

INSTITUTE OF ENGINEERING & TECHNOLOGY



**BUNDELKHAND UNIVERSITY
JHANSI**

**DEPARTMENT OF BIOTECHNOLOGY
ENGINEERING**

**Course Structure and syllabus for B.Tech
Biotechnology Engineering Programme**

COURSE STRUCTURE

**INSTITUTE OF ENGINEERING & TECHNOLOGY
BUNDELKHAND UNIVERSITY, JHANSI**

**STUDY AND EVALUATION SCHEME
YEAR I, SEMESTER-I
B. Tech. BIOTECHNOLOGY ENGINEERING**

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total
			L	T	P	SESSIONAL EXAM.			ESE	
						CT	TA	Total		
THEORY										
1.	*MA-102/ BT-101	Elementary Mathematics-I /Remedial Biology	3	1	0	30	20	50	100	150
2.	HU-101	Professional Communication	3	1	0	30	20	50	100	150
3.	PH-101/ CY-102	PHYSICS/ CHEMISTRY	3	1	0	30	20	50	100	150
4.	EE-101/ ME-101	Electrical Engineering/ Mechanical Engineering	3	1	0	30	20	50	100	150
5.	EC-101/ CS- 101	Electrical Engineering/ Information Technology	3	1	0	30	20	50	100	150
PRACTICAL/TRAINING/PROJECT										
6.	PH-151/ CY-151	PHYSICS/ CHEMISTRY	0	0	2	10	10	20	30	50
7.	EE-151/ ME-151	Electrical Engineering/Mechanical Engineering	0	0	2	10	10	20	30	50
8.	CS-151/ WS-151	Computer Programming Lab/Workshop Practice	0	1	2	10	10	20	30	50
9	CE-151	Engineering Graphics	0	0	3	10	10	20	30	50
10	GP-101	General Proficiency	-	-	-	-	-	50	-	50
		Total	15	6	9	-	-	-	-	1000

NOTE :

*Elementary Mathematics is for the students who passed 10+2 examination with Biology and Remedial Biology is for the students who passed 10+2 with Mathematics.

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**STUDY AND EVALUATION SCHEME
YEAR I, SEMESTER-II
B. Tech. BIOTECHNOLOGY ENGINEERING**

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total
			L	T	P	SESSIONAL EXAM.			ESE	
						CT	TA	Total		
THEORY										
1.	MA-202/BT-201	Elementary Mathematics-II/ Remedial Biology II	3	1	0	30	20	50	100	150
2.	CE-201	Environmental Studies	3	1	0	30	20	50	100	150
3.	PH-201/CY-201	PHYSICS/ CHEMISTRY	3	1	0	30	20	50	100	150
4.	EE-201/ME-201	Electrical Engineering/Mechanical Engineering	3	1	0	30	20	50	100	150
5.	EC-201/IT-201	Electrical Engineering/Information Technology	3	1	0	30	20	50	100	150
PRACTICAL/TRAINING/PROJECT										
6.	PH-251/CY-251	PHYSICS/ CHEMISTRY	0	0	2	10	10	20	30	50
7.	EE-251/ME-251	Electrical Engineering/Mechanical Engineering	0	0	2	10	10	20	30	50
8.	CS-251/WS-251	Computer Programming Lab/Workshop Practise	0	1	2	10	10	20	30	50
9	HU-251	Communication Lab (English)	0	0	3	30	20	50	-	50
10	GP-201	General Proficiency	-	-	-	-	-	50	-	50
		Total	15	6	9	-	-	-	-	1000

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**STUDY AND EVALUATION SCHEME
YEAR II, SEMESTER-III
B. Tech. BIOTECHNOLOGY ENGINEERING**

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total
			L	T	P	SESSIONAL EXAM.			ESE	
						CT	TA	Total		
THEORY										
1.	BT 301	Biochemistry	3	1	0	30	20	50	100	150
2.	BT-302	Microbiology & Cell Biology	3	1	0	30	20	50	100	150
3.	CH-301	Fluid Flow and Solid Handling	3	1	0	30	20	50	100	150
4.	MA-302	Statistical Techniques	3	1	0	30	20	50	100	150
5.	CS-306	Data structure & Algorithms	3	1	0	30	20	50	100	150
PRACTICAL/TRAINING/PROJECT										
6.	BT 351	Biochemistry Lab	0	0	6	0	40	40	60	100
7.	BT-352	Microbiology Lab	0	0	6	0	20	30	50	50
8.	CH-351	Fluid Mechanics Lab	0	0	3	10	10	20	30	50
9.	GP-301	General Proficiency	-	-	-	-	-	50	-	50
		Total	15	5	12	-	-	-	-	1000

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**STUDY AND EVALUATION SCHEME
YEAR II, SEMESTER-IV
B. Tech. BIOTECHNOLOGY ENGINEERING**

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total
			L	T	P	SESSIONAL EXAM.			ESE	
						CT	TA	Total		
THEORY										
1.	BT-401	Immunology	3	1	0	30	20	50	100	150
2.	BT-402	Enzymology	3	1	0	30	20	50	100	150
3.	BT-403	Genetics & Molecular Biology	3	1	0	30	20	50	100	150
4.	BT-404	Bioinformatics-I	3	1	0	30	20	50	100	150
5.	CH-401	Heat Transfer Operations	3	1	0	30	20	50	100	150
PRACTICAL/TRAINING/PROJECT										
6.	BT-451	Immunology Lab	0	0	6	20	20	40	60	100
7.	BT-452	Genetics & Molecular Biology Lab	0	0	3	10	10	20	30	50
8.	BT-453	Bioinformatics-I Lab	0	0	3	10	10	20	30	50
9.	GP-401	General Proficiency	-	-	-	-	-	50	-	50
		Total	15	5	12	-	-	-	-	1000

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**STUDY AND EVALUATION SCHEME
YEAR III, SEMESTER-V
B. Tech. BIOTECHNOLOGY ENGINEERING**

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total
			L	T	P	SESSIONAL EXAM.			ESE	
						CT	TA	Total		
THEORY										
1.	BT 501	Biophysical Techniques	3	1	0	30	20	50	100	150
2.	BT-502	Bioprocess Engineering-I	3	1	0	30	20	50	100	150
3.	HU-501	Industrial Economics & Principle of Management	3	1	0	30	20	50	100	150
4.	CH-501	Mass Transfer Operations-I	3	1	0	30	20	50	100	150
5.	CS-506	Design & Analysis of Algorithm	3	1	0	30	20	50	100	150
PRACTICAL/TRAINING/PROJECT										
6.	BT-552	Bioprocess Engineering Lab	0	0	6	0	40	40	60	100
7.	CS-551	Design & Analysis of Algorithm Lab	0	0	6	0	40	40	60	100
8.	GP 501	General Proficiency	-	-	-	-	-	50	-	50
		Total	15	5	12	-	-	-	-	1000

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**STUDY AND EVALUATION SCHEME
YEAR III, SEMESTER-VI
B. Tech. BIOTECHNOLOGY ENGINEERING**

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total
			L	T	P	SESSIONAL EXAM.			ESE	
						CT	TA	Total		
THEORY										
1.	BT-601	Bioinformatics-II	3	1	0	30	20	50	100	150
2.	BT-602	Plant Biotechnology	3	1	0	30	20	50	100	150
3.	BT-603	Fermentation Biotechnology	3	1	0	30	20	50	100	150
4.	BT-604	Genetic Engineering	3	1	0	30	20	50	100	150
5.	CH-601	Mass Transfer Operations-II	3	1	0	30	20	50	100	150
PRACTICAL/TRAINING/PROJECT										
6.	BT-651	Bioinformatics-II Lab	0	0	6	0	20	20	30	50
7.	BT-653	Fermentation Lab	0	0	6	0	40	40	60	100
8.	BT-654	Genetic Engineering Lab	0	0	0	0	20	20	30	50
9.	GP-601	General Proficiency	-	-	-	-	-	50	-	50
		Total	15	5	12	-	-	-	-	1000

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**STUDY AND EVALUATION SCHEME
YEAR IV, SEMESTER-VII
B. Tech. BIOTECHNOLOGY ENGINEERING**

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total
			L	T	P	SESSIONAL EXAM.			ESE	
						CT	TA	Total		
THEORY										
1.	OE	Open Elective	3	1	0	30	20	50	100	150
2.	CH-701	Chemical Reaction Engineering	3	1	0	30	20	50	100	150
3.	BT-701	Environmental Biotechnology	3	1	0	30	20	50	100	150
4.	BT-702	Elective-I	3	1	0	30	20	50	100	150
5.	BT-703	Elective-II	3	1	0	30	20	50	100	150
PRACTICAL/TRAINING/PROJECT										
6.	BT-751	Environmental Biotechnology Lab	0	0	3	10	10	20	30	50
7.	BT-752	Seminar	0	0	3	0	50	50	50	50
8.	BT-753	Industrial Training	0	0	3	0	50	50	-	50
9.	BT-754	Mini Project	0	0	3	0	50	50	-	50
10.	GP 701	General Proficiency	0	0	0	0	0	50	-	50
		Total	15	5	12	-	-	-	-	1000

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**STUDY AND EVALUATION SCHEME
YEAR IV, SEMESTER-VIII
B. Tech. BIOTECHNOLOGY ENGINEERING**

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total
						SESSIONAL EXAM.			ESE	
			L	T	P	CT	TA	Total		
THEORY										
1.	BT-801	Bioprocess Engineering-II	3	1	0	30	20	50	100	150
2.	BT-802	Bioseparation & Down Stream Processing	3	1	0	30	20	50	100	150
3.	BT-803	Elective -III	3	1	0	30	20	50	100	150
4.	BT-804	Elective-IV	3	1	0	30	20	50	100	150
PRACTICAL/TRAINING/PROJECT										
5.	BT-851	*Project & Seminar	0	0	12	-	100	100	250	350
6.	GP-801	General Proficiency	0	0	0	-	0	50	0	50
		Total	12	4	12	-	-	-	-	1000

*out of 12 periods, 2 periods per week should be allotted for a group and 10 periods per week should be allotted for self studies & project work.

SYLLABUS

I SEMESTER

PHYSICS (PH-101/ PH-201)

Unit – I: Relativistic Mechanics

Inertial and Non-inertial Frames, Michelson-Morley Experiment, Postulates of Special Theory of Relativity, Galilean and Lorentz Transformation, Length Contraction and Time Dilation, Addition of Velocities, Mass Energy Equivalence and Variation of Mass with Velocity.

Unit – II: Interference

Coherent Sources, Conditions of Interference, Fresnel's Biprism Experiment, Displacement of Fringes, Interference in Thin Films – Wedge Shaped Film, Newton's Rings.

Diffraction : Single and n-Slit Diffraction, Diffraction Grating, Raleigh's Criterion of Resolution, Resolving Power of Telescope, Microscope and Grating.

Unit – III: Polarization

Phenomenon of Double Refraction, Ordinary and Extra-ordinary Rays, Nicol Prism, Production and Analysis of Plane, Circularly and Elliptically Polarized Light, Fresnel Theory, Optical Activity, Specific Rotation, Polarimeter.

Laser : Principle of Laser Action, Einstein's Coefficients, Construction and Working of He-Ne and Ruby Laser.

Unit – IV : Electromagnetic

Ampere's Law and Displacement Current, Maxwell's Equations in Integral and Differential Forms, Electromagnetic Wave Propagation in Free Space and Conducting Media, Poynting Theorem.

Magnetic Properties of Materials

Basic Concept of Para- , Dia and Ferro-Magnetism, Langevin's Theory of Diamagnetism, Phenomenon of Hysteresis and Its Applications

Unit – V: X-Rays

Diffraction of X-Rays, Bragg's Law, Practical Applications of X-Rays, Compton Effect.

Wave Mechanics: Wave Particle Duality, de Broglie Concept of Matter Waves, Heisenberg Uncertainty Principle, Schrödinger Wave Equation and Its Applications: Particle in a Box and One Dimensional Harmonic Oscillator.

References:

1. Robert Resnick : Introduction to Special Theory of Relativity
2. Arthur Beiser : Perspectives of Modern Physics
3. A.K. Ghatak : Optics
4. Wehr Richards & Adiaev : Physics of Atoms

PHYSICS PRACTICAL (PH-151/PH-251)

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 half shade polarimeter.
5. To determine the wavelength of spectral lines using plane transmission grating.
6. To determine the specific resistance of the material of given wire using Carey Foster bridge.
7. To determine the variation of magnetic field along the axis of a current carrying coil and then to estimate the radius of the coil.
8. To verify Stefan's Law by electrical method.
9. To Calibrate the given ammeter and voltmeter.
10. To study the Hall effect and determine Hall coefficient, carrier density and mobility of given semiconductor material using Hall effect set up.
11. To determine energy band gap of a given semiconductor material
12. To determine E.C.E of copper using Tangent or Helmholtz galvanometer.
13. To determine the ballistic constant of a ballistic galvanometer.
14. To determine the viscosity of a liquid.

ELECTRONICS ENGINEERING (EC-101/EC-201)

Unit – I

Semiconductor materials and properties

Group-IV materials, Covalent bond, electron-hole concepts, Basic concepts of energy bands in materials, concept of forbidden gap, Intrinsic and extrinsic semiconductors, donors and acceptors impurities

Junction diode

P-n junction, depletion layer, v-i characteristics, diode resistance, capacitance, diode ratings (average current, repetitive peak current, non-repetitive current, peak-inverse voltage).

Unit-II

Diode Applications

Rectifiers (half wave and full wave), calculation of transformer utilisation factor and diode ratings, Filter (C-filter), calculation of ripple factor and load regulation, clipping circuits, clamping circuits, Voltage multipliers, **Breakdown diodes** Breakdown mechanisms (zener and avalanche), breakdown Characteristics, zener resistance, zener ,Diode ratings, zener diode application as shunt regulator

Unit-III

Bipolar Junction Transistor

Basic construction, transistor action, CB, CE and CC configurations, input/output characteristics, Biasing of transistors-fixed bias, emitter bias, potential divider bias, comparison of biasing circuits, **Transistor Amplifier** Graphical analysis of CE amplifier, concept of voltage gain, current gain, h-parameter model (low frequency), computation of A_i , A_v , R_i , R_o of single transistor CE and CC amplifier configurations.

Unit-IV

Field Effect Transistor

JFET: Basic construction, transistor action, concept of pinch off, maximum drain saturation current, input and transfer characteristics, characteristic equation CG, CS and CD configurations, fixed-, self-biasing, **MOSFET:** depletion and enhancement type MOSFET-construction, operation And characteristics. Computation of A_v , R_i , R_o , of single FET amplifiers using all the three configurations

Unit-V

Switching theory and logic design

Number systems, conversion of bases, Boolean algebra, logic gates, concept of universal gate, canonical forms. Minimization using K-map

Operational Amplifiers

Concept of ideal operational amplifiers, ideal op-amp parameters, inverting, non-inverting and unity gain amplifiers, adders, difference amplifiers, integrators

Reference:

- 1.Boylestad and Nashelsky, 'Electronic Devices and circuits' PHI, 6e, 2001
2. A.Mottershead, Electronic device and circuits, PHI,2000

PROFESSIONAL COMMUNICATION (HU-101)

Unit – I: Technical Communication

Nature; Origin and Scope; Feature and General Writing; Significance; Style: Objective Style as Contrary to Literary Composition. Forms of Technical Communication, Reports: Types, Significance, Structure & Style of Report; Writing of Reports: Project, Thesis, Dissertation Writing; Technical Paper & Scientific Article Writing: Elements, Methods & Technical Objectives; Technical Proposal: Nature, Divisions, Kinds, Uses.

Unit-II : Pre-Requisites of Technical Written Communication

Vocabulary Building : Homophones (Words Similar in sound but different in Meanings); Word-formation; One-Word substitute; New & Select Vocabulary Building (about 500 words)

Functional Grammar: Patterns and Correct usage (Parts of speech); Syntax Concord; Prepositions; Articles.

Requisites of Good Sentence and Paragraph Writing: Requisites of Good Sentence Writing; Paragraph Writing; Unity, Coherence and Emphasis; Development of Paragraph: Inductive Order, Deductive Order, Spatial, Linear, Chronological Orders etc. with Emphasis on Argumentative & Expository Writing.

Unit : III : Business Correspondence: Principles; Features; Sales and Credit Letters: Letters of Enquiry, Quotation, Order, Claim, Complaint and Adjustment letters, Bio-Data Making, Resumes/Job Application Processing.

Unit-IV : Language Learning Through Thematic and Value based Critical Reading (Non-Detailed Text Study) :

A Study of following Value-Oriented Essays:

A.L.Basham	:	The Heritage of India
S. Radhakrishnan	:	The Gandhian Outlook
Francis Bacon	:	Of Studies
J.B. Priestley	:	Making Writing Simple
Virginia Woof	:	How should one Read a Book
R.K. Narayan	:	A Bookish Topic
C.E.M. Joad	:	The Civilization of Today

Study of following Short Stories for making the Students acquaint with the styles of great Writers of World:

O.H. Henry	:	The Gift of the Magi
R.N. Tagore	:	The Renunciation
Katherine Mansfield	:	The Fly
A.P. Chekhor	:	The Lament
M.R. Anand	:	The Barber's Trade Union
Ruskin Bond	:	The Eyes Are Not Here
D.H. Lawrence	:	The Rocking Horse Winner
Ernest Hemingway	:	The Capital of the World

Unit-V : Dimensions of Spoken English: Using English Language Laboratory :

Stress, Intonation, Rhythm, Phonemes, Allophones, Phonetic Transcription, Listening, Reading & Comprehension of Speech and Reproduction of Response.

Texts Books/ References

Singh R.P. (ed) : An Anthology of English Essay; OUP, New Delhi

- Singh R.P. (ed) : An Anthology of English Short Stories; OUP, New Delhi.
- Hornby A.S. : Guide to Patterns & Usage in English; OUP, New Delhi
- Clark S. & Pointon : Word for Word; OUP, New Delhi
- Ruther Ford A. : Basic Communication Skills; Person Education, New Delhi.
- Singh R.P. : Functional Skills in Language & Literature; OUP, New Delhi
- Bansal R.K. & Harrison : Phonetics in English; Orient Longman, New Delhi
- Sethi & Dhamija : A Course in Phonetics & Spoken English; Prentice Hall, New Delhi.
- Blum Rosen : Word Power; Cambridge University Press, New Delhi
- Seely John : Writing Report; OUP, New Delhi
- Suggested Readings :
- Arora V.N. etal : Improve Your Writing; OUP Delhi
- Mohan K. & Sharma R.C. : Business Correspondence of Report Writing; TMH, New Delhi.
- Clive Upton etal : Oxford Dictionary of Pronunciation for Current English; OUP New Delhi.
- Michael Swan : A Dictionary of Modern English Usages; OUP, New Delhi
- John Alveyblrideh : Practical English Usages; OUP, New Delhi
- Jons Daniel : American English Pronouncing Dictionary; OUP New Delhi.
- English Pronouncing Dictionary; Cambridge University Press.

ELEMENTARY MATHEMATICS-I (MA-102)

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 and 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 variety 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, homogenous, 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, samples 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) | cs Part I – Textbook for Class XI, NCERT Publication | Mathemati |
| 2) | cs Part II – Textbook for Class XI, NCERT Publication | Mathemati |

Recommended Textbooks

- | | | |
|----|---|-----------|
| 1) | cs Part I – Textbook for Class XII, NCERT Publication | Mathemati |
| 2) | cs Part II- Textbook for Class XII, NCERT Publication | Mathemati |

Reference Books:

- | | | |
|----|--|----------|
| 1) | Engineering Mathematics by B.V.Ramana (Tata McGraw Hill) | High |
| 2) | modern engineering mathematics by Glyn James (Pearson Education) | Advanced |

Reference Books:

1. Higher Engg. Mathematics by B.S. Grawal
2. Engg Mathematics(vol-I) by H.K.Dass, S Chand publication.
3. Engg.Mathematics by Raman.T M H publication.

REMEDIAL BIOLOGY-I (BT-101)

UNIT – 1

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, Prokaryotic and eukaryotic 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
- 2) Biology - Textbook for Class XII, NCERT Publication

Reference Book

Biology by Peter H Raven, George B Johnson, Kenneth A Mason, Jonathan Losos, Susan Singer (Tata Mcgraw Hill)

ELECTRICAL ENGINEERING (EE-101/EE-201)

Unit I:

Steady State Analysis of A.C. Circuits:

Sinusoidal and phaser representation of voltage and current: single phase a.c. circuit-behaviour of resistance, inductance and capacitance and their combination in series & parallel and power factor, series parallel resonance-band width and quality factor : magnetic circuit.

Unit II :

D.C. Network Theory:

Circuit theory concepts-Mesh and node analysis. Network Theorems- Super-position theorem. Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem, Star Delta transformation.

Measuring Instruments:Construction and principle of operation of voltage and current measuring instruments; introduction to power and energy meters.

Unit III:

Three Phase A.C. Circuits:

Star-Delta connections, line and phase voltage/current relations, three phase power and its measurement.

Transformer :Principle of operation, types of construction, phasor diagram, equivalent circuit, efficiency and voltage regulation of single phase transformer, O.C. and S.C. tests.

Unit IV :

D.C. Machines

Principle of electromechanical energy conversion, types of d.c. machines, E.M.F. equation, Magnetization and load characteristics, losses and efficiency, speed control, DC motors, applications.

Three phase Synchronous Machines :Principle of operation and application of synchronous motor.

Unit V:

Three phase induction Motor

Principle of operation, types and methods of starting, slip-torque characteristics, applications.

Single phase Induction Motor :Principle of operation, methods of starting.

References :

1. V. Del Toro. "Principles of electrical Engineering, "Prentice hall International.
2. W.H. Hayt & J.E. Kennedy," Engineering circuit Analysis, "Mc Graw Hill.
3. I.J. Nagrath, "Basic Electrical Engineering," Tata Mc. Graw Hill.
4. A.e. Fitzgerald, D.E., Higginbotham and A Gabel, "Basic Electrical Engineering " Mc Graw Hill

ELECTRICAL ENGINEERING LAB (EE-151/EE-251)

1. Verification of Newt work Theorems.

2. Study of diode characteristics.
3. To study a half wave and full wave rectifier circuit with without capacitor filter and determine the ripple factor.
4. Determination of common base and common emitter characteristics of a transistor.
5. Study of phenomenon of resonance in RLC series circuit.
6. Measurement of power in three phase circuit by two wattmeter method.
7. Measurement of efficiency of a single phase transformer by load test.
8. Determination of parameter and losses in a single phase transformer by OC and SC test.
9. DC generator characteristics.
10. Speed control of DC shunt motor.
11. Study running and reversing of a three phase induction motor.
12. Study of single phase energy meter.
13. To study the various logic gates (TTL).

References:

1. Morris Mano Digital computer Design, PHI
2. Milliman & Hallikash, Electronic Circuit.
3. Experiment in Electrical Engg.- J.B. Gupta

WORKSHOP PRACTICE (WS-151/251)

Carpentry Shop: 1. study of tools and operation and carpentry joints.

Simple exercise using jack plain. To prepare half lap corner joint, mortise and tennon joints.

Simple exercise on woodworking lathe.

Fitting Bench working shop: 1. Study of tools and operations.

2. Simple exercise involving filling work.

3. Making perfect male female joint.

4. Simple exercise involving drilling/ tapping/dyeing.

Black smith Shop: 1. Study of tool and operation.

2. Simple exercises based on black smithy operations such as upsetting, drawing down, punching, bending, fullering & swaging.

Welding Shop: 1. Study of tools and operations.

2. Simple butt joint.

3. Lap joint.

4. Oxy acetylene welding.

Sheet metal shop: 1. Study of tools and operations.

2. Making funnel complete with soldering.

3. Fabrication of tool box, tray electrical panel box.etc.

Machine Shop: 1. Study of tools and operations.

2. Plane turning.

3. Step turning

4. Taper turning

5. Threading

6. Single point cutting tool grinding.

References:

1. Raghuvashi: Workshop Practice

2. A.Ashif: Workshop Practice

ENGINEERING GRAPHICS (CE-151)

Unit I:

Introduction

Graphics as a tool to communicate ideas, lettering and dimensioning, construction of geometrical figures like-pentagon and hexagon.

Unit II:

Orthographic Projection.

Principles of orthographic projections, Principal and auxiliary planes, First and third angle projections.

Unit III:

Projection of points, Pictorial view.

Projection of lines parallel to both the planes. Parallel to one and inclined to other, Inclined to both the plane.

Unit IV:

Application to practical problems.

Projection of solid in simple position, axis or slant edge inclined to one and parallel to other plane, solids lying on a face or generator on a plane. Section of solid lying in various positions, True shape of the section.

Development of lateral surface, sheet metal drawing.

Unit V:

Isometric projection:

Principles of isometric projection, Isometric projection using box and offset methods.

References:

1. Bhatt: Elementry Engg. Drawing, Charothar publication
2. Laxmi Narayan V & Vaish W: A text book of practical geometry on geometrical drawing.

II
SEMESTER

MECHANICAL ENGINEERING (ME-101/201)

A. THERMODYNAMICS

Unit I : Fundamental Concepts and Definitions

Definition of thermodynamics, system, surrounding and universe, phase, concept of continuum, macroscopic & microscopic point of view. Density, specific volume, pressure, temperature. Thermodynamic equilibrium, property, state, path, process, cyclic process, Energy and its form, work and heat, Enthalpy.

Laws of thermodynamics

Zeroth law: Concepts of Temperature, zeroth law.

First law: First law of thermodynamics. Concept of processes, flow processes and control volume, Flow work, steady flow energy equation, Mechanical work in a steady flow of process.

Second law: Essence of second law, Thermal reservoir, Heat engines. COP of heat pump and refrigerator. Statements of second law. Carnot cycle, Clausius inequality. Concept of Entropy.

Unit II : Properties of steam and thermodynamics cycles:

Properties of steam, use of property diagram, Steam-Tables, processes involving steam in closed and open systems. Rankine cycle. Introduction to I.C. Engines-two & four stroke S.I. and C.I. engines. Otto cycle, Diesel cycle.

B. MECHANICS AND STRENGTH OF MATERIALS

Unit III : Force system and Analysis

Basic concept: Laws of motion. Transfer of force to parallel position. Resultant of planer force system. Free Body Diagrams, Equilibrium and its equation.

Friction: Introduction, Laws of Coulomb friction, Equilibrium of bodies involving dry friction-Belt Friction.

Unit IV : Structure Analysis

Beams: Introduction, Shear force and Bending Moment, shear force and Bending Moment Diagram for statically determinate beams.

Trusses: Introduction, Simple Trusses, Determination of Forces in simple trusses members, methods of joints and method of section.

Unit V : Stress and Strain Analysis

Simple stress and strain: Introduction, Normal shear stresses, stress-strain diagrams for ductile and brittle materials, Elastic constants, one dimensional loading of members of varying cross sections, strain Energy.

Compound stress and strains: Introduction, state of plane stress, Principal stress and strain, Mohr's stress circle.

Pure Bending of Beams: Introduction, Simple Bending theory, Stress in Beams of different cross sections.

Torsion: Introduction, Torsion of Shafts of circular section, Torque and Twist, Shear stress due to Torque.

Reference:

1. Wark Wenneth : Thermodynamics (2nd edition), Mc Graw Hill book Co. NY.
2. Holman, J.P. : Thermodynamics, MC Graw Hill book Co. NY.
3. G.H. Ryder: Stength of materials
4. Yadav R.: Steam & Gas Turbines

MECHANICAL ENGINEERING LAB(ME-251)

1. Study of boiler models- Babcock Wilcox, Lancashire and locomotive.
2. Study of steam engine and stem turbine models.
3. Study of 2- stroke and 4- stroke I.C.E model.
4. Study of faite engine and or diesel engine prototype.
5. Study of vapor compression refrigeration unit tutor/ refrigerator.
6. Study of window type air conditioner.
7. To conduct the tensile test on a UTM and determine ultimate tensile strength percentage elongation for a steel specimen.
8. To conduct the impact test (Izod/charpy) on the impact testing machine and to find the impact strength.
9. To conduct the compression test and determine the ultimate compressive strength for a specimen.
10. To determine the hardness of the given specimen using Brinell/ Rockwell/Vicker testing machine.

References:

1. Dr. D. S. Kumar: Mechanical Engineering Katon Publisher
2. Suresh Prasad: Mechanical Engineering Dhanpat Rai & Co.
3. K.M. Gupta: Mechanical Engineering Umesh publisher.

COMMUNICATION LAB (HU-251)

1. **Stress in speech:** based on accentual Patterns.
2. Intonation- pattern- practice: Rising Falling and level tones.
3. Rhythm in speech – practices on strong and weak form words.
4. Individual conferencing/ speaking alone with quizzes.
5. Conversation skill for interview/ seminar/ workshops with emphasis on kinesics along with promotion of phonetic script skills.
6. Group- Discussion: Practices based on accurate & current grammatical patterns.
7. Official/ Public Speaking: Practices based on mechanics of articulation.
8. Theme presentation- Practices based on linguistic patterns.
9. Developing argument skills/ Role play presentation with proper rhythmic stress.
10. **Testing comprehension:** Reading and listening exercises with the use of audio- visual aids.
11. Audience- based Effective speech production.

CHEMISTRY (CY-102/CY-202)

Unit I:

Molecular theory of diatomic hetro molecules, Bond theory of bonding in metals, Hydrogen bonding.

Solid state Chemistry: Radius Ratio Rule, Space lattice (only cubes), Type of unit cell, Bragg's Law, Calculation of Density of unit cell. One & Two Dimensional solid, graphite as two dimensional solid and its conducting properties. Fullerene & its applications.

Unit II:

Basic principles of spectroscopic methods. The use of UV, Visible, IR, ¹H NMR, for the determination of structure of simple organic compounds., Characteristics and classification of polymers., Structures of the following polymers, viz, Natural and synthetic rubbers, Polyamide and Polyester fibers, polymethylmethacrylate, poly acrylonitrile and polystyrene. A brief account of conducting polymers (polypyrrole & polythiophene) & their applications.

Unit III:

Stability of reaction intermediates, e.g. Carbanion, Carbocation and free radicals. Types of organic reactions, & Mechanism of nucleophilic substitution reaction.

Mechanism of the following reactions.(i) Aldol condensation. (ii) Cannizzaro reaction (iii) Beckmann rearrangement (iv) Hofmann rearrangement, and (v) Diels-Alder reaction

E-Z Nomenclature. Optical Isomerism of organic Compounds containing one chiral center. Examples of optically active compounds without chirality. Conformations of butane.

Unit IV :

Order & Molecularity of reactions. First & Second order reactions. Energy of activation.

Phase Rule: Its application to one component system (Water).

Equilibrium Potential, electrochemical cells (galvanic & concentration cells), Electrochemical theory of corrosion & protection of corrosion.

Unit V :

1. Hardness of water, softening of water by Lenny-S process & Reverse osmosis. Treatment of boiler feed water by Calgon process, Zeolites and ion-exchange resins.

2. Classification of fuels, Coal, Biomass & Biogas. Determination of gross and net calorific values using Bomb Calorimeter.

3. Environmental pollution : Types of pollution & pollutants, Air Pollution. Formation and depletion of ozone, smog and Acid rain.

References :

1. Organic Chemistry (Morrison & Boy)
2. Inorganic Chemistry (I.D. Lee)
3. Physical Chemistry (Barrow)
4. Environmental chemistry (Manahan)
5. Chemistry Practical(CY-151/CY-252)

CHEMISTRY PRACTICAL (CY-151/CY-252)

1. Determination of alkalinity in 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 the given water sample by Mohr's method.
5. Determination of iron content in the given ore using external indicator.
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. Element detection & functional group identification in organic compounds.

References:

1. Engg. Chemistry by Grutu and Mittle, Pragati publication
2. Engg. Chemistry by Sashi chawla
3. Practical Chemistry Vol.I and II by Mishra, Kalra, Rosni Anushandhan, Prakashan, Kanpur.

INFORMATION TECHNOLOGY (IT-101/IT-201)

Unit I: Fundamental Concept of Information

Information Concept and Processing: Definition of information, Data Vs Information, Introduction to Information representation in Digital Media, Text, image, graphics, Animation, Audio, Video etc., Need, Value and Quality of information, Concept of Information Entropy, Shannon's Principles, Entropy of Information, use of Entropy in Coding, Static & Dynamic codes, Category and Level of Information in Business Organization.

Information Representation: Information Content, Entropy, Data Compression, Shannon Fano, Huffman Coding, Extended Huffman Codes, Arithmetic Coding, LZ78, LZW coding, Introduction to JPEG, MPEG, MHEG and other IT Industry Standards.

Unit II: Concepts in Computer & Programming

Computer Appreciation: Definition of Electronic Computer, History, Generations, Characteristic and Application of Computers, Classification of Computers, RAM/ROM, Computer Hardware, CPU, Various I/O devices, Peripherals, Storage Media, Software Definition, Role and Categories, Firmware and Humanware.
Programming Language

Classification & Program Methodology:

Computer Languages, Generation of Languages, Translators-Interpreters, Compiler/Interpreters, Compilers, Flow, Charts, Dataflow Diagram, Assemblers, Introduction to 4GLs, Software Development Methodology, Life Cycles, Software Coding, Testing, maintenance, ISO, CMM standards for IT industry.

Unit III: Digital Devices and Basic Network Concepts

Digital Fundamentals: Various codes, decimal, binary, hexa decimal conversion, floating numbers gates, flip flops, adder, multiplexes, need for Data Transmission over distances, Types of Data Transmission, Media for Data Transmission, Modulation, AM, FM, Digital Modulation, Multiplexing of Signals

Data Communication & Networks:

Computer Networks, Networking of computers- Introduction of LAN and WAN. Network Topologies, Basic Concepts in Computer Networks, Client-server Architecture, ISDN, ATM, and Token based protocol, CSMA/CD, Mobile Communication.

Unit IV: Internet and Web Technologies

Internet & World Wide Web: Hypertext Markup Language, DHTML, WWW, Gopher, FTP, Telnet, Web Browsers, Net Surfing, Search Engines, Email, ISP, EDI, E-Commerce, Public Key Private Key, Safety of Business Transaction on web.

Web Technologies: Elementary Concepts of E-Commerce, Basic Infrastructures for E-Commerce, Electronic Token, Security Threats, Electronic Payment Systems, Digital Signatures, Network, Security, Firewall, Introduction to Web Technologies.

Unit V: Concepts in Operating System, Office Tools and Data Management

Introductory concepts in operating system & Data Management:

Elementary Concepts in Operating System, textual Vs GUI Interface, Introduction to DOS, MS Windows, MS office Tools, MS word, MS EXCEL, MS Power Point, Tools for Data Management, Basics of Database management system, Introduction to basic Commands of Dbase, FoxPro, SQL Etc.

IT Industry Trends, Careers and Applications in India:

Scientific, Business, Educational and Entertainment Application, Industry Automation, Weather Forecasting, Awareness of Ongoing IT projects in India NICNET, BRNET etc. Application of IT to other Areas E Commerce, electronic governance, Multimedia, Entertainment.

References:

1. D S Yadav, "Foundations of IT", New Age, Delhi
2. Curtin, "Information Technology : Breaking News", TMH
3. Rajaraman, "Introduction to Computers", PHI
4. Nelson, "Data Compression", BPB.

COMPUTER PROGRAMMING LAB (CS-151/251)

1. Practical of all internal and external dose commands.
2. Write simple batch program.
3. Giving exposure to windows environment.
4. File and program management in windows.
5. Practice of all UNIX commands.
6. Write simple shell script.
7. Introduction to text editing and word processing.
8. Exposure to advnce feature supported by some editors.
9. Net surfing.
10. Creation and usage of E- mail account.
11. Write small program using C language
12. Handiling of data structure in C.
13. Familiarizing mail account using PINE, delete, creating folder/ mail- messages, adding signature, creating directory of addresses.

ENVIRONMENTAL STUDIES(CE– 201)

Unit I: The Multidisciplinary nature of environmental studies

Definition, scope and importance, Need for public awareness Natural Resources

Renewable and non-renewable resources Natural resources and associated problems.

A) **Forest resources:** Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

b) **Water resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) **Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) **Food resources:** World food problem, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

E) **Energy resources:** Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

f) **Land resources:** Land as resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

Unit II: Ecosystems: Concept of an Ecosystem. Structure and function of an ecosystem.

Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession.

Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: (a) Forest ecosystem (b) Grassland Ecosystem (c) Desert ecosystem (d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III: Biodiversity and its conservation

Introduction- Definition : genetic, species and ecosystem diversity, Bio geographical classification of India,

Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values,

Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-spots of biodiversity,

Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ Ex-situ conservation of biodiversity.

Unit IV: Environmental Pollution: Definition, Causes, effects and control measures of-

Air Pollution. (b) Water Pollution. (c) Soil Pollution (d) Marine Pollution. (e) Noise Pollution. (f) Thermal Pollution. (g) Nuclear hazards.

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Unit V: Social Issues and the Environment

From Unsustainable to Sustainable development, urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns.

Case Studies, Environmental ethics: Issues and possible solutions, Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention

and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation, Public awareness. Human Population and the Environment, Population growth, variation among nations, Population explosion- Family Welfare Programmers, Environment and human health, Human Rights, Value Education., HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Case Studies. Suggested Field work ,Visit to local area to document environmental assets-river/forest/grassland/hill/mountain, Visit to a local polluted site-Urban/Rural /Industrial / Agricultural, Study of common plants, insects, birds, Study of simple ecosystems-pond, river, hill slopes etc

References

1. Agrawal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd. Ahmedabad- 380 013, India
Email : [_ HYPERLINK "mailto:mapin@icenet.net" __mapin@icenet.net_ \(R\)](mailto:mapin@icenet.net)
3. Brunner R.C., 1989, hazardous Waste Incineration, McGraw Hill Inc. 480p.
4. Clark R.S., Marine Pollution, Clarendon Press Oxford (TB)

MATHEMATICS II (MA-201)

Unit I: Differential Equations

Ordinary differential equations of first order, Exact differential equations, Linear differential equations of first order, Linear differential equations of nth order with constant coefficients, Complementary functions and particular integrals, Simultaneous linear differential equations, Solutions of second order differential equations by changing dependent and independent variables, Method of variation of parameters, Applications to engineering problems (without derivation).

Unit II: Series Solutions and Special Functions

Series solutions of ODE of 2nd order with variable coefficients with special emphasis to differential equations of Legendre, and Bessel . Legendre polynomials, Bessels functions and their properties.

Unit III: Laplace Transform

Laplace transform, Existence theorem, Laplace transform of derivatives and integrals, Inverse Laplace transform, Unit step function. Dirac delta function, Laplace transform of periodic functions, Convolution theorem, Application to solve simple linear and simultaneous differential equations.

Unit IV: Fourier Series and Partial Differential Equations

Periodic functions, Trigonometric series, Fourier series of period 2π EMBED Equation.3 Eulers formulae, Functions having arbitrary period, Change of interval, Even and odd functions, Half range sine and cosine series.

Introduction of partial differential equations, Linear partial differential equations with constant coefficients of 2nd order and their classifications - parabolic, elliptic and hyperbolic with illustrative examples.

Unit V: Applications of Partial Differential Equations

Method of separation of variables for solving partial differential equations, Wave equation up to two-dimensions, Laplace equation in two-dimensions, Heat conduction equations up to two-dimensions, Equations of transmission Lines.

References:

1. Higher Engg. Mathematics by B.S. Grawal
2. Engg. Mathematics (vol-i) by H.K. Dass, S. Chand publication.
3. Engg Mathematics (vol-II) by Manish Goyal , Laxmi publication.

III
SEMESTER

BIOCHEMISTRY (BT-301)

Unit I:

Role of water in biological processes, General Structure and function of amino acids, carbohydrates fats, and vitamins and hormones.

Unit II:

Structure & function of cell wall and membrane, membrane lipid, protein and carbohydrate, transport across membrane: active. Passive and facilitated, signal transduction J.

Unit III:

Catabolic and 'anabolic metabolism of carbohydrates (Photosynthesis, Glycolysis, TCA cycle ETS etc), Nitrogen fixation.

Unit IV:

Metabolism of amino acids, nucleic acids, lipids vitamins.

Unit V:

Thermodynamic principles: free energy, Secondary and tertiary Structure of protein, structure and function of hemoglobin and Myoglobin.

Books and Reference

1. Hames and Hooper instant notes on biochemistry Vibha Books PVT.Ltd.
2. Nelson, Cox Lehninger's Principle of Biochemistry Macmillan worth Publication.
3. L.Stryer; Biochemistry.
4. Voet and Voet; Biochemistry; Freeman WH and CH., New York.
5. S.C. Rastogi; Biochemistry ; Tata Macgrow.
6. Mathew's et al Biochemistry ; Pearson education.

BIOCHEMISTRY LAB (BT-351)

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. Cell fractionation.

MICROBIOLOGY & CELL BIOLOGY (BT-302)

Unit I:

Introduction and Classification of “Microbes, isolation and identification of: Microorganism, culture techniques and their maintenance, cell counting methods.

Unit II:

Microbial growth. Kinetics, cell cultivation System, Screening, physical and chemical. Methods for literature control of microorganisms, strain development, Industrial scope of Microbiology.

Unit III:

Characteristics of prokaryotes and eukaryotes, cell organelles cell wall and membrane” Mitochondria, Nucleolus, Ribosome’s, Golgi bodies, Endoplasmic Reticulum organelles, Cytoskeleton.

Unit IV:

Cell division protein targeting and post translational modification.

Unit V:

Cell death and excitation-contraction coupling, ageing, biology of cancerous cells.

Text Book and References:

1. Prescott Harley and Klein; Microbiology 2nd Ed.
2. Rorer and Stainer et Al.
3. P. Tauro , K.K. Kapoor, K.S. Yadav ,An Introduction to Microbiology.
4. Schlegel H.G. – General Microbiology 8th ed .
5. Murray Moo-Yong-Comprehensive Biotechnology, 1st Vol.
6. Wistreich and Lechman-Microbiology, Macmillan Co.
7. Introduction to Microbiology by A.S.Rao, (Prentice Hall).
8. Microbes & Engineering Aspects- U.P. Guts, Chick et al , Springer Verlag.
9. Microbiology – Peleczar, TMH Publication.,
10. Cell and molecular Biology, S.C. Rastogi, New age International.
11. Cell, S.C. Rastogi, New Age International.

MICROBIOLOGY & CELL BIOLOGY LAB (BT-352)

1. Preparation of nutrient agar slants, plates and nutrient broth and their sterilization.
2. Inoculation of agar slants, agar plate and nutrient broth.
3. Culture of microorganism using various techniques.
4. Simple and differential staining procedure, endoscope staining, flagellaer staining, cell wall staining, capsular staining, negative staining.
5. Bacterial colony counting.
6. Observation of different vegetative, capsular and spore forms of bacteria & fungus.
7. Isolation of microorganism from soil samples and determination of the number of colony forming units.
8. Study of growth curve of E.coli

STATISTICAL TECHNIQUES (MA-302)

Unit I :

Data type, Classification and summarization of data, diagrams; Ino Graphs, Measures of Dispersion, Skewness and Kurtosis.

Unit II:

Introduction to probability, laws of probability, Baye's thcorem , 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 Square tests and f-tests, variant one way and two way analysis Of variants, ANOVA.

Unit V:

Principles of experimental design and analysis.

Text Book and references

1. Gcorgr.W. And William G; Statistical methods; IBH Publication.
2. Ipsen J et al ; Introduction to Biostatistics, Harpet & Row Publication.
3. 3.N.T.J. Baily; Statistical methods in Biology; English University Press.
4. Rangaswami; a Text of Agricultural Statistics; New Age Int. Pub.
5. P.S.S. Sudar Rao; An Introduction of Biostatistics : Prentice Half.
6. Zar J; Biostatistics ; Prentice Hali, London.

DATA STRUCTURE AND ALGORITHMS (CS-306)

Unit I: Introduction to data structure and Algorithms:

Performance : Analysis of Algorithm, Time Complexity, Big-oh notation, Elementary data organization data structure operation, organization data structure operations, Recurrences, Arrays, operations on arrays, representation of arrays in memory, single dimensional multidimensional arrays, Sparse matrices character storing in C, string operation.

Unit II: Statistics, Queues and Linked lists

Stack operation, PUSH and POP, Array representation of stacks, operation associated with Slacks Application of stack, Recursion, Polish expression, Representation queues' operation on queues', Priority queues Dquesues, Singly and circularly linked in C, string operations. Lists implements.

Unit III: Tree

Basic terminology, Binary trees representation Algebraic expressions. Complete: Binary trees, extended binary trees, represent binary trees in memory. Linked representation of binary trees, traversing binary tracts & Searching binary searching algorithm, Heaps, general trees, threaded binary tree:

Unit IV: Graphs

Terminology & representations, Graphs Multigraphs, Direct Sequential Representation of graphs, adjacency metrics, transversal, connected component "Spanning trees, Minimum Cost Spanning prisms and crustal Algorithm, BSF," DFS, Shortest path and transitive closure, Activity networks. Topological Sort and critical paths.,

Unit –V: Searching and Sorting.

Linear search ' , ' Binary Search, Internal and External Sorting , Bubble Sorting Insertion Sort, Quick Sort, Two a merge Sort, Heap Sort, sorting on different' keys, practical J/consideration for internal soaring. External Sorting, Storage', Devices: Magnetic tapscs Disk Storage, Sorting With disks and indexing techniques: Introduction 10 B tree, and B³⁺ tree, File organization and storage management Introduction 10 hoisting.

Text 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". Addison Wesley.
4. Basse," Computer Algorithms: Introductiolllo Design & Analysis", Addison Westley.,
5. Lipschutz "Data Structure" , Scatum Series,
6. Aho, ho, ocropr, Uttlman Data Structure & Algorithm, Addison Wesely Wcsley

FLUID FLOW AND SOLID HANDLING (CH-301)

Unit I: Solid Handling

Properties of solids, screening, industrial screening equipment, determination of Particle size, screen analysis, size reduction of solids, Of reduction, operating intermediate and fine size reduction, power requirement and mechanism power driven, Crushers, grinders and conveyers.

Unit II: Filtration

Theory, continuous and batch equipments, Flow of solids through fluids, Classification and Sedimentation.

Unit III: Fluid Flow

Properties of fluids, Fluid Statics: Euler's Equation Hydrostatic pressure, measurement, transport of fluids, energy relationships, pipe fittings minor losses in flow.

Unit IV: Flow measurements

Orifice meter, Nozzle and Venturimeters, rotameter and pitot tube.

Unit V: Pumping and compressing

Reciprocation pumps, rotary pumps, centrifugal pumps and blowers, Introduction of fluidization.

Reference Books:

1. Introduction of fluid mechanics by Robert W. Fox and Sian
2. Medonal, John & sons, Ny- Fourth Ed.
3. Govhane K A, Unit Operations-I, Nirali Publications

1. To determine the experimentally the met centric height of a ship model.
2. To verify the momentum equation experimentally.
3. To determine the coefficient of discharge of an orifice (or a mouth piece) of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice (or the mouth piece).
4. To plot the flow net for a given model using the concept of electrical analogy.
5. To measure surface tension of a liquid.
6. To calibrate an orifice meter and study the variation of the coefficient of discharge with the Reynolds number.
7. To verify Darcy's law and to find out the coefficient of permeability of the given medium.
8. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
9. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
10. To study the variation of friction factor f for turbulent flow in smooth and rough commercial pipes.
11. To determine the loss coefficient for the pipe fitting.
12. To study the flow behavior in a pipe bend and to calibrate the pipe bend for discharge measurement.

IV
SEMESTER

IMMUNOLOGY (BT-401)

Unit-I:

Introduction to immunity, characteristic's of innate and adaptive immunity, primary and secondary lymphoid organ, cell and molecule of immune system, humoral and cell mediated immunity, clonal selection.

Unit-II:

Exogenous and endogenous pathways of antigen processing and presentation structure and function of MHC molecule, characteristics of T & B cell epitopes, polyclonal and monoclonal antibody, complement system, antigen and antibody reaction.

Unit-III:

Structure function & application of cytokines, regulation of immune response, immune tolerance, serological techniques – ELISA RAI & IMMUNOBLOTTING.

Unit-IV:

Production and application of monoclonal & polyclonal antibodies, production of antibodies, factors affecting immunogenicity, adjuvant, dose of antigen, vaccine & types of vaccine preparation.

Unit-V:

Immunity against infectious virus bacteria & protozoa hypersensitivity.

Textbook & References:

1. Essential Immunology-I, by M. Roitt, 10th edition
2. Kuby's Immunology –Murray, 5th edition
3. Lydyard et al, instantnotes Immunology, viva publication.
4. Basic & clinical Immunology, 5th ed. D.P. sites, J.D. stobo.

IMMUNOLOGY LAB (BT-451)

1. Staining of bacterial flagella antigen.
2. Different types of antigen- antibody cross reaction.
3. Isolation ,purification and identification of immunoglobulin from goat blood.
4. Double diffusion techniques for identification of antigen-antibody samples
5. Immuno electrophoresis techniques.
6. .ELISA
7. RIA
8. Immunoblotting using ELISA-dot or western blotting.

ENZYMOLGY BT-402)

Unit I:

Introduction, classification, & nomenclature of enzymes, active sites, is enzyme, coenzyme, cofactors, multienzyme complexes, intracellular and extra cellular enzyme, Physicochemical characteristic of enzyme.

Unit II:

Enzyme kinetics, measurement of K_m & V_{max} kinetics of competitive, non-competitive and un-competitive inhibition of enzymes, effect of pH temperature substrate concentration on enzyme kinetics, allosteric enzyme and their kinetics.

Unit III:

Introduction to industrial enzymes – Topoisomerases, chymotrypsin, glyceraldehydes, phosphate dehydrogenase, lysozyme, carboxypeptidase, ribonuclease, aldolase, glucoisomerases, lactases, ribozyme.

Unit IV:

Molecular folding & defolding of enzymes, stability of enzymes, enzyme immobilization.

Unit V:

Isolation, purification, and characterization of enzymes, industrial diagnosis and therapeutic application of enzymes.

Text Books and References:

1. Methods in Enzymology series.
2. Biochemistry- D.J.Voet & J.G. Voet. 6th ed.
3. Enzyme kinetics-Hans Bisswanger, Wiley Publication
4. Biocatalysis: Fundamentals and Application-A.S. Bommarius' et al. Wiley Publication
5. Hans Bisswanger, Enzyme Kinetics- Wiley Publication
6. Methods in Enzymology- A series.
7. Murray Moo-Young- Comprehensive Biotechnology, II & IV th Vol.

GENETICS AND MOLECULAR BIOLOGY (BT 403)

Unit I:

Fundamental principal of genetics, gene interaction, multiple alleles, complementation linkage, Recombination linkage mapping, extra- chromosomal inheritance chromosomal basis of heredity (characteristics).

Unit II:

DNA as the genetic material, structure & types of DNA, transposable elements central Dogma, DNA repairing, Mutations, cell cycle regulation.

Unit III:

DNA replication processes in prokaryotes & eukaryotes, Activity of DNA polymerase and Topoisomerase, Reverse transcriptase.

Unit IV:

Transcription processes in prokaryotes & eukaryotes, posttranscriptional modification Processes, open reading frames.

Unit V:

Genetic code wobbles hypothesis, translation process in prokaryotes & eukaryotes, Regulation of gene expression in prokaryotes and viruses, Hormonal control of gene expression in eukaryotes.

Text books and references:

1. Genetics – suickberger,2nd Ed.
2. Microbial Genetics – D. frifelder
3. Albert B. Brav Denisetals Molecular biology of the cell, latest ed.
4. Baltimore –molecular biology of the cell.
5. Advance Genetics by G S miglam nalosg publication house.
6. Principle of Genetics by B D singh.

GENETICS AND MOLECULAR BIOLOGY (BT-452)

1. Estimation of DNA content in the given sample by diphenylamine method.

2. Estimation of RNA content by orcinoll method.
3. Determination of T_m of DNA and RNA.
4. Isolation of plasmid DNA.
5. Isolation of bacterial / fungal genomic DNA.
6. Isolation of plant DNA.
7. Purification of DNA through columns.

BIOINFORMATICS I (BT-404)

Unit I:

Principle of DNA, RNA & protein sequencing, file formats for storage of sequence and structural data primary sequence databases of nucleic acids and proteins, organism specific genome databases, structural database.

Unit II:

Specialized sequence databases of expressed sequence tags, gene expression, transcription factor binding site & single nucleotide polymorphisms, OMIM, Unigene etc. Data retrieval with ENTREZ, SRS and DBEGET, secondary databases (Pfam, PROSITE, block, etc)

Unit III:

Sequences alignment (pair-wise and multiple), alignment algorithms, databases similarity, searches (BLAST, FASTA and PSI-BLAST), amino acid substitution matrices, profiles and motifs.

Unit IV:

Protein structure prediction (secondary and tertiary), homology modelling, ORF prediction, gene prediction, micro array data analysis.

Unit V:

Structure visualization methods, structure classification, structural alignment and analysis, Bioinformatics applications in drug and Vaccine discovery.

Text books and references:

1. N. Mishra; Bioinformatics: concept and application pearson Education (In press)
2. O'Reilly; developing bioinformatics Computer Skill – 1st Indian – edition publication.
3. Anthony J.F. Griffiths et al; an intro. to Genetics Analysis – 1st Ed.
4. Michael Starkey and Ramnath Elavarasu ; Genomics Protocols, Humana press.
5. Stephen Misner & Stephen Krawetz; bio informatics – methods and protocols, Humana press.
6. press.

]

1. Construction of database for specific class of protein /enzymes/genes/ORF/EST/promoter sequences/ DNA motif or protein motif using oracle.
2. Access and use of different online protein and gene alignment softwares.
3. Gene related finding 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 software for a given nucleotide sequences.
6. Secondary structure prediction for amino acid sequences of a given protein.

HEAT TRANSFER OPERATION (CH – 401)

Unit I:

Introduction to heat transfer and general concept of heat transfer by conduction and radiation.

Conduction: Basic concepts of conduction in solids, liquids and gases, steady state temperature fields and one dimensional conduction without heat generation e.g. plane wall Cylindrical, spherical surface & composite layers etc. Insulation mg critical and optimum insulation thickness. Extended surface, fin & their -pre applications. Introduction to unsteady state heat transfer.

Unit II:

Convection: Fundamental of Convection, basic concepts & definition Natural & forced convection.

Hydrodynamics & thermal boundary layers, laminar & turbulent Heat transfer inside & outside, tubes, Dimensional analysis, determination of internal And overall heat transfer coefficients & their temperature dependence, heat transfer in Molten metals

Unit III:

Heat transfer with phase change: Condensation of pure and mixed vapours, film wise & drop wise condensation, loading in condenser and basic calculation on condensate heat transfer in boiling liquids, boiling heat transfer coefficients.

Unit IV:

Heat transfer Equipments: classification, principles and design criteria, types of exchanger's viz. double pipe, shell & tube, plate type, extended surface, cooling towers etc. Furnaces and their classification and applications simple conduction.

Unit V:

Radiation & Evaporation: basic laws of heat transfer by radiation, black body & Gray body concepts, view factors Kirchoff's law, solar radiation, combined heat

Transfer coefficient by convection & radiation elementary principle, types of

Evaporators, single & multiple effect evaporators, and their calculation, thermo co Compression.

Text books & references:

1. Heat transfer Mc Graw hill. By Holman J.P.;
2. Heat transmission Mc Graw hill. By Mc-adams W. H. ;
3. Process heat transfer Mc Graw hill By Kern D. Q. ;
4. Introduction to Chemical engineering. TMH By Bedyer W.L. & J. T. Bancharo ;
5. Unit operation II by K. A. Gavhane.
6. Bedger W.L. and Bancharo J.T. "Introduction to Chemical Engineering" Tata McGraw Publishing House.

V

SEMESTER

BIOPHYSICAL TECHNIQUES (BT-501)

Unit-I:

Chromatography: Adsorption, affinity, partition (GLC, GC, HPL, TLC, RPC etc) Immobilized cells, Electrophoresis colloidal solution of biopolymers and their electrochemical properties. Different method of electrophoresis for proteins, nucleic acids, small molecular weight compound and immunoprecipitates, peptide mapping and combination of electro focussing and SDS-PAGE.

Unit-II:

Hydrodynamics properties: Viscosity, diffusion of biopolymers, molecular weight determination, osmotic pressure, Reverse osmosis, and Doman effect, structure of bio-membranes and their electrochemical properties, membrane potential, action potential and action potential and propagation of impulses.

Unit -III:

Introduction to principles and application of (a) spectroscopic method (UV, Viz IR, Fluorescence, ORD, CD, & PAS), (b) NMR, ESR and mass spectrometry. Use of radioactive and stable isotopes and the detection in biological system, introduction to principle and working of light and electron microscopes.

Unit -IV:

Automatic analyser for amino acid, protein, sequencer, peptide synthesizer and nucleic acid synthesizer, Theory of lyophilization and its application to biological system.

Unit -V:

Cell sorter: Principle, working and application theory of centrifugation and application to biological system, Density centrifugation, Ultra centrifugation's principle and application.

Textbook of References:

1. Principles of biochemistry: Macmillan worth publication by Lehninger.
2. Introductory Practical biochemistry: by Sawaney, S.K. and Randhir Singh.
3. DNA and Protein interaction. OUP, 2004: by Travers, Andrew and Malcolm Buckld.
4. Practical biochemistry: by Keith Wilson & Jane Walker.

BIOPROCESS ENGINEERING-I (BT-502)

Unit -I:

Methods of inoculation and medium preparation, media design and optimization, microbial growth in closed, semi-open and open cultivation system, 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 micro organisms, 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 chemo state culture, microbial pellet formation, flocculation kinetics and dynamics of pellet formation.

Unit -IV:

Material and energy balance in steady and unsteady state reaction system, Oxygen transfer in bioreactors, measurement of K_{la} -oxygen, and transfer in large vessels.

Unit -V:

Control of physical, chemical and biological environment of the bioreactor, advanced control strategies Via, PID controllers, fuzzy logic based controllers and artificial, neural network based controllers, role of physical, chemical & biological sensors.

Text book of References:

1. Bioprocess Engineering Principles- P.M. Doran, 5th ed.
2. Baily & Olis- Biochemical Engineering.
3. Chemical Reactor Engineering- Olvin Spiel.
4. Principles of Microbe and cell cultivation- S. Join Pirt.
5. Principles of fermentation Technology-Allan Whitaker,Peter F. Stanbury.

BIOPROCESS ENGINEERING-I Lab (BT-552)

1. Design and construction of different types of laboratory bioreactors(batch,semi batch and continuous homogeneous)
2. Plot growth curve of *E.coli*
3. Quantification of cell mass.
4. Quantification of cell number.
5. Separation of microbial cells from broth.
6. Sterilization of glasswares by dry heat.
7. Sterilization of glasswares by moist heat.
8. Preparation of fermenting media.
9. Determination of kinetic parameter for batch culture of yeast under stationary and shake flask conditions.
10. Growth kinetics studies of yeast in a bench top lab fermenter under controlled conditions.
11. Determination of volumetric oxygen transfer coefficient K_La , effect of aeration and agitation speed.
12. Preparation of immobilized enzymes & cell and evaluation of kinetic parameters.

INDUSTRIAL ECONOMICS AND PRINCIPAL OF MANAGEMENT (HU-501)

Unit-I:

Introduction: Nature and significance of economics, Meaning of science, engineering and technology and their relationship with economic development;

Unit-II:

Basic concept: The concept of demand and supply, Elasticity of demand and supply, indifference curve Analysis, Price effect, income effect and substitution effect.

Unit-III:

Money and banking: Functions of money, Value of money, inflation and measures to control it. Brief idea of functions of banking system, viz., Commercial and central banking, Business fluctuations.

Unit-IV:

Introduction: Definition, Nature and significance of management, Evaluation of Management thought, Contributions of max Weber, Taylor and Fayol.

Unit-V:

Human behaviour: Factors of individual Behaviour, Perception, Learning and Personality Development, interpersonal Relationship and group Behaviour.

Text Books & References:

1. Dewell, K.K./ Modern Economic Theory/S.chand & Co.
2. Luthers Fred/ Organizational Behaviour.
3. Prasad L.M./ Principles of Management.
4. A.w.Stonier & D.C. Horgene / A Textbook of Economic Theory/ Oxford Publishing House Pvt.Ltd

Unit-I

Introduction: Algorithms, analysis of algorithms, Growth of functions, Masters theorem, Designing of algorithms, sorting and order statistics, Heap sort, quick sort, sorting in Linear time, Medians and order Statistics.

Unit-II

Advanced Data Structure: Red – Black Tree, Augmenting, Data Structure. B- Tree, Binomial Heaps, Fibonacci heaps, data structure for disjoint sets.

Unit-III

Advanced data and analysis techniques: Dynamic programming, Greedy Algorithms, Amortized analysis, back tracking.

Unit-IV

Graph Algorithms: Elementary graphs algorithms, Minimum Spanning Tree, Single – source shortest paths, all pair shortest path, maximum flow, Traveling salesman problem.

Unit-V

Selected topics: Randomized algorithms, string matching, NP completeness, and approximation algorithms

Text Book & References:

1. Cormen, Rivest, Lisserson: Algorithm, PHI.
2. Base, Computer algorithms: Introduction to Design & analysis. Addison Wesley.
3. Horowitz & Sahani. Fundamental of Computer Algorithm. Galgotia.

Programming assignment on each algorithmic strategy:

1. Divide and conquer method (quick sort, merge sort, Strassens matrix multiplication)
2. Greedy method (knapsack problem, job sequencing, optimal merge patterns, minimal spanning tree).
3. Dynamic programming (multistage graphs, OBST, 0/1 Knapsack, traveling salesperson problem).
4. Back tracking (n-queens problem, graph coloring problem, Hamiltonian cycles).
5. Sorting: Insertion sort, heap sort, bubble sort.
6. Searching: Sequential and binary search.
7. Selection: Minimum/ Maximum, K^{th} smallest element.

MASS TRANSFER OPERATION –I (CH-501)

Unit-I:

Basic principal of mass transfer

Diffusion: molecular and turbulent diffusion, in fluid, inter phase mass transfer, mass transfer coefficient diffusion coefficient,.

Humidification operation: vapor pressure, Enthalpy, absolute humidity, dew point concept, Understands vapor gas mixtures.

Unit-II:

Gas Absorption: counter current. Co-current , Multistage continuous contact operation.

Unit-III:

Distillation: Entrainment, pressure drops, flooding, transfer coefficient & relative volatility, Mc Cabe thiele and Ponchon method for binary component distillation of azeotropes, flash vaporization & multicomponent distillation.

Unit-IV:

Liquid Extraction: counter current ,co-current operation in single stage & multistage solvent Extraction. Triangular diagram.

Unit-V:

Drying: Batch & freeze drying, Rotary dryers, surface Vs diffusion controlled operations.

Leaching: Types of Leaching, single and multi stage process.

Textbooks and References:

1. Gavhane, K.A., Mass Transfer-II, Nirali Publication.
2. Mass Transfer Operation by Robert E Treybal.
3. Unit Operation of Chemical engg. by Warren L. McCabe & Julian C. Smith. Mc Graw- Hall International Edition.

VI
SEMESTER

BIOINFORMATICS -II (BT-601)

Unit I:

Inference problem 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, drug discovery.

Unit II:

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

Unit III:

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 IV:

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

Unit V:

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. Salzberg S.L. et al., Computational Methods in Biotechnology – Elsevier Science .
2. Evens & Grants , Statistical methods in Bioinformatics-Springer-Verlag, NY.
3. MJE Sterberg , protein structure prediction- A Practical approach , oxford university press.
4. Setubal and Meidanis, Computational molecular biology-PWS publishing co.,1997.

BIOINFORMATICS II LAB (BT-651)

1. In silico gene identification/ Characterization in prokaryotic organism using suitable annotation tools.
2. Secondary structure determination of protein molecules using various tools.
3. Comparative assessment of best available tools for gene annotation.
4. Development of gene finding program using statistical significance and C++/C/perl etc.
5. Establishment of method for gene and protein phylogeny by taking specific example.

PLANT BIOTECHNOLOGY (BT-602)

Unit-I:

Introductory history: laboratory organization; Nutrition of plant cells; Media composition-solid and liquid; biology plant in culture, tissue and organ culture; establishment and maintenance of callus and suspension culture; cellular differentiation and regulation of morphogenesis; somatic embryogenesis; control of organogenesis and embryogenesis; Single cell, method; cytology of callus. Tissue culture and genetic engineering.

Unit-II:

Haploid production-Androgenesis; anther and microspore culture; gynogenesis; embryo culture and rescue in agriculture and horticulture crops; protoplast isolation; culture regeneration; somatic hybrid-cybrid; in vitro selection of mutants-mutants for salts,disease,cold drought, herbicide and other stress condition; plant micro propagation; Application of micro propagation in forestry and historical crops; micro grafting –in vitro clonal multiplication- Meristem culture and virus elimination; shoot tip culture.

Unit-III:

Improved crop varieties through somaclonal variation in vitro culture-causes stability and utilization genetic and epigenetic basis; establishment of cells lines and evaluation; secondary metabolite culture 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 tumifaciens, Ti plasmid derived vector system; physical method of transferring genes to plant- 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 genetic manipulation of flower pigmentation ,developing quality of seed storage, provitamin A, iron protein in rice, modification of food plant test and appearance, yield increase in plants, wild plant relatives as sources of novel gene, plants as bioreactor antibodies, polymers, foreign proteins in seeds genomic mapping efforts in rice & mize potential application.

Text Books & References:

1. Principal & practices in plant science, waltion, 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 taxonomy, O P sharma , TMH publication, 2006.
5. Plant biotechnology, Ashwani kumar shikha rohy, I. K . International Pvt. Ltd. 2006.
6. Biochemistry and molecular bioloy of plants, Kosuge. 1983.
7. Plant cell culture, Advances in biochemical engineering and biotechnology. Anderson,LA.

FERMENTATION BIOTECHNOLOGY (BT-603)

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 pre-treatment of raw materials.

Unit-III:

Different regulatory mechanisms in controlling the catabolic and anabolic processes of microbes. Induction, nutritional repression, carbon catabolite repression, Crabtree effect, feed bed inhibition and repression.

Unit-IV:

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

Unit-V:

Fermentation of recombinant microbial cell for large scale production of genetically engineered primary and secondary metabolites.

Text Books & References:

1. Murray Moo Young, comprehensive Biotechnology, Vol. I & III-latest ed.
2. Industrial Fermentation –Leland, N.Y. Chemical publishers.
3. Prescott & Dunn's – industrial microbiology, 4th ed.
4. Biotechnology series, rehm, reed & Weinheim, Verlag-chemie.
5. Biochemical engg. , Aiba Humphrey & Miller Academic press.
6. Fermentations & Enzyme technology, Wang & Humphery, Wiley & Inter sciences.
7. Microbe & Fermentation, A Let and Kotlers Richard J. Mickey oriffin publication.

FERMENTATION BIOTECHNOLOGY LAB (BT-653)

1. Study of induction effect of galactosidase enzyme in *E.coli*.
2. Fermentation of ethyl alcohol using *Candida albicans*.
3. Fermentation of citric acid using *Aspergillus niger*.
4. Creation of auxotrophic mutants for lysine, valine and essential amino acids.
5. Designing of fermentation processes for penicillin and 6-APA.
6. Design of fermentation process for lysine.
7. Yeast fermentation for production of ethanol.
8. Fermentation of *Penicillium crysogenum* to produce penicillin.

GENETIC ENGINEERING (BT-604)

Unit-I:

Gene cloning: concepts and basic steps ,application of bacteria and viruses in genetic molecular biology of Ecoli and bacteriophages in the context of their use in genetic engineering, General characteristics of the cloning vectors used in genetic engineering , plasmid vectors viz PER 322, pUC plasmids , M13 vectors , lamda vectors , cosmids , phagemids , artificial chromosomes.

Unit-II:

Restriction modification, enzymes used in recombinant DNA Technology endonucleases, ligases and other enzyme useful in gene cloning, PCR for gene/ DNA detection, cDNA, use of Agrobacterium for genetic engineering in plants, use of marker gene. Cloning of foreign genes: DNA delivery method physical and biological methods, Genetic transformation prokaryotic: transferring DNA into E. coli – chemical induction and Electroporation.

Unit-III:

Gene library: construction of cDNA library and genomic library, screening of gene libraries – screening by DNA hybridization, immunological assay and protein activity, Marker genes: selectable markers and screenable marker marker and non antibiotic markers gene expression in prokaryotes: tissue specific promoter, wound inducible promoters, translation expression vector; DNA integration into bacterial genome; Increasing secretion; metabolic load, recombinant protein production in yeast: *Saccharomyces cerevisiae* expression systems; mammalian cell expression Vectors.

Unit-IV:

Origins of organismal cloning in development biology research on frog; nuclear transfer procedures and cloning of sheep (Dolly) & other mammals; application in conservation; therapeutic vs reproductive cloning; ethical issues and prospects for human cloning; two vector expression system; two gene expression vector, directed mutagenesis; transposon mutagenesis, gene targeting, site specific recombination.

Unit-V:

General principle of cell signaling, extra cellular signal molecule and their receptors, operation of signaling molecules over various distances sharing of signal information, cellular response to specific combination of extracellular signal molecules, Western, Southern and Northern blotting, dot-blot hybridization .Sequencing of DNA through Sanger's and Maxim and Gilbert's method, automated DNA sequencing, Antisense technology.

Textbooks and References

1. Albert's-Molecular Biology of the cell – 4th ed –Garland Publication.
2. Benjamin Levin – Genes VIII, Oxford University Press.
3. Boyer – Molecular Biology 2nd ed.
4. Innis –Principles of Genetics, 8th ed.
5. Genetics, C sarin, TMH publication, 2001.
6. Schumm' s Molecular&cell Biology, Gergory B Ralston, William D.Stan's field TMH Publication.
7. Recombined DNA. Waston, 1992.
8. DNA sciences, David A. micklos, Gregory A.K. Feyer, I.K. International Pvt. Ltd,2005.
9. principle of genetics, Robert H Tamarin, TMH publication,2

GENETIC ENGINEERING LAB (BT-654)

1. Extraction and isolation of plasmid DNA.
2. Isolation of genomic DNA.
3. Agarose gel electrophoresis to know the molecular weight of unknown DNA.
4. Agarose/ PAGE electrophoresis to elute the desired DNA.
5. Restriction map preparation for a given DNA.
6. Estimation and quantification of DNA.
7. Cloning experiment for a given DNA fragment into a plasmid vector.
8. Transformation of the recombinant vector in *E.coli*.
9. Southern Blotting.
10. Western Blotting.

MASS TRANSFER OPERATION-II (CH-601)

Unit-I

Diffusion

Molecular and Turbulent diffusion, diffusion coefficient, Ficks law of diffusion, measurement and estimation of diffusivity, diffusion in multicomponent gas mixtures, diffusion in solids, Molecular, Knudsen and surface diffusion.

Inter phase mass transfer: Mass transfer coefficient, diffusion between phases, equilibrium solubility of gases in liquids. Mass transfer theories. Mass transfer in fluidized beds.

Unit-II

Adsorption and stripping

Equipments, gas- liquid equilibria, Henrys law, selection of solvent, absorption in tray column, graphical and analytical methods. Adsorption in packed columns, HTU.NTU & HETP concepts, design equation for packed column.

Unit-III

Humidification and dehumidification

Vapour liquid equilibrium and enthalpy for a pure substance, vapour pressure- temperature curve, vapour gas mixtures, defination and derivation of relationships related with humidity, fundamental concept of humidification. Dehumidification and water cooling, wet bulb temperature, adiabatic and non adiabatic operation, evaporation cooling, classification and design of cooling towers.

Unit-IV

Drying

Solid-gas equilibria, definitions of moisture contents, types of batch and continuous dryers, rate of batch drying, time of drying, mechanism of batch drying, continuous drying.

Unit-V

Crystallization

Equilibrium yield of crystallization, heat and mass transfer rates in crystallization, theories of crystallization. Classification and design of crystallizers.

References:

1. Gavhane, K.A., Mass Transfer-II, Nirali Publication.
2. Mass Transfer Operation by Robert E Treybal.
3. Unit Operation of Chmical enggi. by WarrenL. McCabe & julianC. Smith. Mc Graw- Hall International Edition.

VII
SEMESTER

CHEMICAL REACTION ENGINEERING (CH-701)

Unit-I

Chemical Reaction: Rate of chemical reaction, variable affecting the reaction rate, reaction rate constant, elementary and non- elementary reaction mechanism. Arrhenious equation, collision theory and theory of absolute reaction rates, predictability of reaction rate.

Unit-II

Kinetics of homogeneous chemical reaction, rate equation of simple and complex reactions, irreversible reaction, parallel reactions, consecutive reactions, auto catalytic reactions and homogeneous catalytic reactions.

Unit-III

Interpretation of reaction data in constant volume and variable volume batch reactions, integral and differential method for following kinetic data.

Unit-IV

Classification of chemical reactions, Interpretation of reactor data in flow reactions. Reactor design for homogeneous, batch, semi-batch, plug flow and continuous stirred tank. Electrochemical reactors. Isothermal as well as non- isothermal operation, space velocity and residence time in flow reactors. Size comparison of single reactors like batch, plug flow and CSIR for first and second order single reactions. Multiple reactor systems, plug flow reactions in series and for parallel equal sized CSTRs in series.

Unit-V

Catalysts: Preparation, activity and the factors which influence it. The effect of physical properties such as surface area and pore size etc. on catalyst activity, methods of determination of their physical properties, catalyst poisoning, Biocatalysis, Heterogeneous catalytic reactions, principles, absorption isotherms, kinetics of solid catalysed fluid reactions, rate- controlling steps. Use of computers in designing, modelling, optimization and simulation of chemical process.

References:

1. P.M.Doran, Bioprocess Engg. Principles, Academic press.
2. Coulson and Richardson, Chemical Engg., Pergamon Press.
3. Perryes Handbook of chemical Engg.
4. Fogler: Chemical reaction Engineering

ENVIRONMENT BIOTECHNOLOGY (BT-701)

Unit I:

Factors of environmental degradation. Pollutants and their types: nature and source. Different biogeochemical cycles including nitrogen, carbon, hydrogen, oxygen etc. Pollution monitoring and measurement.

Unit II:

Biosensors for environmental testing: Physical, chemical and biological for sensing the pollutions.

Unit III:

Waste disposal and management; legislation of environmental problems, Microbiological and biochemical aspects of waste treatment processes, Microbial strain improvement with a view to develop scavengers, Bioremediation.

Unit IV:

Characteristics of wastewater; aerobic and anaerobic waste treatment processes. Biological treatment of solid wastes, Process design, Single stage and two stage anaerobic digestion.

Unit V:

Down stream processing in biological treatment process: Effluent disposal and reuse. Biofiltration for waste gas treatment, purification of biogas, Containment of biological treatment processes, vermiculture technology, wastewater treatment using aquatic plants, heavy metal removal by hairy roots.

Text Books and References:

1. J.Winter, Environmental Processes I-UUU, 2nd ed., Wiley Publications
2. Metcalf- a Book on Waste water biotechnology
3. Ted Munn encyclopedia of Global Environmental Change Five volume set, Wily Publication.(Free.[www.wily.co.uk/egee.](http://www.wily.co.uk/egee))

ENVIRONMENTAL BIOTECHNOLOGY LAB (BT-751)

1. Physico-chemical and biological characterization of waste water.
2. Determination of total solids, total dissolved solids, total suspended solids, volatile solids, fixed solid/ash content and moisture content in solid waste and waste water.
3. Determination of MLVSS.
4. Determination of sludge volume index and food to microorganisms.
5. Determination of Kjeldahl nitrogen, nitrate and nitrite nitrogen.
6. Determination of inorganic phosphates.
7. Determination of BOD of wastewater samples.
8. Determination of COD of wastewater samples.

Elective-I

ANIMAL TISSUE CULTURE (BT-702)

Unit-I

Basic laboratory techniques, cell culture media, methods for primary cell & organ culture.

Unit-II

Permanent cell lines: cell strains (monolayers, suspension culture, stationary suspension culture, agar culture and agitated microcarrier suspension culture, hollow fiber systems)

Unit-III

Cell synchronization and cell transformation. Maintenance of cell culture through subculture and cloning, cryopreservation.

Unit-IV

Specific application of cell in culture, pharmaceuticals, vaccines, monoclonal antibodies, recombinant protein.

Unit-V

Embryonic cell lines, gene transfers and transgenic animals and embryo transfer technology.

Reference Books:

1. Animal cell culture course Manul – Cold spring Harbour Lab. New York.
2. Tissue culture methods & Application – Kruse P.E & Patterson M.K.
3. Animal Tissue Culture-Ian Freshney

Elective-II

FOOD BIOTECHNOLOGY (BT-703)

Unit I:

Microbial role in food process, operation and production: new protein foods-SCP, mushroom, food yeast, algal proteins.

Unit II:

Fermentation as a method for preparing and preserving foods, food additives like colouring, flavours and vitamins.

Unit III:

Organisms and their use for production of fermented foods and beverages: pickling, alcoholic beverages, cheese, sour, krat, idli, vinegar.

Unit IV:

Deoxygenating and desugaring by glucose oxidase, beer mashing and chill proofing or cheese making by proteases and various other enzyme catalytic actions in food processing, classification of fruit juice.

Unit V:

Post harvest technology and process of food preservation.

Text Books and References

1. Frazier, Food Microbiology, TMH Publications
2. Heller, Genetic Engineering of Food: Detection of Genetic Modifications –Wiley Publications
3. Lel A. et al., Microorganism & Fermentations- N.y. Chemical
4. Rehm, Biotechnology Set –Wiley Publications

B. Tech. Biotechnology Engineering

7th Semester

Nano Biotechnology (OE-03)

Unit 1

Introduction to Nano Biotechnology & Nano Technology, History of Nano Biotechnology, Cell-Nano Structure Interaction

Unit 2

Protein based nano structures, micro contact printing of proteins, micro contact printing polypeptide, polyhydroxyalkanoates in nano biotechnology : Protein – protein interaction studies

Unit 3

Engineered nanopores, potential applications of nanopores, Biomineralization of magnetosomes in bacteria, Microbial production of alginates

Unit-4

Microbial nanoparticle production, biopolyester particles produced by microbes using polyester syntheses

Unit 5

DNA based nanostructures, DNA protein nanostructures, DNA template electronics, DNA nanostructure for mechanics and computing biomimetic fabrication of DNA based metallic nanowires and networks

References

1. Nanobiotechnology : Concepts, Affiliation and Perspectives by Christopher M Niemeyer, Clad A Mirkin, Wiley-VCH Publications
2. Bionanotechnology : Lesson from Nature by David S Goodsell, Wiley-VCH Publications
3. Nanotechnology in Biology and Medicine : Method Devices & Applications by Tuan Vo-dinh, by Wiley-VCH Publications

MINI PROJECT (BT- 754)

The students will be required to search literature pertaining to design of an equipment/ processing of products of importance for human beings/production of metabolites of microbial origin, comprehend it and prepare a report for assessment

INDUSTRIAL TRAINING (BT- 753)

The student will be required to undertake training in the Biotech industry after third year B.Tech (VI semester) for a specified period (Four weeks) and submit its report after completion for evaluation and oral examination in the VII semester of his studies in final year B.Tech.(VII semester)

VIII
SEMESTER

BIOPROCESS ENGINEERING-II (BT-801)

Unit-I

Microbial growth in closed, semi-open and open cultivation systems, Maintenance energy and yield concepts, Microbial kinetics of growth and substrate utilization, Environmental effect on cell growth.

Unit-II

Material balance in steady and unsteady reaction system, Product formation in batch, plug flow and chemo stat culture, ATP biosynthesis in different pathways.

Unit-III

Mass transfer in different reaction systems, concepts of material and mass balance. Material and energy balance in steady and unsteady reaction systems. Oxygen transfer in bioreactors, measurement of K_La . Oxygen transfer in large vessels.

Unit-IV

Types of bioreactors- batch, fed-batch, fluidized bed, plug flow reactor, air lift, bubble column and continuous stirred tank reactor. Scale – up of bioprocesses: General aspects and scale up methods, Practical considerations for bioreactor construction for cells and enzymes.

Unit-V

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

References Books:

1. Principles of microbe and cell cultivation- S. John Pirt, Butterworth Publication.
2. Bioprocess Engineering Principles- P.M.Doran, Fifth edition.
3. Biochemical Engg. Bailly & Ollis, Academic Press.
4. Introduction to Chemical Engg. Series, MCH Int. Series.

BIOSEPARATION AND DOWNSTREAM PROCESSING (BT-802)

Unit I:

Introduction; An overview of Bioseparation, Separation of cells and other insoluble from fermented broth.

Unit II:

Filtration and Micro filtration. Centrifugation (batch, continuous. designing of centrifuges for desired product of desired capacity.

Unit III:

Cell disruption: Physical method-osmotic shock, grinding with abrasives solid shear, liquid shear. Chemical methods- alkali reagents, enzymatic methods.

Unit IV:

Product isolation: Extraction and adsorption method, solid-liquid separation, liquid-liquid separation, distillation, precipitation method using ammonium sulfate, organic solvents, high molecular weight polymers. Reverses osmosis.

Unit V:

Electrophoresis and Chromatography principles for product purification. Different electrophoresis techniques viz. iso electric focusing, chromatographic techniques viz. paper, gel filtration, column, ion exchange, affinity, GLC, HPLC. Dialysis, ultrafiltration. Product polishing: Crystallization and drying.

Textbooks & References :

1. Bailly & Ollis Biochemical Engg.- Academic press.
2. H. Gunzler – handbook of analytical techniques- Wiley Publications.
3. H. J. Rehmand G. Reed, Biotechnology- Vol. 3,4,5, Verlag Publishers
4. Humphrey, Aiba & Miller, Biochemical Engg., Academic press
5. Murray Moo- Young comprehensive Biotechnology- Vol. II- latest ed., pergamon Publishers.
6. Product Recovery in Bioprocess Technology, Heinemann, Butterworth Publication.
7. Staburry & Whitteker, Principles of Fermentation Technology, Pergamon Press
8. Willard et al., - International Method of Analysis- CBS Publication
9. Wilson and Golding. A Biologist's Guide to Principles & Techniques of Practical Biochemistry, Cambridge University Press

Elective-III

IPR, BIOSAFTEY & BIOETHICS (BT-803)

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
obtaining patent (ii) geographical indication.

Unit-II

Distinction among various forms of IPR, requirement of a patentable novelty, invention step and prior art and state of art, procedure.

Unit-IV

Right/ protection, infringement or violation, remedies against infringement- civil and criminal.

Unit-V

Biosafety and Bioethical issues in Biotechnology.

Reference Books:

1. Patent strategy for researchers & research managers- Knight, Wiley publication.

Elective-IV

INDUSTRIAL BIOTECHNOLOGY (BT-804)

Unit-I:

Fermentative production of organic acids: Lactic acid, citric acid and Acetic acid, Fermentative product of enzymes: Proteases, Lipases and Amylases.

Unit-II

Fermentative product of biofertilizers i.e. Rhizobium, BGA, Biopesticide i.e. *Bacillus thuringiensis*, Single cell protein (SCP) and Bakers yeast.

Unit-III

Fermentative product of antibiotics: penicillin, streptomycin, tetracycline and cephalosporin. Production of vitamins like Vitamin B₁₂, amino acids i.e. L-glutamic acid, phenylalanine and L- lysine.

Unit-IV

Fermentative production of organic solvents i.e. ethanol, Butanol and Acetone.
Alcoholic beverages i.e. Beer, wine, Rum, Gin, Whisky and Brandy.

Unit-V

Biotransformation- Steroid transformation, Important products through r-DNA technology: hepatitis b vaccines, interferon, insulin, somatotropic hormone. Production of biosurfactants, biopolymers like xanthan gum and dextrin. Bioprocess Economics.

References:

1. A.Lel and R.J.Mickey, N.Y.Industrial Fermentations- Chemical Publishers.
2. A.Lel and R.J.Mickey, Microorganisms & Fermentation, Oriffin Publications.
3. Fraizer, Food Microbiology, TMH Publication
4. Robert P. Onellette & Paul N. Application of Biotech- Cherin Siroff Lancaster
5. Prescott and Donn, Industrial microbiology.

PROJECT (BT- 851)

The students will be required to search literature pertaining to design of an equipment/ processing of products of importance for human beings/production of metabolites of microbial origin, comprehend it and prepare a report for assessment

LIST OF ELECTIVE PAPERS

FOR B.TECH BIOTECHNOLOGY ENGINEERING. STUDENTS

Elective-I

- ✓ Animal Tissue Culture
- ✓ Economics of Biotechnology
- ✓ Agriculture Biotechnology
- ✓ Environmental & Ecology

Elective- II

- ✓ Pharmaceutical Biotechnology
- ✓ Plant Tissue Culture
- ✓ Food Biotechnology
- ✓ Immunodiagnostics

Elective- III

- ✓ IPR, Biosafety & Bioethics
- ✓ Metabolic Engg.
- ✓ Immunoinformatics
- ✓ Enzyme & Protein Engg.

Elective- IV

- ✓ Pharmacoinformatics
- ✓ Medical Biotechnology
- ✓ Biomedical Instrumentation
- ✓ Industrial Biotechnology

INSTITUTE OF ENGG. & TECHNOLOGY
BUNDELKHAND UNIVERSITY
JHANSI
LIST OF OPEN ELECTIVE PAPERS

List of open elective of seventh semester for B.Tech Civil/ Electrical and Electronics/ Mechanical & Allied course/ Electronics and communication & Allied Courses? Instrumentation and control & Allied Courses/Computer Engg. & Allied Courses/ Information Technology & Allied courses / Biotechnology/ Marine Engg./Biomedical Engg.

S.no	Paper Code	Subjects	Departments
1	OE-01	Non Conventional Energy Resources	Electrical Engg.
2	OE-02	Reliability Engg.	Electrical Engg.
3	OE-03	Nano-Biotechnology	Material Sc. & Engg. (Mechanical Engg.)
4	OE-04	GIS & Its application	Civil Engg.
5	OE-05	Entrepreneurship Development Programme	Humanities
6	OE-06	Ancient Indian Culture	Humanities
7	OE-07	Quality System & Managment	Mechanical Engg.
8	OE-08	Condition Monitoring & Diagnostics	Mechanical Engg.
9	OE-09	Value Engg.	Mechanical Engg.
10	OE-10	Intelligent Instrument	Instrumentation & Control
11	OE-11	Microprocessor Based Instrumentation system	Instrumentation & Control
12	OE-12	Optical & Mobile Communication	Electronic & Comm.
13	OE-13	Consumer Electronics	Electronic & Comm.
14	OE-14	Solar Engg.	Electronic & Comm.
15	OE-15	Human Computer Interaction	Computer Science
16	OE-16	IT in Business	Information Technology
17	OE-17	Human Value	Humanities
18	OE-18	Solar Energy	Mechanical Engg.
19	OE-19	Human Resource Management	Mechanical Engg.
20	OE-20	Artificial Intelligence in Manufacturing	Manufacturing Tech.
21	OE-21	Advance Foundry Technology	Manufacturing Tech
22.	OE-22	Biotechnology Engineering	Biotechnology Engg.

Note : The students will choose any one subject of course of other than their Engineering Branch.

