G.B. TECHNICAL UNIVERSITY, LUCKNOW

Syllabus

1st, 2nd, 3rd and 4th Year
(Effective from session : 2009-10)

B. TECH. BIO-TECHNOLOGY

U.P. TECHNICAL UNIVERSITY, LUCKNOW
STUDY & EVALUATION SCHEME
B. TECH. BIOTECHNOLOGY
[Effective Form session 2009-10]
YEAR I, SEMESTER-I

S. No	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY											
1.	EBT-101 or EBT-102	Elementary Mathematics-I Remedial Biology-I	3	1	0	30	20	50	100	150	4
2.	EAS-101	Engg. Physics-I	2	1	0	15	10	25	50	75	3
3.	EAS-102/ EME-102	Engg. Chemistry/ Engg. Mechanics	3	1	0	30	20	50	100	150	4
4.	EBT-103/ ECS-101	Basic Electrical & Electronics Engg. / Computer Concepts & programming in C	3	1	0	30	20	50	100	150	4
5.	EBT-104/ EAS-104	Introduction to Biotechnology / Professional Communication	3	1	0	30	20	50	100	150	4
6.	EME-101/ EAS-105	Manufacturing Processes/ Environment & Ecology	2	0	0	15	10	25	50	75	2
7.	EAS-109	*Remedial English Language**	*2*	*0*	*0*	-	-	-	*50**	*50**	*0*
PRACTICAL/TRAINING/PROJECT											
7.	EAS-152/ EME-152	Engg. Chemistry Lab/ Engg. Mechanics Lab	0	0	2	10	10	20	30	50	1
8.	EEE-151/ ECS-151	Electrical Engg Lab / Computer Programming Lab	0	0	2	10	10	20	30	50	1
9.	EWS-151/ ECE-151	Workshop Practice / Computer Aided Engg. Graphics	0	1	3	10	10	20	30	50	2
10.	EAS-151 / EAS-154	Physics Lab/ Professional Communication Lab/	0	0	2	10	10	20	30	50	1 1
			0	0	2	30	20	50	-	50	
11.	GP-101	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	18	6	9	190/210	140/150	380/410	670/640	1000	27

Remedial English language is compulsory Audit-course. Candidate has to secure minimum 30% pass marks

L	=	Lecture
T	=	Tutorial
P	=	Practical
CT	=	Cumulative Test
TA	=	Teacher's Assessment
ESE	=	End Semester Exam.

- **Note : Elementary Math-I (EBT-101) and Elementary Math-II (EBT-201) are for the students of PCB group. Remedial Biology-I (EBT-102) and Remedial Biology-II (EBT202) are for the students of PCM group.**

U.P. TECHNICAL UNIVERSITY, LUCKNOW
STUDY & EVALUATION SCHEME
B. Tech. Biotechnology
[Effective Form session 2009-10]
YEAR I, SEMESTER-II
(Revised)

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	credit
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY											
1.	EBT-201 or EBT-202	Elementary Mathematics-II/ Remedial Biology-II	3	1	0	30	20	50	100	150	4
2.	EAS-201	Engg. Physics-II	2	1	0	15	10	25	50	75	3
3.	EME-201 EAS-202	Engg. Mechanics/ Engg. Chemistry	3	1	0	30	20	50	100	150	4
4.	ECS-201/ EBT-203	Computer Concepts & Programming/ Basic Electrical & Electronics Engg.	3	1	0	30	20	50	100	150	4
5.	EAS-204/ EBT-204	Professional Communication/ Introduction to Biotechnology	3	1	0	30	20	50	100	150	4
6.	EAS-205/ EME-201	Environment & Ecology/ Manufacturing Processes	2	0	0	15	10	25	50	75	1
PRACTICAL/TRAINING/PROJECT											
7.	EME-252/ EAS-252	Engg. Mechanics Lab/ Engg. Chemistry Lab	0	0	2	10	10	20	30	50	1
8.	ECS-251/ EEE-251	Computer Programming Lab/	0	0	2	10	10	20	30	50	1
9.	ECE-251/ EWS-251	Computer Aided Graphics / Workshop Practice	0	1	3	10	10	20	30	50	2
10.	EAS-254/ EAS-251	Professional Communication Lab/ Physics Lab	0	0	2	30	20	50	-	50	1
			0	0	2	10	10	20	30	50	1
11.	GP-201	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	16	6	9	210/190	150/140	410/380	590/620	1000	27

U.P. TECHNICAL UNIVERSITY, LUCKNOW
Study and Evaluation Scheme
B.TECH. BIO-TECHNOLOGY
[Effective from the session 2009-10]
YEAR 2nd , SEMESTER-III
(Revised)

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY SUBJECTS											
1.	ECH-305	Fluid Flow & Solid Handling	2	1	0	15	10	25	50	75	3
2.	EAS-302/ EOE-031 / EOE038	Statistical Techniques/Science Based Open Electives	3	1	0	30	20	50	100	150	4
3.	EHU-301 / EHU302	Industrial Psychology/ Industrial Sociology	2	0	0	15	10	25	50	75	2
4.	EBT-301	Biochemistry	3	1	0	30	20	50	100	150	4
5.	EBT-302	Microbiology & Cell Biology	3	1	0	30	20	50	100	150	4
6.	EBT-303	Molecular Dynamics & Bioenergetics	3	1	0	30	20	50	100	150	4
PRACTICAL/DESIGN/DRAWING											
7.	EBT-351	Fluid Mechanics Lab	0	0	2	10	10	20	30	50	1
8.	EBT-352	Biochemistry Lab	0	0	2	10	10	20	30	50	1
9.	EBT-353	Microbiology Lab	0	0	2	10	10	20	30	50	1
10.	EBT-354	Cell Biology Lab	0	0	2	10	10	20	30	50	1
11.	GP 301	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	-	-	-	-	-	-	-	1000	26

Science Based Open Electives :

Paper Code	Name
EOE-031/EOE-041	Introduction to Soft Computing (Neural Networks, Fuzzy Logic and Genetic Algorithm)
EOE-032/EOE-042	Nano Sciences
EOE033/EOE-043	Laser Systems and Applications
EOE-034/EOE-044	Space Sciences
EOE035/EOE-045	Polymer Science & Technology
EOE-036/EOE-046	Nuclear Science
EOE037/EOE/047	Material Science
EOE-038/EOE-048	Discrete Mathematics

U.P. TECHNICAL UNIVERSITY, LUCKNOW
Study and Evaluation Scheme
B.TECH. BIO-TECHNOLOGY
[Effective from the session 2009-10]
YEAR 2nd , SEMESTER-IV

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY SUBJECTS											
1.	EHU-402/ EHU-401	Industrial Sociology/Industrial Psychology	2	0	0	15	10	25	50	75	2
2.	EOE-041- EOE-048/ EAS-402	Science Based Open Electives / Statistical Techniques	3	1	0	30	20	50	100	150	4
3.	EBT-401	Enzyme Engineering	3	1	0	30	20	50	100	150	4
4.	EBT-402	Immunology	3	1	0	30	20	50	100	150	4
5.	EBT-403	Genetics & Molecular Biology	3	1	0	30	20	50	100	150	4
6.	EBT-404	Bioinformatics-I	3	1	0	30	20	50	100	150	4
PRACTICAL/DESIGN/DRAWING											
7.	EBT-451	Immunology Lab	0	0	3	10	10	20	30	50	1
8.	EBT-452	Molecular Biology Lab	0	0	3	10	10	20	30	50	1
9.	EBT-453	Bioinformatics-I Lab	0	0	2	5	5	10	15	25	1
10.	GP 401	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1000**	**26**

U.P. TECHNICAL UNIVERSITY, LUCKNOW
Study and Evaluation Scheme
B.TECH. BIO-TECHNOLOGY
[Effective from the session 2010-11]
YEAR 3rd , SEMESTER-V

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY SUBJECTS											
1.	EHU-501	Engineering and Managerial Economics	3	1	0	30	20	50	100	150	3
2.	ECS-508	Data Structure and Algorithm	3	1	0	30	20	50	100	150	4
3.	EBT-501	Genetic Engineering	3	1	0	30	20	50	100	150	4
4.	EBT-502	Bio-Informatics-II	2	1	0	15	10	25	50	75	3
5.	EBT-503	Bioprocess Engineering-I	2	1	0	15	10	25	50	75	3
6.	EBT-504	Modern Analytical Techniques	3	1	0	30	25	50	100	150	4
PRACTICAL/DESIGN/DRAWING											
7.	EBT-551	Genetic Engineering Lab	0	0	3	10	10	20	30	50	1
8.	EBT-552	Bioinformatics-II Lab	0	0	2	10	10	20	30	50	1
9.	EBT-553	Bioprocess Engineering Lab	0	0	2	10	10	20	30	50	1
10.	EBT-554	Analytical Techniques Lab	0	0	3	10	10	20	30	50	1
11.	GP 501	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	-	-	-	-	-	-	-	**1000**	**26**

U.P. TECHNICAL UNIVERSITY, LUCKNOW
Study and Evaluation Scheme
B.TECH. BIO-TECHNOLOGY
[Effective from the session 2010-11]
YEAR 3rd , SEMESTER-VI
(Revised)

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.					
			L	T	P	CT	TA	Total	ESE		
THEORY SUBJECTS											
1.	EHU-601	Industrial Management	3	0	0	30	20	50	100	150	3
2.	EBT-011-EBT-012	Departmental Elective-I	3	1	0	30	20	50	100	150	4
3.	EBT-021-EBT-022	Departmental Elective-II	2	1	0	15	10	25	50	75	3
4.	EBT-601	Fermentation Biotechnology	3	1	0	30	20	50	100	150	4
5.	EBT-602	Food Biotechnology	3	1	0	30	20	50	100	150	4
6.	ECH-606	Heat & Mass Transfer	3	1	0	30	20	50	100	150	4
PRACTICAL/DESIGN/DRAWING											
7.	EBT-651	Fermentation Biotechnology Lab	0	0	3	10	10	20	30	50	1
8.	EBT-652	Food Biotechnology Lab	0	0	3	10	10	20	30	50	1
9.	ECH-656	Heat Transfer Lab	0	0	2	5	5	10	15	25	1
10.	GP 601	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1000**	**26**

U.P. TECHNICAL UNIVERSITY, LUCKNOW
Study and Evaluation Scheme
B.TECH BIO-TECHNOLOGY
[Effective from the session 2011-12]
YEAR 4th , SEMESTER-VII
(Revised)

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.			ESE		
			L	T	P	CT	TA	Total			
THEORY SUBJECTS											
1.	EOE-071-EOE-074	Open Elective-I	3	1	0	30	20	50	100	150	4
2.	EBT-031-EBT-032	Departmental Elective-III	3	1	0	30	20	50	100	150	4
3.	EBT-041-EBT-042	Departmental Elective-IV	3	1	0	30	20	50	100	150	4
4.	EBT-701	Down Stream Processing	3	1	0	30	20	50	100	150	4
5.	EBT-702	Bioethics, Biosafety & IPR	3	0	0	30	20	50	100	150	4
PRACTICAL/DESIGN/DRAWING											
6.	EBT-751	Down Stream Processing Lab	0	0	3	-	20	20	30	50	1
7.	EBT-752	Project	0	0	3	-	50	50	-	50	2
8.	EBT-753	Seminar	0	0	2	-	50	50	-	50	1
9.	EBT-754	Industrial Training Viva-Voce	0	0	2	-	50	50	-	50	1
10.	GP 701	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	15	3	10	150	270	470	530	1000	26

Open Electives-I

EOE-071   Entrepreneurship Development
EOE-072   Quality Management
EOE-073   Operation Research
EOE-074   Introduction to Biotechnology

Note : Biotechnology students cannot take the Open Elective course EOE-074 Introduction to Biotechnology.

U.P. TECHNICAL UNIVERSITY, LUCKNOW
Study and Evaluation Scheme
B.TECH BIO-TECHNOLOGY
[Effective from the session 2011-12]
YEAR 4th , SEMESTER-VIII

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total	Credit
						SESSIONAL EXAM.					
			L	T	P	CT	TA	Total	ESE		
THEORY SUBJECTS											
1.	EOE-081-EOE-084	Open Elective-II**	3	1	0	30	20	50	100	150	4
2.	EBT-051-EBT-052	Departmental Elective-V	3	1	0	30	20	50	100	150	4
3.	EBT-061-EBT-062	Departmental Elective-VI	3	1	0	30	20	50	100	150	4
4.	EBT-801	Environmental Biotechnology	3	0	0	30	20	50	100	150	3
PRACTICAL/DESIGN/DRAWING											
5.	EBT-851	Project	0	0	12	-	100	100	250	350	8
6.	GP 801	General Proficiency	-	-	-	-	-	50	-	50	1
		Total	**12**	**3**	**12**	**120**	**180**	**350**	**650**	**1000**	**24**

Open Electives-II

Paper Code	Name
EOE-081	Non Conventional Energy Resources
EOE-082	Non Linear Dynamic System
EOE-083	Product Development
EOE-084	Automation and Robotics

B.TECH. BIOTECHNOLOGY
List of Departmental Electives

Elective-I

S.No.   Paper Code   Name

1.   EBT-011   Animal Biotechnology
2.   EBT-012   Plant Biotechnology

Elective-II

1.   EBT-021   Enzyme & Protein Engineering
2.   EBT-022   Biophysics
3.
Elective-III

1.   EBT-031   Vaccine Technology & Immunoinformatics
2.   EBT-032   Biofuels & Alcohal Technology

Elective-IV

1.   EBT-041   Molecular Modeling & Drug Design
2.   EBT-042   Bioprocess Engineering-II

Elective-V

1.   EBT-051   Biotechnology in Health Care
2.   EBT-052   Nanobiotechnology
Elective-VI

1.   EBT-061   Biomedical Instrumentation
2.   EBT-062   Genomics & Proteomics

EBT-101 : Elementary Mathematics –I

UNIT-I: CALCULUS
Limits and Derivatives:
Derivative introduced as rate of change both as that of distance function and geometrically, intuitive idea of limit. Definition of derivative, relate it to slope of tangent of the curve, derivative of sum, difference, product and quotient of functions. Derivatives of polynomial and trigonometric functions.

UNIT-II :
Continuity and Differentiability: Continuity and differentiability, derivative of composite functions, chain rule, derivatives of inverse trigonometric functions, derivative of implicit function.Concept of exponential and logarithmic functions and their derivative. Logarithmic differentiation. Derivative of functions expressed in parametric forms. Second order derivatives. Rolle's and Lagrange's Mean Value Theorems (without proof) and their geometric interpretations.
Applications of Derivatives:
Applications of derivatives: rate of change, increasing/decreasing functions, tangents & normals, approximation, maxima and minima (first derivative test motivated geometrically and second derivative test given as a provable tool). Simple problems (that illustrate basic principles and understanding of the subject as well as real-life situations).

UNIT – III :
Integrals: Integration as inverse process of differentiation. Integration of a variaty of functions by substitution, by partial fractions and by parts, only simple integrals of the type to be evaluated. Definite integrals as a limit of a sum, Fundamental Theorem of Calculus (without proof). Basic properties of definite integrals and evaluation of definite integrals.
Applications of the Integrals: Applications in finding the area under simple curves, especially lines, areas of circles/parabolas/ellipses (in standard form only), area between the two above said curves (the region should be clearly identifiable).

UNIT –IV : Differential Equations
Definition, order and degree, general and particular solutions of a differential equation. Formation of differential equation whose general solution is given.Solution of differential equations by method of separation of variables, homogeneous differential equations of first order and first degree. Solutions of linear differential equation of the type:+ py = q, where p and q are functions of *x.*

UNIT –V : PROBABILITY
Random experiments: outcomes, sample spaces (set representation). Events: occurrence of events, 'not', 'and' and 'or' events, exhaustive events, mutually exclusive events Axiomatic (set theoretic) probability, connections with the theories of earlier classes. Probability of an event, probability of 'not', 'and' & 'or' events. Multiplication theorem on probability. Conditional probability, independent events, total probability, Baye's theorem, Random variable and its probability distribution, mean and variance of haphazard variable. Repeated independent (Bernoulli) trials and Binomial distribution.

Recommended Textbooks.
1) Mathematics Part I - Textbook for Class XI, NCERT Publication
2) Mathematics Part II - Textbook for Class XI, NCERT Publication
Recommended Textbooks.
1) Mathematics Part I - Textbook for Class XII, NCERT Publication
2) Mathematics Part II - Textbook for Class XII, NCERT Publication
Reference books:

1) Higher engineering mathematics by B.V.Ramana (Tata Macgraw Hill)
2) Advanced modern engineering mathemtics by Glyn james (pearson education)

EBT-102 : Remedial Biology –I

UNIT -I
Diversity in Living World
Diversity of living organisms Classification of the living organisms (five kingdom classification, major groups and principles of classification within each kingdom).
Systematics and binomial System of nomenclature.

UNIT -II
Salient features of animal and plant classification, viruses, viroids, lichens, Botanical gardens, herbaria, zoological parks and museums.

UNIT -III
Structural Organisation
Tissues in animals and plants.Morphology, anatomy and functions of different parts of flowering plants: Root, stem, leaf, inflorescence, flower, fruit and seed.

UNIT - IV
Cell: Structure and Function
Cell: Cell theory; Prokanyotic and encaryotic cell, cell wall, cell membrane. Nucleus and nuclear organization. Mitosis, meiosis, cell cycle (elementary idea).Basic chemical constituents of living bodies.

UNIT - V
Plant Physiology
Movement of water, food, nutrients and gases, Respiration, Photosynthesis, Plant growth and development.

Recommended Textbooks.
1) Biology - Textbook for Class XI, NCERT Publication
Recommended Textbooks.
1) Biology - Textbook for Class XII, NCERT Publication

Reference book:

Biology by Peter H Raven, George B Johnrson, Kenneth A. Mason, Jonathan Losos, Susan Singer(Macgraw Hill)

EAS-101 : ENGINEERING PHYSICS-I

	L	T	P
	2	1	0

Unit – I
Relativistic Mechanics:
Inertial & non-inertial frames, Michelson- Morley experiment, Einsteins postulates. Lorentz transformation equations. Length contraction & Time dilation, Addition of velocities; Variation of mass with velocity Mass energy equivalence.   06 Hrs.

Unit - II
Optics:
Interference: Interference of light, Biprism experiment, displacement of fringes, Interference in thin films- wedge shaped film, Newton's rings,

Diffraction - Single, Double & N- Slit, Diffraction grating, Grating spectra, Rayleigh's criterion and resolving power of grating. 10 Hrs.

Unit - III

Polarization- Phenomena of double refraction, Nicol prism, Production and analysis of plane, circular and elliptical polarized light, Fresnel's theory of optical activity, Polarimeters .

Laser: Spontaneous and stimulated emission of radiation, Einstein's Coefficients, construction and working of Ruby, He-Ne lasers and laser applications. 08 Hrs.

Unit – IV

Fiber Optics and Holography

Fundamental ideas about optical fiber, Types of fibers, Acceptance angle and cone, Numerical aperture, Propagation mechanism and communication in optical fiber. Attenuation, Signal loss in optical fiber and dispersion.

Basic Principle of Holography, Construction and reconstruction of Image on hologram and applications of holography. 06 Hrs.

Reference Books:

(i)	Concepts of Modern Physics	-	Aurthur Beiser (Mc-Graw Hill)
(ii)	Introduction to Special theory of Relativity	-	Robert Resnick - Wiely
(iii)	Optics	-	Ajoy Ghatak (TMH)
			Brijlal & Subramanian (S. Chand)
(iv)	Optical Fibre & Laser	-	Anuradha De. (New Age)
(v)	Fundamental of Physics	-	Resnick, Halliday & Walker (Wiely)
(vi)	Principles of Physics	-	R.A. Serway & J.W. Jewett (Thomson Asia Pvt. Ltd.)

EAS102/EAS202 : ENGINEERING CHEMISTRY

```
                        L   T   P
                        3   1   0
```

UNIT-I : CHEMICAL BONDING AND STATES OF MATTER

M.O. theory and its applications in diatonic molecules. Hydrogen bond, metallic bond and their applications. Various states of matter including liquid crystallite state, classification and applications of liquid crystals. Types of unit cell, space lattice (only cubes, Bragg's Law. Calculation and density of the unit cell, one and two dimensional solids such as graphite and its conduction properties. Fullerenes and their applications.

UNIT-II: REACTION KINETICS, PHASE RULE AND ELECTROCHEMISTRY

Order and molecularity of reactions, Zero order, first order and second order reactions. Integrated rate equations. Theories of reaction rates. Phase rule and its applications to one component system (water). Equilibrium potential, electrochemical cells, galvanic and concentration cells, electrochemical theory of corrosion and protection of corrosion. Fuel cells.

UNIT-III : STRUCTURAL AND MECHANISTIC CONCEPTS OF ORGANICS

Inductive, electromeric mesomeric and hyperconjugative effects. Stability of reaction intermediates e.g. carbocation and free radicals. Mechanism of nucleophilic substitutions. Mechanism of the following reactions:
  (i)   Aldol condensation
  (ii)   Cannizaro reaction
  (iii) Beckman rearrangement
  (iv)   Hoffmann rearrangement and
  (v)   Diels-Alder reaction.
     E-Z nomenclature, R.S. configuration, optical isomerism, chirality and its implications, conformations of butene.

UNIT-IV : POLYMERS AND ORGANOMETALLICS

Polymerization and its classification. Thermoplastic and Thermosetting resins. Eleastomers and synthetic fibres. Ion exchange resins. Organic conducting and biodegradable polymers.

Classification and general methods of synthesis of organics and their applications in polymerizations and catalysis.

UNIT-V : ANALYTICAL METHODS AND FUELS

Titrimetic analysis with reference to acid-base, redox, precipitations and complexometric titrations. Elementary ideas and simple applications of u.v., visible, infra-red and ^{H}NMR spectral techniques. Water treatment methods for boiler feed water by calgon process, zeolites and ion-exchange resins. Classification of fuels. Analysis of coal, determination of colorific values. Biomass and biogas.

Text Books
1. Advanced Inorganic Chemistry, by Cotton, F.A., Wilkinson G., Murrillo, C.A. and Bochmann, Wiley, ehichester, 1999.
2. March's Advanced Organic Chemistry : Reactions, Mechanisms and Structure Smith, Michael B./March, Jerry, John Willey & sons, 6th Edition, 2007.
3. Elements of Physical Chemistry, Glasstonne, Samuel B. ELBS, 2005.
4. Organic Chemistry, Finar, I.L. : Addision – Wesley Longman, Limited, 2004.

Reference Books
1. Text Book of Polymer Science by F.W. Billmeyer, John Wiley & sons, 1994.
2. Liquid Crystals and Plastic Crystals, vol.-I, edited by G.W. Gray and P.A. Winsor, Ellis Harwood Series in Physical Chemistry, New York.
3. Corrosion Engineering by M.G. Fontana McGraw Hill Publications.

EME-102 / EME-202 : ENGINEERING MECHANICS

                                                                           L T P
                                                                           3 1 0

UNIT I
Two Dimensional Force Systems: Basic concepts, Laws of motion, Principle of Transmissibility of forces, Transfer of a force to parallel position , Resultant of a force system, Simplest Resultant of Two dimensional concurrent and Non-concurrent Force systems, Distributed force system, Free body diagrams, Equilibrium and Equations of Equilibrium, Applications.   5

Friction: Introduction, Laws of Coulomb Friction, Equilibrium of Bodies involving Dry-friction, Belt friction, Application.   3

UNIT II
Beam: Introduction, Shear force and Bending Moment, Differential Equations for Equilibrium, Shear force and Bending Moment Diagrams for Statically Determinate Beams.   5

Trusses: Introduction, Simple Truss and Solution of Simple truss, Method f Joints and Method of Sections.   3

UNIT III
Centroid and Moment of Inertia: Centroid of plane, curve, area, volume and composite bodies, Moment of inertia of plane area, Parallel Axes Theorem, Perpendicular axes theorems, Principal Moment Inertia, Mass Moment of Inertia of Circular Ring, Disc, Cylinder, Sphere and Cone about their Axis of Symmetry.   6

UNIT IV
Kinematics of Rigid Body: Introduction, Plane Motion of Rigid Body, Velocity and Acceleration under Translation and Rotational Motion, Relative Velocity.   4

Kinetics of Rigid Body: Introduction, Force, Mass and Acceleration, Work and Energy, Impulse and Momentum, D'Alembert's Principles and Dynamic Equilibrium.   4

UNIT V
Simple Stress and Strain: Introduction, Normal and Shear stresses, Stress- Strain Diagrams for ductile and brittle material, Elastic Constants, One Dimensional Loading of members of varying cross-sections, Strain energy.   3
Pure Bending of Beams: Introduction, Simple Bending Theory, Stress in beams of different cross sections.   3
Torsion: Introduction, Torsion of shafts of circular section, torque and twist, shear stress due   to torque.   3

Text books:
1.   Engineering Mechanics by Irving H. Shames, Prentice-Hall
2.   Mechanics of Solids by Abdul Mubeen, Pearson Education Asia.
3.   Mechanics of Materials by E.P.Popov, Prentice Hall of India Private Limited.

EBT -103/ EBT-203 : Basic Electrical and Electronics Engineering

Unit-I   6
D C Circuit Analysis and Network Theorems:
Circuit Concepts: Concepts of network, Active and passive elements, voltage and current sources, concept of linearity and linear network, unilateraland bilateral elements, R, L and C as linear element transformation.
Kirchhoff's laws; loop and nodal methods of analysis
Network Theorems: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem

Unit-2   6
Electrical machines: Principles of electro mechanical energy conversion,
DC machines: types, e. m. f. equation of generator and torque equation of motor, characteristics and applications of dc motors
Single phase induction motor : Principle of operation and introduction to methods of starting applications.

Unit-3   14
Semiconductor Diodes and Applications:
p-n junction, depletion layer, diode ratings (average current, repetitive peak current, peak-inverse voltage) p-n junction as rectifiers (half wave and full wave) filter (Shunt capacitor filter), clippling circuits, clamping circuits, Zener Diode.
Bipolar Junction Transistor (BJT):
basic construction, transistor action, CB, CE and CC configurations, input/ output characteristics, Different types of transistor biasing
JFET: Basic construction, principle of working, concept of pinch-off   maximum drain saturation current, input and transfer characteristics characteristic equation, CG, CS and CD configurations, fixed and self biasing of JFET amplifier

Unit-4   10
Switching Theory and logic design:
number system, conversion of bases (decimal, binary, octal and hexadecimal numbers) addition and subtraction, BCD numbers, Boolean algebra, logic gates, concept of universal gates canonical forms, minimization using K-map

Unit-5   4
Electrical Instruments:
Types of instruments, construction and working principles of PMMC and moving iron type voltmeters & ammeters, single phase dynamometer wattmeter and induction type energy meter.

Electronics Instruments:
working principle of digital voltmeter, digital multimeter (block diagram approach) CRO (its working with block diagram) measurement of voltage, current, phase and frequency using CRO
Text Books and Reference Books:

1) Robert L. Boylestad/ Louis Nashelsky "Electronic Devices and Circuit Theory", 9th Edition, Pearson Education
2) Devid A. Bell "Electronic Devices and Circuits", 5th Edition, OXFORD University Press 2008
3) Morris Mano "Digital Computer Design", PHI 2003
4) H.S. Kalsi "Electronic Instrumentation", 2nd Edition, TMH 2007
5) D.E. Fitzgerald & A. Grabel Higginbotham, " Basic Electrical   Engineering "
6) I.J. Nagarath, " Basic Electrical Engineering" Tata McGraw Hill

ECS-101/ECS-201 : COMPUTER CONCEPTS AND PROGRAMMING IN C

L T P
3 1 0

UNIT 1:
Introduction to any Operating System [Unix, Linux, Windows], Programming Environment, Write and Execute the first program, Introduction to the Digital Computer; Concept of an algorithm; termination and correctness. Algorithms to programs: specification, top-down development and stepwise refinement. Introduction to Programming, Use of high level programming language for the systematic development of programs. Introduction to the design and implementation of correct, efficient and maintainable programs, Structured Programming, Trace an algorithm to depict the logic, Number Systems and conversion methods

UNIT 2:
Standard I/O in "C", **Fundamental Data Types and Storage Classes:** Character types, Integer, short, long, unsigned, single and double-precision floating point, storage classes, automatic, register, static and external, **Operators and Expressions:** Using numeric and relational operators, mixed operands and type conversion, Logical operators, Bit operations, Operator precedence and associativity,

UNIT 3:
Conditional Program Execution: Applying if and switch statements, nesting if and else, restrictions on switch values, use of break and default with switch, **Program Loops and Iteration:** Uses of while, do and for loops, multiple loop variables, assignment operators, using break and continue, **Modular Programming:** Passing arguments by value, scope rules and global variables, separate compilation, and linkage, building your own modules.

UNIT 4:
Arrays: Array notation and representation, manipulating array elements, using multidimensional arrays, arrays of unknown or varying size, **Structures:** Purpose and usage of structures, declaring structures, assigning of structures, **Pointers to Objects:** Pointer and address arithmetic, pointer operations and declarations, using pointers as function arguments, Dynamic memory allocation, defining and using stacks and linked lists.

UNIT 5:
Sequential search, Sorting arrays, Strings, Text files, **The Standard C Preprocessor:** Defining and calling macros, utilizing conditional compilation, passing values to the compiler, **The Standard C Library:** Input/Output : fopen, fread, etc, string handling functions, Math functions : log, sin, alike Other Standard C functions.

Lecture-wise Break-UP

Week	Lecture 1	Lecture 2	Lecture 3	Lab Meeting
Week-1	Introduction to any OS,	A Simple C program	Need of Datastructures &	Get familiar with OS and Environment.

			Algorithms	
Week-2	An Example, Termination, Correctness	Different Types of Programming Languages	Number Systems	Get familiar with C compiler Implement and Test Small Routine in C
Week-3	Number Systems	Standard I/O in C	Data Types and Variables	Implement and Test Small Routine in C
Week-4	Data Types and Variable	Data Types and Variable	Operators & Expression	Evaluation of Expression
Week-5	Operators & Expression	Operators & Expression	Operators & Expression	Evaluation of Expression
Week-6	IF, SWITCH Statements	IF, SWITCH Statements	Nested If Statement	Iteration
Week-7	Repetition structure in C	Repetition structure in C	Modular Programming	Iteration, Function
Week-8	Modular Programming	Modular Programming	Arrays	Recursion, Function
Week-9	Arrays	Structures	Structures	Arrays, Structures
Week-10	Pointers	Pointers	Pointers	Linked Lists
Week-11	Searching	Selection	Sorting	Searching, Selection
Week-12	Sorting	Strings	Strings	Sorting, Strings
Week-13	Files	Files	Std C Preprocessor	Files
Week-14	Std C Library	Std C Library	Std C Library	Use of Std. C Library

Text Books :
1. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B.Koffman, Pearson Addision-Wesley, 2006.
2. Computer Science- A Structured Programming Approach Using C, by Behrouz A. Forouzan, Richard F. Gilberg, Thomson, Third Edition [India Edition], 2007

EBT -104/ EBT -204 : Introduction to Biotechnology

Unit I
Introduction to Biotechnology
Fundamentals of Biochemical Engineering, Biotechnology and Society. Principles and Processes; Application in Health, food, medicine and Agriculture; genetically modified (GM) organisms; biosafety issues.

Unit II
Biomolecules
Building Blocks of Biomolecules-Structure and dynamics. Structure and function of Macromolecules (Carbohydrates, Proteins ,Lipids). Classification of Enzymes; Purification and characterization of enzymes from natural sources. Comparison of chemical and enzyme catalysis.

Unit III

Cell as a basic unit of life. Introduction: Definition, Study of Microbes, Types of microbes, Classification of microbes. Origin of microbiology. Application of microbes in fermentation Biotechnology. Cellular Techniques including chromatography.

Unit IV

History of Bioinformatics. Introduction and application. Biological databases (nucleotide and protein data bases, Structure databases) and their retrival.. Sequence file formats . Information Sources Analysis using Bioinformatics tools.

Unit V

Genomics

Introduction Genome Sequencing Projects, Gene Prediction and counting, Genome similarity, SNP's and comparative genomics.

TEXT BOOKS:
1. Text book of Biotechnology by H.K.Dass (Wiley India publication)
 2. Biotechnology by B.D.Singh (Kalyani Publishers)
3. Text book of Biotechnology by R.C.Dubey (S.Chand and company)

Reference books:
1) Introduction to Biotechnology by William J. Thieman, Michael A. Palladino, Publisher: Benjamin Cummings
2) Basic Biotechnology by Colin Ratledge Publisher: Cambridge University Press

EAS-104/EAS-204 : PROFESSIONAL COMMUNICATION

L T P
3 1 0

Unit -1 Basics of Technical Communication
Technical Communication: features; Distinction between General and Technical communication; Language as a tool of communication; Levels of communication: Interpersonal, Organizational, Mass communication; The flow of Communication: Downward, Upward, Lateral or Horizontal (Peer group); Importance of technical communication; Barriers to Communication.   5

Unit - II Constituents of Technical Written Communication
Words and Phrases: Word formation. Synonyms and Antonyms; Homophones; Select vocabulary of about 500-1000 New words; Requisites of Sentence Construction: Paragraph Development: Techniques and Methods -Inductive, Deductive, Spatial, Linear, Chronological etc; The Art of Condensation- various steps.   8

Unit - III Forms of Technical Communication
Business Letters: Sales and Credit letters; Letter of Enquiry; Letter of Quotation, Order, Claim and Adjustment Letters; Job application and Resumes.
Official Letters: D.O. Letters; Govt. Letters, Letters to Authorities etc.
Reports: Types; Significance; Structure, Style & Writing of Reports.
Technical Proposal; Parts; Types; Writing of Proposal; Significance.
Technical Paper, Project. Dissertation and Thesis Writing: Features, Methods & Writing.   10

Unit - IV Presentation Strategies
Defining Purpose; Audience & Locale; Organizing Contents; Preparing Outline; Audio-visual Aids; Nuances of Delivery; Body Language; Space; Setting Nuances of Voice Dynamics; Time-Dimension.   7

Unit - V Value- Based Text Readings
Following essays form the suggested text book with emphasis on Mechanics of writing,
(i)   The Aims of Science and the Humanities by M.E. Prior
(ii)   The Language of Literature and Science by A.Huxley
(iii)   Man and Nature by J.Bronowski
(iv)   The Mother of the Sciences by A.J.Bahm
(v)   Science and Survival by Barry Commoner
(vi)   Humanistic and Scientific Approaches to Human Activity by Moody E. Prior
(vii)   The Effect of Scientific Temper on Man by Bertrand Russell.   10

Text Book
1.	Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, New Delhi .
2.	Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press 2007, New Delhi.

Reference Books
1.	Effective Technical Communication by Barun K. Mitra, Oxford Univ. Press, 2006, New Delhi
2.	Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., New Delhi.
3.	How to Build Better Vocabulary by M.Rosen Blum, Bloomsbury Pub. London.
4.	Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. & Distributors; Delhi.
5.	Developing Communication Skills by Krishna Mohan, Meera Banerji- Macmillan India Ltd. Delhi.
6.	Manual of Practical Communication by L.U.B. Pandey & R.P. Singh; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, Delhi.

EME-101/EME-201 : MANUFACTURING PROCESSES

Unit-I   Basic Metals & Alloys : Properties and Applications

Properties of Materials: Strength, elasticity, stiffness, malleability, ductility, brittleness, toughness and hardness. Elementary ideas of fracture, fatigue & creep.   **2**

Ferrous Materials: Carbon steels, its classification based on % carbon as low, mild, medium & high carbon steel, its properties & applications. Wrought iron. Cast iron. Alloy steels: stainless steel, tool steel.   Elementary introduction to Heat- treatment of carbon steels: annealing, normalizing, quenching & tempering and case-hardening.   **3**

Non-Ferrous metals & alloys: Common uses of various non-ferrous metals & alloys and its composition such as Cu-alloys: Brass, Bronze, Al-alloys such as Duralumin.   **2**

Unit-II   Introduction to Metal Forming & Casting Process and its applications

Metal Forming: Basic metal forming operations & uses of such as : Forging , Rolling , Wire & Tube-drawing/making and Extrusion, and its products/applications. Press-work, & die & punch assembly, cutting and forming, its applications. Hot-working versus cold-working.   **4**

Casting: Pattern & allowances. Molding sands and its desirable properties. Mould making with the use of a core. Gating system. Casting defects & remedies. Cupola Furnace. Die-casting and its uses.   **3**

Unit-III   Introduction to Machining & Welding and its applications

Machining: Basic principles of Lathe-machine and operations performed on it. Basic description of machines and operations of Shaper-Planer, Drilling, Milling & Grinding.   **4**

Welding: Importance & basic concepts of welding, classification of welding processes. Gas-welding, types of flames. Electric-Arc welding. Resistance welding. Soldering & Brazing and its uses.   **3**

Unit-IV   Misc. Topics

Manufacturing: Importance of Materials & Manufacturing towards Technological & Socio-Economic developments. Plant location. Plant layout – its types. Types of Production. Production versus Productivity.   **3**

Non-Metallic Materials: Common types & uses of Wood, Cement-concrete, Ceramics, Rubber, Plastics and Composite-materials.   **2**

Misc. Processes: Powder-metallurgy process & its applications, Plastic-products manufacturing, Galvanizing and Electroplating.   **2**

EAS105/EAS205 : ENVIRONMENT & ECOLOGY

2 -0 -0

UNIT-I
Definition, Scope & Importance, Need For Public Awareness- Environment definition, Eco system – Balanced ecosystem, Human activities – Food, Shelter, Economic and social Security. 3
Effects of human activities on environment-Agriculture, Housing, Industry, Mining and Transportation activities, Basics of Environmental Impact Assessment. Sustainable Development. 3

UNIT-II
Natural Resources- Water Resources- Availability and Quality aspects. Water borne diseases, Water induced diseases, Fluoride problem in drinking water. Mineral Resources, Forest Wealth, Material cycles- Carbon, Nitrogen and Sulphur Cycles. 4
Energy – Different types of energy, Electro-magnetic radiation. Conventional and Non-Conventional sources – Hydro Electric, Fossil Fuel based, Nuclear, Solar, Biomass and Bio-gas. Hydrogen as an alternative future source of Energy. 4

UNIT-III
Environmental Pollution and their effects. Water pollution, Land pollution. Noise pollution, Public Health aspects, Air Pollution, Solid waste management. 3
Current Environmental Issues of Importance : Population Growth, Climate Change and Global warming- Effects, Urbanization, Automobile pollution. 3
Acid Rain, Ozone Layer depletion, Animal Husbandry. 3

UNIT-IV
Environmental Protection- Role of Government, Legal aspects, Initiatives by Non-governmental Organizations (NGO), Environmental Education, Women Education. 3

Text Books
1.	Environmental Studies – Benny Joseph – Tata McgrawHill-2005
2.	Environmental Studies – Dr. D.L. Manjunath, Pearson Education-2006.
3.	Environmental studies – R. Rajagopalan – Oxford Publication - 2005.
4.	Text book of Environmental Science & Technology – M. Anji Reddy – BS Publication..

Reference Books
1.	Principles of Environmental Science and Engineering – P. Venugoplan Rao, Prentice Hall of India.
2.	Environmental Science and Engineering – Meenakshi, Prentice Hall India.

EAS-109 : REMEDIAL ENGLISH LANGUAGE

L T P
2 0 0

Unit -1 Basic Applied Grammar and Usage
The Sentences; Kinds of Sentences; Kinds of Phrases; Parts of Speech: Noun: Kinds, Gender; Case; Usage: Rules for Singular Nouns, Nouns in Plural form but Singular in sense etc. Nouns ending in - ics. Nouns ending in - es etc;
Pronoun: Definition, Kinds; Number, Gender, Person, Usage.
Adjectives and Determiners: Kinds, Position; Comparatives and Superlatives,
Conversion of Adjectives as Nouns, as adverbs, as Verbs. Determiners- Kinds. Usage of Adjectives and Determiners.
Articles: Kinds, Articles and Number System, Articles and Gender System, Omission of Articles, Repetition of Articles.
Adverbs: Kinds; Formation, Position of Adverbs, Degree of Comparison, Usage.
Preposition: Kinds, Prepositions and Adverbial Participles, Position; correct Usage, Meaning & Usage.
Verbs: Kinds; Auxiliaries; Principal Auxiliaries: Usage; Be, Have, Do, Modal
auxiliaries: Usage- Can/Could, May/Might; Must; Shall/Should; Will/Would; Ought to, Semi-Modals- Need; Dare; Used to.
Non-Finite Verbs: Kinds of Non-Finite: Infinitives, Gerund; Participle.

Concord: Of Numbers, Of Person. Exceptions to Grammatical; Concord; Concord System.
Conjunction: Coordinating Conjunction; Subordinating Conjunction.
Interjection: Definition, Types.
Mood: Indicative, Imperative, Subjunctive.
Active and Passive Voice.
Conditional Sentences.   10

Unit - II The Structure of Sentences/Clauses
Adverb Clause; Adjective Clause; Noun Clause. Sentences: Simple, Double, Multiple and Complex. Transformation of Sentences:
Simple to complex and vice versa; Transformation of Degree; Simple to Compound and vice versa; Interrogative into Assertive; Affirmative into Negative and vice versa:
Transformation of Statement into Exclamation. Sequence of Tenses: Usage.   8

Unit - III Paragraph Writing
Structure of Paragraph; Construction of Paragraph; Techniques of Paragraph Writing, Unity; Coherence; Emphasis. Expansion: Definition, Method of Expansion; Making of Expansion.
Paraphrasing : Use of Paraphrasing; Exercises.   5

Unit - IV Comprehension & Precis Writing
Role of Listening; Ear Training, Reading Comprehension; Reasons for poor Comprehension; Improving Comprehension Skills; Developing Skills of Comprehension; Exercises. Precis Writing: Difference from Comprehension; Techniques of Precis Writing; Topic Sentences and its Arrangement.

Short Essay Writing
Definition of Essay; Types of Essay, Relevant Essay Writing for Engineers/Professionals; Use of Essay Writing,
Dimensions of Essay Writing : Literary, Scientific, Sociological: Contemporary
Problem Solving Essays.
Horizons of Essay Writing: Narrative Essays; Descriptive Essays; Reflective Essays;
Expository Essays; Argumentative and Imaginative Essays. Exercise.   5

Text Book
1.   A Remedial Course in English for Colleges Books 1-3 by B.K. Das & A. David, Oxford Univ. Press, New Delhi.

Reference Books
1.   Current English Grammar and Usage with composition by R.P. Sinha, Oxford Univ. Press, New Delhi.
2.   English Grammar, Composition and Usage by J.C. Nesfield, Macmillan India Ltd. Delhi.
3.   Oxford Practice Grammar by John Eastwood, Oxford Univ. Press, New Delhi.
4.   Fowler's Modem English Usage by R.W. Burchfield, O.U.P. New Delhi.
5.   English Grammar & Composition by P.C. Wren & Martin, S. Chand & Co. Ltd., New Delhi.

EBT-201: Elementary Mathematics –II
UNIT-I: ALGEBRA
Statement of Fundamental Theorem of Algebra, solution of quadratic equations in the complex number system.
Linear Inequalities:
Linear inequalities. Algebraic solutions of linear inequalities in one variable and their representation on the number line. Graphical solution of linear inequalities in two variables. Solution of system of linear inequalities in two variables- graphically.

UNIT –II: Permutations & Combinations:
Fundamental principle of counting. Factorial n. ($n!$)Permutations and combinations, derivation of formulae and their connections, simple applications.
 Sequence and Series:
Sequence and Series. Arithmetic progression (A. P.). arithmetic mean (A.M.) Geometric progression (G.P.), general term of a G.P., sum of n terms of a G.P., geometric mean (G.M.), relation between A.M. and G.M. Sum to n terms of the special series n, $n2$ and $n3$.

UNIT-III: COORDINATE GEOMETRY
1. Straight Lines:
Brief recall of 2D from earlier classes. Slope of a line and angle between two lines. Various forms of equations of a line: parallel to axes, point-slope form, slope-intercept form, twopoint form, intercepts form and normal form. General equation of a line. Distance of a point from a line.

2. Conic Sections:
Sections of a cone: circle, ellipse, parabola, hyperbola, a point, a straight line and pair of intersecting lines as a degenerated case of a conic section. Standard equations and simple properties of parabola, ellipse and hyperbola. Standard equation of a circle.

3. Introduction to Three -dimensional Geometry
Coordinate axes and coordinate planes in three dimensions. Coordinates of a point. Distance between two points and section formula.

UNIT-IV: VECTORS AND
1. Vectors:
Vectors and scalars, magnitude and direction of a vector. Direction cosines/ratios of vectors. Types of vectors (equal, unit, zero, parallel and collinear vectors), position vector of a point, negative of a vector, components of a vector, addition of vectors, multiplication of a vector by a scalar, position vector of a point dividing a line segment in a given ratio. Scalar (dot) product of vectors, projection of a vector on a line. Vector (cross) product of vectors.

UNIT – V :THREE-DIMENSIONAL GEOMETRY
Three - dimensional Geometry:
Direction cosines/ratios of a line joining two points. Cartesian and vector equation of a line, coplanar and skew lines, shortest distance between two lines. Cartesian and vector equation of a plane. Angle between (i) two lines, (ii) two planes. (iii) a line and a plane. Distance of a point from a plane.

Recommended Textbooks.
1) Mathematics Part I - Textbook for Class XI, NCERT Publication
2) Mathematics Part II - Textbook for Class XI, NCERT Publication
Recommended Textbooks.
1) Mathematics Part I - Textbook for Class XII, NCERT Publication
2) Mathematics Part II - Textbook for Class XII, NCERT Publication
Reference books:
  1) Higher engineering mathematics by B.V.Ramana (Tata Macgraw Hill)
  2) Advanced modern engineering mathemtics by Glyn james (pearson education)

EBT-202 : Remedial Biology –II

UNIT – I
Human Physiology-I
Digestion and absorption. Breathing and respiration. Body fluids and circulation.

UNIT-II
Human Physiology-II
 Neural control and coordination, chemical coordination and regulation

UNIT – III
Reproduction
 Reproductive system in male and female, menstrual cycle, production of gametes, fertilization, embryo development.

UNIT –IV

Reproductive Health& human Welfare *:* Population and birth control, sexually transmitted diseases, infertility. Cancer and AIDS. Adolescence and drug / alcohol abuse. Basic concepts of immunology, vaccines.

UNIT -V
Evolution

Evolution: Origin of life, theories and evidences, adaptive radiation, mechanism of Evolution, origin and evolution of man

Recommended Textbooks.
1) Biology - Textbook for Class XI, NCERT Publication
Recommended Textbooks.
1) Biology - Textbook for Class XII, NCERT Publication

Reference books:

1) Human anatomy and physiology by Marieb (pierson Education)
2) Textbook of human physiology by Chakraborthy and Ghosh (2nd ed. Calcutta, The New Bookstall)
3) Human Physiology by Pocock and Richards (oxford University press)

EAS-201 : ENGINEERING PHYSICS- II

	L	T	P
	2	1	0

Unit - I
Wave Mechanics and X-ray Diffraction

Wave- particle duality, de-Broglie matter waves, Phase and Group velocities, Davisson-Germer experiment, Heisenberg uncertainty principle and its applications, Wave function and its significance, Schrödinger's wave equation – particle in one dimensional box.
Diffraction of X-rays by crystal planes, Bragg's spectrometer, Compton's effect.   10 Hrs.

Unit – II

Dielectric and Magnetic Properties of Materials:
Dielectric constant and Polarization of dielectric materials, Types of Polarization (Polarizability) . Equation of internal fields in liquid and solid (One- Dimensional), Claussius   Mussoti-Equation, Ferro and Piezo electricity (Qualitative), Frequency dependence of dielectric constant, Dielectric Losses, Important applications of dielectric material, Langevin's theory for dia and paramagnetic material, Phenomena of hysteresis and its applications.
Ultrasonic: Generation, detection and application of ultrasonics   08 Hrs.

Unit-III
Electromagnetics

Displacement Current, Maxwell's Equations (Integral and Differential Forms). Equation of continuity, EM- Wave equation and its propagation characteristics in free space and in conducting media, Poynting theorem and Poynting vectors.   06 Hrs.

Unit-IV
Superconductivity and Science and Technology of Nanomaterials:

 Temperature dependence of resistivity in superconducting materials, Effect of magnetic field (Meissner effect), Type I and Type II superconductors, Temperature dependence of critical field, BCS theory (Qualitative), High temperature superconductors. Characteristics of superconductors in superconducting state, Applications of Super-conductors.
 Introduction to Nanomaterials- Basic principle of nanoscience and technology, creation and use of buckyballs, structure, properties and uses of Carbon nanotubes, Applications of nanotechnology.   06 Hrs.

Reference books:
1- Concept of Modern Physics - by Beiser (Tata Mc-Graw Hill)
2- Solid State Physics - by C. Kittel, 7th edition (Wiley Eastern)
3- Materials Science and Engineering - by V. Raghavan (Prentice- Hall India)
4- Solid State Physics - by S.O. Pillai, 5th edition (New Age International)
5- Nanotechnology - by Rechard Booker and Earl Boysen (Wiley Publishing)
6- Introduction to Electrodynamics - by David J. Griffith (PH I)

EAS152/EAS-252 : ENGINEERING CHEMISTRY (PARACTICALS)
List of Experiments
1. Determination of alkalinity in the given water sample.
2. Determination of temporary and permanent hardness in water sample using EDTA as standard solution.
3. Determination of available chlorine in bleaching powder.
4. Determination of chloride content in bleaching powder.
5. Determination of iron content in the given water sample by Mohr's methods.
6. pH-metric titration.
7. Determination of Equivalent weight of iron by the chemical displacement method. The equivalent weight of copper is 63.5.
8. Viscosity of an addition polymer like polyester by Viscometer.
9. Determination of iron concentration in sample of water by colorimetric method. The method involves the use of KSCN as a colour developing agent and the measurements are carried out at λ_{max} 480nm.
10. Element detection and functional group identification in organic compounds.
11. Preparation of Bakelite resin.

EME-152/252 : ENGINEERING MECHANICS LAB.

L T P
0 0 2

(Any 10 experiments of the following or such experiments suitably designed)

1. To conduct the tensile test and determine the ultimate tensile strength, percentage elongation for a steel
    specimen.
2. To determine the compression test and determine the ultimate compressive strength for a specimen
3. To conduct the Impact-tests (Izod / Charpy) on Impact-testing machine to find the toughness.
4. To determine the hardness of the given specimen using Vicker/Brinell/Rockwell hardness testing
    machine..
5. To study the slider-crank mechanism etc. of 2-stroke & 4-stroke I.C. Engine models.
6. Friction experiment(s) on inclined plane and/or on screw-jack.
7. Simple & compound gear-train experiment.
8. Worm & worm-wheel experiment for load lifting.
9. Belt-Pulley experiment.
10. Bending of simply-supported and cantilever beams for theoretical & experimental deflection.
11. Torsion of rod/wire experiment.
12. Experiment on Trusses.
13. Statics experiment on equilibrium

14. Dynamics experiment on momentum conservation
15. Dynamics experiment on collision for determining coefficient of restitution.
16. Experiment on Moment of Inertia.

EEE151/EEE251 : ELECTRICAL ENGINEERING LABORATORY

L T P
0 0 2

List of Experiments

Note : A minimum of 10 experiments from the following should be performed

1. Verification of Kirchhoff's laws
2. Verification of (i) Superposition theorem (ii) Thevenin's Theorem (iii) Maximum Power Transfer Theorem.
3. Measurement of power and power factor in a single phase ac series inductive circuit and study improvement of power factor using capacitor
4. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
5. Measurement of power in 3- phase circuit by two wattmeter method and determination of its power factor.
6. Determination of parameters of ac single phase series RLC circuit
7. Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a single phase transformer
8. To study speed control of dc shunt motor using (i) armature voltage control (ii) field flux control.
9. Determination of efficiency of a dc shunt motor by load test
10. To study running and speed reversal of a three phase induction motor and record speed in both directions.
11. To measure energy by a single phase energy meter and determine error.
12. To study P-N diode characteristics
13. To study full wave and half wave rectifier circuits with and without capacitor and determine ripple factors.
14. To study various logic gates (TTL)
15. To study Operational Amplifier as Adder and Subtractor
16. To study transistor as a switch.

ECS 151/ECS 251 : COMPUTER PROGRAMMING LAB

L T P
0 0 2

Suggested Assignments to be conducted on a 3-hour slot. It will be conducted in tandem with the theory course so the topics for problems given in the lab are already initiated in the theory class. The topics taught in the theory course should be appropriately be sequenced for synchronization with the laboratory. A sample sequence of topics and lab classes for the topic are given below:
 1.   Familiarization of a computer and the environment and execution of sample programs
 2.   Expression evaluation
 3.   Conditionals and branching
 4.   Iteration
 5.   Functions
 6.   Recursion
 7.   Arrays
 8.   Structures
 9.   Linked lists
 10. Data structures

Week	Lecture 1	Lecture 2	Lecture 3	Lab Meeting
Week-1	Introduction to any OS, Programming Environment	A Simple C program	Need of Datastructures & Algorithms	Get familiar with OS and Environment.
Week-2	An Example, Termination, Correctness	Different Types of Programming Languages	Number Systems	Get familiar with C compiler Implement and Test Small Routine in C
Week-3	Number Systems	Standard I/O in C	Data Types and Variables	Implement and Test Small Routine in C
Week-4	Data Types and Variable	Data Types and Variable	Operators & Expression	Evaluation of Expression
Week-5	Operators & Expression	Operators & Expression	Operators & Expression	Evaluation of Expression
Week-6	IF, SWITCH Statements	IF, SWITCH Statements	Nested If Statement	Iteration
Week-7	Repetition structure in C	Repetition structure in C	Modular Programming	Iteration, Function
Week-8	Modular Programming	Modular Programming	Arrays	Recursion, Function
Week-9	Arrays	Structures	Structures	Arrays, Structures
Week-10	Pointers	Pointers	Pointers	Linked Lists
Week-11	Searching	Selection	Sorting	Searching, Selection
Week-12	Sorting	Strings	Strings	Sorting, Strings
Week-13	Files	Files	Std C Preprocessor	Files
Week-14	Std C Library	Std C Library	Std C Library	Use of Std. C Library

It is suggested that some problems related to continuous domain problems in engineering and their numerical solutions are given as laboratory assignments. It may be noted that some of basic numerical methods are taught in the Mathematics course.

EWS-151/EWS-251 : WORKSHOP PRACTICE

L T P
0 1 3

1.   **Carpentry Shop:** 1. Study of tools & operations and carpentry joints. 2. Simple exercise using jack plane.
3. To prepare half-lap corner joint, mortise & tennon joints. 4. Simple exercise on woodworking lathe.

2.   **Fitting Bench Working Shop:** 1. Study of tools & operations 2. Simple exercises involving fitting work.

3. Make perfect male-female joint. 4. Simple exercises involving drilling/tapping/dieing.

3.   **Black Smithy Shop:** 1. Study of tools & operations 2. Simple exercises base on black smithy operations such as upsetting, drawing down, punching, bending, fullering & swaging.

4.   **Welding Shop:** 1.Study of tools & operations of Gas welding & Arc welding 2. Simple butt and Lap welded joints. 3. Oxy-acetylene flame cutting.

5.   **Sheet-metal Shop:** 1. Study of tools & operations. 2. Making Funnel complete with 'soldering'.
       3. Fabrication of tool-box, tray, electric panel box etc.

6.   **Machine Shop:** 1. Study of machine tools and operations. 2. Plane turning. 3. Step turning 4. Taper turning. 5. Threading 6. Single point cutting tool grinding.

7.   **Foundry Shop:** 1. Study of tools & operations 2. Pattern making. 3. Mould making with the use of a core.
       4. Casting

ECE-151/ECE-251 : COMPUTER AIDED ENGINEERING GRAPHICS

L T P
0 1 3

Unit-I
1.   Introduction to Computer Aided Sketching
Introduction, Drawing Instruments and their uses, BIS conventions, lettering Dimensioning and free hand practicing.
Computer screen, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools. Coordinate system and reference planes. Definitions of HP, VP, RPP & LPP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line convention, material conventions and lettering.
2-Sheet
2. Orthographic Projections
Introduction, Definitions- Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes (No application problems).   **2-Sheet**
3. Orthographic Projections of Plane Surfaces
      (First Angle Projection Only)
Introduction, Definitions-projections of plane surfaces-triangle, square rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method only (No problems on punched plates and composite plates.)   1**-Sheet**

4. Projections of Solids (First Angle Projection Only)
Introduction, Definitions- Projections of right regular- tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions. (No problems on octahedrons and combination solid)   **2-Sheet**

5.   Sections and Development of Lateral Surfaces of Solids

Introduction, Section planes, Sections, section views, Sectional views, apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP. (No problems on section of solids)   **1-Sheet**

Development of lateral surface of above solids, their frustums and truncations. (No problems on lateral surfaces of trays, Tetrahedrons spheres and transition pieces).

6.   Isometric Projection (Using Isometric Scale Only)

Introduction, Isometric scale, Isometric Projection of simple plane figures, Isometric Projection of tetrahedron, hexahedron (cube), right regular prisms, pyramids, cylinders, cones, spheres, cut spheres and combination of solids (Maximum of three Solids).   **1-Sheet**

Note : At least 3 drawing assignments must be on any popular Computer Aided Design and Drafting (CADD) Software .

Text Book
1. Engineering Drawing – N.D. Bhatt & V.M. Panchal, 48th edition, 2005 Charotar Publishing House, Gujarat.
2. A Primer on Computer Aided Engineering Drawing-2006, Published by VTU, Belgaum.

Reference Book
1. Computer Aided Engineering Drawing – S. Trymbaka Murthy, - I.K. International Publishing House Pvt. Ltd., New Delhi, 3rd revised edition-2006.
2. Engineering Graphics – K.R. Gopalakrishna, 32nd edition, 2005 – Subash Publishers Bangalore.
3. Fundamentals of Engineering Drawing with an Introduction to Interactive Computer Graphics for Design and Production – Luzadder Warren J., duff John M., Eastern Economy Edition, 2005 – Prentice- Hall of India Pvt. Ltd., New Delhi.

EAS-151/EAS-251 : PHYSICS LAB

L T P
0   0 2

List of Experiments

Any ten experiments, at least four from each group.

Group -A
1. To determine the wavelength of monochromatic light by Newton's ring.
2. To determine the wavelength of monochromatic light with the help of Fresnel's biprism.
3. To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.
4. To determine the specific rotation of cane sugar solution using polarimeter.
5. To determine the wavelength of spectral lines using plane transmission grating.
6. To study the polarization of light by simple reflection using laser.
7. Measurement of Wavelength of a laser (He- Ne) light using single slit diffraction.

Group – B

8.   To determine the specific resistance of a given wire using Carey Foster's bridge.
9.   To study the variation of magnetic field along the axis of current carrying - Circular coil and then to estimate the radius of the coil.
10.   To verify Stefan's Law by electrical method.
11.   To calibrate the given ammeter and voltmeter by potentiometer.
12.   To study the Hall effect and determine Hall coefficient, carrier density and - mobility of a given semiconductor using Hall effect set up.
13.   To determine the energy band gap of a given semiconductor material.
14   To determine E.C.E. of copper using Tangent or Helmholtz galvanometer.
15.   To draw hysteresis curve of a given sample of ferromagnetic material and from - this to determine magnetic susceptibility and permeability of the given specimen.
16.   To determine the ballistic constant of a ballistic galvanometer.
17.   To determine the coefficient of viscosity of a liquid.
18.   Measurement of fiber attenuation and aperture of fiber.

19. High resistance by leakage method.
20. Magnetic Susceptibility of paramagnetic solution.

EAS-154/EAS-254 : PROFESSIONL COMMUNICATION LABORATORY

L T P
0 0 2

Interactive and Communicative Practical with emphasis on Oral Presentation/Spoken Communication based on International Phonetic Alphabets (I.P.A.)
LIST OF PRACTICALS
1. Group Discussion: Practical based on Accurate and Current Grammatical Patterns.
2. Conversational Skills for Interviews under suitable Professional Communication Lab conditions with emphasis on Kinesics.
3. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistics/Kinesics.
4. Presentation Skills for Technical Paper/Project Reports/ Professional Reports based on proper Stress and Intonation Mechanics.
5. Official/Public Speaking based on suitable Rhythmic Patterns.
6. Theme- Presentation/ Key-Note Presentation based on correct argumentation methodologies.
7. Individual Speech Delivery/Conferences with skills to defend Interjections/Quizzes.
8. Argumentative Skills/Role Play Presentation with Stress and Intonation.
9. Comprehension Skills based on Reading and Listening Practicals on a model Audio-Visual Usage.

Reference Books
1. Bansal R.K. & Harrison: Phonetics in English, Orient Longman, New Delhi.
2. Sethi & Dhamija: A Course in Phonetics and Spoken English, Prentice Hall, New Delhi.
3. L.U.B.Pandey & R.P.Singh, A Manual of Practical Communication, A.I.T.B.S. Pub. India Ltd. Krishan Nagar, Delhi.
4. Joans Daniel, English Pronouncing Dictionary, Cambridge Univ. Press.

ECH-301 :FLUID FLOW AND SOLID HANDLING

L T P
3 1 0

Unit-I
SOLIDS AND THEIR HANDLING
1. Properties of solids, screening, industrial screening equipment. Determination of particle size, screen analysis, size reduction of solids, stages of reduction, operating variables, intermediate and fine size reduction, power requirement and mechanism.
   Power driven machines: Crushers, grinders and conveyers.   [08]
Unit-II
 Filtration
   Theory, continuous and branch equipments.
   Flow of solids through fluids, classification and sedimentation.   [08]
Unit-III
FLUID FLOW
1. Properties of fluids.
2. Fluid statics: Euler's equation, Hydrostatic Law and Pressure Measurement.
3. Transport of fluids, energy relationships, pipe fittings, minor losses in pipe flow.   [08]
Unit-IV
   Flow measurements: Orifice meter, Nozzel and venturi meters, rotameter and pitot tube.   [08]
   Pumping and compressing: reciprocating pumps, rotary pumps,centrifugal

Pumps and blowers.
Introduction of fluidization.   [08]
Reference Book

1. Introduction of Fluid Mechanics by Robert W.Fox and Slan T. Mcdonald, John
   urley & sons, Ny. Fourth Ed.
2. Unit Operation in Chamical Engg., Mccable Smit Vth Ed.

EAS-302/EAS-402:Statistical Techniques

L T P
3 1 0

Unit-I
        Data type, classification and summarization of data, diagrams and Graphs, Measures of
Dispersion, Skewness and kurtosis.   8

Unit-II
Introduction to probability, Laws of probability, Baye's theorem, Binomial distribution Poison
distribution, Normal distribution and Gaussian distribution.
Unit-III
Positive and Negative correlation, Pearson and Mathew correlation coefficient, Non parametric
tests, Receiver operating characteristics (ROC) curve, Linear and Non linear regression,
multiple regression.
Unit-IV
Hypothesis tests, Chi squire tests and F-tests, Variant, One way and two way analysis of
variants, ANOVA.
Unit-V
Principles of experimental design and analysis.
Text books and references
  1. Georgr W. and William G., Statistical Methods; IBH Publication.
  2. Ipsen J et al; Introduction to Biostatistics, Harper & Row Publication.
  3. N.T.J. Baily; Statistical methods in Biology; English University Press.
  4. R.Rangaswami; A Text book of Agricultural statistics; New Age Int. Pub.
  5. P.S.S.Sundar Rao; An Introduction to Biostatics; Prentice Hall.
  6. Zar J; Biostatistics; Prentice Hall, Londan.

EBT-301 : Biochemistry

UNIT-I
pH, Buffers, Biological Buffers, Water, Vitamins, Brief description of animal and plant hormones.

UNIT-II
Carbohydrate as biomoloecule. Classification of carbohydrates. Metabolism – Glycolysis, TCA
cycle, Gluconeogenesis, PEP, ETC, Oxidative phosphorylation. Disorder/ diseases of
carbohydrate metabolism.

UNIT –III
Fats and lipids – Structure and function, biosynthesis of fatty acids, Degradation of fatty
acids.Cholestrol Biosynthesis and degradation. Disorder/ diseases of lipid metabolism.

UNIT –IV

Aminoacids and proteins. Biosynthesis of amino acids from Acetyl Co enzyme. Biodegradation of amino acids, Determination, transamination, Urea Cycle. Proteins as coenzymes. Structure of proteins. Disorder/ diseases of amino acids metabolism.

UNIT –V

Purines and pyrimidines – Structure and properties. Their biosynthesis and degradation. Vitamins Biosynthesis. , Disorder of purines and pyrimidines metabolism.

Text books:
1. Biochemistry and molecular biology by Elliot and Elliot. (Oxford university Press)
2. Biochemistry by trehan (New age international)
3. Biochemistry by Lehninger (CBS Publication)

Reference books:
1. Biochemistry by Voet and Voet (Wiley New York)
2. Biochemistry by Stryer (Freeman Int. Edition)

EBT-302 : MICROBIOLOGY & CELL BIOLOGY

UNIT – I

 Morphology and Classification of bacteria. Culture media. Isolation and identification of microbes, culture techniques. Preservation of cultures.

UNIT-II

Physical and chemical methods for the control of microbes. Enumeration of bacteria. Microbial growth kinetics. Cell cultivation system. Strain improvement.

UNIT-III

Biological nitrogen fixation. Biofertilizers. Bacterial Photosynthesis :Photosynthetic structures, types of bacterial photosynthesis, photosynthesis pigments, photosynthetic electron transport system, photophosphorylation, dark phase of photosynthesis; CO_2 utilization.

UNIT-IV

Applications of microbiology.
Environmental; Mirobiology of domestic water and waste water. Microbes in bioremediation.
Medical Microbiology: tuberculosis, typhoid, diarrhoea, amoebiosis, Rabies
Other applications.

UNIT-V

Cell organelles. Protein targeting, cell aging. Biology of cancerous cells.

Text books:
1. Microbiology by Pelczar (W C Brown publication)
2. Genral Microbiology by stainer (Mac Millan Publication)
3. Microbiology by Pawar and Dagniwala (Himalaya publishing House)

Reference books:
1. Microbiology –an introduction by Tortora (Pierson education Publication)
2. Industrial microbiology by Prescott and Dunn

EBT-303 : MOLECULAR DYNAMICS & BIOENERGETICS

UNIT-I

Energy, energy flow cycle, energy conversion; Structure and properties of ATP; High energy compounds, Thermodynamic considerations, Coupling reactions of ATP and NDP (nucleotide di phosphate); photosynthesis.

UNIT-II

Biological membrane: structure, permeability, properties, passive transport and active transport, facilitated transport, energy requirement, mechanism of Na^+/K^+, glucose and amino acid transport; Organization of transport activity in cell; Active potentials; Role of transport in signal transduction processes. Signal Tansduction.

UNIT-III

Metabolism and bioenergetics; Generation and utilization of ATP; Metabolism of Nitrogen containing compounds: nitrogen fixation, amino acids and nucleotides;

UNIT-IV
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.

UNIT-V
Electron Flow as source of ATP Energy, Site of Oxidative Phosphorylation, ATP synthetase, Electron- Transferring Reactions, Standard Oxidation, Electron Carrier, electron transport complexes, Incomplete reduction of Oxygen, Mechanism of Oxidative Phosphorylation, Oxidation of Extra mitrochondrial NADH, ATP yield and P: O Ratio, Role of Electron Transport Energy, Respiratory Inhibitors, Regulatory control among Glycolysis, the Citric Acid Cycle and Oxidative Phosphorylation

Text books:
1. Introduction to Chemical Engineering thermodynamics by Smith and Vannes (Mcgraw Hill)
2. Chemical engineering thermodynamics by Y.V.C. rao (New age international)

Reference books:
1. Engineering Thermodynamics by J.B.Hawkins (University Press)
2. Engineering Thermodynamics by Spading and Cole(ELBS).

EBT-401 : ENZYME ENGINEERING-

Unit- I
Extraction 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 of Enzyme Action; Concept of active site and energetics of enzyme substrate complex formation; Specificity of enzyme action; Kinetics of single substrate reactions; turnover number; estimation of Michaelis-Menton parameters. Importance of K_M, Multi-substrate reaction mechanisms and kinetics.

UNIT III

Types of Inhibition- kinetic models; Substrate and Product Inhibition; Allosteric regulation of enzymes; Deactivation kinetics.

UNIT-IV

Physical and Chemical techniques for enzyme Immobilization – adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding - examples; Advantages and disadvantages of different Immobilization techniques; Overview of applications of immobilized enzyme systems, Applications of enzymes in analysis; Design of enzyme electrodes and their applications as biosensors in industry, health care and environment.

UNIT-V

Design of Immobilized Enzyme Reactors-Packed- bed, Fluidized-bed Membrane reactors; Bioconversion calculations in free- enzyme CSTRs and immobilized enzyme reactors.

Text books:
1. Fundamentals of enzymology by Nicolas C. price and Lewis stevens . Oxford University Press
2. Enzymes by Trevor palmer, East west Press
3. Enzyme Technology by Messing

Reference books:
1.Enzymes : Dixon and Webb.(IRL Press)
2. Enzyme technology by Chaplin and Bucke. Cambridge Univerity Press
3. Biochemical engineering fundamentals, second edition. James E Bailey, David F., Ollis, McGraw Hill Intl. Edition

EBT-402 : IMMUNOLOGY

UNIT--1

Introduction to immunity, Characteristics of innate and adaptive immunity, Humoral and Cell mediated immune response, Hematopoiesis, Cells and Molecules of the immune system, Primary and Secondary lymphoid organs, Inflammation, Characteristics of T&B cell epitopes, T &B cell maturation, activation and differentiation.

UNIT-2

Characteristics and types of Antigens, Factors affecting the immunogenicity, Haptens and adjuvants, ABO blood group antigens, Epitopes, Structure, functions and characteristics of different classes of antibodies, Antigenic Determinants on Immunoglobulins.

UNIT-3

Structure and Function of MHC molecules, Exogenous and Endogenous pathways of antigen processing and presentation, Complement system, Structure, function and application of cytokines, regulation of immune response, immune tolerance.

UNIT-4

Antigen and antibody interactions, cross reactivity, precipitation reactions, serological techniques – ELISA, RIA and western blotting Production and application of monoclonal antibodies, dose of antigens, Vaccines.

UNIT-5

Immunity against infectious diseases (virus, bacteria and protozoan), Hyper-sensitivity, Autoimmunity, Cancer, AIDS and Transplantation immunology.

Text books:
1. Immunology and immunotechnology by Ashim k. Chakravarty (Oxford university Press)
2. Immunology by C. Fatima
3. Immunology by Kuby (Free man publication)

Reference books:
1. Essentials of immunology by Roitt (Blackwell scientific publication)
2. Immunology by Benacera

EBT : 403 GENETICS AND MOLECULAR BIOLOGY

L T P
3 1 0

Unit I
Fundamental principles of genetics, gene interaction, multiple alleles, complementation, linkage, recombination and linkage mapping, extra-chromosomal inheritance, chromosomes basis of heredity.   [8]

Unit II
DNA as the genetic material, structure & types of DNA transposable elements; Central Dogma, DNA repairing, Mutations, Cell type regulation.   [8]

Unit III
DNA replication process in prokaryotes & Eukaryotes, Activity of DNA polymerases and topoisomerases, Reverse transcriptase.   [6]

Unit IV
Transcription process in prokaryotic and eukaryotic, Post transcriptional modification processes open reading frames.   [8]

Unit V
Genetic Code, Wobbel hypothesis, translation process in Prokaryotes and Eukaryotes
Regulation of gene expression in prokaryotes and Virues. Hormonal control of gene expression in eukaryotes.   [8]

Textbooks and references:
   1. Albert B, Bray Denis et al.: Molecular Biology of The Cell, latest ed.
   2. Watson, Hopkin, Roberts et al.: Molecular Biology of the Gene, 4 th ed.
   3. Genetics- Strickberger, 2 nd.
   4. Microbial Genetics – D. Frifielder.
   5. Baltimore- Molecular Biology of the Cell.
   6. Benjamin Levin – Genes VIII, 8 th ed.
   7. Advance Genetics by G.S. Miglani, Narosa Publishing House.

EBT-404 : Bioinformatics –I

UNIT-I
Primary and secondary databases. Specialized sequence databases of EST, TFB Sites, SNP's, gene expression. Pfam, PROSITE, BLOCK(Secondary databases). Data retrieval with ENTREZ, SRS, DBGET

UNIT-II
Principles of DNA sequencing (chemical chain termination, Dideoxy chain termination method, Automatic sequencer). RNA sequencing . Protein sequencing (Edmand degradation method)

UNIT-III
Sequence alignment (pairwise and multiple, global and local). Sequence alignment algorithm (FAST , BLAST, Needleman and Wunsch, Smith Waterman). Database similarity searches (BLAST, FASTA and PSI BLAST). Amino acid substitution matrices (PAM BLOSUM)

UNIT-IV
Protein structure prediction (Chou Fasman method) : Secondary and tertiary structures. Homology Modelling, ORF prediction, Gene prediction, Micro array data analysis. Profiles and motifs.

UNIT-V

Structure visualization methods (RASMOL, CHIME etc.) . Protein Structure alignment and analysis. Application of Bioinformatics in drug discovery and drug designing.

Text books:
1. Bioinformatics : Principles and applications by Ghosh and Mallick (oxford) university press)
2. Bioinformatics by Andreas D Boxevanis (Wiley Interscience)
3. Fundamental concept of bioinformatics by Dan e. krane

Reference books:
1. Introduction to bioinformatics by Attwood and Parry Smith (Pierson education Publication)
2. instant notes in Bioinformatics by Westhead, parish and Tweman (Bios scientific publishers)

EBT-351 : FLUID MECHANICS LAB

L T P
0 0 3

Experiments related to measurement of flow by venturi meter, orifice meter, notches, rotameter, velocity measurement by pitot tube. Verification of Bemoulli's theorem. Vortex, friction factor, equivalent length of fittings, pump characteristics, Streamlines.

EBT-352 BIOCHEMISTRY LAB

L T P
0 0 3

1. Estimation of carbohydrates
2. Estimation of proteins
3. Estimation of nucleic acids
4. Isoelectric precipitation
5. Separation of aminoacids by paper chromatography.
6. Extraction of lipids
7. Thin layer chromatography
8. Gel electrophoresis
9. Assay of enzyme activity and enzyme kinetics
10. Identification and estimation of an intermediate of ENP pathway
11. Cell fractionation

EBT 353 : MICROBIOLOGY LAB

L T P
0 06

1. Preparation of nutrient agar slants, plates and nutrient broth and their sterilization.
   (Microwave Oven, Heating mantles, Fridge, Heating Oven, Tube racks)
2. Inoculation of agar slants, agar plate and nutrient broth
   (Incubators, Water bath, Laminar hood, dry heat sterilizer i.e. bead sterilizer)
3. Culture of microorganisms using various techniques.
   (Shakers i.e. Cooling and Open shaker).
4. Simple and differential staining procedures, endospore staining, flageller staining, cell wall staining, capsular staining, negative staining.
   (Moist chambers, spirit lamps, slides, loops & microscopes, haemocytometer)
5. Bacterial colony counting.
   (Moist chambers, spirit lamps, slides, loops & microscopes, haemocytometer)
6. Observation of different vegetative, capsular and spore forms of bacteria & fungus under various microscopes).

7. Isolation of microbes from soil samples and determination of the number of colony forming units.
   (U.V. spectrophotometer, Colony counter etc.)
8. Study of growth curve of *E. coli*
   Practical Books and References
   1. Lab Manual in microbiology by P Gunasekaran (New Age Int. Pub.)

TBT 354 : CELL BIOLOGY LAB

L T P
0 0 6

Experiments

1. Microscopy
2. Identification and staining of different types of cells.
3. Measurement of various Cell Organelles.
4. Lipid Solubility of Membranes.
5. Determination of Osmosis
6. Determination of Pinocytosis process
7. Isolation of Chloroplasts from spinach Leaves.
8. Detection of Mitosis with the help of microscope.

EBT : 451 IMMUNOLOGY LAB

L T P
0 0 6

1. Different types of antigen –antibody cross reaction
2. Isolation, purification and identification of immunoglobulin from goat blood.
3. Double diffusion techniques for identification of antigen-antibody samples
4. Immunoelectrophoresis techniques.
5. ELISA (Enzyme linked Immunosorbent Assay)
6. RIA (Radio Immuno Assay)
7. Immunoblotting using ELISA-dot or Western blot techniques.

Reference books
1. Handbook of Experimental Immunology, Vol. I & II, IV- Blackwell Scientific Publications.
2. Practical Immunology- Hudson L. and Hay H. C. Blackwell Scientific Publications.
3. Hybridoma Techniques: A Lab Course- Muthukkaruppan Vr, Basker S and F. Singilia. Macmillan India Ltd.

EBT : 452 MOLECULAR BIOLOGY LAB

L T P
0 0 3

1. Estimation of DNA content in the given sample by diphenylamine method.
   (Nitrogen cylinders, -20^0C fridge, grinders, cooling centrifuges, etc.)
2. Estimation of RNA content by the Orcinol method.
3. Determination of Tm of DNA and RNA.
4. Isolation of Plasmid DAN.
5. Isolation of bacterial/fungal genomic DAN.
6. Isolation of plant DNA.
7. Purification of DNA through columns.
   (Sorval, Cyclomixer, Electrophoresis units both vertical & horizontal, transillulminator, U.V. Torch, Gel documentation system, Thermal cycler etc.)

EBT-453 BIOINFORMATICS-I LAB

L T P
0 03

1. Construction of database for specific class of proteins/enzymes, genes/ ORF/ EST/Promoter sequences/ DNA motifs or protein motifs using oracle.
2. Access and use of different online protein and gene alignment softwares
3. Gene finding related search for a given nucleotide sequence in order to predict the gene
4. ORF prediction for different proteins out of some given nucleotide sequences.
5. Exon identification using available softwares for a given nucleotide sequences
6. Secondary structure prediction for amino acid sequences of a given protein.

ECS-508, Data Structure and Algorithms

L T P
3 1 0

Unit-I : Introduction to data structure and Algorithms
Performance analysis of Algorithm, time complexity, Big-oh notation, Elementary data organization data structure operations, Recurrences, Arrays, Operation on arrays, representation of arrays in memory, single dimensional and multidimensional arrays, spare matrices, Character storing in C, String operations.
08

Unit-II : Stacks, Quesues and Linked Lists
Stack operation, PUSH and POP, Array representation of stacks, Operation associated with stacks Application of stacks, Recursion, Polish experession, Representation quesues opration on quesues, Priority quesues Dquesues, Singly and circularly linked list, List operations Lists implementations.
08

Unit-III : Tree
Basic terminology, Binary Trees, Binary tree representation, Algebraic/expressions, Complete Binary Trees, Extended binary tree, representing binary tress in memory, linked representation of Binary trees, Traversing binary trees & Searching in binary trees, Inserting in binary search trees, Complexity of searching algorithm, Heaps, general trees, Threaded binary tree.
08

Unit-IV : Graphs
Terminology & representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, adjacency Matrices, Transversal, connected component and spanning trees, Minimum Cost spanning tree, Prims and Kruskal Algorithm, BFS, DFS, Shortest path and transitive closure, Activity networks, topological sort and critical paths.
08

Unit-V : Searching and Sorting
Linear search, binary Search, Internal and External sorting, Bubble sorting, selection sort, Insertion sort, quick sort, Two way merge sort, Heap sort, sorting on different keys, practical consideration for internal sorting, External Sorting, Storage Devices : Magnetic tapes, Disk Storage, Sorting with disks and Indexing techniques, introduction to B tree and B+ tree, File organization and storage management, Introduction to hoisting.
08

Test Books and references
1. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication.
2. Coreman, Rivest, Lisserson, "Algorithms", PHI Publication.
3. Weiss, "Data Structure & Algorithm Analysis in C", Addision Wesley.
4. Basse, "computer Algorithms : Introduction to Design & Analysis", Addision Wesley.
5. Lipschutz, "Data structure, "Schaum series.
6. Aho, hopcropt, Ullman, " Data Structure & Algorithm", Addision Wesley.

EBT-501, Genetic Engineering

L T P
3 1 0

Unit I
Gene cloning -concept and basic steps; application of bacteria and viruses in genetic engineering; Molecular biology of *E. coli* and bacteriophages in the context of their use in genetic engineering, Cloning vectors: Plasmid cloning vector PBR322, Vectors for cloning large piece of DNA; –Bacteriophage-l and other phage vectors; Cosmids, Phagemids; YAC and BAC vectors, Model vectors for eukaryotes - Viruses,

Unit II
Restriction modification, enzymes used in recombinant DNA technology endonucleases, ligases and other enzymes useful in gene cloning, PCR technology for gene/DNA detection, cDNA, Use of *Agrobacterium* for genetic engineering in plants; Gene libraries; Use of marker genes. Cloning of foreign genes: DNA delivery methods -physical methods and biological methods,

Genetic transformation of prokaryotes: Transferring DNA into *E. coli* –Chemical induction and Electroporation,

Unit III
Gene library: Construction cDNA library and genomic library, Screening of gene libraries – screening by DNA hybridization, immunological assay and protein activity, Marker genes: Selectable markers and Screenable markers, nonantibiotic markers, Gene expression in prokaryotes: Tissue specific promoter, wound inducible promoters, Strong and regulatable promoters; increasing protein production; Fusion proteins; Translation expression vectors; DNA integration into bacterial genome; Increasing secretions; Metabolic load, Recombinant protein production in yeast: *Saccharomyces cerevisiae* expression systems; Mammalian cell expression vectors: Selectable markers;

Unit IV
Origins of organismal cloning in developmental biology research on frogs; nuclear transfer procedures and the cloning of sheep (Dolly) & other mammals; applications in conservation; therapeutic vs. reproductive cloning; ethical issues and the prospects for human cloning; Two-vector expression system; two-gene expression vector, Directed mutagenesis; transposon mutagenesis, Gene targeting, Site specific recombination

Unit V
General principles of cell signaling, Extracellular signal molecule and their receptors, Operation of signaling molecules over various distances, Sharing of signal information, Cellular response to specific combinations of extracellular signal molecules; Different response by different cells to same extracellular signal molecule, NO signaling by binding to an enzyme inside target cell, Nuclear receptor; Ion channel linked, G-protein- linked and enzyme-linked receptors, Relay of signal by activated cell surface receptors via intracellular signaling proteins, Intracellular signaling proteins as molecular switches, Interaction between modular binding domain and signaling proteins, Remembering the effect of some signal by cells.

Text books and references:
1. DNA cloning 1 and 2. Glover, D.M. and Hames, B.D. 1995. IRL Press (Oxford University Press, USA).
2. Molecular Cloning, A laboratory Manual. Sambrook, J., Fritsch, E.F., Mariatis.3rd edition. 2001. Cold Spring Harbor Laboratory, USA.
3. Recombinant DNA. Watson, 1992.
4. Molecular Biology of the Cell (4th edition). Alberts, Johnson, Lewis, Raff, Roberts and Walter.
5. Advanced Genetics, G.S. Miglani, Narosa Publishing House, 2002.
6. DNA Science, David A. Micklos, Grog. A Freyer, I.K. International Pvt. Ltd, 2005.
7. Frontiers in Plant Science, K.G. Mukerji etal, I.K. International Pvt. Ltd, 2005.
8. Schaum's - Molecular & Cell Biology, Gregory B. Ralston,William D. Stan's field, TMH Publication, 2005.
9. Schaum's – Genetics, Susan Elrod, William Stan's field, TMH Publication, 2005.
10. Principle of Genetics, Robert H. Tamarin, TMH Publication, 2006.
11. Genetics, C. Sarin, TMH Publication, 2001.

<div align="center">

EBT-502, Bioinformatics - II

L T P
3 1 0
</div>

Unit I
Inference problems and techniques for molecular biology. Overview of key inference problems in biology: homology identification, genomic sequence annotation, protein structure prediction, protein function prediction, gene expression characterization, network identification, and drug discovery.

Unit II

Overview of key computational induction techniques for density estimation, clustering, discrimination and regression. Statistical inference: significance testing, regression, Bayes' rule, dimensionality reduction.

Machine learning: information theoretic decision tree induction, neural networks, the E/M algorithm (including K-means clustering and fitting hidden Markov models), genetic algorithms, simulated annealing, support vector machines, and the relation between statistics and machine learning. Evaluation of prediction methods: parametric tests, cross-validation and empirical significance testing.

Unit III

Overview of key computational simulation techniques: differential equation simulators, parameter estimation, and sensitivity analysis. Overview of key techniques for the management of large document collections and the biological literature: information retrieval, document clustering, and natural language information extraction.

Unit IV

Advanced topics in bioinformatics. This course will address recent developments in bioinformatics and focus on advanced issues in specific areas including (but not limited to), information extraction from biomedical literature, inference of biochemical networks from high throughput data, and prediction of protein function.

Text Books & References
1. Computational Methods in Biotechnology – Salzberg S. L. et al., Elsevier Science .
2. Statistical Methods in Bioinformatics-Evens & Grants, Springer-Verlag, NY.
3. Computational Molecular Biology- Setubal and Meidanis, PWS publishing Co., 1997.
4. Protein Structure Prediction-A Practical Approach, MJE Sternberg, Oxford University Press.
5. Purifing Protein for Protemics, Richard J. Sinpson, I.K. International Pvt. Ltd.

EBT-503, Bioprocess Engineering I

L T P
3 1 0

Unit I

Methods of inoculation and medium preparation, media design and optimization. Microbial growth in closed, semi-open and open cultivation systems. Maintenance energy and yield concepts, parameters of growth and analysis of growth data, estimation of biomass.

Unit II

Sterilization: concept and methods. Sterilization of medium. Kinetics of thermal death of microorganisms. Batch sterilization. Continuous sterilization. Sterilization of air: Methods, filters and design of depth filters.

Unit III

Microbial kinetics of growth and substrate utilization. Product formation in batch, plug flow and chemostat culture., Microbial pellet formation. Flocculation. Kinetics and dynamics of pallet formation.

Unit IV

Material and energy balance in steady and unsteady reaction systems. Oxygen transfer in bioreactors, measurement of $K_L a$. Oxygen transfer in large vessels.

Control of physical, chemical and biological environment of the bioreactor. Advanced control strategies viz. PID controllers, fuzzy logic based controllers and artificial neural network based controllers, Role of physical, chemical & biological sensors.

Text books and references:

1. Principles of Microbe and cell cultivation- S. John Pirt, Butterworth Publication.
2. Bioprocess Engineering Principles – P. M. Doran, 5th ed.
3. Hand Book Of Bioengineering- Skalak R & Shu Chien, 4th ed.
4. Biochemical Engg. Bailly & Ollis, Academic Press
5. Introduction to Chemical Engg. Series, MCH Int. Series.
6. Biochemical & Biological Engg. Science, N. Blakebraugh, Academic Press

EBT-504 - MODERN ANALYTICAL TECHNIQUES

Unit - 1   Introduction to Analysis

1.1   Concept of Good Laboratory Practice and Quality Management
1.2   Analysis: Steps of Analysis
1.3   Basic Aspects of Qualitative Analysis
1.4   Basic Aspect of Quantitative Analysis.
.
Unit - 2   Spectroscopy

2.1   Interaction of EM radiation with matter : Overview of Electromagnetic spectrum; physical phenomenon : Absorption, Resonance fluorescence, Emission, Refraction, Diffraction, Scattering, Raman Scattering, Resonance Raman Scattering, Beer-Lambert's Laws.
2.2   UV-Vis spectrophotometer: Principle, Instrumentation, working and Application

2.3   Atomic spectroscopy: Principles and application of Atomic Absorption / Emission Spectrometer
2.4   Mass Spectroscopy, MALDI
2.5   Basics of IR and NMR and their application in biotechnology and Basics of X-Ray diffraction analysis and their application in biotechnology

Unit - 3 Advance microscopy methods and centrifugation.

3.1   Differential interference contrast microscopy. Electron microscopy: TEM and SEM, Atomic force microscopy and con focal scanning laser microscopy
3.2   Protein sequencing by automated Edmen degradation process.
3.3   Filtrations: Types and their application
3.4   Distillation, Crystallization and Dialysis
3.5   Centrifugation: Theory of centrifugation and sedimentation, use and design of different types of rotors Types of centrifuges, Preparative and analytical centrifugation Density gradient centrifugation (zonal and isophycnic), differential centrifugation), Application of centrifugation for preparative and analytical purpose.

Unit - 4   Chromatography and Electrophoresis:

4.1   Chromatography :Basic Theory of Chromatography, Plate and Rate Theory and HETP, Partition theory and solvent extraction theory Introduction to key terms: retention time, retardation factor(Rf), elution, Capacity   factor ,peak shapes, bard broadenings, column Efficiency and resolution, selectivity, normal and reverse phase chromatography, countercurrent chromatography.
4.2   Partition and adsorption chromatography
4.3   Different techniques of chromatography: Principle, stationary and Mobile phase, operation, Detection/elusion of solute, Application -Planner Chromatography, (Paper Chromatography, TLC) , GC, Ion exchange chromatography, Gel exclusion chromatography, Affinity, chromatography, HPLC and FPLC .Adsorption chromatography-Hydroxylapatitie chromatography and hydrophobic chromatography.
4.4   Electrophoresis : Theory of electrophoresis, electrophoresis of protein-PAGE,SDS PAGE,Agarose electrophoresis of nucleic acid, Iso electric focusing of protein pulse gel electrophoresis and western blotting.

Unit - 5   Biosensors

5.1   Biosensors : Principles and definition, characteristics of Ideal biosensors, Basic measuring procedure, Biochemical components of biosensors :
      Enzyme based biocatalyst sensors, Bioaffinity systems, Immunosensors
5.2   Application of Biosensors: Clinical laboratory, In vivo determination of metabolites, Environmental monitoring of toxic compound. .

Text/Reference Books:

1.   Handbook of Analytical Techniques Published Online: 2008. Helmut Günzler, Alex Williams. Wiley Interscience
2.   Fundamentals of Analytical Chemistry (with CD-ROM and InfoTrac) by Douglas A. Skoog, Donald M. West, F. James Holler, Stanley R. Crouch, Hardcover: 992 pages, Publisher: Brooks Cole.
3.   Biosensors and modern biospecific analytical techniques, 44. l. gorton. elsevier. 2005
4.   Wilson, K, Walker, J.: Principles and Techniques of Practical Biochemistry. 5th Ed. - Cambridge University Press,. Cambridge 1999.

EBT-551, Genetic Engineering Lab

L T P
0 0 3

1. Isolation of the DNA, by dinitrophenyleamine methods.
2. Isolation of RNA by Orcinol method.
3. Restriction mapping of the DNA isolated from plant, bacteria and fungi.
4. Isolation of the plasmid from the bacterial sample.
5. Transformation of the bacterial cell.
6. Estimation of Tm in given sample of DNA.
7. PAGE electrophoresis of the given sample of DNA

TBT-552, Bioinformatics – II Lab

L T P
0 0 3

1. In silico gene identification/characterization in a prokaryotic organism using suitable annotation tools.
2. Secondary structure determination of a protein molecule using various tools.
3. Comparative assessment of best available tools for gene annotation.
4. Development of a gene finding program using statistical significance and C++/C/Perl etc.
5. Establishments of methods for gene and protein phylogeny by taking specific examples.

EBT-553, Bioprocess Engineering Lab

L T P
0 0 6

1. Determination of kinetic parameters for batch cultivation of yeast under stationary and shake flask conditions.

2. Growth kinetic studies of yeast in a bench top lab Fermentor under controlled conditions.

3. Determination of volumetric oxygen transfer coefficient (K_L a), effect of aeration and agitation speed etc.

4. Determination of specific thermal death rate constant (K_d) and activation energy for microbial strains.

5. Optimization of Bioprocess for production of Enzyme using specific experimental design.

6. Preparation of immobilized enzymes & cells and evaluation of kinetic parameters.

7. Computational Design of Fermentative Process for I-Lysine production.

EBT-554   - Analytical Techniques Lab

Exp1   Introduction to quality control. Use concepts of accuracy and precision.
Exp2   compute component of given percentage solution, molarity solution, PRN, PPS solution and stock solution.

Exp3   pH meter :
-   List uses of pH meter, measurement, detailed diagram of pH electrod and reference electrode (combined electrod also), find pH of a solution giving detailed account of pH meter operation, troubleshouting.
-   Preparation of solution using pH meter.
-   Demonstration of the effect of the solution

Exp4   Spectroscopy :
-   To determine maximum absorption spectra of mixtures (potassium dichromate and potassium permanganate) solution.

Exp5   Centrifugation :
-   Measure components and working of centrifuges, solving g and RPM of centrifuge with respect to various heads. rotors
-   Isolation of cellular organelles by differential centrifugation

Exp6   Chromatography :
-   Solvent-solvent extraction of plant pigmnets,
-   Use of paper chromatography for separation of plant pigments
-   Use of thin-layer chromatography for amino acid (TLC)
-   Demonstration of Ion-exchange chromatography
-   Demonstration of Gel-exclusion chromatography

Exp7   Electrophoresis: Electrophoresis of protein by SDS-PAGE
Exp-8 Demonstration of Sterilization of solution by filteration
Exp-9 PCR
Exp-10Demonstration of Dialysis

EBT-601, Fermentation Biotechnology

L T P
3 1 0

Unit I

History and development of fermentation industry: Introduction to submerged and solid state fermentation, Primary and secondary metabolite.

Unit II
Raw material availability, quality, processes and pretreatment of raw materials.

Unit III
Different regulatory mechanisms involved in controlling the catabolic and anabolic processes of microbes. Induction, nutritional repression, carbon catabolite repression, crabtree effect, feedback inhibition and feedback repression.

Unit IV
Creation/procedures for developing mutants of the desired microbes with the stable capacity of producing desired metabolites. Isolation and preservation of different types of mutants-induction resistant, feedback inhibition resistant. Concept for overproduction of metabolites.

Unit V
Fermentations of recombinant microbial cells for large-scale production of genetically engineered primary and secondary metabolites

Text books and references:

1. Murray Moo -Young , Comprehensive Biotechnology, Vol. 1 & III-latest ed.

2. Microbes & Fermentation, A. Lel and Kotlers Richard J. Mickey, Oriffin Publication
3. Industrial Fermentations- Leland, N. Y. Chemical Publishers.
4. Prescott and Dunn's- Industrial Microbiology, 4 th, ed.
5. Biotechnology Series, Rehm, Reed & Weinheim, Verlag-Chemie.
6. Biochemical Engg., Aiba, Humphrey & Miller, Academic Press.
7. Fermentations & Enzyme technology,Wang & Humphrey, Wiley & Inter Science

EBT-602   --FOOD BIOTECHNOLOGY

Unit : 1
History of Microorganisms in food, Historical Developments. role and significance of microorganisms in foods. Intrinsic and Extrinsic .Parameters of Foods that affect microbial growth. Basic principles, unit operations, and equipment involved in the commercially important food processing methods and unit operations

Unit : 2
Microorganisms in fresh meats and poultry, processed meats, seafood's, fermented and fermented dairy products and miscellaneous food products. **Starter cultures**, cheeses, beer, wine and distilled spirits, SCP, medical foods, probiotics and health benefits of fermented milk and foods products. **Brewing**, malting, mashing, hops, primary & secondary fermentation: Biotechnological improvements: catabolic repression, High gravity brewing, B-glucan problem, getting rid of diacetyl. Beer, wine and distilled spirits.

Unit : 3
 Nutritional boosts and flavor enhancers: Emerging processing and preservation
technologies for milk and dairy products. **Microbiological Examination** of surfaces, Air Sampling, Metabolically Injured Organisms. Enumeration and Detection of Food-borne Organisms. Bioassay and related Methods

Unit 4:
 Food Preservation, Food Preservation Using Irradiation, Characteristics of Radiations of Interest in Food Preservation. Principles Underlying the Destruction of Microorganisms by Irradiation, Processing of Foods for Irradiation, Application of Radiation, Radappertization, Radicidation, and Radurization of Foods Legal Status of Food Irradiation, Effect of Irradiation of Food constituents.

Unit 5:
Storage Stability Food Preservation with Low Temperatures, Food Preservation with High Temperatures, Preservation of Foods by Drying, Indicator and Food-borne Pathogens, Other Proven and Suspected Food-borne Pathogens. Rheology of Food Production.

Text / Reference Books:
1. Frazier, W.S. and Weshoff, D.C., 1988. Food Microbiology, 4th Edn., McGraw Hill Book Co., New York.
2.Mann & Trusswell , 2007. Essentials of human nutrition. 3rd edition .oxford university press.
3. Jay, J.M., 1987. Modern Food Microbiology, CBS Publications, New Delhi.
4 Lindsay, 1988. Applied Science Biotechnology. Challenges for the flavour and Food Industry. Willis Elsevier.
5. Roger, A., Gordon, B. and John, T., 1989. Food Biotechnology.

ECH 606 HEAT AND MASS TRANSFER   3 1 0
Heat Transfer Operation
Unit I Conduction and Convection
Introduction, Conduction: Basic concepts of conduction in solids, liquids and gases, One and two dimensional heat conduction. Critical and optimum insulation thickness. Introduction to unsteady state heat transfer. Principles of convection, Equations of forced and free convection.   *[8]*

Unit II Radiation

Basic laws of heat transfer by radiation, black body and gray body concepts, solar radiations, combined heat transfer coefficients by convection and radiation. Introduction of Heat Transfer Equipments: Heat Exchangers, Evaporators, Condenser.   [4]

Mass Transfer Operation
Unit III   Diffusion

Molecular and turbulent diffusion, Diffusion coefficient, Flick's Law of diffusion, Dependence of diffusion coefficient on temperature, pressure and composition, Diffusion in multi-component gas mixtures. Diffusion in solids: Molecular, Knudsen &surface diffusion Inter- phase mass transfer, Mass transfer coefficients ,Diffusion between phases , Equilibrium solubility of gases in liquids, Mass Transfer theories, Mass transfer in fluidized beds , flow past solids and boundary layers , Simultaneous heat and mass transfer.   [10]

Unit IV   Drying and Crystallization

Solid-gas equilibria, Different modes of drying operation, , Types of batch and continuous dryer Definitions of moisture contents, Rate of batch drying, Time of drying, Mechanism of batch drying, Continuous drying.

Equilibrium yield of crystallization, Heat and mass transfer rates in crystallization, Theories of crystallization, Factors governing nucleation and crystal growth rates, controlled growth of crystal, Classification of crystallizers.   [8]

Unit V   Absorption and Adsorption

Gas-Liquid equilibria.Henry's Law, Selection of solvents, Absorption in tray column, Graphical and analytical methods, Absorption in packed column, Design equation for packed column, HTU, NTU and HTEP concepts, Equipments.

Description of adsorption process and their application, Types of adsorption Nature of adsorbents, Adsorption equilibrium and adsorption hysterises, Stage wise and continuous contact adsorption operation operations, Determination of number of stages, Equipments. [10]

Books Recommended
1. Holman, J.P.: "Heat Transfer" 9 th ed. McGraw Hill (1989).
2. Treybal, R "Mass Transfer Operations", 3rd ed. New York: McGraw-Hill, (1980).

Reference Books
1. McCabe Smith: Unit Operations in Chemical Engineering, McGraw Hill
2. Foust A. S. et.al., "Principles of Unit Operations" John Wiley (1980).

EBT-651, Fermentation/Biotechnology Lab

```
L  T  P
0  0  6
```

1. Fermentative production of Penicillin Antibiotics using *Penicilium chrysogenum*.
2. To study the induction effect of β-galactosidase enzyme in *E.coli*.
3. Citric acid production by (a) solid state and (b) submerged fermentation.
4. Microbial production of enzymes by (a) solid state and (b) submerged fermentation.
5. Fermentative production of Ethanol using *Saccharomyces cerevisiae.*
6. Wine Fermentation.
7. Microbial production of Biosurfactant using suitable strain.
8. Microbial production of Biopolymer using suitable Strain.

Food Biotechnology Lab (EBT-652)

1. Isolation and Characterization of food fermenting organism from idli batter.
2. Estimation of ascorbic acid from given food sample by titrimetric method.
3. Analysis of mycotoxin (Aflatoxin) in fungus contaminated food material.
4. Microscopic examination of Food/Milk by breed method.

5. Estimation of lactose from milk.
6. Quality characterization of pasteurized milk by MBRT method.
7. To judge efficiency of pasteurization of milk by Phosphatase test.
8. Detection of microbial count in Milk by SPC method.
9. Determination of Minimum Inhibitory Concentration (MIC) of Antibiotic.

References :-

1. Gaud R.S. (2000), Practical biotechnology, Nirali Prakashan.
2. Sadashivam S. and Manickam A. (1996), Biochemical Methods, 2nd Edi. New age International (P) Ltd., Publications, New Delhi.
3. Schmauder Hans Peter (1997), Methods in Biotechnology, Taylor and Francis, London.
4. Sharma P.K and Dandiya P.C (2004), Pharmaceutical Biochemistry: Theory and Practicals, Vallabh Prakashan , Delhi.
5. Thimmaiah S.K (2006), Standard Methods of Biochemical Analysis, Kalyani Publishers, New Delhi.

ECH 656 Heat Transfer Lab

L T P

List of Experiments   **0 0 3**
Any 10 experiments are compulsory for lab work.

1. To find out the thermal conductivities of all layers of Composite wall.
2. To find the thermal conductivity of Composite cylinder.
3. To find out the thermal conductivity of insulating powder.
4. To find the thermal conductivity of liquid / gases.
5. To find the temperature profile of any regular shaped thermal conductor for steady and unsteady state conduction.
6. Any Experiment on natural convection.
7. Experiment on Heat Pipe.
8. Any experiment on determination of emissivity.
9. Heat load and Over all heat transfer coefficient for parallel flow condition.
10. Heat load and Over all heat transfer coefficient for Counter flow condition.
11. To study the Plate heat exchanger and Double Pipe Heat Exchanger.
12. To study the shell & Tube heat exchanger.

EBT-701 DOWN STREAM PROCESSING

L T P
3 0 0

Unit I
An overview of Bioseparation. Role of Downstream Processing in Biotechnology. Problems and requirement of bioproduct purification.Cost cutting strategies.
Unit II
Primary separation and Recovery Process:Cell, Disruption methods(Physical,chemical and Enzymatic) for intracellular prducts.Removal of insoluble, biomass. Separation techniques – Flocculation, Sedimentation, Centrifugation and Filtration..
Unit III
 Product Isolation - Extraction and Adsorption methods, Solid- Liquid , Liquid -liquid Separation, Distillation.Enrichment operation-Membrane based Separation -micro and
ultrafiltration (Theory, Design and Configuration of the Equipment), Precipitation methods-Ammonium, Sulphate, organic solvents, High molecular weight polymers.

Unit IV

Product Purification: Electrophoresis and Chromatography principle for product purification, Different Electrophoresis technique –Isoelectric, focussing ,chromatographic technique with special reference to ion-exchange ,affinity, GLC, HPLC

Unit V

Product Polishing: Crystallization, Drying. A Few case studies: Citric acid, Glutamic acid, Penicillin G,Extracellular Enzymes, Intracellular enzymes, Antibodies

Recommended Books:
1. Comprehensive biotechnology- Murray Moo-Young, Vol. II-latest ed., Pergan Publishers.
2. H. J. Rehm and G. Reed, Biotechnology- Vol. 3, 4, 5, Verlag Publishers
3. Stanbury & Whitteker, Principles Of Fermentation Technology, Pergamon Press
4. A Biologist's Guide to Principles & Techniques of Practical Biochemistry- Wilson and Golding, Cambridge University Press
5. Humphrey, Aiba & Miller, Biochemical Engg., Academic Press.
6. Biochemical Engg. -Bailly & Ollis, Academic Press.
7. Product Recovery in Bioprocess Technology, Heinemann, Butterworth Publication.
8. Electrophoresis in Practice, Westermeier- Wiley Publications.
9. Handbook of Analytical techniques-H. Gunzler, Wiley Publications.
10. International Methods of Analysis- Willard et al., CBS Publication.
11. Bioseparation Techniques, Sivasankar, Prentice-Hall of India, 2004.
12. Bioseparations (Principles & techniques), B. Sivasankar, Prentice-Hall of India, 2005.
13. Citric Acid Biotechnology, Linden, Ane/Rout Publishers.

EBT-702 : Bioethics, Biosafety & IPR

L T P
3 0 0

Unit I
Jurisprudential definition and concept of property, rights, duties and their correlation. History and evolution of IPR- like patent, design and copy right, Indian patent act 1970 (amendment 2000), international convention in IPR, major changes in Indian patent system as post TRIPS effects
(i) obtaining patent (ii) geographical indiation.
Unit II
Distinction among various forms of IPR, Requirement of a patentable novelty, invention step and prior art and state of art, procedure
Unit III
Rights/protection, infringement or violation, remedies against infringement – civil and criminal.
Unit IV
Detailed information on patenting biological products, Biodiversity, Budapest treaty, Appropriate case studies.
Unit V
Biosafety and Bioethical issues in Biotechnology
Recommended Books:
1. Patent Strategy For Researches & Research Manegers- Knight, Wiley Publications.
2. Agriculture & Intellectual & Property Rights, V. Santaniello & R E Evenson, University Press.
3. Intellectual Property Protection & Sustainable Development, Phillipe Cullet, Ldexix Nexis Butterworths.
4. Biotechnology & Safety Assessment, Thomas, Ane/Rout Publishers.
5. Biotechnology in Comparative Perspective, Fuchs, Ane/Rout Publishers.

DOWN STREAM PROCESSING LAB – EBT 751

1.Cell disruption techniques.
2.Solid separation methods-filtration, sedimentation techniques. 3.Centrifugation techniques
3. Product enrichment operations (precipitation, ultra filtration, two-phase aqueous extraction)
4. High-resolution purification
5. Preparative liquid chromatographic techniques
6. Product crystallization and drying

EBT-801 ENVIRONMENTAL BIOTECHNOLOGY

L T P
3 1 0

Unit I
Environmental pollution: Land, water , air , and noise (introduction , sources , effects and measurements). Types of wastes , properties and steps involved in aerobic and anaerobic treatments of solid waste ,sewage and industrial effluents and their reuse .

Unit II
Biological waste treatments and biofuel production**.**   Methanogenesis: methanogenic , acetogenic , and fermentative bacteria – anaerobic and aerobic digestion processes and conditions . Minimal national standards for waste disposal. .

Unit III
Principles and design aspects of various waste treatments methods, with advanced bioreactor configuration : activated sludge process , trickling filter, fluidized expanded bed reactor , upflow anaerobic sludge blanket reactor , contact process , fixed / packed bed reactor , hybrid reactor , sequential batch reactor .

Unit IV
Kinetic models for biological waste treatment :bioconversion of agricultural and other higly organic waste materials into gainfully utilizable products – biogas, H2, cellulases and food and feed stocks. Economical and social aspects of waste treatment.

Unit V
Bioremediation : land , water , industries , organic contaminants , heavy metals and nitrogenous wastes .

Recommended Books:
1. Ecology & Environment- P. D. Sharma, 8th ed.
2. Waste Water Engineering- Metcalf & Fuddy, 3rd ed.
3. Environmental Processes I-III, J. Winter, 2nd ed., Wiley Publications
4. Introduction to Waste Water Treatment- R. S. Ramalho, Academic Press.
5. Environmental Studies- Dwivedi & Mishra, Ed. 2007.
6. Environmental Biotechnology, B.C. Bhattacharya & Ritu Banerjee, Oxford Press, 2007.
7. Essentials of Ecology & Environmental Science, S.V.S. Rana, Prentic-Hall India, 2006.
8. Perspectives in Environmental Studies, Anubha Kaushik & C P Kaushik, New Age International Publishers, 2004.
9. Environmental Biotech., Pradipta Krimar, I.K. International Pvt. Ltd., 2006.
10. Environmental Microbiology & Biotechnology, D.P. Singh, S.K. Dwivedi, New Age International Publishers, 2004.
11. Industrial & Environmental Biootechnology, Ahmed, Ane/Rout Publishers.
12. Environmental Biotechnology & Cleaner Bioprocesses, Olguin, Ane/Rout Publishers.
13. Global Environmental Biotechnology, Wise, Elsevier Ex. Pubishers

EBT-011- ANIMAL BIOTECHNOLOGY

Unit I

Basic cell culture techniques, Types of cell culture media; Ingredients of media; Physiochemical properties; CO_2 and bicarbonates; Buffering; Oxygen; Osmolarity; Temperature; Surface tension and foaming; Balance salt solutions; Antibiotics growth supplements; Foetal bovine serum; Serum free media; Trypsin solution; Selection of medium and serum; Conditioned media; Other cell culture reagents; Preparation and sterilization of cell culture media, serum and other reagents.

Unit II

Different tissue culture techniques; Types of primary culture; Chicken embryo fibroblast culture; Chicken liver and kidney culture; Secondary culture; Trypsinization; Cell separation; Continuous cell lines; Suspension culture; Organ culture etc.; Behavior of cells in culture conditions: division, growth pattern, metabolism of estimation of cell number; Development of cell lines; Characterization and maintenance of cell lines, stem cells; Cryopreservation; Common cell culture contaminants.

Unit III

Cell cloning and selection; Transfection and transformation of cells; Commercial scale production of animal cells, stem cells and their application; Application of animal cell culture for *in vitro* testing of drugs; Testing of toxicity of environmental pollutants in cell culture; Application of cell culture technology in production of human and animal viral vaccines and pharmaceutical proteins.

Unit IV

Cell culture reactors; Scale-up in suspension; Scale and complexity; Mixing and aeration; Rotating chambers; Perfused suspension cultures; Fluidized bed reactors for suspension culture; Scale-up in monolayers; Multisurface propagators; Multiarray disks, spirals and tubes; Roller culture; Microcarriers; Perfused monolayer cultures; Membrane perfusion; Hollow fiber perfusion; Matrix perfusion; Microencapsulation; Growth monitoring

Unit V

Transgenic animal production; Methods of transgene delivery; Integration of foreign genes and their validation; Gene targeting; Methods and strategies; Improving transgene integration efficiency; Cell lineages and developmental control genes in drosophila and mice; Differentiation of germ layers; Cellular polarity; Stem cell differentiation; Blood cell formation; Fibroblasts and their differentiation; Differentiation of cancerous cells and role of protooncogenes; Stem cell markers; Methods of stem cell production in farm animals; Using stem cells for SCNT; Transgenesis and Xenotransplants.

Texts/References:

1. B. Hafez and E.S.E Hafez, Reproduction in farm animals, 7th Edition, Wiley Blackwell, 2000
2. G.E. Seidel, Jr. and S.M. Seidel, Training manual for embryo transfer in cattle (FAO Animal Production and Health Paper-77), 1st Edition, W.D. Hoard and sons FAO, 1991
3. I. Gordon, Laboratory production of cattle embryos, 2nd edition, CAB International, 2003.
4. Louis-Marie Houdebine, Transgenic Animals: Generation and Use 5th Edition, CRC Press, 1997.

TBT-012, Plant Biotechnology

L T P
3 1 0

Unit I
Introductory history: Laboratory organization; Nutrition of plant cells; Media composition –solid and liquid; Biology plant cell in culture, Tissue and organ culture; Establishment and maintenance of callus and suspension cultures; Cellular differentiation and regulation of morphogenesis; Somatic embryogenesis; Control of organogenesis and embryogenesis; Single cell methods; Cytology of callus, Tissue culture & genetic engineering.

Unit II
Haploid production -Androgenesis; Anther and microspore culture; Gynogenesis; Embryo culture and rescue in agricultural and horticultural corps; Protoplast isolation; Culture – regeneration; Somatic hybrid-cybrids; *In vitro* selection of mutants –mutants for salts, disease, cold, drought, herbicide and other stress conditions; Plant micropropagation: Application of micropropagation in forestry and historical crops, Micrografting – *in vitro* clonal multiplication – Meristem culture and virus elimination; Shoot tip culture.

Unit III
Improved crop varieties through somaclonal variation in *in vitro* cultures -- Causes- stability and utilization – genetic and epigenetic basis; Establishment of cell lines and evaluation; Secondary metabolite in cell culture; Application of tissue culture for crop improvement in agriculture, horticulture and forestry

Unit IV
Introduction to Plant genetic Engineering: Methodology; Plant transformation with Ti plasmid of *Agrobacterium tumifacians*; Ti plasmid derived vector systems; Physical methods of transferring genes to plants - Microprojectile bombardment, Electroporation; Manipulation of gene expression in plants; Production of marker free transgenic plants.

Unit V
Developing insect-resistance, disease-resistance, herbicide resistance; stress and senescence-tolerance in plants-oxidative, salt and submergance stress, fruit ripening, Genetic manipulation of flower pigmentation, Developing quality of seed storage, Provitamin A, iron proteins in rice, Modification of food plant taste and appearance, yield increase in plants, Wild plant relatives as a source of novel genes, Plants as bioreactor - antibodies, polymers, foreign proteins in seeds. Genome mapping efforts in rice & maize, potential applications.

Text Books & References
1. Principles and Practices in Plant Science. Walton, P.D. Prentice Hall 1988.
2. Plant Tissue Culture: Application and Limitations. Bhowjwani, S.S. 1990.
3. Plant Cell Culture: A practical approach. Dixon. 1994.
4. Plant Biotechnology and Development, SRC Series of Current Topics in Plant molecular Biology. Gresshoff, P.M.
5. Plant Cell Culture, Advances in Biochemical Engineering and Biotechnology. Anderson, L.A.,
6. Recombinant DNA. Watson, 1992.
7. Gene transfer to Plants. Portykns, 1995.
8. Plant Biotechnology. Mantell and Smith, 1984.
9. Genetic Engineering of Plants. Kosuge, 1983.
10. Biochemistry & Molecular Biology of Plants. Kosuge. 1983
11. Biochemistry & Molecular Biology of Plants, Buchnan, Gruissen Jones, I.K. International Pvt. Ltd., 2004.
12. Plant Biotechnology, Ashwani Kumar, Shikha Rohy, I.K. International Pvt. Ltd, 2006.
13. Plant Taxonomy, O.P. Sharma, TMH Publication, 2006.

EBT-021 : ENZYME & PROTEIN ENGINEERING

L T P
2 1 0

Unit I
Stability of enzymes: Enzyme stabilization by selection and genetic engineering,, protein engineering, Reaction environment rebuilding, chemical modification, intra-molecular Cross-linking and immobilization. Molecular structure and function of enzymes. Folding and active site formation in enzymes. Phenomena of allosterism and allosteric kinetics.

Unit II
Various techniques used for the immobilization of enzymes, chemical modifications. Applications of immobilized enzyme in Biotechnology. Kinetics of immobilized enzymes. Kinetics of inhibition of immobilized enzymes. mass transfer effects on enzyme kinetics both in free and immobilized enzyme system.
Different types of enzyme reactors, Heterogeneous reaction systems, transient analysis of enzyme reactors. Process design and operational strategies of immobilized enzyme reactors.

Unit III
Biosynthesis of proteins. Conformation studies of different proteins. Specific conformation of enzymes considering position of active sites. Effect of amino acids on structure of proteins. Energy status of a protein molecule, structure , function relation of enzymes.

Unit IV
Physical methods such as X-ray crystallography for determination of protein structure. Site directed mutagenesis for specific protein function. Basic concept for designing a new protein/enzyme molecule. Specific examples of enzyme engineering, Tryesyl t RNA synthetase, Dihydrofolate reductase, Subtilisin.

Recommended books:
1. Enzymes-Dixon and Webb
2. Practical Chemical Biochemistry
   Ed. H. V. Varley, A. H. Goven Lock and M. Bell William Heinnemann Medical Books Ltd. London.
3. Biochemistry- A. L. Lehninger- Kalyani Publication
4. Biochemical Engg. Aiba, Humphrey & Miller, Academic Press.
5. Fermentation & Enzyme Technology- Wangs & Humphrey, Wiley International
6. Microbial Enzymes & Bioconversions- A. H. Rose, Academic Press.
7. Heat & Mass Transfer- Srivastava & Murthy S., TMH publication.
8. Biotech. For Engineering Biological Systems in Technological Process- Scorgy A. H.- Christopher Ellis Horwood Press
9. Protein Biotechnology and Biochemistry, 2nd ed.- Walsh, Wiley Publications.
10. Handbook of Metaloproteins- Messer-schmidt, Wiley Publications.
11. Novel Therapeutic Proteins-Klaus Dembowsky, Wiley Publications.

EBT-022 BIOPHYSICS

Unit I
Principle, Instrument Design, Methods & Applications of UV-Visible Spectra, IR Spectra, Raman Spectra, Fluorescence spectra, NMR and ESR Spectra.
Principle, Instrument Design, Methods & Applications of all types of Adsorption & Partition Chromatography, Centrifugation & Ultracentrifugation, Viscometry, Osmosis, Diffusion and Surface tension.

Unit II

Principle, Instrument Design, Methods & Applications of Free & Zone (Paper, gel, Pulsed-field, PAGE, SDS-PAGE, Capillary) Electrophoresis, isoelectric focusing, Potentiometry, pH meter, ion selective electrodes, conductometry.

Unit III

Principle, Instrument Design, of Polarimetry, ORD, CD, Light scattering, Refractometry, Flowcytometry, Cytophotometry, Compound, Phasecontrast, Interference, Fluorescence, Polarizing, Scanning & Transmission Electron Microscopy, CCD Camera, Introduction to Methods & Applications of Atomic Force Microscopy

Unit IV

Crystals, Molecular crystal symmetry, X ray diffraction by crystals, Bragg's Law, laue powder and rotation methods, Calculating electron density and patterson maps (Fourier transform and Structure factors, convolutions),phases, model building & evaluation, Neutron diffraction, Electron diffraction, Application in Biology.

Text Books / Reference books :
1) Text Book Of Biophysics Revised Edition (Hardcover) by R. N. Roy. New Central Book Agency (p) Ltd
2) Biophysics Principles & Techniques By Subramanian Ma. MJP PUBLISHERS
3) Principles Of Biochemistry And Biophysics by Dr. B. S. Chauhan. Usp
4) Biophysical Chemistry(Principles and Techniques) By Avinash Upadhyay, Kakoli Upadhyay ,Nirmalendu Nath. Himalaya

EBT-031 -Vaccine Technology & Immunoinformatics

Unit –I

Vaccines : Introduction to immunity, Fundamental concepts in vaccination and traditional methods of vaccine production (production of DPT and Rabies vaccine), Production of Modern Vaccines (production of Hepatitis vaccine)

Unit -II

Applications of immunological methods in diagnosis.

Unit - III

Reverse vaccinology and immunoinformatics . Databases in Immunology

Unit – IV

B-cell epitope prediction methods

T-cell epitope prediction methods

Resources to study antibodies, antigen-antibody interactions

Unit -V

Structure Activity Relationship – QSARs and QSPRs, QSAR Methodology, Various Descriptors used in QSARs: Electronics; Topology; Quantum Chemical based Descriptors. Use of Genetic Algorithms, Neural Networks and Principle Components Analysis in the QSAR equations

Text books/Reference Books
1: *Kuby Immunology 4e* by Richard A. Goldsby, Thomas J. Kindt and Barbara A. Osborne
2. Immunoinformatics: Predicting Immunogenicity in Silico By Darren R Flower
Publisher: Humana Press
3: Immunoinformatics (Immunomics Reviews:)By Shoba Ranganathan ,Vladimir Brusic, Christian Schonbach. Publisher: Springer

EBT-032 - Biofuels & Alcohol Technology
Unit -I
Introduction to Alcohol Technology, Raw Material of Alcohol Industry, Storage & handling of Raw material in detail, Study of different yeast strains used in alcohol industries, Study of yeast production as single protein cell.
Unit-II
Study of different alcoholic fermentation techniques, Batch fermentation, Continuous fermentation, Modem
techniques of Continuous fermentation, Bio still fermentation, Encillium process
Wet milling of grain for alcohol production, Grain dry milling cooking for alcohol production, Use of cellulusic feed stocks for alcohol production, Scaling in distilleries, Fusel oil separation
Unit III
Study of different recycling process, Biochemistry of alcohol production, The management of fermentation in
the production of alcohol.
Unit IV
Alcohol distillation-The fundamental, Parameters & affecting alcoholic fermentations, By product of alcoholic
fermentation, Distillery quality control, Alcoholometry
Unit – V
Various biofuels/bioenergy from biomass. Biomass conversion to heat and power: thermal gasification of biomass, anaerobic digestion. Biomass conversion to biofuel: thermochemical conversion, syngas fermentation.
Recommended Books
1. Chemical Process Principles – Part I, Material and Energy Balances by Olaf A Hougen, Kwenneth M. Watson, and Roland A Ragatz, CBS Publishers and Distributors (1995).
2. Text books of alcohol tech by T. P. Lyons.
3. Product Recovery in Bioprocess Technology ", BIOTOL Series,   VCH, 1990
4. Shreve's Chemical Process Industries , 5th Ed. Reference
5. Out lines of Chemical Technology by Chmles E.
6. Chemical Process Industries, 4th Ed. By shieve, Mc.Graw

EBT-041 MOLECULAR MODELING AND DRUG DESIGN

UNIT I
Introduction to Molecular Modelling. What are models used for? Areas of application – Single molecule calculation, assemblies of molecules. Reaction of the molecules. Drawbacks of mechanical models as compared to graphical models. Co-ordinate systems two – matrix, potential energy surface. Postulates of quantum mechanics, electronic structure calculations, ab initio, semi-empirical and density functional theory calculations, molecular size versus accuracy. Approximate molecular orbital theories.
UNIT II
Molecular Mechanisms, energy calculations, Bond stretch, angle bending, torsional term. Electrostatic interaction- Van der waals interactions. Miscellaneous interaction. Introduction, Molecular Dynamics using simple models. Dynamics with continuous potentials. Constant temperature and constant dynamics. Conformation searching, Systematic search. Applications to protein folding
UNIT III
Modelling by Homology-the alignment, construction of frame work ,selecting variable regions, side chain placement and refinement, validation of protein models –Ramchandran plot, threading and ab initio modeling.
UNIT V
Introduction to QSAR. lead module, linear and nonlinear modeled equations, biological activities, physicochemical parameter and molecular descriptors, molecular modelling in drug discovery.

UNIT V
3D pharmacophores ,molecular docking, De novo Ligand design, Free energies and solvation, electrostatic and non-electrostatic contribution to free energies. 3D data base searching and virtual screening, Sources of data, molecular similarity and similarity searching, combinatorial libraries – generation and utility,
REFERENCES:
1. Principles and applications of modelling by Leach
2. Molecular Modelling by Hans Pieter,Heltje & Gerd Folkens, VCH.
3. Chemical Applications of Molecular Modelling by Jonathan Goodman.
4. Computational Chemistry by Guy H, Grant & W. Graham Richards, Oxford University Press

EBT-042 BIOPROCESS ENGINEERING-II

Unit I
Introduction to engineering calculations; unit conversion, measurement conventions, Errors in Data and Calculations, Presentation of Experimental Data, Data Analysis, General Procedures For Plotting Data, Process Flow Diagrams

Unit II
Material balances, Material balances with recycle, by-pass and purge streams, Stoichiometry of growth and product formation, electron balances, biomass yield, maximum possible yield, theoretical oxygen demand, stoichiometry of single-cell protein synthesis, Mass transfer; Role of diffusion in bioprocessing, convective mass transfer, oxygen uptake in cell cultures, factors affecting cellular oxygen demand

Unit III
Design and operation of various bioreactors, viz CSTR, fed batch systems, air-lift bioreactors, fluidized bed bioreactors. Scale up of bioreactors. Criteria for selection of bioreactors. Ideal Bioreactors; Fed-Batch Reactor, Enzyme-catalysed reactions in CSTRs, CSTR reactors with recycle and wall growth, the ideal plug-flow tubular reactor, Dynamics model and Stability of bioreactor,. Reactors with non-ideal mixing: Mixing time in agitated tanks, Resident time distributions, Models for no-ideal reactors, Mixing-Bio reaction interactions

Unit IV
Scale up of bioprocess; General aspects, Criteria and Basic principle of scale-up of bioreactor, Practical considerations for bioreactor construction

Unit V
Control of physical, chemical and biological environment of the bioreactor, Advanced control strategies viz. PID controllers, fuzzy logic based controllers and artificial neural network based controllers, Role of physical, chemical & biological sensors.

Text & References:

1. Principles of Microbial and cell cultivation by S.J.Pirt, Butterworth Publications
2. Bioprocess Engineering Principles by P.M.Doran
3. Principles of Fermentation Technology by Whitaker
4. Bioreactor Design & Product Yield, BIOTOL Series
5. Operational Models of Bioreactor, BIOTOL Series
6. Bioreactors in Biotechnology: A Practical approach by Scragg
7. Biochemical Engineering by Bailly & Ollis
8. Process Biotechnology Fundamentals by S.N. Mukopadhyay

9. Bioprocess Engineering: Basic Concepts by Shular & Kargi
10. Fermentation Microbiology & Biotechnology by Mansi

EBT-051 -BIOTECHNOLOGY IN HEALTH CARE

Unit-1

Therapeutic Aspects of Biomacromolecules: Introduction, Endogenous pepticdes and proteins, Modification of endogenous peptides and proteins
Immune System: Overview, Antibody-mediated response, Vaccines, Cell-mediated immune response, Cancer immunotherapy

Unit -2

Oligonucleotides: Overview, Gene therapy, Antisense therapy, Ribozymes
Oligosaccharides: Overview, Oligosaccharide synthesis, Heparin, Glycoproteins, Polysaccharide bacterial vaccines, Approaches to carbohydrate-based cancer vaccines.

Unit -3

Radiological Agents: Radiosensitizers and Radioprotective agents
Cardiovascular Drugs: Myocardial infarction agents, Endogenous vasoactive peptides, Hematopoietic agents, Anticoagulants, anthrombotics and hemostatics

Unit -4

Chemotherapeutic Agents: Synthetic antibacterial agents, Lactam antibiotics, Anthelminitic agents, Anthelmintic agents, Antiamebic agents, Antiviral agents.
Endocrine Drugs: Female sex hormones and analogs, Agents affecting the immune Response

Unit -5

Drug Targeting Organ-Specific Strategies: Basic concepts and novel advances, Brain-specific drug targeting strategies, Pulmonary drug delivery, Cell specific drug delivery.

Text / Reference Books:
1. Pharmaceutical Chemistry by Christine M. Bladon. John Wiley & Sons, Ltd. (2002).
2. Burger's Medicinal Chemistry and Drug Discovery (5th edition) by Manfred E. Wolff. A Wiley & Sons, Inc. (2000).
3. Drug Targeting Organ-Specific Strategies by Grietje Molema and Dirk K. F. Meijer. Wiley-VCH. (2002).

EBT-052: NANOBIOTECHNOLOGY

L T P
3 1 0

Unit I
Basic biology principles and practice of micro fabrication techniques, Atomic force microscopy, biological production of metal nano particles, macro molecular assemblies.

Unit II

Application in Biomedical and biological research, nano particles, viruses as nano-particles , nano chemicals and application., tumor targeting and other diagnostic applications.

Unit III
Developing drug delivery tools through nano biotechnology, nano particle based immobilization assays, quantum dots technology and its application.
Unit IV

Synthesis and characterization of different classes of biomedical polymers- their uses in pharmaceutical, cardiovascular ophthalmologic orthopedic areas.
Unit V
Biosensors and nano biotechnology principles used in construction of micro electronic devices sensors and macro mechanical structures.and their functioning, immuno-nanotechnology

Recommended Books:
1. **Nanobiotechnology- concepts, applications and perspectives, niemeyer, christof m. Mirkin, chad a., wiley publishers.**
2. **Nanobiotechnology of biomimetic membranes, martin, donald (edt), springer verlag publishers.**

EBT-061 : BIOMEDICAL INSTRUMENTATION

L T P
3 1 0

Unit I
Introduction to biomedical instrumentation, Basic transducer principles, Sources of bioelectric potentials, Electrodes.
Unit II
The Cardiovascular system, Cardiovascular measurements, Patient care and monitoring, Measurements in the respiratory system.
Unit III
Noninvasive diagnostic instrumentation, The nervous system, Instrumentation for sensory measurements and the study of behaviors, Biotelemetry.
Unit IV
Instrumentation for the clinical laboratory, X-ray and radiosotope instrumentation.
Unit V
The computer in biomedical instrumentation, Electrical safety of medical equipment.
Recommended books:
1. Biomedical Instrumentation and Measurement by Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer
2. Biomedical Instrumentation: Technology and Applications by Raghbir Singh
3. Medical Instrumentation for Health Care by Leslie Cromwell
4. Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation by Robert B. Northrop
5. Introduction to Bioinstrumentation: With Biological, Environmental, and Medical Application by Clifford D. Ferris.

EBT-062 GENOMICS & PROTEOMICS

Unit I
Introduction to Genomics
Structure and organization of prokaryotic and eukaryotic genomes nuclear, mitochondrial and chloroplast genomes; Computational analysis of sequences- finding genes and regulatory

regions; Gene annotation; Similarity searches; Pairwise and multiple alignments; Alignment statistics; Prediction of gene function using homology,context, structures, networks; Genetic variation-polymorphism,deleterious mutation; Phylogenetics; Tools for genome analysis–PCR, RFLP, DNA fingerprinting, RAPD, Automated DNA sequencing; Linkage and pedigree analysis; Construction of genetic maps; Physical maps, FISH to identify chromosome landmarks.

Unit II

Genome sequencing

Human genome project-landmarks on chromosomes generated by various mapping methods; BAC libraries and shotgun libraries preparation; Physical map-cytogenetic map, contig map, restriction map, DNA sequence; DNA sequencing and sequence assembly;

Model organisms and other genome projects; Comparative genomics of relevant organisms such as pathogens and nonpathogens;Evolution of a pathogen e.g. Hepatitis C virus or a bacterial pathogen; Taxonomic classification of organisms using molecular markers- 16S rRNA typing/sequencing;

Unit III

DNA Microarray technology

Basic principles and design: cDNA and oligonucleotide arrays;Applications: Global gene expression analysis, Comparative transcriptomics, Differential gene expression; genotyping/SNP detection; Detection technology; Computational analysis of microarray data.

Unit IV

Proteomics

Overview of protein structure-primary, secondary, tertiary and quarternary structure; Relationship between protein structure and function; Outline of a typical proteomics experiment; Identification and analysis of proteins by 2D analysis; Spot visualization and

picking; Tryptic digestion of protein and peptide fingerprinting; Mass spectrometry : ion source (MALDI, spray sources); analyzer (ToF, quadrupole, quadrupole ion trap) and detector; clinical proteomics and disease biomarkers; Prions; proteins in disease;

Protein-protein interactions: Solid phase ELISA, pull-down assays (using GST-tagged protein), far western analysis, by surface plasmon resonance technique, Yeast two hybrid system, Phage display; Protein interaction maps; Protein arrays-definition, applications- diagnostics, expression profiling.

Unit V

Human disease genes; DNA polymorphism including those involved in disease; Hemoglobin and the anemias; Phenylketonuria (monogenic) and diabetes (multigenic) genetic disorders; 'disease' gene vs. 'susceptibility' gene; SNP detection: hybridization based assays (allele specific probes); Polymerization based assays (allele specific nucleotide incorporation, allele-specific PCR); Ligation based assays (allele specific oligonucleotide ligation); Polymorphism detection without sequence information: SSCP;

Proteomics and drug discovery; High throughput screening for drug discovery; Identification of drug targets; Pharmacogenomics and pharamacogenetics and drug development; Toxicogenomics; Metagenomics.

Texts/References:

1. Introduction to Genomics . Arthur Lesk. Oxford University Press, 2008
2. Brown TA, Genomes, 3rd Edition, Garland Science, 2006.
3. Campbell AM & Heyer LJ, Discovering Genomics, Proteomics and
4. Bioinformatics, 2nd Edition, Benjamin Cummings, 2007.
5 Primrose S & Twyman R, Principles of Gene Manipulation and
Genomics, 7th Edition, Blackwell, 2006.
6. Glick BR & Pasternak JJ, Molecular Biotechnology, 3rd Edition,
ASM Press, 1998.