INSTITUTE OF ENGINEERING AND TECHNOLOGY

(DEPARTMENT OF BIOTECHNOLOGY)

Course Structure and syllabus
For
B.Tech Biotechnology Programme

Revised

2014

BUNDELKHAND UNIVERSITY, JHANSI
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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
						SESSIONAL EXAM.				
			L	T	P	CT	TA	Total	ESE	Total
THEORY										
1.	1842*MA-102/1852/ BT-101	Elementary Mathematics-I /Remedial Biology-I	3	1	0	30	20	50	100	150
2.	1850/ME101	Manufacturing Process	2	1	0	15	10	25	50	75
3.	1843/PH-101	Engineering Physics-I	2	1	0	15	10	25	50	75
4.	1844/ CY-102	Engineering Chemistry	3	1	0	30	20	50	100	150
5.	1846/EC-101/	Electrical Engineering	3	1	0	30	20	50	100	150
6.	1848/EC-101	Electronic Engineering	3	1	0	30	20	50	100	150
PRACTICAL/TRAINING/PROJECT										
7.	10859/PH-251/	Physics Lab	0	0	2	10	10	20	30	50
8.	10853/CY-151	Engineering Chemistry	0	0	2	10	10	20	30	50
9.	10857/ WS-151	Workshop Practice	0	0	3	10	10	20	30	50
10.	10855/EE-151	Electrical Engineering Lab	0	0	2	10	10	20	30	50
11.	10861/GP-101	General Proficiency	-	-	-	-	-	50	-	50
		Total	**16**	**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.

INSTITUTE OF ENGINEERING & TECHNOLOGY
BUNDELKHAND UNIVERSITY, JHANSI
STUDY AND EVALUATION SCHEME

YEAR I, SEMESTER-II

B. Tech. BIOTECHNOLOGY ENGINEERING

S.No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total
						SESSIONAL EXAM.				
			L	T	P	CT	TA	Total	ESE	
THEORY										
1.	*MA-202/ BT-201	Elementary Mathematics-II /Remedial Biology	3	1	0	30	20	50	100	150
2.	1863/HU-101	Professional Communication / Engineering Chemistry	3	1	0	30	20	50	100	150
3.	1857/PH-201	Engineering Physics-II	2	1	0	30	20	50	100	150
4.	1859/ ME-201	Engineering Mechanics	3	1	0	30	20	50	100	150
5.	1861/ CS-201	Computer Concepts and Programming in C	3	1	0	30	20	50	100	150
6.	1865/CE-201	Environment and Ecology/	2	1	0	15	10	25	50	75
PRACTICAL/TRAINING/PROJECT										
7.	10874/ HU-251	Professional Communication Lab	0	0	2	30	20	50	-	50
8.	10870/ CS-251	Computer Programming Lab	0	0	2	10	10	20	30	50
9.	10872/ CE-251	Computer Aided Engineering Graphics	0	0	3	10	10	20	30	50
10.	10868/ME-251	Engineering Mechanics Lab	0	0	2	10	10	20	30	50
11.	10875/GP-201	General Proficiency	-	-	-	-	-	50	-	50
		Total	**16**	**6**	**9**	-	-	-	-	**1000**

NOTE :

INSTITUTE OF ENGINEERING & TECHNOLOGY
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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
						SESSIONAL EXAM.				
			L	T	P	CT	TA	Total	ESE	
	THEORY									
1.	BT 301 /2461	Biochemistry	3	1	0	30	20	50	100	150
2.	BT-302 / 2462	Applied Microbiology	3	1	0	30	20	50	100	150
3.	CH-301 / 2463	Fluid Flow and Solid Handling	3	1	0	30	20	50	100	150
4.	MA-302 / 2464	Statistical Techniques	3	1	0	30	20	50	100	150
5.	CS-306 / 2465	Data structure & Algorithms using C	3	1	0	30	20	50	100	150
	PRACTICAL/TRAINING/PROJECT									
6.	BT 351 / 2461	Biochemistry Lab	0	0	6	0	40	40	60	100
7.	BT-352 /20467	Applied Microbiology Lab	0	0	6	0	20	30	50	50
8.	CH-351 /20468	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
						SESSIONAL EXAM.				
			L	T	P	CT	TA	Total	ESE	
	THEORY									
1.	BT-401 / 2466	Immunology	3	1	0	30	20	50	100	150
2.	BT-402 / 2467	Enzymology	3	1	0	30	20	50	100	150
3.	BT-403 / 2468	Genetics & Molecular Biology	3	1	0	30	20	50	100	150
4.	BT-404 / 2469	Bioinformatics-I	3	1	0	30	20	50	100	150
5.	CH-401 / 2470	Heat Transfer Operations	3	1	0	30	20	50	100	150
	PRACTICAL/TRAINING/PROJECT									
6.	BT-451 / 20471	Immunology Lab	0	0	6	20	20	40	60	100
7.	BT-452 / 20472	Genetics & Molecular Biology Lab	0	0	3	10	10	20	30	50
8.	BT-453 / 20473	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
						SESSIONAL EXAM.				
			L	T	P	CT	TA	Total	ESE	
THEORY										
1.	BT 501 / 3461	Biophysical Techniques	3	1	0	30	20	50	100	150
2.	BT-502 / 3462	Bioprocess Engineering-I	3	1	0	30	20	50	100	150
3.	HU-501 / 3463	Industrial Economics & Principle of Management	3	1	0	30	20	50	100	150
4.	CH-501 / 3464	Mass Transfer Operations-I	3	1	0	30	20	50	100	150
5.	CS-506 / 3465	Design & Analysis of Algorithm	3	1	0	30	20	50	100	150
PRACTICAL/TRAINING/PROJECT										
6.	BT-552 / 20466	Bioprocess Engineering Lab	0	0	6	0	40	40	60	100
7.	CS-551 / 30467	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
						SESSIONAL EXAM.				
			L	T	P	CT	TA	Total	ESE	Total
THEORY										
1.	BT-601/ 3466	Bioinformatics-II	3	1	0	30	20	50	100	150
2.	BT-602 / 3467	Plant Biotechnology	3	1	0	30	20	50	100	150
3.	BT-603 / 3468	Fermentation Biotechnology	3	1	0	30	20	50	100	150
4.	BT-604 / 3469	Genetic Engineering	3	1	0	30	20	50	100	150
5.	CH-601 / 3470	Mass Transfer Operations-II	3	1	0	30	20	50	100	150
PRACTICAL/TRAINING/PROJECT										
6.	BT-651 / 30471	Bioinformatics-II Lab	0	0	6	0	20	20	30	50
7.	BT-653 / 30472	Fermentation Lab	0	0	6	0	40	40	60	100
8.	BT-654 / 30473	Genetic Engineering Lab	0	0	0	0	20	20	30	50
9.	GP-601	General Proficiency	-	-	-	-	-	50	-	50
		Total	15	5	12	-	-	-	-	1000

S. No.	Course Code	SUBJECT	PERIODS			Evaluation Scheme				Subject Total
						SESSIONAL EXAM.				
			L	T	P	CT	TA	Total	ESE	
		THEORY								
1.	OE-03 / 4461	Nano Biotechnology	3	1	0	30	20	50	100	150
2.	CH-701 / 4462	Chemical Reaction Engineering	3	1	0	30	20	50	100	150
3.	BT-701 / 4463	Environmental Biotechnology	3	1	0	30	20	50	100	150
4.	BT-702 / 4464	Animal Tissue Culture	3	1	0	30	20	50	100	150
5.	BT-703 / 4465	Food Biotechnology	3	1	0	30	20	50	100	150
		PRACTICAL/ TRAINING/PROJECT								
6.	BT-751 / 40466	Environmental Biotechnology Lab	0	0	3	10	10	20	30	50
7.	BT-752 / 40467	Seminar	0	0	3	0	50	50	50	50
8.	BT-753 / 40468	Industrial / Organizational Training	0	0	3	0	50	50	-	50
9	BT-754 / 40469	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**

INSTITUTE OF ENGINEERING & TECHNOLOGY
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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.				
				T	P	CT	TA	Total	ESE	
THEORY										
1.	BT-801 / 4466	Bioprocess Engineering-II	3	1	0	30	20	50	100	150
2.	BT-802 / 4467	Bioseparation& Down Stream Processing	3	1	0	30	20	50	100	150
3.	BT-803 / 4468	IPR, Biosafety & Bioethics	3	1	0	30	20	50	100	150
4.	BT-804 / 4469	Industrial Biotechnology	3	1	0	30	20	50	100	150
PRACTICAL/TRAINING/PROJECT										
5.	BT-851 / 40471	*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

ELEMENTARY MATHEMATICS-I (MA-102/1842)

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Unit I:

Differential Calculus

Function, Limit of Function, Differentiation of function, Product of Function, Product rule, Quotient Rule of Differentiation, Differentiation of Function of a Function, Inverse of Trigonometric Function, Differentiation of Logarithmic Form, Parametric Form, Differentiation by substation, Tangents and Normals, maxima &minima of one variable.

Unit: II:

Integral Calculus

Integration as inverse process of differentiation, Infinite integrals of standard form, Integration of functions by substitution, by partial fraction parts, Basic properties of definite integrals & evaluation of definite integrals.

Unit III:

Differential Equations

Definition, order & degree, General & particular solutions of a differential equation,Differential equations of first order & first degree, Solutions of differential equations by method of separation of variables, homogenous differential equations, linear differential equation, Exact differential equation.

Unit IV:

Trigonometry

System of Measurement of angles, Trigonometric ratios or functions, fundamental trigonometric identities, addition, subtraction & transformation formulae, Signs of the values of Trigonometric functions in different quadrants, ratios of Multiple, Trigonometric ratios of allied & compound angles, Transformation Formulae, Trigonometric ratios of submultiples angles, allied & certain angles.

Unit V:

Statics

Measures of central values, Frequency distribution, graphical representation, characteristics of a frequency distribution, Arithmetic mean, median, mode, relation between AM, GM, HM. Definition of probability, laws of probability.

Reference Books:

1. Engg. Mathematics (Vol- 1) by H K Dass, S. Chand Publication.
2. Objective Mathematics by R D Sharma, DhanpatRai Publication.

REMEDIAL BIOLOGY-I (BT-101/1852)

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3 1 0

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, Prokanyotic and encaryotic cell, cell wall, cell membrane, Nucleus and nuclear organization, Mitosis, Melosis, 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

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

ENGINEERING PHYSICS-I (PH-101/1843)

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

Unit - II
Optics:
Interference- Interference of light, Biprism experiment, displacement of fringes, Interference in thin films- wedge shaped film, Newton's rings
Diffraction- Single, Double & N- Slit, Diffraction grating, Grating spectra, Rayleigh's criterion and resolving power of grating.

Unit -III
Polarization- Phenomena of double refraction, Nicol prism, Production and analysis of plane, circular and elliptical polarized light, Fresnel's theory of optical activity, Polarimeters.
Laser: Spontaneous and stimulated emission of radiation, Einstein's Coefficients, construction and working of Ruby, He-Ne lasers and laser applications.

Unit – IV
Fiber Optics and Holography- Fundamental ideas about optical fiber, Types of fibers, Acceptance angle and cone, Numerical aperture, Propagation mechanism and communication in optical fiber. Attenuation, Signal loss in optical fiber and dispersion.
Basic Principle of Holography, Construction and reconstruction of Image on hologram and applications of holography.

Reference Books:
1. Concepts of Modern Physics - AurthurBeiser (Mc-Graw Hill)
2. Introduction to Special theory of Relativity - Robert Resnick (Wiley)
3. Optics - AjoyGhatak (TMH) - Brijlal& Subramanian (S. Chand)
4. Optical Fibre& Laser - Anuradha De. (New Age)
5. Fundamental of Physics - Resnick, Halliday& Walker (Wiely)
6. Principles of Physics - R.A. Serway& J.W. Jewett

PHYSICS LAB (PH-151/10859)

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List of Experiments

Any ten experiments, at least four from each group.

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

Group – B
1. To determine the specific resistance of a given wire using Carey Foster's bridge.
2. To study the variation of magnetic field along the axis of current carrying Circular coil and then to estimate the radius of the coil.
3. To verify Stefan's Law by electrical method.
4. To calibrate the given ammeter and voltmeter by potentiometer.
5. To study the Hall Effect and determine Hall coefficient, carrier density and - mobility of a given semiconductor using Hall Effect set up.
6. To determine the energy band gap of a given semiconductor material.
7. To determine E.C.E. of copper using Tangent or Helmholtz galvanometer.
8. To draw hysteresis curve of a given sample of ferromagnetic material and from - this to determine magnetic susceptibility and permeability of the given specimen.
9. To determine the ballistic constant of a ballistic galvanometer.
10. To determine the coefficient of viscosity of a liquid.
11. Measurement of fiber attenuation and aperture of fiber.
12. High resistance by leakage method.
13. Magnetic Susceptibility of paramagnetic solution.

Text books:-
1. Gupta & Kumar (Physics Practical).
2. S.L. Arora (Physics Practical).
3. Engineering Physics Practical, S.K. Gupta

ENGINEERING CHEMISTRY(CY-102/1844)

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UNIT-I
CHEMICAL BONDING AND STATES OF MATTER

M.O. theory and its applications in diatonic molecules.Hydrogen bond, metallic bond and their applications. Various states of matter including liquid crystallite state, classification and applications of liquid crystals. Types of unit cell, space lattice (only cubes, Bragg's Law.

Calculation and density of the unit cell, one and two dimensional solids such as graphite and its conduction properties. Fullerenes and their applications.

UNIT-II
REACTION KINETICS, PHASE RULE AND ELECTROCHEMISTRY

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

UNIT-III
STRUCTURAL AND MECHANISTIC CONCEPTS OF ORGANICS

Inductive, electromericmesomeric and hyperconjugative effects. Stability of reaction intermediates e.g. carbocation and free radicals. Mechanism of nucleophilic substitutions. Mechanism of the following reactions:
1. Aldol condensation
2. Cannizaro reaction
3. Beckman rearrangement
4. Hoffmann rearrangement and
5. Diels-Alder reaction.

E-Z nomenclature, R.S. configuration, optical isomerism, chirality and its implications, conformations of butene.

UNIT-IV
POLYMERS AND ORGANOMETALLICS

Polymerization and its classification. Thermoplastic and Thermosetting resins. Eleastomers and synthetic fibres. Ion exchange resins. Organic conducting and biodegradable polymers.Classification and general methods of synthesis of organics and their applications in polymerizations and catalysis.

UNIT-V
ANALYTICAL METHODS AND FUELS

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

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

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

ENGINEERING CHEMISTRY LAB(CY -151/10853)

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List of Experiments

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

ELECTRONICS ENGINEERING (EC-101/1848)

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Unit – I
Semiconductor Diodes and Applications:

p-n junction, depletion layer, v-i characteristics, ideal and practical, diode resistance, capacitance, diode ratings (average current, repetitive peak current, peak-inverse voltage), p-n junction as rectifiers (half wave and full wave), filter (Shunt capacitor filter), calculation of ripple factor and load regulation, clippling circuits, clamping circuits, voltage multipliers

Breakdown diodes:

Breakdown mechanism (zener and avalanche), kdown characteristics, zener resistance, zener diode ratings, zener diode application as shunt regulator

Unit – II
Bipolar Junction Transistor (BJT):

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, graphical analysis of CE amplifier, concept of voltage gain, current gain, h-parameter model (low freq), computation of Ai, Av, Ri, Ro of single transistorCE amplifier configuration

Unit – III
Field Effect Transistor (FET):

JFET: Basic construction, principle of working, concept of pinch-off, maximum drain saturation current, input and transfer characteristics, characteristic equation, CG, CS and CD configurations, fixed and self biasing of JFET amplifier

MOSFET: depletion and enhancement type MOSFET- construction, operation and characteristics

Operational Amplifier (Op-Amp): concept of ideal operational amplifier, ideal and practical

Op-Amp parameters, inverting, non-inverting and unity gain configurations, applications of Op-Amp as adders, difference amplifiers, integrators and differentiator

Unit – IV
Switching Theory and Logic Design (STLD):

Number system, conversion of bases (decimal, binary, octal and hexadecimal numbers) addition and subtraction, fractional numbers, BCD numbers, Boolean algebra, logic gates, concept of universal gates, canonical forms, minimization using K-map (don't care conditions)

Unit – V
Electronics Instruments:

Working principle of digital voltmeter, digital multimeter (block diagram approach),

CRO (its working with block diagram), measurement of voltage, current, phase and frequency using CRO

Text Books:

1. Robert L. Boylestad/ Louis Nashelsky "Electronic Devices and Circuit Theory", 9th Edition, Pearson Education 2007
2. Devid A. Bell "Electronic Devices and Circuits", 5th Edition, OXFORD University Press 2008
3. Jacob Millman/ Christos C. Halkias/ SatyabrataJit "Electronics Devices and Circuits", 3rd Edition, TMH 2008
4. Morris Mano "Digital Computer Design", PHI 2003
5. H.S. Kalsi "Electronic Instrumentation", 2nd Edition, TMH 2007

ELECTRICAL ENGINEERING (EE-101/1846)

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3 1 0

UNIT-I

D C Circuit Analysis and Network Theorems: Circuit Concepts: Concepts of network,Active and passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements, R, L and C as linear elements, source transformation.

Kirchhoff's laws; loop and nodal methods of analysis; star-delta transformation; NetworkTheorems: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, MaximumPower Transfer Theorem (simple numerical problems).

UNIT-II

Steady- State Analysis of Single Phase AC Circuits: AC Fundamentals: Sinusoidal,square and triangular waveforms – average and effective values, form and peak factors, concept of phasors, phasor representation of sinusoidally varying voltage and current. Analysis of series, parallel and series-parallel RLC Circuits: apparent, active & reactive powers, power factor, causes and problems of low powerfactor, powerfactor improvement; resonance in series and parallel circuits, bandwidth and quality factor (simple numerical problems).

UNIT-III

Three Phase AC Circuits: Three phase system-its necessity and advantages, meaning ofphase sequence, star and delta connections, balanced supply and balanced load, line and phase voltage/current relations, three-phase power and its measurement (simple numerical problems).

Measuring Instruments: Types of instruments, construction and working principles ofPMMC and moving iron type voltmeters & ammeters, single phase dynamometer wattmeter and induction type energy meter, use of shunts and multipliers (simple numerical problems on energy meter, shunts and multipliers).

UNIT-IV

Introduction to Power System: General layout of electrical power system and functions ofits elements, standard transmission and distribution voltages, concept of grid (elementary treatment only).

Magnetic Circuit: Magnetic circuit concepts, analogy between electric & magnetic circuits,magnetic circuits with DC and AC excitations, magnetic leakage, B-H curve, hysteresis and eddy current losses, magnetic circuit calculations, mutual coupling.

Single Phase Transformer: Principle of operation, construction, e .m. f. equation,equivalent circuit, power losses, efficiency (simple numerical problems), introduction to auto transformer.

UNIT-V

Electrical Machines: Principles of electro mechanical energy conversion, DC machines:types, e. m. f. equation of generator and torque equation of motor, characteristics and applications of dc motors (simple numerical problems).

Three Phase Induction Motor: types, Principle of operation, slip-torque characteristics,applications (numerical problems related to slip only).

Single Phase Induction motor: Principle of operation and introduction to methods ofstarting, applications.

Three Phase Synchronous Machines: Principle of operation of alternator andsynchronous motor and their applications.

Text Books:

1. V. Del Toro, " Principles of Electrical Engineering" Prentice Hall International
2. I.J. Nagarath, " Basic Electrical Engineering" Tata McGraw Hill
3. D.E. Fitzgerald & A. Grabel Higginbotham, " Basic Electrical Engineering Mc- Graw Hill

Reference Books:
1. Edward Hughes," Electrical Technology" Longman
2. T.K. Nagsarkar& M.S. Sukhija, " Basic Electrical Engineering" Oxford University Press.
3. H. Cotton, " Advanced Electrical Technology" Wheeler Publishing
4. W.H. Hayt& J.E. Kennely, " Engineering Circuit Analysis" McGraw Hill

ELECTRICAL ENGINEERING LAB (EE-151/10855)

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

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

MANUFACTURING PROCESSES (ME-102/1850)

L T P
2 0 0

Unit-I
Basic Metals & Alloys: Properties and Applications
Properties of Materials: Strength, elasticity, stiffness, malleability, ductility, brittleness, toughness and hardness. Elementary ideas of fracture, fatigue & creep.

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

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

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

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

Unit-III
Introduction to Machining & Welding and its applications
Machining: Basic principles of Lathe-machine and operations performed on it.Basic description of machines and operations of Shaper-Planer, Drilling, Milling & Grinding.
Welding: Importance & basic concepts of welding, classification of welding processes. Gas-welding, types of flames. Electric-Arc welding. Resistance welding. Soldering & Brazing and its uses.

Unit IV
Misc. Topics
Manufacturing: Importance of Materials & Manufacturing towards Technological & Socio- Economic developments. Plant location.Plant layout – its types.Types of Production.Production versus Productivity.
Non-Metallic Materials: Common types & uses of Wood, Cement-concrete, Ceramics, Rubber, Plastics and composite-materials
Misc. Processes: Powder-metallurgy process & its applications, Plastic-products manufacturing, Galvanizing and Electroplating.

Text books:-
1. Manufacturing Processes – K.M. Moeed
2. Manufacturing Processes – V. Upadhyay, Agarwal

WORKSHOP PRACTICE(WS-151/10857)

L T P
0 1 3

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

1. Fitting Bench Working Shop:
   o Study of tools & operations
   o Simple exercises involving fitting work.
   o Make perfect male-female joint.
   o Simple exercises involving drilling/tapping/dieing.

2. Black Smithy Shop:
   ° Study of tools & operations

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

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

4. Sheet-metal Shop:
   o Study of tools & operations.
   o Making Funnel complete with 'soldering'.
   o Fabrication of tool-box, tray, electric panel box etc.

5. Machine Shop:
   o Study of machine tools and operations.
   o Plane turning.
   o Step turning
   o Taper turning.
   o Threading
   o Single point cutting tool grinding.

6. Foundry Shop:
   o Study of tools & operations
   o Pattern making.
   o Mould making with the use of a core.
   o Casting

Text Book:-
1. Workshop Technology- S.K. Garg

II
SEMESTER

ELEMENTRY MATHEMATICS-II(MA-202/1856)

L T P
3 1 0

UNIT-I:
SEQUENCE AND SERIES:
Sequence and Series, Arithmetic progression (A.P.), Aritmmetic Mean (A.M.), geometric mean (G.M.), Geometric progression (G.P.), general term of an A.P. and G.P., sum of n terms of an A.P. and G.P., sum of an infinite, Harmonic progression (H.P), properties of A.M., G.M., Permutations and combinations, Partial Fractions.

UNIT-II:
MATRIX:
Types of Matrixs, addition, subtraction, multiplication and transpose of matrix, adjoint and inverse of matrix, application of matrix in solving equatios, determinants and its properties, application of determinants in solution of linear equations, elementary row and column transformation, rank of matrix, eigen values and eigen vector, Cayley Hamilton theorem (without proof).

UNIT –III:
COORDINATE GEOMETERY:
Distance between two points, Area of triangle, section formula, equation of a straight line, Slope of a line and angle between two lines, equations of a line parallel to axes, different forms of the equation of a straight line, Standard equation of a circle, ellipse, parabola and hyperboa.

UNIT-IV:
VECTORS:
Vectors and scalars, magnitude and direction of a vector, equality of vectors, Types of vectors (equal, unit, zero, parallel and collinear vectors), addition of vectors, Scalar (dot) product of vectors, Scalar product in term of component, Angle between two vector, Vector (cross) product of vectors. Vectors product in term of components, Scalar triple product, scalar triple products in terms of components, vector differentiation, vector differential perator, gradient, divergence and curl.

UNIT-V:
DIFFERENTIAL CALCULUS II:
Sucessive differentiation, lebinitiztheorem(without proof), partial differentiation, Euler's theorem on homogenous functions, Expansion of several variables, Taylor's series of two variables (without proof), jacobians.

Reference books:
1. Engg. Mathematics(Vol-I) by H.K. Dass, S.ChandPublicatio.
2. Ocjective mathematics by R DSharma, DhanpatRai Publication.
3. Higher engineering mathematics by B.V. Ramana(Tata Macgraw Hill)

REMEDIAL BIOLOGY –II (BT-202/1866)

L T P
3 1 0

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

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

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

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

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

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

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

ENGINEERING PHYSICS- II (PH-201/1857)

L T P
2 10

Unit - I

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

Unit – II

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

Ultrasonic: Generation, detection and application of ultrasonics08 Hrs.

Unit-III

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

Unit-IV

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

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

ENVIRONMENT &ECOLOGY(CE- 201/1865)

L T P
2 0 0

UNIT-I

Definition, Scope & Importance, Need For Public Awareness- Environment definition, Eco system – Balanced ecosystem, Human activities – Food, Shelter, Economic and social Security.

3 hrs

Effects of human activities on environment-Agriculture, Housing, Industry, Mining and Transportation activities, Basics of Environmental Impact Assessment. Sustainable Development. 3 hrs

UNIT-II

Natural Resources- Water Resources- Availability and Quality aspects. Water borne diseases, Water induced diseases, Fluoride problem in drinking water. MineralResources, Forest Wealth, Material cycles- C, N and S Cycles.

4hrsEnergy – Different types of energy, Electro-magnetic radiation. Conventional and Nson- Conventional sources – hydro Electric, Fossil Fuel based, Nuclear, Solar, Biomass and Bio-gas. Hydrogen as an alternative source of Energy.

4 hrs

UNIT-III

Environmental Pollution and their effects. Water pollution, Land pollution. Noise pollution, Public Health aspects, Air Pollution, Solid waste management.3 hrs

Current Environmental Issues of Importance : Population Growth, Climate Change and Global warming- Effects, Urbanization, Automobile pollution.

3hrs

Acid Rain, Ozone Layer depletion, Animal Husbandry.

3 hrs

UNIT-IV

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

3 hrs

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

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

COMPUTER CONCEPTS AND PROGRAMMING IN C (CS-201/1861)

L T P
3 1 0

UNIT -I

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

UNIT -II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

Text Books:

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

COMPUTER PROGRAMMING LAB (CS- 251/10870)

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Suggested Assignments to be conducted on a 3-hour slot. It will be conducted in tandem with the theory course so the topics for problems given in the lab are already initiated in the theory class. The topics taught in the theory course should be appropriately be sequenced for synchronization with the laboratory. A sample sequence of topics and lab classes for the topic are given below:

1. Familiarization of a computer and the environment and execution of sample programs
2. Expression evaluation
3. Conditionals and branching
4. Iteration
5. Functions
6. Recursion
7. Arrays
8. Structures
9. Linked lists
10. Data structures

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

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

Text Books:
1. YashwantKanetkar, "Lee us C".
2. "ANSI C" by Balagurusamy.
3. Herbert Schildt, "C: The complete reference", OsbourneMcgraw Hill.
4. V. Raja Raman, " Computer Programming in V", Prentice Hall of India.

Reference Books :
1. Kernighan &Ritche, "C Programming Language", The (ASnsi C Version), PHI
2. J.B. Dixit, "Fundamentals of Computers and Programming in C".
3. P.K. Sinha and PritiSinha, "Computer Fundamentals", BPB Publication

ENGINEERING MECHANICS(ME- 201/1859)

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31 0

UNIT- I

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

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

UNIT- II

Beam: Introduction, Shear force and Bending Moment, Differential Equations forEquilibrium, Shear force and Bending Moment Diagrams for Statically Determinate Beams. **Trusses:** Introduction, Simple Truss and Solution of Simple truss, Method f Joints andMethod of Sections.

UNIT- III

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

UNIT- IV

Kinematics of Rigid Body: Introduction, Plane Motion of Rigid Body, Velocity andAcceleration under Translation and Rotational Motion, Relative Velocity.
Kinetics of Rigid Body: Introduction, Force, Mass and Acceleration, Work and Energy, Impulse and Momentum, D'Alembert's Principles and Dynamic Equilibrium.

UNIT V

Simple Stress and Strain: Introduction, Normal and Shear stresses, Stress- Strain

Diagrams for ductile and brittle material, Elastic Constants, One Dimensional Loading of members of varying cross-sections, Strain energy.

Pure Bending of Beams: Introduction, Simple Bending Theory, Stress in beams of differentcross sections.

Torsion: Introduction, Torsion of shafts of circular section, torque and twist, shear stressdue to torque.

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

ENGINEERING MECHANICS LAB(ME- 251/10868)

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

(Any ten experiments from the above list or institute may suitably design experiments)

PROFESSIONAL COMMUNICATION (HU-201/1863)

L T P
3 1 0

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

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

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

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

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

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

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

PROFESSIONL COMMUNICATION LABORATORY (HU-251/10874)

L T P
0 0 2

Interactive and Communicative Practical with emphasis on Oral Presentation/Spoken Communication based on International Phonetic Alphabets (I.P.A.)

LIST OF PRACTICALS

1. Group Discussion: Practical based on Accurate and Current Grammatical Paterns.
2. Conversational Skills for Interviews under suitable Professional Communication Lab conditions with emphasis on Kinesics.
3. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistic's/Kinesics.
4. Presentation Skills for Technical Paper/Project Reports/ Professional Reports based on proper Stress and Intonation Mechanics.
5. Official/Public Speaking based on suitable Rhythmic Patterns.
6. Theme- Presentation/ Key-Note Presentation based on correct argumentation methodologies.
7. Individual Speech Delivery/Conferences with skills to defend Interjections/Quizzes.
8. Argumentative Skills/Role Play Presentation with Stress and Intonation.
9. Comprehension Skills based on Reading and Listening Practicals on a model Audio-Visual Usage.

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

COMPUTER AIDED ENGINEERING GRAPHICS (CE -251/10872)

L T P
0 1 3

1. Introduction to Computer Aided Sketching

Introduction, Drawing Instruments and their uses, BIS conventions, lettering Dimensioning and free hand practicing.

Computer screen, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools. Coordinate system and reference planes.Definitions of HP, VP, RPP & LPP.Creation of 2D/3D environment.Selection of drawing size and scale. Commands and creation of Lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line convention, material conventions and lettering. 2-Sheet

2. Orthographic Projections

Introduction, Definitions- Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes (No application problems). 2-Sheet

3. Orthographic Projections of Plane Surfaces

(First Angle Projection Only) Introduction, Definitions-projections of plane surfaces-triangle, square rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method only (No problems on punched plates and composite plates.) 1-Sheet

4. Projections of Solids (First Angle Projection Only)

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

5.   Sections and Development of Lateral Surfaces of Solids

Introduction, Section planes, Sections, section views, Sectional views, apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP. (No problems on section of solids) 1- Sheet Development of lateral surface of above solids, their frustums and truncations. (No problems on lateral surfaces of trays, Tetrahedrons spheres and transition pieces).

6. Isometric Projection (Using Isometric Scale Only)

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

Note: At least 3 drawing assignments must be on AUTOCAD.

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

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

III
SEMESTER

BIOCHEMISTRY (BT–301/ 2461)

L P T
3 1 0

Unit I:
Role of water in biological processes, General Structure and function of amino acids, carbohydrates, fats, 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 .

Unit III:
Catabolic and anabolic metabolism of carbohydrates (Photosynthesis, Glycolsis, 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/ 20466)

1. Estimation of carbohydrates.

2. Estimation of proteins.

3. Estimation of nucleic acids.

4. Isoelctric 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.

APPLIED MICROBIOLOGY(BT-302/2462)

L T P
3 1 0

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 literaturecontrol of microorganisms, strain development.

Unit III:
Effect of environment on cell growth, growth limitation by environmental factors. Microbial nutrition, common nutrient requirement, requirement for carbon, hydrogen and oxygen, culture media. Formulation of media, Nutritional types of microorganisms, uptake of nutrients by cell.

Unit IV:
Mechanism of gene transfer in bacteria, conjugation, Transformation and transduction, impact of microbial biotechnology.

Unit V:
Industrial scope of Microbiology, Fermentation, microorganisms as food amendments, Biofuels, Microarray, Biosensors.

Text Book and References:
1. Prescott Harley and Klevin; Microbiology 2nd Ed.
2. Rorer wiStainer 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, Macamillan Co.
7. Introduction to Microbiology by A.S.Rao,{Prentice Hell).
8. Microbes & Engineering Aspects- U.P. Guts, Chick ctal , 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/ 20467)

L T P
0 0 6

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, flagellaerstaining,cellwall 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/ 2464)

L P T
3 1 0

Unit I :

Data type, Classification and summarization of data, diagrams; Inographs, Measures of Central tendency : Arithmetic mean, Geometric Mean, Harmonic Mean, Merits & Demerits of A.M., G.M., & H.M. Median, Mode

Unit II:

Measures of Dispersion: Range, Mean deviation, Standard deviation, Variance, Coefficient of variance. Skewness,maethods of measuring skewness, Kurtosis , measure of Kurtosis..,

Unit III:

Introduction to probability,Addiation and Multiplication, laws of probability, Baye'sthcorcm , Binomial distribution, Poison distribution, Normal distribution, Application of these distribution.

Unit IV:

Correlation, Type of correlation, Method of determining Correlation: Scatter DiagramMethod, Karl Pearsons coefficient of corelation. Spearman's Rank coefficient of correlation, Regression analysis, Type of regression models, Curve of regression, Line of regression.

Unit V:

Sampling,Hypothesis tests, Chi Square tests and f-tests, Student-test,degree of freedom one way analysis of variant, ANOVA.Principles of experimental design .

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. SudarRao; An Introduction of Biostatistics : Prentice Half.
6. Zar J; Biostatistics ; Prentice Hali, Londan.

FLUID FLOW AND SOLID HANDLING (CH-301/ 2463)

L T P
3 1 0

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 branch equipments, Flow of solids through fluids, Classification and Sedimentation.

Unit III: Fluid Flow

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

Unit IV: Flow measurements

Orifice meter, Nozzle and Venturimeters, rotamater 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
4.Unit Operation of Chmicalenggi. byWarrenL. McCabe &julianC.Smith.
5.McGraw- Hall International Edition.

FLUID MECHANICS LAB (CH-351/ 20468)

L T P
0 0 3

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.

DATA STRUCTURE AND ALGORITHMS USING C (CS-306 / 2465)

L T P

3 1 0

Unit I: Introduction to data structure and Algorithms:

Performance : Analysis of Algorithm, Time Complexity, Big-oh notation, Elementary data organization data structure operation, organization data structure operations, Recurrences, Arrays, operations on arrays, representation of arrays in memory, single dimensional multidimensional arrays, Spare 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 tapcs Disk Storage, File organization and storage management .

Text Books and references:

1. Horowitz: andSahani." Fundamentals of Data Structures", Galgotia Publication.
2. Coreman, Rivest, Lisscrson, "Algorithms"; PHI Publication.
3. Weiss, " Data Structure & Algorithm Analysis in C". AddisionWesly.
4. Basse," Computer Algorithms: IntroductiollO Design & Analysis", AddisionWestley.,
5. Lipschutz "Data Structure" , Scahum Series,
6. Aho, ho, ocropr, Uttlman Data Structure & Algorithm, AddisionWeselyWcslcy

IV
SEMESTER

IMMUNOLOGY (BT-401/ 2466)

L T P
3 1 0

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 structer and function of MHC molecule, characteristics of T & B cell epitopes, policlinic 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 & IMMUNOBLLOTING.

Unit-IV:

Production and application of monoclonal & polyclonal antibiotics, production of antibiotics, factor affecting in the immunogenicity, aduvent , 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 –Murry ,5th edition
3. Lydyardetal, instantnotesImmology, viva publication.
4. Basic & clinical Immunology, 5th ed. D.P. sites, J.D. stobo.

IMMUNOLOGY LAB (BT-451/ 20471)

L T P
0 0 6

1. Staining of bacterial flagella antigen.

2. Different typesofantigen- antibody cross reaction.

3. Isolation ,purification and identification of immunoglobulin from goat blood.

4. Double diffusion techniques for identification of antigen-antibody samples

5. Immunoelectrophoresis techniques.

6. .ELISA

7. RIA

8. Immunoblotting using ELISA-dot or western blotting.

ENZYMOLOGY (BT-402/ 2467)

L T P
3 1 0

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_{maxs} kinetics of competitive, non-competitive and un-competitive inhabitation of enzymes, effect of pH temperature substrate concentration on enzyme kinetics, allosteric enzyme and their kinetics.

Unit III:

Introduction to industrial enzymes – Topoisomerases, chymotrypsia, glyceraldehydes, phosphate dehydrogenise, lysozye, 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. Biocatelysis: 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- Comprhensive Biotechnology, II & IV th Vol.

GENETICS AND MOLECULAR BIOLOGY(BT-403 / 2468)

L T P
3 1 0

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. friflelder
3. Albert B. BravDenisetals Molecular biology of the cell, latest ed.
4. Baltimore –molecular biology of the cell.
5. Advance Genetics by G S miglamnalosg publication house.
6. Principle of Genetics by B D Singh.

GENETICS AND MOLECULAR BIOLOGY LAB (BT-452/ 20472)

L T P
0 0 3

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

2. Estimation of RNA content by orcinoll method.

3. Determination of Tm 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.

BIOINFORMATICES I (BT-404/ 2469)

L T P
3 1 0

Unit 1:

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 side & single nucleotide polymorphisms, OMIM, Unigene etc. Data retrieval with ENTREZ, SRS and DBEGET, secondary databases (Pfam, PROSTTE, block, etc)

Unit III:

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

Unit IV:

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

Unit V:

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

Text books and references:

1. N. Mishra; Bioinformatices: concept and application pearson Education (In press)

2. ORelly; developing bioinformatices Computer Skill – 1st Indian – edition publication.

3. Anthony J.F. griffithsetal; an intro. to Genetics Analsis – 1st Ed.

4. Michaclstarkey and RamnathElaswarapu ;GenomicesProtocols,Humana press.

5. Stephen Misner& Stephen Krawetz; bio informatics – methods and protocols, Hur press.

BIOINFORMATICS- I LAB (BT-453/ 20473)

L T P
0 0 3

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/ 2470)

L T P
3 1 0

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, fine & their -pre applications. Introduction to unsteady state heat transfer.

Unit II:
Convection: Fundamental of Convection, basic concepts & definition Natural & fixed 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, films wise & drop wisecondensation, loading in condenser and basic calculation on condenses 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, viewfactors Kerchief's law, solar radiation, combined heat

Transfer coefficient by convention & radiation elementary principle, types of Evaporators, single & multiple effect evaporators, and their calculation, thermo co Compression.

Text books & references:

1. Heat transfer McGraw hill. By Holman J.P.;
2. Heat transmission McGraw hill. By Mc-adums W. H. ;
3. Process heat transfer McGraw hill By Kern D. Q. ;
4. Introduction to Chemical engineering. TMH By Bedyer W.L. & J. T. Banchero ;
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 TECNIQUES (BT-501/ 3461)

L T P
3 1 0

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 immunoprecipitets, 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) NME, 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, sequenator, peptide synthesizer and nucleic acid synthesizer, Theory of lyophillyzation 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. Principal 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 MaleolmBuckld.
4. Practical biochemistry: by Keith Wilson &Jone walker.

BIOPROCESS ENGGINEERING-I (BT-502/ 3462)

L T P
3 1 0

Unit -I:

Methods of inoculation and medium preparation, media design and optimization.Microbial batch 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 v/s plate filters. Efficiency and application of air 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 pallet formation.

Unit -IV:

Concepts of material and energy balance. Dissolved oxygen in liquids.Surface and natural aeration, Bubble aeration.Oxygen transfer resistances.Measurement of K_{La}-oxygen, and transfer in large vessels.

Unit -V:

Agitation and mixing: mechanically & Non mechanically agitated systems, Mixing VsK_{La} , Power consumption and operating variables, medium rheology, Agitator for Newtonian and Non-Newtonian fluids.

Text book of References:

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

BIOPROCESS ENGGINEERING-I Lab (BT-552/ 20466)

L T P
0 0 6

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 flake conditions.

10. Growth kinetics studies of yeast in a beench top lab fermenter under controlled conditions.

11. Determination of volumetric oxygen transfer coefficient KLa, effect of aeration and agitation speed.

12. Preparation of immobilized enzymes & cell and evaluation of kinetic parameters.

INDUSTRIAL ECONIMICES AND PRINCIPAL
OF
MANAGEMENT (HU-501/ 3463)

L T P
3 1 0

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 Theorey/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 Theorey/ Oxford Publishing House Pvt.Ltd

DESIGN & ANALYSIS OF ALGORITHMS (CS-506/ 3465)

L T P
3 1 0

Unit-I

Introduction: Algorithms, analysis of algorithms, Growth of functions, Masters theorem, Designing ofalgorithms, sorting and order statistics, Heap sort, quick sort, sorting in Linear tune, 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. Coreman, Rivest, Lisserson: Algorithm, PHI.
2. Base, Computer algorithms: Introduction to Design & analysis. Addision Wesley.
3. Horowitz &Sahani. Fundamental of Computer Algorithm. Galgotia.

DESIGN & ANALYSIS OF ALGORITHMS LAB (CS-551/ 30467)

L T P
0 0 6

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/ 3464)

L T P
3 1 0

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 vaporgas mixtures.

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

Unit-III:
Distillation: Entrainment, pressure drops, flooding, transfer coefficient &relative volatility, McCabethieleandPonchon method for binary component distillation of azoetrope's, flash vaporization & multicomponent distillation.
Unit-IV:
Liquid Extraction: counter current ,co-current operation in single stage & multistage soluvent 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 Chmicalenggi. byWarrenL. McCabe &julianC. Smith. McGraw- Hall International Edition.

VI SEMESTER

BIOINFORMATICS -II (BT-601/ 3466)

L T P
3 1 0

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 focous 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/ 30471)

L T P
0 0 6

1. Insilico gene identification/ Characterization in prokaryotic organism using suitable annotation tools.

2. Secondary structure determination of protein molecules using various tools.

3. Comparetive assessment of best available tools for gene annotation.

4. Development of gene finding program using statical significance and C++/C/perl etc.

5. Establishment of method for gene and protein phylogeny by taking specific example.

PLANT BIOTECNOLOGY (BT-602/ 3467)

L T P
3 1 0

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 corps; 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 foresty.

Unit-IV:

Introduction to plant genetic engineering: methodology; plant transformation with Ti plasmid of Agrobacterium tumifacians, 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, proviamin 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 &practicesin 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, Ashwanikumarshikharohy, 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/ 3468)

L T P
3 1 0

Unit-I:

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

Unit-II:

Raw material availability, quality processes and 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 woth 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. Prescoott& 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/ 30472)

L T P
0 0 6

1. Study of induction effect of galactosidase enzyme in *E.coli.*

2. Fermentation of ethyl alcohol using *Candida albicans*.

3. Fermentation of cetric acid usinf*Aspergillusniger.*

4. Creation of auxotropic 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 Penicilliumcrysogenum to produce penicillin.

GENETIC ENGINEERING (BT-604/ 3469)

L T P
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Unit-I:

Gene cloning: concepts and basic steps ,application of bacteria and viruses in genetic molecular biology of Ecoli and bacteriophases 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 assy and protein activity, Marker genes:selectable markers and screenabal marker marker and non antibiotic markers gene expiration in prokaryotes: tissue specific promoter, wound inducible promoters, translation expression vector; DNA interigation into bacterial genome; lncreasing secretion; metabolic load, recombint protein production in yest: Sacchromycescerevasiae expression systems; mammalian cell expression

Vectors.

Unit-IV:

Origins of organismal cloning in development biology research on frong; nuclear transfer procedures and cloning of sheep (Dolly) &oter 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; transposson 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 Nothern 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. Schaumm' sMoleculer&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/ 30473)

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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/ 3470)

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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, definastion 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.

Refrences:

1. Gavhane, K.A.,Mass Transfer-II,Nirali Publication.
2. Mass Transfer Operation by Robert E Treybal.
3. Unit Operation of Chmicalenggi. ByWarrenL. McCabe &JulianC. Smith. McGraw- Hall International Edition.

VII SEMESTER

CHEMICAL REACTION ENGINEERING (CH-701/4462)

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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 loke 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 catalytics reactions, principles, absorption isotherms, kinetics of solid catalysed fluid reactions, rate- contolling steps. Use of computers in designing, modelling, optimization and simulation of chemical process.

Refrences:
1. P.M.Doran,BioprocessEngg. 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/ 4463)

L T P
3 1 0

Unit I:

Concepts of the environments : Ecosystem, Factors of environmental degradation. Pollutants and their types: nature and source. Different biogeochemical cycles including nitrogen, carbon, hydrogen, oxygen etc.

Unit II:

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

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.Biological treatment of solid wastes.

Unit IV:

Characteristics of wastewater; aerobic and anaerobic waste treatment processes. Process design, Single stage and two stage anaerobic digestion. Methanogensis- Methanogensis& Fermentative bacteria.Technical process & conditions. Kinetic models for biological waste treatment –Bioconversions of agricultural and other highly organic waste materials into gainfully utilizable products- Biogas, Biohydrogen, Cellulases, food and feed stocks, Vermiculture technology

Unit V:

Down stream processing in biological treatment process: Effluent disposal and reuse. Biofilteration for waste gas treatment, purification of biogas, Containment of biological treatment processes, 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& Eddy- Waste water treatment.
3. Ted Munn encyclopedia of Global Environmental Change Five volume set, Wily Publication.(Free.www.wily.co.uk/egee.)

ENVIRONMENTAL BIOTECHNOLOGY LAB (BT-751 / 40466)

L T P
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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/ 4464)

L T P
3 1 0

Unit-I
Basic labotatory 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/ 4465)

L T P
3 1 0

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 proteasesand 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,FoodMicrobiology,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

Nano Biotechnology (OE-03 /4461)

L T P
3 1 0

Unit 1
Introduction to Nano Biotechnology & Nano Technology, History of Nano Biotechnology, Cell-Nano StructureInteraction

Unit 2
Protein based nano structures, micro contact printing of proteins, micro contact printing polypeptide,polyhydroxyalkanoates in nanobiotechnology :Proetin – 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 formechanics 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 Publication

MINI PROJECT (BT- 754/40469)

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0 0 3

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 / plant /animal origin, comprehend it and prepare a report for assessment

INDUSTRIAL / ORGANIZATIONAL TRAINING (BT- 753/ 40468)

L T P
0 0 3

The student will be require to undertake training in the Biotech industry / organization 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 / her studies in final year B.Tech.(VII semester)

VIII
SEMESTER

BIOPROCESS ENGINEERING-II (BT-801/ 4466)

L T P
3 1 0

Unit-I
Microbial growth in closed, semi-open and open cultivation systems, Turbiodostat, chemostat with feedback of biomass.

Unit-II

Death of cells in growing culture, death rate, production of dead cells at the time of division, effect of cell death on growth .Conditions affecting metabolic fates of carbon and energy substrates.

Unit-III
Mass transfer in different reaction systems.Material and energy balancein steady and unsteady reaction systems.Oxygen demand and supply. Effect of oxygen on microbial culture..

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

Unit-V
Instrumentation for environmental control of fermentation system, physical environment sensors, chemical environment sensors, Direct and indirect control. PID controllers, fuzzy logic based controllers and artificial neural network based controllers. Bioprocess economics

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 ChemicalEngg. Series, MCH Int. Series.

BIOSEPARATION AND DOWNSTREAM PROCESSING (BT-802/ 4467)

L T P
3 1 0

Unit I:

Introduction; An overview of Bioseperation, 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. Reveres 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, ulterafilteration. 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., pergan 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/ 4468)

L T P
3 1 0

Unit-I
Jurisprudential definition and concept of property, rights, dities 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
Biosaftey and Bioethical issues in Biotechnology.

Reference Books:
1. Patent stategy for researches & research manegers- Knight, Wily publication.

Elective-IV

INDUSTRIAL BIOTECHNOLOGY (BT-804/ 4469)

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3 1 0

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 thuringienesis,* Single cell protein (SCP) and Bakers yeast.

Unit-III
Fermentative product of antibiotics: penicillin, streptomycin, tetracycline and cephalosporin. Production of vitamins like Vitamin B_{12}, 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, bioplymers 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- CherinSiroff Lancaster
5. Prescott and Donn, Industrial microbiology.

PROJECT (BT- 851/ 40471)

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

LIST OF ELECTIVE PAPERS

Elective-I

- Animal Tissue Culture

- Economics of Biotechnology

- Agriculture Biotechnology

- Environment& Ecology

Elective- II

- Pharmaceutical Biotechnology

- Plant Tissue Culture

- Food Biotechnology

- Immunodiagnostics

Elective- III

- IPR, Biosaftey& Bioethics

- Metabolic Engg.

- Immunoinformatics

- Enzyme & Protein Engg.

Elective- IV

- Pharmacoinformatics

- Medical Biotechnology

- Biomedical Instrumentation

- Industrial Biotechnology