SCHEME OF INSTRUCTION AND EXAMINATION
FOUR YEAR B.Tech DEGREE COURSE
(Effective from 2006-07)
(For Bio-Technology branch)

FIRST YEAR

S. No	Subject	Abbre-viation	Scheme of Instruction periods/week			Duration of Univ. Exam Hours	Scheme of Examination Max Marks		
			L	D/T	P		Univ. Exam	Sessional Exam	Total
	Theory								
1.	Professional Communication in English	PCE	2	-	-	3	70	30	100
2.	Computer Programming	CP	3	-	-	3	70	30	100
3.	Mathematics for Bio-Technologists	MBT	2	1	-	3	70	30	100
4.	Fundamentals of Biology	FB	3	-	-	3	70	30	100
5	Physical Sciences	PS	4	-	-	3	70	30	100
6.	Basic Electrical & Electronics Engineering	BEE	4	-	-	3	70	30	100
7.	Process Engineering Principles	PEP	3	1	-	3	70	30	100
	Practical								
8.	Engineering Drawing Practice Lab	EDP	1	3	-	3	50	25	75
9.	Phonetics & Communication Skills Lab	PCP	-	-	2	2	50	25	75
10	Computer Programming Lab	CPP	-	-	3	3	50	25	75
11	a) Physics Lab b) Chemistry Lab	PHP CHP	-	-	2* 2*	2 2	25 25	13 12	75
12	Engineering Workshop Practice Lab	EWP	-	-	3	3	50	25	75
			22	**5**	**10**		**740**	**335**	**1075**

* Alternate Weeks

FOUR YEAR B.Tech DEGREE COURSE
Scheme of instruction and Examination
(Effective from 2006-07)

II - BIO-TECHNOLOGY - First Semester

Sl. No.	Subject	Abbre-viation	Scheme of Instruction periods/week			Duration of Univ. Exam Hours	Scheme of Examination Max Marks		
			L	D/T	P		Univ. Exam	Sessional Exam	Total
	Theory								
1.	Environmental Studies	ESD	4	-	-	3	70	30	100
2.	Cell Biology	CB	4	-	-	3	70	30	100
3.	Microbiology	MB	4	1	-	3	70	30	100
4.	Bioorganic Chemistry	BOC	4	1	-	3	70	30	100
5	Biochemistry	BC	4	1	-	3	70	30	100
6.	Chemical and Bio-thermodynamics	CBT	4	1	-	3	70	30	100
	Practical								
7	Bioorganic Chemistry Lab	BOC (P)	-	-	3	3	50	25	75
8	Biochemistry, Microbiology and Cell Biology Lab	BM & CB (P)	-	-	3	3	50	25	75
Total			**24**	**4**	**6**		**520**	**230**	**750**

L: Lecture periods per week
T/S: Tutorial/ Seminar periods per week
P: Practical / Drawing periods per week

NOTE: The end examination question paper shall consist of eight questions.
The student shall answer any five questions.

FOUR YEAR B.Tech DEGREE COURSE

(Effective from 2006-07)

Scheme of instruction and Examination

II - BIO-TECHNOLOGY - Second Semester

Sl. No.	Subject	Abbre-viation	Scheme of Instruction periods/week			Duration of Univ. Exam Hours	Scheme of Examination Max Marks		
			L	D/T	P		Univ. Exam	Sessional Exam	Total
	Theory								
1.	Genetics	G	4	-	-	3	70	30	100
2.	Basic Industrial Biotechnology	IB	4	1	-	3	70	30	100
3.	Bioprocess Engineering - I	BPE- I	4	1	-	3	70	30	100
4.	Enzyme Engineering and Technology	EET	4	1	-	3	70	30	100
5	Instrumental Methods of Analysis	IMA	4	-	-	3	70	30	100
6.	Molecular Biology	MB	4	1	-	3	70	30	100
	Practical								
7	Molecular Biology and Genetics Lab	MBG (P)	-	-	3	3	50	25	75
8	Instrumental Methods of Analysis Lab	IMA(P)	-	-	3	3	50	25	75
Total			**24**	**4**	**6**		**520**	**230**	**750**

L: Lecture periods per week

T/S: Tutorial/ Seminar periods per week

P: Practical / Drawing periods per week

NOTE: The end examination question paper shall consist of eight questions. The student shall answer any five questions.

FOUR YEAR B.Tech DEGREE COURSE
(Effective from 2006-07)
Scheme of instruction and Examination

III - BIO-TECHNOLOGY - First Semester

Sl. No.	Subject	Abbre-viation	Scheme of Instruction periods/week			Duration of Univ. Exam Hours	Scheme of Examination Max Marks		
			L	D/T	P		Univ. Exam	Sessional Exam	Total
	Theory								
1.	Mass Transfer Operations	MTO	4	1	-	3	70	30	100
2.	Genetic Engineering	GE	4	1	-	3	70	30	100
3.	Bio Reaction Engineering	BRE	4	1	-	3	70	30	100
4.	Plant Biotechnology	PB	4	1	-	3	70	30	100
5	Environmental Biotechnology	EB	4	-	-	3	70	30	100
6.	Managerial Economics and Financial Analysis	MEFA	4	-	-	3	70	30	100
	Practical								
7	Genetic Engineering & Plant Bio-technology Lab	GE & PB (P)	-	-	3	3	50	25	75
8	Bioprocess Lab - I	BPE (P)	-	-	3	3	50	25	75
Total			**24**	**4**	**6**		**520**	**230**	**750**

L: Lecture periods per week
T/S: Tutorial/ Seminar periods per week
P: Practical / Drawing periods per week

NOTE: The end examination question paper shall consist of eight questions.
The student shall answer any five questions.

FOUR YEAR B.Tech DEGREE COURSE
(Effective from 2006-07)
Scheme of instruction and Examination

III - BIO-TECHNOLOGY - Second Semester

Sl. No.	Subject	Abbre-viation	Scheme of Instruction periods/week			Duration of Univ. Exam Hours	Scheme of Examination Max Marks		
			L	D/T	P		Univ. Exam	Sessional Exam	Total
	Theory								
1.	Instrumentation and Process Control	IPC	4	-	-	3	70	30	100
2.	Analytical Techniques in Biotechnology	ATB	4	1	-	3	70	30	100
3.	Bioinformatics	BI	4	-	-	3	70	30	100
4.	Bioprocess Engineering – II	BPE- II	4	1	-	3	70	30	100
5	Immunology & Immuno technology	IMT	4	1	-	3	70	30	100
6.	Protein Engineering	PE	4	1	-	3	70	30	100
	Practical								
7	Bioprocess Engineering Lab– II	BPE-II(P)	-	-	3	3	50	25	75
8	Immunology and Bio-informatics Lab	IM & BI (P)	-	-	3	3	50	25	75
Total			**24**	**4**	**6**		**520**	**230**	**750**

L: Lecture periods per week
T/S: Tutorial/ Seminar periods per week
P: Practical / Drawing periods per week

NOTE: The end examination question paper shall consist of eight questions. The student shall answer any five questions.

FOUR YEAR B.Tech DEGREE COURSE
(Effective from 2006-07)
Scheme of instruction and Examination

I V - BIO-TECHNOLOGY - First Semester

Sl. No.	Subject	Abbre-viation	Scheme of Instruction periods/week			Duration of Univ. Exam Hours	Scheme of Examination Max Marks		
			L	D/T	P		Univ. Exam	Sessional Exam	Total
	Theory								
1.	Genomics & Proteomics	GP	4	1	-	3	70	30	100
2.	Down Stream Processing	DSP	4	1	-	3	70	30	100
3.	Biopharmaceutical Technology	BPT	4	1	-	3	70	30	100
4.	Biodiversity, IPR and Management of Biotechnology	BMB	4	1	-	3	70	30	100
5	Elective - I		4	-	-	3	70	30	100
6.	Elective - II		4	-	-	3	70	30	100
	Practical								
7	Down Stream Processing Lab	DSP(P)	-	-	3	3	50	25	75
8	Bio-pharmaceuticals, Genomics and Proteomics Lab	BP & GP (P)	-	-	3	3	50	25	75
	Total		**24**	**4**	**6**		**520**	**230**	**750**

L: Lecture periods per week
T/S: Tutorial/ Seminar periods per week
P: Practical / Drawing periods per week

NOTE: The end examination question paper shall consist of eight questions.
The student shall answer any five questions.

FOUR YEAR B.Tech DEGREE COURSE
(Effective from 2006-07)
Scheme of instruction and Examination

IV - BIO-TECHNOLOGY - Second Semester

Sl. No.	Subject	Abbre-viation	Scheme of Instruction periods/week			Duration of Univ. Exam Hours	Scheme of Examination Max Marks		
			L	D/T	P		Univ. Exam	Sessional Exam	Total
	Theory								
1.	Elective - III		4	-	-	3	70	30	100
2.	Elective - IV		4	-	-	3	70	30	100
3.	Project work	PW		-	6	-	150	50	200
Total			**8**	**-**	**6**		**290**	**110**	**400**

L: Lecture periods per week
T/S: Tutorial/ Seminar periods per week
P: Practical / Drawing periods per week

NOTE: The end examination question paper shall consist of eight questions.
The student shall answer any five questions.

LIST OF ELECTIVES

S.No.	Title	Abbreviation
1	Molecular Biology of Cancer	**MBC**
2	Molecular Pathogenesis	**MP**
3	Bioethics, Bio-safety & Intellectual property rights	**BBIR**
4	Bioprocess Economics & Plant Design	**BEPD**
5	Creativity, Innovation and New product Development	**CIND**
6	Spectroscopic Analysis of Biomolecules	**SAB**
7	Metabolic Engineering	**MTE**
8	Molecular Modelling & Drug Design	**MMDD**
9	Chromatographic Separations	**CMS**
10	Food Science & Technology	**FST**
11	Biology of Ageing & Apoptosis	**BAA**
12	Biophysics of Macromolecules	**BPM**
13	Neurobiology and Cognitive Science	**NBCS**
14	Biosensors & Bioelectronics	**BSB**
15	Animal Bio-Technology and Tissue Engineering	**ABTE**
16	Tissue Engineering and Biomaterials	**TEB**

BIOTECHNOLOGY SYLLABUS

PROFESSIONAL COMMUNICATION IN ENGLISH (PCE)
(Common to All Branches of I. B.Tech)

Contact Periods : 2 L/week — Sessional Marks : 30
University Exam : 3 Hours — University Marks : 70

I. Text : Selections from "Heritage of English " edited by Devendra Kohli and Harish Trivedi, Published by Macmillan India Ltd., Hyderabad.

Selected Topics

1. A Tea Party : Ruth Prawer Jhabvala
2. The Panorama of India's Past : Jawaharlal Nehru
3. English Zindabad Vs Angrezi Hatao : Kushwant Singh
4. Examination : R.K. Narayan
5. Man's War Against Nature : Rachel Carson

Vocabulary Based on the Text Book :

a. Synonyms
b. Antonyms
c. Idioms and Verbal Phrases
d. One Word Substitutes
e. Prefixes and Suffixes

II Technical Report Writing :

a. Feasibility Report on the establishment of an industry
b. Factual Report

III Composition:

a. Letter Writing
b. Resume preparation

IV Grammar :

1. Remedial Grammar (correction of sentences)
2. Word order in English sentences
3. Voices
4. Direct and Indirect Speeches
5. Degrees of comparison
6. Simple, Complex, Compound and Compound-complex sentences

Reference Books :

1. "Practical English Usage" by Michael Swan published by Oxford University Press
2. "English Grammar , Composition and Correspondence" by M.A. Pink and S.E. Thomas Published by S. Chand & Co.,
3. "English for Professional Students" by S.S. Prabhakara Rao.
4. "Effective Technical Communication" by M. Ashraf Rizvi, Published by Tata McGraw-Hill Publishing Company Ltd.

COMPUTER PROGRAMMING (CP)

(Common to All Branches of I B.Tech.)

Contact Periods: 3L / Week — Sessional Marks: 30
University Exam: 3 Hours. — University Marks: 70

Unit –1

Over view of revolution in computers & communications: From the analog to the digital age, Overview of a computer and communications system: people, procedures, Data, information, Hardware - operations of computing, hardware Categories, Software - application software and system software, developments in computer technology, types of programming languages, algorithms, flow charts.

Problem Solving: C fundamentals, Syntax, identifiers and key words, data types, constants and variable declarations, Arithmetic operators, expressions, assignment statements, data input / output, printf, scanf, getchar, putchar, gets, puts.

Unit – 2

Flow Control: Relational, logical operators, conditions and boolean expressions. Selection, if, If else, nested if statements, switch statement, goto statement. Looping, conditional loops, count loops. While, do-while, for loops, break, continue, nested loops, Examples to find terms and sums for series problems.

Unit – 3

Subprograms: Definition of a function, accessing of a function, passing arguments to a function, argument data types, function prototypes. Local and global variable declarations, storage classes-automatic, external, static, register, recursion.

Unit – 4

Arrays: Defining an array, processing an array, passing arrays to a function, multidimensional arrays, character strings and character arrays. Searching-linear search, binary search, Sorting-Selection, bubble, matrix operations.

Pointers : Concept of pointers, Pointer declarations, passing pointers to a function, pointers and one-dimensional arrays, Operations on pointers, pointers and multidimensional arrays of pointers.

Unit – 5

Structures and Unions: Defining a structure, processing a structure, User-defined data types (typedef), structures and pointers, passing structures to a function, self-referential structures, unions.

Data Files: Opening and closing a data file, creating a data file, processing a data file.

Text Books:

1. Programming with C-Byron S. Gottfried (Tata Mc Graw Hill Publications – Schuam Outline Series)
2. Using Information Technology By Sawyer, Williams, and Hutchinson

Reference Book:

Programming in C By E. Balaguruswamy (TMH)

MATHEMATICS FOR BIOTECHNOLOGISTS (MBT)
(For I B.Tech - Bio – Technology branch)

Periods: (2L + 1T) / Week — Sessional Marks: 35
University Exam : 3 hours — University Marks:70

Unit-I: Differential Calculus

Introduction to Sets, Relations, Functions.

Concepts of limit, continuity, differentiation, product rule, quotient rule. Differentiation of trigonometric, logarithmic, exponential functions. Applications of differentiation – problems on tangent, sub tangent normal, sub normal. Introduction to partial differentiation, Euler's theorem.

Integral Calculus

Introduction, Integration of different functions, methods of Integration, Integration by parts. Concept of definite integrals. Applications of definite integrals – problems on areas.

Unit II: Matrices

Types of matrices, determinants, Inverse of a square matrix, Solving of simultaneous equations by Cramer's method Matrix inversion method and Gauss Jordan methods. Rank of a matrix, Echelon form. Solutions for linear equations. Eigen values and Eigen vectors.

Unit III: Ordinary Differential equations

Forming of differential equation by eliminating arbitrary constants, first order and first degree – variables and separables, exact, homogeneous, linear and Bernoulli's equations.

Bernoulli's equations

Non-homogeneous Linear Differential Equations of Second and higher order with constant coefficients with RHS term of the type – Polynomials in x, Applications to first order differential equations to growth and decay problems

Unit IV: Numerical Methods

Iterative Methods: Bisection, Newton Raphson, Successive approximation, Guass Jordan and Guass siedel methods. Interpolation, Lagrange interpolation, Newton's forward difference, backward difference and central difference interpolation methods. Numerical Integration by Trapezoidal and Simpson's rules, numerical solution to differential equations, Euler, Ranga kutta methods.

Unit – V

Laplace Transforms

Laplace transforms of some standard functions, linear property, shifting theorems, change of scale property, multiplication by powers of t, division by t.

Inverse Laplace Transforms - Shifting property, finding inverse laplace by partial fractions, multiplication by powers of s, division by s.

Applications of laplace transforms for solving ordinary differential equations.

Mathematical Modelling in Biotechnology.

Text books:

1. A Text Book of Engineering Mathematics Volume-II, 2005 T,K.V.Iyengar, B.Krishna Gandhi and others, S. Chand and Company.
2. Engineering Mathematics, B.V.Ramana, Tata McGraw-Hill 2003.
3. Introductory Methods of Numerical Analysis: S.S.Sastry, Prentice Hall of India, Pvt Ltd.,

Reference books:

1. Advanced Engineering Mathematics (eighth edition), Erwin Kreyszig, John Wiley & Sons (ASIA) Pvt. Ltd.2001.
2. Advanced Engineering Peter V.O'Neil Thomson Brooks/Cole.
3. Advanced Engineering Mathematics, Merle C.Potter, J.L.Goldberg, E.F. Arbufadel, /oxford University Press. Third Edition 2005.
4. Elementary Numerical Analysis: An Algorithmic Approach: S.D.Conte and Carl.D.E.Boor, Tata Mac-Graw Hill

FUNDAMENTALS OF BIOLOGY (FB)
(For I B.Tech - Bio – Technology branch)

Periods: 3 L / Week — Sessional Marks: 30
University Exam : 3 hours — University Marks:70

Unit I:

Nature and scope of Biology, Biological classification – kingdom systems and Five-kingdom classification of living organisms– Classification of plant and animal kingdoms up to classes.

Introduction to Microorganisms

Outline classification of microorganism. Difference between prokaryotic and eukaryotic microorganisms.General characteristics and outline classification and outline classification and importance of bacteria, cyanobacteria and virus.

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.

Animal Biology

Classification of Animal kingdom. Outlines of Morphology, growth, reproduction and economic importance of invertebrates and vertebrates. General account of human parasites – *Plasodium, Entameoba histolytica, Taenia solium* and *Ascaris* species

Unit III: Human Biology

Introduction of body as a whole. Cells and Tissue Organization, Electrolytes and Body fluids. Physiology of blood. Digestive system, Respiratory system and Endocrine system.

Human Physiology: Biological axons and neurons, Neuromuscular and synaptic functions, Sensory systems – hearing, taste, smell and visual receptors

Unit IV: Introduction to Biotechnology

Biotechnology – definition, history, scope and importance. Drugs and chemicals from plants and animals. Definition and importance (in general) of Biofuels, Biofertilizers, Biopesticides, Bioindicators and Biosensors.

Unit – V:Applications of Biotechnology

Microbial enzymes; Single cell protein (SCP); Monoclonal antibodies. Introduction of Transgenic plants and animals; Advantages and limitations of genetically modified crops and foods.

Text Books:

1. Microbiology Pelczar M.J. Chan ECS and Krieg N.R, Tata McGraw Hill.
2. Basic Biotechnology, Second Edition, by Colin Ratledge and BjormKristiansen, Cambridge University Press.

Reference Books

1) Plant Physiology F.B Salisbury & C.W. Ross 4th edition Thomson Wadsworth
2) General Microbiology by Hons. G. Schlege, Cambridge University Press.
3) A Textbook of Biotechnology by R.C. Dubey, S.Chand Publishers.
4) Dr. C.C. Chatterjee*, Human Physiology (11th Edition) Vol I and II,* Medical Allied Agency, Kolkata, 1987.
5) Anatomy and Physiology In Health and Disease,K. J.W. Wilison and A. Waugh, Churchill & Livingston.

PHYSICAL SCIENCES (PS)
(For I B.Tech - Bio – Technology branch)

Contact Periods : 4 periods/week — Sessional Marks : 30
University Exam : 3 Hours — University Marks : 70

Part-A Physics

Lectures: 2 Periods/week — Sessional Marks : 15
University Marks : 35

Unit-1:

Oscillations : Free, Damped and Forced Vibrations Equation of motion and solution, Resonance, Effect of damping on resonance , Applications to electromagnetic oscillators LC and LCR circuits
Acoustics of Buildings: Basic requirement for the acoustically good halls, Reverberation and time of reverberation, Sabine's formula for reverberation time. Absorption coefficient and its measurement. Transmission of sound and transmission loss. Factors affecting the architectural acoustics and their remedy. Sound absorbing materials.

Unit-2:

Elasticity : Concepts of stress, strain, elastic unit, proportionability limit, Hooke's law, young modulus, rigidity modulus, bulk modulus, poisson's ratio. Twsiting couple on a cylinder or wire, Torsion pendulum, determination of coefficient of a rigidity for a wire. Bending of Beams, Bending moment. Cantilever - Loaded at free end - Loaded uniformly. Transverse vibrations of a loaded cantilever. Depression of a beam supported at the ends – Beam loaded at the center – Beam loaded uniformly. Determination of Young's modulus by bending of Beam.
Crystallography : Unit cell, Bravai's lattice, Crystal systems and miller indices, Bragg's law – Bragg spectrometer – Crystal structure determination.

Unit-3:

Interference: Super position principle, Division of wavefront and amplitude – Thin Films. Wedge shaped film, Newtons Rings - applications of Interference.
Diffraction: Fraunhoffer diffraction (single, double and multiple slits) – Resolving Power – Dispersive power – Applications.

Text Book :

1. Engineering Physics - by R.K. Gaur & S.L. Gupta (Dhanpatrai)

Reference Books :

1. Solid State Physics - by S.O. Pillai (New Age International)
2. Physics I & II by - by Halliday & Resnick (Wiley Eastern)
3. Solid State Physics - by K. Vijaya Kumar & T. Sreekanth(S. Chand)
4. Properties of Matter - by D.S. Mathur

Part – B Chemistry

Lectures: 2 Periods/week

Sessional Marks : 15
University Marks : 35

Unit – 1 :

Thermodynamics: System-isolated, closed and open systems, State of system. Homogeneous and heterogeneous systems, Extensive and intensive properties, Reversible and irreversible processes, Isothermal and adiabatic processes, First law of Thermodynamics, Internal energy, Enthalpy, Molar heat capacities, Application of equation to isothermal and adiabatic expansions of an ideal gas, Second law of Thermodynamics.

Electrochemistry: Electrode potentials, Nernst equation, Electrochemical series, Hydrogen, Calomel and Glass electrodes – their applications in the determination of pH.

Corrosion: Theories of Corrosion, Galvanic and Concentration cells, methods of minimizing corrosion – (a) Cathodic protection and (b) Metal coatings – Hot dipping and Electroplating.

Unit – 2 :

Refractories and Insulators :- Refractories – Definitions, Classification with examples; Characteristics of a good refractory.
Insulators – Definition and classification with examples, Thermal and Electrical Insulators, their characteristics – Engineering applications.
Polymers: Definitions, Addition and condensation polymerization (without mechanisms), Plastics – Thermosetting and Thermoplastic resins, compounding of plastics, preparation and engineering uses of (i) Polyethylene, (ii) Teflon (iii) Nylon (iv) PVC and (v) Bakelite. Natural Rubber – Preparation and processing of latex, Compounding of rubber, Vulcanization. Preparation and engineering uses of (i) Buna-S and (ii) Silicon rubber.

Unit – 3 :

Water Technology: Nature of impurities in water, Hardness of water and its determination by EDTA method, Boiler troubles, Sludge and scale formation and their effects, Priming and foaming, Caustic embrittlement, Boiler feed water, Treatment by ion-exchange process, Treatment of water for domestic purpose, Sedimentation, Coagulation, Filtration, Sterilization and Disinfections (Basic principles only).

Fuels and Combustion: Classification of fuels, Characteristics of a good fuel, Calorific value – units, Gross and net calorific values, determination of calorific value by using Bomb calorimeter. Petrol – Knocking and octane number, Diesel – Ignition and Cetane number. Viscosity index - determination, Flash and fire points definitions, Aniline point – significance. Lubricants - Characteristic properties -classification. Manufacture, composition and uses of producer gas, Combustion calculations.

Text Books:

1. Essentials of Physical Chemistry – B.S.Bahl, G.D.Tuli and Arun Bahl (S.Chand & Co., New Delhi)
2. Engineering Chemistry – P.C.Jain and Monica jain (Dhanpat Rai Publishing Company, New Delhi)

Reference Books:

1. Chemistry of Engineering Materials – C.V.Agarwal (Tara Publishers, Varanasi)
2. Chemistry of Engineering & Technology (Vol. I & II) – J.C.Kuriacose and T.Rajaram (Tata McGraw-Hill Pub. Co., New Delhi)
3. Text Book of Physical Chemistry – B.R.Puri, L.R.Sarma and M.S.Pathania (Shobhanlal Nagin Chand & Co., Jalandhar)

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (BEE)
(For I B.Tech - Bio – Technology branch)

Lectures: 4 Periods/week — Sessional Marks : 30
University Exam: 3hours — University Marks : 70

Part- A : Basic Electrical Engineering

Lectures: 2 Periods/week — Sessional Marks : 15
University Marks : 35

Unit-I

DC CIRCUITS: Ohm's law, network elements, Kirchoff's laws. Analysis of circuits using loop current methods and node voltage method. Series and parallel combination of resistances, Thevenin's and Norton's theorems (simple problems only).

AC CIRCUITS: Sinusoidal sources, Phasor representation of sinusoidal quantities, average and RMS value, form factor, Analysis of RLC circuits to sinusoidal inputs, power factor, active power, reactive power, energy stored in inductance and capacitance (Simple problems only).

Generation of 3-phase Voltages, Phase and line relationship - Star – delta connections, Power in balanced three phase circuit.

Unit-II

DC MACHINES: Construction and working principle of a DC machine. Production of emf in a generator, types of excitation, Characteristics of series, shunts and compounds generators. Production of torque in a DC motor, Characteristics of series, shunt and compound motors. Speed control of DC motors, Losses and efficiency (Simple problems only).

TRANSFORMERS: Ideal transformer – Principles of transformation- Working of actual transformer under no load and load condition – Approximate equivalent circuit, losses and efficiency – principle and use of auto transformer (Simple problems only).

Unit-III

INDUCTION MOTORS: Production of rotating magnetic field, construction and principle of induction motors, slip, slip-torque characteristics, and methods of starting of induction motor. Basic idea of single phase induction motor, universal motor and applications (simple problems only).

AC GENERATORS: Construction, production of emf, synchronous Impedance, losses and regulation (synchronous impedance method only) (simple problems only).
ILLUMINATION: Units and laws of Illumination – Simple lighting calculations – Types of lamps – Incandescent lamps, Fluorescent lamps and Sodium-vapour lamps – Lighting schemes.

Text Books

1. Introduction to Electrical Engineering – M.S. Naidu & S. Kamakshaiah
2. Electrical Technology – H. Cotton

Reference Books:

1. Principles of Electrical Engineering – V.K.Mehata., S.Chand & Co., 1995
2. Electrical Machines – S.K. Bhattacharya
3. Electrical technology – B.L. Thereja
4. Electric Circuits – by Joseph Edminister – Schaum's Series (TMH)
5. Generation, Distribution and utilization of Electric energy-C.L.Wadhwa.(NEW AGE)

PART – B : BASIC ELECTRONICS ENGINEERING

Lectures: 2 Periods/week

Sessional Marks : 15
University Marks : 35

Unit-I

DIGITAL ELECTRONICS: Number Systems – Binary, Octal & Hexadecimal; Boolean algebra, Logic gates, k-maps (upto four variables), flip-flops, Asynchronous counters, multiplexers, decoders, demultiplexers, adders and substracters, Types of Semiconductor memories.

Unit-II

BASIC DEVICES & CIRCUITS: Characteristics of pn diode, Zener diode & SCR. Half wave and full wave rectifiers, inductive and capacitive filters. Applications of Zener diodes, SCRs. Characteristics of transistor (CE, CB, CC), Transistor as an amplifier, Transistor biasing, CE Amplifier, Cascading of Amplifiers. Classification of Amplifiers – Class A, Class B and Class C.

Unit-III

SIGNALS & TRANSMISSION MEDIA: Analog and digital signals, Encoding and Modulating – Digital to Digital Conversion, Analog to Digital Conversion, Digital to Analog Conversion, Analog to Analog Conversion. Transmission Media – Guided Media and Unguided Media.

Text Books

1. Electronic Devices and Circuits- An Introduction- Allen Mottershead- PHI Pub.
2. Digital Principles and Applications- Malvino & Leach- Mc Graw Hill.
3. Data Communications and Networking – Behrouz A. Forouzan - Tata McGraw Hill.

Reference Books

1. Integrated Electronics- Jacob Mc Millman & Christos C. Halkias- Tata Mc Graw Hill.
2. Digital Computer Electronics- Malvino- Tata Mc Graw Hill.

PROCESS ENGINEERING PRINCIPLES (PEP)
(For I B.Tech - Bio – Technology branch)

Periods: (3 L + 1T)/ Week | Sessional Marks: 30
University Exam : 3 hours | University Marks: 70

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.

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

Unit - II

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 .

Rheology of fluids - Newton's law of viscosity. Concept of Newtonian and non-Newtonian fluids- Different types of non-Newtonian fluids with examples in bioprocessing. Measurement of viscosity using extrusion rheometer, plate and cone viscometer, coaxial cylinder viscometer etc.

Unit-III

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-IV

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, concept of fluidization, mechanism of fluidization, fluidized beds and pressure drop in fluidized beds. Correlating the concept of packed beds and fluidized beds with immobilized bioreactors.

Unit - V

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.

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)
2. Bio-process Engineering Principles, Pauline M.Doran. Academic press (1995)

References:

1. Unit operations of chemical engineering, Mc Cabe, W.L, Smith J.C., and Harriot, P., Mc-Graw Hill, 3rd Ed. (1993).
2. "Technical aspects of the rheological properties of microbial cultures", - Charles, M (1978) in Advanmces in Biochemical Engineering, Ghose, T.K., Fiechter, A and Blakebrough, N.(Eds), Spinger-Verlag, Berlin, pp. 1-62
3. Non-Newtonian Flow and Heat Transfer, Skelland, A.H.P. (1967), John Wiley and Sons, Inc., Newyork, 27-49.
4. Unit operation in Food processing, Earle, R.L. (1996) Pergamon Press, Oxford, PP. 212-282.

Unit operation in Food processing, Earle, R.L. (1996) Pergamon Press, Oxford, PP. 212-282.

ENVIRONMENTAL STUDIES (ESD)
(For II B.Tech., Biotechnology -I Semester)

Contact Periods: (4L) / week — Sessional Exam Marks: 30
End Exam: 3 Hours — End Exam Marks : 70

Unit 1 :
Introduction : Multidisciplinary nature of Environmental studies, definition, scope and importance.
Natural Resources:
Water resources-use and over utilization of surface and ground water, floods, drought, conflicts over water. Dams-benefits and problems.
Forest resources-use and over-exploitation of forests, deforestation, timber extraction, mining, dams and their effects on forests and tribal people.
Energy resources-growing energy needs, renewable and non-renewable energy sources, alternate energy sources, need for the conservation of energy.

Unit -2
Ecosystems: Concepts of an ecosystem, structure and function of an ecosystem, Energy and nutrient flow in an ecosystem, relation between producers, consumers and decomposers. Ecological succession, Food chains, food webs and ecological pyramids. Introduction, characteristic features and functions of (i) Forest ecosystem (ii) Grass land ecosystem (iii) Desert ecosystem (iv) Pond ecosystem (v) Ocean ecosystem and (vi) River ecosystem.

Unit -3
Biodiversity and its conservation: Definition, genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity-consumptive use, productive use, social, ethical, aesthetic and optional values. Threats to iodiversity-habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity.

Unit – 4
Environmental pollution: Causes, effects and control measures of air pollution, water pollution, soil pollution, noise pollution and nuclear hazards. Role of individual in prevention of pollution.
Solid waste Management: Urban, industrial, nuclear and e-waste management.

Unit -5
Social Issues and Environment: Consumerism and waste products, from unsustainable to sustainable development. Population explosion-Family welfare programme. Environment and human health epidemics. Women and child welfare. Role of information Technology in environment and human health. Need for public awareness.
Environment protection Act: Air, Water, forest and wild life acts, enforcement of environmental legislation.
Text books:
1. Benny Joseph, "Environmental studies", Tata Mc Grow Hill.
2. Gilbert M. Masters, "Introduction to Environmental Engineering & Science", Pearson Education.
3. Chandrasekhar M., "Environmental Science", Hitech Publishers.

Reference books:

1. A.K. De, "Environmental chemistry", New Age India publishing.
2. E.P. Odum, "Fundamentals of Ecology", W.B. Sunders co. USA.
3. M.N. Rao and A.K. Datta, "Waste water Treatment", oxford and IBH.
4. Bharucha Erach,"The Biodiversity of India", Mapin publishing pvt. Ltd.

CELL BIOLOGY (CB)

(**for II B.Tech I Sem for Biotechnology branch**)

Unit - I : Cell Structure and Function

Discovery of cell : Basic properties of cell : cell theory : complexity : different classes of cells : prokaryotic & Eukaryotic system, Dimensions of cells : size & shape of prokaryotic & Eukaryotic cells; Chemistry of the cell ; importance of carbon; importance of water; plasma membrane; Structure and Function; cytoplasm & cytoskeleton – Microtubules, microfilaments, intermediate filaments.

Unit – II : Intracellular Compartments

Intracellular compartments, Nucleus structure and function; endoplasmic reticulum , types of ER, Golgi complex, role of Golgic complex & ER, protein Glycosylation, protein sorting and protein transport, exo & Endocytosis, lysosome & cellular digestion, peroxisomes both in plant and Animal Cells; Chloroplast structure and function; mitochondria structure and function; vacuole.

Unit – III : Cell Division And Cell Cycle

Mitosis and cell division ; meiosis and sexual reproduction; The cell cycle Interphase ; The G1, S and G2 phases.

Unit – IV : Cell Differentiation

General characteristics of cell differentiation; Localization of cytoplasmic determinants in eggs; nucleoplasmic interactions molecular mechanism of cell differentiation.

Unit – V : Signal Transduction Cascades

Chemoreceptors of bacteria that detect attractants and repellents and send signals to flagella; cAMP as second messenger in to action of hormones; Ca^{+2} , a ubiquitous cytosolic messenger; Role of tyrosine kinases in control of cell growth and differentiation; Mechanism of action of streroid hormones.

REFERENCES

1. Cell and Molecular Biology by Gerald Karp (2^{nd} Edition) (Wiley publications)
2. The world of the cell by Becker, Reece, Poenie (3^{rd} Edition) Benjamin publications.
3. The cell by Cooper
4. Molecular Biology of the cell by Bruce Alberts
5. Cell and Molecular biology – De Robertis and De Roberts 1998 Waverly Pvt. Ltd.,

MICROBIOLOGY (MB)
(**for II B.Tech I Sem Biotechnology**)

Unit – I : Introduction To Microbiology

1. Discovery of microorganism; theory of spontaneous generation, germ theory of diseases; Major contribution and events in the field of microbiology, Scope and relevance of microbiology.

2. Diversity classification of Woose et al. 3 domains of life. Five kingdom system of Whittaker, Taxonomic ranks, classification systems (phylogenic, phonetic), Numerical taxonomy, Polyphonic Taxonomy; major characteristics used in taxonomy – morphological, Physiological, ecological, biochemical immunological, genericall and molecular. Identification of Microorganisms – A general account microdiversity.

UNIT – II : MAJOR GROUPS OF MICROORGANISMS

1. Characteristics of major groups of bacteria (archea, eubacteria) Characteristics of important groups of bacteria as per Bergey's manual.
2. Distribution, general characters, nutrition, reproduction, important uses, harmful effects and general classification of fungi, algae, General characteristics of protozoa with special reference to pathogenic forms.

Unit – III : Nutrition Of Microorganisms

1. Nutrition of micro organisms; Macro and micronutrients, their sources and physiological functions; Growth factors and their functions in metabolism; Uptake of nutrients by cell, transport of nutrients through the cytoplasmic membrane; Primary and Secondary transports; Simple diffusion, facilitated diffusion, active, transport, group translocation, iron transport, ionophores, siderophores.

Unit – IV : Growth And Cultivation Of Microbiology

1. Growth of microorganisms : Growth curve, mathematics of growth, measurement of microbial growth (cell numbers, cell mass), growth yields and the effect of limiting factor, continuous growth, chemostat, turbidostat, balanced and unbalanced growth.
2. Cultivation of microorganisms : Culture media, synthetic, complex media, solidifying agents, types of media – selective, differential and enrichment and enriched media, importance and isolation of pure cultures – spread plate, pour plate and streak plate; colony characteristics.
3. Preservation of Microorganisms: working and primacy stock cultures – agar slants, agar stabs, spore preparation, use of sterile soil, cryopreservation, lyophilisation, Application and limitations of various methods.
4. Influence of environmental factors on growth – solutes, water activity, pH, temperature, oxygen, osmotic pressure, radiation.
5. Principles of staining – techniques; Fixation, Principle dyes, simple staining , differential staining , staining of specific structures.

UNIT – V Control Of Micro-organisms

1. Control of microorganisms: Inhibition of growth and killing, sterilization and disinfection, physical (most and dry heat, radiation and filtration), chemical agents (disinfectants). Characteristics & mode of action of antimicrobial agent. Classes of disinfectants – phenol and phenolics, alcohol, halogens (Cl_2, Chloramines, Br_2, I_2, tinctures of iodine, iodophores), surfactants (soaps and detergents) alkylating agents (formaldehyde, glutaraldehyde, β- propiolactone and ethylene oxide) Heavy metals (Hg, silver and copper containing compounds). Factors affecting sterilization and disinfection. Evaluation of disinfectants.
2. Microbiology in production and QC of food and pharmaceuticals, methods of sterilization, clean rooms, environment monitoring sterility tests, bioburden and microbial quality, microbiological verification of water systems, cleaning and sanitization procedures. Developing standard operating procedures for microbiological system.

References:

1. Microbiology Pelczar M J Chain ECS and Krieg NR, Tata McGraw Hill.
2. Biology of Micro organisms BROCK, Prestice Hall, international inc.
3. General Microbiology by Hons. G. Schlege, Cambridge University Press.
4. General Microbiology by Roger Y Stanier, Macmillan
5. Bergey's manual of systematic bacteriology 2nd Edition.
6. General Microbiology, Prescott & Dunn

BIO-ORGANIC CHEMISTRY (BOC)
(**for II B.Tech I Sem Biotechnology**)

UNIT – I : Introduction To Bio-Organic Chemistry

Basic considerations – Proximity effects in organic chemistry – Molecular Adaptation – Molecular recognition and the supramolecular level.

UNIT – II : Bio-Organic Chemistry Of Amino Acids & Peptides

Chemistry of living cells, Analogy between organic reactions and Biochemical Transformations, Chemistry of the peptide bend Asymmetric. Synthesis of amino acids. Transition state Analogues Chemical mutations, Molecular Recognition and Drug Design.

Unit – III : Enzyme chemistry

Introduction to catalysis – introduction to enzymes – Multifunctional catalysis and simple models – alpha chymotrypsin. Hydrolytic, Enzymes, Stereo electronic controllmmobilised enzymes – Enzymes in synthetic organic chemistry – Design of molecular clefts. Biotransformation.

UNIT – IV : Metalions In Biological Systems

Metal ions in proteins and biological molecules – Carboxypeptidase and role of Zinc . Hydrolysis of Amides and peptides, iron and oxygen transport – Copperian – Bio models for photosynthesis and Energy transfer Cobalt and vitamin B 12 actions – oxidation's and reduction reactions.

UNIT – V Enzyme Models

Host guest complexation Chemistry, Developments in Crown ether chemistry. Membrane chemistry and micelles - Cyclodextrin – Enzyme design using steroid templates – remote fictionalization reaction – Biomimetic polyene cyclisations.

Reference:

1. Zubay G, Biochemistry, Maxwell Macmi Jlan International Editions, 2nd Edition, 1987.
2. Dugas H, Bio-organic Chemistry – A chemical approach to enzyme action, Springer Velrlag , 1989.

BIOCHEMISTRY (BC)

(**for II B.Tech I Sem Biotechnology**)

UNIT – I : Carbohydrate Structure & Function

Structure and properties of Mono, Di, Oligo and polysaccharides, complex carbohydrates, Confirmation of pyranose & furanse ring, glycosidic bond, glycogen, starch & dextran; as mobilizable stores of glucose, cellulose, glycoproteins, glycosminoglycns, lectins structure and function.

UNIT – II : Lipids & Their Metabolism

Structures and roles of fatty acids; fatty acid breakdown; fatty acid synthesis; metabolism of triglycerols, cholesterol metabolism, lipoproteins.

UNIT – III : Biosynthesis Of Amino Acids

Amino acids area building blocks of proteins; N_2 fixation; ammonia and nitrate nitrogen, reductive amination & transamination; glutamate pathway; serine pathway; shikimate & chorismate pathways for the production of aromatic amino acids.

UNIT – IV : Intermediary Metabolism

Glycolysis, glycogenolysis gluconeogenesis, ED Pathway, pentose phosphate shunt TCA cycle, interconnection of pathways, Metabolic regular, Bioenergetics; respiratory chain, energy rich compounds. Aerobic and anaerobic respiration: fermentation.

UNIT – V : Photosynthesis

Bacterial & plant photosynthesis : oxygenic photosynthesis; chlorophylls as trappers of solar energy, photosynthetic reaction centres, hill reaction, PS I & PS II, Photophosphorylation – cyclic & non-cyclic; Dark reaction & CO2 fixation.

Reference

1. Lehninger A.L, Nelson O.L, M.M.Cox, Principles of Biochemistry, CBS Publications , 1993.
2. Voet O, Voet G, Biochemistry, 2nd Edition, John Wiley and sor 1st , 1994.
3. Stryer L, Biochemistry, 4th Edition, 1994.
4. Marson & Byed – Organic
5. O.P. Agarwal – Organic
6. Chromatography by Liyd or Snyder, Jospne A. Krislend
7. Partical HPLC Method Development – Jopne L Glajcha

CHEMICAL & BIOCHEMICAL THERMODYNAMICS (CBT)
(**for II B.Tech I Sem Biotechnology**)

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.

UNIT – II : Thermodynamic Properties of Fluids
Volumetric properties of gases exhibiting non-ideas behavior ; Residual properties; Estimation of thermodynamic properties using equations of state; Maxwell relationships and their applications; Calculation of flow processes based on actual property changes.

UNIT – III : Solution Thermodynamics
Partial molar properties ; concepts of chemical potential and fugacity ideal non ideal solutions; Gibbs Duhem equation; Excess properties of mixtures; Activity Coefficient – composition models

UNIT – IV : Phase Equilibria
Criteria for phase equilibria; Vapour-liquied equilibrium calculations for binary mixtures, liquid equilibria and Solid-liquid equilibria.

UNIT – V : Chemical Reaction Equlibria
Equilibrium criteria for homogeneous chemicals reactions; Evaluation of equilibrium constant and effect of pressure and temperature on equilibrium constant; Calculation of equilibrium conversions and vields for single and multiple chemical reactions.

UNIT – VI : Biochemical Thermodynamics
Energetics of Metabolic Pathways : Energy Coupling (ATP & NADH); Stoichiometry and energetic analysis of Cell Growth and Product Formation – elemental Balances, Degree of reduction concepts; available – electron balances; yield coefficients; Oxygen consumption and heat evolution in aerobic cultures; thermodynamic efficiency of growth.

References

1. J.M. Smith, H.C.Van Ness and M.M.Abbott. Introduction to Chemical Engineering Thermodynamics McGraw Hill
2. J.A. Roels, Kinetcs and Energetics in Biotechnology, Elsevier, 1983.

GENETICS (G)
(**for II B.Tech II Sem Biotechnology**)

Unit – I : Physical Basis of Heredity
Basic laws of inheritance mono-hybrid, dihybrid and tri-hybrid rations. Modification of Mendel's ratios due to gene interaction Multiple arrays, multiple factors to inheritance. Genes and environment; identification of the genetic materials – classical experiments. Hershey Chase, Avery McLeod etc. packing of DNA, organization of genetic material in prokaryotes, eukaryotes and chromosome structure.

Unit – II : Linkage, Recombination and Mapping
Chromosomal inheritance, the concept of linkage & recombinations, cytological basis of crossing over, two point and three point test crosses and gene mapping, mapping of genes by tetrad analysis by mitotic crossing over. Genetic Transfer: conjugation, Transduction and transformation.

Unit – III : Chromosome Structure, Organization & Aberrations
Chromosome morphology, classification, karyoty ping special chromosome , chromosome aberrations, origins, types and cytogenetic effects. Euchromain and Heterochromatin organization of Nucleosomes.

Mutations, spontaneous, induced, lethal, mutagens their types and actions, classifications of mutations, characters of mutations, applications.

Unit – IV : Sex Determintion
Mechanism of sex determination in animals and plants, sex differentiation and developments in humans, Dosage compensation, maryleons hypothesis, Sex linked disorders in human beings.

Unit – V : Extra Chromosomal Inheritance
Criteria of non mendelian inheritance, examples of extra chromosomal inheritance; Petite phenotyopes in yeast, unipair inheritance in algae. The maternal inheritance.

Reference

1. Genetics, Goodenough U, Hold Saunders International 1985
2. Principles of Genetics, Gander EJ, Simmons MJ Slustad DP, 1991
3. Genetics Strickberger

BASIC INDUSTRIAL BIOTECHNOLOGY (IB)
(**for II B.Tech II Sem Biotechnology**)

Unit – I: Introduction to Industrial Bioprocess

A historical overview of Industrial fermentation processes and products. Role of a bioprocess engineer in the Biotechnology Industry; Outline of the various unit operations involved in an integrated bioprocess; Process Flow-Sheeting; a brief survey of organisms, processes, products and market economics relating to modern industrial biotechnology.

Unit – II: Raw Materials for Fermentation Process

Isolation, preservation and improvement of Industrial Micro-Organisms for overproduction of Primary and Secondary metabolites, Medium requirements for fermentation processcarbon, nitrogen, minerals, vitamins and other nutrients – examples of simple and complex media; Industrial substrates.

Unit – III: Production of Primary & Secondary Metabolites

A brief outline of processes for the production of some commercially importance 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)

Study of production processes for various classes of low molecular weight secondary metabolites; Antibiotics - betalactams (Penicillins), aminoglycosides (streptomycin), macrolids (erythromycin), quinones, aromatics etc., Vitamins (B12) and Steroids, dual or multiple fermentation.

Unit – IV: Production Of Commercially Important Enzymes And Recombinant Proteins

Proteases, Amylases Lipases, Cellulases, Pectinases, Isomeraese and other commercially important enzymes for the food pharmaceutical industries; Production of recombinant proteins (Insulin, Interleukin) having therapeutic and diagnostic applications; production of vaccines.

Stoichiometry of microbial growth and product formation. Strain improvement through physical and chemical mutation molecular tools, protoplast fusion.

UNIT – V: Specialty Bioproducts for Agricultural, Food and Pharmaceutical Industries

Biopesticides, Biofertilizers and Plant Growth Factors; Natural Biopresevatives (Nisin), and Biopolyoners (Xanthan Gum and PHB); Single Cell Protein, interferons, vaccines, role of viruses phages in human health care. Production of synthetic Penicillins and Cephalosporins; Racemically-pure Drug Intermedials: Steroid Biocoversions; High- Fructose corn syrup; Bioconversion of vegetable oils;

Text Books

1. Biotechnology, 3rd edition by John E. Smith. CAMBRIDGE LOW PRICE EDITIONS
2. Industrial Microbiology:- J.E. Casida
3. Industrial Microbiology: - A.H. Patel
4. Microbiology: - Prescott and Dunn
5. Microbial biotechnology : Glazer A.N.and Nikaido H. 1995 W.H. Freeman and company, Newyork.

BIOPROCESS ENGINEERING – I (BPE-I)
(**for II B.Tech II Sem Biotechnology**)

Unit – I: Introduction To Bioprocesses
Historical development of bioprocess technology, An overview of traditional and modern applications of biotechnology industry, outline of an integrated bioprocess and the various (upstream and downstream) unit operations involved in bioprocesses, generalized process flow sheets

Unit – II: Fermentation Processes
General requirements of fermentation processes, Basic design and construction of fermentor and ancillaries, Main parameters to be monitored and controlled in fermentation processes. 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 – III: Media Design And Sterilisation For Fermentation Processes
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, thermal death kinetics of microorganisms, batch and continuous heat. Sterilization of liquid media, filter sterilization of liquid media, air. Design of sterilization equipment.

Unit – IV: Metabolic Stoichiometry and Energetics
Stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients, Energetic analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

Unit – V: Kinetics of Microbial Growtha Product Formation
Phases of cell growth in batch cultures, simple unstructured kinetic models for microbial growth, monod model, Growth of filamentous organisms. Growth associated (primary) and non-growth associated (secondary) product formation kinetics, Leudeking- piret models, substrate and product inhibition on cell growth and product formation. Introduction to structured models for growth and product formation.

Text Books
1) Biochemical Engineering fundamentals by Bailley and Ollis, Mcgraw Hill (2nd Edition) , 1986.
2) Bioprocess Engineering, Kargi and Schuler, Prentice Hall, 1992.
3) Fundamentals of Biochemical Engineering by AVN Swamy 2007.

ENZYME ENGINEERING AND TECHNOLOGY (EET)
(**for II B.Tech II Sem Biotechnology**)

Unit – I: Applications Of Enzymes

Classification of Enzymes: Commercial applications of enzymes in food, pharmaceutical and other industries; Enzymes for analytical and diagnostic applications. Purification and characterization of enzymes from natural sources. Production and Purification of Crude Enzyme extracts from plant – animal and microbial sources-some case studies; methods of characterization of enzymes; development of enzymatic assays.

Unit – II : Mechanisms and Kinetics of Enzyme action

Mechanisms of Enzyme Action; Concept of active site and exegetics of enzyme substrate complex formation; Specificity of enzyme action; Kinetics of single substrate reactions; lurnover number; estimation of Michaells – Menten parameters. Multi-substrate reactkons –mechanisms and Kinetics; Types of Inhibition kinetic models; Substrate and Product Inhibition; allosteric regulation of enzymes; Deactivation kinetics.

Unit – III: Enzyme Immobilization

Physical and Chemical techniques for enzymes immobilization – adsorption matrix entrapment encapsulation cross-linking covalent binding etc., examples; advantages and disadvantages of different immobilization techniques overview of applications of immobilized enzyme systems.

Unit – IV: 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; Design of immobilized Enzyme Reactors-Packed bed. Fluidized-bed Membrane reactors; Bioconversion calculations in free –enzyme CSTRs and immobilized enzyme reactors.

Unit – V : Enzyme Biosensors

Applications of enzymes in analysis; Design of enzyme electrodes and their application as biosensors in industry health care and environment.

Text Books and References

1. Biochemical engineering fundamentals second edition, by James E Balley, David F. Ollis 2nd Edition, 1986, McGraw Hill.

INSTRUMENTAL METHODS OF ANALYSIS (IMA)
(**for II B.Tech II Sem Biotechnology**)

Unit – I : Introduction
Types of Analytical Methods – Instruments for Analysis – Uncertainties in Instrumental measurements – Sensitivity and detection limit for instruments.

Unit – II: UV-Visible and Infra Red Spectroscopy
Absorptive – Appetent deviations from Beer's law – Double beam spectrophotometer operation – Sources of radiation – Detectors – Photo metric accuracy – instrumentation – chemical applications – Qualitative analysis – determination of ligand /metal ratio in complex – Quantitative analysis – additivity of abosorbents – photo metric titrations.

Unit – III : Atomic Absorption and Emission Spectroscopy
Atomization – Flame atomization – Graphite furnace atomizers – application of atomic absorption spectroscopy. Atomic emission spectroscopy; Instrumentation – quantitative analysis – direct reading spectrometers – plasma excitation – Flame excitation – direct reading spectrometers – plasma excitation – Flame excitation – Laser excitation – chemical interferences – concentration range.

Unit – IV: Magnetic Resonance and Electron Spin Resonance Spectroscopy
Scanning spectrometer – High resolution NMR – Chemical shift – Spin – spin coupling Frequency lock – double resonance – applications of proton NMR – quantitative analysis – qualitative analysis. ESR instrumentation – applications of ESR.

Unit – V: Chromatography
Paper, Column, TLC, GC, HPLC and GPC – Principles and applications. Capillary columns, the stationary liquid phase – Bonded phase – sample injection – solid samples – detectors – first family detectors – second family detectors – detector scavenging – dual detection – temperature programming – commercial gas chromatographs – qualitative analysis – simulated distillation, qualitative analysis. Solvent extraction and ion-exchange techniques.

Books

1. R.A. Day & A.L. Underwood, Quantitative analysis, Prentice – Hall of India Pvt.,Ltd., 1985.
2. Skoog & West, Fundamentals of Analytical Chemistry, 1982.
3. Hobert H Willard DL Merrit & JRJA Dean , Instrumental methods of analysis, CBS Publication and distributors, 1992.
4. Vogal, Text Book of quantitative inorganic analysis, 1990
5. Ewing, Instrumental Methods of Analysis, 1992.

MOLECULAR BIOLOGY (MB)
(**for II B.Tech II Sem Biotechnology**)

Unit – I: Structure of Dna And Its Biosynthesis:
Detailed structure of DNA, variation form Watson& Crick model – Z – DNA, A & B DNA, Denaturation & melting curves. Genome organization in prokaryote & eukaryotes – Enzymes, Molecular Biology involved in replication, step by step process, Heteroduplexes. Models of DNA replication – Semiconservative Mechanism of DNA replication in E. coli (bidirectional). Mitochondrial (D-loop). Viral DNA (Rolling circle), Single stranded - DNA phages (M13, 174), Eukaryotic telomeres and its replication; Selfish DNA, Alu sequences.

Unit –II : Rna Structure and Bio-Synthesis
m-RNA, r- RNA structures. Transcription apparatus and proteins involved in transcription. Processing of t-RNA , r-RNA , m- RNA splicing – Concept of Ribozyme.

Unit- III : Protein Structure and Biosynthesis
Protein structure and (Primary, secondary, Tertiary and Quaternary ;) Protein folding. The genetic code and Wobble Hypothesis, codon usage; Protein synthesis : Translation in Prokaryotes and Eukaryotes. Post translation modifications.

Unit-IV : Mutagenesis
Types of mutagens, molecular basis of mutatuions, analysis of mutations, Site – directed mutagenesis and reverse genetics. DNA damage and repair mechanisms. Mutagenicity testing using microbial systems. – Ames TEST; Concept of gene: Benzers, fine structure Analysis, Introns & Exons. Complementation and functional allelism.

Unit- V: Genetic Recomnination in Bacteria
Discovery, Detection, Molecular mechanisms of transformation, transformation methods. Bacterial conjugation: Sex factors in bacteria, F and Hfr transfer, mechanism of transfer, linkage mapping. Mechanism of recombination. Bacterial transduction : Transduction phenomena. Methods of transduction , cotransduction, Generalized, Specialized & Abortive transduction, sex ductions and their applications. Genetics of eukaryotic viruses. Bacteriophages, Iytic & Iysogenic life cycle, plasmids, Transposons, Rectroposons.

Reference

1. Molecular Biology, David Friefeldur, Norasa Publising Home.
2. Lodish, H., Berk A., Zipursky, S.L. Matsudaria P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology, Media connected, W.H. Freeman and Company.
3. Benjamin Lewin – Gene – VII.
4. Cell and Molecular Biology 1996. De Robertis E.D.P and De Robertis E.M.F. B.I Waverly Pvt. Ltd., New Delhi

MASS TRANSFER OPERATIONS (MTO)
(for III B.Tech I Sem Biotechnology)

1. Diffusion in gases**,** liquids and solids – Convective mass transfer and mass transfer coefficients.
2. Vapour – Liquid equilibrium – Simple, steam and flash Distillation – with reflux – McCabe Thiete method and enthalpy – concentration method.
3. Siq-Siq equilibrium – staged and continuous extraction solid – liquid extraction – equilibrium relation and staged leaching.
4. Adsorption – equilibrium – Batch and fixed bed adsorption – ion exchange process.
5. Membrane separation proceses – Types siq and gas – membrane processes – complete mixing, cross flow and counter current flow models.

TEXT BOOKS:

1. Robert E. Treybal, Mass Transfer Operations, III Edition, Mc. Graw Hill international.
2. Christi J. Geankoplis, transport process and Unit operations, III Edition - Prentice Hall of India Pvt. Ltd.

REFERENCE:

1. Judson Kind, Separation Processes, II edition Mc Graw Hill Chemical Engineering series.
2. Philip A. Schweitzer, Hand book of separation Techniques for chemical Engineering, III Edition, Mc. Graw Hill.
3. Philip C. Wankat Rate, Controlled separations, champman and Hall, 1985.

GENETIC ENGINEERING (GE)
(for III B.Tech I Sem Biotechnology)

Unit - I : Gene Regulation and Expression

Lac operon, Arabinose and Tryptophan operons; Repressors and activators; Sigma switch in Bacillus subtills. Gene regulation in Eukaryotic system, Repetitive DNA, Gene rearrangement, Promoters, enhancer elements, gene amplification. Signal transduction: concept of second messenger – cAMP, Cgmp, Protein kinases, G-proteins, Steroid / peotide hormone regulation, Tissue specific regulation.

Unit - II : Plasmids and Transposons

Plasmids: Definition, types of plasmids, identification and classification of plasmids, purifications of plasmids, plasmid transfer and its mechanism, host restriction in transfer. Transposable elements : Definition detection of transposition in bacteria, types of bacterial transposons, mechanisms of transposition and excision, applications of transposons.

Unit – III : DNA Technology

Purification of genomic DNA from living cells, Manipulation of purified DNA; Cloning vectors, Enzymes involved in genetic engineering; Restriction mapping, cloning strategies, Methods of gene transfer, Introduction of DNA into living cells.

Detection of clones and its expression: Expression of cloned genes in yeast & E coli, Blot analysis – Southern & Western blot; dot and slot blot immunological techniques; DNA methylation, DNA hybridization, Genomic and c-DNA library construction and application.

Unit – IV : PCR and its Application
Principle, designing of primers, PCR methodology, RT- PCR, multiplex PCR, identification of PCR product, application of PCR technology.

Molecular markers: RFLP, RAPD, AFLD, gene chip and microarray; applications in disease profile, drug target, gene discovery, drug action and toxicity.

Unit –V : Application of R-Dna Technology
Gene cloning in medicine, Gene cloning in agriculture, production of protein from cloned genes, Transgenic animals, gene therapy; cloning in plants, T_1 plasmid of Agrobacteriums.

Text Books:
1. Old RW, Primrose SB, Principles of Gene manipulation, An introduction to Genetic engineering, Blackwell Scientific Publications, 1993.
2. T.A. Brown, Gene Cloning.

Reference :
1. Ansubel FM., Brent R, Kingston RE, Moore DD, Current protocols in Molecular Biology, Greene Publishing Associates, NY, 1988.
2. Berger SL, Kimmer AR, Methods in Enzymology, Vol 152, Academic press 1987.

BIO REACTION ENGINEERING (BRE)
(for III B.Tech I Sem Biotechnology)

Unit – I : Kinetics of Homogeneous Reactions

Searching for mechanism – Arrhenius equation – Batch reactor analysis for kinetics. Growth Kinetics: Batch growth quantifying cell connectration, grow profiles and kinetics in batch culture, fed batch growth, continues growth and their growth kinetic quantification chemostat growth /DO-stat/PH-stat/semi-continuous/ exponential feeding strategy. (Synchronous growth and its application in product production)

Unit – II : Ideal Reactors
Single reactor and multiple reactor design

Unit – III : Multiple Reactions
Parallel, series and series – parallel – Design principles – Non isothermal reactos and pressure effects

Unit – IV : NON IDEAL FLOW
Non ideal flow models and reactor performance
UNIT – V : BIOCHEMICAL REACTIONS
Cell growth – Rate equations – Stoichiometry – Mass balance – Design equations

Text Book
1. Chemical Reaction Engineering – Third edition – Octave levenspiel – John Wiley

Reference

1. H. Scott Fogler, Elements of chemical Reaction Engineering, II Edition, Prentice Hall of India Pvt., Ltd.,
2. Charles D Holland, Fundamentals of Chemical Reaction Engineering, Johan Wiley and sons, 1990
3. JM Smith, Chemical Engineering kinetics Mc Graw Hill, 1981
4. Biochemical Engineering by Aiba and Millis 1973 Eds., Academic Press.

PLANT BIOTECHNOLOGY (PB)
(for III B.Tech I Sem Biotechnology)

UNIT – I : Tissue Culture & Applications

Introduction to cell and tissue culture ; Tissue culture media (composition, preparation); Initiation and maintenance if callus and cell suspension culture, organogenesis; Protoplast isolation culture and fusion. Production of secondary metabolites from plant cell cultures; Processes for production of secondary metabolites technology of plant cell culture for production of chemicals; Bioreactors systems and models for mass cultivation of plant cells; Plantibodies, plant vaccines, metabolic engineering.

UNIT - II : Agrobacterium and Plant Genetic Engineering

Agrobacterium medicated gene transfer and cloning. Types of plant vectors and their use in gene manipulation.

UNIT – III : Plant Viruses

Classification, diagnosis – remedy –viruses as a tool to deliver foreign DNA

UNIT – IV : Developmental Aspects Of Rhizobium

Legume Symbiosis, symbiotic Nitrogen fixation, Regulation of nif and nod gene.

UNIT – V : Molecular Aspects Of Resistance

Transposable elements, factors influencing disease resistance and susceptibility RFLP, RAPD.

Herbicide tolerance – insect resistance - viral resistance – stress tolerance – development of disease resistance plants by introducing Bacillus thuingiensis genes.

References :

1. Mantal SH Mathews JA, Mickee RA Principle of plant biotechnology – an introduction to genetic engineering in pants, Blackwell Scientific publications, 1985.
2. Mark JL Revolution in Biotechnology, Cambridge University Press, 1989
3. Dodds JH Plant Genetic Engineering, Cambridge University Press, 1985.

ENVIRONMENTAL BIOTECHNOLOGY (EB)
(for III B.Tech I Sem Biotechnology)

UNIT – I : Biological Treatment Of Waste Water

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 biological treatment – contact digesters, packed column reactors, UASB.

UNIT – II : Bioremediation

Introduction, constraints and priorities of Bioremediation, biostimulation of naturally occurring microbial, activities, bioaugmentation, in situ, exsitu, intrinsic & engineered bioremediation, solid phase bioremediation – land farming, prepared beds, soil poles, phytoremediation, composting, bioventing & biosparging; Liquid phase bioremediation – suspended bioreactors, fixed bio-film reactors.

UNIT – III : Metal Biotechnology

Mining and metal biotechnology ; Microbial transformation , accumulation and concentration of metals, metal leaching, extraction and future prospects.

UNIT – IV : Bio Fuels

Microorganisms and energy requirements of mankind; Production of nonconventional fuels-methane (biogas) hydrogen alcohols and algal hydrocarbons. Use of microorganism in augmentation of petroleum recovery

UNIT – V : Hazardous Waste Management

Introduction – xenobiotic compounds, recalcitrance – hazardous wastes – biodegradation of xnobiotics – biological detoxification – market for hazardous wastes management – biotechnology application to hazardous wastes management – examples of biotechnological applications to hazardous wastes management – cyanide detoxification – detoxification of oxalate, urea etc - toxic organics – phenols.

REFERENCE

1. Stanier RY, Ingrahm JL, Whellis ML, Painter RR, General Microbiology, McMillan Publications, 1989.
2. Foster CF. Jophn Ware DA., Environmental Biotechnology, Ellis Horwood Ltd., 1987
3. Karrely D., Chakrabarty K., Omen GS. Biotechnology and Biodegradation, Advances in Applied Biotechnology Series, Vol.4, Guld Publication Co., London, 1989.
4. Biodegradation & bioremediation – 1999 martin Alexander Academic Press.
5. Bioremediation Engineering ; design and application 1995 Joh. T. cookson Jr. Mc Graw Hill Inc.,

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (MEFA)
(for III B.Tech I Sem Biotechnology)

UNIT – I : Introduction to Managerial Economics

Managerial economics; Definition, nature and scope – Demand analysis ; Law of demand, demand determinants – Elasticity of Demand; definition, types, measurement and significance – Demand Forecasing methods.

UNIT – II : Theory of Production

Firm and industry – Production function – Cobb Douglas Production function – Laws of Returns – Internal and external economics of scale. Cost Analysis; cost concepts, fixed Vs variable costs , explicit Vs implicit costs , out-of-pocket costs Vs imputed costs, opportunity cost, sunk costs and abandonment costs. Break-even analysis – Concept of Break-even Point (BEP) – Break Even Chart – Determination of BEP in volume and value – Assumptions underlying and practical significance of BEP (Simple Problems)

UNIT – III : Introduction to Markets and Business Organizations

Market structures – Types of competition – Features of Perfect competition , Monopoly, Monopolistic Competition – Price – output determination.

UNIT – IV : Introduction to Capital

Capital and its significance – Types of capital – Estimation of fixed and working capital requirements – Methods of raising capital.

Introduction to capital budgeting methods; pay back method, Accounting rate of Return (ARR) and net Present Value (NPV) method (Simple problems)

UNIT – V : Introduction to Financial Accounting and Financial Analysis

Double Entry Book keeping – journal – Ledger – Trial balance – Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments.

Ratio Analysis: Computation of liquidity ratios (current ratio and quick ratio), activity ratios (inventory turnover Ratio and Debtor Turnover Ratio) Capital structure ratios (Dept Equity Ratio and Interest Coverage Ratio) and profitability Ratios (gross Profit Ratio, Net Profit Ratio, Operating Ratio, P/E Ratio and EPS). Analysis and interpretation.

Books for Reference

1. Joel Dean, Managerial Economics, Prentice Hall of India, 2001.
2. James C, Van Home, Financial Management Policy , Pearson Education Asia.
3. Varshney & Maheshwari, Managerial Economics, S Chand and Co., 2000.
4. YK Bhushan, fundamentals of Business Organization and management, Sultan Chand, New Delhi.
5. Narayan Swamy, Financial Accounting , Prentice Hall of India, 2001.
6. AR Aryasri, Managerial Economics and Financial Analysis (MEFA) for JNTU (B.Tech), Tata McGraw-Hill, New Delhi
7. RK Mishra et al , Readings in Accounting and Finance
8. RL Gupta, Financial Accounting, Volume I, Sultan Chand, New Delhi, 2001.

INSTRUMENTATION AND PROCESS CONTROL (IPC)
(for III B.Tech II Sem Biotechnology)

UNIT- I : Process Dynamics
Process variables- Load variables- Dynamics of simple processes. Flow, Level, temperature and pressure – interacting and non-interacting system continuous and batch process- self – regulation- Servo and regulator operation problems.

UNIT-II : 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+O and P+I+O control modes-problems-pneumatic, hydraulic and electronic controllers to realize various control actions.

UNIT-III : Optimum Controller Settings:
Evaluation criteria. ¼ decay ratio, IAE ,ISE,ITAE-determination of optimum settings for mathematically described process using time response and frequency response . Tuning process reaction curve method-continuous, oscillation method-damped oscillation method-problems.

UNIT – IV : Final Control Element:
I/P Converter-pneumatic, electric and hydraulic actuators-valve positioner – control valve-characteristics of control valves-valve body- Globe, butterfly, diaphragm, Ball valves- Control valve sizing-Cavitation, flashing problem.

UNIT – V : Muti Loop Control System
Feed forward control-Ration control-Cascade control-Split range-Multivariable control and examples from distillation column & Boiler systems.

TEXT BOOKS

1. Process control, Pollard A. Heinemann Educational Books. London; 1971.
2. Process control, Harriott P.,Tata McGraw-Hill publishing Co. New Delhi. Reprint 1991.
3. Industrial Instrumentation by Donald P. Eckman, Wibey Easters, 1950.
4. Chemical Process Control Stephanoupoulis, G. Prentice Hall, New-1 Delhi. 1990.
5. Process Control Palranabis.

ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY (ATB)
(for III B.Tech II Sem Biotechnology)

UNIT-I :Microscopy
Microscopic identification of various microorganisms; bright field, dark field, fluorescent and phase contrast and confocal microscopy; SEM – TEM & STEM microscopy.

UNIT-II : Methods of Biochemical Analysis
Glucose, Sugars, Carbohydrates, Lipids, proteins and nucleotides; enzymatic assays of various metabolities.

UNIT- III :Electrophoretic Techniques
Electrophoresis of proteins and nucleic acids: 1D & 2D Gels: Pulsed field electrophoresis: capillary electrophoresis: Western blotting; gel documentation: chromatographic techniques. Southern, Northern Blotting; dot, slot blots, NUCLEOTIDE AND DNA Isolation, DNA purification, PCR based analysis; DNA finger printing: DNA sequencing.

UNIT – IV Immuno – Techniques
Antiserum production, immunofluroscence, immuno histocompatability ELISA: Localization of cells in tissues immunoblotting; monoclonal antibodies, RIA, single & double, electro immunodiffussion, agglutination reactions. FACS (Fluorescence Activated Cell Sorter) confocal microscope.

UNIT – V Analysis of Bioprocesses
Analysis of biomass; measurement of dry weight and biomass composition; analysis of substrate uptake and product formation rates; measurement of BOD and COD in waste eaters; Gas analysis for O2 and CO2; flow injection analysis; computerized data acquisition of bioprocesses, total dissolved solids, estimation N, P, S.

Reference
Reading in Scientific American, W.H. Freeman, 1985-1993. AAS – Elemental analysis.

BIO INFORMATICS (BI)
(for III B.Tech II Sem Biotechnology)

UNIT –I : What Is Bioinformatics:
Scope of bioinformatics – Elementary commands and protocols,ftp, telnet, http. Primer on information theory.

UNIT-II : Sequencing Alignment and Dynamic Programming
Introduction – strings – Edit distance two strings – sting similarity local alignment gaps – parametric sequence alignments – suboptimal alignments – multiple alignment – common multiple alignment methods.

UNIT - III : Sequence Databases and Their Use
Introduction to database – database search – Algorithms issues in database search – sequence database search – FASTA – BLAST Amino acid substitution matrices PAM and BLOSSUM.

UNIT – IV : Evolutionary Trees and Phylogeny
Ultrasonic trees – parsimony – Ultrametric problem – Perfect Phylogeny – phylogenetic alignment – connection between multiple alignment and tree construction.

UNIT- V : Special Topics in Bioinformatics
DNA mapping and sequencing – Map alignment – Large scale sequencing and alignment – Shortgun – DNA sequencing – Sequence assembly – Gene Predictions Molecular predictions with DNA strings.

Reference:

1. Bioinformatics Basics. Applications in Biological Science and Medicine by Hooman H. Rashidi and Lukas K. Bueher CRC Press 2000.
2. Algorithms on Strings Trees and Sequences Dan Gusfiled, Cambridge University Press 1997.
3. Bioinformatics : A. Machine Learning Approach P. Baldi S. Brunak, MIT Press 1988.

BIOPROCESS ENGINEERING –II (BPE-II)
(for III B.Tech II Sem Biotechnology)

UNIT – I : Introduction - Bioreactor

Classification of bioreactors and their application, different accessories of bioreactors, critical non-critical process parameters, batch / fed-batch/continuous cultivation of microorganisms Media optimization. Statistical technique and media optimization.

UNIT – II : Desgin and Analysis of Bioreactors

Modeling of Non- Ideal Behaviour in Bioreactors – Tanks series and dispersion models – applications to design of continuous sterilizers; Design and operation reactors; Airlift, stirred tank, fed batch reactor. Fluidized – bed – bioreactors; Stability analysis of bioreators.

UNIT – III : Monitoring of Bioprocesses

On-line data analysis for measurement of important physicochemical and biochemical parameters; Methods of on-line and off – line biomass estimation; microbial calorimetry; Flow injection analysis for measurement of substrates, products and other metabolites, State and parameters optimization techniques for biochemical processes; Computer-based data acquisition, monitoring and control LABVIEW Software.

UNIT- IV : Modern Biotechnological Aprocesses

Recombinant cell culture processes, guidelines for choosing host-vector systems, plasmid stability in recombinant cell culture, limits to over expression, Modeling of recombinant bacterial cultures; Bioreactor strategies for maximizing product formation; Bioprocess design considerations for plant and animal cell cultures. Metabolic engineering enzyme flow design.

UNIT –V : Modelling and Simulation of Bioprocesses

Study of Structured Models for analysis of various bioprocess; Model simulation using MATLAB-SIMULINK and 181M software packages.

TEXT BOOKS

1. Biochemical Engineering fundamentals Bailey and Ollis, Mc Graw Hill (2^{nd} Ed.), 1986.
2. Bioprocess Engineering, Shule and Kargi, Prentice Hall, 1992.
3. Fundamental of Biochemical Engineering by AVN Swamy. BS Publication – 2007.

IMMUNOLOGY & IMMUNOTECHNOLOGY (IMT)
(for III B.Tech II Sem Biotechnology)

UNIT – I : The Immune System

Introduction Lymphocytes, their origin and differentiation, antigens, their structures and classification, complement and their biological function, types of immune responses, anatomy of immune response, innate, acquired immunochemistry.

UNIT - II : Humoral Immunity

B- Lymphcytes and their activation, structure and function of immunoglobulin, immunoglobulin classes and subclasses, genetic control of antibody production, mono clonal antibodies and diagnosis, idiotypes and idiotypic antibodies, major histocompatibility complex. Antigen antibody reactions.

UNIT – III : Cellular Immunolgoy

Thymus derived lumphocytes (T cells) their classification, antigen presenting cells (APC) macrophages, langerhance cells, their origin and functions, mechanisms of phagocytosis, identification of cell types of immune system, immunosuppression, immune tolerance, hybridoma technology. Stem cell technology.

UNIT - IV : Immunity to Infection

Antigen- Antibody interaction. Hypersensitivity reactions, mechanisms of T cell activation, cytokines and theie rile in immune response macrophage activation and granuloma formation Vaccines;

UNIT- V : Transplantation and Autoimmunity

Graft rejection, evidence and mechanisms of graft rejection, prevention of graft rejection, immunosuppressive drugs, HLA and disease, mechanisms of immunity to tumour antigens, immunotoxins. Auto antibodies in humans. Pathogenic mechanisms, experimental models of autoimmune disease treatment of auto immune disorders, cancer & immune systems.

References

1. Riott I, Essential immunology, Vaccines Conventional, subunit and recombinant, antidiotypic vaccine Blackwell Scientific publications, Oxford,1991.
2. Benjamin E abd Kesjiwutz S. immunology A short course Wiley Liss, NY, 1991 ELISA immunological techniques. DNA vaccines immunotechnology.
3. Kuby – Immunology
4. Immunology and Immuno Technology by A.K.Chakravarthy. Oxford University Press, India.

PROTEIN ENGINEERING (PE)
(for III B.Tech II Sem Biotechnology)

Unit - I : Stucture of Proteins Primary & Secondary Structure
Primary structure and its determination, secondary structure prediction and determination of supersecondary structures, protein folding pathways.

UNIT – II : Tertiary and Quarternary Structure
Tertiary structure and domain in proteins, quarternary structure, post translational modification.

UNIT - III : Structure Function Relationship of Proteins
DNA binding proteins, prokaryotic and eukaryotic transcription factors, DNA polymerases, Membrane proteins and receptors, bacteriorhodopsin, photosynthetic centers, epidermal growth factor, insulin and PDGF receptors and their interaction with effectors, protein phosphorylation, immunoglobulins, Nucleotide binding proteins, enzymes; serine proteases, ribonucleases, lysizyme.

UNIT- IV : PROTEIN ENGINEERING
Protein data base analysis, methods to alter primary structure of proteins, examples of engineered proteins

UNIT – V : PROTEIN DESIGN
Protein design, principles and examples.

REFERENCE:

1. Moody PCE, and AJ Wilkinson, Protein Engineering IRO Press Oxford, 1990'
2. Creightgon TE, Proteins, Freeman WH, Second Ed, 1993
3. Braden C, Tooze, Introduction of protein structure Garland, 1993.

GENOMICS & PROTEOMICS (GP)
(For IV B.Tech. I sem Biotechnology)

UNIT-I : Prokaryote Genome Organisation & Expression
Biodiversity, evolution, basic and functional units of life, information storage molecule – the DNA, Information copying process – the DNA replication and information dissemination, Genome organization – Prokaryotic genome, Prokaryotic Gene Structure and Regulation of Gene Expression.

UNIT – II : Eukaryotic Gene Structure and Regulation of Gene Expression
Eukaryotic Gene Structure and regulation of Gene Expression. Repetitive DNA (junk DNA)/ transposable elements and their implication, junk DNA and genome variation, information maintenance (DNA damage and repair), The RNA World, Protein Structure, Post-Translational Modification and Protein – Protein interaction.

UNIT – III : Genetic Counselling Mapping Of Genome
Sequencing DNA, Genome Projects Microbes and Invertebrates, : Plant, : Human and Animal, Model Organisms, Gene Prediction – intrinsic, Gene Prediction – Comparing genomes,

UNIT – IV : Gene Prediction
Homology Based Gene Prediction, Reductionistic versus Holistic approach in Biology, Methods of studying Gene Expression EST approach in Biology, Microarrays – Basics,Application of cDNA arrays, Genomics and genome variation, Proteomics – basics, Proteomics – Applications.

UNIT – V : Metabolomics
Metobolomics basics, Pharmacogenomics, Single Nucleotide Polymorphism, Disease Genes and their identification, Drug uptake, action and metabolism, Drug targets and Designer medicine, Genomics Context of Complex Traits, Genomics Perspective of Bio terrorism, Ethical and Legal Implications, Intellectual Property Rights.

R**eferences**:

1. S Sahai, Genomics and Proteomics, Functional an Computational Aspects, Plenum Publications, 1999

DOWN STREAM PROCESSING (DSP)
(For IV B.Tech. I sem Biotechnology)

UNIT - I : Role of Downstream Processing in Biotechnology.
Role and importance of downstream processing in biotechnological processes. Problems and requirements of bioproduct purification. Economics od downstream processing in Biotgechnology, 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), physico-chemical basis of biosepration processes. Recent development in product isolation (for ex. One step purification, reverse Micro cellar extraction, on line membrane separation).

UNIT – II : Primary Separation and Recovery Process
Cell disruption methods for intracellular products, removal of insolubles, biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods.

UNIT – III : Enrichment Operations.
Membrane-based separations (micro and ultrafiltration), theory, design, and configuration of memberance separation equipment. Applications, precipitation methods (with salts, organic solvents, and polymers, extractive separations, aqueous tow-phase extraction, supercritical extraction), insitu product removal, integrated bioprocessing.

UNIT – IV : Product Resolution/Fractionation
Adsorptive chromatographic separation processes, electrophoretic separations (all electrophoresis techniques including capillary electrophoresis), hybrid separation technologies (membrance chromatography, electrochromatography etc) Mass spectroscopy

UNIT –V : Product Polishing
Gel permeation Chromatography, dialysis, Crystallisation

Reference:

1. Wankat PC. Rate controlled separations, Elsevier, 1990.
2. Belter PA and Cussler E. Bioseparations, Wiley 1985.
3. Product Recovery in bioprocess Technology, BIOTOL Series, VCH, 1990.
4. Asenjo J.M. Separation processes in Biotechnology, 1993, Marcel Dekkere Inc.

BIOPHARMACEUTICAL TECHNOLOGY (BPT)
(For IV B.Tech. I sem Biotechnology)

UNIT – I : Introduction
Development of Drug and Pharmaceutical Industry therapeutic agents, their uses and Economics; Regulatory aspects

Biopharmaceutical industries. Drug Design and New Drug discovery; Logic and rationality; Drug metabolism and Pharnacokinetics ; Biopharmaceuticals – Vaccines, therapentic proteins, growth factors from prokaryotic and eukaryotic Cells **Ex.** Interferon, Insulin etc., Pro-clinical and invitro screening of drugs.

UNIT - II : Drug Metabolism and Pharmacokinetics
Drug metabolism-physico chemical principles, radioactivity pharma kinetics-action of drugs on human bodies.

UNIT - III : Important Unit Process and Their Applications
Bulk drug manufacture Types of Reactions in Bulk drug Manufacture and Processes. Special Requirements for Bulk Drug Manufacture.

UNIT - IV : Manufacturing Priciples
Compressed baltes, wet granulation- dry granulation or slugging- direct compression- tablet presses, coating of tablets, capsules, sustained action dosage, forms-parental solutions – ora1 liquids- injectioins- ointments – Topical Applications, Preservation, analytical methods and test for various drugs and pharmaceuticals, Packing – Techniques, Quality Managemtn, GMP

UNIT - V : Pharmaceutical Products and Their Control
Therapeutic categories such as vitamins, laxatives, analgesics, non-steroidal contraceptives, Antibiotics, biologicals, hormones.

References

1. Leon Lachman et at – at theory and Practice of Industgrial Pharmacy. 3rd Edition, Lea and Febiger, 1986
2. Remington's Pharmaceutical Sciences, Mark publishing and Co.

BIO DIVERSITY, IPR AND MANAGEMENT OF BIOTECHNOLOGY (BMB)
(For IV B.Tech. I sem Biotechnology)

UNIT - I : Basic Concepts of Biodiversity
Introduction – Characterization of Biodiversity, species richness, numerical diversity the niche, types and levels of biodiversity – Magnitude and Distribution of Biodiversity – Generation, Maintenance and loss of Biodiversity.

UNIT - II : Biodiversity Ecosystem Functions
The impacts of civilization aliens, pests and pollution: economic value of biodiversity. Biodiversity and ecosystem functioning – Basic Principles, ecosystem analysis – inventorying and monitoring of biodiversity – The Resource base for Biodiversity assessments.

UNIT – III : Biodiversity Conservation
Measures for conservation for Biodiversity and sustainable use of its components.
United Nations & environmental education, world conservation on strategy, riodeclaration environment & development, major international conventions on biodiversity. Innovative Techniques in Conservation Genetics: In vitro fertilization and embryo transfer; use of surrogate mother; protein electrophoresis; mitochondrial DNA analysis; single locus and multilocus fingerprinting, random amplified polymorphic DNA (RAPD). Management, Protected Areas, national Parks and biosphere reserves; national parks and reserves red data books; gene banks. Conservation of rare species and intraspecific genetic diversity.

UNIT - IV : Intellectual Property Rights
Intellectual property rights, and Intellectual Property protection, patents and methods of application of patents, Trade Secrets, copy rights, Trade Marks, Legal implications, farmers rights, plant breeder rights.

UNIT - V : Intellectual Property Rights –II
International and National conventions on bio-technology and related areas. GATT, TRIPS, Biodiversity convention, etc.

Reference

1. VH.Heywood. R.T.Watson Global Biodiversity Assessment, Cambridge University Press 1996.
2. GILLMAN, m. (1993) Biodiversity Conservation Open University Press
3. MAY.R (1992)"How many species inhabit the Earth?" Scientific American, 267(4).
4. A special issue on Conservation genetics in Molecular Ecology, 3 (4), August 1994.

ELECTIVES

MOLECULAR BIOLOGY OF CANCER (MBC)
(ELECTIVE-I)
(For IV B.Tech. I sem Biotechnology)

UNIT - I : Fundamentals of Cancer Biology
Regulation of Cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, modulation of cell cycle in cancer, Different forms of cancers, Diet and cancer.

UNIT- II : Principles of Carcinogenesis
Chemical Carcinogenesis, Metabolism of Carcinogenesis, Natural History of carcinogenesis, Targets of chemical Carcinogenesis, Principles of Physical carcinogensis, X – ray radiation-mechanism of radiation carcinogenesis.

UNIT – III : Priciples of Molecular Cell Biology of Cancer
Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, detection of Oncongenes, Growth Factor and Growth Factor receptors that are Oncongenes. Oncogenes/Proto Oncogene activity. Growth factors related to transformations.

UNIT - IV : Principles of Cancer Metastasis
Clinical significances of invasion, heterogeneity of metastatic phenotype, Metasttatic cascade, Basaement Membrane disruption, Three step theory of Invasion, Proteinases and tumour cell invasion.

UNIT - V : New Molecules for Cancer Therapy
Different forms of therapy, Chemotherapy, radiation Therapy, Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection:

REFERENCES:

1. Maly B.W.J. Virology a practical approach, IRL Press, Oxford, 1987.
2. Dunmock N.J. and Primrose. S.B. Introduction to modern Virology, Blackwel 1 scientific Publication, Oxford, 1988.
3. An Introduction to Cellular and Molecular Biology of Cancer, Oxford Medical publications, 1991.

MOLECULAR PATHOGENESIS (MP)
(ELECTIVE –I)
(For IV B.Tech. I sem Biotechnology)

UNIT - I : Introductiion

Introduction to pathogenesis; components of microbial pathogenicity. Population genetics of Microbial Pathogenesis, methods to detect genetic diversity and structure in nature population, epidemiology, cryptic diseases.

UNIT - II : Host Defences

Host, defences against pathogens, clinical importance of understanding host defences, components of the host surface defences systems like skin, mucosa and the defences systems of the eye, mouth, respiratory tract etc., components of the systemic defence like the tissues and blood.

UNIT - II : Host-Pathogen Interacation

Virulence and virulence factors, colonoising virulence factors, virulence factors damaging the host tissues, virulence genes and regulation of the virulence genes.

Experimental methods to study host-pathogen interaction, selecting the pathogen model, measurement of virulence, identification of potential virulence factors, modulation of immune response by vaccines, properties of vaccines, other immuno modulators.

UNIT - IV : Paradigms Of Pathogenesis:

Diphtheria disease by colonization; Disease without colonization, Clostridium *botulinum* and Staphylococcus aureus; Intestinal infections, Shigella and E. Coli infections; vibrio cholera Salmonella infections; fungal infections.

UNIT - V : Future Challenges

Gastric and duodenal ulcers – are they due to infections?
Lyme disease and Syphilis – unsolved mystery
Legionnaires disease – aftermath of comforts
Tuberculosis and other mycobacterial infections – re-emerging with vengeance.
Rheumatic fever and glomerulo nephritis – still a question to be solved.

References:

1. Lglewski B.H. and Clark V.L. Molecular basis of Bacterial pathogenesis, Academic press, 1990.
2. Talaro K. and talaro A. Foundations in Microbiology, W.C. Brown Publishers, 1993.
3. Roitt I. Essentials of Immunology, 8th edition, Blackwell Scientific Publishers, 1994.
4. Janeway C.A Jr, and Travers P.T. Immunobiology, Blackwell J Scientific Publishers, 1994.
5. Austyn J.M. and Wood K.J. Principles Cellular and Molecular Immunology, Oxford University Press, 1993.

BIOETHICS, BIO SAFETY AND INTELLECTUAL PROPERTY RIGHTS (BBIR)
(ELECTIVE – I)
(For IV B.Tech. I sem Biotechnology)

UNIT- I : Bioethics
Public education of the processes of biotechnology involved in generating new forms of life for informed decision making

UNIT - II : Socio Economic Impacts Of Biotechnology
Beneficial application and development of research focus to the need of the poor, identification of directions for yield effect in agriculture, aquaculture, bioremediation etc.,

UNIT - III : Biosafety
Bio-safety regulation and national and international guidelines r-DNA guidelines. Experimental protocol approvals, levels of containment, environmental aspects of biotech applications, Use of genetically modified organisms and their release in environment, special procedures for r-DNA based product production (GMP)

UNIT - IV : Intellectual Propety Rights – I
Intellectual property rights, and intellectual Property protection, patents and methods of application of patents, Trade Secret, copy rights, Trade Marks, Legal implications, farmers rights, plant breeder's rights.

UNIT - V : Intellectual Property Rights- II
International and National conventions on biotechnology and related areas. GATT, TRIPS, Biodiversity convention, etc.

Reference:

1. Sasson a, Biotechnologies and Development, UNESCO Publications, 1988.
2. Sasson A. Biotechnologies in developing countries present and future, UNESCO publishers, 1993.
3. Singh K. Intellectual Property rights on Biotechnology, BCIL, New Delhi.

BIOPROCESS ECONOMICS & PLANT DESIGN(BEPD)
(ELECTIVE – I)
(For IV B.Tech. I sem Biotechnology)

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
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. Manufacturing costs-Direct Production costs I 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 - IV : Plant Overheads
Administration, safety and other auxiliary services, payroll overheads, warehouse and storage facilities etc. Profitability Analysis-return on original investment, interest rate of return, accounting for uncertainty and variations and future developments.

UNIT - V : Optimization, Ipr & Ipp
Optimization techniques – Linear and Dynamic programming. Optimization strategies. Patent concept and its composition and protection of right and their limitation and IPR (Intellectual properly rights). Intellectual property protection.

References:

1. Peters and Timmerhkus, Plant design and Economics for Chemical Engineers, McGraw Hill 4^{th} edition, 1989.
2. Rudd and Watson, Strategy of Process Engineering, Wile. 1987.
3. Gearing Up for Patents, the Indian Scenario, Universities Press By Ganguli.

CREATIVITY, INNOVATION AND NEW PRODUCT DEVELOPMENT (CIND)
(ELECTIVE –I)
(For IV B.Tech. I Sem Biotechnology)

UNIT - I Introduction

The process of technological innovation – factors contributing to successful technological innovation – the need for creativity and innovation – creativity and problem solving – brain storming – different techniques.

UNIT - II Project Selection And Evaluation

Collecting of ideas and purpose of project – Selection criteria – screening ideas for new products (evaluation techniques).

UNIT - III : New Product Development

Research and new product development – Patents – patent search – Patent laws – International code for patents – Intellectual property rights (IPR).

UNIT - IV : New Product Planning

Design of proto type –testing – quality standards – marketing research – introducing new products. GMP.

UNIT - V : LABORATORY.

Creative design – Model Preparation – testing – Cost – evaluation Patent application –GLP

References

1. HARRY NYSTROM – Creativity and innovation – john Wiley & Sons, 1979.
2. BRAIN TWISS, Managing technological innovation, Pitman Publishing Ltd.1992
3. HARRY B.WATTON – New Product Planning – Prentice-Hall inc. 1992.
4. P.N.KHANDWALLA – fourth Eye (Excellence through Creativity) – Wheeler Publishing, Allahabad, 1992.
5. I.P.R. Bulletins. TIFAC, New Delhi, 1197.
6.

SPECTROSCOPIC ANALYSIS OF BIOMOLECULES(SAB)
(ELECTIVE –II)
(For IV B.Tech. I Sem Biotechnology)

UNIT - I :Spectroscopy

Interaction of radiation with matter, Definitions : frequency, Wavelength, Wave number, types of electromagnetic radiation, interparticle forces and energies, energy levels. Population of energy levels, Scattering, Absorption and Emission.

UNIT - II : Infrared Spectroscopy

Measurement of Infranred spectrum – Physical basis of infrared spectra, Infrared of Polyatomic molecules, biological examples, Infrared of oriented samples.

UNIT - III : Ultraviolet & Visible Spectroscopy

Electronic energy levels – Electronic transitions, Selection regime, Absorption range of biological chromophores, transition metal d-d transition – change transfer spectra, application of UV spectra to proteins, properties associated withy the transition dipole moment and interaction between them, measurement of molecular dynamics by florescence spectroscopy.

UNIT - IV : Nuclear Magnetic Resonance

The phenomenon – magnetization – measurement, spectral parameters in NMR, Intensity, chemical Shift – spin, Spin coupling T1 and T2 relaxation times, line widths, nuclear overhauser effect, chemical exchange paramagnetic centres, application of NMR in biology, assignment in NMR, studies of Macromolecules, ligand, binding, ionization studies and pH kinetics, molecular motion.

UNIT - V :Electron Paramagnetic Resonance

Introduction – Resonance condition – measurement – spectral – parameters, intensity g values – spectral anisotropy, time scale of EPR – spin labels, transition metal ions, spin trapping.

Reference

1. Campbell I.D, and Dwek R.A, Biological Spectroscopy, Benjamin Cummins and Company, 1986.
2. Atkins P.W., Physical Chemistry, Oxford IV Edition, 1990.

METABOLIC ENGIEERING (MTE)
(ELECTIVE – II)
(For IV B.Tech. I Sem Biotechnology)

UNIT - I : Introduction

Induction – Jacob Monod mode, catabolite regulation, glucose effect, cAMP deficiency, feed back regulation, regulation in branched pathways, differential regulation by isoenzymes, concerted feed back regulation, cumulative feed back regulation, amino acid regulation of RNA synthesis, energy charge, regulation, permeability control, passive diffusion. Facilitated diffusion, active transport, group transportation.

UNIT - II : Synthesis Of Primary Metabolites

Alteration of feed back regulation, limiting accumulation of end products, feed back, resistant mutants, alteration of permeability.

UNIT- III : Biosyntesis of Secondary Metabolites

Precursor effects, prophase. Idiophase relationship, enzyme induction, feed back regulation, catabolite regulation by passing control of secondary metabolism, producers of secondary, metabolites.

UNIT - IV :Bioconversions

Advantages of Bioconversions, specificity, yields, factors important to bioconversions, regulation of enzyme synthesis, mutation, permeability, co-metabolism, avoidance of product inhibition, mixed or seqencial bioconversions, conversion of insoluble – substances.

UNIT - V : Regulation of Enzyme Production

Strain selection, improving fermentation, recognizing growth cycle peak, induction, feed back repression, catabolite repression, mutants resistant to repression, gene dosage.

REFERENCE

1. Wang.D.IC Cooney C.L. Demain A.L. Dunnil.P Humphrey A.E Lilly M.D. Fermentation and Enzyme Technology, John Wiley and sons, 1980.
2. Stanbury P.F. and Whitaker A., Principles of Fermentation Technology, Pergamon Press, 1984. Zubay G., Biochemistry, Macmillan Publishers, 1989.

MOLECULAR MODELING & DRUG DESIGN(MMDD)
(ELECTIVE – II)
(For IV B.Tech. I Sem Biotechnology)

UNIT- I : Empirical Force Fields and Molecular Mechanisms

Bond Stretching – Angle Bending – Torsional I terms – Out of plane – bonding motions – electrostatic interactions – Van Der Waals interactions – Effective pair potentials – Hydrogen Bonding. Simulation of liquid water.

UNIT - II : Computer Simulation Methods.

Calculation of thermodynamic properties – Phase space – Practical aspect of computer simulation – Boundaries monitoring Equilibrium – Long range process – Analysing results of simulation and estimating errors.

UNIT- III : Molecular Dynamics Simulation Methods

Molecular Dynamics using simple modules – molecular dynamics with continuous potentials – running Molecular dynamics simulation – Constant dynamics. Time dependent properties – Molecular Dynamics at constant temperature and pressure.

UNIT – IV : Monte Carlo Simulation Methods.

Metropolis methods – Monte Carlo simulation of molecules p Monte Carlo simulation
Of polymers – Calculating chemical potentials – Monte Carlo simulation Molecular dynamics.

Reference:

1. A.R. Leach, Molecular Modelling Principles and Applications, Longman, 1996.
2. J.M. Haile, Molecular Dynamics Simulation Elementary Methods, John, Wiley nd Sons, 1997.
3. GROMOS 95 Manual, BIOMOS Switzerland 1995
4. HYPERCHEM Manual hypercube Canada, 1195.

CHROMATOGRAPHIC SEPARATIONS(CMS)
(ELECTIVE – III)
(For IV B.Tech. II Sem Biotechnology)

UNIT - I : Introduction
Classification of techniques , distribution coefficients, retention chromatography, sorption mechanisms, retention parameters, factors affecting retention, qualitative and quantitative aspects of chromatography, peak shape sorption isotherms, column efficiency, band broadening processes, selectivity and resolution.

UNIT – II : Classical Chromatography
Stationary phases, applications of ion exchange size exclusion, TLC – HPTLC.

UNIT - III : High Performace Liquid Ghromatography
Introduction – design of a typical HPLC machine types of columns – applications.

UNIT - IV : Gas Chromatography
Introduction – instrumentation – columns – qualitative and quantitative aspects of gas chromatography – quantitative analysis of GC.

UNIT - V : Chiral Chromatography
Principles – types of chromatography – scopes and limitations applications – capillary electrophoresis.

Reference
1. Sewell R.A. Clarke B. Chromatographic Separations, John wiley & Sons, 1991.
2. Lindsay B. High Performance Liquid Chromatography, John Wiley & Sons, 1991.

FOOD SCIENCE & TECHNOLOGY(FST)
(ELECTIVE – III)
(For IV B.Tech. II Sem Biotechnology)

UNIT - I : Introduction to Food Processing
Biotechnology in relation to the food industry, nutritive value of food, types of microorganisms associated with food, its sources, types and behavior in foods.

UNIT - II : Food Preservation
Bioprocessing of meat, fisheries, vegetables, dairy products, enzymes and chemicals used in food processing, biochemical engineering for flavour and food production, cryopreservation, irradiated foods.

UNIT - III : Fermented Food Product
Dairy products, non beverage plant products, beverages and related products of baking.

UNIT - IV : Food Spoilage & Food Borne Disease
Quality control, case studies on Biotechnology in the evolution of food quality, HFCS, (High Fructose Corn Syrup) and mycoproteins. Food-borne infections & intoxications.

UNIT - V : Food Microbiology

Utilization of microorganisms in food Industry, genetic manipulations, Single cell protein, food borne disease. Natural and artificial sweeteners and their role in controlling diseases and deficiencies.

Reference

1. Lindsay, Willis Biotechnology, Challenges for the flavour and food Industries, Elsevier Applied Science, 1988.
2. Roger A.Gordan B. and John T. Food Biotechnology, 1989.
3. George J.B. Basic Food Microbiology, CBS Publishers Distributors, 1987.
4. James M.J. Modern Food Microbiology, CBS Publishers.
5. Frazier, Food Microbiology.

BIOLOGY OF AGEING & APOPTOSIS(BAA)
(ELECTIVE – III)
(For IV B.Tech. II Sem Biotechnology)

UNIT - I : Basic Concepts

Basic concepts of developmental Biology: mosaic and regulative development. Pattern formation, positional information. Development of fish, amphibian, avian and mammalian embryos, development of Celegans, Drosophila and Arabidopsis.

UNIT - II : Body Axes

Setting up of body axes – Dorsoventral and anteroposterior axes. Modes of axes determination.

UNIT - III : Germ Layers

Origins of Germs layers, go mite formation, role of Organizer region, Hox genes and Homeotic genes.

UNIT - IV : Drosophila Development

Drosophila development – positional information gradient, gap genes, segment polarity gene, pair-rule of maintenance-genes. Maternal and zygotic genes.

UNIT - V : Pattering

Patterning in C.elegans and slime molds, Morphogenesis, Cell differentiation, Organogenesis, Tissue growth, ageing and senescence.

Reference

L. Worlpert "Principles of Developmental Biology, Oxford University Press, 1998.

BIOPHYSICS OF MACROMOLECULES(BPM)
(ELECTIVE – IV)
(For IV B.Tech. II Sem Biotechnology)

UNIT - I : Introduction
Levels of structures in Biological macromolecules, Central questions in biophysics, basic strategies in biophysics.

UNIT – II : Conformational Analysis
Forces that determine protein and nucleic acid structure, basic problems. Polypeptide chains; geometrics, potential energy calculations, observed values for rotation angles, hydrogen bonding, hydrophobic interactions and water structures; ionic interactions, disulphide bonds.

UNIT - III : Structural Analysis of Macromolecules
Prediction of proteins structure; nucleic acids; general characteristics of nucleic acid structure, geometrics, glycosidic bond rotational isomers backbone rotational isomers and ribose puckering forces stabilizing ordered forms, base pairing, base stacking; tertiary structure of nucleic acids.

UNIT - IV : Kinetics of Ligand Interactions:
Biochemical Kinetics studies, unimolecular reactions, simple biomolecular multiple intermediates, steady state kinetics, catalytic efficiency relaxation spectrometry, ribonuclease as an example.

UNIT - V : Techniques for The Study of Biological Structure & Function
Size and shape of macromolecules methods of direct visualization- macromolecules as hydrodynamic particles – macromolecular diffusion – ultracentrifugation – viscometry; X-ray crystallography; determination of molecular structures, X-ray fibre diffraction electron microscopy; neutron scattering –light scattering.

Reference
1. Cantor R. Samuel. P.R.. Biophysical chemistry, W.H. Freeman & Co. 1985.

NEUROBIOLOGY AND COGNITIVE SCIENCES(NBCS)
(ELECTIVE – IV)
(For IV B.Tech. II Sem Biotechnology)

UNIT – I : Introduction To Nervous Systems
Central and Peripheral nervous Systems

UNIT- II : Feuro Anatomy
Structure and functions of neurons, synapse, their function, signals produced by neurons, sensors function, Glial cells, molecular and cellular organization of neuronal differentiation, characterization of neuronal cells.

UNIT - III : Neurophysiology And Neuropharmacology
Pharmaceutical mediator released by neurons. Hormones and their effect on neuronal function. Conduction of impulses by neurons, Correlation of sensory functions.

UNIT - IV : Neurological Disorders
Its Pathogenesis, Genetic basis of neurological disorders

UNIT - V : Behavour Science
Neuronal mechanism of behavior, Animal behavior, Behavior in various environments.

Reference
1. A.B. Schiebel Neurobiology of higher cognetine function Guilford Press 1990.

BIOSENSORS & BIOELECTRONICS(BSB)
(ELECTIVE – IV)
(For IV B.Tech. II Sem Biotechnology)

UNIT - I : Introduction
What are Biosensors? Advantages and limitations, various components; biocatalysis based biosensors, bioaffinity based biosensors & microorganisms based biosensors, biologically active material and analyte. Type of membranes used in biosensor constructions.

UNIT - II : Transducers In Biosensors
Various types of transducers; principles and applications – Calorimetric, optical, potentiometric / amperometric conductrometric / resistometric, piezoelectric, semiconductor, impedimetric mechanical and molecular electronics based transducers. Chemiluminiscene – based biosensors.

UNIT- III : Application And Uses Of Biosensors
Biosensors in clinical chemistry, medicine and health care; biosensors for veterinary, agriculture and food; low cost biosensor for industrial processes for online monitoring; biosensors for environmental monitoring.

UNIT - IV : Molecular Electronics
Potential advantages & Developments towards a bimolecular computer; development of molecular arrays as memory stores; molecular wires and switches; mechanisms of unit assembly;

UNIT - V : Design For A Biomolecular Photonic Computer
Assembly of photonic biomolecular memory store; Information processing; commercial prospects for biomolecular computing systems.

References
1. Aboul – Enein, H.V. Stefan, R. And Van Staden, (1999) Chemiluminiscene –based biosensors – An overview crit Rev. Anal. Chem 29,323-331.
2. Pearson, J.E. Gill, A. and Vadgama, P. (2000) Analytical aspects of biosensors Ann Clin Biochem 37, 119- 145
3. Rogers, K.R. and Mascine, M. 2001. Biosensors for analytical monitoring EPA biosensors group.
4. Roger, K.R. and Gerlach, C.L.1999. Update on environmental for biosensors.Env. Sci. Technol 33 500A – 506A.
5. Bilitewski, U. Turner, A.P.F. 2000 biosensors for environmental monitoring Harwood, Amsterdam.
6. Moses, V and Cape, R.E. 1991, Biotechnology the science and business, Harwood, Academic Publishers, London.

TISSUE ENGINEERING AND BIOMATERIALS(TEB)
(ELECTIVE – IV)
(For IV B.Tech. II Sem Biotechnology)

The biotechnological application of Biomaterials is growing tremendously in day-to-day healthcare systems. Hence, the research and development of for newer products, newer processes for production of such materials are found to be demanding.

Introduction to Biomaterials: properties regularities

Review of Cell and Tissue Structure and their Functions

Functional Requirements of Biomaterials and Tissue Replacements

Biocompatibility: Immunology of materials;

Cell material interactions / Blood compatibility

Cell material interactions / Befouling

Cardiovascular Biomaterials: Tissue properties of blood vessels, Treatments of atherosclerosis; Biomechanical design issues pertaining to stents, balloon angioplasty, and pacemakers

Testing material compatibility

Polymer properties and measurements

Biodegradation of materials

Metallic Biomaterials

Ceramic and Natural Biomaterials

Orthopedic materials

Biomaterials in gene therapy

Biomaterials in drug delivery

Biomaterials for tissue engineering

Soft Tissue Reconstruction; Natural and Synthetic. Wound healing. Tissue in growth; Stability; Biofixation, Foreign body response, Soft implants,. Case Studies Tissue Engineering: Current issues and Future Directions.

Reference

1. Biomaterials : Principals and Applications Ed J B Park and J D Bronzino CRC Press (2003)
2. Biomaterials Sciences : An introduction to Materials in Medicine, 2nd Edition (Ed) Ratner, Hoffman, Schoen, Lemons, Academic Press 2004.

TISSUE ENGINEERING AND BIOMATERIALS (TEB)
(For IV B.Tech. II Sem Biotechnology)
(ELECTIVE – IV)

One of applications of biotechnology is the cell and tissue engineering. Hence it is necessary to understand the principles and methods of engineering and life sciences toward the fundamental understanding of structure-function relationships in normal and pathological mammalian tissues, especially as they relate to the development of biological substitutes to restore, maintain, or improve tissue/organ function. Current concepts and strategies including drug delivery, tissue and cell transplantation, bioartificial organs and in vivo tissue regeneration are introduced, as well as their respective clinical applications.

Tissue Engineering : Past and Present
Tissue Structure and Function and various types of tissues and their organization
Imaging technologies for cell and tissue evaluation a
Cells as a functional element of tissue engineering
Gene Therapy
Extracellular Matrix(ECM) structure and functions
Cell and Tissue Culture
Tissue Repair: Cell migration and wound healing; wound healing materials; reconstruction and regeneration methods.
Angiogenesis
Cell and Tissue Transplantation; encapsulation of cells
Stem Cells
Biomaterials: different types, their structure and functions. Natural and synthetic biomaterials; Application of biomaterials in medical care, in dental, orthopedics, cardiovascular and other medical care, in dental, orthopedics, cardiovascular and other medical segments.
Biomechanics
Mass Transport
Cell Signaling
Mechanobiology
Bioreactors
Regulatory Issues in tissue engineering
Manufacturing issue
Tissue engineering market and their scope

Biomaterials Science; An Introduction to Materials in Medicine, 2nd Edition (ed) Ratner, Hoffman, Schoen, Lemons, Academic Press 2004.

ANIMAL BIOTECHNOLOGY AND TISSUE ENGINEERING(ABTE)
(For IV B.Tech. II Sem Biotechnology)
(ELECTIVE – IV)

Subjects

Introduction to animal tissue and cell culture – historical background; Terminology in tissue and cell culture; Application of cell cultures. Advantage and disadvantage of cell culture.

Setting of animal cell culture labs and instruments; cell culture media and their major components; Physical and chemical requirement of media: Sera and their importance in cell culture; serum free media and their use; sterilization procedure used in regents and media preparation in cell culture; contamination in cell culture.

Cell lines and primary cultures; Culturing of animal cells; suspension and adherent cells; quantification of animal cells and growth cure preparation; characterization of cell lines;

Cryopreservation techniques in cell cultures; instrument and requirement for cryopreserving cells; cell repositories.

Hybridoma techniques and monoclonal antibody production; stem cells and their applications; cloning and transfection; In vitro fertilization; cytotoxicity assays. Transgenic and cloned animals.

Scaling up of animal cells – adherent and suspension cells; physical and biophysiocal parameters of reactors; bioreactors and their functions and use.

Introduction to tissue engineering: Basic definition; current scope of development; use in therapeutics and in vitro testing; Structure and organization of tissues: epithelial, connective; vascularity, lymph. Cell-cell Interacations; Extra cellular matrix; cell migration, wound healing, cell transplantation and encapsulatiaaon of cells; biomaterials and their applications.

Specialized instruments: FACS Inverted microscope: florescent assays: Fluorescent microscope, spectrofluorometer, chemiluminescence, microinjection; electro fusion; Programmable freezers, 120 freezers, electron microscopy etc.,

Bio-safety consideration in cell culture

Reference

1. Cell and tissue cultures: Lab procedures in Biotechnology, Alan Doyal and Bryan Grifth (Ed)
2. Freshney lan: Animal cell culture techniques
3. Biomaterials: Principals and Applications Ed J B Park and J D Bronzino CRC Press 2003)

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