emphasis on structural Bioinformatics.

UNIT VI: TAXONOMY AND PHYLOGENY
Basic concepts in systematics, Molecular evolution, Definition and description of Phylogenetic trees and types of trees.

UNIT VII: DENDROGRAMS
Dendograms and its interpretation.

UNIT VIII: DRUG DESIGN
Drug discovery cycle, Role of Bioinformatics in Drug discovery.

TEXT BOOKS:

REFERENCES:
4. BRANDOND TOOZE – Proteomics
UNIT I: BASIC CONCEPT
Definition of bioreactor, fundamental principles, Concept in energy and mass balances and in biological reaction modeling.

UNIT II:
Classification of reactors and their configurations, Application in submerged fermentation and solid state fermentation, classification based schuegerl, kafarov components of bioreactors and operation of bioreactors.

UNIT III: ANALYSIS OF IDEAL REACTORS
Concepts of reactors based on flow characteristics, design of ideal reactors using material and energy balance. Batch bioreactor design.

UNIT IV: CHEMOSTAT ANALYSIS
Definition of chemostat, turbidostat, single flow single stage chemostat, single flow multistage chemostat, recycle flow in chemostat, concepts of dilution rate productivity analysis.

UNIT V: PLUG FLOW REACTION SYSTEM
Plug flow behavior, design of plug flow reactor, comparison of productivity in plug flow and single stage single flow chemostat.

UNIT VI: NON-IDEAL BEHAVIOUR IN REACTION SYSTEMS
Reasons for non-ideality, concept of macro using –RTD analysis (E-C-F functions), diagnosing the ills of non-ideal bioreactors.

UNIT VII: DESIGN AND ANALYSIS OF ENZYME REACTORS
Application tubular reactor concept in immobilized packed bed reactors, fluidized bed reactors.

UNIT VIII: SPECIFIC BIOREACTORS ANALYSIS AND SCALE-UP
Design and analysis of fed-batch and air-lift bioreactors. Application in animal cell culture. Basic concept of scale-up, non-dimensional analysis.

Text Books:

References:
UNIT-I: BASICS OF HEAT TRANSFER

UNIT-II: CONDUCTIVE HEAT TRANSFER:
Steady state and unsteady state heat transfer by conduction. Heat transfer through slab and cylinder. Concept of log mean radius for transfer through pipes. Extended surface heat transfer through fins etc.

UNIT-III
Convection–Dimensional analysis, Forced convection in pipe and other geometries

UNIT-IV
Natural convection - various correlation for evaluating heat transfer coefficients.

UNIT-V
Boiling and condensations. Mechanism of boiling: Film and nucleate boiling.

UNIT-VI: HEAT TRANSFER EQUIPMENTS
Double pipe heat exchangers, Shell and tube heat exchangers, pinfin heat exchangers-Overall transfer coefficient. Overview of various types of heat exchangers and concept of LMTD.

UNIT-VII
Single and Multiple effect evaporators and problems on evaporators. Steam economy, Steam capacity, evaporators performance with various feedings viz, forward, backward and parallel.

UNIT-VIII
Analogy between heat, mass and momentum transfer. Applications of heat transfer in bioprocessing-batch sterilization and design of continuous sterilizer.

* Relevant basic numerical problems should be dealt in the units.

TEXT BOOKS:

REFERENCE BOOKS:
BIOTOL Series: Transport phenomena in bioprocesses, Verlag
UNIT I: PROCESS DYNAMICS
Process variables-Load variables-Dynamics of simple processes. Flow, level, temperature and pressure

UNIT II:
Interacting and non-interacting system, continuous and batch process-self - regulation-Servo and regulator operation problems.

UNIT III: CONTROL ACTIONS AND CONTROLLERS
Basic control actions-characteristics of two position, three position, proportional, single speed floating. Integral and derivative control modes- P+I, P+D and P+I+D control modes.Problems on pneumatic, hydraulic and electronic controllers to realize various control actions.

UNIT IV: OPTIMUM CONTROLLER SETTINGS
Evaluation criteria, 1/4th decay ratio, IAE. ISE, ITAE- determination of optimum settings for mathematically described process using time response and frequency response.

UNIT V:
Tuning process reaction curve method-continuous, oscillation method-damped oscillation method-problems.

UNIT VI: FINAL CONTROL ELEMENT
I/P Converter-pneumatic, electric and hydraulic actuators- valve positioner- control valves-characteristics of control valves-valve body-Globe, butterfly, diaphragm; Ball valves- Control valve sizing-Cavitation, flashing problem.

UNIT VII: MULTI LOOP CONTROL SYSTEM
Feed forward control-Ratio control-Cascade control-Split range-Multivariable control and examples from distillation column & Boiler system.

UNIT VIII: BIOSENSORS
Types, Transducers in biosensors- calorimetric, optical, potentiometric / ampltometric, conductometric/resistometric, piezoelectric, semi conductor, mechanical and molecular electronics based, molecular wires and switches, development of molecular arrays as memory stores, design for a biomolecular photonic computers-information processing.

TEXT BOOKS:
3. J.R. Leigh: Modeling and control in bioprocesses
4. Patranabis, Process Control year?
5. KR Rogers, M. Mascion, Biosensors for analytical monitoring EP & biosensors year

REFERENCES:
UNIT I: THE IMMUNE SYSTEM
Introduction, Phylogeny of the Immune system, Innate and acquired immunity. Immunochemistry:
Immunogens, antigens, their chemical nature, Properties influencing immunogenicity, Haptens, adjuvants.

UNIT II: BIOLOGY OF THE IMMUNE SYSTEM
Cells of the IS: Haematopoiesis, lymphocyte leafficking, T, B, Macrophases, Dendritic cells, Natural killer
cells, Eosinophils, Neutrophils, Mast cells and Phasocytosis.

UNIT III: ORGANS OF THE I.S. :
Primary and Secondary organs of I.S. (Thymus, Spleen, Lymphnode, lymphoid fo kicle, MALT, CALT, SALT

UNIT IV: HUMORAL IMMUNITY-I
B-lymphocytes, their lineage, Immunoglobulins, their structure function, classes, sub classes, genetic control
of ab production. (Maturation of B cell) Isotype, allotypes, Idiotypes. Antigen-Antibody interactions,
hypersensitivity.

UNIT V: HUMORAL IMMUNITY -II
Activation of B cells, their differentiation and effector functions. Hybridoma Technology Monoclonal
antibodies their application. Immunotoxing chimeric antibodies and abzymes.

UNIT VI: CELL MEDIATED IMMUNITY
T-cells subclasses their lineage, maturation TCR diversity, MHC, Ag processing and presentation, T-cell
activation, effector functions.

UNIT VII: Hypersensitivity
Hypersensitivity: Types of hypersensitivity, Principle, mechanisms their relevance & significance. Role of
immune system in transplantation, autoimmunity, tumors.

UNIT VIII: Role of immune system in transplantation, autoimmunity, tumors
Transplantation- Graft rejection evidence and mechanisms of graft rejection ,prevention of graft rejection,
immuno suppressive drugs, Autoimmunity – experimental models of autoimmune disease treatment of
autoimmune disorders and Tumor immunology.

TEXT BOOKS:

REFERENCES:
JAWAHarlAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD

III Year B.Tech BT  II-Sem

PROBABILITY AND STATISTICS

UNIT-I
Probability: Sample space and events – Probability – The axioms of probability – Some Elementary theorems - Conditional probability – Baye’s theorem.

UNIT-II

UNIT-III
Binomial and poison distributions Normal distribution – related properties.

UNIT-IV
Sampling distribution: Populations and samples - Sampling distributions of mean (known and unknown) proportions, sums and differences.

UNIT-V
Estimation: Point estimation – interval estimation - Bayesian estimation.

UNIT-VI
Test of Hypothesis – Means– Hypothesis concerning one and two means– Type I and Type II errors. One tail, two-tail tests.

UNIT-VII

UNIT-VIII
Queuing Theory: Pure Birth and Death Process M/M/1 Model and Simple Problems.

Text Books:


References:

JAWAHRLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD

III Year B.Tech BT II-Sem

PLANT TISSUE CULTURE LAB

1. Preparation of Media
2. Surface sterilization
3. Callus induction
4. Organ culture
5. Protoplast isolation, culture and Cytological examination
6. Agrobacterium mediated gene transfer, selection of transformants, reporter gene (GUS) assays.

REFERENCE:

EQUIPMENTS:

1. Autoclave.
2. pH Meter.
3. Laminar air flow chamber.
4. B.O.D. Incubator.
1. Immunoprecipitation
   a) Ouchterlony’s immuno diffusion technique.
   b) Counter current immuno electrophoresis.
3. Enzyme linked immunosorbant assay (ELISA)
4. Immunoglobulins purification.
5. Differential (Identification of cell types) & Total leukocyte counts of blood
6. Isolation & Viability determination of Lymphocytes from peripheral blood.
7. Lymphocyte proliferation with mitogen and migration with capillary tubes.
8. Identification of cell types by receptors – Immunofluorescence.

Equipments:
1. Haemocytometer
2. ELISA reader
3. Centrifuge
4. Electrophoresis unit
5. Microscope
UNIT I: INTRODUCTION TO BIOINFORMATICS
Scope of Bioinformatics, Elementary commands and protocols, ftp, telnet, http. Primer on information theory.

UNIT II: INTRODUCTION TO HOMOLOGY

UNIT III: SPECIAL TOPICS IN BIOINFORMATICS
DNA mapping and sequencing, Map alignment, Large scale sequencing methods Shotgun and Sanger method.

UNIT IV: SEQUENCING ALIGNMENT AND DYNAMIC PROGRAMMING

UNIT V: PRIMARY DATABASE AND THEIR USE
Introduction to Biological databases, Organization and management of databases. Searching and retrieval of information from the World Wide Web. Structure databases - PDB (Protein Data Bank), Molecular Modeling Databases (MMDB). Primary Databases NCBL, EMBL, DDBJ.

UNIT VI: SECONDARY DATABASES
Introduction to Secondary Databases Organization and management of databases Swissprot, PIR,KEGG

UNIT VII: BIOCHEMICAL DATA BASES
Introduction to BioChemical databases-organization and Management of databases. KEGG, EXGESCY, BRENDA, WIT.

UNIT VIII: EVOLUTIONARY TREES AND PHYLOGENY
Multiple sequence alignment and phylogenetic analysis.

TEXT BOOKS:

REFERENCES:
3. Developing Bioinformatics Skills. Cynthia Gibbas & Per Jamberk
7. Bioinformatics – A Practical guide to the Analysis of Genes and Proteins – ANDREAS D.BAXEVANIS, B.F.FRANCIS OUELLETTE.
UNIT I: BIOETHICS
Introduction to Bioethics. Social and ethical issues in Biotechnology

UNIT II: BIOSAFETY I

UNIT III: BIOSAFETY II
Use of genetically modified organisms and their release in to the environment. Special procedures for r-DNA based products

UNIT IV: REGULATORY AFFAIRS
Regulatory requirements for drugs and Biologics. GLP, GMP

UNIT V: INTELLECTUAL PROPERTY RIGHTS I
Intellectual property rights, and Intellectual Property protection, patents and methods of application of patents,

UNIT VI: INTELLECTUAL PROPERTY RIGHTS II
Trade Secrets copyrights, Trade Marks, legal implications, farmers rights, plant breeder’s rights.

UNIT VII: INTELLECTUAL PROPERTY RIGHTS III
International and National conventions on biotechnology and related areas.

UNIT VIII
WTO guidelines

TEXT BOOKS:

REFERENCE:
DOWNSTREAM PROCESSING

UNIT I: ROLE OF DOWNSTREAM PROCESSING IN BIOTECHNOLOGY
Role and importance of downstream processing in biotechnological processes. Problems and requirements of bioproduct purification. Economics of downstream processing in Biotechnology, cost-cutting strategies, characteristics of biological mixtures, process design criteria for various classes of bioproducts (high volume, low value products and low volume, high value products)

UNIT-II:
Physico-chemical basis of bio-separation processes. Recent development in product Isolation (for ex. one step purification, reverse Micro cellular extraction on line membrane separation).

UNIT III: PRIMARY SEPARATION AND RECOVER PROCESS
Cell disruption methods for intracellular products, removal of insoluble, biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods.

UNIT IV: MEMBRANE SEPARATIONS
Membrane-based separations (micro and ultrafiltration), theory, design and configuration of membrane separation equipment applications,

UNIT V: ENRICHMENT OPERATIONS
Precipitation methods (with salts, organic solvents, and polymers, extractive separations, aqueous two-phase extraction, supercritical extraction), in situ product removal, integrated bioprocessing.

UNIT VI: ELECTROPHORESIS
Electrophoresis of proteins and nucleic acids, 1D-2D Gels, Types of Electrophoretic techniques (Capillary and Pulse field).

UNIT VII: PRODUCT RESOLUTION / FRACTIONATION
Chromatographic techniques- Paper, TLC, Adsorption, Ion exchange, Gel filtration, affinity chromatographic separation processes, GC, HPLC, FPLC, Chromatofocusing electrophoretic separations.

UNIT VIII: NEW AND EMERGING TECHNOLOGIES
Dialysis, Crystallization Pervaporation, super liquid extraction foam based separation case study with examples for processing of Two Industrial Products (Citric acid / Penicillin and Low volume high value product like recombinant proteins).

TEXT BOOKS:

REFERENCES:
UNIT I: INTRODUCTION
What are Biosensors? Advantages and limitations, various components of biosensors

UNIT II TYPES OF BIOSENSORS
Biocatalysis based biosensors, bioaffinity based biosensors & microorganisms based biosensors, biologically active material and analyte. Types of membranes used in biosensor constructions.

UNIT III: TRANSDUCTORS IN BIOSENSORS I
Various types of transducers; principles and applications - Calorimetric, optical, potentiometric / amperometric conductometric/resistometric,

UNIT IV: TRANSDUCTORS IN BIOSENSORS II
Piezoelectric, semiconductor, impedimetric, mechanical and molecular electronics based transducers.
Chemiluminiscence - based biosensors.

UNIT V: APPLICATION AND USES OF BIOSENSORS I
Biosensors in clinical chemistry, medicine and health care, biosensors for veterinary, agriculture and food

UNIT VI: APPLICATION AND USES OF BIOSENSORS II
Low cost- biosensor for industrial processes for online monitoring; biosensors for environmental monitoring.

UNIT VII: MOLECULAR ELECTRONICS I
Potential advantages & Developments towards a biomolecular computer, development of molecular arrays as memory stores; molecular wires and switches; mechanisms of unit assembly;

UNIT VIII: DESIGN FOR A BIOMOLECULAR PHOTONIC COMPUTER
Assembly of photonic biomolecular memory store; Information processing; commercial prospects for biomolecular computing systems.

TEXT BOOKS:

REFERENCES:
UNIT I: INTRODUCTION
Definition of polymers and biomaterials, functionality, polymer isomerism

UNIT II: SELECTION OF BIOMATERIALS
Selection criteria, fiber folding, membrane lamination, in situ polymerization

UNIT III: BIOLOGICALLY DERIVED BIOMATERIALS
Polyhydroxialkanoates, polylactides- characterization, synthesis in organism and extraction

UNIT IV: MATERIALS FOR TISSUE ENGINEERING
Case studies with regenerated polymers

UNIT V: TRENDS IN BIOCOMPOSITE
Biodiode , polymer coated blood, polymer precursor synthesis and characterization

UNIT VI: IMPROVED FUNCTIONS OF BIOPOLYMERS
Genetic and molecular Biology aspects of synthesis

UNIT VII: FERMENTATIVE PRODUCTION
Biopolyester, microbial polysaccharides, microbial cellulose, bioadhesive, polyglutamic acid

UNIT VIII: OPTIMIZATION OF PRODUCTION KINETICS, SEPARATION
Statistical optimization of probable variables for production of biomaterials, use of reactors, kinetic analysis for production, separation of Biomaterials by cell digestion and extraction

BOOKS:

REFERENCE BOOK:
1. A. Steinbuechel – Biopolymers.
UNIT I: INTRACELLULAR SIGNALING.
Introduction, Receptor-Ligand interactions.

UNIT II: ROLE OF RECEPTORS –I
Extra Cellular Receptors, Coupling to different signal transducing systems.

UNIT III: ROLE OF RECEPTORS –II
Type of intracellular receptors, steroid receptors, structure and function.

UNIT IV: SPECIFIC MOLECULES
Role and functions of G-proteins, CREB proteins, Calcium channels, second messengers-inositol, diacyl glycerol

UNIT V: MECHANISM
Signal transduction, mechanism and involvement of molecules.

UNIT VI: RECEPTORS
Regulations of receptor function, modification and adaptation of cells.

UNIT VII: PATHWAYS
Signal transduction pathways, applications in development and diseases.

UNIT VIII: ROLE OF DEFECTIVE SIGNALING
Development of abnormalities, signal transducing machinery as targets for potential drugs.

Textbooks
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD

IV Year B.Tech BT I-Sem

STRUCTURAL BIOLOGY

( Elective - I )

UNIT I: INTRODUCTION
Levels of structures in Biological macromolecules, the chirality of biomolecules, proteins, nucleic acids, carbohydrates and lipids, cofactors, vitamins and hormones.

UNIT II: CONFORMATIONAL ANALYSIS
Forces that determine Protein and Nucleic acid structure, basic problems. Polypeptide chains; geometric, potential energy calculations, observed values for rotation angles, hydrogen bonding, hydrophobic interactions and water structures; ionic interactions, disulphide bonds.

UNIT III: PROTEIN FOLDING
Types of proteins and interactions that govern protein folding, protein structure, The protein globule and hydrophic interactionsorganized folds, folding mechanisms, membrane proteins, helix-coil transitions,

UNIT IV: BIOMOLECULAR INTERACTIONS
Molecular recognition, supramolecular interactions, Functional importance of Proteinprotein and protein-nucleic acid interactions. Specific and non-specific DNA-protein complexes.

UNIT V: STRUCTURAL ANALYSIS OF MACROMOLECULES
Prediction of protein structure; Sequence-structure relationships, Nucleic acids; general characteristics of nucleic acid structure, geometric, glycosidic bond rotational isomers backbone rotational isomers and ribose puckering forces stabilizing ordered forms, base pairing, base stacking; tertiary structure of nucleic acids.

UNIT VI: KINETICS OF LIGAND INTERACTIONS
Biochemical Kinetics studies, uni-molecular reactions, simple bimolecular multiple intermediates, steady state kinetics, catalytic efficiency relaxation spectrometry, ribonuclease as an example.

UNIT VII: TECHNIQUES FOR THE STUDY OF BIOLOGICAL STRUCTURE & FUNCTION I
Size and shape of micro molecules: photons, chromophores, transition dipole moments, absorbance, and concentration. circular dichroism: molecular chirality and structural transitions of macromolecules, methods of direct visualizationmacromolecules as hydrodynamic particles - macromolecular diffusion ultra centrifugation viscometry.

UNIT VIII: TECHNIQUES FOR THE STUDY OF BIOLOGICAL STRUCTURE & FUNCTION II
X- ray crystallography; determination of molecular structures, X- ray fiber diffractionelectron microscopy; neutron scattering - light scattering. NMR spectroscopy.

Text Book:

References:
1. Introduction to Protein Architecture, by A.M. Lesk
2. Introduction to Protein Structure, by Branden and Tooze
IV Year B.Tech BT I-Sem

CANCER BIOLOGY

(Elective-I)

UNIT I: FUNDAMENTALS OF CANCER BIOLOGY
Regulation of Cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches,

UNIT II: TUMOR SUPPRESSION
tumour suppressor genes, modulation of cell cycle in cancer. Different forms of cancers, Diet and cancer.

UNIT III: PRINCIPLES OF CARCINOGENESIS I
Chemical Carcinogenesis, Metabolism of Carcinogenesis, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis

UNIT IV: PRINCIPLES OF CARCINOGENESIS II

UNIT V: MOLECULAR CELL BIOLOGY OF CANCER

UNIT VI: PRINCIPLES OF CANCER METASTASIS
Clinical significances of invasion, heterogeneity of metastatic phenotype, Metastatic cascade, Basement Membrane disruption, Three-step theory of Invasion, Proteinases and tumour cell invasion.

UNIT VII: DETECTION OF CANCER
Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection.

UNIT VIII: NEW MOLECULES FOR CANCER THERAPY
Different forms of therapy, Chemotherapy, radiation Therapy, and Immuno therapy: advantages and limitations.

TEXT BOOKS

REFERENCE:
1. Dunmock N.J and Primrose S.B., Introduction to modern Virology, Blackwel
UNIT I INTRODUCTION
The process of technological innovation, factors contributing to successful technological innovation

UNIT II CREATIVITY
The need for creativity and innovation, creativity and problem solving, brainstorming- different techniques.

UNIT III PROJECT SELECTION AND EVALUATION
Collection of ideas and purpose of project.- Selection criteria - screening ideas for new products (evaluation techniques).

UNIT IV NEW PRODUCT DEVELOPMENT
Research and new product development Patents - patent search

UNIT V: PATENT LAWS

UNIT VI NEW PRODUCT PLANNING I
Design of prototype - testing - quality standards

UNIT VII NEW PRODUCT PLANNING II
Marketing research - introducing new products. GMP

UNIT VIII LABORATORY

TEXT BOOKS

REFERENCES
UNIT I: BASIC CONCEPT
Definition of nano scale with reference to biosystems, Scope and future prospects.

UNIT II: TOOLS OF NANOSCIENCE
Scanning probe instrument, spectroscopy, electron microscopy.

UNIT III: TOOLS FOR NANOSTRUCTURE
Molecular synthesis, Self assembly, Polymerisation, Nanoscale lithography, e-beam lithography.

UNIT IV: SMART MATERIALS
Heterogenous nano structure and composites, nanoscale biostructures.

UNIT V: HYBRID COMPUTERS
Protein-hybrid computers, role of genetically engineered polymer proteins.

UNIT VI: DIRECTED SYNTHESIS
Molecular biology of biosynthesis and molecular design.

UNIT VII: APPLICATIONS
Drugs-Photodynamic therapy, molecular motors, neuroelectronic interphases, development of nanoluminiscent tags.

UNIT VIII: BIOSYNTHESIS OF DESIGNER COMPOUNDS
Designer biopolymers, Procollagen, DNA Polynode, RNA topoisomerase, Protein–magnetic materials.

Textbooks:

References:
UNIT I: INTRODUCTION
Identification of metabolic regulation is a key point in metabolic engineering.

UNIT II: SYNTHESIS OF PRIMARY METABOLITES
Amino acid synthesis pathways and its regulation at enzyme level and whole cell level, Alteration of feedback regulation, Limiting accumulation of endproducts.

UNIT III: BIOSYNTHESIS OF SECONDARY METABOLITES

UNIT IV: BIOCONVERSIONS
Applications of Bioconversions, Factors affecting bioconversions, Specificity, Yields, Co metabolism, Product inhibition, mixed or sequential bioconversions, Conversion of insoluble substances.

UNIT V: REGULATION OF ENZYME PRODUCTION
Strain selection, Genetic improvement of strains, Gene dosage, metabolic pathway manipulations to improve fermentation, Feedback repression, Catabolite Repression, optimization and control of metabolic activities. The modification of existing - or the introduction of entirely new - metabolic pathways

UNIT VI: METABOLIC FLUX
Integration of anabolism and catabolism, metabolic flux distribution analysis in bioprocess, material balance, kinetic types, equilibrium reaction. Experimental determination method of flux distribution, Metabolic flux analysis and its applications, Thermodynamics of cellular processes

UNIT VII: METABOLIC ENGINEERING WITH BIOINFORMATICS
Metabolic pathway modeling, Analysis of metabolic control and the structure metabolic networks, Metabolic pathway synthesis algorithms,

UNIT VLLL: APPLICATIONS OF METABOLIC ENGINEERING
Application in pharmaceuticals, chemical bioprocess, food technology, agriculture, environmental bioremediation and biomass conversion.

TEXT BOOKS:

References:
http://ocw.osaka-u.ac.jp/contents/19/ME040512.pdf For unit VI & VII
http://ocw.osaka-u.ac.jp/contents/19/ME040421.pdf For unit VI
http://ocw.osaka-u.ac.jp/contents/19/ME040526.pdf For unit VII
http://ocw.osaka-u.ac.jp/contents/19/ME040602.pdf For unit VI & VII
http://www.bioinfo.de/isb/gcb01/poster/hurlebaus.html
BIOINFORMATICS LAB

1) Demonstration of BLAST, FASTA and other search engines
2) Clustering and contig assembly tool
3) Multiple sequence alignment and phylogenetic analysis.
4) Gene finder (Prediction)
5) Restriction site analysis tools
6) Protein visualization tools (RASMOL)

EQUIPMENTS:
1. Computers
2. Internet facility
3. Bioinformatics software
DOWNSTREAM PROCESSING LABORATORY

Cell disruption techniques.

Solid separation methods-filtration, sedimentation, centrifugation, product enrichment operations, precipitation, ultra filtration, two-phase aqueous extraction, high-resolution purification, preparative liquid chromatographic techniques, product crystallization and drying.

Equipments
1. Tangential flow filtration unit
2. Ultra filtration membrane
3. Centrifuge
4. Chromatographic matrix
5. Chromatographic columns
6. UV-Vis spectrophotometer
7. separating funnels
8. Lyophilizer
9. Magnetic stirrer
Unit I:
Structure and Organization of animal cell; Equipments and materials for animal cell culture technology; Primary and established cell line cultures; Introduction to the balanced salt solutions and simple growth medium.

Unit II:
Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium. Role of carbon dioxide. Role of serum and supplements; Serum & protein free defined media and their application.

Unit III:
Measurement of viability and cytotoxicity; Biology and characterization of the cultured cells, measuring parameters of growth;

Unit IV:
Basic techniques of mammalian cell culture in vitro; disaggregation of tissue and primary culture, maintenance of cell culture; cell separation.

Unit V:
Cell synchronization; Cell cloning and micromanipulation; Cell transformation; Application of animal cell culture; Scaling-up of animal cell culture.

Unit VI:
Stem cell cultures, embryonic stem cells and their applications; Cell culture based vaccines, Somatic cell genetics.

Unit VII:
Organ and histotypic cultures; Measurement of cell death; Apoptosis;

Unit VIII:
Three dimensional culture and tissue engineering.

TEXT BOOKS:

REFERENCES
UNIT -1 INTRODUCTION TO FOOD SCIENCE & TECHNOLOGY
Fundamentals and Aims of food science and technology. Interdisciplinary approach, Nutritive value of foods, Food as a source of energy, Food Health and disease.

UNIT -2 FOOD CHEMISTRY
Food chemistry-definition and importance, water in food, water activity and shelf life of food. Carbohydrates-functional properties of sugars and polysaccharides in foods. Lipids: use of lipids in foods, physical and chemical properties, effects of processing on functional properties and nutritive value. Protein and amino acids: physical and chemical properties, distribution, amount and functions of proteins in foods, functional properties, effect of processing.-Losses of vitamins and minerals due to processing.

UNIT -3 FOOD MICROBIOLOGY

UNIT -4 FOOD Preservation

UNIT -5 FOOD Biotechnology
Biotechnology in relation to food industry, Enzymes in foods and food industry, Nature and type of starters, Role of starters in Fermented foods, Fermentation of Milk products-Fermented soy and peanut milk, Fruit and cereal based beverages, Non beverage plant products. Mycoprotein production.

UNIT -6 FOOD Additives and ANALYSIS
Sampling techniques and theory and practice of chemical and physical methods of food analysis for determination of food composition; Pigments in food, food flavours, food additives and toxicants. Natural sweeteners and artificial sweeteners and their role in controlling diseases and deficiencies, Nutraceuticals, and Functional Foods

UNIT -7 FOOD PROCESSING
Basic principles, unit operations, and equipment involved in the commercially important food processing methods and unit operations; materials and containers used in food packaging.

UNIT -8 FOOD QUALITY ASSURANCE

2 Food processing and Preservation PHI private ltd, New Delhi
3 Food Microbiology fourth edition William C. Frazier, Tata Mc Graw Hill
4 Food Microbiology 2nd Edition, Michael P. Doyle, ASM press
UNIT I: INTRODUCTION TO MOLECULAR MODELLING
Introduction to Molecular Modelling. What are models used for? Areas of application – Single molecule calculation, assemblies of molecules. Reaction of the molecules. Drawbacks of mechanical models as compared to graphical models. Co-ordinate systems two – matrix, potential energy surface.

UNIT II – QUANTUM MECHANICS
Postulates of quantum mechanics, electronic structure calculations, ab initio, semi-empirical and density functional theory calculations, molecular size versus accuracy. Approximate molecular orbital theories.

UNIT III: EMPIRICAL FORCE FIELD MODELS
Molecular Mechanisms, energy calculations, Bond stretch, angle bending, torsional term. Electrostatic interaction- Van der waals interactions. Miscellaneous interaction.

UNIT IV – MOLECULAR DYNAMICS
Introduction, Molecular Dynamics using simple models. Dynamics with continuous potentials. Constant temperature and constant dynamics. Conformation searching, Systematic search. Applications to protein folding

UNIT V – COMPARATIVE PROTEIN MODELING
Modelling by Homology-the alignment, construction of frame work ,selecting variable regions, side chain placement and refinement, validation of protein models –Ramchandran plot, threading and ab initio modeling.

UNIT VI: ANALOG BASED DRUG DESIGN
Introduction to QSAR. lead module, linear and nonlinear modeled equations, biological activities, physicochemical parameter and molecular descriptors, molecular modelling in drug discovery.

UNIT VII: STRUCTURE BASED DRUG DESIGN
3D pharmacophores ,molecular docking, De novo Ligand design, Free energies and solvation, electrostatic and non-electrostatic contribution to free energies.

UNIT VIII: FURTHER APPLICATIONS ON THE DESIGN OF NEW MOLECULES
3D data base searching and virtual screening, Sources of data, molecular similarity and similarity searching, combinatorial libraries – generation and utility,

TEXTBOOKS
1. Principles and applications of modelling by Leach
2. Molecular Modelling by Hans Pieter,Heltje & Gerd Folkens, VCH.

REFERENCES:
1. Chemical Applications of Molecular Modelling by Jonathan Goodman.
2. Computational Chemistry by Guy H, Grant & W. Graham Richards, Oxford University Press. April 1985
BIOPROCESS ECONOMICS & PLANT DESIGN
(Elective - III)

UNIT I: PROCESS DESIGN DEVELOPMENT
Technical feasibility survey, process development, flow diagrams, equipment design and specifications.

UNIT II: GENERAL DESIGN CONSIDERATION
Marketability of the product, availability of technology, raw materials, equipments, human resources, land and utilities, site characteristics, waste disposal, govt. regulations and other legal restrictions, community factors and other factors affecting investment and production costs.

UNIT III: COST ESTIMATION I
Capital investments- fixed capital investments including land, building, equipments and utilities, installation costs (including equipments, instrumentation, piping, electrical installation and other utilities), working capital investments.

UNIT IV: COST ESTIMATION II
Manufacturing costs- Direct Production costs (including raw materials, human resources, maintenance and repair, operating supplies, power and other utilities, royalties. etc.), fixed charges (including depreciation, taxes, insurance, rental costs etc.).

UNIT V: PLANT OVERHEADS
Administration, safety and other auxiliary services, payroll overheads, warehouse and storage facilities etc.

UNIT VI: PROFITABILITY ANALYSIS
Profitability Analysis- return on original investment, interest rate of return, accounting for uncertainty and variations and future developments.

UNIT VII: OPTIMIZATION
Optimization techniques - Linear and Dynamic programming, Optimization strategies.

UNIT VIII: PATENTS, IPR AND IPP

TEXT BOOKS:
2. Rudd and Watson, Strategy of Process Engineering, Wiley. 1987

REFERENCE:
UNIT I: INTRODUCTION TO PHARMACEUTICALS

UNIT II: PHARMACODYNAMICS

UNIT III: PHARMACOKINETICS
Pharmacokinetics- Drug absorption, factors that affect the absorption of drugs, Distribution of drugs, Biotransformation of drugs, Bioavailability of drugs.

UNIT IV: DRUG MANUFACTURING PROCESSES I
Good manufacturing practices, manufacturing facilities, sources of Biopharmaceuticals,

UNIT V: DRUG MANUFACTURING PROCESSES II
Production & analysis of Biopharmaceuticals.

UNIT VI: PRODUCTION OF BIOPHARMACEUTICALS
Production of Therapeutic Proteins, Hormones, Cytokines - Interferons, Interleukins I & II, Tumor Necrosis Factor (TNF); Nucleic acids.

UNIT VII: APPLICATIONS OF BIOPHARMACEUTICALS
Role of Biopharmaceuticals in treatment of various health disorders

UNIT VIII: DRUG DELIVERY SYSTEMS, BIOMATERIALS AND THEIR APPLICATIONS

Reference:
PHYTOCHEMICALS AND HERBAL MEDICINE
(ELECTIVE – IV)

UNIT I: CRUDE DRUGS
Crude Drugs – Scope & Importance, Classification (Taxonomical, Morphological Chemical, Pharmacological); Cultivation, Collection & processing of Crude Drugs.

UNIT II: MEDICINAL & AROMATIC PLANTS
Cultivation and Utilization of Medicinal & Aromatic Plants in India. Genetics as applied to Medicinal herbs.

UNIT III: TISSUE CULTURE OF MEDICINAL PLANTS
Plant Tissue Culture as source of medicines, Plant Tissue Culture for enhancing secondary metabolite production (Withania somnifera, Rauwolfia serpentina, Catheranthus roseus, Andrographis paniculata, Dioscorea sp.); Anticancer drugs, Biogenesis of Phytopharmaceuticals.

UNIT IV: ANALYSIS OF PHYTOCHEMICALS
Methods of Drug evaluation (Morphological, Microscopic, Physical & Chemical). Preliminary screening, Assay of Drugs – Biological evaluation / assays, Microbiological methods


UNIT VI: TYPES OF PHYTOCHEMICALS_I
Carbohydrates & derived products; Glycosides - extraction methods (Digitalis, Aloe, Dioscorea,); Tannins (Hydrolysable & Condensed types); Volatile Oils - extraction methods (Clove, Mentha);

UNIT VII: TYPES OF PHYTOCHEMICALS_II
Alkaloids - extraction methods (Taxus, Papaver, Cinchona); Flavonoids- extraction methods, Resins-extraction methods.

UNIT VIII: APPLICATIONS OF PHYTOCHEMICALS
Application of phytochemicals in industry and healthcare; Biocides, Biofungicides, Biopesticides.

Text Books:

References
UNIT I: BASIC CONCEPT
Overview of experimental design in biological processes, understanding of variables in biological processes.

UNIT II: OPTIMIZATION APPROACHES
Non-statistical, statistical and numerical optimization-fundamental theory.

UNIT III: STATISTICAL OPTIMIZATION
First order and second order designs, differences in approaches, general response surface analysis.

UNIT IV: FIRST ORDER DESIGNS
Statistical experimental procedures for pickett-burman taguchi’s designs.

UNIT V: DETERMINATION OF OPTIMAL CONDITIONS
Method of Ridge analysis, Nelder-Mead simplex method, optimization of multi response biological systems.

UNIT VI: MIXTURE DESIGNS AND ANALYSIS
Simple, latis arrangement and their associated models.

UNIT VII: VARIANCE AND DESIGN
Variance minimizing design, mixed variable and multi response generalized distance function approaches for multiresponse optimization.

UNIT VIII: NON-STATISTICAL OPTIMIZATION AND EXAMPLES
Self –directing optimization, case studies with single response and multi response analysis.

BOOKS
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD

IV Year B.Tech BT II-Sem

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INDUSTRY ORIENTED MINI PROJECT
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD

IV Year B.Tech BT II-Sem

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SEMINAR
JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABAD

IV Year B.Tech BT II-Sem

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PROJECT WORK
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COMPREHENSIVE VIVA