

B.Tech– BIOTECHNOLOGY PROGRAMME EDUCATIONAL OBJECTIVES:

- ❖ Graduates will be successful in professional career by acquiring the knowledge in the fundamentals of Biotechnology, Chemical Engineering principles and professional skills.
- ❖ Graduates will analyze real life problems and design the socially accepted and economically feasible biotechnological systems.
- ❖ Graduates will apply the acquired practical skills and broad biotechnological training to excel in entrepreneurship, teaching, research and development
- ❖ Graduates will exhibit good communication skills in their professional career, lead a team with good leadership traits and good interpersonal relationship with the members in other engineering teams.

B.Tech– BIOTECHNOLOGY Programme Outcomes:

- a. Apply knowledge of mathematics, physical sciences and Biotechnological fundamentals.
- b. Able to identify, formulate, analyze and solve Biotechnological problems.
- c. Able to design and realize Biotechnological solutions to meet desired needs within practical constraints such as economical, environmental, ethical, health and safety, manufacturability and sustainability.
- d. Able to investigate and conduct experiments, as well as to analyze and interpret data.
- e. Understanding implications of Biotechnology in social context
- f. Contextual knowledge to assess societal, health, safety, legal and cultural issues related to Bio Technology.
- g. Realize the impact of Biotechnological engineering solutions in a global, economic and environmental context.
- h. Apply ethical principles and commitment to professional ethics and responsibility.
- i. Function as an individual and as a member or leader in multidisciplinary teams.
- j. Communicate effectively with the engineering community and society at large.
- k. Knowledge and understanding of management and business practices and their limitations.
- l. Recognize the need for, and have the ability to engage in life-long learning.

REGULATION – 2016
B.TECH. BIOTECHNOLOGY
CURRICULUM & SYLLABI
Full time candidates admitted during 2016-2017 and onwards

S.No	Course Code	Course Title (with category)	Category	Pre-requisite	Credits			
					L	T	P	C
SEMESTER – I								
Theory								
1	161HS11	Essential English	HS		3	0	0	3
2	161MA11	Engineering Mathematics - I	BS		3	1	0	4
3	161PH11	Engineering Physics	BS		3	0	0	3
4	161CY11	Engineering Chemistry	BS		3	0	0	3
5	161CS11	Computer Programming	ES		3	0	0	3
6	161ME11	Engineering Graphics	ES		3	0	0	3
Practicals								
7	161PC17	Physics and Chemistry Laboratory-I	BS		0	0	3	2
8	161CS17	Computer Practices Laboratory	ES		0	0	3	2
9	161EE17	Engineering Practices Laboratory	ES		0	0	3	2
Total					18	3	9	25

S.No	Course Code	Course Title	Category	Pre-requisite	Credits			
					L	T	P	C
SEMESTER – II								
Theory								
1	161HS21	Technical English	HS		3	0	0	3
2	161MA21	Engineering Mathematics - II	BS		3	1	0	4
3	161PH21	Physics of Materials	BS		3	0	0	3
4	161CY21	Environmental Science	BS		3	0	0	3
5	161BT21	Biochemistry – I	ES		3	0	0	3
6	161BT22	Microbiology	ES		3	0	0	3
Practicals								
7	161PC27	Physics and Chemistry Laboratory–II	BS		0	0	3	2
8	161BT27	Biochemistry Laboratory	ES		0	0	3	2
9	161BT28	Microbiology Laboratory	ES		0	0	3	2
Total					18	2	9	25

Semester III

S.No.	CODE	COURSE TITLE	Category	Pre-requisite	L	T	P	C
THEORY								
1	161MA31	Transforms and Partial Differential Equations	BS		3	1	0	4
2	161BT31	Stoichiometry and Fluid Mechanics	PC		3	0	0	3
3	161BT32	Cell Biology	PC		3	0	0	3
4	161BT33	Principles of Genetics	PC		3	0	0	3
5	161BT34	Enzyme Technology	PC		3	0	0	3
6	161BT35	Biochemistry–II	PC		3	0	0	3
PRACTICALS								
7	161BT37	Cell Biology Laboratory	PC		0	0	3	2
8	161BT38	Bio organic Chemistry Laboratory	PC		0	0	3	2
9	161HS39	Functional English I	MC		0	0	2	-
Total					18	1	8	23

SEMESTER IV

S.No	CODE	COURSE TITLE	Category	Pre-requisite	L	T	P	C
THEORY								
1	161MA42	Statistics and Numerical Methods	BS		3	0	0	3
2	161BT41	Molecular Biology	PC		3	0	0	3
3	161BT42	Unit Operations	PC		3	1	0	4
4	161BT43	Chemical Engineering Thermodynamics	PC		3	0	0	3
5	161BT44	Analytical Methods in Biotechnology	PC		3	0	0	3
6	161BT45	Basic Industrial Biotechnology	PC		3	0	0	3
PRACTICALS								
7	161BT47	Analytical Methods in Biotechnology Lab	PC		0	0	3	2
8	161BT48	Chemical Engineering Lab	PC		0	0	3	2
9	161HS49	Functional English II	MC		0	0	2	-
Total					18	0	8	23

SEMESTER V

S.No	CODE	COURSE TITLE	Category	Pre-requisite	L	T	P	C
THEORY								
1	161BT51	Bioprocess Principles	PC		3	0	0	3
2	161BT52	Bioinformatics	PC		3	0	0	3
3	161BT53	Mass Transfer operations	PC		3	0	0	3
4	161BT54	Plant Biotechnology	PC		3	0	0	3
5	161BT55	Protein Engineering	PC		3	0	0	3
6	161BT56	Bioethics	PC		3	0	0	3
PRACTICALS								
7	161BT57	Molecular Biology Lab	PC		0	0	3	2
8	161BT58	Bioinformatics Lab	PC		0	0	3	2
9	161HS59	Career English I	MC		0	0	2	-
Total					18	0	8	22

SEMESTERVI

S.No	CODE	COURSE TITLE	Category	Pre-requisite	L	T	P	C
THEORY								
1	161BT61	Chemical Reaction Engineering	PC		3	1	0	4
2	161BT62	Immunology	PC		3		0	3
3	161BT63	Genetic Engineering	PC		3		0	3
4	161HS61	Engineering economics and management	HS		3		0	3
5		Elective1	PE		3		0	3
6		Elective2	OE/PE		3		0	3
PRACTICALS								
7	161BT67	Genetic Engineering Laboratory	PC				4	2
8	161BT68	Immunology Lab	PC				4	2
9	161HS69	Career English I	MC				2	-
Total					18	0	10	23

SEMESTERVII

S.No	CODE	COURSE TITLE	Category	Pre-requisite	L	T	P	C
THEORY								
1	161BT71	Bioprocess Engineering	PC		3	1	0	4
2	161BT72	Down stream processing	PC		3	0	0	3
3	161BT73	Proteomics and genomic	PC		3	0	0	3
4	161BT74	Nanobiotechnology	PC		3	0	0	3
5		Elective1	PE		3	0	0	3
6		Elective 2	OE/PE		3	0	0	3
PRACTICALS								
7	161BT77	Bioprocess Lab	PC		0	0	4	2
8	161BT78	Down stream processing Lab	PC		0	0	4	2
Total					1	0	8	23

SEMESTERVIII

S.No.	CODE	COURSE TITLE	Category	Pre-requisite	L	T	P	C
1		Elective1	PE		3	0	0	3
2		Elective 2	PE		3	0	0	3
PRACTICAL								
3	161BT831	Project Work	EEC		0	0	12	6
Total					6	0	12	12

BS-Basic Science, ES-Engineering Science, HS-Humanities and Social Sciences, PC-Professional Core,

PE-Professional Elective, OE-Open Elective, EEC-Employability Enhancement Course, MC- Mandatory Course

B.Tech. Biotechnology program total credit- 176

LIST OF ELECTIVES

CODENO.	COURSE	L	T	P	C
161BTE01	Biophysics	3	0	0	3
161BTE02	Biological Spectroscopy	3	0	0	3
161BTE03	Developmental Biology	3	0	0	3
161BTE04	Biopharmaceutical Technology	3	0	0	3
161BTE05	Principles of Food Processing	3	0	0	3
161BTE06	Marine Biotechnology	3	0	0	3
161BTE07	Animal Biotechnology	3	0	0	3
161BTE08	Cancer Biology	3	0	0	3
161BTE09	Bioconjugate Technology	3	0	0	3
161BTE10	Stem Cell Technology	3	0	0	3
161BTE11	Molecular Pathogenesis	3	0	0	3
161BTE12	Molecular Modeling & Drug Design	3	0	0	3
161BTE13	Metabolic Engineering	3	0	0	3
161BTE14	Immunotechnology	3	0	0	3
161BTE15	Neurobiology and Cognitive Sciences	3	0	0	3
161BTE16	Process Instrumentation Dynamics and Control	3	0	0	3

S. No.	Course Code	OPEN ELECTIVES OFFERED BY CSE DEPARTMENT	Category	L-T-P	Credit
1	161OE101	Web development using PHP	OE	3-0-0	3
2	161OE102	Programming in PERL	OE	3-0-0	3
3	161OE103	Multimedia & Animation Tools	OE	3-0-0	3
4	161OE104	Multicore Architecture	OE	3-0-3	3
5	161OE105	Green Computing	OE	3-0-3	3
6	161OE106	Soft Computing	OE	3-0-3	3
7	161OE107	Java Scripts	OE	3-0-3	3

OPEN ELECTIVES OFFERED BY ECE					
Sl.	Code	Course Title	Category	L-T-P	C
1	161OE201	Bio Medical Instrumentation	OE	3-0-0	3
2	161OE202	Digital Image Processing	OE	3-0-0	3
3	161OE203	Consumer Electronics	OE	3-0-0	3
4	161OE204	Multimedia Compression and Communication	OE	3-0-0	3
5	161OE205	High Speed Networks	OE	3-0-0	3

OPEN ELECTIVES OFFERED BY EEE					
Sl.	Code	Course Title	Category	L-T-P	C
1	161OE401	Energy audit and conservation	OE	3-0-0	3
2	161OE402	Principles of Virtual Instrumentation	OE	3-0-0	3
3	161OE403	Sensors and Transducers	OE	3-0-0	3
4	161OE404	Aircraft electronic system	OE	3-0-0	3
5	161OE405	Electrical safety	OE	3-0-0	3
6	161OE406	Vehicle electric power Systems	OE	3-0-0	3
7	161OE407	Domestic and Industrial Electrical Installation	OE	3-0-0	3

CODENO.	OPEN ELECTIVES OFFERED BY BIOTECHNOLOGY DEPARTMENT	Category	L	T	P	C
161OE501	Process Equipment and Plant Design	OE	3	0	0	3
161OE502	Biomaterials	OE	3	0	0	3
161OE503	Biosensors	OE	3	0	0	3
161OE504	Food Science and Technology	OE	3	0	0	3

Open Electives – Offered by Department of Mechanical Engineering

Sl.No.	Code	Course Title	Category	L-T-P	C
1	161OE601	Maintenance Engineering	OE	3-0-0	3
2	161OE602	Non Destructive Testing and Materials	OE	3-0-0	3
3	161OE603	Operations Research	OE	3-0-0	3
4	161OE604	Renewable Sources of Energy	OE	3-0-0	3
5	161OE605	Robotics	OE	3-0-0	3

OPEN ELECTIVES OFFERED BY CIVIL ENGG DEPARTMENT					
1.	161OE701	Disaster Management System	Category	3-0-0	3
2.	161OE702	Fundamentals of Fire Safety Engineering	OE	3-0-0	3
3.	161OE703	Optimization in Engineering	OE	3-0-0	3
4.	161OE704	Renewable Energy Sources	OE	3-0-0	3
5.	161OE705	Environmental Impact and Risk Assessment	OE	3-0-0	3
6.	161OE706	Environment and Ecology	OE	3-0-0	3
7.	161OE707	Technology Management	OE	3-0-0	3
8.	161OE708	Sustainable Management of Urban Ecology	OE	3-0-0	3

LIST OF OPEN ELECTIVES OFFERED BY MBA DEPARTMENT

S. No.	Code No.	Course Title	Category	L-T-P	C
1	161OE801	Essentials of Management	OE	3-0-0	3
2	161OE802	Fundamentals of Marketing	OE	3-0-0	3
3	161OE803	Managing Human Resources	OE	3-0-0	3
4	161OE804	Professional Ethics in Engineering	OE	3-0-0	3

161HS11

ESSENTIALENGLISH

(Common to all Branches)

L-T-P

3-0-0

C

3

AIM:

To impart Basic English Language skill to develop the students ability to use English effectively

Course Outcomes:

The Students will be able to

CO1:Understand and use different forms of language

CO2:Write formal letters

CO3:Speak in English with clarity

CO4:Listen actively and grasp the contents of the speech

CO5:Read general texts and comprehend their content

CO6:Use grammar to make meaning in both speaking and writing

CO7:Describe situations both in speaking and writing

UNIT I

9

Grammar-tense –past simple, present simple, verbal vs non-verbal communication, Vocabulary- Commonly used words-Spelling, Reading- Reading News papers, Writing- Formal Letters-Requisition for leave- Bona fide, Listening- Listening to famous speeches, Speaking- introducing oneself.

UNIT II

9

Grammar-tense- past and present simple continuous, Vocabulary- Prefixes, Suffixes-Parts of Speech, Reading-Basic reading comprehension, Writing Formal Letters- Permission letters- In-plant training- Industrial visit, Listening- Listening to Interviews, Speaking- Speaking about interests, one's friends, hobbies, favourite programmes.

UNIT III

9

Grammar-tense-past and present perfect, Vocabulary -Forms of Verb-Analogy-Sentences-Types, Reading-Cloze Test, Writing- Paragraph writing-descriptions-Comparing and contrasting- describing pictures, Listening- Listening to News, Speaking- Future plan-Native place, Appropriate body language.

UNIT IV

9

Grammar-perfect tenses, Vocabulary -Single-line definitions-Pronoun-Adverbs-Preposition, Reading- Reading for comprehension, Writing- e- mail- basic conventions writing – Instructions-Recommendations, Listening- Listening to Debates, Speaking- Giving opinions.

UNIT V

9

Grammar- subject –verb agreement, Vocabulary –commonly confused words-Linkers-Abbreviation-Voice, Reading- Reading for Inferences, Writing- Agenda Note-taking- Editing the text, Listening- Listening to Telephonic Conversation, Speaking- short talks on general topics, short conversations.

Total Periods

45

Text Books

1. Jack.C. Richards, interchange (fourth edition), Cambridge University Press, New Delhi. 2015 ISBN 9781107570894

References

1. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011
2. www.usingenglish.com
3. www.grammar.org
4. www.audioenglish.com
5. <http://www.manythings.org>
6. www.onestopenenglish.com
7. www.learnenglish.com

161MA11

ENGINEERING MATHEMATICS - I

(Common to all Branches)

L -T -P C

3- 1- 0 4

AIM: The Course is aimed at Developing the basic mathematical skills of Engineering Student

Course Outcomes:

The Students will be able to

CO1: Able to find the inverse of given matrix and reduce matrix equation using Cayley- Hamilton Theorem.

CO2: Elaborate given function as a power series using Taylor's series.

CO3: Develop a series solution to an ODE, and recognize special functions defined by series.

CO4: Make use of Calculus in finding the envelope, Evolutes & Involutives.

CO5: Able to check whether the series is convergent or divergent.

CO6: Evaluate maxima and minima for function of two variables.

MATRICES

12

Characteristic equation - Eigen Values and Eigen vectors of a real matrix - Properties of Eigen values - Cayley-Hamilton Theorem (without proof) and its application - Orthogonal Transformation of a Symmetric matrix to diagonal form - Quadratic form - Orthogonal reduction to canonical form.

ORDINARY DIFFERENTIAL EQUATIONS

12

Higher order linear differential equations with constant coefficients – Method of variation of parameters – Cauchy's and Legendre's linear equations – Simultaneous first order linear equations with constant coefficients.

DIFFERENTIAL CALCULUS

12

Curvature - Radius of curvature - Cartesian and Parametric Coordinates - Circle of Curvature - Involutives and Evolutes – Envelope.

FUNCTIONS OF SEVERAL VARIABLES

12

Partial Derivatives - Total Derivative - differentiation of Implicit function – Jacobian - Taylor's Expansion - Maxima/Minima for function of two variables - Method of Lagrange's multipliers

SEQUENCES AND SERIES

12

Sequences: Definition and examples – Series: Types and Convergence – Series of positive terms – Tests of convergence: Comparison test and D'Alembert's ratio test – Alternating series – Leibnitz's test - Series of positive and negative terms – Absolute and conditional convergence.

Total Periods(Theory 45 + Tutorial 15) 60

Text Books

1. B.S.Grewal, 'Higher Engineering Mathematics', Thirty Sixth Edition, Khanna Publishers, Delhi, 2005.
2. Veerarajan.T "Engineering Mathematics(for first year)", Fourth Edition, Tata McGraw – hill publishing company Ltd, New Delhi, 2005

References

1. Greenberg, M.D. "Advanced Engineering Mathematics", Second Edition, Pearson Education Inc. (First Indian reprint), 2002
2. Venkataraman. M.K., "Engineering Mathematics", Volume I and II Revised enlarged Fourth Edition, The National Publishing Company, Chennai, 2004.
3. Dr.P. Kandasamy, Dr.K.Thilagavathy, Dr.K.Gunavathy, S.Chand & Company Ltd. Ram Nagar, New Delhi.
4. Ravish R Singh, Mukul Bhatt, "Engineering Mathematics-I", McGraw Hill Education (India) Private Ltd, New Delhi.
5. Kreyszig, E., Advanced Engineering Mathematics, 8th edition, John Wiley Sons, 2001

161PH11

ENGINEERING PHYSICS
(Common to all Branches)

L-T-P **C**
3-0-0 **3**

AIM: To endow the students with the fundamentals of Physics and apply new ideas in the field of Engineering and Technology.

Course Outcomes:

The Students will be able to

CO1: Understand the theory and various crystal structures and crystal growth techniques.

CO2: Acquire knowledge about the properties of sound, production of ultrasonic waves and their application in the field of Non-destructive testing and Sonogram.

CO3: Gain knowledge about basic equations of Quantum mechanics and its applications.

CO4: Know about the basic configuration of a Laser, types of lasers and the industrial applications of Laser.

CO5: Understand principle behind fiber optic communication and the electronic devices involved in the transmission and reception of data.

CRYSTAL PHYSICS

9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Crystal growth techniques- Solution, melt (Bridgmann and Czochralski).

ACOUSTICS

9

Classification of sound – Decibel-Weber- Fechner Law- Sabine’s formula-Derivation using growth and decay method- absorption coefficient and its determination- Acoustic of building-Factors affecting acoustics of buildings and their remedies.

ULTRASONICS

9

Production of Ultrasonics – Magnetostriction - Piezoelectric methods - Velocity measurement – Acoustic grating - Industrial applications –Non Destructive Testing – Pulse echo system through transmission and reflection modes - SONAR, Medical applications – Sonograms.

QUANTUM PHYSICS

9

Black body radiation – Planck’s theory (derivation)- Photoelectric effect - Matter waves – Schrödinger’s wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box.

APPLIED OPTICS

9

LASERS: Introduction – Principle of Spontaneous emission and stimulated emission. Population inversion, pumping. Einsteins A and B coefficients – Derivation- Types of lasers – CO₂, Nd-YAG - Industrial Applications - Lasers in welding, cutting – Holography and its applications.

FIBER OPTICS: Optical Fiber-Classification- Principle and propagation of light in optical fibres- Numerical aperture and Acceptance angle-Fibre optical communication system- Sensors (Active and passive) –Displacement and Temperature Sensors.

Total Periods **45**

Text Books

1. Gaur R. K., Gupta S. C., “Engineering Physics” Dhanpat Rai Publications, New Delhi(2003)
2. Avadhanulu M. N., Kshirsagar, P. G., “A Text book of Engineering Physics”, S.Chand and company, Ltd., New Delhi, 2005.

References

1. Serway and Jewett., “Physics for Scientists and Engineers with Modern Physics”,6th Edition, Thomson Brooks/Cole, Indian reprint (2007)
2. AritherBeiser, Concepts of Modern Physics, Tata McGraw Hill, NewDelhi (2010)
3. Palanisamy, P.K., “Engineering Physics” Scitech publications, Chennai, (2007).
4. Rajendran, V and Marikani A, “Engineering Physics” Tata McGraw Hill Publications Ltd, III Edition, New Delhi, (2004).
5. Chitra Shadrach and SivakumarVadivelu, “Engineering Physics”, Pearson Education, New Delhi, (2007).

161CY11

ENGINEERING CHEMISTRY

(Common to all Branches)

L-T-P

3-0-0

C

3

AIM: To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

Course Outcomes:

The Students will be able to

CO1: Demonstrate the essential concept of water chemistry with their properties and applications of water technology.

CO2: Understand the operating principles and the reaction involved in electrochemistry.

CO3: Explain the core concepts of surface chemistry.

CO4: Illustrate the structure, properties and applications of nano materials.

CO5: Learn the principles, importance and application of analytical techniques.

WATER TECHNOLOGY

9

Hardness-Types and Estimation by EDTA method, alkalinity – types of alkalinity and determination– Domestic water treatment –disinfection methods (Chlorination, ozonation, UV treatment) – Boiler feed water– requirements – disadvantages of using hard water in boilers – internal conditioning (phosphate, calgon and carbonate conditioning methods) – external conditioning – demineralization process – desalination and reverse osmosis.

ELECTROCHEMISTRY

9

Electrochemical cells – reversible and irreversible cells – EMF — electrochemical series and its significance- Single electrode potential – Nernst equation (problem) – reference electrodes –Standard Hydrogen electrode -Calomel electrode – Ion selective electrode – glass electrode and measurement of pH– potentiometer titrations (redox - Fe^{2+} vs dichromate) and conductometric titrations (acid-base – HCl vs NaOH) titrations

SURFACE CHEMISTRY

9

Adsorption- types – adsorption of gases on solids – adsorption isotherms –Frendlich and Langmuir isotherms – adsorption of solutes from solution – role of adsorbents in catalysis, ion-exchange adsorption and pollution abatement.

NANOCHEMISTRY

9

Nanomaterials – introduction to nanochemistry – synthesis – hydrothermal, solvothermal – Chemical vapour deposition – sol-gel - Electro deposition – ball milling – properties of nanoparticles and applications. Carbon nanotubes- fabrication - arc method – pulsed laser deposition - Chemical vapour deposition - structure, properties & applications.

SPECTROSCOPY & QUANTITATIVE ANALYSIS

9

Beer-Lambert's law (problem) – UV-visible spectroscopy and IR spectroscopy – principles –instrumentation (problem) (block diagram only) – estimation of iron by colorimetry – Determination of the amount of calcium in milk powder by EDTA Complexometry - Estimation of iodine in iodized common salt by Iodometry - Estimation of phosphoric acid in soft drinks (coca cola) by molybdenum blue method .

Total Periods

45

Text Books

1. P. Kannan, A. Ravikrishnan, "Engineering Chemistry", Sri Krishna Hi-tech Publishing Company Pvt. Ltd. Chennai, 2009.
2. P.C.Jain and Monica Jain, "Engineering Chemistry" DhanpatRai Pub, Co., New Delhi (2002)

References

1. S.S. Dara, S.S. Umare, "Engineering Chemistry", S. Chand & Company Ltd., New Delhi 2010.
2. B.K.Sharma, "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
3. B.Sivasankar, "Engineering chemistry" Tata McGraw Hill Publishing Company (P) Ltd., New Delhi, 2006.
4. Pradeep, "Nano the essential" McGraw Hill Publishing Company (P) Ltd., New Delhi,

161CS11

COMPUTER PROGRAMMING

(Common to all Branches)

L-T-P

3-0-0

C

3

AIM: To provide an awareness to Computing and Programming

Course Outcomes:

The Students will be able to

CO1: Able to have fundamental knowledge on basics of computers hardware and number systems.

CO2: Able to understand the basic terminology used in computer programming.

CO3: Able to write, compile and debug programs in C language.

CO4: Able to use different data types in a computer program.

CO5: Able to design programs involving decision structures, loops and functions.

CO6: Able to understand the dynamics of memory by the use of pointers.

CO7: Able to use different data structures and create/update basic data files.

INTRODUCTION

9

Generation and Classification of Computers- Basic Organization of a Computer – Number System – Binary – Decimal – Conversion – Problems. Software – Types, Development Steps. Algorithm – Pseudo code – Flow Chart. Problem formulation – Problem Solving.

C PROGRAMMING BASICS

9

Introduction to Unix Operating System – Introduction to ‘C’ programming –fundamentals – structure of a ‘C’ program – compilation and linking processes – Constants, Variables – Data Types – Expressions using operators in ‘C’ – Managing Input and Output operations – Decision Making and Branching – Looping statements – solving simple scientific and statistical problems.

ARRAYS AND STRINGS

9

Arrays – Initialization – Declaration – One dimensional and Two dimensional arrays. String- String operations – String Arrays. Simple programs- sorting- searching – matrix operations.

FUNCTIONS AND POINTERS

9

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers - Definition – Initialization – Pointers arithmetic – Pointers and arrays- Example Problems.

STRUCTURES AND UNIONS

9

Introduction – need for structure data type – structure definition – Structure declaration – Structure within a structure – Union – Programs using structures and Unions – File Manipulation – Storage classes – Pre-processor directives.

Total Periods 45

Text Books

1. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, Dorling Kindersley (India) Pvt. Ltd., Pearson Education in South Asia, 2011.
2. PradipDey, ManasGhosh, “Fundamentals of Computing and Programming in C”, 1/e, Oxford University Press, 2009.
3. Yashavant P. Kanetkar. “Let Us C”, BPB Publications, 13/e, 2011.

References

1. Byron S Gottfried, “Programming with C”, Schaum’s Outlines, Second Edition, Tata McGraw-Hill, 2006.
2. Dromey R.G., “How to Solve it by Computer”, Pearson Education, Fourth Reprint, 2007.
3. Kernighan,B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2006.

Prerequisites: Basic knowledge in geometrical drawing

Aim: To develop graphics skills in students

Course Outcomes: The Students will be able to

CO1: Follow the conventions used in engineering graphics.

CO2: Practice plane curves and free hand sketching.

CO3: Draw the projections of points, lines and plane.

CO4: Draw the projections of simple solids and their sectional views.

CO5: Describe the applications of development of surfaces.

CO6: Practice isometric and perspective projections.

Concepts and conventions (Not for Examination) 12

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning.

PLANE CURVES 12

Curves used in engineering practices:

Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method – Construction of cycloid – Construction of involutes of square and circle – Drawing of tangents and normal to the above curves.

PROJECTION OF POINTS, LINES AND PLANE SURFACES 12

Projection of straight lines located in the first quadrant – inclined to both planes – Determination of true lengths and true inclinations – Projection of regular polygonal and circular lamina inclined to both reference planes.

PROJECTION OF SOLIDS 12

Projection of simple solids like Prisms, Pyramids, Cylinder and Cone when the axis is inclined to one reference plane.

SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 12

Sectioning of above solids in simple vertical position by cutting planes inclined to HP and perpendicular to VP – Obtaining true shape of section.

Development of lateral surfaces of truncated solids – Prisms, Pyramids, Cylinder and Cone.

ISOMETRIC AND PERSPECTIVE PROJECTIONS 12

Principles of isometric projection – isometric scale – isometric projections of truncated Prisms, Pyramids, Cylinder and Cone.

Perspective projection of simple prism and pyramid by Visual ray method

Total Periods: 60

Text Books:

1. K.V. Natrajan, “A text book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai (2015)
2. M.S. Kumar, “Engineering Graphics”, D.D. Publications, (2014)

References:

1. K. Venugopal and V. Prabhu Raja, “Engineering Graphics”, New Age International P.Ltd.2015
2. M.B. Shah and B.C. Rana, “Engineering Drawing”, Pearson Education (2014)
3. K.C. John, “Engineering Graphics for degree” PHI Learning Pvt. Ltd., New Delhi, (2013)
4. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, (2013)
5. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, (2014)

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets
2. IS 9609 (Parts 0 and 1) – 2001: Technical products Documentation – Lettering
3. IS 10714 (Part 20) – 2001 and SP 46 – 2003: Lines for technical drawings
4. IS 11669 – 1986 and SP 46 – 2003: Dimensioning of Technical Drawings
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods

Special points applicable to end semester examination on Engineering Graphics:

1. There will be five questions, first question is compulsory from Unit-I on engineering curves. Other four questions are either or type from Unit-II to V
2. All questions will carry equal marks of 20 each making a total of 100
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size
4. The end semester examination will be conducted in two sessions (FN and AN on the same day) for 50 percent of student (approx) at a time

161PC17**PHYSICS AND CHEMISTRY LABORATORY-I****L-T-P****C**

(Common to all Branches)

0-0-3**2****Pre/Corequisites:** Engineering Physics & Engineering Chemistry**AIM:** To introduce the basic Physics concepts through experiments and to impart the basic analyzing chemistry.**Course Outcomes:**

The Students will be able to

CO1: Understand the laser light propagation in optical fibre

CO2: Learn the principle of interference

CO3: Understand the knowledge of their home town water

CO4: Estimate the amount of substance by potentiometric technique

CO5: Outline the application of analytical instrument

LIST OF EXPERIMENTS - PHYSICS PART (A minimum of five experiments shall be offered)		
S.No	NAME OF THE EXPERIMENT	
1)	(a) Determination of Particle Size using Diode LASER. (b) Determination of wavelength of the LASER source. (c) Determination of Acceptance angle and Numerical aperture of an optical fibre.	3
2)	Determination of thickness of thin wire – Air wedge method.	3
3)	Determination of Velocity of sound and compressibility of liquid - Ultrasonic Interferometer.	3
4)	Determination of Dispersive power of a prism using Spectrometer.	3
5)	Determination of Young's modulus of the material - Non uniform bending	3
6)	Determination of thermal conductivity of a bad conductor - Lee's Disc method	3

LIST OF EXPERIMENTS – CHEMISTRY PART		
S.No	NAME OF THE EXPERIMENT	
1	Estimation of Total Hardness of their home town water by EDTA method.	3
2.	Estimation of Copper in brass solution by EDTA method.	3
3.	Estimation of Ferrous Ion by Potentiometric Titrations.	3
4.	Conductometric titration of strong acid vs strong base	3
5.	Estimation of Alkalinity of water sample	3
6.	Estimation of Iron by spectrophotometer (Demo only)	3

References:

1) Text book of Quantitative Inorganic Analysis, A.I.Vogel, ELBS,London.

2) A. Ravikrishnan "Practical Engineering Chemistry", Sri Krishna Publications, Chennai (2002)

161CS17

COMPUTER PRACTICES LABORATORY

(Common to all Branches)

L-T-P

C

0-0-3

2

AIM: To provide an awareness to Computing and C Programming

Course Outcomes:

The Students will be able to

CO1: have fundamental concept on basics commands in Linux.

CO2: write, compile and debug programs in C language.

CO3: formulate problems and implement algorithms in C.

CO4: effectively choose programming components that efficiently solve computing problems in real-world.

CO5: design application oriented programs in C.

CO6: Structures and unions through which derived data types can be formed.

S.No	LIST OF EXPERIMENTS
1.	eSearch, generate, manipulate data using MS office/ Open Office
2.	Presentation and Visualization – graphs, charts, 2D, 3D
3.	C Programming using Simple statements and expressions
4.	Scientific problem solving using decision making and looping.
5.	Simple programming for one dimensional and two dimensional arrays.
6.	Solving problems using String functions
7.	Programs with user defined functions – Includes Parameter Passing
8.	Program using Recursive Function and conversion from given program to flow chart.
9.	Program using structures and unions.
10.	Program using files

161EE17

ENGINEERING PRACTICES LABORATORY

(Common to all Branches)

L-T-P

C

0-0-3

2

AIM: To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering

Course Outcomes:

The Students will be able to

CO1. Express the pipe connections And identify the various components used in plumbing

CO2. Produce simple wooden joints using wood working tools

CO3. Create simple lap, butt and tee joints using arc welding equipments

CO4. Generate the simple components using lathe and drilling machine

CO5. Identify the fitting usage of square joint, L joint and stepped joints.

CO6. Facilitate the operation of fluorescent lamp, staircase wiring and measuring the consumed electrical energy

CO7. Express and analyze the fundamentals of Boolean algebra and digital logic gates

CO8. Generate clock signal and measure the parameters of the signal

LIST OF EXPERIMENTS

GROUP A (CIVIL and MECHANICAL)

I CIVIL ENGINEERING PRACTICE

12

Plumbing Works:

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- (b) Preparation of plumbing line sketches for water supply and sewage works
- (c) Hands-on-exercise
- (d) Basic pipe connections – Mixed pipe material connection – Pipe
- (e) Connections with different joining components

Carpentry using Power Tools only:

- (a) Study of the joints in roofs, doors, windows and furniture
- (b) Hands-on-exercise: Dismantling & Assembling of various wooden furniture like stool, Chairs & Bench

II MECHANICAL ENGINEERING PRACTICE

12

Welding:

- (a) Preparation of arc welding of butt joints and lap joints
- (b) Study of Gas welding equipments & practice

Fitting:

- (a) Hands-on-exercise: Preparation of square fitting, vee & step – fitting models

III GROUP B (ELECTRICAL and ELECTRONICS)

12

Electrical:

- (a) Residential house wiring using switches, fuse, indicator, lamp and energy meter.
- (b) Fluorescent lamp wiring.
- (c) Stair case wiring
- (d) Measurement of electrical quantities – voltage, current, power and power factor in RLC circuit.
- (e) Measurement of energy using single phase energy meter.

Electronics:

- (a) Study of Electronic components and equipments – Resistor, colour coding.
- (b) Measurement of AC signal parameter (peak-peak, rms period, frequency) using CRO.

Course code	Course Title	L-T-P	C
161HS21	TECHNICAL ENGLISH (Common to all Branches)	3-0-0	3

Prerequisites: 161HS11 ESSENTIAL ENGLISH

AIM: To improve confident of the learner to communicate effectively using technical related workplace modules

Course Outcomes:

The Students will be able to

- CO1: remember words and its meaning for the specific purpose
- CO2: apply written communication methodologies at workplace
- CO3: develop listening skill to respond and to gather information
- CO4: interpret the text using comprehending skill
- CO5: describe the topic using appropriate vocabulary
- CO6: summarize the key points in the audio script
- CO7: evaluate the uses of different vocabulary in use

UNIT I	9
Language and Grammar- Technical words-Foreign words-Adjective Reading- Reading Technical passages Writing- Formal Letters-Calling for Quotation, placing order Listening- Listening to TED Talks to take notes- Speaking- Introducing others	
UNIT II	9
Language and Grammar- Interrogative Statements-Acronym-One-word substitution Reading- Note-taking - Writing- Essay writing- Preparing Questionnaire Listening- Listening to Group Discussion Speaking- Public Speech practice	
UNIT III	9
Language and Grammar- Conditional Clauses-Punctuation-Concord Reading- Reading Book/film/music reviews Writing- Report writing Listening- Listening to Technical Presentation Speaking- Reporting events	
UNIT IV	9
Language and Grammar- Words followed by prepositions-Articles-Action verb Reading- Reading Famous speech text Writing- Minutes-Checklist- Memo Listening- Listening for Gist Speaking- discussing about uses of gadgets & machines	
UNIT V	9
Language and Grammar Vocabulary, cause and effect, reported speech Reading- Reading for vocabulary Writing- dialogue writing Listening- Listening for Gist Speaking- discussing about uses of gadgets & machines	

Total Periods 45

Text Books	
1.Department of English, Anna University, ‘ English for engineers and technologists’(Vol. 1& 2) combined edition, Orient Black swan, Chennai 2012	
References	
1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012	
1. www.usingenglish.com	
2. www.grammar.org	
3. www.audioenglish.com	
4. http://www.manythings.org	

161MA21	ENGINEERING MATHEMATICS - II (Common to all Branches)	L-T-P	C
		3-1-0	4

Prerequisites: Engineering Mathematics-I

AIM: To analyze the engineering problems using the techniques and the mathematical skills acquired by studying vector calculus, Laplace transform, complex variables and multiple integral.

Course Outcomes:

The Students will be able to

CO1: Apply Laplace transform to solve first and second order differential equations with elementary forcing function.

CO2: Classify Green's theorem to evaluate line integrals along simple closed contours on the plane.

CO3: Construct an analytic function using the properties of analytic function.

CO4: Make use of Cauchy's residue theorem for applications in Engineering.

CO5: Evaluate complicated real integrals using the basics of analytic functions and the complex Integration.

CO6: Apply double integration to find area between two curves.

LAPLACE TRANSFORM 12

Laplace transform – Conditions for existence – Transform of elementary functions –Basic properties – First Shifting Theorem -Transform of derivatives on $tf(t)$, $f(t)/t$ and periodic functions – Transform of unit step function and impulse functions. Inverse Laplace transform by partial fraction method and Convolution theorem (excluding proof) – Initial and Final value theorems – Solution of linear ODE of second order with constant coefficients using Laplace transformation techniques.

ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy– Riemann equation and Sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function(without proof) – Harmonic conjugate – Construction of analytic functions – Conformal mapping : $w = z+c$, cz , $1/z$, and bilinear transformation.

COMPLEXINTEGRATION 12

Statement and application of Cauchy's theorem and Cauchy's integral formula, Taylor and Laurent expansion, Singularities, Classification, Residues, Cauchy's residue theorem, Contour integration (Type I&II).

MULTIPLE INTEGRALS 12

Double Integration – Cartesian and Polar co-ordinates – Change of order of Integration - Change of variable between Cartesian and polar co-ordinates – Triple integration – Area as a double integral by Cartesian co-ordinates – Volume as a triple integral.

VECTORCALCULUS 12

Gradient, Divergence and Curl – Directional derivative – Irrotational and Solenoidal vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Simple applications involving cubes and rectangular parallelepipeds.

Total Periods(Theory 45 + Tutorial 15) 60

Text Books

1. B.S.Grewal, 'Higher Engineering Mathematics', Thirty Sixth Edition, Khanna Publishers, Delhi, 2005.
2. T. Veerarajan, "Engineering Mathematics(for first year)",Fourth Edition, Tata McGraw – hill publishing company Ltd, New Delhi, 2005.

References

1. Greenberg. M.D. "Advanced Engineering Mathematics, Second Edition, Pearson Education Inc. (First Indian reprint), 2002
2. Venkataraman.M.K., "Engineering Mathematics", Volume I and II Revised enlarged Fourth Edition, The National Publishing Company, Chennai, 2004.
3. Kreyszig, E., Advanced Engineering Mathematics, 8th edition, John Wiley Sons, 2001.
4. Ravish R Singh,Mukul Bhatt, "Engineering Mathematics-I", McGraw Hill Education(India)Private Ltd,New Delhi.
5. Dr.P.Kandasamy, Dr.K.Thilagavathy, Dr.K.Gunavathy, S.Chand& Co. Ram Nagar, New Delhi.

161PH21

PHYSICS OF MATERIALS

L-T-P

C

(Common to all Branches)

3 0 0

3

Prerequisites: Engineering Physics

Aim: To endow the students with the fundamentals of physics, materials and apply new ideas in the field of Engineering and Technology.

Course Outcomes:

At the end of the course the student will be able to

CO1: Understand the theory and processing of conducting, superconducting materials.

CO2: Acquire knowledge of classification of semi conducting materials.

CO3: Gain knowledge about the types of magnetic and dielectric materials and their applications.

CO4: Understand about some exciting properties of modern engineering materials.

CO5: The students will acquire knowledge about nanomaterial's and their Characterization Techniques.

CONDUCTING MATERIALS

9

Conductors: classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory –Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

Super Conductors: properties - Types of super conductors - Applications of superconductors – SQUID, cryotron, magnetic levitation.

SEMICONDUCTING MATERIALS

9

Intrinsic semiconductor – carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – Extrinsic semiconductors – carrier concentration derivation in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration– Hall effect – Determination of Hall coefficient – Applications.

MAGNETIC AND DIELECTRIC MATERIALS

9

Magnetic Materials: Origin of magnetic moment – Bohr magneton – Dia and para magnetism – Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti – ferromagnetic materials – Ferrites – applications.

Dielectric Materials: Polarization - electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation –dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

ADVANCED MATERIALS

9

Metallic glasses: Preparation, properties and applications.

Shape memory alloys (SMA): Characteristics - Properties of NiTi alloy – Applications -Advantages and disadvantages of SMA. **Bio Materials:** Biomaterials and their Types –Uses of biomaterials - Biosensor

Unit-V NANOMATERIALS & CHARACTERIZATION TECHNIQUES

9

Synthesis of nanomaterials – Chemical vapour deposition – Ball milling - Properties of nanomaterials and applications. Principle, Characterization and applications of X- Ray diffraction – Scanning Electron Microscope – Transmission Electron Microscope

TOTAL NUMBER OF PERIODS : 45

Text books: Ragavan, V., “Material science and Engineering”, Prentice Hall of India (2004).

References:

1. Arumugam M., “Materials Science”, Anuradha publications, Kumbakonam (2006).
2. William D. Callister, Jr., “Material Science and Engineering”, John Wiley & Sons Inc., Seventh Edition, New Delhi (2010).
3. Charles P. Poole and Frank J.Ownen., “Introduction to Nanotechnology”, Wiley India (2007)
4. Charles Kittel., “Introduction to solid state Physics”, John Wiley & Sons, 7th editions, (2007)

(Common to all Branches)

Aim: To Impart the social groups and individuals to acquire knowledge of pollution and environmental degradation

Course Outcomes: At the end of the course the student will be able to know the fact of science and technology development on ecosystem

Unit-I Introduction to Environmental Studies and Natural Resources 9

Definition, scope and importance – Need for public awareness – Forest resources: Use and over-exploitation, deforestation, case studies. dams and their effects on forests and tribal people–Energy resources: Growing energy needs, renewable (solar energy and wind energy) and non renewable energy sources- Nuclear energy – fission and fusion reactions and light water nuclear reactor for power generation (block diagram only), Petroleum processing and fractions, LPG and Natural gas.

Unit-II Ecosystem and Biodiversity 9

ECOSYSTEM : Concept of an ecosystem – Structure and function of an ecosystem: Producers, consumers and decomposers, Energy flow in the ecosystem-Nitrogen cycle, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the Forest ecosystem and Aquatic ecosystems (lake and rivers) –**BIODIVERSITY** : Introduction to Biodiversity – Definition– Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values –India as a mega-diversity nation – Hot-spots of biodiversity

Unit-III Environmental Pollution 9

Definition – Causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Marine pollution (d) Noise pollution (e) Thermal pollution – Solid waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

Unit-IV Social Issues and the Environment 9

From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, Ozone layer depletion, nuclear accidents -case studies- Goal of Green chemistry

Unit-V Human Population and the Environment 9

Population growth, variation among nations – Population explosion – Family Welfare Programme – Human Rights – Value Education – HIV/AIDS –Women and Child Welfare – Role of Information Technology in Environment and human health-Case studies.

TOTAL NUMBER OF PERIODS : 45

1. A. Ravikrishnan, “Environmental Science and Engineering, Sri Krishna Hitech Publishing Company Private Limited, 2010.
2. Benny Joseph, “Environmental Science and Engineering”, Tata McGraw-Hill, New Delhi, 2006.
References:
1. Anubha Kaushik, C.P. Kaushik, “Environmental Science and Engineering”, New Age International Publishers, 2016.
2. Raman Sivakumar, <i>Introduction to Environmental Science and Engineering</i> , Tata McGraw Hill Education Private Limited, New Delhi, 2010.
3. P.Meenakshi, <i>Elements of Environmental Science and Engineering</i> , PHI learning (P) Ltd., India.

AIM

To enable students learn the basic fundamental of biochemical processes.

OBJECTIVES

- To ensure students have strong grounding in structure and reactions of biomolecules.
- To introduce them to metabolic pathway of the major biomolecular and relevance to clinical conductors.
- To correlate biochemical processes with biotechnology applications.

WATER **9**

Structure of water; non covalent (weak) interactions - hydrogen bonding, ionic, hydrophobic, van der Waals, osmolarity and osmolality; introduction to buffering system and biological buffers; Cellular reactions of water- ionization, concept of pH, pK, acids and bases, Henderson-Hasselbalch equation.

CARBOHYDRATES **9**

Nomenclature; structure, classification and functions of carbohydrates: monosaccharides – reactions - sugar derivatives; disaccharides – structure and function; polysaccharides-homo and hetero polysaccharides; Glycosaminoglycans; glycoproteins. Bacterial cell wall polysaccharides.

LIPIDS **9**

Classification - structure and functions of lipids; Fatty acids - Nomenclature; Essential fatty acids; TAG structure and properties; Phospholipids – functions; Sphingo lipids and Glycolipids. Lipoproteins; Derived lipids – cholesterol – steroids; Properties of lipid aggregates.

AMINOACIDS AND PROTEINS **9**

Classification, Structure and function of aminoacids – Properties; Proteins – Classification – hierarchy of proteins – primary, secondary, tertiary and quaternary structure – Determination of primary structure; biologically important peptides

NUCLEIC ACIDS AND VITAMINS **9**

Structure, functions and types of bases - purines and pyrimidines; Nucleotides – Nucleosides; Structure of DNA and RNA. Vitamins – classification; biological importance, deficiency disorders and biochemical functions; Anti-oxidants and their role in biological systems.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Nelson D.L., Cox M.M., “Lehninger’s Principles of Biochemistry”, 6th Edition. Macmillan worth Publisher, 2012.

References

2. Berg J. M., Tymoczko J. L., Stryer, L., “Biochemistry” 7th Edition, Macmillon, 2012.
3. Moran L. A., Horton R.A., Scrimgeour G., Perry M., Rawn D., “Principles of Biochemistry” 5th Edition, Pearson New international Edition, 2014.
4. Voet D., Prat W.C., Voet J., “Principles of Biochemistry”, John Wiley and Sons, 4th Edition 2012.
5. Rodwell V., Bender D., Botham K., Kennelly P., Anthony Weil P., “Harpers Illustrated Biochemistry” McGraw Hill, 30th Edition 2015.

Course outcome

- * Understand the basic design of life, classification, structure and function of bio molecules.
- * Understand the hierarchical organization of proteins and nucleic acid.
- * Able to understand the basic chemistry and classification of biomolecules.
- * Understand the enzyme catalyzed metabolic reactions and their regulation.
- * Calculate the energy transduction in metabolism of bio molecules.

AIM

The course aims to develop skills of the Students in the area of Microbiology particularly to identify microbes, their structure, their metabolism and their industrial applications. This will be a prerequisite for all courses offered in Bioprocess Technology.

OBJECTIVES

- To know the microbial classification, characterization and their applications.
- To understand the role of microbes in industrial biotechnology.
- Students got exposure in microbial culture and contaminations.

INTRODUCTION**9**

Basic of microbial existence; history of microbiology, classification and nomenclature of microorganism, microscopic examination of microorganisms, light and electron microscopy; principles of different staining techniques like gram staining, acid fast, capsular staining, flagellar staining.

MICROBES-STRUCTURE AND MULTIPLICATION**9**

Structural organization and multiplication of bacteria, viruses, algae and fungi with a special mention of life history of actinomycetes, yeast, mycoplasma and bacteriophage

MICROBIAL NUTRITION, GROWTH AND METABOLISM**9**

Nutritional requirements of bacteria and different media used for bacterial culture; growth curve and different methods to quantitative bacterial growth, aerobic and anaerobic cultivation of microbes.

CONTROL OF MICROORGANISMS**9**

Physical and chemical control of microorganisms; host-microbe interactions; anti-bacterial, anti-fungal and anti-viral agents, mode of action and resistance to antibiotics; clinically important microorganisms.

ENVIRONMENTAL MICROBIOLOGY**9**

Preservation of food; biogas; bioremediation; leaching of ores by microorganisms; bio-fertilizers and bio-pesticides; biosensors

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Pelczar MJ, Chan ECS and Kreig NR, Microbiology, Tata McGraw-Hill Edition, New Delhi, India.

References

2. Talaron K, Talaron A, Casita, Pelczar and Reid. Foundations In Microbiology, W.C. Brown Publishers, 1993.

3. Prescott LM, Harley JP, Klein DA, Microbiology, 3rd Edition, Wm. C. Brown Publishers, 1996.

Course Outcomes

- Able to remember the classification, structural organization and multiplication of microbes.
- Able to understand the working principles of different microscopes.
- Able to identify nutritional requirements and growth characteristics of microbes.
- Able to optimize different methods for control of microorganisms.
- Able to understand various applications of microorganisms in industry and environment.

161PC27**PHYSICS AND CHEMISTRY LABORATORY-II****L-T-P****C**

(Common to all Branches)

0-0-3**2****AIM:**

To introduce the basic Physics concepts through experiments and to impart knowledge on the application of chemistry in engineering branches.

Course Outcomes:

The Students will be able to

CO1: Understand the rigidity modulus of the materials.

CO2: Learn the Young's modulus of the material.

CO3: Study the flow of liquid in capillary tube.

CO4: Determine the quantity of unknown solution by instrumental method.

CO5: Analyze the corrosion rate of a iron.

S.No	LIST OF EXPERIMENTS – PHYSICS PART	
1)	Torsional pendulum – Determination of rigidity modulus	3
2)	Determination of Young's modulus of the material – Uniform bending	3
3)	Determination of viscosity of liquid – Poiseuille's method.	3
4)	Determination of wavelength of mercury spectrum- Spectrometer Grating.	3
5)	Determination of Band Gap of a semiconductor material.	3
6)	Determination of specific resistance of a given coil of wire – Carey Foster Bridge.	3

(A minimum of five experiments shall be offered)

LIST OF EXPERIMENTS – CHEMISTRY PART		
S.No	NAME OF THE EXPERIMENT	
1)	Estimation of HCl by pH meter	3
2)	Conductometric titration of mixture of acids (HCl & CH ₃ COOH)	3
3)	Estimation of Chloride ion in water sample by Argentometric method.	3
4)	Determination of molecular weight of a polymer by viscometry method	3
5)	Determination of corrosion rate by weight loss method	3

References

- 1) Text book of Quantitative Inorganic Analysis, A.I.Vogel, ELBS,London.
- 2) "Practical A. Ravikrishnan Engineering Chemistry", Sri Krishna Publications, Chennai (2002)
- 3) Engineering Physics Laboratory Manual
- 4) Engineering Chemistry Laboratory Manual

161BT27**BIOCHEMISTRY LABORATORY****L****T****P****C****0****0****3****2****LIST OF EXPERIMENTS**

1. Demonstration of use of volume and weight measurements devices.
2. Titration of weak acid-weak base.
3. Quantitative Test for carbohydrates.
4. Distinguish reducing and non reducing sugars.
5. Using ninhydrin for distinguishing Imino and amino acids .
6. Protein estimation by Biuret method.
7. Protein estimation by Lowry's method.
8. Protein estimation by Bradford colorimetric methods.
9. Extraction of lipids and analysis by TLC.
10. Estimation of nucleic acid by absorbance at 260nm and hyper chromicity.

Reference Book

Jeyaraman J., "Laboratory Manual in Biochemistry", New Age International Publi., 2nd Edition, 2011

Course Outcomes

After completion of the course students will be able to

- * Develop skills in accurate weighing and other measurements.
- * Familiarize with physiochemical parameters calibration.
- * Qualitatively analyze and various biochemical components.
- * Understand basics and functional reactions of biomolecules.

161BT28

MICROBIOLOGY LABORATORY

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. Laboratory safety and sterilization techniques
2. Microscopic methods in the identification of microorganisms
3. Preparation of culture media–nutrient broth and nutrient agar
4. Culturing of microorganisms–in broth and in plates (pour plates, streak plates, isolation and preservation of bacterial cultures)
5. Staining techniques–Gram’s and differential
6. Quantitation of microorganisms.
7. Effect of disinfectants on microbial flora
8. Isolation and identification of microorganisms from different sources–soil, water and milk
9. Antibiotic sensitivity assay
10. Growth curve–observation and growth characteristics of bacteria and yeast.
11. Effect of different parameters on bacterial growth (pH, temperature &UV irradiation)

Reference Book

Benson H.J., “Microbiological Applications: Laboratory Manual in General Microbiology”, McGraw-Hill, 12th Edition 2011.

COURSE OUTCOMES:

- * Able to describe sterilization techniques and good laboratory practices in microbiology.
- * Demonstrate competency in isolation, subculture, identification and preservation of microbe using appropriate basic microbiology technique.
- * Evaluate the activity of antibiotics and disinfectant on microbial growth.
- * Observe different phases of microbial growth curve.
- * Demonstrate the effect of pH, temperature and irradiation on microbial growth.

161MA31

TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATION

L	T	P	C
3	1	0	4

(Common to all branches)

Prerequisites: Engineering Mathematics-I , Engineering Mathematics II

AIM: The Course is aimed to developing the basic mathematical skills of Engineering Student.

Course Outcomes:

The students will be able to

CO1: Classify the Fourier series and half range Fourier sine and cosine series.

CO2: Explain the Fourier transform and with their properties.

CO3: Determine Z-inverse transform using convolution theorem and partial fraction method.

CO4: Solve the partial differential equation by using Lagrange’s linear equation.

CO5: Analyze separation of variable to solve linear partial differential equation.

CO6: Discuss the formation of partial differential equation.

FOURIER SERIES

12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier Series – Parseval's identify – Harmonic Analysis.

FOURIER TRANSFORMS

12

Fourier integral theorem (without proof) – Fourier transform pair – Sine and Cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

PARTIAL DIFFERENTIAL EQUATIONS

12

Formation of partial differential equations – Lagrange's linear equation – Solutions of standard types of first order partial differential equations (without reducing the standard type) – Linear partial differential equations of second and higher order with constant coefficients.

APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

12

Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) – Fourier series solutions in Cartesian coordinates.

Z -TRANSFORMS AND DIFFERENCE EQUATIONS

12

Z-transforms – Elementary properties – Inverse Z-transform – Convolution theorem – Formation of difference equations – Solution of difference equations using Z-transform.

TOTAL: 60 PERIODS

TEXT BOOK(S)

1. Grewal, B.S, "Higher Engineering Mathematics", 40th Edition, Khanna publishers, Delhi, (2007)
2. Dr. G. Balaji, "Transforms and Partial Differential Equation", Balaji Publishers, 12th Edition November 2016, Chennai.

References

1. Bali, N.P and Manish Goyal "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications(P) Ltd. (2007).
2. Ramana B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company limited, New Delhi (2007).
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd edition-Pearson Education (2007).
4. Erwin Kreyszig "Advanced Engineering Mathematics", 8th edition-Wiley India (2007).

161BT31 STOICHIOMETRY AND FLUID MECHANICS

L T P C
3 0 0 3

AIM

The course aims to develop skills of the Students in the area of Chemical Engineering with emphasis in Thermodynamics fluid mechanics. This will be necessary for certain other course offered in the subsequent semesters and will serve as a prerequisite.

OBJECTIVES

- To understand the basic mechanisms of chemical reaction
- To correlate the chemical reaction with biological reaction
- To introduce them prerequisite for biological process.

OVERVIEW OF PROCESS INDUSTRY

9

System of units, conversion of units; fundamental concepts of stoichiometry; Introduction to fluid flow heat transfer and mass transfer operations; process automation; environment; conservation factors; applied mathematics for experimental curve fitting; numerical differentiation; integration.

MATERIAL BALANCES

9

Conservation of mass and energy; unit operations and Overall and component balances; material balances without and with chemical reactions; degrees of freedom; steady and unsteady state; recycle and bypass;

humidity calculations.

FIRST AND SECOND LAWS OF THERMODYNAMICS 9

Energy balances; sensible heat, latent heat; vapour pressure; steady and unsteady state calculations.

FLUID MECHANICS 9

Fluids; fluid statics and applications in chemical engineering; fluid flow; laminar; turbulent pressure drops; compressible fluid flow concepts; multiphase flow concepts.

FLOW THROUGH PACKED COLUMNS 9

Fluidization; centrifugal and piston pumps; characteristics; compressors; work.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Narayanan K.V., Lakshmikutty B."Stoichiometry and process calculations",1st Edition, Prentice Hall India, 2006.
2. McCabe W.L., Smith J.C, Harriot P."Unit Operations In Chemical Engineering", 7th Edition, McGraw-Hill Inc.,2014.

REFERENCES

- 1.Himmelblau D.M., "Basic principles and calculations in Chemical Engineering", Prentice Hall International, 8th Edition, 2011
2. Foust A.S., "Principles of Unit Operations", John Wiley & Sons, 2nd Edition, 2008

COURSE OUTCOMES:

After completion of this course students will be able to

- Understand, analyze chemical operations and solve problems related to units and conversions and fit the given data using the methodologies.
- Solve problems related to energy balance concepts, flow and design unit operation equipment and reactors for biochemical processes.
- Apply their knowledge in the field of biochemical engineering from the principles of thermodynamics.
- Acquire knowledge related to fluid statics and dynamics, transportation of fluids in Chemical processes and Bioprocesses.

161BT32

CELL BIOLOGY

**L T P C
3 0 0 3**

AIM

The course aims to develop skills of the Students in the area of Cell Biology and Cell Signalling pathways. This will be necessary for studies in course like Microbiology, Molecular course is also a prerequisite for other Biology, etc. This course offered in the subsequent semesters.

OBJECTIVES

- To know the basic of biological system prerequisite for post graduate and other course.
- To understand the mechanism of cell multiplication and formation of life.
- To ensure students have a strong groundings in cell culture techniques.

CELL STRUCTURAL ORGANISATION 9

Eukaryotic and prokaryotic cells, principles of membrane organisation, cytoskeletal proteins-Microtubules, Microfilaments, Intermediate Filaments, Structure and functions of Nucleus, Endoplasmic reticulum, Ribosomes, Golgi Complex, Lysosomes, Peroxisomes, Chloroplast & Mitochondria

CELL DIVISION AND DIFFERENTIATION 9

Overview of the Cell Cycle, Interphase, Mitosis, Meiosis and Cytokinesis. Animal Cell & Yeast Cell Division, Cell Cycle Control & Checkpoints. General Characteristics of Cell Differentiation, Historical events in Cell differentiation, Cytoplasmic determinants, Nucleoplasmic Interactions; Stem Cell differentiation and its Biological importance.

TRANSPORT ACROSS CELL MEMBRANES

9

Passive & active transport, permeases, sodium potassium pump, Ca²⁺ATPase pumps, lysosomal and vacuolar membrane ATP dependent proton pumps, cotransport, symport, antiport, transport into prokaryotic cells, endocytosis and exocytosis. Entry of viruses and toxins into cells.

RECEPTORS AND SIGNAL TRANSDUCTION

9

Cytosolic, nuclear and membrane bound receptors, role of secondary messengers, signal amplification, autocrine, paracrine and endocrine models of action, steroid / Peptide hormone regulation, tissue specific regulation, quantitation and characterization of receptors.

BASIC TECHNIQUES IN CELL BIOLOGY

9

Cell fractionation and flow cytometry, morphometric measurement, localization of proteins in cells by immune staining, techniques for the propagation of eukaryotic and prokaryotic cells, cell culture contamination and control measure,

TOTAL: 45 PERIODS

TEXT BOOKS

1. DeRobertis & DeRobertis, "Cell and Molecular Biology", 8th Edition, B.I. Publ. Pvt. Ltd, 2010.

REFERENCES

1. Darnell J, Lodish H, Baltimore D, "Molecular Cell Biology", W.H. Freeman
2. Kimball T.W., "Cell Biology", Wesley Publishers;
3. James D. Watson, "Molecular Biology of the Cell".

Course Outcomes:

The students will be

- Able to differentiate microbial, plant and animal cells.
- Able to understand the transport phenomena across the plasma membrane.
- Able to understand the cell machinery of signal amplification.
- Able to relate cancer and malfunctioning of signaling pathways.
- Able to develop knowledge on cell fraction and propagation methods

161BT33

PRINCIPLES OF GENETICS

L	T	P	C
3	0	0	3

AIM

To enable students learn the basic and fundamental of genetics

OBJECTIVES

- To understand the basic of character transmission, segregation and expression.
 - To introduce them prerequisite for genetic engineering.
- To analyze the role of genes and mutation

MENDELIAN GENETICS

9

Mendel's experiment and principle of segregation, monohybrid crosses – dominance, recessiveness, codominance, semi dominance and lethals; principle of independent assortment – dihybrid crosses, multiple alleles – ABO blood type and Rh factor alleles.

SEX DETERMINATION

9

Linkage, crossing over and chromosomal mapping, Mechanism of sex determination, sex differentiation, sex linked inheritance, linkage of genes on x and y chromosomes, crossing over and chromosomal mapping in human recombination.

GENETIC MATERIAL AND GENETIC TRANSFER

9

Identification of genetic material by Hershey & Chase, Avery, McLeod and Fraenkel - Singer experiments; chromosome structure in prokaryotes and eukaryotes, recombination in bacteria - transformation, transduction and conjugation.

MUTATION AND CHROMOSOMAL INHERITANCE 9

Mutations - spontaneous, physical and induced; applications of mutation, organization of DNA in mitochondria and plastids, cytoplasmic male sterility in plants.

POPULATION AND EVOLUTIONARY GENETICS 9

Genetic variation, random mating and Hardy-Weinberg method, inbreeding, out breeding and assortative mating, genetic equilibrium and evolutionary genetics.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Snustad D.P. and Simmons M.J., "Principles of Genetics", Wiley, 6th Edition, 2011

REFERENCES

1. Robert H.Tamarin, "Principles of Genetics" 7 ed., Tata McGraw Hill, 2002.
2. Daniel L., Hartl and Elizabeth W. "Essential Genetics" Jones, 3 ed., Jones and Bartlett publishers, Massachusetts, 2002.

Course Outcomes

- Able to define and understand the Mendelian terms, gene inheritance and interaction.
- Able to know the gene arrangement in chromosomes and their mapping
- Able to understand the process of gene exchange and role of transposons
- Able to understand mutation and its impact on variation, health and disorders

161BT34

ENZYME TECHNOLOGY

L	T	P	C
3	0	0	3

AIM

The course aims to develop skills of Students in the area of Organic Chemistry and its applications in Biology. This will be a prerequisite to courses like Molecular Modeling, Bio separations etc.

OBJECTIVES

- To understand enzyme reaction and kinetics.
- To provide basic knowledge on immobilization techniques and their applications.
- To support various metabolic and physiological process.

INTRODUCTION TO ENZYMES 9

Classification of enzymes. Mechanisms of enzyme action; concept of active site and energetics of enzyme substrate complex formation; specificity of enzyme action; Principles of catalysis – collision theory, transition state theory - Role of entropy in catalysis.

KINETICS OF ENZYME ACTION 9

Kinetics of single substrate reactions - Estimation of Michaelis – Menten parameters - Multi-substrate reactions: mechanisms and kinetics - Turnover number - Types of inhibition & models: substrate, product - Allosteric regulation of enzymes - Monod Changeux Wyman model - pH and temperature effect on enzymes & deactivation kinetics.

ENZYME IMMOBILIZATION 9

Physical and chemical techniques for enzyme immobilization – adsorption, matrix entrapment,encapsulation, cross-linking, covalent binding etc.,-examples, Matrix used in immobilization advantages and disadvantages.

PURIFICATION AND CHARACTERIZATION OF ENZYMES 9

Production and purification of crude enzyme extracts from plant, animal and microbial sources: precipitation, Dialysis, hydrophobic interaction chromatography, gel filtration, and ion exchange chromatography - Methods of characterization of enzymes- SDS-PAGE, X- Ray spectroscopy - Development of enzymatic assays.

ENZYME BIOSENSORS 9

Principles of electrochemistry - Design of enzyme electrodes - Types of Biosensor and their application as biosensors in industry, healthcare and environment.

TEXT BOOKS

1. Palmer T., Bonner P.L., "Enzymes: Biochemistry, Biotechnology, Clinical Chemistry", Elsevier, 2nd Edition, 2008.
2. Ashok P., Colin W., Carlos R.S., Christian L., "Enzyme Technology", Springer, 1st Edition, 2006.

REFERENCES

1. Structure and Mechanism In Protein Science: A Guide To Enzyme Catalysis and Protein Folding; A.R. Fersht, W.H. Freeman, 1999.
2. Bioorganic Chemistry; H.Dugas, Springer Verlag, 1999.
3. James. E. Bailey & David F. Ollis, "Biochemical Engineering Fundamentals", McGraw-Hill.
4. Wiseman, "Enzyme Biotechnology", Ellis Horwood Pub.

Course Outcomes:

Upon the completion of the course, students will be able to

- Understand the types of enzymes and kinetics of enzyme action.
- Deal with the immobilized enzymes and biosensors.
- Purify and produce the enzyme from the natural sources.

161BT35**BIOCHEMISTRY II****L T P C
3 0 0 3**

Aim: To develop skills of the students in Biochemistry with special emphasis on the metabolizing aminoacids, nucleicacids, polysaccharide & lipids and biomembranes. This maybe a pre-requisite for certain-elective courses like Metabolic Engineering; Molecular Modelling and Drug Design etc.

OBJECTIVES

At the end of the course, the student would have gained an extensive knowledge of Biochemistry particular various metabolic pathways & bio membranes. This knowledge will be useful for project work.

INTRODUCTION TO METABOLISM**9**

Overview of metabolic pathways - anabolism, catabolism and amphibolism; Interconnection pathways; Chemistry of metabolism; concepts of bioenergetics- standard free energy change; High energy compounds. Respiratory chain – calculation of ATP molecules.

METABOLISM OF CARBOHYDRATES AND LIPIDS

Glycolysis – citric acid cycle – gluconeogenesis – glycogenesis – glycogenolysis – Pentose phosphate pathway – glyoxalate cycle; Regulations; Biosynthesis of starch and glycogen; Glycogen storage diseases; Fatty acid biosynthesis and degradation; Cholesterol biosynthesis and ketone bodies formation.

METABOLISM OF AMINO ACIDS**9**

Nitrogen metabolism and urea cycle. Biosynthesis of amino acids - Gly, Met, Lys, Leu and aromatic amino acids. One-carbon metabolism. Degradation of aminoacids – Metabolic disorders associated with amino acid metabolism. Biologically important molecules derived from amino acids.

METABOLISM OF NUCLEOTIDES**9**

Biosynthesis of nucleotides - de novo and salvage pathways for purines and pyrimidines, Degradation of proteins and nucleotides. Disorders caused by nucleotide metabolism. Hyperuricemia and gout, Hartnup's disease.

BIOCHEMISTRY OF CLINICAL DISEASES**9**

Diabetes mellitus, atherosclerosis, fatty liver, obesity, hormonal disorders, aging and inborn errors of metabolism; Organ function tests – Liver and kidney.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. David L. Nelson and Michael M Cox, Lehninger's Principles of Biochemistry, Macmillan Worth Publisher, 6th Edition, 2012

2. Lubert Stryer, Biochemistry, 4th Edition, WH Freeman & Co., 2000.

REFERENCES

1. Voet and Voet, Biochemistry, 2nd Edition, John Wiley & Sons Inc., 1995.
2. Murray, R. K., Granner, B.K., Mayes, P.A., Rodwell. V.W., Harper's Biochemistry, Prentice Hall International.
3. Salway, J.G., Metabolism at a Glance, 2nd Edition, Blackwell Science Ltd., 2000.

Course Outcomes are: Students familiar with the following aspects

- The anabolic and catabolic pathways of amino acids and disorders associated with them.
- The mechanism of protein transport to various destinations and degradation.
- The mechanism of nucleic acid synthesis and degradation
- The intricate network of metabolic interactions to provide metabolic fuel and regulation of metabolism.
- The physiological and metabolic significance of vitamins

161BT37

CELL BIOLOGY LABORATORY

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. Introduction to principles of sterile techniques and cell propagation
2. Principles of microscopy, phase contrast and fluorescent microscopy
3. Identification of given plant, animal and bacterial cells and their components by microscopy
4. Leishman Staining
5. Micrometry
6. Giemsa Staining
7. Separation of Peripheral Blood Mononuclear Cells from blood
8. Osmosis and Tonicity
9. Trypan Blue Assay
10. Staining for different stages of mitosis in *Allium Cepa* (Onion)
11. Staining and observation of meiosis in testes of the grasshopper

Reference

Harris J.R., Graham J.M., and Rickwood D., "Cell Biology: Essential Techniques", Wiley-Blackwell, 2006

COURSE OUTCOMES:

- * Students able to understanding of cell separation, identification and microscopy.
- * Identify various types of blood cellular component and various stages of mitosis using staining techniques.
- * Able to differentiate viable, nonviable, plant and animal cells.
- * Demonstrate the effect of osmosis and tonicity on red blood cells.

161BT38

BIOORGANIC CHEMISTRY LABORATORY

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. Synthesis of aspirin
2. Hydrolysis of sucrose
3. Preparation of pyruvic acid.
4. Isolation of lycopene from tomato paste
5. Preparation of L-proline
6. Preparation of L-cysteine from hair
7. Screening and Isolation of enzyme
8. Effect of p^H, Temperature, Substrate on Invertase enzyme activity.
9. Protease assay study on Casein isolated from milk.

10. Enzyme Inhibition kinetics.
11. Cell and Enzyme immobilization.

Reference:

Pauline, D., "Bioprocess Engineering Principles", Elsevier, 2nd Edition, 2012

Course Outcomes

- Students able to synthesis and characterize the organic molecule
- Able to screen and isolating biological enzymes
- Understanding the various parameters regulating enzyme activity
- Able to develop immobilization techniques and inhibition kinetics

161BT41	MOLECULAR BIOLOGY	L	T	P	C
		3	0	0	3

AIM: Familiarize students with the cell and molecular biology of both Prokaryotes and Eukaryotes. This will be needed for any project work in modern biotechnology.

Structure of Nucleic Acids 9

Introduction to nucleic acids: Nucleic acids as genetic material, Structure and physicochemical properties of elements in DNA and RNA, Biological significance of differences in DNA and RNA. Primary structure of DNA: Chemical and structural qualities of 3', 5'-Phosphodiester bond. Secondary Structure of DNA: Watson & Crick model. Different Types of DNA.

DNA Replication 9

Overview of Central dogma. Organization of prokaryotic and eukaryotic chromosomes. DNA replication: Meselson & Stahl experiment. Fidelity of DNA replication, Inhibitors of DNA replication, D-loop and rolling circle mode of replication. DNA mutation and Mutagens.

Transcription 9

Structure and function of mRNA, rRNA and tRNA. Characteristics of promoter and enhancer sequences. RNA synthesis: Initiation, elongation and termination of RNA synthesis, Proteins of RNA synthesis, Fidelity of RNA synthesis, Inhibitors of transcription, RNA processing: 5'-Capping, Splicing-Alternative splicing, Poly 'A' tail

Translation 9

Introduction to Genetic code: Elucidation of genetic code, Codon degeneracy, Steps in translation: Initiation, Elongation and termination of protein synthesis. Inhibitors of protein synthesis.

Regulation of Gene Expression in Prokaryotes And Eukaryotes 9

Hierarchical levels of gene regulation, Regulation of gene activity In prokaryotes: Operon Concept: Lac operon, Trp Operon. Regulation of gene activity on eukaryotes.

TEXT BOOKS

1. David Friefelder, Molecular Biology, 2nd Edition, Narosa Publ. House. 2008

REFERENCES

2. Benjamin Lewin, Gene VII, Oxford University Press. 2000
3. Watson JD, Hopkins WH, Roberts JW, Steitz JA, Weiner AM, Molecular Biology of the Gene. 1987

Course Outcomes

Students would understand

- the significance of DNA as a genetic material.
- genetic, biochemical and biophysical aspects facilitate DNA and RNA to perform its biological function.
- translation, transcription and replication are regulated in a coordinated fashion to operate the cellular machinery and life as a whole.
- repercussions on biological functions due to changes at nucleotides by mutagenic agents

161BT42

UNIT OPERATIONS

L T P C
3 1 0 4

AIM

The course aims to develop skills of the Students in area of unit operations. This course will be a prerequisite for certain engineering subjects offered in the subsequent semesters.

OBJECTIVES

- To develop skills of the Students in area of unit operations involved in various biological process.
- To correlate the mechanical unit with biological unit
- To understand various convection and transfer factors

MIXING AND AGITATION

12

Dimensional analysis; power for agitation; agitation of liquids; gas-liquid systems; gas- solid suspensions; agitator scale up.

FILTRATION

12

Constant pressure, constant volume batch filtration; continuous filtration; industrial filters; settling and sedimentation; centrifugation.

MECHANISM OF HEAT TRANSFER

12

Steady state conduction; combined resistances; unsteady state conduction; lumped heat capacity; extended surfaces; combined conduction and convection.

CONVECTION HEAT TRANSFER

12

Dimensional analysis; forced and natural convection; convection in flow over surfaces through pipes boiling and condensation.

HEAT EXCHANGERS

12

Equipments; over all heat transfer coefficients; design of heat exchangers; NTU concept; evaporators; single and multiple effects; mass and enthalpy balances.

TOTAL: 60 PERIODS

TEXT BOOKS

1. McCabe W.L. Smith J.C. "Unit Operations in Chemical Engineering" 7th Edition McGraw Hill. 2014.

REFERENCES

1. Incropera F.P. Fundamentals of Heat and Mass Transfer. JohnWiley.1998
2. Geankoplis C.J. "Transport Processes and "Unit Operations" Prentice Hall India.2002.

Course Outcomes:

- Able to understand the purpose of mixing and agitation, type of agitators, scale up of agitators.
- Understand about the various mechanical- physical separation processes.
- Know about the various modes of heat transfer process and its mechanisms
- Understand various types of heat exchanger and evaporators.

161BT43

CHEMICAL ENGINEERING AND THERMODYNAMICS

L T P C
3 0 0 3

AIM

The course aims to expose the students to the area of chemical thermodynamics. This will serve as a prerequisite for courses like enzyme engineering, Mass transfer, etc.

OBJECTIVES

- To understand the various law of thermodynamics involving in biological process.
- To correlate chemical thermodynamics with biological thermodynamics.
- To equip the students for engineering design.

THERMODYNAMIC PROPERTIES OF FLUIDS

9

Volumetric properties of fluids exhibiting non ideal behavior; residual properties; estimation of thermodynamic properties using equations of state; calculations involving actual property exchanges; Maxwell's relations and applications.

SOLUTION THERMODYNAMICS 9

Partial molar properties; concepts of chemical potential and fugacity; ideal and non-ideal solutions; concepts and applications of excess properties of mixtures; activity coefficient; composition models; Gibbs Duhem equation.

PHASE EQUILIBRIA 9

Criteria for phase equilibria; v-l-e calculations for binary and multi component systems; liquid-liquid equilibria and solid-solid equilibria.

CHEMICAL REACTION EQUILIBRIA 9

Equilibrium criteria for homogeneous chemical reactions; evaluation of equilibrium constant; effect of temperature and pressure on equilibrium constant; calculation of equilibrium conversion and yields for single and multiple reactions.

THERMODYNAMIC ANALYSIS OF PROCESSES 9

Concept of lost work; entropy generation; calculation of real irreversible processes; power cycle; liquefaction.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Smith J.M., VanNess H.C., Abbot M.M. Chemical Engineering Thermodynamics. 7th Edition. McGraw-Hill, 2012.
2. Narayanan K.V. "A Text Book Of Chemical Engineering Thermodynamics", 2nd Edition, Prentice Hall India, 2013.

REFERENCES

1. Sandler S.I. "Chemical And Engineering Thermodynamics" John Wiley, 1989

COURSE OUTCOMES:

After this course students will be able to

- Derive the thermodynamics property relations in accordance with laws of thermodynamics
- Appreciate the significance of solution thermodynamics
- Understand the phase equilibria and chemical reaction equilibria
- Investigate the potential applications of thermodynamics in real life scenario

161BT44 ANALYTICAL METHODS IN BIOTECHNOLOGY L T P C
3 0 0 3

AIM

The course aims to develop the skills of the students in the area of Instrumentation in Biotechnology. This will be prerequisite for understanding specialized courses & project work that will be offered in the subsequent semesters.

OBJECTIVES

- To understand the principles of measurements and instrumental methods.
- Providing experimental explanation to understand the mechanism of process.
- To ensure students have a strong background in instrumentation techniques.

BASICS OF MEASUREMENT 9

Classification of methods—calibration of instrumental methods—electrical components and circuits—signal to noise ratio—signal—noise enhancement.

OPTICAL METHODS 9

General design—sources of radiation—wavelength selectors—sample containers—radiation transducers—types of optical instruments—Fourier transform measurements.

MOLECULAR SPECTROSCOPY

9

Measurement of transmittance and absorbance – beer's law – spectrophotometer analysis –qualitative and quantitative absorption measurements -types of spectrometers– UV–visible–IR –Raman spectroscopy–instrumentation–theory.

THERMAL METHODS

9

Thermo-gravimetric methods – differential thermal analysis – differential scanning calorimetry

SEPARATION METHODS

9

Introduction to chromatography–models–ideal separation–retention parameters– van–deemter equation–gas chromatography–stationary phases–detectors–kovats indices–HPLC–pumps–columns–detectors–ion exchange chromatography–size exclusion chromatography–supercritical chromatography–capillary electrophoresis

TOTAL: 45 PERIODS

TEXT BOOKS

1. Willard, Merrit H., “Instrumental Methods of Analysis”, Prentice hall of India, 7thEdition, 2012
2. Skoog, “Principles of Instrumental Analysis” Brooks Cole, 6th Edition, 2007.

REFERENCES

1. Wilson K., Walker J., “Principles and Techniques of Biochemistry and Molecular Biology”, Cambridge University Press, 7th edition, 2010.
2. Pungor E., Horvai E., “A Practical Guide to Instrumental Analysis”, CRC Press, 1994.

Course outcomes

- Able to understand the components of instruments, methods to calibrate and techniques to enhance signal noise ratio.
- To characterize the biomolecules by Molecular spectroscopy.
- To separate and purify biomolecules by exploiting their different physical and chemical properties.
- Analyze the nature of chemical reactions during phase transition and the principle and application of freeze drying for preservation of food and microbial culture.

161BT45

BASIC INDUSTRIALBIOTECHNOLOGY

L T P C
3 0 0 3

AIM

This course aims to develop the skills of the students in the area of important bio products and its production protocol.

OBJECTIVES

- To know the basic industrial fermentation process.
- To study the industrially important products produced from microbes
- To study the various production protocols of primary and secondary metabolites.

INTRODUCTION TO INDUSTRIAL BIOPROCESS

9

A historical overview of industrial fermentation process – traditional and modern biotechnology. A brief survey of organisms, processes, products relating to modern biotechnology. Process flow sheeting–block diagrams, pictorial representation

PRODUCTION OF PRIMARY METABOLITES

9

A brief outline of processes for the production of some commercially important organic acids (e.g. citric acid, lactic acid, acetic acid etc.); amino acids (glutamic acid, phenylalanine, aspartic acid etc.) and alcohols (ethanol, butanol etc.)

PRODUCTION OF SECONDARY METABOLITES

9

Study of production processes for various classes of secondary metabolites: antibiotics: beta-lactams (penicillin, cephalosporin etc.), aminoglycosides (streptomycin etc.), macrolides (erythromycin), vitamins and steroids.

PRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS 9

Production of industrial enzymes such as proteases, amylases, lipases, cellulases etc., Production of biopesticides, biofertilisers, biopreservatives (Nisin), cheese, biopolymers (xanthanum, PHB etc.), single cell protein.

PRODUCTION MODERN BIOTECHNOLOGY PRODUCTS 9

Production of recombinant proteins having therapeutic and diagnostic applications, production of vaccines. Production of monoclonal antibodies. Products of plant and animal cell culture.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Casida Jr, L.E., "Industrial Microbiology", New Age International (P) Ltd.
2. Prescott and Dunn. "Industrial Microbiology", CBS Publishers & Distributors, 4th Edition, 2005

REFERENCES

1. Wulf Cruger and Anneliese Crueger, "Biotechnology: A Textbook of Industrial Microbiology", Panima Publishing Corporation, 2nd Edition, 2000
2. Murrey Moo & Young, "Comprehensive Biotechnology", Pergamon, 2nd Edition, 2011

Course Outcomes are:

- Students able to understand the industrial bioprocess and their applications.
- They are able to apply the knowledge on the production of primary metabolites.
- They have applying the knowledge on the production of secondary metabolites.
- Can able to apply the knowledge on the production of enzymes.
- Able to apply the knowledge on the production of modern biotechnological products.

161BT47 ANALYTICAL METHODS IN BIOTECHNOLOGY LABORATORY

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. Precision and validity in an experiment using absorption spectroscopy and Validating Lambert-Beer's law using KMnO_4
2. Finding the molar absorptivity and stoichiometry of the $\text{Fe}(1,10\text{phenanthroline})_3$ Using absorption spectrometry.
3. Finding the pK_a of 4-nirophenol using absorption spectroscopy.
4. UV spectra of nucleic acids.
5. Estimation of Sulphate by nephelometry.
6. Estimation of Aluminium alizarin by flourimetry.
7. Chromatography analysis using Paper and TLC.
8. UV spectra of nucleic acids.
9. Chromotography using column.
10. UV-spectra of proteins.

Reference:

Jeyaraman J., "Laboratory Manual in Biochemistry", New Age Interantional Publishers, 2nd Edition, 2011

COURSE OUTCOMES:

- * Validate an instrumental method with high precision and accuracy.
- * Systematically execute an experiment
- * Separate different compounds by Chromatography

161BT48 CHEMICAL ENGINEERING LABORATORY

L	T	P	C
0	0	3	2

LIST OF EXPERIMENTS

1. Flow measurement through annular pipe
2. Flow measurement through straight pipe
3. Pressure drop in pipes and packed columns

4. Fluidization
5. Filtration
6. Heat exchanger
7. Simple and steam distillation
8. Distillation in packed column
9. Liquid-liquid equilibria in extraction
10. Adsorption equilibrium

Reference:

Mccabe & Smith “Unit Operations of Chemical Engineering”, McGraw Hill, 7th Edition, 2014

Course Outcomes

- Able to calculate pressure and flow rate of liquid
- Find out the efficiencies of filtration and distillation range
- Calculate the energy conversion limit
- Separate soluble components by using liquid equilibria

161BT51

BIOPROCESS PRINCIPLES

L	T	P	C
3	0	0	3

AIM

To develop skills of the students in the area of Bio process Technology with emphasis a Bioprocess principles. This is a pre-requisite for courses a Bioprocess technology offered in the subsequent semesters.

OBJECTIV]

At the end of the course, the students would have learnt about fermentation processes, Metabolic stoichiometry, Energetics, Kinetics of microbial growth etc. This will serve as an effective course to understand certain specialized electives in Bioprocess related fields.

OVERVIEW OF FERMENTATION PROCESSES

9

Overview of fermentation industry, general requirements of fermentation processes, basic configuration of Fermentor and ancillaries, main parameters to be monitored and controlled in fermentation processes.

RAW MATERIALS AND MEDIA DESIGN FOR FERMENTATION PROCES

9

Criteria for good medium, medium requirements for fermentation processes, carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, medium formulation of optimal growth and product formation, examples of simple and complex media, design of various commercial media for industrial fermentations – medium optimization methods

STERILIZATION KINETICS

9

Thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid media, air sterilization and design of sterilization equipment - batch and continuous.

METABOLIC STOICHIOMETRY AND ENERGETICS

9

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

KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION

9

Modes of operation - batch, fed batch and continuous cultivation. Simple unstructured kinetic models for microbial growth, Monod model, growth of filamentous organisms, product formation kinetics - leudeking-piret models, substrate and product inhibition on cell growth and product formation.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Shuler and Kargi, "Bioprocess Engineering", Prentice Hall, 2nd Edition, 2002.
2. Bailey, J.E. and Ollis, D.F., "Biochemical Engineering Fundamentals", McGraw Hill, 2nd Edition, 2010

REFERENCES

1. Pauline Doran, "Bioprocess Engineering Calculation", Blackwell Scientific Publications. 2012
2. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, "Principles of Fermentation Technology", Science & Technology Books. 2009
3. Harvey W. Blanch, Douglas S. Clark, "Biochemical Engineering", Marcel Dekker, Inc. 2015

Course Outcomes:

The students will be able to

- Apply engineering principles to systems containing biological catalysts to meet the needs of the society.
- Optimize the medium suitable for the production of the biological products based on the microbial growth kinetics.
- Design the sterilization equipment based on the thermal death kinetics.
- Interpret the kinetics of living cells and to develop a strategy to solve the issues emerging during fermentation processes.
- Enhance and modify the biological materials to improve its usefulness by finding the optimal formulation materials to facilitate product production.

161BT52	BIOINFORMATICS	L	T	P	C
AIM		3	0	0	3

This course aims to develop the skills of the students in Bioinformatics. This is a pre-requisite for certain elective courses offered in the subsequent semesters & for project work.

OBJECTIVES

At the end of this course, the students would have learnt about tools used in Bioinformatics & how to use them. This will facilitate the students to undertake projects in the modern biology.

INTRODUCTION 9

Basic UNIX commands–telnet–ftp–protocols–hardware–topology–search engines–search algorithms– Perl programming.

DATABASES 9

Data management – data life cycle – database technology – interfaces and implementation– biological databases and their uses.

PATTERNMATCHING&MACHINELEARNING 9

Pair wise sequence alignment–local vs. global alignment–multiple sequence alignment – dot matrix analysis – substitution matrices – dynamic programming – bayesian Methods–tools–BLAST–FASTA– machinelearning–neuralnetworks–statisticalmethods– HiddenMarkovmodels– Homology Modeling.

PHYLOGENY 9

Introduction; mutations; irrelevant mutations; controls; mutations as a measure of time; distances; reconstruction; distances between species; estimating time intervals from distances

ADVANCEDTOPICSINBIOINFORMATICS 9

Biomolecular and cellular computing–microarray analysis–systems biology.

TOTAL: 45 PERIODS

TEXT BOOKS

1. B. Bergeron, Bioinformatics Computing, PHI, 2002.
2. Westhead, D.R., Parish, J.H., Twyman, R.M., Instant Notes In Bioinformatics, BIOS Scientific Publishers, 2000.

REFERENCES

1. C. Gibas & P. Jambeck, Developing Bioinformatics Skills, O'Reilly, 1999.
2. Arthur K.L., "Introduction to Bioinformatics", Oxford University Press, 4th Edition, 2014

Course Outcomes: Students are

- Able to understand the basic concepts of OS, Linux commands, databases and get familiarity with biological databases.
- Able to perform different types of sequence alignments and various kinds of blast search.
- Able to understand the concepts involved in phylogenetic analysis and structure predictions.
- Able to understand the different machine learning techniques and its applications in biotechnology.
- Able to acquire programming skills in Perl.

161BT53

MASSTRANSFER OPERATIONS

L T P C
3 0 0 3

AIM

To develop skills of the students in Biochemistry with special emphasis on the metabolizing aminoacids, nucleicacids, polysaccharide & lipids and biomembranes. This maybe a pre-requisite for certain-elective courses like Metabolic Engineering; Molecular Modelling & Drug Design etc.

OBJECTIVES

At the end of the course, the student would have gained an extensive knowledge of Biochemistry particular various metabolic pathways & Biomembranes. This knowledge will be useful for project work.

DIFFUSION ANDMASSTRANSFER

9

Molecular diffusion in fluids and solids; Inter phase Mass Transfer; Mass Transfer coefficients; Analogiesin Transport Phenomenon

GASLIQUID OPERATIONS

9

Principles of gas absorption; Single and Multicomponent absorption; Absorption with Chemical Reaction; Design principles of absorbers; Industrial absorbers; HTU, NTU concepts.

VAPOURLIQUID OPERATIONS

9

V-L Equilibria; Simple, Steam and Flash Distillation; Continuous distillation; McCABE-THIELE & PONCHON-SAVARIT Principles; Industrial distillation equipments, HETP, HTU and NTU concepts.

EXTRACTIONOPERATIONS

9

L-L equilibria, Staged and continuous extraction, Solid-liquid equilibria, Leaching Principles.

SOLIDFLUID OPERATIONS

9

Adsorption equilibria– Batch and fixed bed adsorption; Drying-Mechanism-Drying curves-Time of Drying; Batch and continuous dryers.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Treybal R.E. Mass Transfer Operations.3rd edition. McGraw-Hill, 1981.
2. GeankoplisC.J.TransportProcessesandUnitOperations.3rd edition, Prentice Hall of India, 2002.

REFERENCES

1. Coulson and Richardson’s Chemical Engineering. Vol.I & II, Asian Books Pvt. Ltd, 1998.

COURSE OUTCOMES:

- Discuss the fundamental concepts of mass transfer and apply those concepts to solve real engineering problems.
- Construct and analyze the simultaneous phase equilibrium and mass balances in the absorption which is involved in the various process industries.
- Complete design calculations for equilibrium staged separation processes like distillation.
- Learn about the solid-fluid operations like adsorption and drying and the industrial equipments.

161BT54

PLANTBIOTECHNOLOGY

L T P C
3 0 0 3

AIM

To develop the skills of the students in the area of Plant Biotechnology and its application in modern world.

OBJECTIVES

At the end of the course the student would have learnt about the applications of Genetic Engineering in Plant and how to develop Transgenic plants. This will facilitate the student to take up project work in this area.

ORGANIZATION OF GENETIC MATERIAL 9

Genetic material of plant cells–nucleosome structure and its biological significance;

Junk and repeat sequences; outline of transcription and translation.

9

CHLOROPLAST & MITOCHONDRIA

Structure, function and genetic material; rubisco synthesis and assembly, coordination, regulation and transport of proteins. Mitochondria: Genome, cytoplasmic male sterility and import of proteins.

NITROGEN FIXATION 9

Nitrogenase activity, nod genes, nif genes, bacteroids.

UNIT IV AGROBACTERIUM & VIRAL VECTORS 9

Pathogenesis, crown gall disease, genes involved in the pathogenesis, Ti plasmid–t- DNA, importance in genetic engineering. Viral Vectors: Gemini virus, cauliflower mosaic virus, viral vectors and its benefits.

UNIT V APPLICATION OF PLANT BIOTECHNOLOGY 9

Outline of plant tissue culture, transgenic plants, herbicide and pest resistant plants, molecular pharming, therapeutic products.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Gamburg OL, Philips GC, Plant Tissue & Organ Culture fundamental Methods, Narosa Publications. 1995.
2. Singh BD. Text Book of Biotechnology, Kalyani Publishers. 1998

REFERENCES

1. Heldt HW. Plant Biochemistry & Molecular Biology, Oxford University Press. 1997.
2. Ignacimuthu.S, Applied Plant Biotechnology, TataMcGraw-Hill. 1996.

Course Outcomes

- * Familiarize with genetic organization in plants and mitochondrial genome
- * Understand the method of transformation and their implications
- * Develop knowledge on genetic engineering and recombinant technology
- * Know the solution for agriculture plantation and therapeutic products production

161BT55

PROTEINENGINEERING

L T P C
3 0 0 3

AIM

This course aims to deliver students a wide knowledge about structure, basic working, activity of various proteins and their role in the field of biotechnology.

OBJECTIVES

- To study about various structure and behavior of proteins.
- To study the basic building blocks of protein and their bonding nature.
- To study the need & advantage of protein engineering in biotechnology.

AMINOACIDSANDTHEIRCHARACTERISTICS 9

Aminoacids (the students should be thorough with three and single letter codes) and their molecular properties (size, solubility, charge, pKa), Chemical reactivity in relation to post-translational modification (involving amino, carboxyl, hydroxyl, thiol, imidazole groups) and peptide synthesis.

BONDSANDENERGIESINPROTEIN MAKEUP 9

Covalent, Ionic, Hydrogen, Coordinate, hydrophobic and Vander walls interactions in protein structure. Interaction with electromagnetic radiation (radio, micro, infrared, visible, ultraviolet, X-ray) and elucidation of protein structure.

PROTEIN ARCHITECTURE 9

Primary structure: peptide mapping, peptide sequencing-automated Edman method & mass-spec. High-through put protein sequencing setup Secondary structure: Alpha, beta and loop structures and methods to determine Super-secondary structure: Alpha-turn-alpha, beta-turn-beta (hairpin), beta-sheets, alpha-beta, topology diagrams, up and down & TIM barrel structures Tertiary structure: Domains, folding, denaturation and renaturation, Quaternary structure: Modular nature, formation of complexes.

STRUCTURE-FUNCTIONRELATIONSHIP 9

DNA-binding proteins: prokaryotic transcription factors, Helix-turn-Helix motif in DNA binding, Trp repressor, Eucaryotic transcription factors, Zn fingers, helix-turn helix motifs in homeodomain, Leucine zippers, Membrane proteins: General characteristics, Trans- membrane segments, prediction, bacteriorhodopsin and Photosynthetic reaction center, Immunoglobulins: IgG Light chain and heavy chain architecture, abzymes and Enzymes: Serine proteases, understanding catalytic design by engineering trypsin, chymotrypsin and elastase, substrate-assisted catalysis other commercial applications.

PROTEINENGINEERING 9

Advantages and purpose, overview of methods, underlying principles with specific examples: thermal stability T4-lysozyme, recombinant insulin to reduce aggregation and inactivation, *denovo* protein design.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Voet D. and Voet G., "Biochemistry", Third Edn. John Wiley and Sons, 2001
2. Branden C. and ToozeJ., "Introduction to Protein Structured, Second Edition", Garland Publishing, NY, USA, 1999.

REFERENCES

1. Creighton T.E. Proteins, Freeman WH, Second Edition, 1993
2. Moody P.C.E. and Wilkinson A.J. "Protein Engineering", IRL Press, Oxford, UK, 1990.

161BT56

Bioethics and Biosafety in Biotechnology

L T P C

3 0 0 3

Aim:

This course aims to deliver students a wide knowledge about bioethics and its need in biological system.

OBJECTIVES

To study about various ethical analytical systems.

To study the clinical settings in ethics related to biotechnology.

To study the need of bioethics practice

Overview of Ethics in Biotechnology

9

Brief history and origin of bioethics, philosophical reflections on experimenting with human subjects, advantageous and disadvantages of biotechnology in developing countries and case studies.

Intellectual Property Rights

9

Implications of IPRs and Agricultural Technology, role of WTO, General Agreement on Tariffs and Trade (GATT), Patenting and the procedures involved in the application for granting of a patent. Bioethics in biodiversity, Ethics of Resource Management, Impact of GM Crops and GM Foods.

Human Genome Project

9

The human genome project diversity, strategies and ethical issues. Foetal sex determination and abortion, ethical issues related to genomic studies

Stem Cell Research

9

Application and ethics involved in stem cells research, animal cloning and animal experiments, ethics in human cloning, Psychological aspect of infertility and ethics of invitro fertilization.

Organs Transplantation in Human Beings and Medical care

9

Ethics in Xenotransplantation and Transgenesis, medical ethics, CCAC Guidelines on Transgenic Animals and animal welfare, the need of ethical review.

TEXT BOOKS

1. Sree Krishna V. Bioethics and Biosafety in Biotechnology, The New Age International P.Ltd. Publishers, 2007.

REFERENCE

2. Nancy S. Jecker, Albert R. Jonsen, Robert A, Bioethics, second edition, Pearlman.

161BT57

MOLECULAR BIOLOGY LABORATORY

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P

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4

2

LIST OF EXPERIMENTS

1. Isolation of bacterial DNA
2. Isolation of plant cell genomic DNA
3. Isolation of animal cell genomic DNA
4. DNA Extraction from Bovine spleen
5. Evaluation of isolated plasmid by agarose gel electrophoresis
6. Restriction enzyme digestion
7. Competent cells preparation and Blue and white selection for recombinants
8. Plating of λ phage
9. O phage lysis of liquid cultures
10. SDS PAGE

TOTAL : 45 Periods

Reference:

Denny R. Randall, Molecular Biology Laboratory Manual, MERLOT Publication, 2016

Course Outcomes

* Students would have learnt basic techniques used in Molecular Biology and its application. Techniques learnt would help students to undertake research projects in the area of modern biology.

* Students understand the ethical and biosafety issues and consequences while performing experiments.

161BT58

BIOINFORMATICS LABORATORY

L	T	P	C
0	0	3	2

AIM

To develop the skills of the students in the area of bioinformatics by using various tools and softwares

OBJECTIVE

- To know the basics of UNIX commands
- To know the basics of PEARL programming
- To know the handling of various bioinformation tools and softwares.

LIST OF EXPERIMENTS

1. Introduction to UNIX basic commands and UNIX Filters.

2. Perl programming and applications to Bioinformatics.

1. Basic scripting.
2. Regular expressions.
3. File i/o & control statement.
4. Subroutines & functions.
5. Writing scripts for automation.

1. Types of Biological Databases and Using it.

1. Genbank.
2. Protein Data Bank.
3. Uniprot.

4. Sequence Analysis Tools

1. Use of BLAST, FASTA (Nucleic Acids & Proteins).
2. Use of ClustalW.
3. Use of EMBOSS.

5. Phylogenetic Analysis

1. Use of Phyllip.

6. Molecular Modeling

1. Homology Modeling–Swiss modeller.
2. Any Open Source Software.

TOTAL : 45 Period

Reference

Arthur K.L., “Introduction to Bioinformatics”, Oxford University Press, 4th Edition, 2014

Course Outcomes

- * Able to understand the basic concepts of OS, databases and get familiarity with biological databases.
- * Able to perform different types of sequence alignments and various kinds of blast search.
- * Able to perform phylogenetic analysis and structure predictions.
- * Able to sign in different machine learning techniques and its applications in biotechnology.

161BT61

CHEMICAL REACTION ENGINEERING

L T P C
3 1 0 4

AIM

This course aims to develop the skills of the students in the area of chemical reaction engineering. This is a pre-requisite for courses offer in Bioprocess Technology and for designing a reactor.

OBJECTIVES

At the end of the course, the student would have learnt chemical kinetics, various types of reactors, and how they function. This will help the student to take up PG courses in Bioprocess, Biochemical Engineering and also the project work.

SCOPE OF CHEMICAL KINETICS & CHEMICAL REACTION ENGINEERING 12

Broad outline of chemical reactors; rate equations; concentration and temperature dependence; development of rate equations for different homogeneous reactions. Industrial scale reactors.

IDEAL REACTORS 12

Isothermal batch, flow, semi-batch reactors; performance equations for single reactors; Multiple reactor systems; multiple reactions.

IDEAL FLOW AND NON IDEALFLOW 12

RTD in non-ideal flow; non-ideal flow models; reactor performance with non-ideal flow.

GAS-SOLID, GAS-LIQUID REACTIONS 12

Resistances and rate equations; heterogeneous catalysis; reactions steps; resistances and rate equations.

FIXED BED AND FLUID BED REACTORS 12

G/l reactions on solid catalysis; trickle bed, slurry reactors; three phase-fluidized beds; Reactors for fluid- fluid reactions; tank reactors.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Levenspiel O. "Chemical Reaction Engineering", 3rd Edition. JohnWiley.1999
2. Fogler H.S. "Elements of Chemical Reaction Engineering", Prentice Hall India.2002

REFERENCE

1. Missen R.W., Mims C.A., Saville B.A. "Introduction To Chemical Reaction Engineering And Kinetics", JohnWiley.1999.

161BT62

IMMUNOLOGY

L T P C
3 0 0 3

AIM

This course aims to develop the skills of the students in Immunotechnology, Proteomics and genomics etc.

OBJECTIVES

At the end of the course students would have learnt about the mechanisms by which a human body interacts with a pathogenic microbe & how it eliminates it. Students, also familiarize themselves with the pathogenesis of diseases like AIDS, Cancer, TB etc.

INTRODUCTION 9

Cells of immune system; innate and acquired immunity; primary and secondary lymphoid organs; antigens: chemical and molecular nature; haptens; adjuvants; types of immune responses; theory of clonal selection.

CELLULARRESPONSES 9

Development, maturation, activation and differentiation of T-cells and B-cells; TCR; antibodies: structure and functions; antibodies: genes and generation of diversity; antigen-antibody reactions; monoclonal antibodies: principles and applications; antigen presenting cells; major histocompatibility complex; antigen processing and presentation; regulation of T-cell and B-cell responses.

INFECTION AND IMMUNITY 9

Injury and inflammation; immune responses to infections: immunity to viruses, bacteria, fungi and parasites; cytokines; complement; immunosuppression, tolerance; Hypersensitivity; AIDS and Immuno deficiencies; resistance and immunisation; Vaccines.

TRANSPLANTATION AND TUMOR IMMUNOLOGY 9

Transplantation: genetics of transplantation; laws of transplantation, Mechanism and clinical manifestation of Graft rejection, Tumor immunology.

AUTOIMMUNITY 9

Autoimmunity, Organ specific and Systemic autoimmune Disorders, Diagnosis and Treatment.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Roitt I, Male, Brostoff, Immunology, Mosby Publ., 2002.
2. Kubly J, Immunology, WH Freeman & Co., 2000.

REFERENCE

1. Ashim K. Chakravarthy, Immunology, Tata McGraw-Hill, 1998.

Course Outcomes

After completion of this course students

- * Able to understand the various types of cells and organs involved in immune system.
- * Able to illustrate the pathways involved in cell mediated and humoral immune responses.
- * Able to apply the concepts of immunology in vaccine development and treatment of infectious diseases.
- * Able to understand basic concepts in transplantation and tumour immunology.
- * Able to analyze the reason behind the development of various autoimmune disorders and its treatment.

161BT63

GENETIC ENGINEERING

**L T P C
3 0 0 3**

AIM

This course aims to develop the skills of the students in Immunotechnology, Proteomics and genomics etc.

OBJECTIVES

At the end of the course students would have learnt about the mechanisms by which a human body interacts with a pathogenic microbe & how it eliminates it. Students, also familiarize themselves with the pathogenesis of diseases like AIDS, Cancer, TB etc.

BASICS OF RECOMBINANT DNA TECHNOLOGY 9

Role of genes within cells, genetic elements that control gene expression, restriction and modifying enzymes, safety guidelines of recombinant DNA research.

CREATION OF RECOMBINANT MOLECULES 9

Restriction mapping, linkers and adaptors. Characteristics of plasmid and phage vectors, Types – pBR322, selectable markers, cosmids, Phagemids, Artificial chromosomes - BAC, PAC.

CONSTRUCTION OF LIBRARIES 9

Construction of cDNA and genomic libraries. Blotting Techniques: Southern, Northern and Western

POLYMERASE CHAIN REACTION 9

PCR: Basic principle, Applications, Types- Nested PCR, Inverse PCR, RACE PCR. Molecular beacons, RFLP, RAPD and Site directed mutagenesis. Nucleic acid sequencing: Sanger's method of DNA sequencing.

APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY 9

Genetic Transformation in plants, Ti plasmid and *Agrobacterium* mediated transformation, transgenic and knockout animals.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Primrose SB and R. Twyman "Principles of Gene Manipulation & Genomics Blackwell

Science Publications, 2006.

REFERENCE

1. Berger SI, Kimmer AR, "Methods In Enzymology", Vol. 152, Academic Press, 1987.
2. Ansabel FM, Brent R, Kingston RE, Moore DD, "Current Protocols In Molecular Biology", Greene Publishing Associates, NY, 1988.

Course Outcomes:

Students would understand

- how to clone a gene of interest, what are the parameters to be considered while designing a cloning strategy.
- the variety of screening techniques to characterize the clones.
- the importance of PCR in cloning, diagnosis and mutant generation including the development of high value products.
- the significance and power of recombinant DNA technology within the constraints of environmental and ethical consequence of practicing Genetic engineering.
- how to exploit the benefits of transgenic for societal applications.

161HS61

ENGINEERING ECONOMICS AND MANAGEMENT

L- T- P C

3- 0- 0 3

FUNDAMENTALS OF ECONOMICS

9

Concept and scope of engineering economics - basic concepts of goods, utility, value and wealth - relation between economic decision and technical decision - Law of demand & supply – factors influencing demand - elasticity of demand – demand forecasting - Basic economic problems - causes, types and measures to control Poverty, Un employment and Inflation.

THEORY OF PRODUCTION

9

Theory of production; production function, meaning, factors of production (meaning & characteristics of Land, Labour, capital & entrepreneur) - Law of variable proportions & law of returns to scale - Introduction to Human Resource Management; definitions, objectives of manpower planning, process, sources of recruitment, process of selection - Corporate Social Responsibility; meaning, importance - Business Ethics; meaning, importance.

FUNCTIONS OF MANAGEMENT

9

Introduction to Management & administration, skill, types and roles of managers – Management Principles; Scientific principles, Administrative principles, Maslow's Hierarchy of needs theory – Functions of Management – Planning, Organizing, Staffing, Directing, Controlling – Organizational Structures; meaning, principles of organization, types (explanation with merits and demerits), span of control, departmentalization.

DEPRECIATION AND REPLACEMENT ANALYSIS

9

Depreciation – various methods of depreciations – inflation adjusted decisions – procedure to adjust inflation – Types of maintenance – types of replacement problem - determination of economic life of an asset – replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender.

COST ANALYSIS

9

Types of costing – traditional costing approach – activity base costing – cost output relationship in the short run and in long run – types of pricing and its practice – appraising project profitability – internal rate of return – payback period – net present value – cost benefit analysis – feasibility reports- break even analysis - managerial uses of break even analysis.

TOTAL PERIODS: 45

TEXTBOOK(S)

1. Dewett K.K. & Varma J.D., "Elementary Economic Theory", S Chand & Co., 2006.
2. Suma Damodaran, "Managerial economics", Oxford University press 2006.

REFERENCE BOOK(S)

1. Sharma, K.K., "Principle of Economics", Abishek publications, 2002.
2. Panneer Selvam, R., "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.

Course Outcomes:

At end of this course, the students will be able to

- 1: Explain about the fundamentals of economic concepts.
- 2: Describe the concept of theory of production and Human resource management.
- 3: Demonstrate the Management Principles, functions of management & organizational structures.
- CO4: Adjust inflation and solve different types of replacement problems.
- 5: Prepare internal rate of return, payback period, net present value and cost benefit analysis.
- 6: Prepare feasibility reports and break even analysis.

161BT67

GENETIC ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

LIST OF EXPERIMENTS

1. Preparation of plasmid DNA.
2. Elution of DNA from agarose gels.
3. Ligation of DNA into expression vectors.
4. Transformation.
5. Optimisation of inducer concentration for recombinant protein expression.
6. Optimisation of time of inducer for recombinant protein expression.
7. SDS-PAGE, 2DGel, ISO-electric Focussing.
8. Western blotting.
9. Hybridisation with anti-sera.
10. PCR.

TOTAL : 45 Periods

Reference:

Frederick M.A., Roger B., Robert E. K., David D. M., Seidman J.G., John A.S., Kevin S., "Short protocols in molecular biology- Volume I & II", Wiley & sons, 1st Edition, 2002

Course Outcomes

- * Students would have learnt about cloning of genes, how to express them for protein production.
- * Students understand the power of genetic engineering tools to produce products beneficial in agriculture and healthcare
- * Students understand the ethical and biosafety issues and consequences while performing experiments in the laboratory.

161BT68

IMMUNOLOGY LABORATORY

L	T	P	C
0	0	4	2

LIST OF EXPERIMENTS

1. Handling of animals, immunization and raising antisera
2. Identification of cells in a blood smear
3. Identification of blood group
4. Immunodiffusion
5. immunoelectrophoresis

6. Testing for typhoid antigens by Widal test
7. Enzyme Linked Immunosorbent Assay (ELISA)
8. Isolation of peripheral blood mononuclear cells
9. Isolation of monocytes from blood
10. Immunofluorescence

TOTAL : 45 Periods

Reference:

Roitt I., Brostoff M., "Immunology", Mosby Publication, 5th Edition, 2002

Course Outcomes

- * Able to handle animals for immunological experiments.
- * Able to design and perform diagnostics tests like identification of blood cells, ELISA and Electrophoresis.
- * Able to determine the toxicity of the natural and commercially available drugs.

161BT71

BIOPROCESS ENGINEERING

L	T	P	C
3	1	0	4

AIM

This course aims to develop the skills of the students in the area of Bioprocess Engineering. This will be a pre-requisite for a few elective courses and for project in Bioprocess Technology.

OBJECTIVES

- To study about the modeling strategies in bioprocess engineering.
- To study the reactor scaleup process principles.
- To study the various modeling and stimulation principles.

ANALYSIS OF STR

12

Stirred tank reactor - non-ideality, RTD and stability analysis, tanks in series and dispersion models – application to design of continuous sterilizer.

ANALYSIS OF OTHER CONFIGURATIONS

12

Packed bed reactor, airlift reactor, fluidized bed reactor bubble column reactors – non-ideality, RTD and stability analysis.

BIOREACTOR SCALE-UP

12

Regime analysis of bioreactor processes, oxygen mass transfer in bioreactors – microbial oxygen demands; methods for the determination of mass transfer coefficients; mass transfer correlations. Scale up criteria for bioreactors based on oxygen transfer, power consumption and impeller tip speed.

MODELLING AND SIMULATION OF BIOPROCESSES

12

Study of structured models for analysis of various bioprocess – compartmental models, models of cellular energetics and metabolism, single cell models, plasmid replication and plasmid stability model. Dynamic simulation of batch, fed batch, steady and transient culture metabolism.

BIOREACTOR CONSIDERATION IN ENZYME SYSTEMS

12

Analysis of film and pore diffusion effects on kinetics of immobilized enzyme reactions; formulation of dimensionless groups and calculation of effectiveness factors. Design of immobilized enzyme reactors – packed bed, fluidized bed and membrane reactors.

TOTAL: 60 PERIODS

TEXT BOOKS

1. Shuler and Kargi, Bioprocess Engineering, Prentice Hall, 2001.
2. Pauline D., "Bioprocess Engineering Principles", Elsevier, 2nd Edition, 2012.

REFERENCES

1. Blanch H. W., Clark S. D., "Biochemical Engineering", Taylor & Francis, 2nd Edition, 1997
2. EMT.EL-Mansi. CFA. Bryce, A.L. Demain, AR. Allman: Fermentation Microbiology and Biotechnology, Second Edition 2007.
3. Bailey, J.E., Ollis, D.F., "Biochemical Engineering Fundamentals", McGraw Hill, 2nd Edition, 2010.

Course Outcomes:

- * Able to understand reactor design and mode of operation and required modifications to meet production target.
- * Able to scale up the reactors based on power, oxygen transfer and mixing time.
- * Understand the influence of mass transfer resistances in immobilized enzymes and appreciate their significance in design of immobilized enzymes based reactors
- * Acquire knowledge about the modeling and simulation concepts in bioprocessing
- * Able to understand about different cultivation systems for recombinant cells.

161BT72**DOWNSTREAM PROCESSING**

L	T	P	C
3	0	0	3

AIM

Aims to explore students in the field of downstream processing and its application in product recovery.

OBJECTIVES

- To study about the need of various downstream processing with its principle.
- To study the use of various higrade equipment in product separation and product polishing
- To study the various product isolation techniques.

DOWNSTREAM PROCESSING	9
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Introduction to down stream processing principles characteristics of biomolecules and bioprocesses. Cell disruption for product release–mechanical, enzymatic and chemical methods. Pretreatment and stabilization of bio products.

PHYSICAL METHODS OF SEPERATION	9
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Unit operations for solid-liquid separation-filtration and centrifugation

ISOLATION OF PRODUCTS	9
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Adsorption, liquid-liquid extraction, aqueous two-phase extraction, membrane separation
– Ultrafiltration and reverse osmosis, dialysis, precipitation of proteins by different methods.

PRODUCT PURIFICATION	9
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Chromatography–principles, instruments and practice, adsorption, reverse phase, ion- exchange, size exclusion, hydrophobic interaction, bioaffinity and pseudo affinity chromatographic techniques.

FINALPRODUCTFORMULATION ANDFINISHINGOPERATIONS	9
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Crystallization, drying and lyophilization in final product formulation.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. P.A. Belter, E.L. Cussler and Wei-Houhu – Bioseparations – Down stream Processing For Biotechnology, Wiley Interscience Pub.(1988).
2. R.O.Jenkins, (Ed.)–Product Recovery In Bioprocess Technology–Biotechnology By Open Learning Series, Butterworth-Heinemann (1992).

REFERENCES

1. J.C.Janson And L.Ryden,(Ed.)– Protein Purification– Principles, High Resolution Methods And Applications, VCH Pub.1989.
2. R.K.Scopes –Protein Purification–Principles And Practice, Narosa Pub.(1994).
3. Roger.G. Harrison, Paul Todd, Scott R. Rudge and Demetri P. Petrides,
4. Bioseperation Science and Engineering, Oxford University Press, Newyork, 2003.

Course Outcomes:

- Able to choose the list of bioseparations considering the physicochemical and biochemical properties of biological products
- Able to design strategy for isolation and purification of intracellular bioproducts
- Able to understand the chemical basis of various isolation methods considering the

biomolecule characteristics and stability.

- Able to design strategy for purification of bioproducts for process industries considering the process economics
- Able to appreciate quality control and quality assurance involved in production and marketing of bioproducts considering their end applications.

161BT73

GENOMICS AND PROTEOMICS

L T P C
3 0 0 3

This course aims to develop the skills of the students in Proteomics and Genomics. This is a prerequisite for certain elective courses offered in the subsequent semesters & for project work.

OBJECTIVES

At the end of this course, the students would have learnt about tools used in Proteomics and Genomics & how to use them. This will facilitate the students to undertake projects in the modern biology.

INTRODUCTION 9

Overview of Genomes of Bacteria, Archae and Eukaryota.

PHYSICAL MAPPING TECHNIQUES 9

Top down and bottom up approach; linking and jumping of clones; genome sequencing; placing small fragments on map: STS assembly; gap closure; pooling strategies; cytogenetic mapping techniques

FUNCTIONAL GENOMICS 9

Gene finding; annotation ; ORF and functional predication; Subtractive DNA library screening; differential display and representational difference analysis; SAGE; TOG

UNIT IV PROTEOMICS TECHNIQUES 9

Protein level estimation; Edman protein micro sequencing; protein cleavage; 2 D gel electrophoresis; metabolic labeling; detection of proteins on SDS gels; pattern analysis;
Mass spectrometry – principles of MALDI-TOF; tandem MS-MS; Peptide mass fingerprinting.

UNIT V STRUCTURE FUNCTION RELATIONSHIP OF PROTEINS 9

Post translation modification; protein –protein interactions; glycoprotein analysis; phosphor protein analysis, NMR and Crystallography of protein of elucidate protein structure, protein structure by modally.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Cantor, C.R and Smith, C.L “Geneomics”, John Wiley & Sons, 1999.
2. Pennington, S.R. and Dunn, M.J.”Proteomics: from Protein Sequence to Function”, viva books publishers, 2002.

REFERENCES

3. Liebler, D.L. “ Introduction to Proteomics : Tools for the new Biology”, Humana press, 2002.
4. Hunt , S.P. and Livesey, F.L. “ functional genomics “, oxford university Press ,2000.

161BT74

NANOBIOTECHNOLOGY

L T P C
3 0 0 3

AIM

To develop the skills of the students in the area of Nano biotechnology and its applications.

OBJECTIVES

At the end of the course, the student would have learnt about nanotechnology and its important in Biotechnology.

Basics of Nanobiology and Self –Assembly Systems 9

Introduction to nanobiology, nanobiotechnology, molecular nanotechnology; Benefits of molecular nanotechnology; Nanodendrimers; Buckyball and nanotube; Self assembly of biomolecules - Van der Waal forces, hydrogen bonding, models, synthesis and measurement; Molecular assembly and applications.

Structure of biological macro molecule 9

Principles of protein structure; Principles of DNA structure; Sequence/Structure relationships of DNA; Structural motifs; Introduction to in-silico prediction of 3D-structure and structure/function relationships, examples

Patterning of biomolecules and other biological substances 9

Necessity of patterning of biomolecules and other biological substances on surfaces; Chemical/physical binding of biomolecules on surfaces. Patterning methods-microspotting, mechanical methods, dip-pen lithography, microcontact printing methods (soft lithography related methods); Other emerging methodologies; Potential applications and comparison of patterning methods.

Microscopy for Nano science 9

Basic principles and applications of Scanning probe microscopy (SPM), Scanning tunneling microscopy, Atomic force microscopy (AFM), Scanning optical probe microscopy (SOPM), Confocal FRET, SEM, TEM in nanotechnology.

Applications of Nanobiotechnology 9

Application of nanobiotechnology in Medicine - pharmaceutical applications, Drug delivery, tissue repair and implantation; Environment, Agriculture; Molecular electronics; Nano-Bio Devices & Systems.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Pradeep .T., “NANO: The Essentials Understanding Nanoscience and Nanotechnology”, McGraw – Hill Education (India) Ltd, 2007

REFERENCE

2.Ratner,M. Ratener, D. “Nanotechnology A Gentle Introduction to the Next Big Idea”, Prentice Hall, 2003

161BT77

BIOPROCESS ENGINEERING LABORATORY

L	T	P	C
0	0	4	2

LIST OF EXPERIMENTS

1. Thermal death kinetics
2. Batch sterilization design
3. Batchcultivation,estimationofk_{la}–dynamicgassingmethod,exhaustgasanalysis
–carbon balancing, gas balancing
4. Batch and Fed batch cultivation ,exhaust gas analysis–carbon balancing, gas balancing
5. Total cell retention cultivation, exhaust gas analysis – carbon balancing, gas balancing
6. Estimation of k_{la}–sulphite oxidation method
7. Estimation of k_{la}–power correlation method
8. Residence time distribution
9. Estimation of overall heat transfer coefficient
10. Continuous cultivation–x–diagram, pulse and shift method, evaluation of kinetic parameters, exhaust gas analysis–carbon balancing, gas balancing.
11. Enzyme kinetics– Micheles Menton parameters.
12. Enzyme immobilization–gel entrapment & cross linking methods.

TOTAL : 45 Periods

Reference:

Stanbury, P.F., Stephen J.H., Whitaker A., “Principles of Fermentation Technology”, Elsevier, 2nd Edt., 2009

Course Outcomes

- * Ability to understand the mechanism and kinetics of the enzyme reaction.
- * Ability to medium formulation and optimization for their role in economy of the process.
- * Able to study the growth kinetics of bacteria

161BT78

DOWNSTREAM PROCESSING LABORATORY

L T P C
0 0 4 2

LIST OF EXPERIMENTS

1. Solid liquid separation—centrifugation, microfiltration
2. Cell disruption techniques—ultra sonication, French pressure cell
3. Cell disruption techniques—Enzyme and chemical method
4. Precipitation—ammonium sulphite precipitation
5. Ultrafiltration separation
6. Aqueous two phase extraction of biologicals
7. High resolution purification—affinity chromatography
8. High resolution purification—ion exchange chromatography
9. Product polishing—gel filtration chromatography
10. Product polishing spray drying freeze drying.

TOTAL : 45 Periods

Reference:

Belter P.A., Cussler E.L., Houhu W., “Bioseparations: Downstream Processing for Biotechnology”, Wiley Interscience Publications., 1st edition, 2011.

Course Outcomes

- * Able to apply the lab scale techniques in large scale operations considering complexity involved in scale up
- * To design and carry out experiments while taking into account product stability, biosafety, accuracy of results and time duration
- * Able to appreciate the complexity of products of biological origin and design strategy accordingly to purify them.

Core Elective

161BTE01

BIOPHYSICS

L T P C
3 0 0 3

AIM

To familiarize with the conjugational study between physics and biology in its structural and working principle.

OBJECTIVES

- To study about the various molecular structural of biomolecule.
- To study the potent cellular transport mechanisms with its working molecular principle.
- To study the energetic and dynamics of biological systems.

UNIT I

MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEMS

9

Intramolecular bonds—covalent—ionic and hydrogen bonds—biological structures- genera features—water structure—hydration—interfacial phenomena and membranes— self assembly and molecular structure of membranes.

UNIT II

CONFORMATION OF NUCLEICACIDS

9

Primary structure—the bases—sugars and the phosphodiester bonds-double helical structure—the a, b and z forms—properties of circular DNA—topology—polymorphism and flexibility of DNA structure of ribonucleicacids— hydration of nucleicacids.

UNIT III	CONFORMATION OF PROTEINS	9
Conformation of the peptide bond–secondary structures–ramachandran plots–use of potential functions–tertiary structure–folding–hydration of proteins–hydropathy index.		
UNIT IV	CELLULAR PERMEABILITY AND ION– TRANSPORT	9
Ionic conductivity–transport across ion channels–mechanism-ion pumps-proton transfer –nerve conduction–techniques of studying ion transport and models.		
UNIT V	ENERGETICS & DYNAMICS OF BIOLOGICAL SYSTEMS	9
Concepts in thermodynamics–force and motion–entropy and stability–analyzes of luxes– diffusion potential–basic properties of fluids and biomaterials–laminar and turbulent.		

TOTAL: 45 PERIODS

TEXT BOOKS

1. Biophysics; R.Glaser, Springer Verlag, 2000.
2. Biophysics: Molecules In Motion; R.Duane. Academic Press, 1999.

REFERENCES

1. Voet and voet, biochemistry, 2ndedition, John Wiley and Sons Inc., 1995.
2. Lehninger’s Principles of biochemistry David L. Nelson and Micheal Mcox, Macmillon worth publications, 4thedition 2007.

161BTE02	BIOLOGICAL SPECTROSCOPY	L	T	P	C
		3	0	0	3

AIM

To develop the skills of the students in the area of Biological spectroscopy with a clear knowledge in High grade optical instruments to view and characterize biological molecules.

OBJECTIVES

- To study about the various instruments with its working principle for biological molecules imaging.
- To study the application of these equipments in biotechnology in molecules imaging, tracing biomolecules, etc.

UNIT I	OPTICALROTATORY DISPERSION	9
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Polarized light–optical rotation–circular dichroism–circular dichroismof nucleic acids and proteins.

UNIT II	NUCLEARMAGNETICRESONANCE	9
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Chemical shifts–spin–spin coupling– relaxation mechanisms–nuclear over hauser effect–multi dimensional NMR spectroscopy–determination of macromolecular structure by NMR–magnetic resonance imaging.

UNIT III	MASS SPECTROMETRY	9
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Ion sources sample introduction– mass analyzers and ion detectors– bio molecule mass spectrometry–peptide and protein analysis–carbohydrates and small molecules– specific applications.

UNIT IV	X-RAY DIFFRACTION	9
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Scattering by x-rays–diffraction by a crystal–measuring diffraction pattern–bragg reflection–unit cell–phase problem–anomalous diffraction–determination of crystal structure–electron and neutron diffraction

UNIT V	SPECIALTOPICSANDAPPLICATIONS	9
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Electron microscopy – transmission and scanning electron microscopy – scanning tunneling and atomic for cemicroscopy–combinatorial chemistry and high throughput screening methods.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Hammes, G. G., “Spectroscopy for the Biological Sciences”, Wiley-Blackwell, 1st Edition, 2005.
2. Atkins P.W. “Physical Chemistry”, Oxford IV Edition, 1990.

REFERENCES

1. Lawrence B., Jacques R., “In Vivo Spectroscopy (Biological Magnetic Resonance)”, Springer, 1st Edition, reprint, 2013.
2. Nicolau B., “Carbon-13 NMR Spectroscopy of Biological Systems”, Academic Press, 1st Edition, 2005

161BTE03

DEVELOPMENTAL BIOLOGY

L T P C

3 1 0 3

AIM: This course aims to develop the skills of the students in the area of developmental biology. This is a pre-requisite for courses offered in Biotechnology.

Course Objectives:

- To study the principles of developmental biology
- To study the mechanism of early embryonic development.
- To learn about basic embryology and to understand the molecular and cellular mechanisms of development

Course Outcomes:

1. Understand the basic concepts of developmental biology
2. Develop major ideas in cell formation and developmental biology
3. Acquire an idea about fertilization and cleavage process
4. Understand the process and consequence of gastrulation and organogenesis
5. Understand basic concepts of growth, regeneration and metamorphosis
6. Acquire the concepts of gene expression and regulation during early development
7. Knowledge about different types of placenta and *in vitro* fertilization

BASIC CONCEPTS IN DEVELOPMENTAL BIOLOGY

10hrs

Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients. Spermatogenesis and Oogenesis in amphibians.

FERTILIZATION AND ZYGOTE FORMATION

8hrs

Fertilization: Activation of sperm and egg—Sequence of events in sperm entry and Egg surface changes. Zygote formation, cleavage and its types. Double fertilization in plants.

BLASTULATION AND GASTRULATION

10 hrs

Stages of embryo: blastula formation, embryonic fields, gastrulation and formation of germ layers and their fates in amphibians. Neurulation.

METAMORPHOSIS & REGENERATION

9 hrs

Metamorphosis in amphibia, insects and their hormonal regulation—thyroid hormones, ecdysone & juvenile hormone. Homeotic genes. Regeneration – Types, Mechanism of regeneration in amphibia.

PLACENTATION & TERATOGENESIS

8 hrs

Placenta: Classification and functions, *in-vitro* fertilization –test tube babies. Causes for infertility. Teratogenesis: Genetic and Environmental factors.

TEXT BOOKS

1. Developmental Biology by Scott Gilbert -11th edition, Sinauer Associates, 2016.
2. Balinsky –An introduction to embryology CBS college Publishers, 2005

REFERENCES

1. Developmental Biology by Scott Gilbert -10th edition, Sinauer Associates, 2013

161BTE04

BIOPHARMACEUTICAL TECHNOLOGY

L T P C

3 0 0 3

AIM

To familiarize with the biopharmaceutical technology, drug designing, drug formulation, pharmacokinetics and pharmacodynamics. To understand the application of biopharmaceutical technology in living systems.

OBJECTIVES

- To study about the drug formulation, designing and action on living system.
- To study the active ingredients like incipient and excipients.
- To study the application of biopharmaceuticals in industries.

INTRODUCTION	9
Pharmaceutical industry & development of drugs; types of therapeutic agents and their uses; economics and regulatory aspects.	
DRUG ACTION, METABOLISM AND PHARMACOKINETICS	9
Mechanism of drug action; physico-chemical principles of drug metabolism; radioactivity; Pharmacokinetics.	
MANUFACTURE OF DRUGS, PROCESS AND APPLICATIONS	9
Types of reaction process and special requirements for bulk drug manufacture.	
PRINCIPLES OF DRUG MANUFACTURE	9
Compressed tablets; dry and wet granulation; slugging or direct compression; tablet presses; coating of tablets; capsule preparation; oval liquids—vegetable drugs—topical applications; preservation of drugs; analytical methods and other tests used in drug manufacture; packing techniques; quality management; gmp.	
BIOPHARMACEUTICALS	9
Various categories of therapeutics like vitamins, laxatives, analgesics, contraceptives, antibiotics, hormones and biological.	
TOTAL: 45 PERIODS	

TEXT BOOKS

1. Gareth Thomas. Medicinal Chemistry. An introduction. John Wiley. 2000.
2. Katzung B.G. Basic and Clinical Pharmacology, Prentice Hall of Intl. 1995.

REFERENCES

1. Michael E.A., "Pharmaceutics, Design and manufacture of Medicines", Churchill Livingstone, 4th Edition, 2008.

161BTE05	PRINCIPLES OF FOOD PROCESSING	L T P C
		3 0 0 3

AIM

To develop the skills of the students in the area of need of Food Process Technology and its applications.

OBJECTIVES

- To study about the various components potent role in food processing.
- To study the various food additives used to enhance food quality.
- To study the various process involved in food processing and preservation.

FOOD AND ENERGY **9**

Constituents of food—carbohydrates, lipids, proteins, water, vitamins and minerals, dietary sources, role and functional properties in food, contribution to organoleptic and textural characteristics.

FOOD ADDITIVES **9**

Classification, intentional and non-intentional additives, functional role in food processing and preservation; food colourants—natural and artificial; food flavours; enzymes as food processing aids.

MICROORGANISMS ASSOCIATED WITH FOOD **9**

Bacteria, yeasts and molds – sources, types and species of importance in food processing and preservation; fermented foods and food chemicals, single cell protein.

FOOD BORNE DISEASES **9**

Classification – food infections – bacterial and other types; food intoxications and poisonings – bacterial and non-bacterial; food spoilage—factors responsible for Spoilage, spoilage of vegetable, fruit, meat, poultry, beverage and other food products.

FOOD PRESERVATION

9

Principles involved in the use of sterilization, pasteurization and blanching, thermal death curves of microorganisms, canning; frozen storage-freezing characteristics of foods, microbial activity at low temperatures, factors affecting quality of foods in frozen storage; irradiation preservation of foods.

TOTAL: 45 PERIODS

TEXT BOOKS

1. T.P.Coultate–Food–The Chemistry of Its Components, 2ndEdn. Royal Society, London, 1992.
2. B.Sivasanker–Food Processing and Preservation, Prentice Hall of India Pvt. Ltd. NewDelhi 2002.

REFERENCES

1. W.C.Frazier and D.C. Westhoff–Food Microbiology, 4thEd., McGraw-HillBook Co., NewYork1988.
2. J.M.Jay–Modern Food Microbiology, CBS Pub. New Delhi, 1987.

161BTE06

MARINE BIOTECHNOLOGY

L T P C
3 0 0 3

AIM

To study the field of biotechnology in marine environment and its potent application in pharmacology, aqua culture etc.

OBJECTIVES

- To explore the marine environment and its wide spread resource.
- To study the application in the field of pharmacology.
- To know about the of aquaculture design, resource, culture conditions etc.

INTRODUCTION TO MARINE ENVIRONMENT

9

World ocean sans seas–ocean currents–physical and chemical properties of sea water–abiotic and biotic factors of the sea–ecological divisions of the sea–history of marine biology–biochemical cycles–food chain and food web.

UNIT II IMPORTANT MARINE ORGANISMS

9

Phytoplankton's–zooplanktons–nektons–benthos–marinemammals–marinealgae–mangroves–coralreefs–deep sea animals and adaptation–intertidal zone–fauna and flora.

UNIT III MARINE ENVIRONMENTAL BIOTECHNOLOGY

9

Marine pollution – biology indicators (marine micro, algae) – biodegradation &bioremediation–marine fouling and corrosion.

UNIT IV MARINEPHARMACOLOGY

9

Medicinal compound from marine flora and fauna – marine toxins, antiviral and antimicrobial agents.

UNIT V AQUACULTURE TECHNOLOGY

9

Important of coastal aquaculture–marine fishery resources–common fishing crafts and gears–aqua farm design and construction.

TOTAL: 45 PERIODS

TEXT BOOKS

1. M.Fingerman , R .Nagabhusanam, Recent advances in marine biotechnology volume 3, Mary–Frances Thomson.
2. Se-kwon Kim and J Venkatesan, Hand Book of Marine Biotechnology, Springer, 2015

REFERENCES

1. Le Gal, Yves, Ulber, Roland, Marine Biotechnology, Springer, 2005

161BTE07	ANIMAL BIOTECHNOLOGY	L	T	P	C
AIM		3	0	0	3

To develop the skills of the students in the area of animal biotechnology and its applications.

OBJECTIVES

At the end of the course, the student would have learnt about animal cell culture, molecular diagnostic of animal diseases and Transgenic animal production. This will facilitate the student to undertake project work in this area.

UNIT I ANIMAL CELL CULTURE 9

Introduction to basic tissue culture techniques; chemically defined and serum free media; animal cell cultures, their maintenance and preservation; various types of cultures- suspension cultures, continuous flow cultures, immobilized cultures; somatic cell fusion; cell cultures as a source of valuable products; organ cultures.

UNIT II ANIMAL DISEASES AND THEIR DIAGNOSIS 9

Bacterial and viral diseases in animals; monoclonal antibodies and their use in diagnosis; molecular diagnostic techniques like PCR, *in-situ* hybridization; northern and southern blotting; RFLP.

UNIT III THERAPY OF ANIMAL DISEASES 9

Recombinant cytokines and their use in the treatment of animal infections; monoclonal antibodies in therapy; vaccines and their applications in animal infections; gene therapy for animal diseases.

UNIT IV MICROMANIPULATION OF EMBRYO'S 9

What is micromanipulation technology; equipment used in micro manipulation; enrichment of x and y bearing sperms from semen samples of animals; artificial insemination and germ cell manipulations; in vitro fertilization and embryo transfer; micromanipulation technology and breeding of farm animals.

UNIT V TRANSGENIC ANIMALS 9

Concepts of transgenic animal technology; strategies for the production of transgenic animals and their importance in biotechnology; stem cell cultures in the production of transgenic animals.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Ranga M.M. Animal Biotechnology. Agrobios India Limited, 2002
2. Ramadass P, Meera Rani S. Text Book of Animal Biotechnology. Akshara Printers, 1997.

REFERENCES

1. Masters J.R.W. Animal Cell Culture: Practical Approach Oxford University Press, 2000.
2. R. Ian Freshney, Culture of Animal cells, A Manual of basic technique 4th Edition, 2002.

161BTE08	CANCER BIOLOGY	L	T	P	C
AIM		3	0	0	3

AIM

To explore about the molecular base of cancer, various stages of cancer, various carcinogens and advanced molecular treatment established for cancer.

OBJECTIVES

- To explore the basic molecular pathway of cancer infection.
- To study about various stages of cancer (carcinogenesis, metastasis, etc.)
- To know about various carcinogens and treatment for cancer.

UNIT I FUNDAMENTALS OF CANCER BIOLOGY 9

Regulation of cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, modulation of cell cycle in cancer, different forms of cancers, diet and cancer. Cancer screening and early detection, Detection using biochemical assays, tumor markers, molecular tools for early diagnosis of cancer.

UNIT II PRINCIPLES OF CARCINOGENESIS 9

Theory of carcinogenesis, Chemical carcinogenesis, metabolism of carcinogenesis, principles of physical carcinogenesis, x-ray radiation-mechanisms of radiation carcinogenesis.

UNIT III	PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER	9
Signal targets and cancer, activation of kinases; Oncogenes, identification of Oncogenes, retroviruses and Oncogenes, detection of Oncogenes. Oncogenes/proto oncogene activity. Growth factors related to transformation.		
UNIT IV	PRINCIPLES OF CANCER METASTASIS	9
Clinical significances of invasion, heterogeneity of metastatic phenotype, metastatic cascade, basement membrane disruption, three step theory of invasion, proteinases and tumor cell invasion.		
UNIT V	NEWMOLECULESFORCANCERTHERAPY	9
Different forms of therapy, chemotherapy, radiation therapy, detection of cancers, prediction of aggressiveness of cancer, advances in cancer detection. Use of signal targets towards therapy of cancer; Gene therapy.		
TOTAL: 45 PERIODS		

TEXT BOOKS

1. Maly B.W.J, "Virology A Practical Approach", IRLI Press, Oxford, 1987.
2. Dunmock N.J and Primrose S.B., "Introduction to Modern Virology", Blackwell Scientific Publications, Oxford,1988.

REFERENCES

1. "An Introduction Top Cellular and Molecular Biology of Cancer" Oxford Medical Publications, 1991.

161BTE09	BIOCONJUGATE TECHNOLOGY	L	T	P	C
		3	0	0	3

AIM

To develop the skills of the Student in the field of Bioconjugate technology and its industrial applications.

OBJECTIVES

At the end of the course, the student would have learnt about enzymes, nucleic acids And how to modify them for target specificity. Student also gets familiarized with the Industrial applications of this technology.

UNIT I **FUNCTIONALTARGETS** **9**

Modification of Amino Acids, Peptides and Proteins – Modification of sugars, polysaccharides and glycoconjugates –modification of nucleic acids and oligonucleotides.

UNIT II **CHEMISTRYOFACIVEGROUPS** **9**

Amine reactive chemical reactions–Thiol reactive chemical reactions–carboxylate reactive chemical reactions – hydroxyl reactive chemical reactions –aldehyde and ketone reactive chemical reactions–Photo reactive chemical reactions.

UNIT III **BIOCONJUGATEREAGENTS** **9**

Zero length cross linkers–Homo bifunctional cross linkers–Hetero bifunctional cross linkers–Trifunctional cross linkers– Cleavable reagent systems–tag sand probes.

UNIT IV **ENZYMENDNUCLEICACIDMODIFICATIONANDCONJUGATION** **9**

Properties of common enzymes– Activated enzymes for conjugation –biotinylated enzymes –chemical modification of nucleic acids–biotin labeling of DNA-enzyme conjugation to DNA–Fluorescent of DNA.

UNIT V **BIOCONJUGATEAPLICATIONS** **9**

Preparation of Hapten-carrier Immunogen conjugates - antibody modification and conjugation – immunotoxin conjugation techniques – liposome conjugated and derivatives- Colloidal–gold-labeledproteins–modificationwithsyntheticpolymers.

TOTAL: 45 PERIODS

TEXT BOOKS

1. G.T.Hermanson, Bioconjugate Techniques, Academic Press, 2013.

REFERENCES

1. Junhua (Alex) Tao and Romas Kazlauskas, Biocatalyst for green chemistry and chemical process development, John Wiley & Sons, 2011.

161BTE10

STEM CELL TECHNOLOGY

L T P C
3 0 0 3

AIM

To explore the basic molecular principles and emerging trends in stem cell technology and its application in various modern therapies.

OBJECTIVES

- To understand stem cell, molecular principle of stem cell technology.
- To explore its use in animal & plant biotechnology.
- To know its potent use in various molecular therapies.

UNIT I STEMCELLSANDCELLULARPEDIGREES 9

Scope of stem cells–definition of stem cells–concepts of stem cells–differentiation, maturation, proliferation, pluripotency, self – maintenance and self – renewal–problems in measuring stem cells–preservation protocols.

UNIT II STEMCELLCONCEPTINPLANTS 9

Stem cell and founder zones in plants–particularly their roots–stem cells of shoot meristems of higher plants.

UNIT III STEMCELLCONCEPTIN ANIMALS 9

Skeletal muscle stemcell–Mammary stem cells–intestinal stem cells–keratinocyte stem cells of cornea–skin and hair follicles–tumour stem cells–factors influencing proliferation and differentiation of stem cells–hormone role in differentiation.

UNIT IV HAEMOPOIETICSTEMCELL 9

Biology–growth factors and the regulation of haemopoietic stem cells.

UNIT V POTENTIALUSESOF STEMCELLS 9

Cellulartherapies–vaccines–genetherapy–immunotherapy–tissueengineering– Blood and bone marrow–Fc cells.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Satish Totey and Kaushik D. Deb, Stem Cell Technologies: Basics and Applications, McGraw-Hill, 2010

REFERENCES

1. Kyle C., Curtis L.C., “Perinatal Stem Cells”, Wiley-Blackwell, 2nd Edition, 2013
2. Lanza R., Gearhart J., “Essential of Stem Cell Biology”. Elsevier Academic press, 1st Edition 2009

161BTE11

MOLECULAR PATHOGENESIS

L T P C
3 0 0 3

AIM

To develop the skills of the students in the area of molecular principles of Molecular Pathogenesis

OBJECTIVES

- To understand pathogenesis.
- To explore its various defence mechanisms, various infection control strategies.
- To know the mechanism of bloody diarrhea and Hemolytic Uremic Syndrome, Enterococcal Aggregative *E.coli*(EAEC). Shigella: Entry, macrophage apoptosis, induction of macropinocytosis etc.

UNIT I OVERVIEW 9

Historical perspective-discovery of microscope, Louis Pasteur’s contributions, Robert Koch’s postulates, early discoveries of microbial toxins, toxic assays, vaccines, antibiotics and birth of molecular genetics and modern molecular pathogenesis studies, Various pathogen types and modes of entry.

UNIT II HOST-DEFENSE AGAINST PATHOGENS AND PATHOGENIC STRATEGIES 9

Attributes & components of microbial pathogenesis, Host defense: skin, mucosa, cilia, secretions, physical movements, limitation of free iron, antimicrobial compounds, mechanism of killing by humoral and cellular defense mechanisms, complements, inflammation process, general disease symptoms, Pathogenic adaptations to overcome the above defenses.

UNIT III MOLECULAR PATHOGENESIS (WITH SPECIFIC EXAMPLES) 9

Virulence, virulence factors, virulence-associated factors and virulence life style factors, molecular genetics and gene regulation in virulence of pathogens, *Vibrio Cholerae*: Cholera toxin, co-regulated pili, filamentous phage, survival *E.coli* pathogens: Enterotoxigenic, Entero-pathogenic and Enteroaggregative *E.coli*. Pathogenic plasmodium and knob Virulence assays: adherence, invasion, cytopathic, cytotoxic effects. Influenza virus: Intracellular stages, Neuraminidase & Haem agglutinin entry, M1&M2 proteins in assembly and disassembly, action of 58 immune 58ine.

UNIT IV EXPERIMENTAL STUDIES ON HOST-PATHOGEN INTERACTIONS 9

Virulence assays: adherence, invasion, cytopathic, cytotoxic effects. Criteria & tests in identifying virulence factors, attenuated mutants, molecular characterization of virulence factors, signal transduction & host responses

UNIT V MODERN APPROACHES TO CONTROL PATHOGENS 9

Classical approaches based on serotyping. Modern diagnosis based on highly conserved virulence factors, 58 immune & DNA-based techniques. New therapeutic strategies based on recent findings on molecular pathogenesis of a variety of pathogens, Vaccines- DNA, subunit and cocktail vaccines.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Eduardo A. Groisman, Principles of Bacterial Pathogenesis, Academic Press, 2001.
2. Tizard: Immunology; An introduction; 4th Edition, Thomson Publication.
3. Peter Williams, Julian Ketley & George Salmond, "Methods in Microbiology: Bacterial Pathogenesis, Vol.27", Academic Press, 1998.
4. Abigali A. Salyers and Dixie D. Whitt, Bacterial Pathogenesis – A molecular Approach, Second Edition, ASM Press, Washington, 2002.

REFERENCES

1. Recent reviews in Infect. Immun., Mol. Microbiol, Biochem. J., EMBO etc.
2. Nester, Anderson, Roberts, Pearsall, Nester, "Microbiology: A human Perspective", McGraw-Hill, 3rd Edition, 2001.

161BTE12 Molecular Modeling and Drug Design

L T P C
3 0 0 3

AIM

To develop skills of students in the area of Molecular modeling. Pre requisite for courses on Drug Design

OBJECTIVES

At the end of the course the student would have learnt Classical & Statistical mechanics, and Quantum mechanics and its applications.

UNIT I

Newtons laws of motion – time intervals – algorithms

UNIT II

Boltzman's Equation – Ensembles – Distribution law for non interacting molecules – Statistical mechanics of fluids.

UNIT III

Photoelectric effect – De Broglies hypothesis – Uncertainty principle – Schrodinger's time independent equation – particle in a one-dimensional box.

UNIT IV

Energy minimization, application of Fourier transformer – force fields – principal components analysis– RMSD calculation–applications–dynamics of a molecule– concepts of parallelizing work.

UNIT V

Methods–Basic sets–Model chemiststrix–inputs–outputs–uses.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Statistical Mechanics; D.McQuarrie, Narosa, 1999.
2. Quantum Mechanics; D.McQuarrie, Narosa, 1999.

REFERENCES

1. GROMOS Handbook

161BTE13

METABOLIC ENGINEERING

L	T	P	C
3	0	0	3

AIM

To develop skills of the students in the area of Metabolic Engineering principle & its application in bioprocess, molecular therapeutics & genetic engineering etc

OBJECTIVES

At the end of the course, the student would have learnt about Biosynthesis of primary & secondary metabolites, Bioconversion etc. and its relevance to Industrial applications.

UNIT I INTRODUCTION

9

Induction-jacob monod model, catabolite regulation, glucose effect, camp deficiency, feedback regulation, regulation in branched pathways, differential regulation by isoenzymes, concerted feedback regulation, cumulative feedback regulation, amnioacid regulation of rna synthesis, energy charge, regulation, aminoacid regulation of rna synthesis, energy charge, regulation, permeability control passive diffusion, active transport group transportation.

UNIT II SYNTHESIS OF PRIMARY METABOLITES

9

Alteration of feedback regulation, limiting accumulation of end products, feedback, resistant mutants, alteration of permeability, metabolites.

UNIT III BIOSYNTHESIS OF SECONDARY METABOLITES

9

Precursor effects prophophase, idiophase relationship, enzyme induction, feedback regulation, catabolite regulation bypassing control of secondary metabolism, producers of secondary metabolites.

UNIT IV BIOCONVERSIONS

9

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

UNIT V REGULATION OF ENZYME PRODUCTION

9

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

TOTAL: 45 PERIODS

TEXT BOOKS

1. Wang D.I.C., Cooney C.L., Demain A.L., Dunnill P., Humphery A.E., Lilly M.D., "Fermentation And Enzyme Technology", John Wiley And Sons., 1980.
2. Stanbury P.F., And Whitaker A., "Principles of Fermentation Technology", Pergamon Press, 1984

REFERENCE

1. Zubay G., "Biochemistry", Macmillan Publishers, 1989.

161BTE14

IMMUNOTECHNOLOGY

L T P C
3 0 0 3

AIM

To develop the skills of the students in the area of Immunotechnology pre-requisite for PG studies in biotechnology & related fields.

OBJECTIVES

At the end of the course, the student would have learnt various techniques like Developing diagnostic tests, characterization of lymphocytes, purification of antigens, Antibody Engineering etc. This knowledge will be beneficial for Industrial applications.

UNIT I ANTIGENS 9

Types of antigens, their structure, preparation of antigens for raising antibodies, handling of animals, adjuvants and their mode of action.

UNIT II ANTIBODIES & IMMUNODIAGNOSIS 9

Monoclonal and polyclonal antibodies—their production and characterization, western blot analysis, immune electrophoresis, SDS-PAGE, purification and synthesis of antigens, ELISA-principle and applications, radio immunoassay(RIA) principles and applications, non isotopic methods of detection of antigens –enhanced chem. Luminescence assay.

UNIT III ASSEMENT OF CELL MEDIATED IMMUNITY 9

Identification of lymphocytes based on CD markers, Tcell activation parameters, cytokine Bioassay, macrophages activation, macrophage microbicidal assays, FACS, HLA typing.

UNIT IV VACCINE TECHNOLOGY 9

Basic principles of vaccine development, protein based vaccines, DNA vaccines, Plant based vaccines, Recombinant antigens as vaccines, Reverse Vaccinology

UNIT V DEVELOPMENT OF IMMUNOTHERAPEUTICS 9

Engineered antibodies, catalytic antibodies, production of idiotypic and anti-idiotypic antibodies, combinatorial libraries for antibody isolation.

UNIT VI CURRENT TOPICS IN IMMUNOLOGY

Trends in Immunology of infectious diseases and tumors, topics as identified from time to time.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Talwar G.P. and Gupta S.K., “A hand book of practical and clinical immunology” Vol. 1&2, CBS Publications, 1992.
2. Weir D.M., Practical Immunology, Blackwell Scientific Publications, Oxford, 1990.

REFERENCES

1. Austin J.M. and Wood K. J., Principle of cellular and molecular immunology, Oxford university press, Oxford, 1993.

161BTE15

NEUROBIOLOGY AND COGNITIVE SCIENCES

L T P C
3 0 0 3

AIM

To develop the skills of students in the area of macrobiology and cognitive sciences.

OBJECTIVES

At the end of the course, the student would have learnt about the human nervous system, neurophysiology & neuropharmacology. The student also gains knowledge in the mechanisms of neurological behaviour.

UNIT I NEUROANATOMY 9

What are central and peripheral nervous systems; Structure and function of neurons; types of neurons; Synapses; Glial cells; myelination; Blood Brain barrier; Neuronal differentiation; Characterization of neuronal cells; Meninges and Cerebrospinal fluid; Spinal Cord.

UNIT II	NEUROPHYSIOLOGY	9
Resting and action potentials; Mechanism of action potential conduction; Voltage dependent channels; nodes of Ranvier; Chemical and electrical synaptic transmission; information representation and coding by neurons.		
UNIT III	NEUROPHARMACOLOGY	9
Synaptic transmission, neurotransmitters and their release; fast and slow neurotransmission; characteristics of neurites; hormones and their effect on neuronal function.		
UNIT IV	APPLIEDNEUROBIOLOGY	9
Basic mechanisms of sensations like touch, pain, smell and taste; neurological mechanisms of vision and audition; skeletal muscle contraction.		
UNIT V	BEHAVIOURSCIENCE	9
Basic mechanisms associated with motivation; control of feeding, sleep, hearing and memory; Disorders associated with the nervous system.		

TOTAL: 45 PERIODS

TEXT BOOKS

1. Mathews G.G.Neurobiology,2nd edition, Blackwell Science, UK, 2000.

REFERENCE

1. John Hart JR, The neurobiology of cognition and behavior, Oxford University press, 2016.

161BTE16	PROCESS INSTRUMENTATION DYNAMICS AND CONTROL	L	T	P	C
		3	0	0	3

AIM

To introduce control equipment used to control the production process of a chemical factory and to introduce the control mechanism through automation and computers.

OBJECTIVES

Gains knowledge in designing a control system and identifying the alternative control configuration for a given process plant or entire plant. He will be familiar with the control mechanism before attempting to tackle process control problems.

UNIT I	9
Laplace transformation, transform of standard functions, derivatives and integrals, inversion, theorems in Laplace transformation, application .Open-loop systems, first order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics, transfer function for chemical reactors and dynamics.	
UNIT II	9
Closed loop control systems, development of block diagram for feed-back control systems, servo and regulator problems, Transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transportation lag, transient response of closed-loop control systems and their stability.	
UNIT III	9
Introduction to frequency response of closed-loop systems, control system design by frequency, Bode diagram, stability criterion, Nyquist diagram; Tuning of controller settings.	
UNIT IV	9
Controller mechanism, introductionto advanced control systems, cascade control, feed forward control, control of distillation towers and heat exchangers, introduction to microprocessors and computer control of chemical processes.	
UNIT V	9
Principles of measurements and classification of process control instruments, measurementsof temperature, pressure, fluidflow, liquidweightandweightflowrate, viscosity and consistency, pH, concentration, electrical and thermal conductivity, humidity of gases, composition by physical and chemical properties and spectroscopy.	

TOTAL: 45 PERIODS

TEXT BOOKS

1. CoughnowrandKoppel,“ProcessSystemsAnalysisandControl”,McGraw-Hill,New York,1986.

2. George Stephanopolous, "Chemical Process Control", Prentice-Hall of India Pvt. Ltd., NewDelhi,1990.

REFERENCES

1. Thomas, E. Marlin, ProcessControl,2ndEdn, McGraw-Hills International Edn. 2000.
2. George Stephanopoulos, Chemical Process Control, Prentice HallofIndia2003.
3. Norman H.CEAGLSKE, Automatic process control for chemical engineers, John Wiley & Sons.

1615OE01 **PROCESS EQUIPMENTS AND PLANTDESIGN** **L T P C**
3 0 0 3

AIM

To develop the skills of the students in the area of process equipment and Design. This is a pre-requisite for higher PG studies in Biotechnology.

OBJECTIVES

At the end of the course, the student would have learnt about various types of process equipment, principles involved in their function, and its industrial applications.

UNIT I HEAT EXCHANGERS, CONDENSERS, EVAPORATORS 9

Single and multiprocess exchangers, double pipe, U tube heat exchangers, combustion details supporting structure. Single and vertical tube evaporation, Single and multi effect evaporators, forced circulation evaporators

UNIT II STORAGE VESSEL FOR VOLATILE AND NONVOLATILE FLUIDS, PRESSUREVESSEL STRUCTURE 9

Design of the following equipments as per ASME, ISI codes, drawing according to scale; Mono block and multiplayer vessels, combustion details and supporting structure.

UNIT III EXTRACTOR, DISTILLATION AND ABSORPTION TOWER 9

Construction details and assembly drawing; Plate and Packed Extraction Towers; Plate and Packed absorption Towers; Plate and Packed Distillation Towers.

UNIT IV PUMPS, MECHANICAL SEALS, VALVES AND SWITCHES 9

Various types of pumps, Principle of working, construction, usages, advantages and disadvantages; Various types of seals, effectiveness, usages; Pneumatic Seals; Gate, Globe and Butterfly Valves, their material of construction; Pneumatically Controlled Valves.

UNIT V PIPING,PLANTLAYOUTANDDESIGN 9

Various types of Piping, material of construction, their usage; Pipe layout; Modern Plant Design and case Studies.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Brownbell I.E., YoungE.H.,ChemicalPlantDesign,1985
2. Kern D.Q. "Heat Transfer", McGraw-Hill,1985.

REFERENCES

1. McCabe W.L., Smith J.C. "Unit Operations in Chemical Engineering", McGraw-Hill, 1976.

1615OE02 **BIOMATERIALS** **L T P C**
3 0 0 3

AIM

To develop the skills of the students in the area of biological materials and application.

OBJECTIVES

At the end of the course, the student would have learnt about various biological materials with their properties, biomaterial usage in medical implantation and aids, developing and implementation of biomolecules in industrial and environmental protection applications.

Fundamentals of Biomaterials 9 hrs

Overview of biomaterials, structure and properties of biomaterials- (physical and mechanical), Sterilization and quality improvement

Synthetic and Biopolymers 9 hrs

Polymers in biomedical use- polyethylene, polypropylene and perfluorinated polymers, hydrogels, polyurethanes, polyamides, biodegradable synthetic polymers, silicone rubber. Collagens, elastin, mucopolysaccharides, proteoglycans, cellulose and derivatives, chitin and others

Tissue grafts and soft tissue application 9 hrs

Tissue grafts and rejection processes – blood, skin and connective tissue, bulk space fillers, maxillofacial and fluid transfer implants, percutaneous devices, biomaterials in urological practice and microencapsulation of live animal cells.

Biomaterials in Cardiovascular and Ophthalmology 9 hrs

Implants in blood vessels, heart, kidney, lungs, cardiac pacemakers and blood substitutes, Viscoelastic solutions, contact lenses, optical implants and artificial tears.

Orthopaedic and Dental materials 9 hrs

Bone composition and properties, temporary fixation devices, joint replacement and repair and bone regeneration. Teeth composition and mechanical properties, filling and restorative materials, metals in dentistry and oral implants.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Sujata V. Bhat, Biomaterials, 2nd Edition, Narosa Publishing House, 2010

REFERENCE

1. J.S. Temenoff and A.G. Mikos, “The Introduction of Biology and material science”, Pearson Education, New Delhi, 2009

1615OE03

BIOSENSORS

**L T P C
3 0 0 3**

OBJECTIVES

To impart knowledge on basic principles of Biosensors, working of enzymes as sensors and immunosensors and their applications.

FUNDAMENTALS OF BIOSENSOR 9

Definition - Historical development - Important aspects of sensors - Recognition elements - Transducers Methods of Immobilization of the Receptor Component in Biosensors - Signal transduction; Physico-chemical and Biological transducers - Performance factors: calibration, selectivity, sensitivity, reproducibility, detection limits, response time.

TRANSDUCTION AND SENSING ELEMENTS 9

Electrochemical Transducers - Potentiometry and Ion-Selective Electrodes - The Nernst Equation - Voltammetry and Amperometry - Conductivity - Field-Effect Transistors - Ionic Recognition - Molecular Recognition - Biological Recognition elements - Choice of bioreceptor - Choice of transducer.

ENZYMATIC SENSORS 9

Some Enzymes with Relevance to Biosensors - Transduction Methods in Enzymatic Biosensors - Potentiometric enzyme electrodes - Amperometric enzyme electrodes - Semiconductor enzyme sensors - Optical enzyme sensors - Thermal enzyme sensors - Piezoelectric enzyme sensors.

IMMUNOLOGICAL SENSORS 9

General Principles - Immobilization Methods in Immunosensors - Immunoassay Formats - Membrane Immunosensors - Piezoelectric Systems - Optical Immunosensors - Biosensors Using Intact Biological Receptors.

NANOTECHNOLOGY BASED BIOSENSORS 9

anomaterials for Sensing Applications - Signal Amplification Using Nanomaterials for Biosensing - Nanomaterial-Based Electroanalytical Biosensors for Cancer and Bone Disease - Gold Nanostructure LSPR-Based Biosensors for Biomedical Diagnosis - DNA Sensors Employing Nanomaterials for Diagnostic Applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Eiggins B. R., “Chemical sensors and Biosensors”, John Wiley & Sons Ltd, 1st Edition, 2003.
2. Banica F. G., “Chemical sensors and Biosensors Fundamentals and Applications” John Wiley & Sons Ltd, 1st Edition, 2012.

REFERENCE BOOKS:

1. Serra P.A., “Biosensors”, Intech Publishers, 1st Edition, 2010.
2. Tuantranont A ., “Applications of Nanomaterials in Sensors and Diagnostics”, Springer, 2013.

COURSE OUTCOMES:

Upon completion of the course students will be able to

- * Demonstrate the importance of using biomolecules as sensors.
- * Deliver the impact transduction and choice of sensing elements in biosensor design.
- * Understand the role of enzymatic sensors and immunosensors.
- * Apply nanoconstructs in design of Biosensors.

1615OE04

Food Science and Technology

L T P C
3 0 0 3

Nutritional value of natural foods

9 hrs

Nutritional values of cereals, pulses, fruits, vegetables and meats. Food ingredients and adulteration.

Scope and importance of food processing.

9 hrs

National and international perspectives. Principles and methods of food processing and preservation (freezing, heating, dehydration, canning, additives, fermentation, irradiation, extrusion cooking, dielectric heating)

Milk and milk products

9 hrs

Milk and milk products: composition, properties and nutritional importance of milk, processing of milk, study of some common milk products (cheese, ice cream, yoghurt); Beverages: processing of some common beverages (tea, coffee); Sugar and confectionary: composition, nutritive value, crystallization, caramellization, hydrolysis; Indian confectionary, Chikki: source of energy.

Food packaging

9 hrs

Food Packaging: Packaging materials & its advancement, Mass transfer in packing material, Innovation in food packing (active, passive, intelligent), Package testing, CA & MA, Kinetics of biological reactions - kinetics of reactions occurring in processed foods, reaction velocity constant, order of reaction; quality changes during storage of foods; application of Arrhenius equation to biological reactions.

Food hygiene and sanitation

9 hrs

Food poisoning and food borne illness (Bacterial & non-bacterial), and their control. Contamination during handling and processing and its control; Method for microbial examination of food: indicator organisms, direct examination, cultural techniques, Rapid methods in detection of microorganisms.

Text Books:

1. S.Sood , Food presevation & processing, Kalyani publ.
2. Food Science- N.Potter & J.H.Hotchkiss- CBS Publishers & Distributors, New Delhi.
3. Toxicological aspects of food: Eds. Miller Elsevier -scientific publications.