

**COURSE STRUCTURE
AND
DETAILED SYLLABUS
for
B.Tech Four Year Degree Course
in
BIOTECHNOLOGY
(BT)**

(Applicable for the batches admitted from 2015-2016)



SREENIDHI INSTITUTE OF SCIENCE & TECHNOLOGY
(An Autonomous Institution approved by UGC and affiliated to JNTUH)
Yamnampet, Ghatkesar, R.R.District-501 301.

B. TECH - BIOTECHNOLOGY**I YEAR I SEMESTER COURSE STRUCTURE**

S. No	Subject Code	Subject	L	T	P/D	C	Max Marks	
							Int	Ext
1	5H101	English-I	2	-	-	2	25	75
2	5H112	Fundamentals of Mathematics	3	1	-	3	25	75
	5G101	or Fundamentals of Biology						
3	5H121	Engineering Physics – I	3	1	-	3	25	75
4	5H131	Engineering Chemistry	2	1	-	2	25	75
5	5F101	Computer Programming	3	1	-	3	25	75
6	5B101	Engineering Drawing - I	1	1	4	3	25	75
7	5H171	English Language Communication skills Lab	-	-	2	1	25	75
8	5H181	Engineering Physics Lab-I	-	-	2/2	1	25	75
9	5H186	Engineering Chemistry Lab	-	-	2/2	1	25	75
10	5F171	Computer Programming Lab	-	-	3	2	25	75
11	5B171	Engineering Workshop-I	-	-	2/2	1	25	75
12	5F172	IT Workshop - I	-	-	2/2	1	25	75
13	5G191	Seminar on Current Affairs/Technical Topic	-	-	2	1	100	-
Total			14	5	15	24	400	900

B. TECH - BIOTECHNOLOGY
I YEAR II SEMESTER COURSE STRUCTURE

S. No	Subject Codes	Subject	L	T	P/D	C	Max Marks	
							Int	Ext
1	5H202	English - II	2	2	-	2	25	75
2	5H213	Engineering Mathematics – II	3	1	-	3	25	75
3	5AC41	Elements of Electrical Engineering	3	1	-	3	25	75
4	5E201	Data Structures and C++	3	1	-	3	25	75
5	5B202	Engineering Drawing – II	1	1	2	2	25	75
6	5H232	Environmental Chemistry and Ecology	2	1	-	2	25	75
7	5BC04	Elements of Mechanical Engineering	3	1	-	3	25	75
8	5H233	Ethics, Morals , Gender Sensitization and Yoga	1	1	-	1	25	75
9	5E271	Data structure and C++Lab	-	-	3	2	25	75
10	5AC91	Electrical Engineering Lab	-	-	3/2	1	25	75
11	5F273	IT Workshop – II	-	-	2/2	1	25	75
12	5G292	Seminar on Science and its impact	-	-	2	1	100	-
Total			18	9	11	24	375	825

B. TECH - BIOTECHNOLOGY
II YEAR I SEMESTER COURSE STRUCTURE

S. No	Subject code	Subject	L	T	P/D	C	Max Marks	
							Int	Ext
1	5G302	Biochemistry	3	1	-	3	25	75
2	5G303	Microbiology	3	1	-	3	25	75
3	5G304	Cell Biology	3	1	-	3	25	75
4	5G305	Process Engineering Calculations	3	2	-	2	25	75
5	5C347	Elements of Electronics Engineering	3	1	-	3	25	75
6	5H316	Mathematics for Biotechnology	3	1	-	3	25	75
7	5H373	Functional Communicative Written English (FCWE)	1	2	-	1	25	75
8	5G371	Biochemistry Lab	-	-	3	2	25	75
9	5G372	Microbiology and Cell Biology Lab	-	-	3	2	25	75
10	5C381	Electronics Engineering Lab	-	-	3/2	1	25	75
11	5G393	Seminar on Technology and its impact	-	-	2	1	100	-
Total			19	9	10	24	350	750

B. TECH - BIOTECHNOLOGY**II YEAR II SEMESTER COURSE STRUCTURE**

S. No	Subject Code	Subject	L	T	P/D	C	Max Marks	
							Int	Ext
1	5G406	Genetics	3	1	-	3	25	75
2	5G407	Molecular Biology	3	1	-	3	25	75
3	5G408	Analytical Techniques in Biotechnology	3	1	-	2	25	75
4	5G409	Thermodynamics for Biotechnologists	3	1	-	3	25	75
5	5G410	Bioprocess Engineering	3	2	-	3	25	75
6	5H416	Probability and Statistics	3	1	-	3	25	75
7	5H474	Effective English Communication (EEC)	-	1	2	1	25	75
8	5G473	Analytical Techniques in Biotechnology Lab	-	-	3	2	25	75
9	5G474	Bioprocess Engineering Lab	-	-	3	2	25	75
10	5G475	Comprehensive Viva-voce - I	-	-	-	1	25	75
11.	5G494	Technical Seminar	-	-	2	1	100	-
Total			18	8	10	24	350	750

B. TECH - BIOTECHNOLOGY**III YEAR I SEMESTER COURSE STRUCTURE**

S. No	Subject Code	Subject	L	T	P/D	C	Max Marks	
							Int	Ext
1	5ZC01	Managerial Economics and Financial Analysis	2	1	-	2	25	75
2	5G511	Genetic Engineering	3	1	-	3	25	75
3	5G512	Bioinformatics	3	1	-	3	25	75
4	5G513	Mass Transfer and Separations	3	2	-	4	25	75
5		Professional Elective-I	3	1	-	3	25	75
6		Open Elective – I	2	1	-	2	25	75
7	5HC75	Quantitative Aptitude	-	-	2	1	25	75
8	5G576	Bioinformatics Lab	-	-	4	2	25	75
9	5G577	Genetics, Molecular Biology and Genetic Engineering Lab	-	-	4	2	25	75
10	5G578	Group Project	-	-	2	1	25	75
11	5G595	Technical literature review and Seminar -I	-	-	2	1	100	-
Total			16	7	14	24	350	750

B. TECH - BIOTECHNOLOGY**III YEAR II SEMESTER COURSE STRUCTURE**

S. No	Subject code	Subject	L	T	P/D	C	Max Marks	
							Int	Ext
1	5G619	Plant Biotechnology	3	1	-	3	25	75
2	5G620	Immunology	3	1	-	3	25	75
3	5G621	Biochemical Reaction Engineering	3	2	-	4	25	75
4		Professional Elective-II	3	1	-	3	25	75
5		Open Elective – II	2	1	-	2	25	75
6		Open Elective-III	2	1	-	2	25	75
7	5HC77	Logical Reasoning	-	-	2	1	25	75
8	5G679	Plant Biotechnology Lab	-	-	4	2	25	75
9	5G680	Immunology lab	-	-	4	2	25	75
10	5G681	Comprehensive Viva Voce-II	-	-	-	1	50	50
11	5G696	Technology Review & Seminar II	-	-	2	1	100	-
Total			18	7	10	24	375	725

B. TECH - BIOTECHNOLOGY**IV YEAR I SEMESTER COURSE STRUCTURE**

S. No	Subject code	Subject	L	T	P/D	C	Max Marks	
							Int	Ext
1	5ZC02	Management Science	3	-	-	3	25	75
2	5G728	Downstream Processing	3	1	-	3	25	75
3	5G729	Animal Biotechnology	3	1	-	3	25	75
4	5G730	Momentum and Heat Transfer	3	2	-	3	25	75
5		Professional Elective-III	3	1	-	3	25	75
6		Professional Elective-IV	3	1	-	3	25	75
7	5G782	Downstream Processing Lab	-	-	4	2	25	75
8	5G783	Animal Biotechnology Lab	-	-	4	2	25	75
9	5G784	Project Phase - I	-	1	3	3	100	-
10	5G785	Industry Oriented Mini Project	-	-	-	2	25	75
11	5G797	Technology Review and Seminar -III	-	-	2	1	100	-
Total			18	7	13	28	425	675

IV YEAR II SEMESTER COURSE STRUCTURE

S. No	Subject Code	Subject	L	T	P/D	C	Max Marks	
							Int	Ext
1	5G840	Industrial biotechnology	3	-	-	3	25	75
2		Professional Elective - V	3	-	-	3	25	75
3	5G886	Project Phase - II	-	-	20	12	50	150
4	5G887	Comprehensive Viva-voce- III	-	-	-	1	50	50
5	5G888	Technology Review and Seminar -IV	-	-	2	1	100	-
Total			6	-	22	20	250	350

List of Open Electives

Subject code	Open Elective – I	Subject code	Open Elective – II	Subject code	Open Elective – III
5FC32	Data Base Systems (DBS)	5EC04	Fundamentals of Operating Systems	5FC17	Big Data Analytics
5EC26	SAP-I: SAP ABAP Workbench Fundamentals	5EC27	SAP-II: SAP ABAP Workbench Concepts	5ZC08	Enterprise Resource Planning
5ZC03	Banking Operations, Insurance and Risk Management	5ZC19	Entrepreneurship, project management and structure finance	5ZC08	Enterprise Resource Planning
5ZC20	Product and Services	5ZC06	General Management Entrepreneurship	5ZC08	Enterprise Resource Planning

List of Professional Electives

Professional Elective-I			
S. No.	Stream	Subject Code	Subject Name
1	Medical Biotechnology	5G514	Molecular Pathogenesis
2	Plant Biotechnology	5G515	Metabolic Engineering
3	Environmental Biotechnology	5G516	Environmental Biotechnology
4	Bioprocess Engineering	5G517	Instrumentation and Bioprocess control
5	Nanobiotechnology	5G518	Nanobiotechnology
Professional Elective-II			
1	Medical Biotechnology	5G622	Molecular Toxicology
2	Plant Biotechnology	5G623	Phytochemicals & Herbal medicine
3	Environmental Biotechnology	5G624	Green Manufacturing Technology
4	Bioprocess Engineering	5G625	Optimization and numerical methods in biotechnology
5	Nanobiotechnology	5G626	Biosensors and Bioelectronics
Professional Elective-III			
1	Medical Biotechnology	5G731	Applied Virology
2	Plant Biotechnology	5G732	Computational Biology
3	Environmental Biotechnology	5G733	Enzyme Engineering
4	Bioprocess Engineering	5G734	Advanced Bioprocess Control
5	Nanobiotechnology	5G735	Nanomaterials : synthesis and characterization
Professional Elective-IV			
1	Medical Biotechnology	5G736	Cancer Biology
2	Plant Biotechnology	5G737	Molecular Markers and crop Improvement
3	Environmental / genomics	5G738	Food Biotechnology
4	Bioprocess Engineering	5G739	Bioprocess economics and plant design
5	Nanobiotechnology	5G740	Nanotoxicology
Professional Elective-V			
1	Medical Biotechnology	5G841	Clinical Research & Regulatory Affairs
2	Plant Biotechnology	5G842	Biopharmaceutical technology
3	Environmental / Genomics	5G843	Bioethics, Biosafety and IPR
4	Bioprocess Engineering	5G844	Advanced Mass transfer separations
5	Nanobiotechnology	5G845	Tissue Engineering

SYLLABUS FOR B. TECH - BIOTECHNOLOGY

I Year I semester
(Common to all branches)

ENGLISH-I

a	b	c	d	e	f	g	h	i	j	k	l
						x					

Subject Code: 5H101

L	T	P/D	C
2	-	-	2

COURSE OBJECTIVES

To enable the students to

- Appraise their knowledge base
- Acquire basic sentence construction skill
- Know the aspects of Interpersonal Communication
- Know the features of spoken language
- Acquire the basic correspondence ability by using the medium of letters

UNIT I:

- Diagnostic Test
- Remedial Sessions (with special attention to below average performers)
- Assessing Students' Functional English Capacity
- Nuances of English Language Learning- Punctuation
- Training in entry level components of Functional English: Grammar and Vocabulary (Sentence structures, articles, prepositions etc)

UNIT II:

- Short Story – **A Devoted Son** by Anita Desai
- Vocabulary: Words often confused; Affixes; Synonyms, Antonyms, Phrasal Verbs
- Speaking: Review of Articles from Newspaper (Sports features, reviews etc)
- Sentence correction with concentration on the use of articles and prepositions

UNIT III:

- **Evolution of Indomitable Spirit in Youth** by A. P. J. Abdul Kalam
- Reading Strategies: Skimming and Scanning
- Newspaper Reading and Related Activities ((Sports features, reviews etc)
- Concord: Subject verb agreement

UNIT IV:

- Paragraph Writing
- Letter Writing: Official and Personal (Letters to the editor; Letters of complaint etc.)
- One word substitutes

UNIT V:

- **Swami Vivekananda's address:** World Parliament of Religions

- Listening with intent and other sub-skills of listening
- Sentence Correction with special emphasis on tenses

UNIT VI:

- **A Tea Party** by Ruth Prawar Jhabwala
- Oral Presentations
 - Overcoming Stage Frigh / Inhibitions / Practicing Presentations

PRESCRIBED TEXT

English for Professional Success – An Interactive Approach

(Compiled by the Faculty of English, Department of Science and Humanities, Sreenidhi Institute of Science and Technology)

SUGGESTED READING

- ***Essential English Grammar and Intermediate English Grammar*** by Raymond Murphy
- ***Skill Sutras*** by Jayashree Mohanraj
- ***Basic Communication Skills for Technology*** by Andrea J Rutherford
- ***Strengthen Your English*** by V R Narayanaswami
- ***Spoken English for You*** by G Radhakrishna Pillai
- ***Situational spoken English*** by T Venkat Rajaiah

UNIT-VI

Integration: Introduction, Integration of standard functions, Methods of integration- Method of substitution, Integration by parts, Definite Integrals. Applications of integration in finding areas of bounded regions.

TEXT BOOKS:

1. CBSE Mathematics for Class XI & XII, Dinesh Khattar and Anita Khattar, P H I Publications.
2. Engineering Mathematics, Srimanta Pal, OXFORD university press.
3. A Text Book of KREYSZIG's Engineering Mathematics, Dr. A. Ramakrishna Prasad, Wiley Publications.

REFERENCE BOOKS:

1. Differential Calculus, Shanti Narayan & P.K.Mittal, S.Chand Publications.
2. Integral Calculus, Shanti Narayan & P.K.Mittal, S.Chand Publications.

I Year I Semester

**SYLLABUS FOR B. TECH - BIOTECHNOLOGY
(5G101) FUNDAMENTALS OF BIOLOGY
(FOR MPC STUDENTS)**

a	b	c	d	e	f	g	h	i	j	k	l
X	X			X			X		X	X	

L T P/D C
3 1 -- 3

COURSE OUTCOMES

1. Ability to apply the knowledge of biology to evaluate the effects of bacteria, viruses and protozoan on human health.
2. Ability to distinguish major plant phyla and analyze algae, mosses, ferns, gymnosperms and angiosperms
3. Ability to distinguish the major animal phyla and evaluate the effects of protozoans and helminthes on human health.
4. Ability to understand the functional inter relationships of the structures of all the organ systems and analyse their functional inter-relationships .
5. Ability to demonstrate a substantive knowledge of other fields of biology and how they relate to biotechnology
6. Ability to evaluate the impact of biotechnology on society

UNIT I: Introduction to Biology: Origin of life, Diversity in biological systems, Kingdom systems of classification, General characters, brief account on ecology, morphology, nutrition, locomotion and reproduction, useful and harmful effects of Bacteria, Viruses, Algae, Fungi and Protozoans

UNIT II: Biology of Plants: Classification of Plant Kingdom, Concepts of Growth, Meristems, Development of different plant organs; Plant Growth Regulators; Economic Importance of Plants, Biology of Pests in relation to Rice, Cotton, Sugarcane and Groundnut, Photosynthesis – overview

UNIT III: Biology of Animals: Classification of Animal Kingdom, General Characters of Chordates and Non-chordates, Protozoan Parasites (*Plasmodium*, *Entamoeba histolytica*), Helminth parasites (*Taenia solium*, *Ascaris*)

UNIT IV: Human Biology I: Introduction to human body, Structure and function of Digestive, Respiratory, And Circulatory systems.

UNIT V: Human Biology II: Structure and function of Nervous, Endocrine, Excretory and Reproductive systems

UNIT VI: Developmental Biology: Gametogenesis, fertilization, gastrulation, Cleavage, organogenesis, sex determination, developmental gene regulation, and teratology.

TEXT BOOKS:

1. Introduction To Biology And Biotechnology by Vaidyanath K. , K. Patrap Reddy, BS publications, Second Edition
2. Basic Biotechnology, Second Edition, by Colin Ratledge and Bjorn Kristiansen, Cambridge University Press.

REFERENCES

1. Dr. C.C. Chatterjee, Human Physiology (11th Edition) Vol I and II, Medical Allied Agency, Kolkata, 1987.
2. H.G. Rehm and G. Reed, Biotechnology Volume I & 2

I Year I semester

SYLLABUS FOR B. TECH - BIOTECHNOLOGY
(Common to all branches)
ENGINEERING PHYSICS – I

a	b	c	d	e	f	g	h	i	j	k	l
x											

Subject Code: 5H121

L	T	P/D	C
3	1	-	3

Unit I

Principles of Quantum Mechanics: Waves and Particles, de Broglie Hypothesis, Matter waves, Davisson and Germer's Experiment, G.P. Thomson Experiment, Heisenberg's Uncertainty Principle, Schrodinger's Time Independent Wave Equation – Physical Significance of the Wave Function – Particle in One Dimensional Potential Box.

Unit II

Free electron theory of Metals: Classical free electron theory (Drude and Lorentz), drift velocity, Relaxation time, Collision time, mean free path, Mobility and conductivity. Success of classical free electron theory, Breakdown of free electron theory, the quantum free electron theory, Electrical Conductivity from quantum free electron theory of metals.

Unit III

Band Theory of Solids: Bloch Theorem, Kronig-Penny Model (Qualitative Treatment), E-K Curve, velocity of electron in periodic lattice, effective mass of an electron and its significance, Origin of Energy Band Formation in Solids, Classification of Materials into Conductors, Semi Conductors and Insulators.

Unit IV

Elements of Statistical mechanics: Phase space, Ensemble, Canonical, Micro canonical & grand canonical ensembles, Maxwell – Boltzmann Statistics, Bose – Einstein Statistics, and Fermi – Dirac Statistics, Fermi – Dirac distribution function – variation of F-D function with temperature, Density of states (Quantitative treatment).

Unit V**Physical Optics:**

Interference: Introduction, Superposition of waves, Young's double slit experiment, Interference in thin films due to reflection of light, Newton's rings. Applications: Calculation of Refractive Index of liquid, Thickness of glass plate.

Diffraction: Introduction, Plane diffraction grating (Qualitative), Theory of plane transmission grating, Resolving power of a grating-application; calculation of wavelength of spectral light by using grating.

Polarization: Polarized and Un-polarized light, double refraction, negative and positive crystals properties of O – ray and e – ray. Quarter Wave Plate and half Wave plate, Theory of Plane, Circularly and elliptically polarized light.

Unit VI

Magnetic Properties: Permeability, Field Intensity, Magnetic Induction, Magnetization, Magnetic Susceptibility, Origin of Magnetic Moment, Bohr Magneton. Hysteresis behavior of Ferro Magnetic materials based on Domain Theory or Weiss theory. Hard and Soft Magnetic Materials, Properties of

Anti-Ferro and Ferri Magnetic Materials and their applications, Super conductivity, effect of Magnetic Field, Critical current density, Meissner's effect, Type-I and Type-II superconductors, Introduction to BCS theory of Superconductivity, applications of super conductors.

Text Books:

1. P K Palanisamy, <http://www.amazon.com/Solid-State-Physics-Neil-Ashcroft/dp/0030839939> Engineering Physics, Sitech Publications
2. B.K.Pandey, Engineering Physics, Cengage Learning

Reference Books:

1. Charles Kittel, Introduction to Solid State Physics, John Wiley Publisher
2. Dr.M.N.Avadhanulu, Engineering Physics, S Chand
3. Sanjay D Jain, Engineering Physics, Universities Press
4. Neil W. Ashcroft, N. David Mermin, <http://www.amazon.com/Solid-State-Physics-Neil-Ashcroft/dp/0030839939>, Solid State Physics, Thomson Publisher,
5. Donald Allan McQuarrie, Statistical Mechanics, University Science Books Publisher, California
6. Sathya Prakash, Statistical Mechanics, Pragathi Prakashan Publisher
7. Quantum Mechanics by G. Aruldas
8. John L Powel, Quantum Mechanics, Narosa Publications
9. Ramamurti Shanker, Principles of quantum Mechanics, Springer Publication
10. M Chandrashekar and P Applla Naidu, Applied Physics, VGS Book Links
11. K. Vijaya Kumar, S Chandralingam, Modern Engineering Physics, S Chand Publisher

I Year I semester

**SYLLABUS FOR B. TECH - BIOTECHNOLOGY
(Common to all branches)
ENGINEERING CHEMISTRY**

a	b	c	d	e	f	g	h	i	j	k	l
x											

Subject Code: 5H131

L	T	P/D	C
2	1	-	2

Course Outcomes:

1. Describe Water quality issues (temporary and permanent) , Industrial Use and treatment of Water methods for consumption and other societal / engineering purposes.
2. Explain applications of Electro Ionics , feateatures , Kohlrausch's law and applications and properties of Electroducts with applications .
3. Describe Cell and batteries types and the application of batteries in Engineering applications
4. Explain concept of Corrosion, its Types and Factors affecting the rate of Corrosion.
5. Describe role and significance Cathodic protection using tinning and galvanizing, Al Cladding ,copper plating and electroless plating (Nickel plating and concepts of Organic coatings- Paints.
6. Explain Phase rule and properties of alloys, significance with its in Engineering applications.

UNIT - I WATER TECHNOLOGY

- (a) **Water quality Parameters**:-Hardness of water – types of hardness (temporary and permanent). Estimation of hardness of water by EDTA Method.
- (b) **Water for Industrial purpose**: Water for steam making, Boiler troubles-Carry over (priming &foaming).Boiler Corrosion, Scale and sludge, caustic embrittlement.
- (c) **Treatment of Water**: Internal Conditioning- Phosphate, Carbonate & Calgon conditioning. External Treatment: Lime- Soda, Zeolite, Ion-exchange process, Desalination-Reverse osmosis and electro dialysis. Methods of Treatment of Water for Domestic purpose-Sedimentation, Coagulation, Filtration, Disinfection-Chlorination, Ozonization. **Engineering applications: Methodology and working of mineral water plant for drinking purpose.**

UNIT - II ELECTRO CHEMISTRY

Electro Ionics:- Conductance – conductors (metallic and electrolytic) – Types of conductance – specific, Equivalent, molar conductance – Effect of dilution on conductance – Kohlrausch's law and its applications i) Determination of equivalent conductance for weak electrolytes ii) Degree of dissociation iii) Solubility of sparingly soluble salts.

Electroducts :- E M F of electrochemical cells – cell notation and cell reaction – electrode potential (oxidation and reduction) Nernst Equation and its applications. Types of electrodes (a) Gas electrode (H₂ electrode) (b) Metal ion electrode (Zn/Zn⁺²) (c) Redox electrode (Quinhyrode electrode) (d) Metal – Metal insoluble salt electrode(SCE) (e) Ion selective electrode. **Engineering Applications.**

UNIT - III ELECTRO CHEMICAL ENERGY SOURCES – BATTERIES

Cell and batteries – types of batteries

- (a) Primary batteries – Lechalanche cell (dry cell), Lithium cell
- (b) Secondary batteries(Accumulators) – Lead acid battery, Ni-Cd battery, , Lithium-ion battery
- (c) Fuel cells- H₂ – O₂ fuel cell

(d) Photovoltaic Cell- Solar Cell

Engineering applications – future water powered car, solar cells in domestic and automobiles.

UNIT - IV CORROSION AND ITS EFFECTS

Corrosion – Basic concepts – Mechanism of chemical, electrochemical Corrosion (absorption of O₂ and evaluation of H₂) – Pilling - Bed worth rule – Types of electrochemical Corrosion – Galvanic Corrosion – Pitting Corrosion – Concentration Cell Corrosion(**water line corrosion**) – Factors affecting the rate of Corrosion. **Engineering Applications**

UNIT – V PROTECTIVE COATINGS

Cathodic protection – sacrificial anode and impressed current cathode method. Surface preparation for metallic coatings like hot dipping (**tinning and galvanizing**) metal cladding (**Al Cladding**) electro plating (**copper plating**) and electroless plating (**Nickel plating**). Methodology and production of gold covering decorative articles.

Organic coatings- Paints

UNIT-VI PHASE RULE AND ALLOYS

Phase rule:- Introduction, definition of terms with examples, one components system – Water system, reduced phase rule – Two component systems- lead – silver system.

Alloys: - Introduction – Definition – properties of alloys – significance of alloying, functions and effect of alloying elements. **Engineering applications of ferrous alloys – Ni chrome and stainless steel, nonferrous alloys – brass and bronze**

TEXT BOOK:

1. Engineering Chemistry: by R.P.Mani & B.Ramadevi ,Cengage Publications (2014)
2. Engineering Chemistry: by Jain & Jain ,Dhanapathrai Publications (2015)

REFERENCE BOOKS:

1. Engineering Chemistry by prasanta rath Cengage publications(2015)
2. Text of Engineering Chemistry by S.S. Dara & Mukkanti, S. Chand & CO, New Delhi (2014)

SYLLABUS FOR B. TECH - BIOTECHNOLOGY**I Year I semester****(Common to all branches)****COMPUTER PROGRAMMING**

a	b	c	d	e	f	g	h	i	j	k	l
x	x										

Subject Code:5F101

L	T	P	C
3	1	-	3

COURSE OUTCOMES :

- 1 Explain basic fundamentals of Computer Systems, computing environments, Computer Languages – Machine Languages. Writing/ Drawing simple Algorithms and flowcharts.
- 2 Describe C language Programs, Structure of a C Program, Comments, the greeting program, identifiers, constants, variables, types, expressions and keywords.
- 3 Describe write programs using control structures such as Pre-test and post-test loops, while, do while, for, break and continue statements, comma expression. Write programs using functions. Write programs using recursion.
- 4 Write programs implementing application on arrays.
- 5 Write programs using Pointers and string handling functions.
- 6 Write programs using Enumerated, Structure, Union types and files.

UNIT I

Computer fundamentals – Computer Systems, Computer Hardware, Computer Software, Computer Environments – Personal Computing Environment, Time-sharing Environment, Client/Server Environment, Distributed Computing, Computer Languages – Machine Languages, Symbolic Languages, High-Level Languages, Creating and running programs – Writing and Editing, compiling, linking, and executing programs, System Development – SDLC (Pages 1 – 28 of Text Book 1).

Problem solving Techniques – Algorithms, pseudo code, flowcharts – Simple illustrations and domain problems like: Sum of digits of a number, Nature of quadratic equations, Income Tax Problem, Standard Deviation (Pages 1019 – 1032 of Text Book 1).

UNIT II

Introduction to the C language – Background, C Programs, Structure of a C Program, Comments, the greeting program, identifiers, constants, variables and keywords.

Types – void, integral, and floating-point types. Variables – declarations and initialization. Input / Output – Streams, Formatting input and output (Pages 29 – 76 of Text Book 1).

Expressions – Primary expressions, post-fix expressions, pre-fix expressions, unary expressions, binary expressions, Precedence and associativity, evaluating expressions, type conversions – implicit type conversion, explicit type conversion, statements – statement type, role of semicolon, statements and defined constants (Pages 94 – 134 of Text Book 1).

Decision control structures – Logical data and operators, Two-way selection – if else, nested if, dangling else, conditional expressions, Multi-way selection – switch statement, else-if (231 – 263 of Text Book 1).

UNIT III

Repetitive control structures – Pre-test and post-test loops – initialization and updation, event and counter controlled loops, while, do while, for, break and continue statements, comma expression (Pages 303 – 348 of Text Book 1).

Functions – User-defined functions - Function definition, arguments, return value, prototype, arguments and parameters, inner-function communication. Standard functions – Math functions, Random numbers. Scope – local global (Pages 149 – 199 of Text Book 1).

Parameter passing – Call by value and call by reference.

Recursive functions – Definition, examples, advantages and disadvantages (Pages 349 – 359 of Text Book 1).

Macros – Definition, examples, comparison with functions.

UNIT IV

Arrays – Definition and declaration, initialization, accessing elements of in arrays, storing values in arrays, inter-function communication – passing individual elements, passing the whole array, array applications, bubble sort, sequential search. Two dimensional and multidimensional arrays (Pages 459 – 487 and 493, 501 of Text Book 1).

UNIT V

Pointers – Introduction, pointer constants, pointer values, pointer variables, accessing variables through pointers, pointer declaration and definition, declaration versus redirection, initialization of pointer variables, pointer for inter function communication, pointer to pointers (Pages 557 – 577 of Text Book 1).

Arrays and pointers – Pointer arithmetic and arrays, Memory allocation functions – static and dynamic memory allocation, array of pointers (Pages 612 – 633 of Text Book 1).

Strings – Input and **Output** functions, string handling functions.

UNIT VI

Enumerated, Structure, and Union types – The type definition (typedef), enumerated types, Structure, Unions (Pages 745 – 786 of Text Book 1).

Files – File name, file information table, streams, text and binary streams, stream file processing, system created steams, Standard library I/O functions, file open and close, formatting I/O functions, character I/O functions, Binary I/O, Standard library functions (Pages 393 – 441, 821 – 840 of Text Book 1).

TEXT BOOKS:

1. Computer science, a structured programming approach using C, B.A. Forouzan and R.F. Gilberg, Third edition, Thomson.

REFERENCES:

1. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education.
2. Let us C by Yashwanth P. Kanetkar 8th edition BPB publications.
3. Computer programming for teens by Mary Farrell.

SYLLABUS FOR B. TECH - BIOTECHNOLOGY
I Year I semester
(Common to all branches)
ENGINEERING DRAWING – I

a	b	c	d	e	f	g	h	i	j	k	l
x											

L	T	P/D	C
1	1	4	3

Subject Code:5B101

COURSE OUTCOMES:

- 1 Construct polygons , perform scaling and draw curves for constructions
- 2 Describe **Projections or Views** .
- 3 Explain with examples **Projections of Planes with** regular Planes, traces, Oblique planes and Auxiliary plane
- 4 Explain **Projections of Solids using** Regular Solids, solids of revolution and Axis inclined to both planes.
- 5 Explain **Sections of Solids with** Prism, Cylinder, Pyramid, Cone and Auxiliary views.
- 6 **Draw Intersection of Similar and Dis-similar Solids using** Line, Cutting plane method , Intersection of Prism Vs Prism, Cylinders Vs Cylinder and Cylinder Vs Prism .

UNIT – I

Introduction to Engineering Drawing: Drawing Instruments and their uses, types of lines, use of pencils, Lettering, Rules of dimensioning.

Construction of polygons: Inscription and superscription of polygons given the diameter of circle.

Introduction To Scales (Theory Only): Scales Used In Engineering Practice and Concept Of Representative Fraction

Curves used in Engineering Practice and their Constructions:

Conic Sections including Rectangular Hyperbola - General method only.

UNIT – II

Drawing of Projections or Views (Orthographic Projection in First Angle Projection Only): Principles of Orthographic Projections – Conventions – First and Third Angle Projections, Projection of Points, Projection of Lines - inclined to both planes, True lengths, traces.

UNIT – III

Projections of Planes: Projections of regular Planes, traces, Oblique planes, Introduction to Auxiliary planes

UNIT –IV

Projections of Solids: Projections of Regular Solids – Regular Polyhedra, solids of revolution, Axis inclined to both planes.

UNIT –V

Sections of Solids: Sections and Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views

UNIT –VI

Intersection of Similar and Dis-similar Solids: Line method, Cutting plane method, Intersection of Prism Vs Prism, Cylinders Vs Cylinder (Under Similar category) and Cylinder Vs Prism (Under Dis-similar category)

TEXT BOOKS:

1. Engineering Drawing, N.D. Bhatt / Charotar publishers
2. Engineering Drawing, K.L.Narayana and Kannaiah / Sciotech publishers.

REFERENCES:

1. Engineering Drawing, K.Venugopal/G.Sreekanjana, New Age International Publishers.
2. Engineering Drawing, B.V.R.Gupta, M.Raja Roy/I.K.International Publishing House.

**Syllabus for B. Tech I Year I semester
(Common to all branches)
ENGLISH LANGUAGE COMMUNICATION SKILLS LAB**

a	b	c	d	e	f	g	h	i	j	k	l
						x					

Subject Code: 5H171

L	T	P/D	C
-	-	2	1

Course Outcomes:

- 1 Describe and use Phonetics and Speech Chain.
- 2 Describe and use Speech Sounds, Monophthongs and Diphthongs in conversations.
- 3 Apply and use Consonants , Consonant Sounds and apply Stress or accent in conversation.
- 4 Practice Situational Dialogues, Role Play and participate in 'Just A Minute' Sessions
- 5 Describe Objects/ Situations/People and practice Telephone Etiquette
- 6 Review of a story , film or a novel

Mastering Speaking:

1. Introduction to Phonetics
2. Speech Chain
3. Speech Mechanism
4. Speech Sounds
5. Monophthongs
6. Diphthongs
7. Consonants
8. Three-Term Labels of Consonant Sounds
 - a. Voice
 - b. Place of articulation
 - c. Manner of articulation
9. Stress or accent
10. Intonation

Communication Skills Activities:

1. Situational Dialogues / Role Play
2. Speaking Activity – Self Introduction
3. 'Just A Minute' Sessions (JAM)
4. Describing Objects/ Situations/People
5. Telephone Etiquette
6. Giving Directions
7. Review of a story/film/novel

**Syllabus for B. Tech I Year I semester
(Common to all branches)
ENGINEERING PHYSICS LAB-1**

a	b	c	d	e	f	g	h	i	j	k	l
x	x										

Subject Code:5H181

L T P/D C
- - 2/2 1

Course Outcomes :

- 1 Determine wave length of monochromatic source of light by using Newton's Rings and refractive index of a material prism by using spectrometer
- 2 Determine Dispersive power of a glass Prism and Cauchy's constant by using spectrometer
- 3 Experiment on R C Circuit and C R series for calculating resonance and Planck's constant.
- 4 Determine of magnetic induction flux density along the axis of a circular coil using Stewart & Gee's Experiment.

Introduction & Description of exercises, processes and procedures with PPT

1. Determination of wave length of monochromatic source of light by using Newton's Rings
2. Determination of refractive index of a material prism by using spectrometer
3. Determination of Dispersive power of a glass Prism by using spectrometer
4. Determination of wave length of spectral light by using Diffraction Grating
5. Determination of Cauchy's constant by using spectrometer
6. Determination of wavelength of a given laser Source of light by using diffraction grating
7. R C Circuit
8. L C R series and parallel resonance
9. Determination of Planck's constant
10. Stewart & Gee's Experiment (Determination of magnetic induction flux density along the axis of a circular coil).

Note: Any **SIX** of the above **TEN** Experiments are to be conducted.

**Syllabus for B. Tech I Year I semester
(Common to all branches)
ENGINEERING CHEMISTRY LABORATORY**

a	b	c	d	e	f	g	h	i	j	k	l
x	x										

Subject Code: 5H186

L T P/D C
- - 2/2 1

Course Outcomes:

1. Determine Hardness of a ground water sample and Prepare Thiokol rubber
2. Determine of Viscosity of a lubricant by Redwood Viscometer. Estimate of percentage of Copper in Brass alloy .
3. Estimate Calcium in Portland cement. Estimate percentage of Iron content in Ore sample using Colorimeter (KSCN)
4. Estimate rate of Corrosion of Aluminium in acidic and alkaline medium. Determine Mohr's salt by Potentiometric method
5. Determine Calorific value of Solid fuel by using Bomb Calorimeter. Experiment Green chemistry;Aldol condensation(not by Classic route)
6. Determine Flash point and fire point of a lubricant. Determine strength of Strong Acid using Strong Base (HCl vs NaOH) by Conductometric titrations

Introduction & Description of exercises, processes and procedures with PPT

The objective of the Laboratory practicals is to make the student to acquire the basic Knowledge used for engineering applications.

1. Determination of Hardness of a **ground water** sample.
2. Preparation of **Thiokol rubber**.
3. Determination of **Viscosity of a lubricant** by Redwood Viscometer..
4. Estimation of Copper in **Brass alloy** (HYPO)
5. Estimation of Calcium in **Portland cement**.
6. Estimation of Iron content in **Ore sample** using Colorimeter (KSCN)
7. Estimation of **rate of Corrosion of Aluminium** in acidic and alkaline medium.
8. Determination of **Mohr's salt** by **Potentiometric** method.
9. Determination of **Calorific value** of Solid fuel by using Bomb Calorimeter.
10. Experiment on Green chemistry;**Aldol condensation**(not by Classic route)
11. Determination of Flash point and fire point of a **lubricant**
12. Determination of strength of Strong Acid using Strong Base (**HCl vs NaOH**) by **Conductometric titrations**.

**Syllabus for B. Tech I Year I semester
(Common to all branches)
COMPUTER PROGRAMMING LAB**

a	b	c	d	e	f	g	h	i	j	k	l
x	x										

Code: 5F171

L	T	P/D	C
-	-	3	2

COURSE OUTCOMES:

- 1 Write algorithms and flowcharts to convert temperature Celsius to its equivalent Fahrenheit, calculate roots and Fibonacci series
- 2 Write programs using control statements while, do-while, and for loops and solve mathematical series summations.
- 3 Write programs in menu driven style .
- 4 Write programs implementing functions , recursion with return values for example Fibonacci , GCD, LCMD , pascal triangle, large and smallest in a set of numbers.
- 5 Write a program to implementing applications on arrays , matrices addition , multiplication and compute symmetric, lower triangular, upper triangular, diagonal, scalar, or unit of a matrix.
- 6 Write programs on complex numbers and structures with suitable examples such as student or employees information.

Introduction & Description of exercises, processes and procedures with PPT

1. Unit I (Cycle 1)

1. Write an algorithm for converting a given Celsius temperature to its equivalent Fahrenheit temperature and draw a flowchart.
2. Write an algorithm to find the largest of three given numbers and draw a flowchart.
3. Write an algorithm and draw a flowchart for finding the roots and nature of roots of a quadratic equation, given its coefficients.
4. Write an algorithm and flowchart for finding the first n Fibonacci numbers, give n.

2. Unit II (Cycle 2)

1. Write an algorithm, flowchart, and C program for:
2. Finding the area and circumference of a circle of given radius.
3. Finding the volume of a sphere of given radius.
4. Finding the lateral surface area of a right circular cone of given base radius and height.
5. Finding selling price of an item, given its cost price and profit percent.
6. Finding the interest on a given principal for a given period of time at a given rate of per year.
7. Write a C program to display all the sizes of data types in C.
8. Write a C program to display a given decimal integer into an equivalent octal number and hexadecimal number using %o and %x in printf function.

3. Unit II (Cycle 3)

1. Write a C program to find the roots and nature of the roots of a quadratic equation, given its coefficients.
2. Write a C program for finding the largest of three given numbers.
3. A salesman gets a commission of 5% on the sales he makes if his sales is below Rs.5000/- and a commission of 8% on the sales that exceeds Rs.5000/- together with Rs.250/-. Write an algorithm or a flowchart and develop C program for computing the commission of the salesman, given his sales.

4. Unit III (Cycle 4)

1. Write three C programs to print a multiplication table for a given number using while, do-while, and for loops.
2. Write a C program to compute the sum of:
3. $1+x+x^2+x^3+\dots+x^n$, given x and n.
4. $1! + 2! + 3! + \dots + n!$, given n.
5. $1 - x^2/2! + x^4/4! - x^6/6! + x^8/8! - x^{10}/10! + \dots$ to n terms where the n^{th} term becomes less than 0.0001.

5. Unit III (Cycle 5)

1. Write a C program in the menu driven style to perform the operations +, -, *, /, % between two given integers.
2. Write a C program to find the largest and the least of some numbers given by the user.
3. Write a C program to find the sum of the digits of a positive integer.

6. Unit III (Cycle 6)

1. Write C functions for the following:
 1. A function that takes an integer n as argument and returns 1 if it is a prime number and 0 otherwise.
 2. A function that takes a real number x and a positive integer n as arguments and returns x^n .
 3. A function that takes a positive integer n as an argument and returns the n^{th} Fibonacci number.
2. Using recursion write C functions for the following:
 1. Factorial of a non-negative integer n.
 2. Number of combinations of n things taken r at a time.
 3. Greatest Common Divisor of two integers.
 4. Least Common Multiple of two integers.

7. Unit III (Cycle 7)

1. Write a menu driven style program to compute the above functions (cycle 6) on the choice of the function given by the user.
2. Define macros for the following and use them to find sum of the squares of the minimum and maximum of two given numbers.
 1. Larger of two numbers.
 2. Smaller of two numbers.
 3. Sum of the squares of two numbers.
3. Write a program to generate Pascal's triangle.
4. Write a program to count the number of letters, words, and lines in a given text.

8. Unit IV (Cycle 8)

1. Write a program to store the numbers given by the user in an array, and then to find the mean, deviations of the given values from the mean, and variance.
2. Write a C program to initially store user given numbers in an array, display them and then to insert a given number at a given location and to delete a number at a given location.
3. Write a program to store user given numbers in an array and find the locations of minimum and maximum values in the array and swap them and display the resulting array.

9. Unit IV (Cycle 9)

1. Write a C program to implement the operations of matrices – addition, subtraction, multiplication.
2. Write a program to find whether a given matrix is symmetric, lower triangular, upper triangular, diagonal, scalar, or unit matrix.

10. Unit V (Cycle 10)

1. Write a function to swap two numbers.
2. Write a function to compute area and circumference of a circle, having area and circumference as pointer arguments and radius as an ordinary argument.

11. Unit VI (Cycle 11)

1. Define a structure for complex number. Write functions on complex numbers (addition, subtraction, absolute value, multiplication, division, complex conjugate) and implement them in a menu driven style.
2. Define a structure point. Write a program to find the distance between two points.
3. Define a structure student having members roll no., name, class, section, marks. Create an array of 10 students give the data and find the average marks, section-wise.

12. Unit VI (Cycle 12)

1. Write a program to:
 1. Create a file by the name given by the user or by command line argument and add the text given by the user to that file.
 2. Open the file created above and display the contents of the file.
 3. Copy a file into some other file, file names given by the user or by command line arguments.
 4. Append a user mentioned file to another file.
 5. Reverse the first n characters of a file.

**Syllabus for B. Tech I Year I semester
(Common to all branches)
ENGINEERING WORKSHOP – I**

a	b	c	d	e	f	g	h	i	j	k	l
x		x									

Subject Code:5B171

L T P/D C
- - 2/2 1

Course Outcomes :

- 1 Perform House wiring and install Tube light, connection of Calling Bell as per circuit diagram and connection of stair case as per circuit diagram .
- 2 Practice of disassembly and assembly of various home appliances such as Fans,Mixers,Air blower, Iron box and Rice cooker .
- 3 Perform Welding as and when needed i.e Lap Joint, Butt Joint and welding of T-Joint

Introduction & Description of Tools, processes and procedures of all trades with PPT

I) House wiring

- To connect the Tube light as per circuit diagram
- To connect the Calling Bell as per circuit diagram
- To connect stair case as per circuit diagram

II) Home Appliances

Practice of disassembly and assembly of various home appliances such as

- Fans
- Mixers
- Air blower
- Iron box
- Rice cooker

III) Welding

- Preparation and welding of Lap Joint
- Preparation and welding of Butt Joint
- Preparation and welding of T-Joint

**Syllabus for B. Tech I Year I semester
(Common to all branches)
IT WORKSHOP – I**

a	b	c	d	e	f	g	h	i	j	k	l
	x	x									

Code:5B172

L	T	P/D	C
-	-	2/2	1

Course Outcomes:

1. Identify peripherals of a computer, describe types of Operating System, Install computer with dual boot operating systems .
2. Assembling and Disassemble system.
3. Install and Use Microsoft Windows 7 for programming and application development .
4. Install linux and install applications in Linux and windows.
5. Trouble Software and hardware problems along with setting configurations for computer security settings and application software of the system.
6. Describe Cyber ethics.

Introduction & Description of exercises, processes and procedures with PPT

Week1:

Introduction to Computer: Identify the peripherals of a computer, components/peripherals in a CPU & its functions. Introduction to the types of Operating System, Install computer with dual boot operating system (Windows, Linux with PowerPoint presentation). Comparison of types of OS in different platform.

Week 2: Assembling and Disassembling Practicals

Week 3:

Introduction to Microsoft Windows 7: Software and data, Components of Desktop, Working with windows

Week 4:

Getting Started with Microsoft Windows 7: Using the Start Menu, Obtaining Help on Windows, Changing Setting, Using Applications in Windows, Shutting Down Windows

Week 5:

Introduction to Linux Operating system, Linux Commands, DOS commands

Week 6:

Install computer applications in Linux and windows.

Software and hardware trouble shoot, personal computer security settings and application software of the system.

Cyber Ethics: Access websites and email, effectively and securely browse (bank sites, https WebPages) and share the data, categories of websites (.com, .in, .edu, .org).

TEXT BOOK:

1. "Comdex Information Technology Course Kit" by Vikas Gupta, Dreamtech Press

**Syllabus for B. Tech I Year I semester
(Common to all branches)
Seminar on Current Affairs / Technical Topic**

a	b	c	d	e	f	g	h	i	j	k	l
						x	x				

Code:5G191

L T P/D C
- - 2 1

Course Outcomes :

1. Identify current general, political and technology related topics.
2. Arrange and present seminar in a effective manner.
3. Collect, survey and organize Content in presentable manner.
4. Demonstrate oratory skills.
5. Exhibit interview facing skills.
6. Demonstrate team leading qualities.

Procedure:

1. Seminar in-charges shall highlight the significance of Technical Seminar in the first two sessions and enlighten the students on the utility of these seminars.
2. The slots, titles shall be decided upfront and seminar In-charge shall take signatures from students.
3. The same sheet shall be affixed in the respective classrooms and seminar register.
4. If any student fails to present his/her seminar on the given slot, to genuine reasons, they may be asked to present in the subsequent slot / week.
5. Progress of the seminars needs to be reviewed by the concerned HOD once in 15 days.
6. The evaluation for Technical Seminars has to be informed to students and displayed in the classrooms.
7. Report and presentation must contain topic, introduction, explanation, diagrams, tables, applications and conclusions.

Distribution of Marks

Day to day progress of the work	15 marks
Final report and viva	15 marks
Level of content	20 marks
Presentation	20 marks
Discussion & Involvement	20 marks
Attendance	10 marks
Total	100 Marks

**Syllabus for B. Tech I Year II semester
ENGLISH-II
(Common to all Branches)**

a	b	c	d	e	f	g	h	i	j	k	l
						x					

Code: 5H202

L	T	P/D	C
2	2	-	2

COURSE OUTCOMES

Students able to

- **Acquire reasonable proficiency in Communicative English**
- **Take part in group activities like sharing information, narrating experience etc**
- **Attain language proficiency (with the help of training in study skills)**
- **Acquire advanced level ability in Functional English**
- **Understand the difference between Technical and General writing**
- **Develop the ability to prepare executive summary**

UNIT I:**A Short Story of an Indian Engineer** by Bhargav Prasanna

- Words and Phrases from the text
- Types of Sentences: Structure and function
- Note Making

UNIT II:**The Convocation Speech** by Narayana Murthy

- Phrasal Verbs from the text and additional material/handout
- Direct and Indirect Speech
- Information Transfer
- Speaking on Current Affairs / Latest Technology (Solo/team)

UNIT III:**One Thousand Dollars** by O'Henry

- Vocabulary: One word substitutes
- Creative Writing and Critical Appreciation
 - Essay writing: Types of Essays (with the use of authentic material – Newspaper)

UNIT IV:**Three Days to See** by Helen Keller

- Concept and elements of a biography, autobiography and memoir
- Types of Narration

UNIT V:

The Cyber Age (Polymer Bank Notes)

- Report Writing
 - Eg: Report on the Economic Status due to Credit or Debit Card
- Essay writing: Types of Essays (with the use of authentic material – Newspaper)
- Debating Skills
 - Eg: On Conventional Currency and Plastic Money

UNIT VI:

On Forgetting by Robert Lynd

- Vocabulary: Text based words / meanings
- Writing: Summarizing

Prescribed Text:

English for Professional Success – An Interactive Approach

(Compiled by the Faculty of English, Department of Science and Humanities, Sreenidhi Institute of Science and Technology)

Suggested Reading:

- ***Essential English Grammar and Intermediate English Grammar*** by Raymond Murphy.
- ***Skill Sutras*** by Jayashree Mohanraj
- ***Objective English-*** Edgar Thorpe And Showick Thorpe- Pea
- ***Test Your English Vocabulary In Use-*** Stuart Redman Ruth Gairns-Cambridge University

A	B	C	D	E	F	G	H	I	J	K	L
X											

I Year B.Tech II Semester
MATHEMATICS FOR BIOTECHNOLOGY –II
(For Bio-Technology)

Code: 5H214

L T P/D C
3 2 0 3

Course Outcomes:

Students will able to

1. Solve the problems of first order and first degree differential equations.
2. Solve higher order differential equations with constant coefficients.
3. Form partial differential equations and find the solution to first order linear and nonlinear partial differential equations.
4. Find the Fourier series of a function, Fourier transformations and their applications.
5. Solve the problems in evaluating Laplace transformation.
6. Solve problems in inverse Laplace transforms and learn its applications to solve ordinary differential equation with constant coefficients.

UNIT– I: First order Ordinary Different Equations: Differential equations of first order and first degree – Exact, Linear and Bernoulli's Equation.

Applications: Newton's Law of Cooling, Law of Natural Growth and Decay.

UNIT– II: Higher Order Differential Equations: Non-homogeneous linear differential equations of second and higher order with constant coefficients. Methods of variation of parameters.

Application: Bending of beams, Simple harmonic motion and LCR circuit.

UNIT– III: Introduction to Partial Differential Equations: Formation of Partial Differential Equations, Solutions to First order Linear and Non-linear Equations, Four Standard types.

UNIT-IV: Fourier series: Fourier coefficients, Fourier series to the functions of any period $p=2L$, Fourier series of even and odd functions, Half-range Expansions.

Applications: Fourier series to ordinary differential equations with boundary conditions.

UNIT–V: Laplace Transforms: Laplace transform of standard functions, shifting theorems, change of scale property, multiplication by powers of t , Division by t , Laplace transform of unit step function, Impulse function and periodic functions.

UNIT–VI: Inverse Laplace Transforms: Inverse Laplace transforms: properties, partial fraction method and convolution theorem (without proof).

Applications: Laplace transforms to solve ordinary differential equations with constant coefficients.

TEXT BOOKS:

1. Mathematical Methods of Science and Engineering, Kanti B.Datta, CENGAGE Learning.
2. Engineering Mathematics, Srimanta Pal, OXFORD University press.
3. Higher Engineering Mathematics, B.S. Grewal, Khanna Publications, New Delhi.
4. Engineering Mathematics, B. V. Ramana, Tata McGraw Hill Publishing Company Ltd.
5. Advanced Engineering Mathematics, Alan Jeffrey.

REFERENCE BOOKS:

1. A Text Book of KREYSZIG's Engineering Mathematics, Dr. A. Ramakrishna Prasad, Wiley Publications.
2. Advanced Engineering Mathematics, S. R. K. Iyengar and R.K. Jain, Narosa Publishing House, London, 2002.

I Year B.Tech. II Semester

Code: 5AC41

Elements of Electrical Engineering
(For Bio-Technology)

L T P/D C

3 1 0 3

a	b	c	d	e	f	g	h	i	j	k	l

Course Outcomes

After studying this course, the student will be able to

1. Understand the principles of electrical engineering.
2. Understand the principles of single and three phase AC circuits.
3. Understand the principle and operation of DC machine along with its applications.
4. Understand the principle and operation of single phase transformer along with its applications.
5. Understand the principle and operation of three phase induction motor with its applications.
6. Understand the principle and operation of different measuring instruments along with its applications.

Unit – I: Introduction to Electrical Engineering:

Ohm's Law, Basic circuit components, Kirchhoff's Laws. Types of sources, Source transformation, V- I relationship for passive elements. Series parallel circuits, Star - delta and delta - star transformations, mesh and nodal analysis. Network theorems – superposition, thevenin's theorem & maximum power transfer theorem, simple problems.

Unit – II: Fundamentals of Single phase and three phase AC circuits:

Principle of AC voltage, wave forms & basic definitions. R.M.S. and Average values of alternating currents and voltage, Form factor and Peak factor, Phasor representation of alternating quantities, the 'j' operator and phasor algebra, Analysis of ac circuits with single basic network elements, Single phase series circuits. Faraday's laws of electro-magnetic induction, concept of self and mutual inductances.

Unit – III: D.C Machines:

Principle of operation of D.C generators, Types of D.C generators, E.M.F equation, Principle of operation of D.C motors, Types of D.C motors, Torque equation, Losses and efficiency calculation in D.C Generators and D.C motors.

Unit – IV: Single Phase Transformers:

Principle of operation, Constructional Details, Ideal Transformer and Practical Transformer, equivalent circuit, Losses, OC and SC Test, Efficiency and Regulation Calculations, Elementary treatment & Simple problems.

Unit – V: Three phase circuits and induction motors:

Three phase circuits – phase sequence, Star and delta connection, Relation between line and phase voltages and currents in a balanced system.

Three phase induction motor: Principle of operation, Construction, Types, Problems on slip, rotor frequency, rotor emf and torque.

Unit – VI: Basic Instruments:

Introduction, classification of instruments, operating principles, essential features of measuring instruments, permanent magnet moving coil (PMMC) instruments, moving iron (MI) instruments, extension of ammeter and voltmeter ranges.

Text Books:

1. Basic electrical Engineering – M.S.Naidu and S.Kamakshiah – TataMcGraw-Hill,2005 edition
2. Basic Electrical Engineering –T.K.Nagesarkar and M.S.Sukhja Oxford University Press.2nd edition

References:

1. Theory and problems of Basic electrical Engineering- D.P.Kotahari & I.J.Nagrath PHI.
2. Principles of Electrical Engineering - V.K.Mehta, S.Chand Publications.2nd edition.

Syllabus for B. Tech I Year II semester
DATA STRUCTURES AND C++
(Common to all Branches)

a	b	c	d	e	f	g	h	i	j	k	l
	x		x					x			

Code: 5E201

L	T	P/D	C
3	1	-	3

Course Outcomes:

1. Explain Abstract data type, stack and Queues with their applications
2. Write programs on Singly linked lists, Doubly linked lists, Circular list and explain their operations.
3. Explain concepts of Trees, AVL Trees and Graphs with examples and applications.
4. Describe object oriented programming approach and its elements
5. Write and explain programs on searching , sorting and hashing operations.
6. Explain and apply concepts of oops , write programs implementing function and operator overloading. Writing programs with inheritance.

UNIT I

Introduction to data structures: Abstract data type (ADT), Stacks, Queues and Circular queues and their implementation with arrays.

Applications of Stack: infix to post fix conversion, postfix expression evaluation.

Applications of Queues

Objective:

On completion of the unit/chapter , a student should be able to: (i) Define what is an abstract data type (ii) Differentiate linear and non-linear data structures (iii) Representation and implementation of stack and queue using arrays. (iv) Convert the given infix expression to post fix notation and evaluate the postfix expression using stack. (v) Understand the applications of stack and queue.

UNIT II

Singly linked lists, Advantages of Linked lists over Arrays, Doubly linked lists, Circular list and their operations, representing stacks and queues with Linked lists.

Objective:

On completion of the unit/chapter a student should be able to:(i) Understand what is a linked list (ii) know how structurally the distinct categories of lists differ from each other (iii) implement various categories of lists such as singly linked lists, doubly linked lists and circular lists (iv) understand how to represent and implement stack and queue using linked list

UNIT III

Trees- Binary trees, terminology, representation, traversals.

AVL trees, AVL tree operations: Insertion, deletion and searching.

Graphs- terminology, representation, graph traversals (DFS & BFS).

Objective:

On completion of the unit/chapter a student should be able to:(i)understand the terminology and uses of trees and graphs(ii)explain distinct representations of trees as well the graphs(iii)analyze binary search tree(iv)construct binary search tree, given the elements and traverse the tree in pre-order, in-order and post-order(v)differentiate Depth First Search(DFS) and Breadth First Search (BFS) techniques and could traverse through the graph using DFS and/or BFS

UNIT IV

Searching - Linear and binary search methods.

Hashing-Hash table representation, Hash functions, Collision Resolution Techniques-Chaining, Linear probing, Quadratic probing, Double hashing.

Sorting - Bubble sort, Selection sort, Insertion sort, Quick sort, Merge sort. Performance analysis of Searching & Sorting Algorithms.

Objective:

On completion of the unit/chapter a student should be able to:(i)understand what is meant by searching and could differentiate linear search operation performed on an ordered set of elements and an unordered set of elements(ii)differentiate the linear search and binary search techniques (iii)explain the procedure involved in binary search method(iv)understand the necessity of sorting techniques(v)list and implement different types of sorting techniques(vi)know and compare the time complexity of each sorting technique.

UNIT V

Introduction to C++ programming-object oriented programming concepts, Structured Vs OOP.

Classes and objects-class definition, Objects, class scope and accessing members, Constructors-default constructor, parameterized constructor, copy constructor. Destructor.

Objective:

On completion of the unit/chapter a student should be able to:(i)differentiate structured programming approach and the object oriented programming approach(ii)understand the terms class, object and could write simple programs in C++ (iii)understand how to use access specifiers (iv)explain the differences between constructor and normal function

UNIT VI

Static class members, this pointer, friend functions, Dynamic memory management with operators new and delete. Overloading-function overloading, Operator overloading, restrictions on operator overloading, overloading unary and binary operators, templates, inheritance: single, multiple and multi level inheritance.

Objective:

On completion of the unit/chapter a student should be able to:(i)describe static class members(ii)make use of this pointer, friend function(iii)demonstrate the dynamic memory allocation and deallocation (iv)understand what is overloading and write programs on function overloading, operator overloading(v)understand and differentiate types of templates (vi)learn inheritance and its usage.

TEXT BOOKS:

1. Data Structures, A pseudocode Approach with C by Richard F. Gilberg & Behrouz A. Forouzan.
2. **Data Structure through C by Yashavant Kanetkar.**
3. The complete reference C++ By Herb Schildt.

REFERENCES:

1. Alfred V. Aho, Jeffrey D. Ullman, John E. Hopcroft. *Data Structures and Algorithms*. Addison Wesley, 1983.
2. Data Structures using c Aaron M.Tenenbaum , Yedidyah Langsam,Moshe J Augenstein.
3. Introduction to Data Structures In C By Kamtane

**Syllabus for B. Tech I Year II semester
Engineering Drawing – II
(Common to all branches)**

a	b	c	d	e	f	g	h	i	j	k	l
x		x									

Code: 5B202

L	T	P/D	C
1	1	2	2

Course Outcome

After completing the subject, students will be able:

- to draw the various types of scales for different applications and using various types of units.
- to understand the practical applications of development of various solids and draw their developments
- to understand the concept of three dimensional representations of simple and complex objects through isometric projection principle given their orthographic representation
- to convert pictorial (Isometric) views to orthographic views.
- to understand the applications and draw the perspective views of various drawing entities
- to understand the computer aided drafting technique and commands for generation of basic entities of drawing

UNIT – I

Scales: Construction of Plain, Diagonal, Comparative, Vernier Scales and Scale of chords.

UNIT – II

Development of Surfaces: Development of Surfaces of Right Regular Solids – Prisms, Cylinders, Pyramids, Cones and their parts.

UNIT – III

Isometric Projections/views: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines.

Conversion of Orthographic Views to Isometric Views of simple objects.

UNIT –IV

Transformation of Projections: Conversion of isometric views to orthographic views of simple objects.

UNIT –V

Perspective Projections: Principle, Perspective elements, Perspective View of Points, Lines, Plane Figures and Simple Solids - Vanishing Point Method, Visual ray method.

UNIT –VI

Introduction to Computer Aided Drafting: Generation of points, lines, curves, polygons, simple solids, dimensioning.

TEXT BOOKS:

1. Engineering Drawing, N.D. Bhatt / Charotar publishers
2. Engineering Drawing, K.L.Narayana and Kannaiah / Scietech publishers.

REFERENCES:

1. Engineering graphics with Auto CAD- R.B Choudary / Anuradha Publishes
2. Engineering Drawing, K.Venugopal/G.Sreekanjana, New Age International Publishers.
3. Engineering Drawing, Basanth Agarwal/CM Agarwal/ MG graw hill Education

**Syllabus for B. Tech I Year II semester
Environmental Chemistry and Ecology
(Common to all Branches)**

a	b	c	d	e	f	g	h	i	j	k	l
x						x					

Code: 5H232

L	T	P/D	C
2	1	-	2

Course Outcomes:

1. Describe air pollution, control, global warming and elements of Environmental Technology. Discuss about Sea water equilibrium.
2. Describe Ecosystem, Bio Diversity, threat to bio diversity and Conservation strategies such as Insitu and Exsitu conservation.
3. Explain concepts, classification and problems relating to natural resources. Describe environmental effects of extracting and using mineral resources.
4. Explain Concept of sustainable development, Strategies for sustainable development. Describe Green Technology and its applications. Explain Toxicology and Biochemical effects of As, Cd, Pb, Hg, CO, NO₂, SO₂, CN⁻, O₃, PAN and Pesticides.
5. Describe elements, features, classification and applications of polymers, Plastics, rubber and conducting polymers. Explain need for Environmental protection from Pollution.
6. Describe classification, features, usage and application of solid, liquid, gaseous Fuel. And Engineering applications of fuels Influence of Fuels on Environment.

UNIT-I POLLUTION CONTROL AND ENVIRONMENTAL TECHNOLOGY

Atmosphere- Introduction –Atmospheric structure- **Air pollution**: causes, effects and Control measures, Case study: Bhopal disaster, Chernobyl disaster, acid rains, green house effect, ozone layer depletion, Global warming, ChloroFlouro carbons(CFC)Photochemical smog.
Hydroshere - Sea water equilibrium.

Water Pollution- use and over-exploitation, floods, drought, dams- benefits and problems, Rain water conservation, Marine Pollution, Micro organisms-The catalyst of Aquatic chemical reaction. Lithosphere- Inorganic & organic components in soil, Nitrogen pathways & NPK in soil.

Soil pollution- soil erosion and desertification, Disaster management : floods, earthquake, cyclone and landslides. Solid Waste Management- Effects of solid waste, Control measures of Urban and Industrial waste.

UNIT - II ECOSYSTEMS and BIO DIVERSITY

Environmental studies, definition and scope, **Ecosystem** - concept, Structure and Function, Ecological succession, Classification (Forest and aquatic Ecosystems), Biodiversity –Definition and types, Value of bio diversity, Hot spots, Threats to bio diversity, Conservation strategies: Insitu and Exsitu conservation.

UNIT- III NATURAL RESOURCES

Definition, classification, **Forest resources**-use and over-exploitation, deforestation, Forest Conservation Act, **Energy resources**-energy demand, renewable and non-renewable energy resources, alternate energy resources, Case studies. **Food Resources**-World Food problems, effects of modern agriculture, fertilizer-pesticide problems, **Mineral resources**: Use and exploitation environmental effects of extracting and using mineral resources.

UNIT –IV SUSTAINABLE CHEMISTRY AND GREEN TECHNOLOGY

Concept of sustainable development, Strategies for sustainable development- Wasteland reclamation, - Environmental management, **Green Technology** - Introduction, Concepts, Principles of green chemistry, development of green chemistry.

Engineering Applications- Manufacture of polylactic acid for plastic production,

Production of biodegradable polymer (poly hydroxyl alkananoates (PHA)).

Toxicology-Impact of toxic chemicals on Enzymes, **Biochemical effects** of As, Cd, Pb, Hg, CO, NO₂, SO₂, CN⁻, O₃, PAN and Pesticides.

UNIT - V POLYMER TECHNOLOGY

Polymer, polymerization - Types of Polymerization.

Plastics – thermosetting and thermoplastics, preparation, properties and Engineering applications of the following: PVC, Teflon, Bakelite, Nylon 6,6 and epoxy resins.

Rubber – natural and artificial rubber, vulcanization of natural rubber, Buna-S, Buna-N and their

Engineering applications. Fibers-Natural and Synthetic (Polyamides & Polyesters)

conducting polymers- classification, preparation of polyacetylene, polyaniline and their **Engineering applications. Effects of polymers on Environmental Pollution.**

UNIT - VI FUEL TECHNOLOGY

Classification of Fuels- Solid, Liquid & gaseous fuels. Characteristics of good fuel, calorific value (HCV&LCV). Determination of calorific value by Bomb calorimeter.

Solid Fuels:- Coal and its chemical composition, Analysis of Coal and their importance.

Liquid fuels:-Source –Petroleum-refining of petroleum- Production of petrol by Bergius process.- (the production of synthetic petrol). **Biodiesel** – Blends, Properties, Applications and Usage in Automobiles, Railways and Aircrafts. Advantages & disadvantages.

Gaseous Fuels:- Natural gas –Analysis of flue gas by Orsat's apparatus. **Engineering applications of fuels Influence of Fuels on Environment.**

TEXT BOOK:

1. ENVIRONMENTAL STUDIES by R. Rajagopalan Oxford University Press III Edition.

REFERENCE BOOK:

1. ENVIRONMENTAL STUDIES by Deeksha Dave & S.S.Katewa, Cengage Publications (2012)
2. ENVIRONMENTAL CHEMISTRY by A.K.DE, New Age Internationals(2014)

**Syllabus for B. Tech I Year II semester
Elements of Mechanical Engineering
(Common to All Branches Except Mechanical Engineering)**

Code: 5BC04

				L		T		P/D		C	
				3		1		-		3	
a	b	c	d	e	f	g	h	i	j	k	l
x		x						x	x		

Course Outcomes

At the end of basic mechanical engineering a student should be able to

1. To acquire the knowledge of basic concepts of thermodynamics and analyze the p-v & t-s diagrams of the different cycles.
2. To identify & understand the function of components used in the steam power plant & gas power plant, & how the power generation takes place in steam and gas power plant.
3. To identify & understand the function of components used in VCR & VAR system, & working principle of VCR & VAR.
4. To acquire the knowledge about the working of hydraulic pumps & hydraulic turbines.
5. To acquire the knowledge to identify the different casting methods and welding methods and their applications.
6. To acquire the knowledge to identify the different machine tools and their construction.

UNIT - I

Thermodynamics: Basic concepts of Thermodynamics, Property of gases, Zeroth Law. First Law of Thermodynamics and its applications, Second Law of Thermodynamics, Carnot cycle, Air standard cycles – Otto, Diesel Cycles.

Internal combustion engines: Internal combustion engines, definition, classification, components, working of two-stroke, four stroke engines, SI and CI Engines, Performance parameters, Need for cooling, and lubrication of IC engines.

UNIT-II

Steam Power plant, Boiler, Steam Turbines: Layout of steam power plant, Fire tube and Water tube Boilers :- "Cochron", Babcock and Wilcox Boiler and High Pressure Boilers. (Benson & La-mount only).

Steam turbines:- Impulse & Reaction Turbines

Gas turbine-power plants :- Closed & Open cycle types

UNIT- III

Hydraulic pumps & turbines:- Centrifugal Pumps, Pelton wheel, Francis turbine and Kaplan Turbine -- Layout of Hydro electric power plant

Refrigeration & Air conditioning systems:- Description of Vapour Compression and Vapour Absorption systems

UNIT-IV

Manufacturing Processes:

Foundry Practice:- Patterns, Moulding and Moulding materials, casting methods-Sand Casting, Shell mould Casting, Investment Casting, Die Casting, Centrifugal casting – Principle and Application of these processes

Welding:- Types of Welding- Electric Arc welding - Coated electrode, TIG welding & MIG welding, Gas welding and cutting, Resistance welding- Spot welding, Soldering and Brazing .

UNIT-V

Mechanical working :- Hot and Cold working, Rolling- Rolling products, Types of Rolling mills, Forging- operations, forging methods, Extrusion-methods, Metal Spinning and Wire Drawing

Press working operations:-Cutting, Bending, Drawing and Squeezing

UNIT-VI

Machine tools: Construction of lathe, shaper, drilling, milling, grinding and CNC machine tools- Advantages, Machine controls, vertical & horizontal spindles.

TEXT BOOKS:

1. Mathur, M.L., Mehta, F.S. and Tiwari, R.P., Elements of Mechanical Engineering, Jain Brothers, New Delhi, 2005.
2. R.K. Rajput, "Elements of Mechanical Engineering", Laxmi Publications, 1994.

REFERENCES :

1. P.N.Gupta, M.P. Poonia, "Elements of Mechanical Engineering", Standard Publishers Distributors Nai Sarak, Delhi.
2. R.C.Gupta, "Mechanical Engineering", Khanna Publishers, Delhi

a	b	c	d	e	f	g	h	i	j	k
				x			x			

**Syllabus for B. Tech I Year II semester
Information Technology
Ethics, Morals, Gender Sensitization, and Yoga
(Common to all Branches)**

Code: 5H233

L	T	P/D	C
1	1	-	1

COURSE OUTCOMES**Students will be able to**

- Discriminate between right and wrong from their own behavior and judge the same in others.
- Understand how moral development involves thoughts, feelings, and behaviors regarding right and wrong and get intrapersonal and interpersonal dimensions.
- Understand Engineer's Responsibility for safety and risk.
- Understand rules and principles set by the society in a customary way.
- Perceive gender literacy and understand the importance of gender perspective and in turn delve into gender issues.
- Understand and appreciate the importance of yoga for an enriched life style.

UNIT I: HUMAN VALUES AND MORALS

Why Value Education, Understanding Social Factors, System, Structure and Source of Generic Values; Morals, Values and Ethics; Integrity; Work Ethics; Service Learning-Civic Virtue-Respect for Others-Living Peacefully-Caring-Sharing; Honesty; Courage; Value Time; Cooperation; Commitment; Empathy; Self Confidence; Spirituality; Character; Loyalty; Confidentiality

UNIT II: ENGINEERING ETHICS AND PERSONALITY DEVELOPMENT

Ethical Principles, Ethical Theories, , Use of Ethical Theories, Types of Inquiry, Engineering and Ethics, Engineering Ethics, Moral Autonomy of Engineers, Professional Ethics, Consensus and Controversy, Ethics in Business, Global business, Understanding Factors of Success, Human Aspirations, Personality and Our Identity, Understanding SELF, Happiness and Self-Interest, Positive Thinking, Custom and Religion, Understanding responsibility toward society, Understanding National and cultural Ethos; Professionalism

UNIT III:ENGINEERING AS SOCIAL EXPERIMENTATION

Comparison with Standard Experiments; Knowledge Gained; Learning from the Past; Engineer as Manager, Consultants and leaders and responsible social Experimenter; Engineers personality Trait, Big Five Personality model, Conscientiousness ,Accountability- Roles of Codes-Codes and

Experimental Nature of Engineering; Engineer's Responsibility for safety and Risk, Concept of Safety-Types of Risks

UNIT IV: GLOBAL PERSPECTIVE

Distinguish between Bribes and Gifts; Occupational Crimes; Globalization- Cross-Cultural Issues; Environmental Ethics; Internet and Computer Codes of Ethics

Case Study:

Ethics in Military and Weapons Development-Ethics in Research work

UNIT V: GENDER SENSITIZATION

Introduction to Gender Study; Introduction to Gender Spectrum; Point of view; Gender and Structure of Knowledge; Contribution of Women in growth and development as Technologist, Scientist, R&D, GDP, Social Life, National Development, International Perspective"- Life Exemplary Madame Curie, Durga bai Deshmukh, Kalpana Chawla, Chanda Kochar, Mary Kom, Indra Gandhi, Mother Teresa, Indra Nooyi, Golda Meir, Margaret Thatcher and other achievers

UNIT VI: YOGA

Introduction to Yoga in India; Origin and Development; Theoretical understanding of yoga; Stress Management : Modern and Yogic perspectives ; Tackling ill-effects of Frustration, Anxiety and Conflict through modern and Yogic methods; Meditation Techniques; Suryanamaskar; Pranayama.

TEXT BOOKS:

1. *Indian Culture Values And Professional Ethics(For Professional Students)* by Prof.P.S.R.Murthy ; B.S.Publications.
2. *Professional Ethics and Human Values* by M. Jayakumar, Published by University Science Press,
3. Telugu Academy, Hyderabad, 2015, *Towards A World of Equals*, A Bilingual Text Book on Gender.

REFERENCE BOOKS:

1. *The Yoga Sutras of Patanjali* by Swami Satchitananda
2. *The Secret Power of Yoga* by Nischala Joy Devi
3. *Light on Pranayama* by B.K.S. Iyengar
4. *Books on the Art of Living* by Poojya Sri Sri Ravi Shanker
5. *Making It Relevant: Mapping the meaning of women's studies in Tamilnadu* by Anandi S and Swamynathan P
6. *Feminism is for Everybody; Passionate Politics* by Bell Hooks
7. *Gender* by Geetha V
8. *"Growing up Male" in what is worth teaching* by K Kumar
9. *The Lenses of Gender: Transforming the Debate on Sexual Inequality* - Sandra Lipsitz Bem
10. *The Lenses Of Gender* - by ANNE MURPHY

Syllabus for B. Tech I Year II semester
DATA STRUCTURES AND C++ LAB
(Common to all Branches)

Code: 5E271

			L		T		P/D		C			
			-		-		3		2			
a	b	c	d	e	f	g	h	i	j	k	l	
x			x					x				

Lab Objective:

On completion of all the exercises, a student should be able to:

- Represent and Implement the operations on basic linear and non-linear data structures
 - Implement basic C++ programs using object oriented programming concepts
1. Write a C program that implement stack and its operations using arrays
 2. Write a C program that implement Queue and its operations using arrays.
 3. Write a C program that implement Circular Queue and its operations using arrays.
 4. Write a C program that uses Stack operations to perform the following
 - i) Converting infix expression into postfix expression
 - ii) Evaluating the postfix expression
 5. Write a C program that uses functions to perform the following operations on singly linked list:
 - i) Creation ii) Insertion iii) Deletion iv) Traversal
 6. Write a C program using functions to perform the following operations on circular singly linked list:
 - i) Creation ii) Insertion iii) Deletion iv) Traversal
 7. Write a C program that uses functions to perform the following operations on doubly linked list:
 - i) Creation ii) Insertion iii) Deletion iv) Traversal in both ways
 8. Write a C program to implement operations on the following Data Structures Using Singly linked list:
 - i) Stack ii) Queue
 9. Write a C program that uses functions to perform the following:
 - i) Creating a Binary Tree of integers
 - ii) Traversing the above binary tree in preorder, inorder and postorder.
 10. Write C programs that use both recursive and non recursive functions to perform the following searching operations for a Key value in a given list of integers :
 - i) Linear search ii) Binary search
 11. Write C programs that implement the following sorting methods to sort a given list of integers in ascending order:
 - i) Bubble sort ii) Insertion sort iii) Selection Sort
 12. Write C programs that implement the following sorting methods to sort a given list of integers in ascending order:
 - i) Quick sort ii) Merge sort
 13. Write a C++ program to read & display the details of student class with data members as name, rollno and 3 subjects' marks.
 14. Write a C++ program to implement all types of constructors.
 15. Write a C++ program to implement operator overloading for addition of two complex numbers.

TEXT BOOKS:

1. **Data Structure through C by Yashavant Kanetkar.**
2. The complete reference C++ by Herb Schildt.
3. Data Structures, A pseudocode Approach with C by Richard F. Gilberg & Behrouz A. Forouzan.

a	b	c	d	e	f	g	h	i	j	k	l
x	x							x			

**Syllabus for B. Tech I Year II semester
Computer Science and Engineering
ELECTRICAL ENGINEERING LAB
(Common to MECH, CSE, IT & BT)**

Code:5AC91

L	T	P	C
-	-	3/2	1

COURSE OUTCOMES:

- 1 Demonstrate OC & SC tests on Single Phase transformer and perform Brake test on 3-phase induction motor along with performance characteristics..
 - 2 Test Speed control of DC shunt motor by applying Armature Voltage Control and Field flux control method.
 - 3 Demonstrate Brake test on DC shunt motor
 - 4 Demonstrate Swinburn's test on DC shunt machine
 - 5 Explain OCC characteristics of DC shunt generator
 - 6 Verify and validate Thevenin's Theorem.
-
1. OC & SC tests on Single – Phase transformer (Predetermination of efficiency and regulation at given power factors).
 2. Brake test on 3-phase induction motor (performance characteristics).
 3. Speed control of DC shunt motor by
 - a) Armature Voltage Control .
 - b) Field flux control method.
 4. Brake test on DC shunt motor.
 5. Swinburn's test on DC shunt machine.
 6. OCC characteristics of DC shunt generator.
 7. Verification of Thevenin's Theorem

Syllabus for B. Tech I Year II semester
IT Workshop – II
(Common to ALL)

Code: 5F273

L T P/D C
 - - 2/2 1

a	b	c	d	e	f	g	h	i	j	k	l
	x	x									

Course Outcomes :

1. Apply MS –Office features for documentation and formatting data.
2. Create Project report document using formatting styles, tables, fonts footnotes spell check and Track changes.
3. Create News letters and prepare Power Point Presentations.
4. Describe and use Excel spread sheets and applying formulas for calculations.
5. Use and Apply HTML Features for Formatting Tags, Linking of pages using Anchor Tags, Table tags.

Week 1:

Introduction to S/W's difference b/w hardware and software. Introduction to MS-Office and its importance. Using word – Accessing, Overview of toolbars saving files, rulers, format painter.

Features: Formatting fonts, Drop cap, Applying text effects, character spacing, Borders, colors, insert Header & Footer, Date & Time options.

Week 2:

Creating Project

Formatting styles, Inserting Table, Bullets & Numbering, Changing Text Direction, Cell Alignment, Footnote, Hyperlink, Symbols, Spell check, Track changes.

Week 3:

Creating News letters

Table of content, Newspaper columns, Images from files & Clip Art, Drawing toolbar & Word Art, Formatting Images, Textboxes, Paragraphs & Mail merge.

Week 4:

Basics of Power Point Presentation

Features : PPT Orientation, Slide layouts, Inserting Text, Word Art, Formatting Text, Bullets & Numbering, Auto shapes, Lines & Arrows, Hyperlinks, Inserting Images, ClipArt, Audio, Video, Objects, Tables & Charts, Master layouts (Slide template & Notes), types of views (basic, Presentation, slide slotter, notes), Inserting – Background, text , Design Templates, Hidden slides.

Week5:

Introduction to Excel

Features: Accessing, Overview at toolbars, saving excel files, Gridlines, Format cells, Summation, Auto fill, formatting text.

Week 6:

Formula in excel – Average, Standard Deviation, Charts, Roaming & Inserting worksheets, Hyper linking, count function, lookup / Vlookup, sorting, Conditional formatting.

Week 7:

Introduction to HTML,

Features: Formatting Tags, Linking of pages using Anchor Tags, Table tags

Websites and Textbooks:

7. Complete Reference Microsoft Office 2010
8. <https://office.microsoft.com/en-us/support/> (office help and how-to)
9. W3schools.com

II Year I Semester

B.Tech - Biotechnology

(5G302) BIOCHEMISTRY

a	b	c	d	e	f	g	h	i	j	k	l
X		X				X	X		X	X	

L T P/D C
4 1 - 4

Course Outcomes

1. Ability to understand the structure and function of monosaccharide's, disaccharides, oligo and polysaccharides.
2. Ability to apply knowledge of Structure, properties, classification and biological functions, metabolism of amino acids
3. Ability to demonstrate the knowledge of Structure, types, properties, classification, assembly and biological functions of proteins
4. Ability to demonstrate the knowledge of properties, classification and biological functions of Enzymes. To study mechanism of action, inhibition and regulatory of enzymes
5. Ability to demonstrate the structure, properties, classification, biological functions and metabolism of fatty acids, Lipoproteins and application of lipids as surfactants in industry
6. Ability to demonstrate the Structure, properties biological functions and metabolism of RNA and DNA

UNIT I: Carbohydrates- Structure, Properties, Classification and Biological functions- monosaccharides, disaccharides, oligo and polysaccharides, Glycolysis, TCA cycle, Aerobic and anaerobic respiration, overview of Respiratory chain

UNIT II: Amino acids - Structure, properties, classification and biological functions of amino acids - Nitrogen Cycle, Nitrogen Balance, Reductive Amination & Transamination & Urea cycle, Biosynthesis of amino acids - Glutamate and Shikimate pathway

UNIT III: Proteins: Structure, properties, classification and biological functions, structural organization of Proteins, Protein folding

Unit IV: Enzymes: Introduction, Properties, classification, Factors affecting enzyme action, enzyme inhibition, enzyme catalysis-acid-base catalysis, covalent catalysis, metal ion catalysis

UNIT V: Lipids: Structure, properties, classification and biological functions-phospholipids, Sphingolipids, fatty acid metabolism, cholesterol structure and function. Lipoproteins – classification & function, Lipid Profile assays

UNIT VI: Nucleic Acids: Structure, properties of DNA and RNA. Metabolism of Purines & Pyrimidines: overview of de Novo & salvage pathway, Conversion of nucleoside monophosphates to nucleoside triphosphate

TEXT BOOKS:

1. Biochemistry, U. Staynarayana and. U. Chakrapani, Third Edition, Published by Books & Allied, 2008
2. Fundamentals of Biochemistry J.L. Jain S. Chand Publishers

REFERENCES:

1. Voet D, Voet J. G, Biochemistry, Second Edition, John C Wiley and Sons, 1994.
2. L. Stryer, J.M. Berg, JL Tymoczko Biochemistry 5th edition, WH Freeman & Co 2002.
3. Biochemistry by K. Mathews, K.E. Van Holde, Kevin G Ahern, Pearson Education.
4. Protein's Structure and function. Daviel Whitford John Wiley Publications.
5. Biochemistry by Cristopher K.Mathews, K.E.Van Holde, Pearsons education.
6. Principles of Biochemistry, Horton,Moran,Scrimgeour, Printice Hall,4th edition, 2006.
7. Lehninger A.L, Nelson O.'L, M.M. Cox, Principles of Biochemistry, 3rd Edition, 2000 CBS Publications, 1993

II Year I Semester

**B.Tech - Biotechnology
(5G303) MICROBIOLOGY**

a	b	c	d	e	f	g	h	i	j	k	l
X				X					X	X	

L T P/D C
4 1 - 4

Course Outcomes

1. Major breakthrough in microbiology apart from the historical development from a non technological to technological era.
2. Understands different methods of identification techniques and classify microbes by very specific activities / function /factors which is applied in disease diagnostics labs.
3. Helps in culturing the single colony microbe pure cultures from complex mixtures by using culture techniques, apart from using selective media / components / factors for optimal growth of microbe, essential in diagnostic and therapeutic approach.
4. Understand the type of sterilization technique to be applied to kill a specific microbe based on the location. It is very important in industries, health sector and daily needs at house.
- 5&6. Emphasis on culturing & advantages and disadvantages of virus and how they could be used for mankind with and without modifications in Biotech Industries.

UNIT I: Introduction To Microbiology: Pioneers and their discoveries in Microbiology: Antony von Leuwenhoeck, Louis Pasteur, Edward Jenner etc, Theory of spontaneous generation, Germ theory of diseases, Major contributions and events in the field of Microbiology, Scope and relevance of microbiology

UNIT II: Major Groups Of Microorganisms: General characteristics of Bacteria, Archaea and Eubacteria, Fungi Classification systems-Phylogenetic, Phenetic, Taxonomic ranks, Major characteristics used in Taxonomy- Morphological, Physiological, Ecological, Biochemical, Immunological, Genetical and Molecular

UNIT III: Nutrition and Cultivation:

Nutritional Types in microbes, Growth curve ,Growth factors, Aerobic and anaerobic metabolism. Medium and its types, Pure culture techniques, special techniques for cultivation of anaerobes, Influence of environmental factors on growth- solutes, water activity, pH, temperature, oxygen, osmotic pressure, radiation etc, bacterial growth curve, methods for determining bacterial numbers, mass and cell constituents.

UNIT IV: Control and Preservation of Microbes:

Control of microorganisms- sterilization and disinfection: physical (moist and dry heat, radiation and filtration), chemical (disinfectants, antiseptics, antibiotics and other chemotherapeutic agent), Preservation of Microorganisms: cryopreservation, Lyophilization, Application and limitation of various methods

UNIT V: Introduction to Viruses:

Virus properties, Structure of viruses, Classification of viruses-Bacteria, plants and animals, Applications of Viruses in Biotech Industry

UNIT VI: Viral replication

Viral replication, Bacterial, plant and animal replication in cytoplasm and nucleus with 1 example each (DNA and RNA viral replication), Cultivation of viruses-overview,

TEXT BOOKS:

1. Microbiology, Pelczar M.J. Chan ECE and Krieg NR. Tata McGraw Hill.
2. Microbiology by Prescott

REFERENCES:

1. Biology of Microorganisms. BROCK, Prentice Hall, International Inc.
2. General Microbiology. Hons. G.Schlege. Combridge university press.
3. General Microbiology. Roger Y stanier, Macmillan.

II Year I Semester

B.Tech - Biotechnology

(5G304) CELL BIOLOGY

a	b	c	d	e	f	g	h	i	j	k	l
X		X	X	X					X	X	

L T P/D C
4 1 - 4

Course Outcomes

1. Ability to understand different approaches used in the discovery of cell, and define Cell constituents / organelles and their basic functions.
2. Ability to observe, identify, compare and describe cell organelles in terms of their function, structure and operation common to both animal and plant cells as well as those that are unique to each cell type.
3. Ability to find the Structure and functions of Nucleus, Endoplasmic Reticulum, Golgi complex, Lysosomes, Peroxisomes, Chloroplast & Mitochondria. Protein Glycosylation, Intracellular protein traffic & targeting
4. Ability to explain the transport processes by which cell components (proteins) move within and outside the cell.
5. Ability to understand various stages of cell cycle, cytokinesis and checkpoints that regulate the progression of cells
6. Ability to demonstrate examples of different types of extracellular signals and receptors, and explain their functional significance.

UNIT I: Introduction to Cell

Basic properties of cells; Cell theory; Cell complexity – Cell size & shape; Chemistry of the cell, Plasma membrane- structure and function; Cytoplasm; Cytoskeleton - Microtubules, Microfilaments & Intermediate filaments, cell motility – cilia & flagella

UNIT II: Cell Organelles

Structure and functions of Nucleus, Endoplasmic Reticulum, Golgi complex, Lysosomes, Peroxisomes, Chloroplast & Mitochondria.

UNIT III: Membrane Transport

Passive and Active Transport, Uniport, Symport, Antiport, Permeases, P- Type & V- Type Pumps, Na⁺/K⁺ ATPase, Lysosomal & Vacuolar membrane ATP dependent Proton Pumps,

UNIT IV: Trafficking

Protein Glycosylation, Intracellular Protein traffic & targeting, Endocytosis and Exocytosis, Transport into Prokaryotic Cells

UNIT V: Cell Cycle & Regulation

Overview of the Cell Cycle, Interphase, Mitosis, Meiosis & Cytokinesis. Animal Cell & Yeast Cell Division, Cell Cycle Control & Checkpoints, General Characteristics of Cell Differentiation, Embryonic and adult stem cells and its Biological Importance. Characteristics of Cancer cells, Benign & Malignant tumor, Metastasis

UNIT VI: Receptors & Signal Transduction

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

TEXT BOOKS:

- 1) The Cell by Cooper.
- 2) Cell and Molecular biology – De Robertis and De Robertis (1998) Waverly Pvt. Ltd.

References:

- 1) Cell & Molecular Biology by Gerald Karp (2nd Ed.) Wiley publishers.
- 2) The World of the cell by Becker, Reece, Poenie (3rd edition) Benjamin Publishers.
- 3) Molecular Biology of the cell by Bruce Alberts.
- 4) The Biochemistry of Cell Signalling-Ernst J. M. Helmreich. Oxford Press.

II Year I Semester

B.Tech - Biotechnology

(5G302) PROCESS ENGINEERING CALCULATIONS

a	b	c	d	e	f	g	h	i	j	k	l
X		X					X				

L
T P/D C
3 2 -- 3

Course Outcomes

1. Ability to convert from one set of units to another, compare dimensionless groups, interconvert mass, volume and moles and their flows, interconvert between different temperature scales and to do mathematical calculations.
2. Ability to understand the differences between real gas and ideal gases, equation of state, saturation, partial saturation.
3. Ability to perform material balances for systems with recycle, bypass purge calculations. Calculate the limiting reactant, excess reactant, fractional conversion and yield.
4. Ability to determine combustion process, perform elemental balances, heat of reaction, calculation of enthalpy changes, energy balance on cell cultures.
5. Ability to estimate the physical properties of process streams, performs energy balances, applications of enthalpy-concentration charts, humidity charts, graphical use etc.
6. Ability to perform a combined material and energy balance analysis for system at unsteady state, Graphical integration

UNIT-I: Introduction to Engineering calculations

Measurement conventions, density, mole, chemical composition, mass fraction, mole fraction, volume fraction, standard conditions and ideal gas, physical and chemical property data, the chemical equation and stoichiometry.

UNIT-II: Gas, Liquid and solids

Properties of gases, liquids and solids, ideal gaseous mixtures, real gas relationships, equations of state, vapor pressure, its change with temperature and pressure, saturation, partial saturation and humidity

UNIT-III: Material Balances

Conservation of mass, types of material balance, procedure for material balance calculations, application of material balance to filtration, mixing, fermentation, distillation, evaporation, crystallization, drying. Material balance with recycle, by-pass and purge systems

UNIT-IV: Energy balances

Intensive and extensive properties, enthalpy, calculation of enthalpy changes, general energy balance equations, energy balance calculations without reaction, heat of combustion, heat of reaction at nonstandard conditions, heat of reaction for processes with biomass production, energy balance for cell cultures

UNIT-V: Combined material and energy balances

simultaneous material and energy balances of steady state, some examples

UNIT-VI: Unsteady state material and energy balances

Unsteady state material and energy equations, material balance in batch distillation, unsteady state energy balance , unsteady state equation for biological systems in CSTR, fed batch and plug flow reactors

TEXT BOOKS:

1. Himmelblau, "Basic Principles and calculations in chemical engineering", VI ed. Prentice Hall.1999.
2. Pauline M Doran, " Bioprocess Engineering Principles", Academic Press,1995.

References:

1. Bhatt and Vora "Stoichiometry" , IV ed. Tata McGraw Hill 2006.
2. Himmelblau, "Basic Principles and calculations in chemical engineering", I ed. Prentice Hall.1999.

II Year, B. Tech, BT – I - Sem.

(5CC47) ELEMENTS OF ELECTRONICS ENGINEERING

a	b	c	d	e	f	g	h	i	j	k	l

After studying this course, the students will be able to

1. Understand the operation of diode and its application as rectifier.
2. Understand the Fundamentals of BJT operation, Characteristics and different biasing circuits.
3. Understand the Fundamentals of JFET operation, Characteristic.
4. Understand the working of amplifiers and oscillators
5. Understand the Basic regulator circuits and voltage multipliers.
6. Understand the number systems and its applications

UNIT-I

SEMICONDUCTOR DIODES AND APPLICATIONS

Review of p-n junction diode, Characteristics, Parameters and AC equivalent circuit. Half-wave diode rectifier, Ripple factor, Full-wave diode rectifier, Other full-wave circuits, Break diodes and their applications in power supply circuits.

UNIT-II

TRANSISTORS

Bipolar Junction transistor, Transistor Voltages and currents, amplification, Common Base, Common Emitter and Common Collector Characteristics, DC Load line and Bias Point. Biasing Methods: Base Bias, Collector to Base Bias, Voltage divider Bias, Comparison of basic bias circuits, 08 periods

UNIT-III

OTHER SEMI CONDUCTOR DEVICES

Silicon Controlled Rectifier (S.C.R), and its applications Unijunction transistor, and its applications, Junction Field effect Transistors JFET Characteristics, JFET Amplification. (Common source)

UNIT-IV

AMPLIFIERS & OSCILLATORS

Concepts of Decibel and Half power points, Single Stage CE Amplifier and Capacitor coupled two stage CE amplifier (Qualitative Discussions Only), Negative Feedback and its Effects. The Barkhausen Criterion for Oscillations, RC phase shift, Hartley, Colpitts and crystal oscillator (Qualitative discussions only). -08 periods

UNIT-V

Voltage Regulators

IC 723 voltage regulators and three terminal IC regulators, Introduction to voltage multipliers, uninterrupted power supplies and switching regulators.

UNIT-VI

NUMBER SYSTEMS

Introduction, decimal system, Binary, Octal and Hexadecimal number systems, addition and subtraction, fractional number, Binary Coded Decimal numbers. -06 periods

Text Books

1. Electronic Devices and Circuits: *David. A. Bell*; PHI, New Delhi, 2004
2. Electrical and Electronics & Computer Engineering for Scientists and Engineers Second Edition -*K.A. Krishnamurthy & M.R.*

References

1. Electronics Devices and Circuits by *Sanjeev Gupta*, Dhanpat Rai Publications
2. Electronics Devices and Circuits Theory by *Baystad and Nashelsky*, PHI

II Year B.Tech. I Semester

MATHEMATICS FOR BIOTECHNOLOGY –II
(For Bio-Technology)

A	B	C	D	E	F	G	H	I	J	K	L
X											

Code: 5H316

L T P/D C
3 2 0 3

Course Outcomes: *Students*

1. Will able to find the solution of linear systems by various methods.
2. Able to evaluate eigen values and eigen vectors, learn properties and applications to find higher powers of a matrix using diagonalization.
3. Able solve problems using finite differences.
4. Able to find the numerical solution of algebraic and transcendental equations.
5. Will learn basic concepts of Numerical integration and able to solve problems.
6. Able to find numerical solution of ordinary differential equation problems.

Unit-I:

Matrices and Linear systems of equations: Introduction, Rank of a Matrix, Elementary Transformation- Echelon Form, Normal Form, Inverse of a Matrix by Gauss-Jordan method, Linear Dependence and Independence of Vectors, Linear Systems Gauss Elimination method, Rank method – Applications.

Unit-II:

Eigenvalues, Eigenvectors: Eigenvalues and Eigenvectors of a Matrix- Properties of Eigenvalues and Eigenvectors, Cayley-Hamilton theorem(without proof) and its Applications, Diagonalization of a Matrix.

Unit-III:

Interpolation: Introduction, Finite differences, Forward Differences, Backward differences, Central differences, Newton's interpolation formulae, Gauss interpolation formulae (without proofs) -Lagrange's Interpolation formula.

Unit-IV:

Solution of Algebraic and Transcendental Equations: Introduction – The Bisection Method – The Method of False Position – The Iteration Method – Newton-Raphson Method.

Unit-V:

Numerical Integration: Trapezoidal Rule and Simpsons 1/3, 3/8 rule. Curve fitting: Fitting a straight line –Second degree curve-exponential curve-power curve by method of least squares.

Unit– VI:

Numerical solution of Ordinary Differential equations: Solution by Taylor's Series-Picard's Method of successive Approximations-Euler's Method, Runge-Kutta Method.

TEXT BOOKS:

1. Mathematical Methods of Science and Engineering, Kanti B.Datta, CENGAGE Learning.
2. Higher Engineering Mathematics, B.S. Grewal, Khanna Publications, New Delhi.
3. Engineering Mathematics, B. V. Ramana, Tata McGraw Hill Publishing Company Ltd.
4. Erwyn Kreyszig: Advanced Engineering Mathematics, John Wiley and Sons, 8th Edition.

REFERENCE BOOKS:

1. A Text Book of KREYSZIG's Engineering Mathematics, Dr. A. Ramakrishna Prasad, Wiley Publications.
2. Advanced Engineering Mathematics, S. R. K. Iyengar and R.K. Jain, Narosa Publishing House, London, 2002.

Syllabus for B. Tech II Year I semester
(Common to all branches)
FUNCTIONAL COMMUNICATIVE WRITTEN ENGLISH (FCWE)

Subject Code:5H373

L	T	P	C
1	2	-	1

COURSE OBJECTIVES

To enable the students to

- **Acquire advanced level Communicative English competence**
- **Develop Interpersonal Communication Skills**
- **Participate in Group Tasks using effective language**
- **Enhance written communication from the employability perspective**

UNIT I:

- Difference between General and Technical Vocabulary
 - General engineering/technical and branch specific
- Collocations
- Phrasal Verbs and Idioms

UNIT II:

- Etymology
 - Word root and origins
 - Word analogy
- Synonyms and Antonyms
- One Word Substitutes

UNIT III:

- Stages of Written Communication: Pre-Writing; Writing and Re-writing
- Difference between General and Technical Communication
- Components of Technical Writing
 - Audience analysis
 - Usage of Language etc.

UNIT IV:

- Report Writing
- E-mail
- Résumés / Curriculum Vitaé

UNIT V:

Group Discussion

- Difference between debate and group discussion
- Rules of Group Discussion
- Team Skills
- Group Etiquette

UNIT VI:

Presentation Skills

- Plan
- Prepare
- Practice
- Perform
- Precautions

Text Book:

Advanced English Proficiency Course: Volume-I

Suggested reading:

- ***Let Us Hear Them Speak***
- ***Developing Speaking-Listening Skills in English (With CD)***
- ***Basic Communication Skills For Technology-*** Andrea J Rutherford- Pearson
- ***Developing Communication Skills-*** Krishna Mohan- Mac
- ***Written Communication Skills-*** Michael Hatton-iste
- ***Soft Skills Know Yourself And Know The World-*** K Alex- S Chand

II Year I SEM

(5G371) BIOCHEMISTRY LABORATORY
B.Tech - Biotechnology**L T P/D C**
- - 3 2

a	b	c	d	e	f	g	h	i	j	k	l
		X									

1. Units, Volume & Weight measurements. Concentration units, pH Measurement. Preparation of buffers
2. Qualitative analysis of carbohydrates
3. Quantitative estimation of Reducing sugars by the DNS / Benedict's method.
4. Qualitative analysis of Amino Acids
5. Qualitative analysis of proteins
6. Quantitative estimation of Amino Acids by Ninhydrin method
7. Quantitative estimation of Proteins by Biuret /Lowry method
8. Quantitative estimation of cholesterol
9. Saponification value of oils
10. Determination of Acid value and Iodine values of oils
11. Quantitative Estimation of DNA/RNA
12. Isolation of urease / alkaline phosphatase

II Year I Semester

B.Tech - Biotechnology

(5G372) MICROBIOLOGY AND CELL BIOLOGY LABORATORY

L T P/D C
- - 3 2

a	b	c	d	e	f	g	h	i	j	k	l
		X									

1. Introduction to microscope and Sterilization techniques (lecture/demonstrations)
2. Identification of Animal, Plant and Bacterial cells by simple staining
3. Micrometry
4. Examination of different stages of mitosis in onion root tips
5. Examination of different stages of meiosis in flower buds
6. Identification of microorganisms by differential staining – Grams
7. Identification of sporulating bacteria by staining with malachite green
8. Determination of motility of bacteria by hanging drop method
9. Preparation of culture Media – Agar & Broth
10. Culturing of microorganisms: (a) Broth (b) Pure culture techniques:- Streak plate, pour plate methods, spread plate techniques
11. Biochemical testing of bacteria - IMVIC test, Catalase test, Coagulase test, Gelatinase test, Oxidase test.
12. Determination of Bacterial growth curve
13. Factors effecting the bacterial growth – effects of temperature, pH.
14. Determination of colony count and cell number of bacteria
15. Antibiotic test - Disc diffusion method, minimum inhibitory concentration.
16. Microbiological examination of water by MPN method

TEXT BOOKS:

1. Microbiological and applications, Laboratory, Manual in General Microbiology by Benson, Mc Graw Publications.
2. Laboratory exercises in Microbiology by Prescott – Harley, 5th edition, 2002

REFERENCES:

1. J.G. Cappucin and N. Sherman, A Laboratory manual, 4th edition, Addison & wesley, 1999.
2. Practical Manual in microbiology, Plant tissue culture and pathology – K.R. Aneja , New age Publication, 2001

II Year I semester

**B. Tech - Biotechnology
ELECTRONICS ENGINEERING LAB**

Subject Code: 5C381

L	T	P	C
-	-	3/2	1

a	b	c	d	e	f	g	h	i	j	k	l	m
x	x							x				

COURSE OUTCOMES:

1. Identify, Specify and test R, L, C Components (Colour Codes), Potentiometers, Switches, Coils, Relays.
2. Identify, Specify and test Active Devices, Diodes, BJTs, Low power JFETs, MOSFETs, Power Transistors, LEDs, LCDs, SCR, UJT.
3. Describe operation of Multimeters, Function Generator and Regulated Power Supplies.
4. Explain and use CRO for experiments.
5. Explain and demonstrate working of PN Junction diode characteristics.
6. Explain and demonstrate working Half and Full wave Rectifier with and without filters.
7. Demonstrate working and applications of FET, CE and RC Phase Shift Oscillator.

PART A: ELECTRONIC WORKSHOP PRACTICE (in 3 lab sessions):

1. Identification, Specifications, Testing of R, L, C Components (Colour Codes), Potentiometers, Switches (SPDT, DPDT, and DIP), Coils, Relays, Bread Boards.
2. Identification, Specifications and Testing of Active Devices, Diodes, BJTs, Low power JFETs, MOSFETs, Power Transistors, LEDs, LCDs, SCR, UJT.
- 3 Study and operation of
 - Multimeters (Analog and Digital)
 - Function Generator
 - Regulated Power Supplies
4. Study and Operation of CRO:

PART B: (For Laboratory examination – Minimum of 6 experiments)

1. PN Junction diode characteristics A. Forward bias B. Reverse bias.
2. Zener diode characteristics
3. Half wave Rectifier with and without filters.
4. Transistor CE characteristics (Input and Output)
5. Full wave Rectifier (Centre tapped and Bridge) with and without filters
6. FET characteristics
7. CE Amplifier
8. RC Phase Shift Oscillator

II Year I semester

B. TECH - BIOTECHNOLOGY
(Common to all branches)
SEMINAR ON TECHNOLOGY AND ITS IMPACT

Subject Code: 5G393

		L		T		P		C						
		-		-		2		1						
a	b	c	d	e	f	g	h	i	j	k	l	m		
						x	x							

COURSE OUTCOMES :

- 1 Deliver lecture on emerging technologies.
- 2 Explain domain knowledge to resolve real time technical issues
- 3 Demonstrate ability to lead and explain concepts and innovative ideas.
- 4 Demonstrate team leading qualities.
- 5 Demonstrate public speaking skills.
- 6 Exchange new information that would not have been available otherwise.
7. Develop debating and interview skills.

Procedure:

1. Seminar in-charges shall highlight the significance of Technical Seminar in the first two sessions and enlighten the students on the utility of these seminars.
2. The slots, titles shall be decided upfront and seminar In-charge shall take signatures from students.
3. The same sheet shall be affixed in the respective classrooms and seminar register.
4. If any student fails to present his/her seminar on the given slot, to genuine reasons, they may be asked to present in the subsequent slot / week.
5. Progress of the seminars needs to be reviewed by the concerned HOD once in 15 days.
6. The evaluation for Technical Seminars has to be informed to students and displayed in the classrooms.
7. Report and presentation must contain topic, introduction, explanation, diagrams, tables, applications and conclusions.

Distribution of Marks

Day to day progress of the work	15 marks
Final report and viva	15 marks
Level of content	20 marks
Presentation	20 marks
Discussion & Involvement	20 marks
Attendance	10 marks
Total	100 Marks

II Year II Semester**B.TECH - BIOTECHNOLOGY
(5G406) GENETICS**

a	b	c	d	e	f	g	h	i	j	k	l
	X	X		X	X			X		X	

L T P/D C
3 1 - 3

COURSE OUTCOMES

1. Ability to gain knowledge in on the laws of inheritance.
2. Ability to understand the genes and inheritance
3. Ability to analyze the evidences for Nucleic acids as genetic material
4. Ability to describe identify , describe and recognize variety of abnormalities in chromosome structure and number
5. Ability to examine and assess data of linkage and independent assortment, and Calculate genotype and allele frequencies using the Hardy-Weinberg equation.
6. Ability to understand the principles of population genetics

UNIT – I: MENDELIAN and NON MENDELIAN GENETICS -I

Mendel's Laws of inheritance, Incomplete dominance and co-dominance, multiple alleles,

UNIT – II: MENDELIAN and NON MENDELIAN GENETICS -II

Epistasis, lethal genes, Genes and environment, sex determination, Sex-linked inheritance, extra chromosomal inheritance

UNIT – III: MOLECULAR GENETICS

Evidences for Nucleic acids as genetic material - Hershey Chase, Avery and McLeod, General Features,

UNIT – IV: CHROMOSOME STRUCTURE AND PLOIDY

Ultrastructure of eukaryotic chromosome, Types of Chromosomes, Variation in chromosome number, Definition & Classification of mutations

UNIT – V: LINKAGE AND CROSSING OVER

Linkage & crossing over, Recombination, chromosomal mapping, Karyotyping,

UNIT- VI : POPULATION GENETICS

Allele frequencies and genotype frequencies, Random mating and Hardy-Weinberg principle, Quantitative inheritance

TEXT BOOKS

1. Molecular Biology of the Gene, James D Watson, Pearson-Benjamin Cummings
2. Molecular Biology, 1987, David Freifelder, Jones and Bartlett Publishing Home
3. Principles of Genetics, 1991, E.J. Gardner, M.J.Simmons & D P Shustad.

REFERENCES:

1. Molecular Cell Biology, 2003, Lodish, H., Berk A., Zipursky, S.L. Matsudaria, P. Baltimore, D. and Darnell, J. W.H. Freeman and Company.
2. Cell and Molecular Biology 1996. De Robertis and De Robertis, Waverly Pvt. Ltd. New Delhi.
3. Genetics, 1985, Goodenough U, Hold International
4. Genetics by Strickberger
5. Genetics from Genes to Genomes-Leland H. Hartwell, Leroy Hood, Mc Graw Hill.

II Year II Semester

B.TECH - BIOTECHNOLOGY

(5G407) MOLECULAR BIOLOGY

a	b	c	d	e	f	g	h	i	j	k	l
	X	X		X	X			X		X	

L T P/D C
3 1 - 3

COURSE OUTCOMES

1. Ability to Define DNA as genetic material, compare types of DNA & understand its replication.
2. Ability to identify and describe DNA damage and repair mechanisms
3. Ability to describe and understand structure and synthesis of different types of RNA
4. Ability to describe and differentiate post translational modifications of different types of RNA.
5. Ability to understand and explain the mechanism of protein synthesis in prokaryotes.
6. Ability to understand how genetic information is expressed to produce protein products in eukaryotes, and explain various Post translational modifications

UNIT – I: DNA and its Replication

Central dogma, Evidences for DNA as genetic material. Watson and Crick model of DNA, different forms of DNA (A, B, Z). Models of DNA replication, Characteristics and functions of bacterial DNA polymerases, Mechanism of prokaryotic DNA replication in Prokaryotes, Eukaryotic DNA polymerases and mechanism of replication, D-loop, Rolling circle, M13 & X173 replication, Inhibitors of DNA replication

Unit II: DNA damage and repair

Introduction, DNA damage, types of DNA repair and their mechanisms – Direct repair, Base excision repair, Nucleotide excision repair, mismatch repair, recombinational repair, Photoreactivation, SOS repair; Telomeres and telomerase,

UNIT – III: Transcription:

Characteristics and function of bacterial RNA polymerases, mechanism of transcription and regulation. Eukaryotic RNA polymerases- transcription factors, mechanism of transcription and regulation.

Unit – IV: Post transcriptional modifications:

Post transcriptional modifications of mRNA (5'CAP formation, poly adenylation, spliciosome assembly, splicing editing), stability. Processing of tRNA and rRNA. Inhibitors of transcription.

Unit V: Translation- I

Genetic code and Wobble Hypothesis, Ribosome assembly, mechanism of activation of amino acids. Mechanism of translation in prokaryotes, codon usage, Inhibitors of protein synthesis.

Unit VI: Translation- II

Protein synthesis in eukaryotes, Differences between prokaryotic and eukaryotic protein synthesis, Co and Post translational modifications, Signal cleavage, disulphide bond formation, Glycosylation, Control of translation in eukaryotes.

TEXT BOOKS

1. Molecular Biology of the Gene, James D Watson, Pearson-Benjamin Cummings
2. Molecular Biology, 1987, David Freifelder, Jones and Bartlett Publishing Home

REFERENCES:

1. Molecular Cell Biology, 2003, Lodish, H., Berk A., Zipursky, S.L. Matsudaria, P. Baltimore, D. and Darnell, J. W.H. Freeman and Company.
2. Cell and Molecular Biology 1996. De Robertis and De Robertis, Waverly Pvt. Ltd. New Delhi.

II Year II Semester**B.TECH - BIOTECHNOLOGY
(5G408) ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY**

a	b	c	d	e	f	g	h	i	j	k	l
X	X						X		X	X	

L T P/D C
3 1 - 3

COURSE OUTCOMES

1. Ability to have a fair knowledge of various Analytical methods and instrumental methods of analysis of biological substances.
2. Ability to understand the principle and working of Bright field, Dark field, Fluorescent, Phase contrast, Electron Microscopy
3. Ability to demonstrate knowledge of Electromagnetic Spectrum. principle, working and application of UV - VIS Spectrophotometer, Spectrofluorimetry, Atomic absorption & Atomic emission spectroscopy
4. Ability to demonstrate knowledge of principle, working and application of various Separation Techniques like -Sedimentation, Centrifugation, Filtration, Dialysis, Salting in & Salting out, Electrophoresis of proteins and nucleic acids, pulse field, capillary and 2 D Gel, Flow cytometry
5. Ability to demonstrate the principle, working and application of various chromatographic techniques like- Paper and Thin Layer & Gas Chromatography, Gel filtration, Ion exchange and Affinity Chromatography, Principles and Operation of HPLC
6. Ability to demonstrate of uses of Radioactive and stable isotopes and their detection in biological systems half-life decay counters and autoradiography

UNIT I: Introduction

Types of Analytical Methods – Instruments for Analysis, classification of instrumental methods, Errors, Precision and Accuracy, Sensitivity and detection limit for instruments

UNIT II: Microscopy

Bright field, Dark field, Fluorescent, Phase contrast, Electron Microscopy

UNIT III: Spectroscopy

Radiation, energy and atomic structure- types of spectra and their biochemical usefulness, Electromagnetic radiation & Spectrum, Beer – Lambert's Law and apparent deviations; UV - VIS Spectrophotometer, Spectro fluorimetry, Atomic absorption & Atomic emission spectroscopy,

UNIT IV: Separation Techniques - I

Sedimentation, Centrifugation, Filtration, Dialysis, Salting in & salting out, Electrophoresis of proteins and nucleic acids, pulse field, capillary and 2 D Gel, Flow cytometry

UNIT V: Separation Techniques - II

Paper, Thin Layer & Gas Chromatography, Gel filtration, Ion exchange and Affinity Chromatography, Principle and Operation of HPLC

Unit VI: Methods in Biochemical Analysis:

Carbohydrates, Lipids, Protein and Nucleotide analysis; Use of Radioactive and stable isotopes and their detection in biological systems

TEXT BOOKS:

1. A Biologist Guide to principles and techniques of practical Biochemistry. By Keith Wilson, Kenneth H. Goulding 3rd ed. ELBS Series
2. Skoog & West, Fundamentals of Analytical Chemistry, 1982

REFERENCES:

1. Vogel, Text Book of Quantitative Inorganic Analysis, 1990
2. Ewing, Instrumental Methods of Analysis, 1992
3. Hobert H Willard D. L. Merritt & J. R. J. A. Dean, Instrumental Methods of
4. Analysis, CBS Publishers & Distributors, 1992
5. F. Settle. Hand book of Instrumental techniques for Analytical Chemistry, Prentice Hall, 1997.

II Year II Semester**B.TECH - BIOTECHNOLOGY****(5G409) THERMODYNAMICS FOR BIOTECHNOLOGISTS**

a	b	c	d	e	f	g	h	i	j	k	l
X	X	X									

L T P/D C
3 1 - 3

COURSE OUTCOMES

1. Student able to understand the terminology associated with engineering and thermodynamics.
2. Student understands the concepts of heat, work and energy conversion and can calculate heat and work for industrial processes.
3. Student understand the applications of First law of thermodynamics, basics of energy calculations involved with thermodynamics.
4. Reiterate the first and second law of thermodynamics and understands the practical implications of these laws in engineering design.
5. Student can calculate the properties of ideal and real gases mixtures based on thermodynamic principles.
6. Can able to understand the Maxwell relations and principles underlying the phase equilibrium, Partial molar properties.

Unit I: CONCEPTS AND DEFINITIONS

System, Surroundings, Intensive and extensive properties, Thermodynamic equilibrium: Thermal, mechanical and chemical equilibrium, Process, work, pure substance, concept of phase, Equations of state: Ideal gas, Vander waals equation of state, critical constants

Unit II: FIRST LAW OF THERMODYNAMICS

First law of thermodynamics, consequences of first law of thermodynamics, constant volume, constant pressure, constant temperature process. Adiabatic processes, Calculation of heat, work, internal energy and enthalpy

Unit III : FIRST LAW ANALYSIS

First law of thermodynamics for a continuous system and a control volume, Steady state flow processes, Fuels and Combustion: Standard Heat of Reaction, Standard enthalpy of formation, standard enthalpy of Combustion, Effect of Temperature on standard heat of reaction,

Unit IV: SECOND LAW OF THERMODYNAMICS

First law of thermodynamics limitation, Statements of Second Law, Equivalence of Kelvin-Planck and Clausius statements, Entropy concept, Carnot cycle, Carnot power cycle, Rankine cycle, practical Rankine cycle, Refrigeration cycles, calculation of COP, Calculations of Entropy change, Second law analysis of control volume.

Unit V: THERMODYNAMIC RELATIONS

Maxwells relations, Thermodynamic potentials: Internal Energy, Helmholtz Potential, Enthalpy, Gibb free Energy . entropy as function of temperature and pressure, entropy as function of temperature and specific volume, Specific heat relations, Clausius-Clapeyron equation

Unit VI: SOLUTION THERMODYNAMICS

Concepts of chemical potential and fugacity, Ideal and non ideal solutions, Activity Coefficient, Criteria for phase equilibrium; Vapor-liquid equilibrium calculations for binary mixtures from Raoult's law and Henry's law

TEXT BOOKS:

1. Y.V.C.Rao An introduction to Thermodynamics, University Press.
2. J.M.smith, H.C.Van Ness and M.M.Abbott. Introduction to chemical Engineering Thermodynamics McGraw Hill.

References:

1. P.K.Nag "Engineering thermodynamics" ,The McGraw Hill Companies, IV ed.

II Year II Semester**B.TECH - BIOTECHNOLOGY
(5G410) BIOPROCESS ENGINEERING**

a	b	c	d	e	f	g	h	i	j	k	l
X	X					X				X	

L T P/D C
3 1 - 3

COURSE OUTCOMES

1. Ability to use microorganisms to transform biological materials for production of fermented foods has its origins in antiquity, such as antibiotics, therapeutic proteins and vaccines which involves upstream and downstream processes.
2. Ability to focus on basic design, ancillaries of fermenter and various important parameters to be monitored and controlled in fermentation process. This enables the student to get a basic idea of fermenter ,operation and maintainance and about different types of reactors which improves their practical knowledge
3. Ability to demonstrate importance and different types of media and use statistical techniques like Plackett-Burman design to solve problems
4. Ability to apply stoichiometry to reactions in the fermentor, yield coefients and apply stoichiometric principles for macroscopic analysis of cell growth and product formation
5. Ability to demonstrate the growth curve of microbe in batch culture, difference between batch,continuos and fed batch culture and inhibition kinetics.
6. Ability to apply the knowledge of bioreactors for mass cultivation of cells

UNIT I: INTRODUCTION TO BIOPROCESS

An overview of traditional and modern applications of biotechnology industry, outline of an integrated bioprocess and the various (upstream and downstream) unit operations involved in bioprocesses, generalized process flow sheets.

UNIT II: FERMENTATION -I

General requirements of fermentation processes, Basic design and construction of fermentor and ancillaries, Main parameters to be monitored and controlled in fermentation processes; An overview of aerobic and anaerobic fermentation processes and their application in the biotechnology industry, solid-substrate, slurry fermentation and its applications, whole cell immobilization

UNIT III: MEDIA FORMULATION

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

UNIT IV: STOICHIOMETRY

Stoichiometry of Cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients, Energy analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

UNIT V: GROWTH KINETICS

Phases of cell growth in batch cultures, Simple unstructured kinetic models for microbial growth, Monod model, Growth of filamentous organisms. Growth associated (primary) and non - growth associated (secondary) product formation Kinetics. Leudeking-Piret models, substrate and product inhibition on cell growth and product formation.

UNIT VI: BIOREACTORS

Differences and similarities between chemical and bioreactors, classifications of bioreactors, fluidized bed reactor, packed bed reactor, bubble column reactors air lift reactors. Bioreactor for plant and animals cells.

All relevant units will have basic numerical problems.

TEXT BOOKS

1. P.M. Doran, "Bioprocess Engineering Principles", Academic Press, 1995.
2. Stanbury, Whitaker, Hall "Principles of fermentation Technology,. Second Edition

References:

- 1 M. L. Shuler and F. kargi "Bioprocess engineering", Prentice Hall of India 1992.

II Year , II Semester

B.TECH - BIOTECHNOLOGY
PROBABILITY AND STATISTICS
 (Common to All Branches)

A	B	C	D	E	F	G	H	I	J	K	L
X											

Code: 5HC17

L	T	P/D	C
3	1	0	3

Course Outcomes: *Students*

1. *Learn basic concepts of probability and able to evaluate probability.*
2. *Will able to solve problems on discrete and continuous probability distributions.*
3. *Learn basic concepts of sampling distribution and able solve problems on estimation.*
4. *Will able to solve problems on correlation and regression.*
5. *Learn basic concepts of test of hypothesis and are able solve problems.*
6. *Learn fundamentals of design of experiments and quality control.*

UNIT-I

Probability: The Axioms of probability, Addition theorem, conditional probability, Multiplication theorem, Baye's Theorem. Random variable – Discrete and Continuous, probability mass and density functions, expectation and variance.

UNIT-II

Probability Distributions: Binomial, Poisson and Gaussian (Normal) distribution–Related properties.

UNIT-III

Sampling Distributions: Populations and samples, Sampling distribution of the Mean (σ - known) and the sampling distribution of the mean (σ -unknown), proportions, sums and differences, Central limit theorem.

Estimation- Point Estimation, Interval Estimation, Bayesian Estimation.

UNIT-IV

Correlation and Regression: Types of correlation, coefficient of correlation, Properties. Methods of finding the coefficient of correlation, Scatter diagram, direct method, Spearman's rank correlation, Karl Pearson's formula. Types of Regression, linear regression, multiple regressions.

UNIT-V**Inferences Concerning Means and Proportions:**

Tests of Hypothesis, Type-I and Type-II Errors, Hypothesis testing concerning to one mean and two means of large and small size samples. Test of Hypothesis Concerning to Proportions.

Test of significance: Student t-test, χ^2 test-Goodness of fit, Independence of Attributes and Elements of ANOVA (one way and two way).

UNIT-VI

Statistical Design of experiments: Basic concepts of CRD, RBD and Latin square designs.

Quality Control: Control Charts –Control lines, determination of control limits, Types of control charts- Control charts for variables (mean chart, Range chart) – charts for attributes (fraction defective, no. of defectives and defects for unit)

Text Books:

1. Probability and Statistics for Engineers: Miller and John E. Freund, PHI Publishers, 9th Edition.
2. Probability and Statistics for Science and Engineering, G.Shnaker Rao, University Press.
3. Fundamentals of Mathematical Statistics: Gupta and Kapoor – S. Chand and Co.
4. Statistical Quality Control, M.Mahajan, Dhanpat Rai & Sons

Syllabus for B. Tech II Year II semester
(Common to all branches)
EFFECTIVE ENGLISH COMMUNICATION (EEC)

Subject Code:5H474

L	T	P	C
-	1	2	1

A	B	C	D	E	F	G	H	I	J	K	L
							X	X	X		X

COURSE OBJECTIVES

To enable the students to

- Acquire mastery in applying various sub-skills of reading
- Develop oratory skills
- Hone the “right” professional traits (Positive thinking, critical thinking etc)
- Attain standard proficiency in all types of professional communication

UNIT I

Reading Comprehension

- Skimming / Scanning
- Speed Reading
- Prediction of Content
- Reading for Specific Information
- Reading for Gist
- Reading Scientific Text
- Reading NEWSPAPER

UNIT II:

Public Speaking

- Audience Analysis
- Overcoming Stage Fear
- Vocal Aspects
- Body Language
- Dos and Don'ts

UNIT III:

Book Review

- Thematic Study – Main and Sub Plot
- Critical Review
- Character Analysis

UNIT IV:

Positive Attitude and Critical thinking

- Nurturing Positive Attitude and critical thinking
- Related Experiences
- Subjective and Objective Views / Perceptions

UNIT V:

Team Skills/Dynamics

- Difference between Group and Team
- Forming Teams
- Leading Teams
- Team Ethics
- Problem solving/conflict management
- Roles and Responsibilities (Leaders and Members)

UNIT VI:

Project Work

- Project work based on Survey and Analysis
- Project on Employability
- Project on Higher Education
- Project on Scholarship Awareness
- Project on Universities (India and Overseas)

Text Book:

Advanced English Proficiency Course: Volume-II

Suggested Reading:

Mastering Communication at Work- Ethan F Becker, Jon Wortmann- Tmh

Oral Business Communication- Urmila Rai and S M Rai- ***hph***

Strategies for Engineering Communication- Susan Stevenson Steve Whitmore- Wiley

Essentials of Business Communication Skills For Engineers- Urmila Rai And M Rai-
HPH

Effective Communication and Public Speaking- S K Mandal- Jaico

II Year II Semester

B.TECH - BIOTECHNOLOGY

(5G473) ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY

L T P/D C
- - 3 2

a	b	c	d	e	f	g	h	i	j	k	l
	x	x	x								

1. Calibration of pH meter, Colorimeter and conductive meter
2. Demonstration of viable cells using Phase Contrast Microscopy
3. Verification of Beer Lambert's Law & Determination of Molar Extinction Coefficient by UV – VIS spectrophotometer
4. Absorption Spectra of Nucleic acids & Amino Acids
5. Estimation of turbidity using Nephelometer
6. Emission spectra of Anthracene using Spectrofluorimeter
7. Estimation of proteins by U.V. Spectrophotometric method
8. Estimation of nucleic acids by U.V. Spectrophotometric method.
9. Separation of compounds by Paper Chromatography
10. Separation of compounds by Thin layer Chromatography
11. Dialysis

II Year II Semester

B.TECH - BIOTECHNOLOGY

a	b	c	d	e	f	g	h	i	j	k	l
	x	x	x								

(5G474) BIOPROCESS ENGINEERING LABORATORY

L T P/D C
- - 3 2

1. Extraction of commercially important enzymes from natural source
2. Quantification of enzyme activity and specific activity
3. Effect of pH, temperature, enzyme and concentration of substrate on enzyme activity
4. Estimation of Michaelis - Menten parameters
5. Immobilization of cells using gel entrapment and calculation of average diameter of bead.
6. Estimation of Monod's parameters μ_{max} and k_s
7. Demonstration of Batch, Fed-batch reactors.
8. Production and estimation of ethanol from Glucose using *Sacharomyces cerevisiae* in batch reactor
9. Production of wine
10. Production and estimation of citric acid by *Aspergillus niger*
11. Determination of BOD
12. Production and assay of antibiotic

II Year II semester

B. TECH - BIOTECHNOLOGY
(Common to all branches)
COMPREHENSIVE VIVA VOCE - I

Subject Code:5G475

L T P C
- - - 1

a	b	c	d	e	f	g	h	i	j	k	l
x	x								x		

Course Outcome :

1. Comprehend the concepts in the core and elective courses.
2. Exhibit technical knowlegde to face interviews.
3. Exhibit life long Learning skills for higher education and to persue Professional practice.

There shall be a Comprehensive Viva-Voce in II year II semester. The Comprehensive Viva-Voce will be evaluated for 100 marks, out of which 25 marks is internal and 75 marks external. The internal evaluation is done by HOD, Two Senior professors /Associate Professors in the department and Comprehensive Viva-Voce coordinator.

The internal evaluation shall consists of

First mid-sessional viva at the end of 5 weeks -25 Marks

Second mid-sessional viva at the end of 10 weeks -25 Marks

The average of two **mid-sessional vivas** will be taken into consideration.

The External 75 marks is evaluated by a Committee consisting of an External Examiner, HoD, and two senior faculty members of the department during End practical examination.

II Year II semester

**B. TECH - BIOTECHNOLOGY
(Common to all branches)
TECHNICAL SEMINAR**

Subject Code: 5G494

L T P C
- - 2 1

a	b	c	d	e	f	g	h	i	j	k	l
x	x								x		

COURSE OUTCOMES:

1. Deliver lecture on emerging technologies.
2. Explain domain knowledge to resolve real time technical issues
3. Demonstrate ability to lead and explain concepts and innovative ideas.
4. Demonstrate team leading qualities.
5. Demonstrate public speaking and lifelong learning skills for higher studies and to pursue professional practice.
6. Exchange new information that would not have been available otherwise.
7. Develop debating and interview skills.

Procedure:

1. Seminar in-charges shall highlight the significance of Technical Seminar in the first two sessions and enlighten the students on the utility of these seminars.
2. The slots, titles shall be decided upfront and seminar In-charge shall take signatures from students.
3. The same sheet shall be affixed in the respective classrooms and seminar register.
4. If any student fails to present his/her seminar on the given slot, to genuine reasons, they may be asked to present in the subsequent slot / week.
5. Progress of the seminars needs to be reviewed by the concerned HOD once in 15 days.
6. The evaluation for Technical Seminars has to be informed to students and displayed in the classrooms.
7. Report and presentation must contain topic, introduction, explanation, diagrams, tables, applications and conclusions.

Distribution of Marks

Day to day progress of the work	15 marks
Final report and viva	15 marks
Level of content	20 marks
Presentation	20 marks
Discussion & Involvement	20 marks
Attendance	10 marks
Total	100 Marks

III year I Semester, B. Tech – Biotechnology

a	b	c	d	e	f	g	h	i	j	k	l
			x					x	x	x	x

L	T	P/D	C
2	1	0	2

5ZC01 MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Course Objective: To make the students understand the concepts and principles of Business Economics at micro level and basic principles of Financial Accounting and Analysis, which facilitate them in making better planning and decisions.

Course Out Comes:

- 1) Understand the basics of Business Economics at Micro level and Demand analysis in particular.
- 2) Understand Production patterns and various Costs involved.
- 3) Understand different types of Markets, Business organizations and Pricing strategies.
- 4) Enrich students with basic concepts of Financial Accounting.
- 5) Understand basic concepts of Depreciation and Final accounts.
- 6) Increase Competence of Analyzing Financial Statements.

UNIT I

INTRODUCTION TO MANAGERIAL ECONOMICS: Definition, Nature and Scope of Business Economics–Demand Analysis: Demand Determinants, Law of Demand and its exceptions, Elasticity of Demand and Demand Forecasting.

UNIT II

THEORY OF PRODUCTION AND COST ANALYSIS: Production Function – Isoquants and Isocosts, Internal and External Economies of Scale, Laws of Returns. Cost Analysis: Cost concepts, different types of costs, cost control and cost efficiency, Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems).

UNIT III

INTRODUCTION TO MARKETS: Market structures: Types of competition, Features of Perfect competition, Monopoly and Monopolistic Competition. Pricing strategies, transfer pricing and performance measurement, Price-Output Determination in case of Perfect Competition and Monopoly

UNIT IV

FUNDAMENTALS OF FINANCIAL ACCOUNTING: Definition of Accounting, Concepts and conventions, principles of Double-Entry system, Book Keeping, Overview of books of original records Journal, Ledger and Subsidiary books

UNIT V

Depreciation of Fixed Assets and Final Accounts

Depreciation, Depreciation of fixed assets, Methods of Depreciation – Straight line method and Diminishing Balance method Classification of revenue and capital expenses, Trial Balance, Final Accounts - Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments.

UNIT VI

RATIO ANALYSIS: Introduction to Ratio analysis – Leverage ratios – Liquidity ratios – Turnover ratios – Profitability ratios, Du-pont chart. (Simple problems)

Books Recommended:

- Aryasri: Managerial Economics and Financial Analysis, 2/e, TMH, 2005.

References:

- Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.
- H. Craig Peterson & W. Cris Lewis, Managerial Economics, PHI, 4th Ed.
- Suma Damodaran, Managerial Economics, Oxford University Press.

**III year I Semester, B. Tech – Biotechnology
(5G511) GENETIC ENGINEERING**

a	b	c	d	e	f	g	H	i	j	k	l
	x	x	x		x						x

L T P/D C
3 1 - 3

OBJECTIVE: This course introduces students to the concept of genetic engineering and biotechnology. It then examines the molecular cloning methods, the various cloning vectors and their hosts, and how to find the right vector for molecular cloning. Aspects of DNA amplification and analysis techniques, cloning and expression of mammalian and plant genes in bacteria and practical applications of genetic engineering and biotechnology are covered under this course.

Unit I: GENE REGULATION: Introduction to Gene regulation, Prokaryotic Gene regulation: The operon model- Lactose, Arabinose & Tryptophan. Regulation of Eukaryotic Gene Expression; Repetitive DNA, Gene Rearrangement, Promoters, Repressors, Activators and Enhancer Elements, Gene Amplification

Unit II: PLASMIDS AND TRANSPOSONS: Definition, Types, Classification, Identification, and Transfer of Plasmids. Isolation and purification of plasmids; Transposons: Definition, Types of Bacterial transposons, mechanisms of transposition and excision, Applications of transposons: Retrotransposons

Unit III: DNA MANIPULATIONS: Purification of DNA, Introduction to Gene manipulation. DNA modifying enzymes Nucleases, Types of Nucleases, Types of Endonucleases. Host restriction and transfer in bacteria. DNA Ligases - Linkers, Adaptors, Homo polymer tailing. Introduction of DNA into living cells- Gene transfer methods- Chemical transformation, Electroporation and Gene Gun

Unit IV: VECTORS AND EXPRESSION: Properties of ideal vectors and types of vectors. Plasmid Vectors, construction of prototype plasmid vector -pBR 322 & pUC 19. Bacteriophage vectors -M13,λ vector, Cosmid, SV40 and Baculoviruses, Expression vector-pGem, Yeast cloning vectors- 2μm Plasmid, YEp, YAC. Expression of heterologus protein in Bacteria (Insulin), Yeast (Hepatitis surface antigen), and Mammalian cells (Tissue plasomogen activator)

Unit V: CLONE SELECTION & PCR TECHNOLOGIES: Genomic and cDNA library construction and its screening. DNA Hybridization, Blot Analysis - Dot Blot, Southern, Northern & Western blot. Principle involved in PCR, designing of primers, PCR methodology, RT - PCR, Multiplex PCR, PCR based Site Directed Mutagenesis

Unit VI: APPLICATIONS OF GENETIC ENGINEERING: Molecular Markers: RFLP, RAPD, AFLP and 16s r-RNA Typing, Gene Therapy (Case Study- ADA) Gene Silencing (RNAi) Introduction to CRISPR.

TEXT BOOKS:

1. Principles of Gene Manipulation, an Introduction to Genetic Engineering Old R. W. Primrose S B, - Blackwell Scientific Publications
2. Gene Cloning and DNA Analysis: An Introduction, T A Brown, *6th edition*. Wiley-Blackwell publications

Reference Books:

1. DNA cloning 1 and 2. Glover, D.M. and Hames, B.D. 1995. IRL Press Oxford University Press.
2. Benjamin Lewin: Gene VII, Oxford University Press, Oxford,
3. An Introduction to Genetic Engineering by Desmond S.T. Nicholl, Cambridge University Press
4. Recombinant DNA. By James D Watson and Michael Gilman. 2nd Edition, (2001). W. H Freeman and Company NY.
5. Molecular Biotechnology: Principles Application of Recombinant DNA by Bernard R Glick and Jack J. Pasternak, 2nd Edition. ASM press Washington DC.

COURSE OUTCOME (CO)		POs
CO:1	To Analyze various operon in bacteria and have Knowledge about Promoters, Repressors, Activators and Enhancer elements, gene amplification	b,c,d,l
CO:II	Classify quantify and isolate different types of plasmids and transposons	b,c,d,l
CO:III	Classify and illustrate the different types of DNA manipulating techniques	b,c,d,l
CO:IV	Classy and illustrate methods of transfer of gene delivery vehicles	b,c,d,l
CO:V	To analyze screening and detection of clones and To Analyze and Identify DNA using PCR	b,c,d,f,l
CO:VI	To have a fair knowledge about various applications of Genetic Engineering	b,c,d,f,l

III Year I Semester

(5G512) BIOINFORMATICS

a	b	c	d	e	f	g	h	i	j	k	l
X	X	X	X	X				X			X

L T P/D C
3 1 - 3

Course Objective:

To impart knowledge on basic techniques of Bioinformatics and to provide a practical description of the topics, tools, issues and current trends in the field including its impact on biology, biotechnology, human health and medicine.

Unit I: Scope Of Bioinformatics: History, definition, importance and applications of bioinformatics, Elementary commands and protocols, ftp, telnet, http.

Unit II: Biological Databases: Introduction to biological data, Organization and management of databases, Nucleotide databases (NCBI, DDBJ, EMBL), Protein Databases (SWISS PROT, PDB, SCOP, CATH), pathway databases (KEGG), Drug Database (Zinc database)

Unit III: Sequence Alignment: Basic concepts of sequence similarity, identity and homology, definitions of homologues, orthologues, and paralogues. Dynamic Programming, Dot Matrix analysis, Smith-Waterman Algorithm, Needleman-Wunsch Algorithm, Scoring matrices: PAM and BLOSUM matrices

Unit IV: Multiple Sequence Alignment And Phylogenetic Analysis: Basic concepts of various approaches for MSA (e.g. progressive, hierarchical etc.). Algorithm of CLUSTALW and its application, Taxonomy and phylogeny: Definition and description of phylogenetic trees and various types of trees.

Unit V: Genomics And Proteomics: Human Genome Project, DNA sequencing, Sanger and Shotgun Sequencing methods, Protein structure, secondary structure prediction and Homology Modeling.

UNIT-VI: Molecular Simulations and Drug Design: Molecular Docking by Argus lab, Auto dock software's Protein-ligand interactions, Protein-protein interactions Drug discovery cycle, Role of Bioinformatics in Drug discovery.

TEXT BOOKS:

1. Bioinformatics. David Mount, 2000. CSH Publications

REFERENCES:

1. Bioinformatics: A Machine Learning Approach P. Baldi. S. Brunak, MIT Press 1988.
2. Genomics and Proteomics-Functional and Computational aspects. Springer Publications. Editor-Sandor Suhai.
3. Bioinformatics – A Practical guide to the Analysis of Genes and Proteins – Andreas D. Baxeavanis, B.F. Francis Ouellette.

COURSE OUTCOME (CO)		POs
CO:I	Demonstrate knowledge and understanding of the biological, computational, engineering and mathematical sciences relevant to biotechnology	a
CO:II	Develop the ability to identify the computational problems within the living systems at molecular level	b,c
CO:III	To understand some basic computer science programming and bioinformatics software	c,e
CO:IV	Be familiar with tools for proteomic and genomic analyses.	c,e
CO:V	Gain an understanding of working in interdisciplinary teams of biologists, biochemists, medical researchers, geneticists, and computer engineers.	i,l
CO:VI	Gain an understanding of bioinformatics problems and their solutions and apply in health care	b,e,d

**III year I Semester, B. Tech – Biotechnology
(5G513) MASS TRANSFER AND SEPARATIONS**

a	b	c	d	e	f	g	h	i	j	k	l
X	X	X	X								

L T P/D C
3 2 0 4

Course Objective: To gain knowledge in fundamentals governing mass transfer and the principles governing a range of separation processes such as absorption, distillation, liquid extraction and oxygen transfer to cells. Students apply the knowledge to the design and evaluation of the separation processes.

UNIT I: PRINCIPLES OF MASS TRANSFER: Introduction to Mass Transfer and Diffusion, Molecular diffusion in gases, Molecular diffusion in Liquids, Molecular Diffusion in Biological solutions and gels, Film theory.

UNIT II: Mass transfer in Bioprocessing-I: Introduction to Convective Mass Transfer, Types of Mass Transfer coefficients and relation between them. Analogy between momentum, heat and mass transfer; Oxygen uptake in cell cultures, factors affecting oxygen transfer in fermenters, measuring dissolved oxygen concentration, estimating oxygen solubility, mass transfer correlations for oxygen transfer

UNIT III: Mass transfer in Bioprocessing-II: Measurement of $k_L a$, measurement of specific oxygen uptake rate, practical aspects of oxygen transfer in large fermenters, alternative methods for oxygenation without sparging, oxygen transfer in shake flasks

UNIT IV: ABSORPTION: Definition, Solubilities of gases in liquids, single stage (one component transferring) operation, Material balances, counter current multi stage operation continuous contact equipments.

UNIT V: DISTILLATION: Relative volatility, single stage equilibrium distillation, simple distillation, Rayleigh equation and steam distillation operation; continuous distillation, continuous multi stage tray towers, McCabe and Thiele Method, Graphical procedure to calculate number of trays (theoretical plates

UNIT VI: LIQUID-LIQUID EXTRACTION AND DRYING: Types of equilibrium system, Single stage extraction, Multi stage cross and counter current operations. **Drying** theory, drying kinetics, mechanism of batch drying, various drying operations, Spray drier, Fluidized Bed drier, Pneumatic drier

TEXT BOOKS:

1. Robert E. Treybal, Mass Transfer Operations III Edition, Mc. Graw Hill International.
2. Christi J. Geankoplis, Transport process & Unit operations, III ed., Prentice Hall India Pvt. Ltd.
3. Pauline M Doran, "Bioprocess Engineering Principles", Academic Press 2nd edition, 2013.

REFERENCES:

1. Judson King: Separation Processes, II Edition, Mc Graw Hill Chemical Engineering series.
2. Philip A. Schweitzer, Handbook of separation Techniques for chemical Engineering, III Edition, Mc. Graw Hill.
3. Philip C. Wankat Rate, Controlled separations, Chapman and Hall, 1985.

Course Outcomes		PO
CO-I	To build basic knowledge in diffusion. Diffusion in different phases. Applications of diffusion in gels and biological solutions.	a
CO-II	Analyzes convective mass transfer, Interface mass transfer, oxygen uptake by the cells and resistances in it.	a, b
CO-III	Understands the mechanism of oxygen transfer in large fermenters and in shake flasks	c
CO-IV	Understands the basic mechanism of absorption. Application of absorption in Industries and able to design the absorption units.	c
CO-V	Simplifies the mechanism of distillation, its importance in process industry and able to design distillation column.	c, d
CO-VI	Determines the importance of liquid-liquid extraction and its application in chemical and biotechnology industry. Understands drying techniques and its applications.	b

**III Year I Semester, B. Tech – Biotechnology
(5G514) MOLECULAR PATHOGENESIS (PROFESSIONAL ELECTIVE-I)**

a	b	c	d	e	f	g	h	i	j	k	l
	x	x	x	X	x						X

**L T P/D
C
3 1 -**

3

OBJECTIVE: The course helps in understanding the virulence of the pathogen and Host - parasite interactions for advanced academic and industrial research in molecular pathogenesis

UNIT I MICROBIAL VIRULENCE FACTORS: Components of microbial pathogenicity, Population diversity in microbes and methods to detect diversity.

UNIT II HOST FACTORS IN PATHOGENESIS: Host defense- physical (skin, mucosa), Chemical (pH, enzymes) and immunological (brief); modes of pathogen entry.

UNIT III HOST-PATHOGEN INTERACTION: Virulence, mechanisms of colonization, disease caused without colonization. Various damages induced in host by pathogen, virulent genes and their regulation and role of bacterial biofilms.

UNIT IV EXPERIMENTAL METHODS TO STUDY HOST-PATHOGEN INTERACTION: Selection of pathogen Model, measurement of virulence, Identification of potential virulence factors considering one example each from Bacteria, viral and parasite

UNIT V MODULATION OF HOST RESPONSE: Immune modulation and evasion, Interleukins (IL-4, IL-2, IFN gamma, IL-12), Chemokines (IL-8, RANTES, CCR/CXCR), Interferons (alpha, beta and gamma).

UNIT VI PARADIGMS OF PATHOGENESIS: Gastroduodenal ulcers, Tuberculosis and other mycobacterial infections, HIV/AIDS, hepatitis, malaria, round worm infestation.

TEXT BOOKS

1. Molecular basis of Bacterial Pathogenesis, Iglewski BH and Clark VL., Academic Press, 1993
2. Immunobiology, Janeway CA and Travers PT., Blackwell Scientific Publishers, 1994

REFERENCE BOOKS

1. Talaro K and Talaro A Foundations in Microbiology, WC Brown Publishers, 1993
2. Roitt I. Essentials of Immunology, 8th Edition, Blackwell Scientific Publishers, 1994
3. Austyn JM and Wood KJ. Principles of Cellular and Molecular Immunology, Oxford University Press, 1993

COURSE OUTCOME (CO)		POs
CO:I	To explain various Components of microbial pathogenecity and methods to detect microbial diversity	b,c,d
CO:II	Examine the various methods of Host defense against pathogens and also mode of entry of pathogens	b,c,d
CO:III	Asses host-pathogen interaction and their importance in disease progression	b,c,d
CO:IV	Evaluate experimental methods to study host-pathogen interaction	b,c,d,e
CO:V	To explain the importance of host Immune modulation in response to the pathogen	b,c,d
CO:VI	To Determine paradigms of pathogenesis	b,c,d,f,l

**III Year I Semester, B. Tech – Biotechnology
(5G515) METABOLIC ENGINEERING
(PROFESSIONAL ELECTIVE-I)**

a	b	c	d	e	f	g	h	i	j	k	l
	x	x	x	X	x						X

L T P/D C
3 1 - 3

UNIT I : Introduction

Identification of metabolic regulation is a key point in metabolic engineering. Basic concepts of Metabolic Engineering – Overview of cellular metabolism – Different models for cellular reactions, induction – Jacob Monod model and its regulation, Differential regulation by isoenzymes, Feed back regulation.

UNIT II : Biosynthesis of Primary Metabolites

Amino acid synthesis pathways and its regulation at enzyme level and whole cell level, Alteration of feed back regulation,

UNIT III: Biosynthesis of Secondary Metabolites

Regulation of secondary metabolite pathways, precursor effects, prophase, idiophase relationship, Catabolite regulation by passing control of secondary metabolism, producers of secondary metabolites, applications of secondary metabolites.

UNIT IV: Regulation of Enzyme Production

Strain selection, Genetic improvement of strains, Gene dosage, metabolic pathway manipulations to improve fermentation, Feed back repression, Catabolite Repression, optimization and control of metabolic activities. The modification of existing - or the introduction of entirely new - metabolic pathways

UNIT V: Metabolic flux

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

UNIT VI: Metabolic engineering with Bioinformatics

Bioinformatics for Metabolic Networks Systems biology frameworks for metabolic engineering; Concepts of metabolic networks; Establishment of metabolic flux analysis and metabolic control analysis, applications of Metabolic engineering with examples.

Text Books

1. Adrian Slater, Nigel Scott and Mark Fowler, Plant Biotechnology: The genetic manipulation of plants, 1st Edition, Oxford University Press, 2003)
2. Chrispeels, MJ and Sadava, DE, Plants Genes and Crop Biotechnology 2003 2nd Edition, American Society of Plant Biologists, Jones and Barlett Publishers, USA.
3. Arie Altman, Marcel Dekkers, Inc 2001 Agricultural Biotechnology
4. Biochemistry and Molecular Biology of Plants Edited by Buchanan, Grissem and Jones 2000, American Society of Plant Biologists, USA.

References :

Zubay G., Biochemistry, Macmillan Publishers, 1989.

**III Year I Semester, B. Tech – Biotechnology
(5G516) Environmental Biotechnology
(PROFESSIONAL ELECTIVE-I)**

a	b	c	d	e	f	g	h	i	j	k	l
	x	x	x	X	L	x					X
				T		P		C			
				3		1		3			

Objective

To gain knowledge in important biotechnological principles and processes in environmental management and in the production of valuable products, to develop professional engineering solutions on waste water and solid waste management for a sustainable development.

UNIT I: Biological Treatment of Wastewater – Aerobic System Biological processes for domestic waste water treatments; Aerobic systems - activated sludge process, trickling filters, biological filters, rotating biological contractors (RBC) Anaerobic biological treatment - contact digesters, UASB.

UNIT II: Bioremediation: Concept of bioremediation, types of bioremediation, Solid phase bioremediation - land farming, prepared beds, soil piles, Composting, Bioventing & Biosparging; Liquid phase bioremediation - suspended bioreactors, fixed biofilm reactors. Phytoremediation

UNIT III: Metal Biotechnology: Bioleaching – Mechanism and its types. Bioleaching of copper, uranium, Biosorption of heavy metal, strategies of heavy metal resistance, Bidesulfurisation of coal

UNIT IV: Eco-Friendly Products: Bioplastics –PHB, Polylactide (PLA) , Biofertilizers – *Rhizobium*, *Azotobacter*, *Azospirillum*, Phosphate solubilizing microorganisms, biopesticides – *Trichoderma*, *Bacillus thuringensis*, Biofuels- methane , biodiesel

UNIT V: Environmental Monitoring: Biological methods- Detection methods for DO, BOD, Pathogen monitoring by heterotrophic plate count, multiple tube method, enzyme detection, Metagenomics, Chemical methods- Detection methods for COD

UNIT VI: Hazardous waste Management: Biotechnology application to hazardous waste management – cyanide detoxification, detoxification of oxalate, urea.

TEXT BOOKS:

1. Environmental Biotechnology By Allen K., Cbs Publisher, Edition 2016, ISBN: 8123928327.
2. Text Book of Environmental Biotechnology by P.K Mohapatra, Edition 2016, I K International Publishing House Pvt. Ltd.

REFERENCE BOOK

Environmental Biotechnology by Vallero, Edition 2010, Elsevier , ISBN: 9380931026

COURSE OUTCOME (CO)	
CO:I	Student shall be able to gain knowledge and apply the biotechnological techniques of pollution control mechanisms
CO:II	Student shall be able to perform the biotechnological methods of water and soil bioremediation
CO:III	Student shall be able to understand the methods of production of biofuels
CO:IV	Student shall be able to identify and detect the toxicants in environment
CO:V	Student shall be able to understand methods of bioleaching
CO:VI	Student shall be able to understand the biotechnological application for production of ecofriendly products

III year I Semester, B. Tech – Biotechnology**(5G517) INSTRUMENTATION AND BIOPROCESS CONTROL
(Professional Elective - I)**

a	b	c	d	e	f	g	h	i	j	k	l
X		X	X			X			X	X	

L T P/D C
3 1 - 3

Course Objective: This course aims at providing knowledge about different types of measuring instruments used in bioprocess industries. It also aims to provide an insight into basics of process control in bioreactors for controlling various process parameters.

UNIT I: ELEMENTS OF INSTRUMENTS : Basic concepts of response of first order type instruments, mercury in glass thermometer, bimetallic thermometer, pressure spring thermometer, static accuracy and response of thermometer. Thermo electricity, industrial thermocouples, measurement of temperature using thermocouples

UNIT II: MEASURING INSTRUMENTS: Measurements of liquid level, pressure measurement in open vessels, level measurements in pressure vessels, Liquid column manometers, measuring elements for gauge pressure and vacuum,, indicating elements for pressure gauges, measurement of absolute pressure.

UNIT III: BIOSENSORS : Types, transducers in biosensors – calorimetric, optical, potentiometric / amphoteric, conductometric / Resistometric, piezoelectric, semi conductor, mechanical and molecular electronics based, molecular wires and switches,

UNIT IV: FIRST AND SECOND ORDER SYSTEMS: Introduction to Laplace transform, Response of First order systems, Transfer function, Transient response to step, impulse, sinusoidal inputs, physical examples of First order systems, Liquid level, mixing process, concept of time constant. Transportation lag control systems, Servo and Regulatory control problems.

UNIT V: CONTROLLERS AND STABILITY: Introduction to block diagram, Ideal transfer function of operational, P, PI, PD and PID controllers. Reduction of physical control system to block diagram; Closed loop transfer functions for servo regulators problems. Overall Transfer function for multi loop control systems. Stability and control system by Routh's criterion.

UNIT VI: FREQUENCY RESPONSE: Introduction, generalization and transportation lag, Bode diagrams - first order system, First order system in series, second order system, Controllers.

TEXT BOOKS:

1. Industrial Instrumentation, Donald P. Eckman.
2. Process Systems Analysis and Control Donald Coughnowr, Second edition McGraw Hill, International Ed.1991.

REFERENCE:

1. Chemical Process Control, stephanoupoulis G., Prentice Hall, N.Delhi, 1990.

Course Outcomes:

CO : I	Ability to solve the first order system in real situation, and will be able to grasp the basic terminology in Instrumentation and process control
CO : II	In this unit student will learn about different types of meters which are used to study flow rates, velocities, etc.
CO : III	Ability to demonstrate the knowledge on bioapplications of process control and various examples like applications of biosensors in environment biotech, sugar test, pregnancy test etc...
CO : IV	Ability to demonstrate different types of systems(first and second order),and physical interpretation of different forcing functions
CO : V	Ability to demonstrate knowledge in different types of controllers their applicability in practical situation
CO : VI	Ability to demonstrate the process control of biological systems using electronic controllers

**III year I Semester, B. Tech – Biotechnology
(5G518) NANOBIO TECHNOLOGY
(PROFESSIONAL ELECTIVE-I)**

a	b	c	d	e	f	g	h	i	j	k	l
		x	x	x							

L T P/D C
3 1 - 3

OBJECTIVE

To gain knowledge in bionanotechnology and its application in the fields of medicine and environment, and to design and conduct experiment, analyze and interpret data in bionanotechnology for developing novel bionanoparticles and structures.

UNIT I: INTRODUCTION TO NANOTECHNOLOGY: Nanotechnology-historical perspective, Definition of nano scale with reference to biosystems; Nanobiotechnology Vs Bionanotechnology; Scope and future prospects; Challenges of nanotechnology.

UNIT II: NANOMATERIALS AND THEIR CHARACTERIZATION: Buckyballs, Nanotubes, Fullerenes, Dendrimers, Nanoparticles, Membranes / Matrices, Nanoshells, Quantum Dot, Nanocrystals, hybrid biological/inorganic devices, Scanning tunneling microscopy, DNA microarrays.

UNIT III: NANOMOLECULES IN BIOLOGICAL SYSTEMS: Lipids as building materials. Self organizing supra molecular structures, nanoscale Motors- Based on Bacteriorhodopsin, ATPase, Ion channels as sensors, DNA as nanowires

UNIT IV: MICROORGANISMS IN NANOMATERIAL SYNTHESIS: Nano biotechnology and microorganisms- PHA in nanobiotechnology, Synthesis of Gold Silver nanoparticles in microorganisms. Applications of Microbial nanoparticles

UNIT V: NANOBIO TECHNOLOGY APPLICATIONS-I: Function and application of DNA based nanostructures. Identification of pathogenic organisms by magnetic nanoparticle-based techniques. Photodynamic therapy, genetically engineered polymer protein, Tissue engineering.

UNIT VI: NANOBIO TECHNOLOGY APPLICATIONS-II: Applications of nanobiotechnology in drug delivery, nanobiosensors and nanobiochips. Nanotechnology for cancer diagnosis and treatment, nanoparticles as biocontrol agent in plants

TEXTBOOKS

1. M. Ratner and D.Ratner, Nanotechnology–a gentle introduction to the next big idea, Pearson Education, 2007.
2. Niemeyer C M and Mirkin C A 2004 Nanobiotechnology- concepts, applications and Perspectives wiley VCH Publishers, New Delhi India
3. R. R. Birge, Protein based computers, Scientific American, 1995.
4. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse Nanotechnology: Basic Science and Emerging Technologies Chapman and Hall/CRC 2002.
5. David S. Goodsell, Bionanotechnology lesson from nature, A John Wiley & Sons, Inc., Publication 2004

REFERENCES

1. L.E.Foster, Nanotechnology-Science, Innovation and opportunity, Person education inc, 2007.
2. Nanoelectronics and nanosystems-Karl Gosser-Springer Engineering Series.

CO : I	Student shall be able to gain knowledge about Scope and future prospects; Challenges of nanotechnology.
CO : II	Student shall be able to gain knowledge about various Nanomaterials and their characterization
CO : III	Student shall be able to gain knowledge about Nanomolecules in biological systems
CO : IV	Ability to demonstrate different types of Microorganism in nanomaterial synthesis
CO : V	Ability to demonstrate knowledge in different types applications of nanobiotechnology
CO : VI	Ability to demonstrate knowledge in different types applications of nanobiotechnology

III year I Semester, B. Tech – Biotechnology
DATA BASE SYSTEMS
(Open Elective-I)

Code: 5FC32

L	T	P/D	C
2	2	1	-

2

Course Objective

- Define a Database Management System
- Give a description of the Database Management structure
- Define a Database
- Define basic foundational terms of Database
- Understand the applications of Databases
- Know the advantages and disadvantages of the different models
- Compare relational model with the Structured Query Language (SQL)
- Know the constraints and controversies associated with relational database model.
- Know the rules guiding transaction ACID
- Identify the major types of relational management systems.
- Compare and contrast the types of RDBMS based on several criteria.
- Understand the concept of data planning and Database design.
- Know the steps in the development of Databases.
- Trace the history and development process of SQL.
- Know the scope and extension of SQL.
- Identify the various functions of Database Administrator.

Course Outcomes

Students will be able to:

1. Explain the basic concepts and the applications of database systems.
2. Utilize the knowledge of basics of SQL and construct queries using SQL.
3. Use commercial relational database system (Oracle) by writing Queries using SQL.
4. Apply relational database theory, and be able to write relational algebra expressions for queries.
5. Explain & use design principles for logical design of databases, including the E-R method and normalization approach.
6. Compare the basic database storage structures and access techniques: file and page organizations, indexing methods including B-tree, and hashing.
7. Demonstrate the basics of query evaluation and apply query optimization techniques.
8. Explain basic issues of transaction processing and concurrency control.

9. Work successfully on a team by design and development of a database application system as part of a team

UNIT I :Data Base Systems:

Data Vs Information, Data base System Applications, data base System VS file System – View of Data – Data Abstraction –Instances and Schemas – data Models – the ER Model – Relational Model – Other Models – Database Languages – DDL – DML – database Access for applications Programs – data base Users and Administrator – Transaction Management – data base System Structure – Storage Manager – the Query Processor, History of Data base Systems.

Data base design and ER diagrams – Design Entities, Attributes and Entity sets – Relationships and Relationship sets – Additional features of ER Model – Concept Design with the ER Model –Data Modeling checklist.

Application- ER diagram for a tiny college

UNIT II:

Introduction to the Relational Model – Integrity Constraint Over relations – Enforcing Integrity constraints – Querying relational data – Logical data base Design – Introduction to Views – Destroying /altering Tables and Views.

Relational Algebra – Selection and projection set operations – renaming – Joins – Division – Examples of Algebra overviews – Relational calculus – Tuple relational Calculus – Domain relational calculus – Expressive Power of Algebra and calculus.

Application-Student database design.

UNIT III:

Form of Basic SQL Query – Examples of Basic SQL Queries – Introduction to Nested Queries – Correlated Nested Queries Set – Comparison Operators – Aggregative Operators – NULL values – Comparison using Null values – Logical connectivity's – AND, OR and NOT – Impact on SQL Constructs – Outer Joins – Disallowing NULL values – Complex Integrity Constraints in SQL Triggers, Embedded SQL.

Application-working with Aviation company database.

UNIT IV:

Schema refinement – Problems Caused by redundancy – Decompositions – Problem related to decomposition – reasoning about FDS – FIRST, SECOND, THIRD Normal forms – BCNF – Lossless join Decomposition – Dependency preserving Decomposition – Schema refinement in Data base Design – Multi valued Dependencies – FORTH Normal Form.

Application-Faculty Evaluation Report.

UNIT V :

Transaction Concept- Transaction State- Implementation of Atomicity and Durability – Concurrent – Executions – Serializability- Recoverability – Implementation of Isolation – Testing for serializability- Lock –Based Protocols – Timestamp Based Protocols- Validation- Based Protocols – Multiple Granularity, Recovery and Atomicity – Log – Based Recovery – Recovery with Concurrent Transactions – Buffer Management – Failure with loss of nonvolatile storage-Advance Recovery systems- Remote Backup systems,

Application-Production Management System.

UNIT VI :

Data on External Storage – File Organization and Indexing – Cluster Indexes, Primary and Secondary Indexes – Index data Structures – Hash Based Indexing – Tree base Indexing – Comparison of File Organizations – Indexes and Performance Tuning- Intuitions for tree Indexes – Indexed Sequential Access Methods (ISAM) – B+ Trees: A Dynamic Index Structure, Query Optimization techniques. Application – Creating B+ tree on Instructor File.

TEXT BOOKS :

1. Data base System Concepts, Silberschatz, Korth, McGraw hill, V edition.
2. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition
3. Database Management Systems, Peter Rob, A.Ananda Rao, Carlos Coronel ,CENGAGE Learning

REFERENCES :

1. Data base Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate Pearson Education
3. Introduction to Database Systems, C.J.Date Pearson Education

III year I Semester, B. Tech – Biotechnology
SAP -I : SAP ABAP Workbench Fundamentals
(OPEN Elective -I)

CODE: 5EC26

L T P/D C
2 1 - 2

Course Objective		
<ol style="list-style-type: none"> 1. Understand the SAP NetWeaver AS fundamentals 2. Work with the ABAP Workbench tools 3. Write simple ABAP programs 4. Understand the ABAP Dictionary 		
Course Outcomes		
<ol style="list-style-type: none"> 1. To acquire through knowledge of SAP Net weaver architecture, ABAP fundamentals (like language elements, modularization, ABAP dictionary) 2. To write simple ABAP programs and reports 3. To be able to debug and analyze errors and performance of programs 		
Unit	Content	Hours
1	Introduction to enterprise resource planning(ERP) <ol style="list-style-type: none"> 1. ERP explained 2. System wide concepts 3. SAP applications and components 4. Sample end to end business process 	4
2	SAP Netweaver application server fundamentals <ol style="list-style-type: none"> 1. SAP systems and SAP applications portfolio 2. SAP Graphical User Interface and Navigation in AS ABAP systems 3. System core 4. Communication and integration technologies 	8
3	ABAP Work bench foundations - Part 1 <ol style="list-style-type: none"> 1. ABAP Program processing 2. ABAP Work bench tools 3. ABAP Language basics, open SQL 4. Modularization techniques 	10
4	ABAP Work bench foundations - Part 2 <ol style="list-style-type: none"> 1. Complex data objects, structures and internal tables 2. Data modeling and Data retrieval 3. Classic ABAP reports 4. Program analysis tools 5. Program calls and memory management 	10
5	ABAP Dictionary <ol style="list-style-type: none"> 1. Domains, Data elements and structures 2. Transparent tables, Pool tables and cluster tables 3. Input Checks 4. Dictionary object dependencies 5. Changes in table structure 6. Views 7. Search Helps 	10

6	Classical UI Programming	10
	1. Selection Screens 2. Screens (Dynpros)	

Textbooks:

1. ABAP Workbench Fundamentals, Part 1, SAP India
2. ABAP Workbench Fundamentals, Part 2, SAP India

References:

www.training.sap.com/in/en

III year I Semester

a	b	c	d	e	f	g	h	i	j	k	l
							x			x	

L	T	P/D	C
2	1	0	2

**5ZC03 BANKING OPERATIONS, INSURANCE AND RISK MANAGEMENT
(OPEN Elective -I)**

Course Objectives: To make the students understand the concepts and principles of Indian Banking Business, Insurance Business and Capital market business products and services, which facilitate them to understand the nature of market.

Course Out Comes:

- 1) Describe the new dimensions and products served by the banking system in INDIA.
- 2) Explain the credit control system and create awareness on NPA's
- 3) Apply the knowledge of Insurance concepts in real life scenarios
- 4) Recognize the importance of regulatory and legal frame work of IRDA
- 5) Identify the risk management process and methods.
- 6) Calculate the diversity of risk and return

UNIT I

INTRODUCTION TO BANKING BUSINESS: Introduction to financial services - History of banking business in India, Structure of Indian banking system: Types of accounts, advances and deposits in a bank. KYC norms, New Dimensions and products- E-Banking: Mobile-Banking, Net Banking, Digital Banking, Negotiable Instruments: Cheque system.

UNIT II

BANKING SYSTEMS AND ITS REGULATION: Banking Systems: Branch Banking, Unit Banking, Correspondent Banking, Group Banking, Deposit Banking, Mixed Banking and Investment Banking - Banking Sector Reforms with special reference to Prudential Norms, Capital Adequacy Norms, Classification of Assets and NPA's, Functions of RBI, Role of RBI in regulating Indian Banking. Banking Ombudsman scheme.

UNIT III

INTRODUCTION TO INSURANCE: Introduction to insurance, Need and importance of Insurance, principles of Insurance, characteristics of insurance contract, branches of insurance and types of insurance: Life insurance and its products, General Insurance and its variants.

UNIT IV

INSURANCE BUSINESS ENVIRONMENT: Procedure for issuing an insurance policy – Nomination - Surrender Value - Policy Loans – Assignment - Revivals and Claim Settlement; Insurance as a tax mitigation tool, Role of IRDA in Insurance Regulation.

UNIT V

FINANCIAL MARKETS AND RISK MANAGEMENT: Introduction to Financial Markets: Money Market – Capital market; Introduction to Risk Management, meaning and classification of risks, Risk management process, Risk Management Approaches and Techniques.

UNIT VI

DERIVATIVES AS A RISK MANAGEMENT TOOL: Introduction to Financial Derivatives, Advantages of Derivatives - types of Derivative Contracts - Forwards, Futures, Options and Swaps - Differences among Forwards, Futures and Option Contracts.

Books Recommended:

- Varshney, P.N., Banking Law and Practice, Sultan Chand & Sons, New Delhi.
- General Principles of Insurance Harding and Evantly
- Mark S. Dorfman: Risk Management and Insurance, Pearson, 2009.

References:

- Scott E. Harringam Gregory R. Nichanus: Risk Management & Insurance, TMH, 2009.
- Geroge E. Rejda: Principles of risk Management & Insurance, 9/e, pearson Education. 2009.
- G. Koteswar: Risk Management Insurance and Derivatives, Himalaya, 2008.

III year I Semester

a	b	c	d	e	f	g	h	i	j	k
								x		x

L	T	P/D	C
2	1	0	2

5ZC20 PRODUCT & SERVICES (OPEN Elective -I)

Course Objectives: This course helps to provide the basic concepts of Product and Services. This course will enable the students to study areas of basic insights in product management and Services Design.

Course Out Comes:

- 1) The students will be introduced to basic concepts of product .
- 2) Will enlighten the students with the process of new product development and stages in the process.
- 3) Will help the students understand the concept of product testing, product planning and the preparatory groundwork for launching a new product
- 4) Will help the students to understand the nature of services, its differences with the goods and the application of marketing principles for services.
- 5) Will enlighten the students to understand the attributes of a good service design and the tools for producing and distributing the services.
- 6) To make the students understand about the importance of quality of services and also introduce some measurement scales to evaluate the service quality.

UNIT- I

PRODUCT AS A COMMERCIAL FACTOR

Product concept: premarketing, product definition, product dimensions. Product classification- by its nature, by final use by reasons for purchase, by consumer groups.

UNIT- II

PRODUCT INNOVATION

New products-What is a new product, Concept, Reasons, Succeed and failure factors, Launch process, Opportunities identification, Idea generation Systems, Evaluation, Check list, Financial analysis, Product concept.

UNIT- III

PRODUCT MANAGEMENT

Concept test, Product testing, Pre-launch, Market test, Final evaluation “Stage / Gate Process” A sequence system for a product launch. Product planning and development- Product planning, Price planning, Break even point analysis, Communications Planning, Advertising Planning, Distribution planning

UNIT - IV: INTRODUCTION TO SERVICE:

Meaning and Definition of Service, Characteristics of Services, Classification of Service, Five levels of Service, Service verses Physical Goods, 7 P’s for Marketing of Services, Marketing Mix for Tourism, Hospitality, Education, and Health Industry.

UNIT – V: SERVICE PROCESS DESIGN:

Challenges & Critical Success Factors, Distribution Methods for Service, Process of Service Delivery, Tools for Service Design, Customer involvement in the Production Process, Tools for Innovation, Role of Intermediaries, Attributes of a Good Design.

UNIT – VI: QUALITY OF SERVICE:

Definition of Service Quality, Elements of Service Quality, Service Quality Measuring Tools; SERVQUAL Scale, Service Quality Gap Analysis, Objective Service Metrics, Cost of Quality in Service. Challenges and Problems of Service Quality in India.

Essential Readings:

- Dr. S.L. Gupta, Product Management, Wisdom Publications
- C. Merle Crawford, New Product Management
- Valarie A. Zeithaml & Mary Jo Bitner: Services Marketing—Integrating Customer Focus Across the Firm, 3/e, Tata McGraw Hill, 2007.
- Thomas J. DeLong & Asish Nanda: Managing Professional Services—Text and Cases, McGraw-Hill International, 2006.
- Christopher Lovelock: Services Marketing People, Technology, Strategy, Fourth Edition, Pearson Education, 2006

III year I Semester, B. Tech – Biotechnology

III Year B.Tech, Semester-I	QUANTITATIVE APTITUDE	L	T	P/D	C
Code: 5HC75	(Common to All Branches)	2	0	0	1
Pre Requisites: Nil					

Course Outcomes: *Students will able to answer*

- 1. The questions given on testing divisibility, prime number and questions of HCF and LCM*
- 2. The questions given on averages, percentage and profit and loss.*
- 3. The questions given on ratio and proportion.*
- 4. The questions given on simple and compound interest.*
- 5. The questions given on time and work, time and distance.*
- 6. The questions given on mensuration and data sufficiency.*

Unit I

Number System: Test for Divisibility, Test of prime number, Division and Remainder – HCF and LCM of Numbers - Fractions.

Unit II

Average: Average of different groups, Replacement of some of the items - Percentage - Profit and Loss.

Unit III

Ratio and Proportion: Properties of Ratio, Comparison of Ratios, Useful Simple Results on Proportion – Partnership and Share.

Unit IV

Simple Interest: Effect of change of P, R and T on Simple Interest - Compound Interest: Conversion Period, Difference between Compound Interest and Simple Interest.

Unit V

Time and Work- Pipes and Cisterns, Time and Distance- Problems on Trains- Boats and Streams, Allegation or Mixtures.

Unit VI

Mensuration: Area of Plane Figures, Volume and Surface Area of Solid Figures.
Data Interpretation: Tabulation, Bar Graphs, Pie Charts, Line Graphs.

Text Books:

1. Quantitative Aptitude by R.S.Agarwal
2. Quantitative Aptitude by Abhijit Guha
3. Quantitative Aptitude for Competitive Examinations, U.Mohan Rao, Scitech Publication

III year I Semester, B. Tech – Biotechnology
III Year I Semester
(5G576) BIOINFORMATICS LABORATORY

a	b	c	d	e	f	g	h	i	j	k	l
X	X	X	X	X				X			X

L T P/D C
- - 3 2

COURSE OBJECTIVES

Be familiar with, and have a working knowledge of the Molecular, Statistical and Database tools for Proteomic and genomic analyses.

Acquire knowledge in the area of Drug discovery and development, a process in which biological and chemical structural knowledge are exploited intelligently, using computational assistance

1. Retrieval of information from Biological databases NCBI,UNI PROT
2. Protein structure databases – PDB,SCOP,CATH
3. Pathway Databases – KEGG,BIOCYC
4. Demonstration of BLAST, FASTA and other search engines
5. Multiple sequence alignment Using ClustalW/ X,
6. Phylogenetic analysis using Tree View and NJ PLOT
7. ORF finder (Gene Prediction)
8. Restriction site analysis tools
9. Protein visualization tools RASMOL and PyMol
10. Protein structure and Function analysis using SPDBV
11. Cheminformatics tool - Mol Inspiration
12. Protein ligand docking using Argus Lab

EQUIPMENTS: Computers , Internet facility, Bioinformatics software

REFERENCE BOOK:

BIOINFORMATICS. A Practical Guide to the. Analysis of Genes and Proteins. SECOND EDITION. Andreas D. Baxevanis, B. F. Francis Ouellette

COURSE OUTCOMES(CO)		PO'S
CO:1	Ability to explore various bioinformatics resources and learn how to perform routine data analysis by using computational software	c,d,e,f,i
CO:2	Ability to perform sequence alignment using various online tools and assess the homology between various species.	c,d,e,f,i
CO:3	Ability to use Phylogenetic analysis softwares and interpret the Phylogenetic relationship at the molecular level.	c,d,e,f,i
CO:4	Ability to analyze the genome sequence information for gene prediction and restriction digestion.	c,d,e,f,i
CO:5	Ability to understand the spatial arrangement of various amino acids in protein three dimensional conformation using visualization softwares	c,d,e,f,i
CO:6	Ability to use drug designing softwares and apply them in drug discovery process	c,d,e,f,i

**III year I Semester, B. Tech – Biotechnology
(5G577) Genetics, Molecular Biology and Genetic Engineering Lab**

a	b	c	d	e	f	g	h	i	j	k	l
	x	x	x		x			x			x

L T P/D C
- - 3 2

OBJECTIVE

This course provides necessary practical skills on Recombinant DNA technology and molecular biology and biotechnology techniques

1. Problems on Mendelian and Non Mendelian genetics
2. Isolation of Genomic DNA.
3. Separation of DNA by Agarose gel electrophoresis.
4. Yield analysis and Checking of purity of DNA samples.
5. Isolation of plasmid and visualization on Agarose gel.
6. Restriction Digestion of DNA
7. Ligation of DNA
8. Transformation of Bacterial Cells
9. Isolation of Total RNA
10. Southern Blotting of DNA
11. Characterization of Proteins by SDS-PAGE
12. Amplification of DNA using PCR

TEXT BOOKS

1. Molecular Cloning: A Laboratory Manual Fourth Edition, Green, Michael R. Cold Spring Harbor Laboratory Press, 2012
2. Current Protocols in Molecular Biology, Frederick M. Ausubel, Roger Brent, Robert E. Kingston, David D. Moore, J.G. Seidman, John A. Smith, Kevin Struhl (eds.), 2003 John Wiley & Sons, Inc.

**III year I Semester, B. Tech – Biotechnology
(5G578) GROUP PROJECT**

L T P/D C
- - 2 1

Course Objective :

To acquire basic knowledge on selecting a project , learn related tools and enhance programming and communication skills for employability.

Pre-Requisites: All Courses till this semester

Course Outcomes: After completing this course, student shall be able to

- Use the concepts learned in the courses, so far, in conceptualizing, designing and executing the modules of the projects.
- Exhibit the interest in learning the modern tools and technologies through the bridge courses arranged in the college, beyond the curriculum, and hence developing the software.
- Inculcate an enthusiasm to use the creative ideas to build the innovative projects which are meeting the current needs of the market and society as a whole.
- Improve their communicative skills and team skills largely improve.
- Work as an individual and in a team.

A group project shall be carried out by a group of students consisting of 2 to 3 in number in third year first semester. This work shall be carried out under the guidance of the faculty assigned as internal guide and shall involve design, fabrication, software development or any other significant activity. This can be of interdisciplinary nature also.

There will be 100 marks in total with 25 marks of internal evaluation and 75 marks of external

The internal evaluation shall consist of:

Day to day work	:	10 marks
Report	:	05 marks
Demonstration / presentation	:	10 marks

		25 marks
 End examination	 :	 75 Marks.

The end examination will be carried out by a committee consisting of an external examiner, head of the department, a senior faculty member and the supervisor.

III Year I Semester (5G595) Technical Literature Review & Seminar - 1

L	T	P/D	C
-	-	2	1

Pre-Requisites: All Courses till this semester

Course Objective :

Learn basics of technical paper writing and enhance verbal and writing skills, which is useful for employability

Pre-Requisites: All Courses till this semester

Course Outcomes: After completing this course, student shall be able to

- Identify a topic from the current technologies of their choice in the Biotechnology domain and the allied fields, after surveying in the internet resources, journals and technical magazines in the library.
- Arrange the contents of the presentation and also write the report of the research paper..
- Present the technical topic in front of the panel and the fellow students, using the oratory skills and also submit the report of the research paper.
- Interact through answering the questions and also can add some points to the seminar

There shall be a Technical Paper writing and seminar evaluated for 100 marks in Third Year First Semester. The evaluation is purely internal and will be conducted as follows:

Content	: 20 marks
Presentation including PPT	: 20 marks
Seminar Notes	: 10 marks
Interaction	: 10 marks
Report	: 25 marks
Attendance	: 10 marks
Punctuality	: 5 marks
Total	<u>100 marks</u>

III year II Semester

(5G619) PLANT BIOTECHNOLOGY

a	b	c	d	e	f	g	h	i	j	k	l
	X	X	X								X

L

L	T	P/D	C
3	1	-	3

Objective:

To learn the concepts, techniques and applications of Plant Cell, Tissue & Organ Culture and to apply them for crop improvement and new product development.

UNIT I: INTRODUCTION TO CELL AND TISSUE CULTURE: Concept of Totipotency, Tissue culture media (composition, preparation); Initiation and maintenance of aseptic culture, callus and cell suspension culture, Somatic embryogenesis, Organogenesis; Clonal propagation

UNIT II: TISSUE CULTURE APPLICATIONS: Protoplast isolation, culture fusion and somatic hybridization; Haploid Production, its application and limitations; Somaclonal variations; Short term and long term Germplasm conservation (Cryopreservation)

UNIT III: PRODUCTION OF PHYTOCHEMICALS: Study of various culture types for production of secondary metabolites in vitro, Strategies for enhancing product yield; Bioreactor systems for mass cultivation of plant cells, Production of Phyto-pharmaceuticals at commercial level (Shikonin, Berberine, Vinca alkaloids)

UNIT IV: TRANSFORMATION TECHNOLOGY: Basic concept and essential steps of the genetic transformation process; Vector Mediated gene transfer: *Agrobacterium*, Vector less : Physical Methods - electroporation, microinjection and particle bombardment chemical methods – PEG , Ca_2PO_4

UNIT V: TRANSGENIC PLANTS: Production of transgenic plants for Abiotic (Drought, Temperature, Salinity) and Biotic Stress (Herbicide resistance, Insect resistance, Bacterial & Fungal Disease resistance, Virus resistance)

UNIT VI: MOLECULAR FARMING: Biotechnology for quality Oil, Transgenic plants as bioreactors, Edible vaccine and Plantibodies.

TEXT BOOKS:

1. Roberta Smith, Plant Tissue Culture: Techniques & Experiments. 2nd ed., Acad. Press, 2000.
2. Bhojwani, S.S. and Razdan, Plant Tissue Culture: Theory and Practice. Elsevier Science, 2004
3. H. S. Chawla, Introduction to Plant Biotechnology, 3rd Edition, Science publishers, 2009

REFERENCES:

1. Bhojwani, S.S., Plant Tissue Culture: Application and Limitations. Amsterdam, Elsevier, 1990.
2. Charles Cunningham and Andrew J.R. Porter, Recombinant Proteins from Plants: Production & Isolation of Clinically Useful Compounds (Methods in Biotechnology), Humana Press, 1997.
3. Bernard R. Glick & John E. Thompson, Methods in Plant Mol. Biology & Biotechnology, CRC Press, 1993.

S. No.	COURSE OUTCOMES	POs
1	Understand & Explain Totipotency, Aseptic Culture systems & Micropropagation	b, c, I
2	Apply <i>in vitro</i> concepts for protoplasts to generate hybrids, produce Haploids, & Somaclones and compare Germplasm conservation methods	b, c, d, I
3	Synthesize commercial Phytochemicals <i>in vitro</i> and Enhance their productivity	b, c, d, I
4	Compare and Evaluate Plant Genetic Transformation systems	b, c, d, I
5	Create Transgenic plants with increased productivity and performance	b, c, d, I
6	Create Transgenic plants with novel products by Molecular farming	b, c, d, I

**III year II Semester, B. Tech – Biotechnology
(5G620) IMMUNOLOGY**

a	b	c	d	e	F	g	h	i	j	k	l
	X		X			X			X	X	

L T P/D C
3 1 - 3

OBJECTIVE

To gain knowledge in various aspects of human immune system, its types, functioning and its response to foreign materials, and to design and conduct research investigations on transplantation and immunological disorders using modern engineering and IT tools.

UNIT I: The Immune System and its biology: Introduction, Innate and acquired immunity. **Immunochemistry:** Immunogens, antigens, their chemical nature, Properties influencing immunogenicity, Haptens, adjuvants. **Cells of the Immune System:** Haematopoiesis, lymphocyte trafficking, T and B lymphocytes, Macrophages, Dendritic cells, Natural killer cells, Eosinophils, Neutrophils, Mast cells.

UNIT II: Organs of the Immune System: Primary and Secondary lymphoid organs (Thymus, Bone Marrow, Spleen, Lymph nodes, MALT, GALT, SALT)

UNIT III: Humoral Immunity: B-lymphocytes, their lineage, Immunoglobulins, their structure function, classes, sub classes, generation of antibody diversity. Activation of B cells, their differentiation and effector functions., Activation of B cells, their differentiation and effector functions. Complement and its activation.

UNIT IV: Antigen-antibody interactions and Hypersensitivity Reactions: Types of antigen-antibody reactions with suitable examples. Hybridoma Technology - Monoclonal antibodies their application. Immunotoxins, chimeric antibodies and abzymes. Types of hypersensitivity, Principle, mechanisms their relevance & significance in diseases.

UNIT VI: Cell-mediated Immunity: T-cells subclasses their lineage, maturation TCR diversity, MHC, Ag processing and presentation, T-cell activation, effector functions.

UNIT VI: Transplantation- Graft rejection evidence and mechanisms of graft rejection ,prevention of graft rejection, immuno suppressive drugs, **Autoimmunity** –autoimmune diseases and mechanisms and **Tumor immunology-** immunity to tumors and immune evasion by tumors

TEXT BOOKS:

- 1.E. Roitt Essential Immunology, Vaccines conventional, subunit and recombinant, antidiotypic vaccine, Blackwell Scientific publications, Oxford, 1991.
2. Kuby Immunology, 5th Edition . Richard A Goldsby, Thomas J Kindt Barbara A Osborne . W H Freeman and Company.

REFERENCES:

1. Benjamin E and Leskowitz S, immunology A short Course. Wiley LISS NY, 1991.
2. ELISA Immunological Techniques. DNA vaccines Immunotechnology
3. Cellular Molecular Immunology. Abul Abbas and Litchman, 2003

COURSE OUTCOME (CO)	
CO:1	Ability to understand the differences between Innate and acquired immunity and immune system
CO:II	Ability to understand the structure and functional aspects of the primary and secondary lymphoid organs(bone marrow, thymus, spleen and others lymphoid organs
CO:III	Ability to Differentiate various immunoglobulin classes and subclasses basing on their structure and function and also understand the mechanism of generation of antibody diversity
CO:IV	Ability to understand the complement system and its role in immunity to pathogens. Classify different antigen-antibody reactions with suitable examples and acquire a comprehensive knowledge of hybridoma technology for monoclonal antibody production and their applications.
CO:V	Ability to understand the process of antigen presentation in the context of MHC resulting in T cell activation. and effector functions and also shall be able to classify hypersensitivity reactions and understand their mechanism and their relevance in diseases
CO:VI	Ability to demonstrate transplantation and graft rejection and their underlying mechanisms. Acquire a comprehensive understanding of tumour immunology and also shall be able to define autoimmunity and understand the models of autoimmune diseases

**III year II Semester, B. Tech – Biotechnology
(5G621) BIOCHEMICAL REACTION ENGINEERING**

a	b	c	d	e	f	G	h	i	j	k	l
X		X							X	X	

L T P/D C

3 2 - 3

UNIT-I INTRODUCTION TO REACTION KINETICS: Concepts of Reaction Kinetics, Types of reaction, order of reaction, Effect of temperature and pH on reaction rate. Rate equations and Reaction mechanisms; Interpretation of batch reactor data, constant volume batch reactor, integral method of analysis of data for reversible and irreversible reactions.

UNIT- II :REACTION MECHANISM AND GROWTH KINETICS: Searching for mechanism - Arrhenius equation - Batch reactor analysis for kinetics, (synchronous growth and its application in product production).Growth Kinetics in Fed batch and continuous mode , Chemostat growth

UNIT- III: MULTIPLE REACTIONS: Parallel series, series – parallel reactions, calculation of yield and selectivity, role of thermodynamic parameters, maximizing the desired product in Parallel Reactions in Batch Reactor and P F R, maximizing the desired product in series Reactions in CSTR.

UNIT- IV: IDEAL AND NON- IDEAL REACTORS: Concepts of reactors based on flow characteristics, design of ideal reactors, Design of Batch bioreactor. Reason for Non-Ideality, RTD studies (E, C & F curves), Diagnosis of Ills of Flow reactors,

UNIT-V MECHANISMS OF ENZYME ACTION Mechanisms of Enzyme Action; Concept of active site and energetic of enzyme Kinetics, substrate complex formation; Specificity of enzyme action. Types of Inhibition- kinetic models; Substrate and Product Inhibition; Allosteric regulation of enzymes;

UNIT-VI ENZYME KINETICS

Kinetics of single substrate enzyme catalyzed reactions,Michaelis-Menten equations. The Brigg's Haden equation and estimation of constants using graphical techniques. Turnover number, kinetics of reversible reactions.Enzyme immobilization methods.

TEXT BOOKS:

1. H. Scott Fogler, Elements of Chemical Reaction Engineering, II Edition, Prentice Hall of India Pvt. Ltd P.M.Doran

REFERENCES:

1. Blanch HW and Clark DS;Biochemical Engineering. CRC Press, 1995
2. M.L. Shuler and F. Kargi Bioprocess Engineering: basic concepts

III Year II Semester, B. Tech – Biotechnology

(5G622) MOLECULAR TOXICOLOGY (Professional Elective-II)

a	b	c	d	e	f	g	h	i	j	k	l	
	X		X		X		X				X	
									L	T	P/D	C
									3	1	-	3

OBJECTIVE

To gain knowledge in various toxins, their metabolism and its application

Unit I: Introduction to Toxicology Definition, History and Scope, Classes of Toxicants, acute toxicity, chronic Toxicity, LC₅₀, LD₅₀, EC₅₀, ED₅₀, IC₅₀, NOAEL, MOAEL, Dose-response relationships, Bioaccumulation, Bioconcentration and biomagnifications

Unit II: Absorption and Distribution of Toxicants: Fate and mechanism of transport in vivo, Routes of absorption, Toxicant distribution-physico-chemical properties and protein-binding, volume of distribution

Unit III: Metabolism and Excretion of Toxicants: Phase-I and Phase-II reactions, Renal elimination, hepatic elimination and respiratory elimination

Unit IV: Free radical induced Oxidative stress and its implications: Concept of oxidative stress, free radicals, lipid peroxidation, role of oxidative stress in disease, biomarkers of oxidative stress – Superoxide Dismutase (SOD), Catalases, Lipid Peroxidases (LPO), Glutathione peroxidase, Glutathione-S-Reductase

Unit V: Toxicity Testing Methods: In vivo- algae, fish, mouse, In vitro-Cell lines, indicators of toxicity in cultured cells, Ames Mutagenity testing, micronuclei test, Genotoxicity-Comet Assay,

Unit VI: Nanotoxicology: Characteristics of Potentially toxic nanomaterials. Biological fate and distribution of engineered nanoparticles; In vitro toxicity studies of engineered nanomaterials-fullerene, copper oxide, titanium dioxide, evaluation of the toxicity of nanoparticles using zebra fish embryos and adult fish

TEXT BOOKS

- 1) A Text Book of Modern Toxicology- Edited by Ernest Hodgson, Wiley-Interscience.
- 2) Molecular Toxicology 2nd edition by P. David Josephy and Bengt Mannervia, oxford University press.

COURSE OUTCOME (CO)		POs
CO:I	To acquire knowledge about the types of toxins and their measurements	b
CO:II	To able to access the absorption and distribution of toxins	b
CO:III	To able to access the metabolism and excretion of toxins	f, h, i
CO:IV	To able to demonstrate the role of oxidative stress and free radical production of toxins	D
CO:V	Demonstrate fair knowledge about testing methods of various toxins	f, h, i
CO:VI	Explain about various nanomaterials to evaluate the toxicology	f, h, i

III Year II Semester, B. Tech – Biotechnology

(5G623) PHYTOCHEMICALS AND HERBAL MEDICINE**(Professional Elective-II)**

a	b	c	d	e	f	g	h	i	j	k	l
	X		X		X		X				X

L	T	P/D	C
3	1	-	3

Unit I: Medicinal & Aromatic Plants

Cultivation and Utilization of Medicinal & Aromatic Plants in India. Genetics as applied to Medicinal herbs.

Unit II: Crude Drugs

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

Unit III: Tissue Culture of medicinal Plants

Plant Tissue Culture as source of medicines, Plant Tissue Culture for enhancing secondary metabolite production (*Withania somnifera*, *Rauwolfia serpentina*, *Catheranthus roseus*, *Andrographis paniculata*, *Dioscorea* sp.); Anticancer drugs, Biogenesis of Phytopharmaceuticals.

Unit IV: Analysis of Phytochemicals

Methods of Drug evaluation (Morphological, Microscopic, Physical & Chemical). Preliminary screening, Assay of Drugs – Biological evaluation / assays, Microbiological methods

Unit V: Chemical Methods of Analysis and Detection of Adulterants: Chemical estimations, Spectrophotometry & Fluorescence analysis. Drug adulteration – Types of adulterants.

Unit VI: Types of Phytochemicals

Carbohydrates & derived products; Glycosides - extraction methods (*Digitalis*, *Aloe*, *Dioscorea*.); Tannins (Hydrolysable & Condensed types); Volatile Oils - extraction methods (*Clove*, *Mentha*); Alkaloids - extraction methods (*Taxus*, *Papaver*, *Cinchona*); Flavonoids- extraction methods, Resins- extraction methods.

Text Books:

1. Pharmacognosy, C. K. Kokate, A. P. Purohit & S. B. Gokhale (1996), Nirali Prakashan, 4th Ed.
2. Natural Products in medicine: A Biosynthetic approach (1997), Wiley.

References

1. Hornok, L. (ed.) (1992). Cultivation & Processing of Medicinal Plants, Chichister, U. K: J. Wiley & Sons.
2. Trease & Evans, Pharmacognosy – William Charles Evans, 14th ed. (1989), Harcourt Brace & Company.

**III Year II Semester, B. Tech – Biotechnology
(5G624) GREEN MANUFACTURING TECHNOLOGY
(Professional Elective-II)**

L	T	P/D	C
3	1	0	3

UNIT - I GREEN MANUFACTURING TRENDS

Green Manufacturing: Fundamentals and Applications - basic definitions and issues surrounding green manufacturing at the process, machine and system - government motivations for green manufacturing - traditional manufacturing to green manufacturing

UNIT - II ECONOMICS

Green manufacturing economic issues- surrounding green manufacturing - the areas of automotive, semiconductor and medical areas as well as in the supply chain and packaging areas Green Manufacturing.

UNIT - III SUSTAINABLE GREEN MANUFACTURING

Introduction - sustainable green manufacturing -green manufacturing sustainability processes, requirements, and risk - The sustainable lean and green audit process. International green manufacturing standards and compliance. Green rapid prototyping and rapid manufacturing. Green flexible automation. Green collaboration processes . Alternative energy resources. Globally green manufacturing supply chains and logistic networks. Sustainable green manufacturing system design.

UNIT - IV WASTE MANAGEMENT

Sustainability and global conditions - Material and solid waste management - Energy management -chemical waste management and green chemistry - Climate change and air emissions management - Supply water and waste water management - Environmental business management .

UNIT - V INDUSTRIAL ECOLOGY

Introduction-Material flows in chemical manufacturing-Industrial parks-Assessing opportunities for waste exchanges and by product synergies-Life cycle concepts-Product stewardship and green engineering-Regulatory, social and business environment for green manufacturing.- Metrics and analytical tools.- Green supply chains.- Present state of green manufacturing.

UNIT - VI GREEN PLASTICS MANUFACTURING

Introduction to commercial plastics and elastomers -Natural Rubber (NR), modified NR and blends -Polyesters from microbial and plant biofactories (polylactic acid and poly hydroxyalkanoates) -Plastics from vegetable oils -Cellulose and starch based materials - Natural fillers, fibers, reinforcements and clay nanocomposites -Biodegradability, life cycle assessment and economics of using natural materials.

References:

1. T. David Allen and David R. Shonnard, Green engineering, Prentice Hall NJ, (2002).
2. David Dornfeld, Green manufacturing fundamental and applications, Prentice hall (2002).
3. G. Sammy Shinga, Green electronics design and manufacturing, Prince publications (2008).
4. James clark, Green chemistry, Blackwell publishing (2008).
5. Paulo Davim, Sustainable Manufacturing, Wiley publications (2010).
6. Frank Kreith, George Tchobanoglous, Solid waste management, McGraw Hill (2002).
7. E. S. Stevens, Green plastics, Princeton university press (2002).
8. U. Robert Ayres, A Handbook of Industrial Ecology, Edward elgar publishing (2002).

III year II Semester, B. Tech – Biotechnology
(5G625) OPTIMIZATION & NUMERICAL METHODS IN BIOPROCESSES
(Professional Elective - II)

a	b	c	d	e	f	g	h	i	j	k	l
X	X					X				X	

L
T P/D C
3 1 3

Course Objectives:

This course aims at providing knowledge on basic concepts in Process Models and understanding of optimization methods in Bioprocessing.

UNIT-I: Process Optimization

Nature and organization, basic concepts and elements of Optimization, single variable functions, direct, indirect and random search methods – with and without acceleration Elimination methods for unrestricted and exhaustive search, Fibonacci search.

UNIT-II :Media Optimization

Plackett- Burmen Design, Response surface Method – Central Composite Design, Box Behnken Design.

UNIT-III: Function Approximation

Function Approximations by Linear and nonlinear least square analysis, Formulation Process Models leading to set of ordinary differential equations and solution procedures by Eulers, Modified Eulers and RungeKutta methods.

UNIT-IV :Formulation of Process Models

Formulation of Process Models leading to set of linear simultaneous equations and solution procedures by Method of determinants, Gauss Elimination, Gauss Jordan, Jacobi and Gauss-Seidel methods.

UNIT-V:Process Models Leading to Transcendental and Polynomial Equations

Formulation of Process Models leading to transcendental and polynomial equations and solution procedures by Bi-section, Reguli-falsi, Newton Raphson,

UNIT-VI : Development of Programs

Development of program for all optimization technique using Excel, C, MATLAB, Mini Tab, Design Expert in bioprocess

Text Books:

1. Higher engineering mathematics by DR. B.S. Grewal, Khanna publishers (1998)
2. Numerical methods for Engineers by Steven C. Chapra and Raymond P Canale, 2nd edition, MCGraw Hill International edition, 1988.

Suggested books:

1. Computer Applications in Bioprocessing by Henry R. Bungay Volume 70/(2000)
Springer.
2. Edger T.E., and Himmelbau D.M., "Optimization of chemical processes", McGraw Hill international edition, 1988
3. Bioprocess engineering Enrique Galindo and Octavio T. Ramírez Volume 16, Issue 7, (1998).

Course Outcomes:

CO : I	Be able to distinguish between different process models
CO : II	Be able to formulate process models leading to set of ordinary differential equations and solution procedures numerical methods.
CO : III	Be able to formulate process models leading to set of linear simultaneous equations and solution procedures.
CO : IV	Be able to formulate process models leading to transcendental and polynomial equations and solution procedures.
CO : V	Understand the steps involved in optimization that are a prerequisite for the development of process flow sheets.
CO : VI	Be able to optimize biochemical process.

III Year II Semester**(5G626) BIOSENSORS AND BIOELECTRONICS
(PROFESSIONAL ELECTIVE –II)**

a	b	c	d	e	f	g	h	i	j	k	l
X		X	X	X	X				X	X	

L T P/D C
3 1 - 3

OBJECTIVE

To understand Biosensors required for the development of small, sensitive and selective biosensor devices and detection systems used in diagnostics, and detection systems to conduct investigations that operate in real time and in extreme environments using modern biotechnology engineering tools.

UNIT I: INTRODUCTION: Definition of Biosensors Advantages and limitations, various components of biosensors

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

UNIT III: TRANSDUCER: types, principles and applications-calorimetric, optical, potentiometric/amperometric conductrometric/resistometric, piezoelectric, bioluminescence and Chemiluminiscence-based biosensors

UNIT IV: APPLICATION OF BIOSENSORS: in clinical chemistry, medicine and health care, biosensors for veterinary, agriculture and food, low cost biosensor for industrial processes on-line monitoring, biosensors for environmental monitoring

UNIT V: NANO BIOSENSORS: Nano optics for biosensors, DNA as tool for Nano bio sensing, Nanowire bio sensing. Implantable biosensors

UNIT VI: MOLECULAR ELECTRONICS: Introduction to molecular electronics, Development of molecular arrays, molecular wires and switches, mechanisms of unit assembly

TEXT BOOKS:

1. Biosensors: An Introduction by Brian R. Eggins Biosensors edited by AEG CASS OIRL press Oxford University John Wiley & Sons (1997). 2.
2. Roger, K.R. and Gerlach, C.L. 1~99. Update on environmental for biosensors. Env. Sci. Techno. 33 500A - 506A.
3. Bilitewski, U. Turner, A.P.F. 2000 Biosensors for environmental monitoring Harwood, Amsterdam.

REFERENCE:

Biosensors, Elizabeth A. H. Hall, open University Press Biotechnology Series

COURSE OUTCOME (CO)	
CO:I	Ability to demonstrate knowledge of definition and make up of Biosensors
CO:II	Ability to demonstrate knowledge of various types of biosensors based on their detecting systems like enzyme, immune and bio affinity based biosensors
CO:III	Ability to understand the principle and working of various transducer used in biosensors
CO:IV	Ability to demonstrate knowledge of various application of biosensors in various fields such as clinical chemistry, medicine and health care, agriculture, veterinary, industrial bioprocess and for environmental monitoring
CO:V	Ability to demonstrate understand about Nano biosensors and their make up.
CO:VI	Ability to demonstrate knowledge about molecular electronics, development of molecular arrays, wire and switches

III Year II Semester

(5EC04) Fundamentals of Operating System

Course Objective

1. Learn basics of operating Systems
2. Understand process management and synchronisation.
3. Learn principles of memory, I/O and file management in a secured environment.

COURSE OUTCOMES:

After completing the subject, students will be able to:

1. Describe the basic functionalities and structure of the Operating System
2. Explain the concepts and implementations of: Processes, Process Scheduling. Describe, contrast and compare various types of Operating systems like Windows and Linux.
3. Comprehend the concepts of Synchronization and Deadlocks in the Operating System
4. Discuss the concepts of Memory Management(Physical and Virtual memory)
5. Explain the concepts of File System with regard to directory and disk management algorithms.
6. Students understand the concepts of I/O systems, protection and security in a case study given

SYLLABUS:

UNIT I

Introduction to Operating System, Computer System Architecture: Single Processor System, Multiprocessor System, Clustered System, Multiprogramming System, Multitasking (Time sharing) system, Operating System Services, System Calls, Types of System Calls, System Programs, Operating System Structure: single structure, layered approach, micro kernels, modules.

UNIT II

Process Management: Process concept, process scheduling, operation on processes; CPU scheduling, scheduling criteria, scheduling algorithms -First Come First Serve (FCFS), Shortest-Job-First (SJF), Priority Scheduling, Round Robin(RR), Multilevel Queue Scheduling.

Engg. Applications – Process scheduling in Windows, Linux.

UNIT III

Process-Synchronization & Deadlocks: Critical Section Problems, semaphores; Monitors; Deadlock Characterization, methods for handling deadlocks-deadlock prevention, Avoidance & Detection; Deadlock recovery.

UNIT IV

Memory Management: Logical & Physical Address Space, swapping, Contiguous memory allocation, Paging and Segmentation techniques, Segmentation with paging;

Virtual memory: Demand Paging, Page-Replacement Algorithms, Thrashing.

Engg. Applications – Memory management in Windows, Linux.

UNIT V

File System: Different types of files and their access methods, directory structures, various allocation methods, disk scheduling and management and its associated algorithms.

UNIT VI

I/O Systems: I/O Hardware, Application I/O Interface, Kernel, Transforming I/O requests, Performance Issues.

Protection and Security: Goals of protection, Principles of protection, Access matrix, Access control list, Capability List. Security Attacks, Program threats.

TEXT BOOKS:

1. Operating System Concepts by Silberchatz Galvin, 8th edition.
2. Modern Operating Systems by A. Tanenbaum, 1992, Prentice-Hall.
3. Operating Systems Internals and Design Principles by William Stallings, 4th edition, 2001, Prentice-Hall

REFERENCES:

1. Operating System By Peterson , 1985, AW.
2. Operating System By Milankovic, 1990, TMH.
3. Operating System Incorporating With Unix & Windows By Colin Ritche, 1974, TMH.
4. Operating Systems by Mandrik & Donovan, TMH
5. Operating Systems By Deitel, 1990, AWL.
6. Operating Systems – Advanced Concepts By Mukesh Singhal , N.G. Shivaratri, 2003, T.M.H

III Year II Semester**SAP – II : SAP ABAP Workbench Concepts
(Open Elective - II)****Code: 5EC27**

L	T	P/D	C
2	1	-	2

Course Objectives

1. Write object oriented programs with ABAP
2. Understand the techniques in enhancements and modifications
3. Create simple Web Dynpro for ABAP applications

Course Outcomes

1. To carry out enhancements and modifications to SAP standard, in future proof manner
2. To develop simple Web Dynpro for ABAP applications
3. To be able to understand Functional Specifications and write Technical Specifications

UNIT – I : ABAP Objects-Part 1

1. Object-Oriented Programming (OOPS Programming)
2. Fundamentals Object-Oriented syntax
3. Inheritance and casting
4. Interfaces and casting
5. Events

UNIT – 2: ABAP Objects-Part2

1. Global Classes and Interfaces
2. Exception handling
3. ABAP Object-Oriented examples-ALV and BAdls
4. Abstract classes, factory methods, singletons

UNIT – 3: Shared Objects and shared Memory Areas

1. Shared Objects
2. Shared Memory Access

UNIT – 4: Dynamic Programming

1. Generic data types
2. Field symbols and data references
3. Runtime Type Identifications (RTTI)
4. Runtime Type Creation (RTTC)

UNIT – 5: Enhancements and Modifications

1. Adjustment of SAP Standard Software
2. Enhancing Dictionary elements
3. Customers Exits
4. Business Add Ins (BAdls)
5. Modifications of the SAP standard applications
6. Implicit and Explicit Enhancements

UNIT – 6: Fundamentals of Webdynpro for ABAP

1. Web Dynpro Components, Windows and Views
2. Web Dynpro Controllers
3. Web Dynpro Context
4. Web Dynpro User Interface
5. Controller and Context programming

Textbooks:

1. SAP ABAP Workbench Concepts, Part 1, SAP India
2. SAP ABAP Workbench Concepts, Part 2, SAP India

References:

www.Training.sap.com/in/en

B. Tech (BT) III Year - II sem

**5ZC19 ENTREPRENEURSHIP, PROJECT MANAGEMENT AND
STRUCTURED FINANCE**

Course Objective: The objective of the course is to make students understand the nature of Entrepreneurship, its importance and to create an awareness regarding the systematic planning and implementation of projects; highlight the components of structured finance and establish a framework of CMBS with respect to Servicing Agreements

Course Out Comes:

- 1) Students will understand the nature of Entrepreneurship and its importance
- 2) Will gain knowledge regarding project, its life cycle and organization
- 3) Will gain knowledge relating to project formulation and implementation
- 4) Comprehend the components of structured finance
- 5) Establish a framework of CMBS
- 6) Students will gain knowledge relating to the CRE Servicing

UNIT I

CONCEPTS OF ENTREPRENEURSHIP: Definition of Entrepreneurship, Evolution of Entrepreneurship, Classification of Entrepreneurs, Characteristics of Entrepreneur, Selection of Product and the means required for starting an enterprise, Financing and Financial incentives available, Success rate of entrepreneurs – a case study.

UNIT-II

BASICS OF PROJECT MANAGEMENT: Concept and characteristics of a project - types of projects - Objectives of project management - Project Organizational structure - Project life cycle - Challenges and problems of project management - Qualities & functions of a project manager.

UNIT III

PROJECT FORMULATION AND IMPLEMENTATION: Generation of Project Ideas; Monitoring the environment; Preliminary Screening of Projects; Feasibility study; Project Selection. Detailed Project Report: Market, Technical, Financial and Economic aspects. Prerequisites for Successful Project Implementation; Control of in-progress Projects (Gantt chart, PERT, CPM); Project Risk Management Process, Post-audit; Abandonment Analysis

UNIT-IV

INTRODUCTION TO STRUCTURED FINANCE: Term Loans, Bonds/Debentures, Types of debentures, Issue of debt instruments. Structured Finance: Evolution, Securitization process, characteristics, and structured finance products (ABS, CDO, MBS, CDS)

UNIT-V

COMMERCIAL MORTGAGE LOAN BASICS: Definition and characteristics of CMBS, CMBS Vs other Mortgage Backed Securities, CMBS three level perspective: property level, loan level, bond level; Life cycle of commercial real estate loans – Loan cycle, Key players in loan cycle; Property types and characteristics, property performance.

UNIT-VI

BASICS OF CRE SERVICING: Introduction to servicing, Role of the Servicer, Servicing approaches, Influence of technology, Ethics in commercial servicing, Servicing – sources of income, Overview of servicing agreements, Pooling & Servicing agreement, Sub servicing agreement.

Books Recommended:

- H. Nandan, Fundamentals of Entrepreneurship, Prentice Hall of India, First Edition, New Delhi, 2007.
- Jeffrey K. Pinto “Project Management”, 2nd edition, Pearson
- Dhandapani Alagiri “Structured Finance – Concepts & Perspectives”, ICFAI University press.

References:

- Projects by Prasanna Chandra, McGraw-Hill Publishing Co. Ltd
- Project Management: Systems approach to Planning Scheduling and Controlling, H. Kerzner.
- The Complete Real Estate Documents by Mazyar M. Hedayat, John J. Oleary
- The Fundamentals of Listing and Selling Commercial Real Estate - By Keim K. Loren (Author)

B. Tech (BT) III Year - II sem

a	b	c	d	e	f	g	h	i	j	k	l
			x					x	x	x	x

L	T	P/D	C
2	1	0	2

5ZC05 GENERAL MANAGEMENT AND ENTREPRENEURSHIP

Course Objective: The course is designed to impart the necessary managerial skills and tactics required for an emerging Entrepreneur for the Engineering students to enhance their career prospects and ambitions of starting a new Enterprise.

Pre-requisites: This course shall require a student to have knowledge in Managerial Economics and Financial analysis, Management Science, Operations management.

Course Outcomes:

1. Describe the necessary managerial skills and tactics required for an emerging Entrepreneur.
2. Distinguish various methods for business process and product development
3. Demonstrate the skills required for the project planning, implementing and controlling
4. Outline the legal aspects and applying for Intellectual Property Rights
5. Illustrate the various sources of finance for venturing a business project.
6. Designing production plant and quality management system.

UNIT I

INTRODUCTION TO MANAGEMENT AND ENTREPRENEURSHIP: Changing Face of Management-Entrepreneurship, Modern Management with Entrepreneurial Orientation.. Meaning of Entrepreneurship. Benefits and Drawbacks of Entrepreneurship Reasons feeding the Entrepreneurial fire. Understanding Entrepreneurship as a Process. Multiple roles of Entrepreneur: Intrapreneur, Inventor, Coordinator, Manager and Controller. Psychological and behavioral aspects of First-Generation Entrepreneur. Case Studies

UNIT II

PROCESS DEVELOPMENT AND INNOVATION PROJECT MANAGEMENT: Business Process Model, Value chain for Manufacturing industries and Service Industries. Frugal Innovation. Creativity process in developing Innovation.. Types of New Products, Forecasting of New Products, Stages in the New Product Development, Prototype building and pitching Going ahead with ideas, killing the ideas through Stage Gate Models, pitching of full fledged idea. Choosing the Start-Up Team.

UNIT III

PROJECT MANAGEMENT AND FEASIBILITY REPORT: Project Inception, Project Implementation, and Project control. Analyzing the project by employing capital budgeting techniques, Risk Management, tools and techniques. Methods of Appraising the Project. Industry Analysis pertaining to the Product, Competitive Analysis and Market analysis. Preparation of feasibility report, Contents of Feasibility Report. Exercise to write an effective Feasibility report. Case Studies.

UNIT IV

PROTECTION OF IDEAS AND MECHANISM: Exposure to intellectual property rights to the entrepreneur in the Indian and the World context. Registration process for Patents, Copyrights, Trademarks, Geographical indicators. Legal Framework in administration of Intellectual property rights. Meaning of Infringement, consequences of Infringement. Cases on Infringement. Case Studies.

UNIT V

VENTURE FINANCING AND ISSUES RELATED TO PRICING: Meaning of Venture Capitalist, Process of Venture Capital, Seed Funding, First Phase Funding, Second Phase Funding and Final Phase funding. Cost analysis, Preparation of standard costing, Finalizing the output, fixing the pricing based on market structure, Monopoly, oligopoly market structures and marketing pricing practices for attracting customers. Case Studies

UNIT VI

MANUFACTURING AND QUALITY MANAGEMENT: Plant Layout, Process and Product Layout, Service Factory. Introduction to Quality Circles, Quality inspection, ISO Certification, process of certification and exposure to the entrepreneurs of the need for certification. Quality certification for Manufacturing industrial. Case Studies

Books Recommended:

- "Projects: Planning, Analysis, Selection, Financing, Implementation, and Review", Prasanna Chandra, TMH, New Delhi, 2012
- "Project Management", Jeffrey K. Pinto, Pearson, 2011
- Small Scale industries and Entrepreneurship Vasanth Desai "Himalya publishing 2012

References:

- Innovation by Design", Gerald H. (Gus) Gaynor, AMACOM {American Management Association), NYC, 2002
- Entrepreneurship Rajeev Roy "" oxford ,2012
- Fundamentals of Entrepreneurship Nandan H, PHI, 2013

III year II Semester, B. Tech – Biotechnology

BIG DATA ANALYTICS

(Open Elective –III)

Code: 5FC17

L	T	P/D	C
3	1	-	3

Course objectives:

- Be exposed to big data
- Learn the different ways of Data Analysis
- Be familiar with data streams
- Learn the mining and clustering
- Be familiar with the visualization

Course Outcomes: After completing this course, student shall be able to

1. Work with big data platform and its analysis techniques.
2. Analyze the big data for useful business applications.
3. Select visualization techniques and tools to analyze big data
4. Implement search methods and visualization techniques
5. Design efficient algorithms for mining the data from large volumes.
6. Explore the technologies associated with big data analytics such as NoSQL, Hadoop

UNIT I

INTRODUCTION TO BIG DATA: Introduction to Big Data Platform – Traits of Big data -Challenges of Conventional Systems –Elements of Big Data , What is Big Data Analytics, Classification of Analytics, Why Big Data Analytics Important; Data Science; Data Scientist; Terminologies used in Big Data Environments; Basically Available Soft State Eventual Consistency (BASE); Open source Analytics Tools; Web Data – Evolution Of Analytic Scalability - Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools

UNIT II

DATA ANALYSIS: Statistical Concepts: Sampling Distributions – Re-Sampling - Statistical Inference - Prediction Error. Regression Modeling - Multivariate Analysis - Bayesian Modeling - Inference and Bayesian Networks - Support Vector and Kernel Methods - Analysis of Time Series: Linear Systems Analysis - Nonlinear Dynamics - Rule Induction - Neural Networks: Learning And Generalization - Competitive Learning - Principal Component Analysis and Neural Networks - Fuzzy Logic: Extracting Fuzzy Models from Data

UNIT III

MINING DATA STREAMS : Introduction To Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream – Estimating Moments – Counting Oneness in a Window – Decaying Window - Real time Analytics Platform(RTAP) Applications - Case Studies - Real Time- Stock Market Predictions.

UNIT IV

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics; Points to Consider during Analysis; Understanding Text Analytics; Analytical Approach and Tools to Analyze Data: Analytical Approaches; History of Analytical Tools; Introducing Popular Analytical Tools; Comparing Various Analytical Tools.

UNIT V

FRAMEWORKS AND VISUALIZATION: The Map Reduce Framework; Techniques to Optimize Map Reduce Jobs; Uses of Map Reduce; Architecture, Storing Big Data with HBase, Role of HBase in Big Data Processing; Storing Data in Hadoop: Introduction of HDFS, Architecture, HDFS Files, File system types, commands, org.apache.hadoop.io package, HDFS High Availability; NoSQL Databases, Visualizations - Visual Data Analysis Techniques - Interaction Techniques;

UNIT VI:

Social Media Analytics and Text Mining: Introducing Social Media; Key elements of Social Media; Text mining; Understanding Text Mining Process; Sentiment Analysis, Performing Social Media Analytics and Opinion Mining on Tweets; Mobile Analytics: Introducing Mobile Analytics; Define Mobile Analytics; Mobile Analytics and Web Analytics; Types of Results from Mobile Analytics; Types of Applications for Mobile Analytics; Introducing Mobile Analytics Tools.

Textbook & Course Materials

Required Text

1. Michael Berthold, David J. Hand, “Intelligent Data Analysis”, Springer, 2007.
2. BIG DATA and ANALYTICS, Seema Acharya, Subhasinin Chellappan, Wiley publications.
3. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.

Recommended Texts & Other Readings

4. BUSINESS ANALYTICS 5e , BY Albright |Winston
5. BIG DATA, Black Book TM , DreamTech Press, 2015 Edition
6. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
7. Anand Rajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2012.
8. Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, John Wiley & sons, 2012.
9. Glenn J. Myatt, “Making Sense of Data”, John Wiley & Sons, 2007
10. Pete Warden, “Big Data Glossary”, O’Reilly, 2011.
11. Jiawei Han, Micheline Kamber “Data Mining Concepts and Techniques”, Second Edition, Elsevier, Reprinted 2008

a	b	c	d	e	f	g	h	i	j	k
		x	x	x	x	x		x		

L T P/D C
2 1 0 2

III year II Semester, B. Tech – Biotechnology
5ZC08 ENTERPRISE RESOURCE PLANNING

Course Objective: This course helps to provide the basic concepts of Enterprise Resource Planning and Management of Information System. This course will enable the students to study areas of BPR, ERP Modules, and types of information systems, security controls, and audit. This course explores the nature and applications of ERP & MIS.

Course Out Comes:

- 1) Provide the basic concepts of ERP, integrated information systems and growth .This will be useful for managing the diversity, contemporary societal and global issues.
- 2) Provide knowledge about BPR and other Business Intelligence systems so that the firm can develop capacity to adapt and innovate and to manage in unpredictable environments.
- 3) Understand the various modules and gain knowledge and apply in new unfamiliar circumstances
- 4) Provide the benefits of ERP in order to understand the value of customers by identifying their needs and providing the services.
- 5) Understand the implementation and maintenance strategy for ERP for better financial decisions and Achieve higher levels of proficiency and self-actualization through pursuing lifelong learning.
- 6) Study the various information systems for the conceptual understanding of relevant disciplines.

UNIT I

INTRODUCTION TO ERP: Overview of ERP, MRP, MRPII and Evolution of ERP, Integrated Management Systems, Reasons for the growth of ERP, Risks of ERP.

UNIT II

ERP & RELATED TECHNOLOGY: Introduction to BPR, BPR process; ERP System Options and Selection, ERP proposal Evaluation.

UNIT III

ERP MODULES- I: Finance, Accounting Systems, Manufacturing and Production Systems.

UNIT IV

ERP MODULES- II: Sales and Distribution Systems, Human Resource Systems, Plant Maintenance System, Materials Management System.

UNIT V

ERP IMPLEMENTATION AND MAINTENANCE: Implementation challenges, ERP Implementation strategies, ERP Implementation life cycle- Pre evaluating screening, Package evaluation-Project planning Phase- GAP Analysis- Reengineering, Configuration-Team Training-Testing & Going Live, Maintaining ERP.

UNIT VI

BENEFITS OF ERP: Reduction of Lead Time, On-Time Shipment, Reduction in Cycle Time, Improved Resource Utilization, Better Customer Satisfaction, Improved Supplier Performance, Increased Flexibility, Reduced Quality Costs, Improved Information Accuracy and Design Making Capabilities.

Books Recommended:

- David L Olson, Managerial Issues of Enterprise Resource Planning Systems, McGraw Hill, International Edition-2012.
- Alexis Leon, ERP (Demystified), 5/E, Tata McGraw-Hill, 2012.

References:

- Mary Sumner “Enterprise Resource planning” Pearson, 2012
- Robert Schultheis and Mary Summer, Management Information System the Manager’s View, Tata McGraw-Hill-2008
- Murthy, CSV, Management Information Systems- Text and Applications, Himalaya Publishing House- 2009.

B. Tech. III Year II semester

a	b	c	d	e	f	g	h	i	j	k
		x	x	x	x	x		x		

LOGICA L REASONING

Code: 5HC77

(Common to All Branches)

L	T	P/D	C
2	0	0	1

Pre Requisites: Nil**Course Outcomes:** *Students will able to answer*

1. The questions given on series completion and analogy.
2. The questions given on odd one out in classification and coding and decoding.
3. The questions given on blood relations.
4. The questions given on directions and Arithmetical reasoning.
5. The questions given on Venn diagrams, cubes and dice. .
6. The questions given on clocks and calendar.

Unit–I: Series Completion: Number Series, Alphabet Series, Alpha – Numeric Series.

Analogy: Completing the Analogous Pair, Simple Analogy, Choosing the Analogous pair, Double Analogy, Word Analogy, and Number Analogy.

Unit–II: Classification / Odd One Out: Word Classification, Number Classification and Letter Classification. Coding – Decoding: Letter Coding, Number Coding, Matrix Coding, Substitution, Deciphering Message Word Codes, Jumbled Coding.**Unit–III:** Blood Relations, Deciphering Jumbled up Descriptions, Relation Puzzle – Direction sense test. Number, Ranking & Time Sequence Test –Mathematical Operations.**Unit –IV:** Directions, Arithmetical Reasoning. Puzzle Test: Classification Type Questions, Seating Arrangements Comparison Type Questions, Sequential Order of Things, Selection Based on given conditions, Family – Based Puzzles, Jumbled Problems.**Unit –V:** Assertions and Reason– Logical Venn Diagrams – Alpha Numeric Sequence Puzzle. Cubes and Dice – Analytical Reasoning .Logical Deduction: Logic, Statement – Arguments,**Unit – VI:** Clocks & Calendar .Data Sufficiency and Syllogism.**Text Books:**

1. Verbal and Non Verbal Reasoning by R.S.Agarwal.
2. Quantitative Aptitude and Reasoning, R.V.Praveen, Second Edition, PHI Learning Pvt. Ltd.

III year II Semester

(5G679) PLANT BIOTECHNOLOGY LAB

a	b	c	d	e	f	g	h	i	j	k	l
	X	X	X								X

L T P/D C
- - 3 2

Objective:

To Learn the Techniques of Plant Cell, Tissue and Organ Culture and apply them for Phytochemical production and Genetic Transformation

1. Introduction to equipments used in plant tissue culture & Preparation of stock solutions
2. Preparation of media (MS / B5)
3. Surface sterilization of different explants
4. Inoculation of explants for callus induction
5. Organogenesis
6. Cell suspension culture
7. Somatic Embryogenesis
8. Protoplast isolation from leaf and callus
9. Extraction of Phytochemicals from medicinal plant
10. Qualitative analysis of phytochemicals
11. Quantitative Estimation of Phytochemicals by colorimeter/spectrophotometer
12. Preparation of *Agrobacterium* culture for transformation

REFERENCES:

1. Plant Biotechnology: Practical Manual, C. C. Giri & Archana Giri, IK International, 2007.
2. Plant Biotechnology: laboratory manual for plant biotechnology, H. S. Chawla, Oxford IBH publishers
3. A Laboratory Manual of Plant Biotechnology (2nd Ed), S. S.Purohit, Agrobios publishers

EQUIPMENTS & FACILITIES:

Autoclave, pH Meter, Laminar air flow chamber, Shaker- incubator, Plant Growth Chamber, Soxhlet Apparatus, Compound Microscope, Tissue Culture Racks, Culture/Incubation Room

S. No.	COURSE OUTCOMES	POs
1	Demonstrate and Make-use-of Equipments & Facilities in Tissue Culture Lab	b, c, d, l
2	Learn Techniques of Sterilization and Establish Aseptic environment	b, c, d, l
3	Prepare Tissue Culture Media and Modify it for further use	b, c, d, l
4	Generate Callus and Establish Suspension Cultures	b, c, d, l
5	Predict and Induce Indirect and Direct Organogenesis	b, c, d, l
6	Isolate, Visualize and Detect Protoplasts	b, c, d, l
7	Extract, Estimate and Compare Phytochemicals	b, c, d, l
8	Apply <i>in vitro</i> Techniques to genetically transform plant material	b, c, d, l

III year II Semester

(5G680) IMMUNOLOGY LAB

a	b	c	d	e	f	g	h	i	j	k	l
	X	X	X								X

L T P/D C
- - 3 2

1. Red blood cell (RBC) count in blood
2. Total leukocyte (White blood cell) count and Differential leukocyte count in peripheral blood
3. Isolation and viability determination of lymphocyte from peripheral blood
4. Haem-agglutination: Blood grouping / typing
5. Assessment of Antigen-Antibody interaction by Ouchterlony / Double Immuno Diffusion technique
6. Counter Current electrophoresis
7. Enzyme-linked Immunosorbent Assay (ELISA)
8. Immunofluorescence
9. Immunoglobulin precipitation / purification
10. Separation of serum proteins by SDS-Poly Acryl amide Gel
11. Assessment of polyclonal antibodies in serum Electrophoresis
12. Lymphoproliferation Assay

a	b	c	d	e	f	g	h	i	j	k	l	m
x		x				x	x	x	x			

Syllabus for B. Tech. III Year II semester

COMPREHENSIVE VIVA VOCE - II

CODE: 5G681

L T P/D C
- - - 1

Pre-Requisites: None

Course Objectives:

Prepare students in basics and advanced relevant courses to revise and face technical interviews for enhancing employability.

Course Outcomes: After completing this course, student shall be able to

1. Assess the relevant courses they have undergone till the completion of that academic year.
2. Comprehend the concepts in the core subjects and the elective subjects, to make them ready to face technical interviews which improve their employability skills.

There will be 100 marks in total with 50 marks of internal evaluation and 50 marks of external evaluation.

Internal:

Comprehensive Viva Voce is Conducted twice in a semester and evaluated for 25 marks each.

End examination : 50 Marks.

The end examination will be carried out by a committee consisting of an external examiner, head of the department, a senior faculty member and the supervisor.

III Year II Semester (5G696) TECHNOLOGY REVIEW & SEMINAR - II

L	T	P/D	C
-	-	2	1

Pre-Requisites: All Courses till this semester

Course Outcomes:

- Students identify a topic from the current technical topics of their choice in the computer science domain and the allied fields, after surveying in the internet resources, journals and technical magazines in the library.
- Student learnt to arrange the contents of the presentation and scope of the topic, in an effective manner.
- Each student then presents the technical topic they chose in front of the panel and the fellow students, using the oratory skills.
- Students also face the questions posed by the panel and the students and answer them.

There shall be a Technical Paper writing and seminar evaluated for 100 marks in Third Year Second Semester. The evaluation is purely internal and will be conducted as follows:

The faculty members In-charge of seminars must give model presentation and prepare model technical report to create good knowledge among the students before presentation and submission of the technical report.

Sl.No	Topic	Marks
1	Selection of topic and literature survey	10 marks
2	Relevance, level of content and report with usual sub topics (This sub topics -Summary, introduction , historical background , basic theory, detailed description, applications, conclusions and future scope)	15 marks
3	Presentation	20 marks
4	Discussion	5 marks
5	Mid semester Viva (after first mid test)	20 marks
6	Final Viva	20 marks
7	Attendance	5 marks
8	Class notes	5 marks
Total Marks		100 marks

IV year I Semester, B. Tech – Biotechnology

a	b	c	d	e	f	g	h	i	j	k	l
			x					x	x	x	x

L	T	P/D	C
3	1	0	3

5ZC02 MANAGEMENT SCIENCE

Course Objective: The course is aimed at giving the basics of management, its principles, practices and latest concepts for increasing the performance of engineering graduates in their respective fields.

Course Out Comes:

- 1) Outlines the significance of management, defines the basic concepts and applicability of management principles in changing paradigms.
- 2) Demonstrates the procedures of the work study method and work measurement, Project management.
- 3) Infers the need to understand the importance of materials management and quality control techniques.
- 4) Relates the knowledge of two functional areas of business, human resource management and marketing management.
- 5) Explains the different dimensions of behavior, personality, perception, attitudes overall to gain insights into organizational behavior.
- 6) Distinguish some aspects related to strategic planning and strategic implementation to gain competitive advantage over competitors.

UNIT I

INTRODUCTION TO MANAGEMENT: Management- Definitions, Levels of Management, Functions of management- Planning: types of planning, planning process; Organizing: Organizational Design and Structure, Staffing; Directing; Controlling: Basic control process- Fayol's principles of Management - Taylor's principles of scientific management- Maslow's Motivational theory,.

UNIT II

INTRODUCTION TO OPERATIONS MANAGEMENT: Plant Location- need, factors; Plant layout – types , Methods of production, Techniques of Project Management - Network Analysis - Program Evaluation and Review Techniques (PERT), Critical Path Method(CPM) , Crashing of Simple Networks.

UNIT III

MATERIALS MANAGEMENT: Objectives of Material management, Inventory control- need for Inventory Control, ABC Analysis, Economic Order Quantity; Just In Time; Introduction to LSCM; Quality Control Techniques– Introduction to SQC, Inspection, ISO standards, Six Sigma.

UNIT IV

(i) Human Resources Management: Objectives of HRM, Challenges of HRM, HR Planning process HR functions and policies – Job Analysis, Recruitment, Selection, Training and Development, Performance Appraisal.

(ii) Marketing Management: Concept of Marketing, Functions, Marketing Mix, Product Life Cycle, Marketing Strategies, Channels of Distribution, Differences between products and services.

UNIT V

INTRODUCTION TO ORGANIZATIONAL BEHAVIOR: Definition, Nature and Scope of OB, Personality-determinants of Personality – Perception- Attitudes- Attribution theory- Johari Window and Transactional Analysis , Stress Management- factors and remedies

UNIT VI

STRATEGIC MANAGEMENT: Introduction to Strategic Management, Vision, Mission, Goals, Objectives, Environmental Scanning- PESTEL, SWOT Analysis, Competitive Advantage, Concept of Core Competence, PORTER's five force model, types of strategies, Strategic formulation and Implementation.

Books Recommended:

- A R Aryasri: Management Science, Tata Mc Graw Hill

Referencess:

- Dr. Y. Satyanarayana: Management control systems in competitive environment,
- Koontz & Weihrich: Essentials of Management, 6/e, TMH, 2005
- Kotler Philip & Keller Kevin Lane: Market Management 12/e, PHI, 2005

**IV year I Semester, B. Tech – Biotechnology
(5G728) DOWN STREAM PROCESSING**

X			X			X			X	
a	b	c	d	e	f	g	h	i	j	k

L T P/D C
3 1 - 3

Course Objective: This course aims to give insights into various downstream processing operations involved in biotechnology.

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

UNIT-II: SOLID-LIQUID SEPARATION-I. Filtration, Centrifugation (types and equipments) methods. Recent development in product Isolation (for ex. one step purification, reverse micelle extraction)

UNIT III: SOLID-LIQUID SEPARATION-II: Cell disruption methods for intracellular products, removal of insoluble, biomass (and particulate debris) separation techniques, flocculation and sedimentation

UNIT IV: CONCENTRATION OF PRODUCTS I:

Membrane-based separations : micro, ultra filtration, hyper filtration, electrodialysis ,Dialysis and Hemodialysis

Precipitation methods (with salts, organic solvents, and polymers), Extractive separations, aqueous two-phase extraction, supercritical fluid extraction.

UNIT V: CONCENTRATION OF PRODUCTS II: Chromatographic techniques- Paper, TLC, Adsorption, Ion exchange, Gel filtration, affinity chromatographic separation processes, GC, HPLC.

UNIT VI: ALTERNATIVE SEPARATIONS METHODS: Crystallization, Pervaporation. Physical adsorption, Chemisorptions, adsorption isotherms, Single stage operation, fixed bed adsorption, Adsorption wave, Introduction to basics of sustainable bioprocessing: lifecycle analysis and disposable bioreactors

TEXT BOOKS:

1. Wankat PC. Rate controlled separations, Elsevier, 1990.
2. Belter PA and Cussler E. Bioseparations, Wiley 1985.

REFERENCES:

1. Product Recovery in Bioprocess Technology, BIOTOL.' Series, VCH, 1990.
2. Asenjo J.M. Separation processes in Biotechnology, 1993, Marcel Dekkera Inc
3. M.R.Ladisich, Bioseparation engineering: Principles, Practice and Economics, Wiley Interscience 2001

Course Outcomes:

- CO:I** Ability to solve Problems and requirements of bioproduct purification and Economics of downstream processing in Biotechnology
- CO:II** Ability to understand Physico-chemical basis of bio-separation processes.
- CO:III** Ability to understand Cell disruption methods and separation techniques.
- CO:IV** Ability to understand Membrane-based separations , configuration , Precipitation methods in integrated bioprocessing.
- CO:V** Ability to demonstrate Electrophoresis of proteins and nucleic acids, Chromatographic techniques- Paper, TLC
- CO:VI** Ability to understand Dialysis, Crystallization Pervaporation, super liquid extraction foam based separation

IV year I Semester

a	b	c	d	e	f	g	h	i	j	k	l
	X	X		X	X			X		X	

(5G729) ANIMAL BIOTECHNOLOGY

L T P/D C
3 1 - 3

UNIT I: ANIMAL CELL CULTURE AND MEDIA: Introduction, Media-balanced salt solutions and simple growth medium, Role of serum, Serum and protein free media, cell growth factors, Equipments and materials for animal cell culture technology, Chemical, physical and metabolic functions of different constituents of culture medium – Over View

UNIT II: ESTABLISHED CELL LINES: Basic techniques, disaggregation of tissue-trypsinization, Primary and established cell lines, cell separation, Cryopreservation, Cell synchronization, cell transformation

UNIT III: CELL VIABILITY AND TOXICITY: Measurement of viability and cytotoxicity, Biology and characterization of the cultured cells, measuring parameters of growth, apoptosis and necrosis.

UNIT IV: APPLICATIONS OF ANIMAL CELL CULTURE: Applications of Animal cell culture- vaccines, Bio-therapeutics, Monoclonal antibodies, Stem cells –Types and applications, scaling up of animal cell culture.

Unit V: EXPERIMENTAL & TRANSGENIC ANIMALS: Concept of Transgenics, Production of transgenic animals - mouse, fish, Poultry, Generation of animal models for biomedical and pharmaceutical studies and limitations of animal models.

UNIT VI: INDUCED ANIMAL BREEDING: Introduction, artificial insemination, cloning, in-vitro fertilization and embryo transfer, nuclear transplantation, selective animal breeding.

Text books:

1. Culture of Animal Cells, (3rd Edition), F1. Ian Freshney, Wiley-Liss
2. Animal Cell Culture-Practical approach, Ed. John R.W.Masters, Oxford

References:

1. Cell Culture Lab Fax. Eds.M.Butler & M.Dawson, Bios Scientific Publications Ltd, Oxford
2. Animal Cell Culture Techniques, Ed. Martin Clynes, Springer
3. Methods in Cell Biology, vol 57, Animal Cell Culture Methods, Ed. Jenni P, Mather and David Barnes, Academic press
4. Cell Growth and Division: A Practical Approach. Ed R.Basega, IRL Press

IV Year I Semester, B. Tech – Biotechnology**(5G730) MOMENTUM AND HEAT TRANSFER**

a	b	c	d	e	f	g	h	i	j	k	l
X		X	X			X			X	X	

L T P/D C
3 2 - 3

Course Objective: This course aims to provide a basic understanding about momentum and heat transfer in bioprocess. First three units deals with basics of fluid mechanics like flow through pipes, viscosity measurements, friction factors etc. Last three units give an insight into various modes of heat transfer, convection, dimensional analysis and various types of evaporators.

Unit-I : BASIC CONCEPTS

Classification of fluids, fluid statics, energy balance in fluid flow through pipes and conduits, Bernoulli's equation and its application, flow measuring devices-manometers, orifice and venture meters and Rota meter.

UNIT-II: FLOW THROUGH PIPES:

Average velocity, flow regimes boundary layer concepts, laminar and turbulent flow, Reynolds number, pressure drop in laminar and turbulent flows, friction factor chart, losses in pipe fittings, flow through porous media.

UNIT-III: RHEOLOGY OF FLUIDS

Newton's law of viscosity, concepts of Newtonian and Non-Newtonian fluids, classification, two parameter models, viscosity measurement, factors affecting broth viscosity, mixing equipment, flow patterns, mechanism of mixing and power requirements.

UNIT-IV: MODES OF HEAT TRANSFER

Heat transfer and their mechanism, Steady state and unsteady state heat transfer by conduction, heat transfer through slab and cylinder. Concept of log mean radius for transfer through pipes, extended surface heat transfer through fins.

UNIT-V: CONVECTION

Dimensional analysis, forced convection in pipes and other geometries, natural convection-various correlations for evaluating the heat transfer coefficients.

UNIT-VI APPLICATIONS OF HEAT TRANSFER IN BIOPROCESSING

Analogy between heat, mass and momentum transfer. Applications of heat transfer in bioprocessing batch sterilization and design of continuous sterilizer, overview of various types of heat exchangers, concept of LMTD, types of evaporators.

TEXT BOOKS:

1. Smith J.C.Hrriot. P "Unit Operations of chemical Engineering " Mc. Cabe W.L...,Mc.Graw Hill, 3rd ed., 1993.
2. Pauline M Doran," Bioprocess Engineering Principles", Academic Press,1995.

References:

1. Christie.J.Geankoplis “Transport processes and separation process principles” Prentice Hall Professional Technical Reference, 2003
2. D.G.Rao “Introduction to Biochemical Engineering” Tata McGraw-Hill, 2005

Course outcomes:

- CO:I** Ability to understand fluid statics and applications of Bernoullis equation (estimate frictional losses, size pipes, size pumps, etc.)
- CO:II** Ability to calculate average veocity,Reynolds number,friction factors and understand flow through pipes.
- CO:III** Ability to know the various classification of fluids and their viscosity measurements. The factors affecting the viscosity
- CO:IV** Ability to calculate heat transfer through cylinder and slab. Understand the concept of log mean radius
- CO:V** Ability to understand dimensional analysis, natural convection for evaluating heat transfer coefficients
- CO:VI** Ability to understand the analogy between three types of transfer. Ability to design sterilizer and understand about various types of evaporators.

IV Year I Semester, B. Tech – Biotechnology
(5G731) APPLIED VIROLOGY (PROFESSIONAL ELECTIVE-III)

a	b	c	d	e	f	g	h	i	j	k	l
x	x	x			x						
L T P/D C											
3 1 - 3											

OBJECTIVE: To gain knowledge about basic properties of virus its structure, cultivation and characterization of viruses. Basic knowledge Plant and viruses their control mechanism

UNIT I: INTRODUCTION TO VIROLOGY: Brief outline of Discovery of Viruses; Properties of Viruses. Classification of viruses & nomenclatures.

Unit II: STRUCTURE OF VIRUSES: Morphology of Viruses- Structure, Capsid Architecture, Envelopes and peplomers; Genome- Structure and Types, Ultra structure and life cycles of Bacteriophages- M13, Mu, T3, T4 & lambda

UNIT III: CULTIVATION OF VIRUSES: General Methods of cultivation of viruses- in Embryonated eggs, cultivation of animal and plant viruses; Isolation and purification of viruses- plant viruses, animal viruses; Criteria of purity, Maintenance and preservation of infectivity

UNIT IV: GENERAL METHODS OF CHARACTERIZATION OF VIRUSES: Electron microscopy, X-ray crystallography, sedimentation, analysis; Enumeration viruses- By electron microscopy, plaque assay, acid end point method, Haemagglutinin assay; Detection of viruses- By serological characterization, detection of viral antigen, detection of viral nucleic acid;

UNIT V: PLANT VIRUSES: Symptoms of diseases caused by plant viruses (Morphological, Physiological and Histological); Ultra structure and life cycles of TMV and CaMV; transmission of plant viruses- Mechanical and biological (vector and non-vector); Basic control measures of plant diseases- vector and chemical control.

UNIT VI: HUMAN VIRUSES: Ultra structure and brief account on life cycles of RNA viruses- Polio, Influenza, Measles, Rota virus and HIV; Ultra structure and brief account on life cycles of DNA viruses- Vaccina, HSV, Adeno, SV40 and Hepatitis Virus; Viral vaccines- types and preparation of conventional vaccines.

TEXT BOOKS

1. Introduction to Modern Virology, Dimmock N J, Primrose S B, 4th edition, Blackwell Scientific Publications, Oxford.
2. Medical Virology, Morag C, Timbury M, Chrchill Livingstone, London
3. Functionals of Plant Virology, Mathews RE, academic Press, San Diego.

REFERENCE BOOKS:

1. Text Book on Principles of Bacteriology, Virology and Immunology, Edward Arnold, London.
2. An introduction to viruses, S B Biswas, Amita Biswas

COURSE OUTCOME (CO)		POs
CO:I	To gain knowledge about classification and properties of virus	b, f
CO:II	Classify and illustrate the different types of Viral Structure	a
CO:III	To Understand general Methods of cultivation of viruses	d
CO:IV	To understand general methods of characterization of viruses	b, f
CO:V	To study various plant viruses and their life cycle	c
CO:VI	To study various Human viruses and their life cycle	b

IV year I Semester, B. Tech – Biotechnology
(5G732) COMPUTATIONAL BIOLOGY
(PROFESSIONAL ELECTIVE-III)

a	b	c	d	e	f	g	h	i	j	k	l
X		X	X			X				X	

L T P/D C
3 - 3

UNIT I: INTRODUCTION TO COMPUTATIONAL MOLECULAR BIOLOGY: Introduction to active areas of research in Computational Molecular Biology, Functional Genomics, Comparative Genomics.

UNIT II: SEQUENCE-BASED DATABASE SEARCHES: BLAST and FASTA algorithms, various versions of basic BLAST and FASTA, Use of these methods for sequence analysis including the on-line use of the tools and interpretation of results.

UNIT III: GENE PREDICTION: Prediction of Genes, Promoters, splice sites, regulatory regions, prokaryotic and eukaryotic genomes, Homology based gene prediction. SNPs and applications. EST approach.

UNIT-IV MICRO ARRAYS: Basics of Micro array, DNA micro array, understanding of micro array data and correlation of gene expression data to biological processes and computational analysis tools.

UNIT V: PROTEIN STRUCTURE PREDICTION: Secondary structure prediction methods, Algorithms of Chou Fasman, GOR methods; concepts in measuring the accuracy of predictions (Q3). Protein homology modeling, Protein threading. Protein ab initio structure prediction.

UNIT VI: MOLECULAR DOCKING: Methods of Docking – Flexible and Rigid Docking, Docking algorithms – Genetic algorithm, QSAR overview and its significance in Docking

TEXT BOOKS:

1. David W Mount. Bioinformatics- Sequence and genome analysis. CSHL Press.
2. Jonathan Pevsner. Bioinformatics and Functional Genomics. A Jhon Wiley & Sons, Inc., Publication

REFERENCES:

1. Moody P C E and A J Wilkinson. Protein Engineering, IRL Press.
2. Creighton T E, Proteins. Freeman W H. Second Edition 1993.
3. Brandon and Tooze – Proteomics

IV Year I Semester, B. Tech – Biotechnology

**(5G733) ENZYME ENGINEERING
(PROFESSIONAL ELECTIVE-III)**

L T P/D C
3 1 - 3

Unit wise Course Outcomes	POs
Students will be able to	
1. Define and understand the nomenclature, classification, applications of the enzymes.	a,b
2. Understand the kinetics of enzyme reactions including different models	c,e
3. Apply enzyme catalysis and Mechanism of enzyme action in different enzyme systems and understand inhibition kinetics.	a,b,c
4. Explain the effect of Temperature and P ^H dependence of rate constants.	b,c
5. Understand Pre-steady-state kinetics of enzymes.	b,c
6. Explain kinetics of immobilized enzymes, effect of external and internal mass transfer	c,f

Unit I: Introduction to Enzyme Engineering

Industrial Enzymes- their source, Isolation, characterization and their purification. Applications of enzymes in Industry, Medicine, Analytical Chemistry, Chemical, Pharmaceutical & Food Sectors. Specific activity, Turnover number. Basis of enzymatic reaction, collision theory and transition state theory.

Unit II: Enzyme Kinetics

Kinetics of single substrate enzyme catalyzed reaction, equilibrium, steady state assumption - Michaelis-Menten (Briggs- Haldane) equation. Transformation of Michaelis- Menten equation. The Lineweaver Burk, Eadie-Hofstee and Hanes plots. Determination of V_{max}, K_m, K_{cat}, Specificity constant (K_{cat}/K_m) and their significance.

Unit III: Mechanism of Enzyme Catalysis and Inhibition

Nature and conformation of active site. Models for identification of functional groups essential for catalysis. Hydrolytic, covalent, acid-base, electrostatic and metal ion involved catalysis. Mechanism of enzyme action- Lysozyme, Carboxy peptidase, Chymotrypsin and Ribonuclease. Enzyme inhibition: Reversible inhibition- Competitive, Noncompetitive (pure, mixed) inhibition, Substrate inhibition, allosteric and irreversible inhibition. Feedback inhibition.

Unit IV: Immobilization of Biocatalysts

Immobilization of biocatalysts an introduction, Electrostatic Effect, effect of charged and uncharged support, Effect of external and internal mass transfer,

Unit V: Engineering of Enzymes

The Goals of Protein Engineering, Classic and Modern Methods to synthesize proteins, Protein Engineering Using PCR, Examples of engineered proteins- insulin and Subtilisin

Unit VI: Modern concepts in Enzymology

Modern concepts of evolution of catalysis – catalytic RNA (Ribozymes), Abzymes (catalytic antibodies), Design of enzyme electrodes and their application as biosensors in industry, healthcare and environment.

TEXT BOOKS:

- 1) Blanch HW and Clark DS: Biochemical Engineering Marcel Decker - 1987.
- 2) Enzymes by palmer
- 3) Blanch HW and Clark DS: Biochemical Engineering, Marcel Decker

REFERENCES:

1. Bailey JE, Ollis, DF: Biochemical Engineering Fundamentals
2. Schugerl K., Bellgardt KH (Eds): Bioreaction Engineering, modeling and control: Springer-Verlag, Berlin
3. Wiseman, A: Handbook of Enzyme Biotechnology, 3rd Edition, Ellis Horwood Publication
4. Moser, A: Bioprocess technology, kinetics and reactors: Springer Verlag

**IV year I Semester, B. Tech – Biotechnology
(5G734) ADVANCED BIOPROCESS CONTROL
(Professional Elective - III)**

a	b	C	d	E	f	g	h	i	j	k	l
X		X	X			X			X	X	

L
L T P/D C
3 1 - 3

Course Objective: This course aims at providing advanced knowledge about different types of stability criteria to determine system stability in bioprocess industries. It also aims to provide an insight into basics of multi loop control systems .

UNIT-I : Review of single input single out put (SISO) systems, Routh stability criteria & Qualitative analysis of Bode and Nyquist stability.

UNIT-II: Feedback control system with large dead time, dead time compensation, control of systems with inverse response

UNIT-III : Multiloop control systems, Cascade control, Selective control systems, Split Range control

UNIT-IV: Logic of feed forward control, Problem of designing feed forward control, Feed forward-Feedback control, ratio control

Unit-V: Adaptive control, self adaptive control, Inferential control with case study of a distillation column

Unit VI: Design questions for MIMO control systems, Degrees of freedom and number of controlled and manipulated variables, Generation of alternative configurations

TEXT BOOKS:

- Stephanopoulos, “Chemical Process Control -An Introduction to theory & Practices” PHI, 2010.

REFERENCE BOOKS:

- Babatunde, O. and Ray W.H., “Process Dynamics, Modeling and Control”., Oxford University Press, 1994.
- Seborg, D.E., Edgar, T.F and. Mellichamp, D.A, “Process Dynamics and control,” Wiley, 2006.

III year I Semester, B. Tech – Biotechnology
(5G735) NANOMATERIALS: SYNTHESIS AND CHARACTERIZATION
(Professional Elective -III)

L	T	P/D	C
3	1	0	3

Unit-I: Introduction to synthesis of nanostructure materials, Physical methods: Inert gas condensation, Arc discharge, Ball milling, electrodeposition, rapid solidification (RSP), consolidation

Unit-II: Chemical methods: Nanocrystals by chemical reduction, photochemical synthesis, electrochemical synthesis, nanocrystals of semiconductors and other materials by arrested precipitation, emulsion synthesis, sonochemical routes

Unit-III: Biological methods – use of bacteria, fungi, actinomycetes for nano-particle synthesis-magnetotactic bacteria for natural synthesis of magnetic nano-particles, role of plants in nano particle synthesis

Thermolysis route - spray pyrolysis and solvated metal atom dispersion, sol-gel method, solvothermal and hydrothermal routes, solution combustion synthesis, CVD method and other variants

Unit-IV: Compositional and structural Characterization techniques: X-ray Photoelectron Spectroscopy (XPS), Electron probe microanalysis (EPMA),

Unit-V: Surface characterization Techniques: Scanning electron microscopy (SEM), Transmission electron microscopy, Spectroscopic techniques: UV-Visible spectroscopy, Infrared (IR) & Fourier Transform infrared (FTIR) spectroscopy,

Unit-VI: Electrical characterization techniques: Hall measurement, Dynamic and static Current voltage (I-V) characteristics, Magnetic & dielectric characterization: SQUID, VSM

Textbooks:

1. Inorganic Materials Synthesis and Fabrication by J.N. Lalena, D.A. Cleary, E.E. Carpenter, N.F. Dean, John Wiley & Sons Inc.
2. Introduction to Nano Technology by Charles P. Poole Jr and Frank J. Owens. Wiley India Pvt Ltd.
3. The Chemistry of nanomaterials: Synthesis, Properties and Applications, Vol-I by C.N.R. Rao, A. Muller and A.K. Cheetham
4. “Nanoscience and Nanotechnology: Fundamentals to Frontiers” by M.S. Ramachandra Rao and Shubra Singh, Wiley Publishers, 2013.
5. Characterization of nanostructured materials by Z.L. Wang
6. Principles of Instrumental analysis by D.A. Skoog, F.J. Hollen and T.A. Niemann

Reference books:

1. Encyclopedia of Nanotechnology by M.Balakrishna Rao and K.Krishna Reddy, Vol I to X, Campus books.
2. Encyclopedia of Nanotechnology by H.S. Nalwa
3. Nano: The Essentials – Understanding Nano Science and Nanotechnology – by T.Pradeep; Tata Mc.Graw Hill

**IV Year I Semester, B. Tech – Biotechnology
(5G736) CANCER BIOLOGY (PROFESSIONAL ELECTIVE- IV)**

a	b	c	d	e	F	g	h	i	j	k	l
x	x	x			x						

L T P/D C
3 1 - 3

OBJECTIVE

To gain knowledge in biological phenomenon of cancer, molecular mechanism of carcinogenesis, treatment and techniques involved, and to facilitate students to conduct investigations using research based knowledge and methods and find modern biotechnology engineering solutions to combat cancer.

UNIT I: FUNDAMENTALS OF CANCER BIOLOGY: Nomenclature of cancer, classification of human cancers, Epidemiology of Human cancer. Various causes of Cancer- carcinogens, genetic susceptibility

Unit II: MUTATION AND CANCER: Regulation of cell cycle, modulation of cell cycle in cancer, mutation that cause change in signal molecules, effect on receptor, signal switches, tumor suppressor genes

UNIT III: PRINCIPLES OF CARCINOGENESIS: Types of chemical carcinogens, Chemical Carcinogenesis, Targets of Chemical Carcinogenesis. Physical carcinogenesis, mechanism of radiation; Carcinogenesis. Role of viruses in cancer, role of diet in cancer, cancer stem cells

UNIT IV: ONCOGENES: Oncogenes / Proto oncogene, identification and detection of Oncogenes, Retroviruses and Oncogenes, Growth Factor and Growth Factor receptors that are Oncogenes.

UNIT V: PRINCIPLES OF CANCER METASTASIS: Angiogenesis and its role in metastasis significances of invasion, three-step theory of Invasion, basement Membrane disruption, role of proteinases in tumour cell invasion., heterogeneity of metastatic phenotype, steps in metastatic cascade

UNIT VI: CANCER DETECTION AND THERAPY: Various methods used for detection of cancers, Advances in Cancer detection., new molecules for cancer therapy- Different forms of therapies for cancer- chemotherapy, radiation therapy, and immuno therapy their advantages and limitations.

TEXT BOOKS

1. L. M. Franks, N. M. Teich. An Introduction to Cellular and Molecular Biology of Cancer, Oxford Medical Publications, 1991.
2. Robert A Weinberg, The Biology of Cancer, Garland Science, 2010
3. Robin Hesketh, Introduction to Cancer Biology, Cambridge University Press, 2013

REFERENCE:

1. Dunmock N.J and Primrose. S.B., Introduction to modern Virology, Blackwell publications.
2. Cancer: Principles and Practice of Oncology, 9th Edition, Vincent T. DeVita, Jr., Theodore S. Lawrence, Steven A. Rosenberg, Lippincott Williams and Wilkins, 2011

COURSE OUTCOME (CO)		POs
CO:I	Classify different types of cancer and assess various causes attributed to cancer	b, f
CO:II	To determine various types mutations which causes cancer	a
CO:III	To determine the role of chemical , Physical and Biological carcinogens and demonstrate their cancer causing ability	d
CO:IV	To understand the role of oncogenes in cancer development	b, f
CO:V	To have an elaborate understanding about cancer invasion and metastasis	c
CO:VI	To compare various detection methods and therapies available for cancer	b

IV Year I Semester, B. Tech – Biotechnology
(5G737) Molecular Markers & Crop Improvement
(PROFESSIONAL ELECTIVE- IV)

a	b	c	d	e	F	g	h	i	j	k	l
x	x	x			x						
						L	T	P	C		
						3	1	-	3		

Unit I: Plant Biotechnology for crop improvement: Conventional plant breeding strategies, Hybridization, Inbred lines, Pure lines, Heterosis. Genetic Engineering of crops for useful agronomic traits for male sterility, food quality, improved crop productivity and molecular farming.

Unit II: Molecular markers: Random amplified polymorphic DNA (RAPD), Restriction fragment length polymorphism (RFLP), Amplified fragment length polymorphism (AFLP), Simple sequence repeats (SSR), Inter Simple sequence repeats (ISSR), Single strand conformation polymorphism (SSCP) and Quantitative trait loci (QTLs)

Unit III: Molecular markers for crop improvement: Marker assisted selection (MAS), Construction of molecular maps in plants, Map based Cloning, Molecular maps and their utility in plant genomics, Advantages and limitations of molecular markers.

Unit IV: Molecular Biology of Plant Processes: Discovery / Cloning of Plant Genes: Probe based screening, Genomic and proteomic approaches, Expressed Sequenced Tags, Developmentally regulated genes

Unit V: Transgenic Crops I: Secondary metabolites, increase in productivity by manipulation of photosynthesis, nitrogen fixation, nutrient uptake efficiency, Metabolomics, post harvest technology, strategies for enhancing nutritive value of crops, introduction to male sterility for hybrid seed production

Unit VI: Transgenic Crops II: Plants as bioreactors, chloroplast transformation transgenic plants for quality improvement of protein, lipid & carbohydrate content, phytoremediation of contaminated soils, Risks and benefits of release of GM crops. Regulation of research and development of transgenic plants.

TEXT BOOKS:

1. Biochemistry & Molecular Biology of Plants (Buchanan, BB, Gruissem, W & Jones, R.L eds.) 2000
2. Molecular Plant Breeding, Yunbi Xu, CABI Publishers, I edition, 2010 (ISBN-13: **978-1845933920**)

REFERENCES

1. Principles of Plant Genetics and Breeding, George Acquaah, Blackwell-Wiley Publishers, I Edition, 2006 (ISBN-13: **978-1405136464**)
2. Plant Molecular Breeding- Sheffield Biological Series, H. John Newbury, Blackwell Publishers, 2003 (ISBN-13: **978-0849328138**)

Unit wise Course Outcomes	POs
Students will be able to	
1. Compare the conventional versus modern plant breeding methods	a,b,
2. Understand the types and importance of molecular markers	a,b
3. Describe application of Molecular markers in crop improvement	a,b
4. Understand the molecular biological aspects of plant processes	a,b,c
5. Understand and Explain various strategies for production of transgenic crops	a,b,c,e
6. Understand and differentiate various transgenic crop production platforms, explain the risks associated with them and safety measures to be employed	a,c,e

**IV Year I Semester, B. Tech – Biotechnology
(5G738) FOOD BIOTECHNOLOGY
(PROFESSIONAL ELECTIVE- IV)**

L	T	P	C
3	1	-	3

Course Outcomes

1. Students shall be able to understand the principles of Food science
2. Students shall be gain knowledge and perform the methods of food preservation.
3. Students shall be able to identify the role of microbes in fermentation
4. Students shall be able to understand the role of food additives and methods to identify food adulterants
5. Students shall be understand the methods in food processing
6. Students shall be able to gain knowledge in the quality control

UNIT I: INTRODUCTION: Objectives of Food science and Technology, Chemical, nutritional, and functional properties of carbohydrates (starch, cellulose, sugars, pectin, fibres (changes during processing) manufacture of maltodextrins and corn syrups, Cyclodextrins, lipids (omega-3 and omega-6 fatty acids and their nutraceutical significance) Rancidity. Proteins (Protein efficiency ratio PER).

UNIT II: FOOD PRESERVATION: Principles of food preservation: Physical (Blanching, Pasteurization, Freezing), Thermal death time, D-value, Z-value, Irradiated foods – Radappertization, Radicidation, and radurization of foods. Chemical : Benzoic acid and parabens, nitrites and nitrates, phenolics, antioxidants: BHA, BHT and biological methods: Bacteriocin, Nisin)

UNIT III: FOOD MICROBIOLOGY AND FERMENTATIONS: Probiotics, types of microorganisms associated with food –meats, seafood, Dairy products. Factors affecting growth and survival of Microorganisms in foods. Fermented meat -sausages, Fisheries - Fish Sauses, vegetables-Sauerkaraut, Olives, Dairy products -cheese, beverages- wine, beer. Spoilage in Meats, Fish, Food -borne infections – Salmonellosis, shigellosis), Food intoxications – Botulism , aflatoxins.

UNIT IV: FOOD ADDITIVES AND ANALYSIS: Pigments in food, Food Flavours and colours, Water activity measurements and its significance in food quality, Enzymatic methods of food analysis, Analysis of pesticides in foods, Analysis of heavy metals in food, analysis of phytosterols.

UNIT V: FOOD PROCESSING: Basic principles, unit operations-size reduction-hammer mill, ball mill, mixing –pan mixers ,masticators, blender. emulsification, centrifugation-tubular bowl centrifuge, disc bowl centrifuge ,Extraction, crystallization-vaccumcrystalizer.

UNIT VI: QUALITY CONTROL: Concept of quality: Quality attributes- physical, chemical, nutritional, microbial, and sensory; their measurement and evaluation. International quality systems and standards like HACCP.

TEXT BOOKS

1. Roger A., Gordan B., and John T., " *Food Biotechnology* ", 1989. 3.
2. George J.B., and John T., " *Food Microbiology* ", CBS Publishers & Distributors, 1987. 4th edition.
3. *Frazier* and D. C. Westhoff ,*Food Microbiology*, 4th ed., 1988..

REFERENCES

1. George, J. B., "Basic Food Microbiology", CBS Publishers Distributors, 1987. 4th edition.
2. *Lindsay, Willis Biotechnology, Challenges for the flavor and food Industries, Elsevier Applied Science, 1988.*

**IV year II Semester, B. Tech – Biotechnology
(5G739) BIOPROCESS ECONOMICS & PLANT DESIGN
(Professional Elective - IV)**

a	b	c	d	e	f	g	h	i	j	k	l
X	X					X				X	

L
L T P/D C
3 1 - 3

Course objective: This course aims to provide knowledge about basic concepts in Interest, capital investment tax and depreciation and provides an insight into capital, overhead and manufacturing costs estimation. The course is designed to give an understanding of process design development and general design considerations. To give insight about various types of valves, pumps, steam traps, spargers and impellers used in biotech industries

UNIT-I ECONOMIC EVALUATION

Capital cost of a project; Interest calculations, nominal and effective interest rates; basic concepts in tax and depreciation; Measures of economic performance, rate of return, payout time; Cash flow diagrams; Cost accounting-balance sheet and profit loss account; Break even and minimum cost analysis.

UNIT- II BIOPROCESS ECONOMICS

Bio-Products regulations; Economic analysis of bioprocess; Capital, overhead and manufacturing costs estimation; Case studies of antibiotics (Penicillin and Streptomycin), recombinant products, single cell protein, anaerobic processes and other fine chemicals.

UNIT- III INTRODUCTION TO PLANT DESIGN

Process design development: design procedures, design information and flow diagrams, material and energy balances, comparison of different process and design specifications;

UNIT- IV OPTIMIZATION

Optimization; General design considerations: Health and safety hazards, Environment protection, plant location and plant layout, plant operation and control

UNIT- IV BASIC DESIGN PROBLEMS

Design examples on continuous fermentation, aeration, and agitation; Design calculation of filter for air sterilization; Design of batch and continuous sterilizers; Design calculations for immobilized enzyme kinetics; Practical considerations in designing of Bioreactor/Fermentor construction.

UNIT- V

Introduction to different types of valves, pumps, steam traps, spargers and impellers used in fermentation industries; Design exercise on trickle flow fermentor; Problems associated with design equations.

Text Books:

1. Plant Design and Economics for Chemical Engineers, 5/e
Max S. Peters, Ronald E. West, (2003) McGraw-Hill Higher,
2. Biochemical Engineering -Humphrey, A. E.; Millis, JSTOR 1966.
3. Biochemical Engineering, by Harvey W. Blanch, Douglas S. Clark CRC; 1st edition (1997).
4. Biochemical Engineering Fundamentals by James; Ollis, David F. Bailey,1977, McGraw-Hill.

Suggested Reading:

1. Biochemical Engineering and Biotechnology Handbook by Bernard Atkinson, FerdaMavitunaGrove's Dictionaries; 2 edition (1992).
2. Bioprocess Engineering:Basic Concepts. Michael L. Shuler / FikretKargi, Reihe:Prentice ,(2001) Hall.
3. Plant Design and Economics for Chemical Engineers” by M. Peters and K. Timmerhaus, McGraw-Hill.
4. Bioprocess and Biosystems Engineering Dirk Weuster-Botz, ISSN: 1615-7591 Journal no. 449, Springer.

Course Outcomes:

CO : I	Be able to carry out interest calculations and prepare balance sheets for business transactions.
CO : II	Be able to determine the economic analysis of bioprocesses.
CO : III	Carry out cost estimations for different industrial productions.
CO : IV	Develop process design, flow diagrams.
CO : V	Be able to design filters for air sterilization, batch and continuous sterilizers, valves etc..
CO : VI	Able to understand different types of valves, pumps, steam traps, spargers and impellers used in fermentation industries;

**IV year I Semester, B. Tech – Biotechnology
(5G740) NANOTOXICOLOGY (PROFESSIONAL ELECTIVE-IV)**

a	b	c	d	e	f	g	h	i	j	k
X		X								

L T P/D C
3 1 - 3

Unit-I: Introduction: Concept of Toxicology, dose-response curve, nanotoxicology laboratory models: cells, fish, rodent studies – Ecotoxicologic studies and nanotoxicology testing

Unit-II: Mechanisms of toxicity: Mechanism of nanosize particle toxicity - reactive oxygen species, role of oxidative stress - mechanisms and health effects - interactions of nanoparticles with cells and their impact on cells-cytotoxicity, apoptosis and necrosis.

Unit-III: Fate of nanomaterials in the environment: Sources, fate and environmental transport of nanomaterials in air, water and soil

Unit-IV: Human exposure to nanosized materials: Toxicology of airborne – manufactured nanomaterials in the environment, biological activities of nanomaterials - respiratory tract – efficient deposition of inhaled NSPS- cytotoxicity of ultrafine particles

Unit-V: Translocation of nanosized materials: Deposition of nsps in the respiratory - epithelium translocation – translocation to the circulatory system - neuronal uptake and translocation -translocation of nsps in the blood circulation to bone marrow in mice - studies of neuronal translocation of ufps from respiratory tract -exposure via GI tract and skin

Unit-VI: Risk assessment: Portals of entry and target tissue – risk assessment – ethical – legal and social implications–development of test protocols for nanomaterials – regulation of engineered nanomaterials in Europe and USA

Text books

1. Yuliang Zhao and Hari Singh Nalwa, ‘Nanotoxicology: interactions of nanomaterials with biological systems, American Scientific Publishers, 2007
2. "Nanotoxicology - interactions of nanomaterials with biological systems", ED. Yuliang Zhao and Hari Singh Nalwa, June 2006
3. “Nanoscience and Nanotechnology Environmental and Health impacts” by Vicki H. Grassian Wiley Publishers, 2008.

Reference books

1. E. P. Widmaier, H. Raff, K.T. Strang, vander, sherman and luciano, 'Human physiology: the mechanisms of body. functions', 9th edition, mcgraw hill, new york, 2004
2. Gunter oberdörster, eva oberdorster and jan oberdorster, *Environmental health perspectives*, volume 113 number 7 , july 2005
3. D. Drobne, 'Nanotoxicology for safe and sustainable nanotechnology', 58, pp. 471-478, december 2007
4. Monteiro-Riv, 'Nanotoxicology: characterization, dosing and health effects', Informa healthcare publishers, 2007

**IV year I Semester, B. Tech – Biotechnology
(5G782) DOWN STREAM PROCESSING LABORATORY**

a	b	c	d	e	f	g	h	i	j	k	l
	x	x	x					x			

L

L T P/D C

- - 3 2

OBJECTIVE

To provide hands on practical training to extract different bioproducts and to characterize them for their biotechnological importance, and to enable the student to design and conduct experiment to isolate novel bioproducts which can be exploited in exploring the future biotechnology.

Experiments:

1. Sedimentation studies
2. Cell disruption using Homogenizer
3. Cell disruption using enzymatic method
4. Isolation of Chloroplasts and estimation of chlorophyll content using centrifugation
5. Precipitation of proteins using Ammonium sulphate
6. Reverse micellar extraction
7. Adsorption isotherms
8. Affinity chromatography
9. Extraction of lipid from microalgal sample
10. FAME analysis by Gas chromatography in given sample
11. Downstream processing of ethanol using distillation technique
12. Ion exchange chromatography

COURSE OUTCOME (CO)	
CO:I	Ability to understand the principle of Sedimentation and calculation of terminal settling velocity
CO:II	Ability to be able to perform Cell disruption by various mechanical method .
CO:III	Ability to be able to perform Cell disruption by enzymatic method
CO:IV	Ability to understand Isolation of cell organelles using downstream processing techniques for ex: chloroplast and estimation of chlorophyll content
CO:V	Ability to demonstrate the mechanism of precipitation by salts like ammonium sulphate
CO:VI	Ability to demonstrate reverse micellar extraction
CO:VII	Ability to understand the principle of adsorption kinetics and isotherms
CO:VIII	Ability to demonstrate Affinity Chromatography and to analyze the samples by spectrophotometry.
CO:IX	Ability to demonstrate extraction of lipid content from sample and quantification of the same
CO:X	Ability to understand the operation of gas chromatography for estimating FAME in the lipid sample
CO:XI	Ability to perform distillation of ethanol from fermented broth and quantitative estimation by potassium dichromate method.
CO:XII	Ability to demonstrate Ion exchange Chromatography and to analyze the samples by spectrophotometry.

IV Year I Semester

**IV year I Semester, B. Tech – Biotechnology
(5G783) ANIMAL BIOTECHNOLOGY LABORATORY**

a	b	c	d	e	f	g	h	i	j	k	l
	x	x		x	x			x		x	

L T P/D C
- 3 2

Objective: Understanding the principles of animal cell culture lab and its application.

1. Aseptic culture techniques in Animal cell culture
2. Visualization of Human Buccal epithelial cells in inverted Microscope
3. Media Preparation and Filter sterilization of RPMI 1640/ DMEM
4. Separation of serum from whole Blood
5. Isolation of Hepatocytes from chicken liver cells
6. Determination of cell number using haemocytometer
7. Cell viability Assay by FDA and Trypan blue, Cell Duplication time.
8. Cell Propagation And Passaging
9. Isolation of lymphocytes and establishment of primary cell culture
10. Primary culture technique for chicken embryo fibroblast
11. Evaluation of toxicity using mammalian cells/ *Danio rerio* (Zebra Fish)
12. Cryopreservation Technique

References

1. Freshney RI. 2005. Culture of Animal Cells. Wiley Liss.
2. Portner R. 2007. Animal Cell Biotechnology. Humana Press.

EQUIPMENTS & FACILITIES:

Phase contrast Microscope, Filtration Unit, CO₂ Incubator, Bio safety cabinet

S. No.	COURSE OUTCOMES	POs
1	Demonstrate and Make-use-of Equipments & Facilities in Cell Culture Lab	b, c, e, f, I, k
2	Learn Techniques of Sterilization and Establish Aseptic environment	b, c, e, f, I, k
3	Prepare Tissue Culture Media and Modify it for further use	b, c, e, f, I, k
4	Generate monolayer and Establish cell lines	b, c, e, f, I, k
5	Predict and Induce toxicity to established cell lines	b, c, e, f, I, k
6	Isolate, Visualize and Detect cell types	b, c, e, f, I, k
7	Extract, Estimate and Compare cell numbers	b, c, e, f, I, k
8	Apply <i>in vitro</i> Techniques to animal cell cultures	b, c, e, f, I, k

**IV year I Semester, B. Tech – Biotechnology
PROJECT PHASE – I**

a	b	c	d	e	f	g	h	i	j	k	l	m
					x	x					X	

Code: 5G784

L T P/D C
- 1 3 3

COURSE OBJECTIVES:

1. to impart to students a flavor of design, innovation, experimentation and research in the field of Biotechnology.
2. to provide a solid foundation in core Biotechnology disciplines, critical thinking and problem-solving skills.
3. Through the academic program students also develop excellent written and oral communication skills, learn to work as a team and project management.

COURSE OUTCOME:

At the end of this course, Students will be able to

1. Identify a topic in advanced areas of Biotechnology.
2. Review literature to identify gaps and define objectives & scope of the work.
3. Generate and implement innovative ideas for social benefit
4. Learn presentation and writ up skills in the process of project report.

The B. Tech. project is a partial requirement for successful completion of the degree. It can be two types: Projects based on implementation of any application oriented problem, which will be more or less experimental in nature, and the others will be based on some innovative/ theoretical work.

This is aimed at the students to identify a project on which they are likely to continue for their project in final year second semester.

The evaluation of internal marks consist of

Day to day progress of the work	20 marks
Mid Semester presentation	20 marks
Report submission	20 marks
Final Presentation and Defense before a departmental Committee consisting of head, a senior faculty and supervisor	40 marks

	100 marks

There shall be no external evaluation in pre-project seminar.

**IV year I Semester, B. Tech – Biotechnology
(5G785) INDUSTRY ORIENTED MINI PROJECT**

a	b	c	d	e	f	g	h	i	j	k	l	m
x	x	x	x	x	x	x	x	x	x		x	

L T P/D C
- - - 2

Course Objective :

To enhance the knowledge on selecting a project , learn related tools and enhance programming and communication skills for employability.

Pre-Requisites: All Courses till this semester

Course Outcomes: After completing this course, student shall be able to

- Use the concepts learned in the courses, so far, in conceptualizing, designing and executing the modules of the projects.
- Exhibit the interest in learning the modern tools and technologies through the bridge courses arranged in the college, beyond the curriculum,
- Inculcate an enthusiasm to use the creative ideas to build the innovative projects which are meeting the current needs of the market and society as a whole.
- Improve their communicative skills and team skills largely improve.
- Work as an individual and in a team.

A group project shall be carried out by a group of students consisting of 2 to 3 in number in third year first semester. This work shall be carried out under the guidance of the faculty assigned as internal guide and shall involve design, fabrication, software development or any other significant activity. This can be of interdisciplinary nature also.

There will be 100 marks in total with 25 marks of internal evaluation and 75 marks of external

The **internal evaluation** shall consist of:

Day to day work	:	10 marks
Report	:	05 marks
Demonstration / presentation	:	10 marks

		25 marks
 End examination	 :	 75 Marks.

The end examination will be carried out by a committee consisting of an external examiner, head of the department, a senior faculty member and the supervisor.

**IV year I Semester, B. Tech – Biotechnology
(5G797) TECHNOLOGY REVIEW & SEMINAR - III**

L T P/D C
- - 2 1

a	b	c	d	e	f	g	h	i	j	k	l	m
					x	x					X	

Pre-Requisites: All Courses till this semester

Course Outcomes: After completing this course, student shall be able to

- Identify a topic from the current technologies of their choice in the Biotechnology domain and the allied fields, after surveying in the internet resources, journals and technical magazines in the library.
- Arrange the contents of the presentation and also write the report of the research paper..
- Present the technical topic in front of the panel and the fellow students, using the oratory skills and also submit the report of the research paper.
- Interact through answering the questions and also can add some points to the seminar

There shall be a Technical Paper writing and seminar evaluated for 100 marks in Third Year First Semester. The evaluation is purely internal and will be conducted as follows:

Content	: 20 marks
Presentation including PPT	: 20 marks
Seminar Notes	: 10 marks
Interaction	: 10 marks
Report	: 25 marks
Attendance	: 10 marks
Punctuality	: 5 marks
Total	100 marks

IV year II Semester

(5G840) Industrial Biotechnology

a	b	c	d	e	f	g	h	i	j	k	l	m
					x	x					X	

L T P C
3 - 3

Objective

To gain knowledge in important biotechnological principles and processes in environmental management and in the production of valuable products, to develop professional engineering solutions on waste water and solid waste management for a sustainable development.

UNIT I: INTRODUCTION TO INDUSTRIAL BIOPROCESS: Fermentation- Bacterial, Fungal and Yeast, Biochemistry of fermentation. Traditional and Modern Biotechnology- A brief survey of organisms, processes, products. Basic concepts of Upstream and Downstream processing in Bioprocess, Process flow sheeting – block diagrams, pictorial representation.

UNIT II: PRODUCTION OF PRIMARY METABOLITES: Bioprocess-overview, Organic acids -Citric acid, Lactic acid, Amino acids -Glutamic acid, Phenyl alanine, Alcohols –Ethanol, Strain improvement , Dual or multiple fermentation

UNIT III: PRODUCTION OF SECONDARY METABOLITES: Antibiotics-Penicillin, Streptomycin, Erythromycin, And Vitamin B₁₂

UNIT IV: PRODUCTION BIOPRODUCTS: Biopesticides, Biofertilizers, Biopreservatives, Biopolymers Biodiesel, Cheese, Beer, SCP & Mushroom culture.

UNIT V: PRODUCTION OF MODERN BIOTECHNOLOGY PRODUCTS: Production and applications of Industrial Enzymes - Proteases, Amylases, Lipases, Enzymes in food and pharmaceutical industries; Production of recombinant proteins - Insulin, IL2, recombinant vaccines- Hepatitis

UNIT VI: PRODUCTION OF BEVERAGES AND DIARY PRODUCTS: Beverages, production of beverages, beer, wine, microbes in baking - production of Baker's Yeast, milk products

TEXT BOOKS:

1. Basic Industrial Biotechnology by S.M Reddy New Age International Pvt Ltd 2016 Edition.
2. "Biotechnology" by Satyanarayana, U. Books & Allied (P) Ltd., 2015 Edition.

REFERENCE BOOKS:

1. Prescott, S.C. and Cecil G. Dunn, "Industrial Microbiology", Agrobios (India), 2012 Edition.
2. Cruger, Wulf and Anneliese Crueger, "Biotechnology: A Textbook of Industrial Microbiology", 2nd Edition, Panima Publishing, 2000.
3. Moo-Young, Murrey, "Comprehensive Biotechnology", 4 Vols. Pergamon Press, (An Imprint of Elsevier) 2004.

COURSE OUTCOME (CO)	
CO:I	Student shall be able to gain knowledge of various industrial process
CO:II	Student shall be able to understand the concept of Primary metabolites
CO:III	Student shall be able to understand the concept of Primary metabolites
CO:IV	Student shall be able to get knowledge about various bioproducts like biofertilizers, biopesticides etc.
CO:V	Student shall be able to understand production of various enzymes with their applications
CO:VI	Student shall be able to understand the biotechnological production of beverages and diary products

IV Year II Semester, B. Tech – Biotechnology

(5G841) CLINICAL RESEARCH AND REGULATORY AFFAIRS (Professional Elective-V)

a	b	c	d	e	f	g	h	i	j	k	l
	x	x			x	x	x				

L T P/D C
3 - 3

OBJECTIVE

To gain knowledge in clinical research, ethics and regulatory affairs and its application in the field of biotechnology

UNIT I: INTRODUCTION TO CLINICAL RESEARCH: Introduction to Drug Discovery and drug Development, Historical Perspectives of clinical Research: Nuremberg Code, Thalidomide study, Nazis Trials, Tuskegee Syphilis Study, The Belmont Report, The declaration of Helsinki, Origin and Principles of International Conference on Harmonization - Good Clinical Practice (ICH-GCP) guidelines

UNIT II: ETHICS IN CLINICAL RESEARCH: Ethics in all aspects of health care, historical cases, negligence, Declaration of Helsinki and informed consent, Ethics committees, constitution and practices up-to-date cases: cloning, human embryos and IVF

UNIT III: CLINICAL STUDY MANAGEMENT: Documentation, Types of Auditing, Audit criteria, Audit process, Responsibilities of stake holders in audit process, Audit follow-up, Audit monitoring and inspection, SOPs

UNIT IV: REGULATIONS IN CLINICAL RESEARCH : ICH GCP guidelines, Clinical Research regulations in India – CDSCO guidelines, USFDA regulations to conduct drug studies, Clinical Research regulations in UK – Medicines and Healthcare Products Regulatory Agency (MHRA) Clinical Research regulations in Europe (EMA), Data protection Act and Regulations relating to electronic signatures

UNIT V: INTRODUCTION TO DRUGS AND COSMETIC ACT: Aims, objectives, import of drugs, manufacturing of drugs, sale of drugs, labeling and packing of drugs. Patents, Investigational New Drug (IND), New Drug Application (NDA), Abbreviated new Drug Application (ANDA) Submissions

UNIT VI: REGULATORY AUTHORITIES AND THEIR APPROVAL: Introduction to FDA, WHO, Schedule Y and its amendments, Hierarchy and working flow of FDA in India, Roles of DCGA and CDSCO in drug control, Clinical trial approval by Drug Controller General of India (DCGI)

TEXT BOOKS:

1. Good Clinical Practices, Central Drugs Standard Control Organization, Govt of India
2. Drugs and Cosmetics Act, 1940

REFERENCES:

1. International Clinical Trial, Volume 1&2, Dominique P. Brunier and Gerhardt Nahler, Interpharm Press, Colorado
2. Code of Federal Regulations by USFDA-Download
3. ICH-GCP Guidelines-Download

COURSE OUTCOME (CO)		POs
CO:I	Demonstrate fair understanding of Origin and Principles of International Conference on Harmonization	d
CO:II	To able to discuss ethical issues related to clinical research	g h
CO:III	To demonstrate fair understanding of clinical auditing	i, k
CO:IV	To able to appraise of various Clinical Research regulations in India and abroad	h
CO:V	Demonstrate fair knowledge about Indian Drug and cosmetic act	h
CO:VI	Explain about various regulatory authorities and their procedures for approvals	h

**IV Year II Semester, B. Tech – Biotechnology
(5G842) BIOPHARMACEUTICAL TECHNOLOGY
(Professional Elective-V)**

a	b	c	d	e	f	g	h	i	j	k	l
x	x							x		x	x

L T P/D C
3 - 3

OBJECTIVE

To understand the process of development of biopharmaceutical products such as polypeptide based therapeutic agents, nucleic acid based drugs, neutraceuticals, and antibiotics, and to gain knowledge in designing and developing new drugs using modern engineering and IT tools, softwares and equipment.

Unit I: Introduction to Pharmaceuticals- History & Definition of Drugs. Sources of Drugs- Plant, Animals Microbes and Minerals different dosage forms. Routes of drug administration.

Unit II: Pharmacodynamics- Definition, Physico-Chemical Principles, Pharmacodynamics- Mechanism of drug action, drug receptors, and Physiological receptors: structural and functional families.

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

Unit IV: Drug manufacturing processes - Good manufacturing practices, manufacturing facilities, sources of Biopharmaceuticals, Analytical for biopharmaceuticals -Physicochemical and bioanalytical considerations. Quality assurance and control- storage and stability of biotech products

Unit V: Crude Drugs from natural sources - Cultivation, Collection, Processing and storage of crude drugs: Factors influencing cultivation of medicinal plants. Adulteration of crude drugs and their detection by microscopic, physical, chemical and biological methods. An introduction to active constituents of drugs: classification and properties.

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

1. Pharmaceutical Biotechnology; Oliver Kayser, Rainer H. Müller, Wiley Publishers, 2005.
2. Drug Discovery and Clinical Applications; Heinrich Klefenz, 2002.
3. Industrial Pharmaceutical Biotechnology, WILEY-VCH Publication, Germany. Daan
4. Pharmaceutical Biotechnology; Taylor and Francis Publications, Newyork. Jay P Rho, Stan G Crommelin, Robert D Sindelar, 2002. Louie, 2003, Hand.

**IV year I Semester, B. Tech – Biotechnology
(5G843) BIOETHICS, BIOSAFETY & IPR
(Open Elective - V)**

L T P C
3 - - 3

Unit wise Course Outcomes	POs
Student will be able to	
1. Think ethically and to act morally to describe the legal, ethical, and emotional issues surrounding withholding and withdrawing medical therapies eg. cloning, and stem cell research	a,c, j a,c, j
2. Understand the risk assessment and risk groups which includes examining laboratory containment levels & assessing containment level requirements	a,c,j
3. Understand different types of IPR and apply their knowledge in understanding Patents writing and filing..	a,c,j
4. Understand and differentiate other types of IPR	a,c,g, j
5. Apply their Biotechnology knowledge towards patenting skills	a,c,g, j
6. Understand various IPR laws, treaties and agreements	

Unit I: Bioethics:

Principles of Bioethics. Ethics in Clinical Research: History structure regulation impact of Ethics in all aspects of health care, historical cases, negligence, informed consent, mental competence, Bioethics in Microbial (Bioterrorism), Plant (GMO) & Animal (Stem Cells, Cloning, human embryos and IVF), shared responsibilities for decisions and the understanding of the risk.

Unit II: Biosafety Concepts & Regulations:

Definition of Biosafety, Biosafety for human health and environment, Assessment of Biological hazard, Levels of biosafety for microbes, plants & animals, Cartagena protocol, Use of genetically modified organisms and their release in to the environment. Special procedures for r-DNA based products. International dimensions in Biosafety. Biotechnology and food safety. Case study – Bt Cotton, Bt Brinjal

Unit III: Introduction to IPR & Patents:

Discovery, Creativity, Innovation, Invention, Need for IPR, Types of IPR, Genesis & development of IPR in India, Definition, Scope, Protection, Patentability Criteria, Types of Patents (Process, Product & Utility Models), Software Patenting. Types of searching, public & private searching Databases. Drafting & Filing of Patent applications, Patent Cooperation Treaty (PCT). Patent infringement.

Unit IV: Other Types of IPR:

Copyrights– Definition, granting, infringement, searching & filing, distinction between copy rights and related rights; Trade Marks - role in commerce, importance, protection, registration, domain names; Trade Secrets, Unfair competition; Industrial Designs – Scope, protection, filing, infringement; Semiconductors, Integrated Circuits & Layout design; Geographical Indications & Appellations of Origin; Case Studies.

Unit V: IPRs and Biotechnology:

Plant variety Protection, Farmers & Breeders Rights, Indian Biodiversity Act, Protection of Traditional Knowledge, Biopiracy & Bioprospecting, ITPGRFA, Budapest Treaty & IDA, Biotechnology Patenting issues, Gene Patenting, Case studies (Diamond vs Chakravarthy, Dimminaco AG vs. Controller of Patents, Basmati Rice, Turmeric, Neem, Harvard Oncomouse, Transgenic Plant Patents)

Unit VI: International and National Conventions& Treaties:

Overview, WTO, GATT, TRIPS, WIPO, Berne Convention, Universal Copyright Convention, the Paris Convention, Madrid Protocol, Rome convention, Budapest Treaty, Hague agreement, Locarno agreement, Indian Patents Law, Copyright Law, Trademark Law, Trade secret Law, GI Law, Designs Act.

Text Books:

1. Bioethics – Shaleesha A Stanley, Wisdom Educational Service, Chennai, 2008
2. V Sree Krishna. Bioethics & Biosafety in Biotechnology. New age International Publications, 2007
3. Deborah E. Bouchoux, Intellectual Property for Paralegals – The law of Trademarks, Copyrights, Patents & Trade secrets, 3rd Edition, Cengage learning, 2012
4. N.S. Gopalakrishnan& T.G. Agitha, Principles of Intellectual Property, Eastern Book Company, Lucknow, 2009.

References

1. Singer, Peter A.; Viens, A.M. (2008), Cambridge Textbook of Bioethics, Cambridge: Cambridge University Press, ISBN 978-0-521-69443-8
2. Anitha Rao R & Bhanoji Rao “Intellectual Property Rights – A Primer”, Eastern Book Company, 2008.
3. Thomas, J.A., Fuch, R.L. (2002). Biotechnology and Safety Assessment (3rd Ed). Academic Press.
4. M. M. S. Karki , Intellectual Property Rights: Basic Concepts, Atlantic Publishers, 2009
5. Neeraj Pandey & Khushdeep Dharni, Intellectual Property Rights, Phi Learning Pvt. Ltd
6. Ajit Parulekar and Sarita D’ Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd, 2006.
7. B. L. Wadehra. Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000.
8. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010

IV year II Semester, B. Tech – Biotechnology

(5G844) ADVANCED MASS TRANSFER AND SEPERATIONS
(Professional Elective - V)

a	b	c	d	e	f	g	h	i	j	k	l
X	X	X	X	X							

L T P/D C
3 - 3

Course Objective: The objective of this course is to provide an understanding of the nature of mass transfer mechanisms, models and their applications in solving different engineering problems.

Unit-I: Distillation: Fields of application, VLE for miscible liquids, VLLE for immiscible liquids. McCabe thiele method, optimum reflux ratio, plate efficiencies, principles of extractive and azeotropic distillation.

Unit-II: Multicomponent systems: Equilibrium and simple distillation, Multi component flash calculation and differential distillation, quantitative relationships.

Unit-III: Binary multistage separations: general graphical approach: straight operating lines, curved operating lines, Processes without discrete stages, general properties of y-x diagrams.

Unit-IV: Liquid-liquid operations: fields of applications of ternary liquid systems. continuous contact extraction (Packed beds), equipment for liquid-liquid extraction operation.

Unit-V: Vapor, gas mixtures: humidity, relative saturation. Wet-bulb and dry bulb temperatures, Psychrometric charts. Enthalpy of gas-vapor mixtures.

Unit-VI: Leaching: fields of application, Preparation of solids for leaching, types of leaching. Single stage and multi stage leaching calculations. Unsteady state operation equipment-Percolation tanks, shank system.

Relevant Problems should be discussed wherever applicable.

Text books:

1. King C.J., Separation processes, Tata McGraw Hill Book company, 2nd Ed., New Delhi, 1983.
2. Treybal R.E., "Mass Transfer operations" 3rd Edition, Mc.Graw Hill, 1980.

Reference:

1. Geankoplis C.J., "Transport processes and unit operations", 4th Edition, PHI, 2006.

Course Outcomes	PO
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CO-I	Understands the importance and industrial applications of distillation and ables to design the distillation columns.	a,e
CO-II	Studies in detail about the process of distillation in multicomponent systems	a, b
CO-III	Understands the importance of separations processes, designs effective columns for separation based on x-y diagrams	d
CO-IV	Studies different equipments used in liquid-liquid operations, working of continuous contact equipments like packed beds.	d
CO-V	Understands indetail the characteristics of vapor and gas mixtures.	c, d
CO-VI	Student studies the fields of application of leaching,types of leaching, Percolation and shank systems.	b

a	b	c	d	e	f	g	h	i	j	k
X	X									

(5G845) TISSUE ENGINEERING (Profession Elective-V)

L	T	P/D	C
3		0	3

Unit – I : Introduction, Biomedical nanomaterials in tissue engineering and health care.

Unit – II : Fabrication of nanomaterials for tissue engineering applications: Synthesis of polymeric nanomaterials for biomedical applications, Engineering nanoporous biomaterials, Layer-by-layer self-assembly techniques for nanostructured devices in tissue engineering,

Unit – III : Synthesis of carbon based nanomaterials for tissue engineering applications, Fabrication of nanofibrous scaffolds for tissue engineering applications, Fabrication of nanomaterials for growth factor delivery in tissue engineering.

Unit – IV : Application of nanomaterials in soft tissue engineering: Nanomaterials for engineering vascularized tissues, Nanomaterials for cardiac tissue engineering, Nanomaterials for neural tissue engineering,

Unit – V : Nanomaterials for cartilage tissue engineering, Biomaterials and nano-scale features for ligament regeneration.

Unit – VI : Application of nanomaterials in hard tissue engineering: Nanomaterials for hard-soft tissue interfaces, Mineralization of nanomaterials for bone tissue engineering, Nanomaterials for dental and craniofacial tissue engineering.

Text Book:

1. “Nanoscience and Nanotechnology Tissue Engineering” by Vicki H. Grassian Wiley Publishers, 2008.

Reference Books:

1. Chemical Sensors and Biosensors; Brian, R Eggins; Wiley; New York, Chichester: 2002.
2. Biosensors and modern biospecific analytical techniques, Wilson & Wilson’s Comprehensive Analytical Chemistry; Ed. L Gorton; Elsevier, Amsterdam, London; 2005.
3. The Immunoassay Handbook; Ed. David Wild; 3rd ed.; Amsterdam: Elsevier; 2005.
4. Electrochemical Methods: Fundamentals and Applications; Allen J Bard and Larry R Faulkner; Wiley, New York, Chichester: 2nd ed.; 2001.

**IV year II Semester, B. Tech – Biotechnology
(5G886) PROJECT PHASE - II**

a	b	c	d	e	f	g	h	i	j	k	l	m
x	x	x	x	x	x	x	x	x	x		x	

L	T	P/D	C
-	-	20	12

Pre-Requisites: All Courses till this semester

- Identify vast application areas for medical , plant and environment and Bioprocess Engineering and Bioinformatics.
- They also understand the working principle of Biotechnology and Fermentation technology
- Students understand various methods of and Applications of Biotechnology
- Understand the issues in the cell receptors and signaling
- Understand the issues in the diseases like cancer and tuberculosis

Out of total 200 marks for project work (in the final year second semester), 50 marks shall be for Internal Evaluation and 150 marks for the External Evaluation at the end of the Semester. External Evaluation of the project (viva-voce) shall be conducted by a committee appointed by the Chief Superintendent. The committee consists of an external examiner, HOD, a Senior Faculty Member and Internal Guide.

The pattern of Internal Evaluation is as follows:

Division of marks for internal assessment – 50 marks

- Progress of Project work and the corresponding interim report as evaluated by internal guides at the end of 5 weeks : 05 Marks
- Seminar at the end of 5 weeks : 05 Marks
- Progress of Project work as evaluated by guides at the end of 10 weeks : 05 Marks
- Seminar at the end of 10 weeks : 05 Marks
- Evaluation by the Guides (at the end of 15 weeks) : 10 Marks
- Project Report : 05 Marks
- Final presentation and defense of the project : 15 Marks

If the project is conducted internally the marks will be given by Internal Guide himself.

Division of Marks for External Evaluation

– 150 Marks

Pattern of External Evaluation for Project

1. Final Project Report : 30 Marks
2. Presentation : 20 Marks
- Demonstration / Defense of Project :100Marks

**IV year II Semester, B. Tech – Biotechnology
(5G887) COMPREHENSIVE VIVA - III**

a	b	c	d	e	f	g	h	i	j	k	l	m
x		x				x	x	x	x			

L T P/D C
- - - 1

Course Objectives:

1. to assess the candidate's knowledge in his or her particular field of learning.
2. To test the student's awareness of the latest developments and relate them to the knowledge acquired during the classroom learning and self learning.

Course Outcomes

After completing the subject, students will be able to:

1. Face any type of interviews, viva-voce, and aptitude tests.
2. Perform well in competitive exams and group discussions
3. Apply knowledge in building their career in particular fields.
4. Enhance their communication skills and interactive-ness.

Students are assessed in the courses they have undergone till the completion of that academic year. They are asked to comprehend the concepts in the core subjects and the elective subjects. to make them ready to face technical interviews which improve their employability skills.

There are 50 internal marks. The internal comprehensive viva will be conducted twice in the semester by group of subject teachers awarding 25 marks in each evaluation.

The end examination shall be conducted by a committee consisting of an External examiner, Head of the department and two senior faculty members. It carries marks 50.

**IV year II Semester, B. Tech – Biotechnology
(5G888) TECHNOLOGY REVIEW AND SEMINAR- IV**

a	b	c	d	e	f	g	h	i	j	k	l	m
					x	x	x		x			

L T P/D C
- - 2 1

Pre-Requisites: All Courses till this semester

Course Objective :

Learn basics of technical paper writing and enhance verbal and writing skills, which is useful for employability

Pre-Requisites: All Courses till this semester

Course Outcomes: After completing this course, student shall be able to

- Identify a topic from the current technologies of their choice in the Biotechnology domain and the allied fields, after surveying in the internet resources, journals and technical magazines in the library.
- Arrange the contents of the presentation and also write the report of the research paper..
- Present the technical topic in front of the panel and the fellow students, using the oratory skills and also submit the report of the research paper.
- Interact through answering the questions and also can add some points to the seminar

There shall be a Technical Paper writing and seminar evaluated for 100 marks in Third Year First Semester. The evaluation is purely internal and will be conducted as follows:

Content	: 20 marks
Presentation including PPT	: 20 marks
Seminar Notes	: 10 marks
Interaction	: 10 marks
Report	: 25 marks
Attendance	: 10 marks
Punctuality	: 5 marks
Total	<u>100 marks</u>