

REGULATIONS 2015
B.TECH GENETIC ENGINEERING
CURRICULUM - SYLLABUS

SEMESTER I

SL.NO	SUB.CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	BEN101	English – I	3	1	0	3
2.	BMA101	Engineering Mathematics-I	3	1	0	3
3.	BPH101	Engineering Physics – I	3	0	0	3
4.	BCH101	Engineering Chemistry - I	3	0	0	3
5.	BBT101	Cell Biology	2	1	0	3
6.	BCS101	Fundamentals of Computing and Programming	3	0	0	3
7.	BBA101	Personality Development	1	1	0	2
8.	BCE101	Basic Civil engineering	2	0	0	2
9.	BME103	Basic Mechanical Engineering	2	0	0	2
PRACTICAL						
10.	BCM1L1	Basic civil and mechanical Engineering practice lab Computer Practice Lab	0	0	3	1
11.	BPC1L1	Physics And Chemistry lab	0	0	3/3	0
		NCC/ NSS/ Yoga (optional) to be conducted during week ends				
For a given program, Total Instruction Periods per week=35; Total No. of Credits = 25						

Laboratory Classes on alternate weeks for Physics and Chemistry. The Lab examinations will be held only in the second semester (including the first semester experiments also)

SEMESTER – II

S.NO	SUB.CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	BEN201	English – II	3	1	0	3
2.	BMA201	Engineering Mathematics - II	3	1	0	3
3.	BPH201	Engineering Physics - II	3	0	0	3
4.	BCH201	Engineering Chemistry - II	3	0	0	3
5.	BCS201	Internet Programming	2	0	0	2
6.	BFI201*	Foreign/Indian language	3	0	0	3
7.	BBT201	Principles of genetics	2	0	0	2
8.	BEE201	Basic Electrical and Electronics Engineering	2	0	0	2
PRACTICAL						
9.	BCS2L1	Internet Practices lab	0	0	3	1
10.	BCS2L2	Computer Practices lab				
11.	BEE2L1	Basic Electrical and Electronics Engineering Practices Lab	0	0	3	1
12.	BPC2L1	Physics and Chemistry Lab II	0	0	3	1
		NCC/ NSS/ Yoga (optional) to be conducted during week ends				
For a given program, Total Instruction Periods per week=35; Total No. of Credits = 25						

*Any one of the following courses: BFR201 – French, BGM201-German, BJP201 – Japanese, BKR201 – Korean, BCN201 – Chinese, BTM201 – Tamil

SEMESTER – III

S.NO	SUB.Code	COURSE TITLE	L	T	P	C
THEORY						
1.	BGE 301	Enzyme Technology	3	1	0	4
2.	BGE 302	Principles of Genetic Engineering	3	1	0	4
3.	BGE 303	Immunology	3	0	0	3
4.	BGE 304	Microbiology	3	0	0	3
5.	BGE 305	Principles of Biochemistry	3	1	0	4
6.	BMA 302	Biostatistics	3	1	0	4
PRACTICAL						
7.	BGE 3L1	Microbiology Laboratory	0	0	4	2
8.	BGE 3L2	Biochemistry Laboratory	0	0	4	2
9.	BGE 3S1	Technical seminar	0	0	2	1
Total			18	3	10	27
Total Contact Hours			31			

SEMESTER – IV

S.NO	SUB.CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	BGE 401	rDNA Technology	3	1	0	4
2.	BGE 402	Molecular Biology	3	1	0	4
3.	BGE 403	Environmental studies	3	0	0	3
4.	BGE 404	Genomics and Proteomics	3	0	0	3
5.	BGE 405	Bio-organic chemistry	3	1	0	4
6.	BGE 406	Basics of Bio-informatics	3	1	0	4
PRACTICAL						
7.	BGE 4L1	Molecular Biology Lab	0	0	4	2
8.	BGE 4L2	Cell Biology Lab	0	0	4	2
9.	BGE 4S2	Technical seminar-II	0	0	2	1
Total			18	4	6	27
Total Contact Hours			28			

SEMESTER – V

S.NO	SUB.CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	BGE 501	Principles of Management and ethics	3	0	0	3
2.	BGE 502	Research Methodology	3	1	0	4
3.	BGE 503	Cytogenetics	3	0	0	3
4.	BGE 504	Metabolic engineering	3	1	0	4
5.	BGE 505	Biophysics	3	1	0	4
6.	BGE 506	Plant tissue Culture	3	0	0	3
7.	BGE 5E1	Elective-I	3	0	0	3
PRACTICAL						
8.	BGE 5L1	Immunology Laboratory	0	0	2	1
9.	BGE 5L2	Plant Genetic Engineering Laboratory	0	0	2	1
10.	BGE 5P2	Mini Project-II	0	0	2	1
Total			21	3	6	27
Total Contact Hours			30			

SEMESTER – VI

S.NO	SUB.CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	BGE 601	Agri, Veterinary and Medical informatics	3	1	0	4
2.	BGE 602	Bio-Pharmaceutical technology	3	0	0	3
3.	BGE 603	Genes and Diseases	3	0	0	3
4.	BGE 604	Gene Therapy	3	0	0	3
5.	BGE 605	Cancer Biology	3	1	0	4
6.	BGE 6E2	Elective-II	3	0	0	3
PRACTICAL						
7.	BGE 6L1	Gene Cloning Laboratory	0	0	4	2
8.	BGE 6L2	Bioinformatics Laboratory	0	0	4	2
Total			18	2	4	24
Total Contact Hours			24			

SEMESTER – VII

S.NO	SUB.CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	BGE 701	Biosafety, Bioethics, IPR & Patents	3	1	0	4
2.	BGE 702	Animal Cell Culture and Transgenic Technology	3	1	0	4
3.	BGE 703	Nanobiotechnology in Healthcare	3	0	0	3
4.	BGE 704	Stem Cell Biology	3	0	0	3
5.	BGE 7E1	Elective-III	3	0	0	3
6.	BGE 7E2	Elective- IV	3	0	0	3
PRACTICAL						
7.	BGE 7L1	Genome Analysis Laboratory	0	0	4	2
8.	BGE 7L2	Animal Cell Culture Laboratory	0	0	4	2
9.	BGE 7P1	Project Phase-I	0	0	4	2
10.	BGE 7V1	Implant Training	0	0	1	1
Total			18	2	13	27
Total Contact Hours			33			

SEMESTER – VIII

S.NO	SUB.CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	BEC 802	Elective –V	3	0	0	3
2.	BGE 8E3	Elective – VI	3	0	0	3
3.	BGE 8E4	Elective – VII	3	0	0	3
PRACTICAL						
4.	BBM8P1	Project work	0	0	18	6
Total			9	0	18	15
Total Contact Hours			27			

Total Credit Hour Summary Table

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Total	25	25	27	27	27	24	27	15	197

LIST OF ELECTIVES

S.No	ELECTIVE CODE	ELECTIVE SUBJECTS	L	T	P	C
1	BGE 001	Human Genetics	3	0	0	3
2	BGE 002	Protein Engineering	3	0	0	3
3	BGE 003	Industrial Microbiology	3	0	0	3
4	BGE 004	Industrial Management	3	0	0	3
5	BGE 005	Bioreactor Design	3	0	0	3
6	BGE 006	Biomedical Engineering	3	0	0	3
7	BGE 007	Chemical Reaction Engineering	3	0	0	3
8	BGE 008	Bioconfinement of Genetically modified organisms	3	0	0	3
9	BGE 009	Molecular Medicine	3	0	0	3
10	BGE 010	Computer skills	3	0	0	3
11	BGE 011	Basic molecular techniques	3	0	0	3
12	BGE 012	Bioprocess principles	3	0	0	3
13	BGE 013	Advanced Molecular techniques	3	0	0	3
14	BGE 014	Momentum Transfer	3	0	0	3
15	BGE 015	Bioprocess Engineering	3	0	0	3

OBJECTIVE

To make the students learn the basics of communication in order to talk fluently, confidently and vividly.

COURSE OUTCOMES (COs)

Students will be able

CO1- To make them master the techniques of professional communication

CO2- to know about E-mail communication

CO3- to understand about comparison studies

CO4- to improve presentation skill

CO5- to know about marking the stress Connectives

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M											
CO2			S		M							
CO3		M		S								
CO4				W								
CO5	S	M				S						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I

12

Parts of speech - Active and passive voices - Subject verb agreement - Writing about School life, Hobbies, Family and friends – Word formation with prefixes and suffixes - Tenses - Concord - Summarizing - Note-making

UNIT II

12

Cause and effect relations – Punctuations –Differences between verbal and nonverbal communication -E - mail communication – Homophones - Etiquettes of E mail communication. Interpreting graphic representation - Flow chart and Bar chart

UNIT III **12**

Degrees of comparison – Positive, Comparative, Superlative - wh questions - SI units -Lab reports- Physics, chemistry, workshop and Survey report for introducing new product in the market.

UNIT IV **12**

Writing project proposals - Presentation skills - Prefixes and suffixes - If conditions - Writing a review-Preparing minutes of the meeting, Agenda, official circulars.

UNIT V **12**

Accident reports (due to flood and fire) - Hints development - Imperatives - Marking the stress Connectives, prepositional relatives.

L=45, T=15, Total No. of Periods: 60

Text Book:

1. Department of humanities and social sciences division, Anna university, oxford university press, 2013.

Reference Books:

1. S.P.Danavel, English and Communication for Students of Science and engineering, Orient Blackswan, Chennai, 2011.
2. Rizvi, M.Asharaf, Effective Technical Communication, New Delhi, Tata McGraw Hill Publishibg Company, 2007. MuraliKrishna and SunithaMoishra, Communication Skills for Engineers, Pearson, New Delhi, 2011.

BMA101 **ENGINEERING MATHEMATICS-I** **3 1 0 3**

OBJECTIVE:

To equip students with adequate knowledge of Mathematics to formulate problems in engineering environment and solve them analytically

COURSE OUTCOME:

The students shall be able

CO1- to apply matrix operations to solve the relevant real life problems in engineering.

CO2- to formulate a mathematical model for three dimensional objects and solve the concerning problems.

CO3- to find area and volume based on a function with one or more variables.

CO4- to know about Cartesian and Polar coordinates

CO5- to get knowledge about Partial derivatives

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2			S		M							
CO3				M								
CO4	S			W								
CO5		M				S						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT-1 MATRICES

12

Characteristic equations- Eigen values and eigen vectors of the real matrix- Properties- Cayley-Hamilton theorem(Excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form- Quadratic form- Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT-II THREE DIMENSIONAL ANALYTICAL GEOMETRY

12

Equation of a Sphere- Plane section of a sphere- Tangent plane- Equation of cone- Right circular cone- Equation of a cylinder- Right circular cylinder.

UNIT-III DIFFERENTIAL CALCULUS

12

Curvature in Cartesian coordinates- Centre and radius of curvature- Circle of curvature- Evolutes- Envelopes- Evolute as envelope of normals.

UNIT-IV FUNCTIONS OF SEVERAL VARIABLES

12

Partial derivatives- Euler's theorem for homogeneous functions- Total derivatives- Differentiation of implicit functions- Jacobians- Taylor's expansion- Maxima and Minima- Method of Lagrangian multipliers.

UNIT-V MULTIPLE INTEGRALS

12

Double integration- Cartesian and Polar coordinates- Change of order of integration- Change of variables between Cartesian and Polar coordinates- Triple integration in Cartesian coordinates- Area as double integral- Volume as triple integral.

L=45, T=15, TOTL NO.OF PERIODS: 60

Text book:

1. Ravish R.Singh and Mukkul Bhatt, “ Engineering Mathematics-I” First Reprint, Tata McGraw Hill Pub Co., New Delhi. 2011.

References:

1. Ramana.B.V. “Higher Engineering Mathematics” , Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Glyn James, “Advanced Engineering Mathematics” , 7th Edition, Pearson Education, 2007.
3. Erwin Kreyszig, “Advanced Engineering Mathematics”, 8th Edition, John Wiley and Sons, New York, 2003.
4. Murray R.Spiegel, “Advanced Calculus”, Schaum’s Outline Series, First Edn, McGraw Hill Intl Book Co., New Delhi, , 1981.
5. Grewal.B.S, “Higher Engineering Mathematics” , 40th Edition, Khanna Publications, Delhi. 2007.

BPH 101**ENGINEERING PHYSICS – I****3 0 0 3****OBJECTIVES**

To make a bridge between the physics in school and engineering courses.

To impart a sound knowledge on the basic concepts of modern sciences like engineering applications of ultrasonics, lasers, fundamentals of crystal physics.

COURSE OUTCOMES

CO1 - To know about Ultrasonics and its application in NDT.

CO2 - To know the principle of Laser and its application in Engineering and medicine.

CO3 - Acquire Knowledge on Quantum Physics.

CO4 – Properties of Electro Magnetic Theory.

CO5 – To understand the impact of Crystal Physics.

CO/PO Mapping**S – Strong, M – Medium, W – Weak**

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S								M		
CO2			S		M							
CO3		M		S		M						M
CO4				W					S			
CO5		M				S						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I - ULTRASONICS**9**

Introduction – Production- Magnetostriction Effect- Magnetostriction Generator- Piezoelectric Effect- Piezo Electric Generator- Detection Of Ultrasonic Waves- Properties- Cavitation- Acoustic Grating -Industrial Applications- Drilling, Welding, Soldering, Cleaning And Sonar- Velocity Measurement- - Non Destructive Testing(NDT)- Pulse Echo System Through Transmission And Reflection modes- A,B And C- Scan Display- Important Medical Applications- Sonogram--problem.

UNIT II – LASER**9**

Introduction- Principle of Spontaneous Emission and Stimulated Emission- Einstein's A & B Coefficients- Derivation-Condition For Producing Laser Beam- Population Inversion- Pumping- Resonance Cavity- Types Of Lasers- ND-YAG- He-Ne- Co₂ Lasers-Industrial Applications- Heat Treatment- Welding-Cutting-Medical Applications-Laser Surgery- Advantages & Disadvantages-problem.

UNIT III - QUANTUM PHYSICS**9**

Drawbacks with classical physics- Blackbody radiation: Max Planck theory and concept of energy quantization, deduction of Wien's displacement law, Raleigh-Jeans law – Matter waves- de Broglie wave length-photoelectric effect – Schrödinger equation (time-independent, and time-dependent equations)- wave functions and energy spectrum- application to particle in box-problem.

UNIT IV - ELECTROMAGNETIC THEORY**9**

Electric charges-coulombs law of inverse squares- Electric field and its calculations-field lines- Gauss's law-applications of Gauss law. Magnetism - Magnetic field- Magnetic field lines- Magnetic flux- Motion of charged particles in magnetic field- Magnetic field of a moving charge. Electromagnetic wave- speed of and electromagnetic wave and its quantitative deduction-group velocity- energy in electromagnetic wave- electromagnetic waves in matter-problem.

UNIT V - CRYSTAL PHYSICS**9**

Lattice- Unit Cell- Bravais Lattice- Lattice Plane- Miller Indices- D-Spacing In Cubic Lattice- Calculation of Number of Atoms Per Unit Cell- Atomic Radius- Coordination Number- Packing Factor- SC,BCC, FCC, HCP Structures- Polymorphism And Allotropy- Crystal Defects- Point, Line And Surface Defects- Burgers Vector-problem.

Text Books:

1. Marikani, A. 'Engineering Physics' Second Edition PHI Learning Pvt Ltd - 2013
2. Sears.F.W., Zemansky.M.W., Young.H.D.; 'University Physics; Narosa Publishing House.

3. Avadhanulu. M.N.; Engineering Physics-Vol-1; S.Chand And Company Ltd, 2010.

Reference Books:

1. Sears., Zemansky., Young.; ‘College Physics; Addison Wesley Publishing Company.
2. Resnick, R., and Halliday, D. and Walker, J.; Fundamental of Physics; John Wiley and Sons.
3. Senthil Kumar, G. ‘Engineering Physics – I’ VRB publishers Pvt Ltd. 2010.

TOTAL NO.OF PERIODS: 45

BCH 101

ENGINEERING CHEMISTRY – I

3 0 0 3

OBJECTIVES

- To impart knowledge to the Students about the principles, water characterization and treatment of portable and industrial purposes.
- To make them understand the Principles of polymer chemistry and engineering applications of polymers
- To impart a sound knowledge about the Principles of electrochemistry, electrochemical cells, emf and applications of emf measurements
- To make the students to have a deep knowledge of the Principles of corrosion and corrosion control and
- To make the students to be well versed with the Conventional and non-conventional energy sources and energy storage devices

COURSE OUTCOMES :

- CO1** – Having a knowledge of Water characterization and treatment of portable and Industrial purposes.
- CO2** – Having the thinking of Principles of polymer chemistry and engineering applications of polymers
- CO3** – Having a deep knowledge about the Principles of electrochemistry
- CO4** – With a true wisdom about Corrosion
- CO5** - Having a sound knowledge in the Field of the Conventional and non-conventional energy .

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				S								
CO2	S		M		M							
CO3		M		S								
CO4												
CO5	S	M				W						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I**WATER TECHNOLOGY****9****INTRODUCTION**

Characteristics :

Hardness of water – types - temporary and permanent hardness - estimation by EDTA method
 Alkalinity – types of alkalinity - Phenolphthalein and Methyl orange alkalinity - determination –
 Domestic water treatment – disinfection methods (Chlorination, ozonation , UV treatment)Boiler
 feed water – requirements – disadvantages of using hard water in boilers (caustic embrittlement ,
 boiler corrosion , priming and foaming) – Prevention of scale formation – softening of hard
 water - Internal treatment (Calgon treatment method) – External treatment – Demineralization
 process – Desalination and Reverse osmosis.

UNIT II**POLYMERS****9****INTRODUCTION****Polymers:**

Definition – polymerization – degree of polymerization - types of polymerisation – Addition
 polymerization and Condensation polymerization – Mechanism of Polymerization - free
 radical polymerization mechanism only

Plastics:

Classification – thermoplastics and thermosetting plastics – difference between thermoplastics
 and thermosetting plastics - preparation, properties and uses of PVC, Teflon, nylon-6,6, PET

Rubber :

Types – drawbacks of natural rubber -vulcanization of rubber - properties and uses of
 vulcanized rubber Synthetic rubbers – butyl rubber and SBR

UNIT III ELECTROCHEMISTRY**9****INTRODUCTION****CELLS :**

Types of Cells :

Electrochemical cells , Electrolytic cells – Reversible and Irreversible cells EMF – measurement
 of emf – Single electrode potential – Nernst equation

Reference electrodes:

Standard Hydrogen electrode -Calomel electrode

Ion selective electrode:

Glass electrode and measurement of pH using Glass electrode

Electrochemical series – significance

Titrations:

Potentiometer titrations (redox - Fe^{2+} vs dichromate titrations)

Conductometric titrations (acid-base – HCl vs. NaOH titrations)

UNIT IV CORROSION AND CORROSION CONTROL

9

INTRODUCTION

Chemical corrosion

Definition - Chemical Corrosion - Electrochemical corrosion – different types (Galvanic corrosion – differential aeration corrosion) – mechanism of Chemical and Electrochemical corrosion factors influencing corrosion

Corrosion control – sacrificial anode and impressed cathodic current methods

Protective coatings :

Paints– constituents of the paint and their functions

Metallic coatings – electroplating of Gold and electroless plating of Nickel.

UNIT V.NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES

9

INTRODUCTION :

Nuclear fission and nuclear fusion reactions – differences between nuclear fission and nuclear fusion reactions – nuclear chain

Reactions – nuclear energy critical mass - super critical mass - sub - critical mass Light water nuclear reactor for power generation (block diagram only) – breeder reactor

Solar energy conversion – solar cells – wind energy

Fuel cells – hydrogen – oxygen fuel cell

Batteries :

Primary and secondary Batteries – differences between Primary and secondary Batteries

Secondary batteries :

Lead–acid storage battery –working –uses

Nickel–cadmium battery - working –uses

Solid – state battery : Lithium battery

TOTAL: 45 PERIODS

Text books:

1. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S. Dara “A text book of engineering chemistry” S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, “Engineering Chemistry, Volume 1”, Crystal Publications, Chennai, (2007).

References:

1. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001)
2. B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008)

BBT 101**CELL BIOLOGY****2103****OBJECTIVE**

To provide a basic understanding of cell, its structure, function, types and about its culture

COURSE OUTCOMES:

The Students will be able to

CO1- To understand the fundamentals of the structure of cells

CO2- To study the types and functions of cell organelles

CO3- To comprehend the methods involved in the cellular transport

CO4- To know the cause, and methods of cell signaling

CO5- To Finally to give a basic knowledge of cell culture and its applications

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S										S	
CO2			S		M							
CO3		M		S			S					
CO4				W								
CO5	S	M				S					M	

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I Cell Structure**6**

Cells-definition, Eukaryotic cell and prokaryotic cell – differences and key organelles, Relationship and evolution of Eukaryotic cell and prokaryotic cell, plant cells and animal cells– differences and general structure- Cellular environment, tissues, various types of cell, Extra cellular matrix, cytoskeletal proteins, Cell cycle-Mitosis and meiosis

UNITII Cell Organelles**6**

Cell Organelles and function – Nucleus, Cytoplasm, Endoplasmic reticulum, Golgi complex, lysosomes, cell membranes, chloroplast, mitochondria – structure, importance and function

UNIT III Cellular Transport**6**

Transport across cell membranes – importance, classification – Active and passive, passive transport – movement of water, small lipid across membrane. Active – Na⁺ K⁺ ATPase Pump, Lysosomal and Vacuolar pumps. Cotransport – Symport, antiport – examples, Endocytosis and Exocytosis transport across prokaryotic membrane, entry of viruses and toxins

UNITIV Cell Signaling And Signal Transduction**6**

Cell signaling – process importance, various kinds of Receptors and ligands – Examples, Different modes of action of ligands, Qualification and characterization of receptors, different modes of signal transduction and amplification with examples, signaling through G-Proteins (Monomeric and trimeric), signaling for growth factors, second messengers, protein kinases, Ca ions and cAMP molecule in signaling.

UNIT V Cell Culture**6**

Definition, Media preparation, Propagation of eukaryotic and prokaryotic cell, cell lines, primary cultures, stock cell cultures, maintenance of cell lines in cell culture, explants cultures, differentiation and contamination

TOTAL NO. OF PERIODS: 30**Text books:**

1. P.K. Gupta, “Cell and Molecular Biology”, Rastogi Publication, 2003
2. Molecular Biology of the Cell, Bruce Albert et al., Taylor and Francis, 2002

Reference books:

1. Molecular Biology of the Cell, Baltimore, Damell J., Lodish, H. Baltimore, D., Freeman Publications, 2003
2. The Cell, T. Cooper, John Wiley and Sons, 2005
3. Cytology, Verma and Aggarwal, S. Chand Publications, 2003

BCS 101 FUNDAMENTALS OF COMPUTING AND PROGRAMMING 3 0 0 3**OBJECTIVE:**

To provide a basic understanding of computing

COURSE OUTCOMES

CO1- To enable the student to learn the major components of a computer system.

CO2- To know the correct and efficient way of solving problem.

CO3- To learn to use office automation tools.

CO4- To learn and write program in “C”.

CO5- to learn about C++

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								W				
CO2	S				M							
CO3			M							M		
CO4				W							M	
CO5	S	M				S						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I: Introduction to Computer

9

Introduction-Characteristics of computer-Evolution of Computers-Computer Generations - Classification of Computers-Basic Computer Organization-Number system. Computer Software: Types of Software—System software-Application software-Software Development Steps

UNIT II: Problem Solving and Office Automation

9

Planning the Computer Program – OBJECTIVE – Algorithm – Flowcharts– Pseudo code
Introduction to Office Packages: MS Word , Spread Sheet, Power Point, MS Access, Outlook.

UNIT III: Introduction to C

9

Overview of C-Constants-Variables-Keywords-Data types-Operators and Expressions -
Managing Input and Output statements-Decision making-Branching and Looping statements.

UNIT IV: Arrays and Structures

9

Overview of C-Constants, Variables and Data types-Operators and Expressions -Managing Input and Output operators-Decision making-Branching and Looping.

UNIT V: Introduction to C++

9

Overview of C++ - Applications of C++-Classes and objects-OOPS concepts -Constructor and Destructor- A simple C++ program –Friend classes and Friend Function.

TOTAL NO. OF PERIODS: 45

Text books:

1. Ashok, N.Kamthane,"Computer Programming", Pearson Education (2012).
2. Anita Goel and Ajay Mittal,"Computer Fundamentals and Programming in C", Dorling Kindersley, (India Pvt Ltd),Pearson Education in South Asia,(2011).
3. Yashavant P. Kanetkar, "Let us C",13th Edition,BPB Publications(2013).
4. Yashavant P. Kanetkar,"Let us C++"10th Edition, BPB Publications (2013).

Reference books:

1. Pradeep K.Sinha, Priti Sinha "Foundations of Computing", BPB Publications (2013).
2. Byron Gottfried, "Programming with C", 2nd edition, (Indian Adapted Edition), TMH publication.
3. PradipDey,ManasGhosh,Fundamentals of Computing and Programming in 'C' First Edition ,Oxford University Press(2009).
4. The C++ Programming Language ,4thEdition,BjarneStroustrup,Addison-Wesley Publishing Company(2013)

BBA101/BBA102**PERSONALITY DEVELOPMENT****1 1 0 2****OBJECTIVE:**

- The students should be able to act with confidence, be clear about their own personality, character and future goals.

COURSE OUTCOMES:

- CO1-** To make students understand the concept and components of personality and thereby to apply the acquired knowledge to themselves and mould their personality.
- CO2-** To impart training for positive thinking, this will keep the students in a good stead to face the challenges.
- CO3-** To bring out creativity and other latent talents with proper goal setting so that self- esteem gets enhanced.
- CO4-** To develop an individual style and sharpen the skills in the area of leadership, decision making, time management and conflict management.
- CO5-** To sharpen the employability skills of the professional undergraduate students and aid them in landing in the desired job.

CO/PO Mapping**S – Strong, M – Medium, W – Weak**

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			M									
CO2		S			W							
CO3							M					
CO4			M				S					
CO5		S							M			

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I Introduction to Personality Development

9

The concept personality - Dimensions of personality –Theories of Freud & Erickson- Significance of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analyses.

UNIT II Attitude & Motivation

9

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude - Advantages – Negative attitude - Disadvantages - Ways to develop positive attitude - Difference between personalities having positive and negative attitude. Concept of motivation - Significance - Internal and external motives - Importance of self-motivation- Factors leading to de-motivation

UNIT III Self-esteem

9

Term self-esteem - Symptoms - Advantages - Do's **and Don'ts to develop positive self-esteem** – Low self-esteem - Symptoms - Personality having low self esteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

UNIT IV Other Aspects of Personality Development

9

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader - Character-building -Team-work - Time management -Work ethics –Good manners and etiquette.

UNIT V Employability Quotient

9

Resume building- The art of participating in Group Discussion – Acing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

TOTAL NO. OF PERIODS: 45

Text Books:

1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata Mc Graw Hill.
2. Stephen P. Robbins and Timothy A. Judge(2014), Organizational Behavior 16thEdition:PrenticeHall.

Reference Books:

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.
2. Heller, Robert.Effective leadership. Essential Manager series. Dk Publishing, 2002
3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003
4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
6. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.
7. Smith, B . Body Language. Delhi: Rohan Book Company. 2004

BCE 101**BASIC CIVIL ENGINEERING****2 0 0 2****OBJECTIVE:**

To understand about the basic concepts in civil engineering

COURSE OUTCOMES:

Students shall be able to

CO1- To expose students with the basics of Civil Engineering

CO2- To understand the components of a building

CO3- To Learn Engineering aspects related to dams, water supply, and sewage disposal

CO4- To know about super structure

CO5- To understand about miscellaneous construction

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M					W					S	
CO2				S								
CO3		S			M			M				
CO4												
CO5	M				M						M	

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT- I Civil Engineering Materials**8**

Introduction – Civil Engineering – Materials – Stones – Bricks – Sand – Cement – Plain concrete- Reinforced Cement Concrete – Steel Sections – Timber – Plywood – Paints – Varnishes (simple examples only).

UNIT II Surveying	5
Surveying – objectives – classification – principles of survey-Measurement of distances – Chain survey – Determination of areas – Use of compass – Use of leveling Instrument – (simple examples only)	
UNIT- III Foundation for Building	5
Bearing Capacity of Soil – Foundation – Functions – Requirement of good foundations – Types of foundations – Merits & Demerits	
UNIT- IV Superstructure	7
Stone Masonry – Brick Masonry – Columns – Lintels – Beams – Roofing – Flooring – Plastering – White Washing (Simple examples only)	
UNIT- V Miscellaneous Topics	5
Types of Bridges –Dam- OBJECTIVE – selection of site - Types of Dams – Water Treatment & Supply sources – standards of drinking- distribution system. – Sewage Treatment (simple examples only)	

TOTAL NO. OF PERIODS: 30

Text books:

1. Raju .K.V.B, Ravichandran .P.T, “Basics of Civil Engineering”, Ayyappa Publications, Chennai, 2012.
2. Seetharaman S., “Basic Civil Engineering”, Anuradha Agencies, (1st ed. 2005).
3. Dr.M.S Palanisamy, “Basic Civil Engineering” (3rded. 2000), TUG Publishers, New Delhi/Tata Mc GrawHill Publication Co., New Delhi

Reference books:

1. Rangwala .S.C,” Engineering Material”s, Charotar Publishing House, Anand, 41st Edition: 2014.
2. National Building Code of India, Part V, “Building Materials”, 2005
3. Ramesh Babu “A Textbook on Basic Civil Engineering” (1998). Anuradha Agencies, Kumbakonam.
4. Ramamrutham S., “Basic Civil Engineering”, Dhanpat Rai Publishing Co. (P) Ltd. (1999).

BME 103 BASIC MECHANICAL ENGINEERING 2 0 0 2

OBJECTIVE:

To impart basic knowledge on mechanical engineering required for all branches of engineering students.

COURSE OUTCOMES:

- CO1-** to provide basic knowledge regarding various power plants.
- CO2-** to provide basic knowledge of I.C engines, Refrigeration and Air- Conditioning.
- CO3-** to provide basic Knowledge of basic manufacturing process.
- CO4-** to provide basic knowledge of mechanical design required for engineering.
- CO5-** to know about design softwares

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S				M						
CO2									W			
CO3		M			S							M
CO4	S							M				
CO5				M								

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT-I Energy Resources and Power Generation 6

Renewable and Non-renewable resources- solar, wind, geothermal, steam, nuclear and hydel power plants- Layout, major components and working. Importance of Energy storage, Environmental constraints of power generation using fossil fuels and nuclear energy.

UNIT-II IC Engines 6

Classification, Working principles of petrol and diesel engines- two stroke and four stroke cycles, functions of main components of I.C engine. Alternate fuels and emission control.

UNIT-III Refrigeration and Air-Conditioning System 6

Terminology of Refrigeration and Air-Conditioning, Principle of Vapour Compression & Absorption system-Layout of typical domestic refrigerator- window & Split type room air conditioner.

UNIT-IV Manufacturing Processes 6

Brief description of Mould making and casting process, Metal forming, Classification types of forging, forging operations, Brief description of extrusion, rolling, sheet forging, and drawing. Brief description of welding, brazing and soldering. Principal metal cutting processes and cutting tools, Brief description of Centre lathe and radial drilling machine.

UNIT-V Mechanical Design 6

Mechanical properties of material-Yield strength, ultimate strength, endurance limit etc., Stress-Strain curves of materials. Stresses induced in simple elements. Factor of safety - Design of Shafts and belts. Types of bearings and its applications. Introduction to CAD/CAM/CIM & Mechatronics.

TOTAL NO. OF PERIODS: 30

Text books:

1. T.J.Prabhu et al , “Basic Mechanical Engineering“ , Scitech Publications(p) Ltd, 2000

References :

1. NAGPAL, G.R, “Power plant Engineering”, Khanna Publishers, 2004.
2. RAO.P.N, “Manufacturing Technology”, Tata McGraw-Hill Education, 2000.
3. Kalpakjian, “Manufacturing Engineering and Technology”, Adisso Wesley publishers, 1995.
4. Ganesan. V, “Internal combustion engines”, Tata McGraw-Hill Education, 2000.
5. C.P.Arora, “Refrigeration and Air Conditioning”, Tata McGraw-Hill Education, 2001.
6. V.B.Bhandari, ”Design of Machine elements”, Tata McGraw-Hill Education, 2010.

BCM1L1 BASIC CIVIL & MECHANICAL ENGINEERING PRACTICES
LABORATORY **0 0 2 1**

OBJECTIVE

To provide exposure to the students with hands on experience on various basic Civil & Mechanical Engineering practices.

COURSE OUTCOMES

- CO1-** To provide hands on exercises in common plumbing and carpentry works associated with residential and industrial buildings.
- CO2-** To expose the students regarding pipe connection for pumps & turbines and to study the joint used in roofs, doors, windows and furnitures.
- CO3-** To provide hands on exercise on basic welding, machining and sheet metal works.
- CO4-** To provide exposure regarding smithy, foundry operations and in latest welding operations such as TIG, MIG, CO2, spot welding etc.,
- CO5-** To expose the students regarding the construction and working of centrifugal pump, air-conditioner and lathe.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S		M			M					M	
CO2												
CO3		S		W				M			S	
CO4	M											
CO5			M				W			S		

Course Assessment Methods:

Direct		Indirect
Observation Book	1	Course and Survey
Record Book	2	Faculty Survey
Model Examination	3	Industry
	4	Alumni
End Semester Examinations		

I. CIVIL ENGINEERING PRACTICE**Buildings:**

Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

- Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
- Study of pipe connections requirements for pumps and turbines.
- Preparation of plumbing line sketches for water supply and sewage works.
- Hands-on-exercise: Basic pipe connection of PVC pipes & G.I. Pipes – Mixed pipe material connection – Pipe connections with different joining components.
- Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Hand tools and Power tools:

- Study of the joints in roofs, doors, windows and furniture.
- Hands-on-exercise: Wood work, joints by sawing, planing and cutting.
- Preparation of half joints, Mortise and Tenon joints.

II MECHANICAL ENGINEERING PRACTICE**Welding:**

Preparation of butt joints, lap joints and tee joints by arc welding.

Basic Machining:

- Simple Turning and Taper turning
- Drilling Practice

Sheet Metal Work:

- Forming & Bending:
- Model making – Trays, funnels, etc.
- Different type of joints.
- Preparation of air-conditioning ducts.

Machine assembly practice:

- Assembling, dismantling and Study of centrifugal pump
- Assembling, dismantling and Study of air conditioner
- Assembling, dismantling and Study of lathe.

Moulding:

Moulding operations like mould preparation for gear and step cone pulley etc.,

Fitting:

Fitting Exercises – Preparation of square fitting and vee – fitting models.

Demonstration:

- a) Smithy operations, upsetting, swaging, setting down and bending. Example – Exercise – Production of hexagonal headed bolt.
- b) Gas welding.

TOTAL NO. OF PERIODS: 45**References:**

1. K. Jeyachandran, S. Nararajan & S, Balasubramanian, “A Primer on Engineering Practices Laboratory” , Anuradha Publications, (2007).
2. T.Jeyapooan, M. Saravanapandian & S. Pranitha, “Engineering Practices Lab Manual”, Vikas Publishing House Pvt. Ltd. (2006)
3. H. S. Bawa, “Workshop Practice”, Tata McGraw – Hill Publishing Company Limited, (2007).
4. A. Rajendra Prasad & P. M. M. S Sarma, “Workshop Practice”, Sree Sai Publication, (2002).
5. P. Kannaiah & K.L. Narayana, “Manual on Workshop Practice”, Scitech Publication, (1999).

BPC 1L1**PHYSICS AND CHEMISTRY LABORATORY****00 2/20****OBJECTIVE:**

To give basic knowledge on physics and chemistry experiments

COURSE OUTCOMES:

CO1 - To Know about Ultrasonics and its application in NDT.

CO2 - To know the principle of Laser and its application in Engineering and medicine.

CO3 – Having a deep knowledge about the Principles of electrochemistry.

CO4 – With a true wisdom about Corrosion.

CO5 - Having a sound knowledge in the Field of the Conventional and non-conventional energy.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2			S		M							
CO3		M		S								
CO4	S		M	W								
CO5					W							

Course Assessment Methods:

Direct		Indirect	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Model Examination	3	Industry
4	End Semester Examinations	4	Alumni

I - LIST OF EXPERIMENTS – PHYSICS

1. Determination of particle size using laser
2. Determination of wavelength of laser light
3. Determination of numerical aperture and acceptance angle of an optical fiber
4. Study of photo electric effect
5. Determination of velocity of sound and compressibility of liquid-ultrasonic interferometer
6. Determination of wave lengths of mercury spectrum - spectrometer grating

II - LIST OF EXPERIMENTS – CHEMISTRY

1. Estimation of hardness of Water by EDTA
2. Estimation of Copper in brass by EDTA
3. Determination of DO in **water (Winkler's method)**
4. Estimation of Chloride in Water sample (Argento metry)
5. Estimation of alkalinity of Water sample
6. Determination of molecular weight and degree of polymerization using Viscometer.

BEN 201**ENGLISH II****3 1 0 3****OBJECTIVE**

To make the students learn the basics of communication in order to talk fluently , confidently and vividly.

COURSE OUTCOMES:

To make them master the techniques of professional communication so that they become employable after completing the course

COURSE OUTCOMES

Students will be able

CO1- To make them master the techniques of professional communication

CO2- to know about E-mail communication

CO3- to understand about comparison studies

CO4- to improve presentation skill

CO5- to know about marking the stress Connectives

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M											
CO2			S		M							
CO3		M		S								
CO4				W								
CO5	S	M				S						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I Orientation

12

Numerical adjectives - Meanings in context - Same words used as different parts of speech - Paragraph writing - Non- verbal communication - Regular and Irregular verbs.

UNIT II Oral Skill

12

Listening to audio cassettes - C.Ds , News bulletin - Special Lectures, Discourse - Note taking Sentence patterns - SV, SVO, SVC, SVOC, SVOCA- Giving Instructions- Reading Comprehension- and answering questions. Inferring meaning.

UNIT III Thinking Skill

12

Self- introduction - Describing things- Group Discussion – Debate - Role play – Telephone etiquette – Recommendations and suggestions- Sequencing jumbled sentences to make a paragraph advertisement and notices, designing or drafting posters, writing formal and informal invitations and replies.

UNIT IV Writing Skill

12

Definitions - Compound nouns - Abbreviations and acronyms - business or official letters(for making enquiries, registering complaints, asking for and giving information, placing orders and sending replies): (b) letters to the editor(giving suggestions on an issue) .

UNIT V Formal Information

12

Editing – Prepositions - Articles - Permission letter for undergoing practical training , Essay writing - Application for a job , letter to the principal authorities regarding admissions, other issues, requirement or suitability of course etc.

L=45, T=15 TOTAL NO. OF PERIODS: 60

Text book:

1. Meenakshi Raman, SangeethaSharma , Technical English for Communication: Principle and Practice, OUP, 2009.

Reference books:

1. Sumanth , English for engineers, Vijay Nicole , Imprints pvt ltd.2013.
2. Meenakshi Raman and SangeethaSharma , Technical Communication Principles and Practice, Oxford University Press, 2009.
3. Sangeetha Sharma, Binodmishra , Communication skills for engineers and scientists , PHI Learning Pvt Ltd, New Delhi, 2010.

BMA 201

ENGINEERING MATHEMATICS – II

3 1 0 3

OBJECTIVE:

To impart adequate knowledge of Mathematics to the students so as to formulate problems in engineering environment and solve them using mathematical tools.

COURSE OUTCOMES:

Students shall be able

- CO1-** To solve differential equations, simultaneous linear equations, and some special types of linear equations related to engineering.
- CO2-** To deal with applications in a variety of fields namely fluid flow, heat flow, solid mechanics, electrostatics, etc.
- CO3-** To find intensity of degree of relationship between two variables and also bring out regression equations.
- CO4-** To know the applications integral theorem
- CO5-** To get basic idea about statistics

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M									M		
CO2			S		M			W				
CO3		M		S				W				
CO4				W						M		
CO5	S	M				S				M		M

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I ORDINARY DIFFERENTIAL EQUATION**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.

UNIT II VECTOR CALCULUS**12**

Gradient, divergence and curl - Directional derivatives - Irrational and solenoidal vector fields - vector integration - Green's theorem in a plane, Gauss divergence theorem and Stoke's theorem (without proofs) - simple applications involving cubes and rectangular parallelepipeds.

UNIT III ANALYTIC FUNCTIONS**12**

Functions of a complex variable - Analytic functions - Necessary conditions, Cauchy-Riemann equation and sufficient conditions (without proofs) - Harmonic and orthogonal properties of analytic functions - Harmonic conjugate - construction of analytic functions - conformal mapping : $W = Z+C, CZ, 1/Z$ and bilinear transformation.

UNIT IV COMPLEX INTEGRATION**12**

Complex integration - Statement and application of Cauchy's integral theorem and Cauchy's integral formula - Taylor and Laurent expansions - Singular points - Residues - Residue theorem - Application of Residue theorem to evaluate real integrals - Unit circle and semi-circular contour (excluding poles on boundaries).

UNIT V STATISTICS**12**

Mean, Median, Mode - Moments - Skewness and Kurtosis - correlation - Rank Correlation - Regression - Chi square test - $2 \times 2, m \times n$.

L=45, T=15 TOTAL NO. OF PERIODS: 60**Text book:**

1. Gupta SC, and VK.Kapoor, "Fundamentals Mathematical Statistics", 11th edition, Sultan Chand Sons, New Delhi, 2014.[Unit V]
2. Bali.N.P and Manish Goyal, "Engineering Mathematics", 3rd Edition, Laxmi Publications (p) ltd, 2008.[Units I to IV]

References:

1. Ramana.B.V, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.

- George B. Thomas and Ross L. Finney. "Calculus and Analytical Geometry" 9th Edn. Narosa Indian Student Edition, New Delhi.
- Grewal .B.S "Higher Engineering Mathematics", 40th Edition, Khanna Publications , New Delhi , 2007 .
- Douglas C. Montgomery, George C. Runger and Norma F. Hubele. "Engineering Statistics" 4th Edn. Wiley India Pvt Ltd. New Delhi-2. 2007.

BPH 201

ENGINEERING PHYSICS – II

3 0 0 3

OBJECTIVES

- To make a bridge between the physics in school and engineering courses.
- To expose the students to multiple areas of Science of Engineering materials which have direct relevance to different Engineering applications.

COURSE OUTCOMES

CO1 - To Know about properties and advancements of conducting materials.

CO2 - To Know the principle and properties semiconducting materials.

CO3 - Acquire Knowledge on magnetic and dielectric materials

CO4 – To Know about the creation of new materials with novel properties

CO5 – To Understand the impact of light in technical uses

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M									M		
CO2			S		M			W				
CO3		M		S				W				
CO4				W						M		
CO5	S	M				S				M		M

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I - CONDUCTING MATERIALS

9

Classical Free Electron Theory of Metals- Drawback of Classical Theory – Wiedemann Franz Law- Density of States- Fermi-Dirac Statistics- Calculation of Fermi Energy and Its Importance - High Resistivity Alloys – Super Conductors – Properties and Applications – Magnetic Levitation, SQUID, Cryotron.

UNIT II - SEMICONDUCTING MATERIALS

9

Elemental and Compound Semiconductors and their Properties- Carrier Concentrations (Electrons and Holes) in Intrinsic Semiconductors - Carrier Concentrations in N- Type and P- Type Semiconductors – Variation of Fermi Level with Carrier Concentration and Temperature - Variation of Conductivity with Temperature – Band Gap Determination – Hall Effect – Experimental Arrangement - Application.

UNIT III - MAGNETIC AND DIELECTRIC MATERIALS

9

Different Type of Magnetic Material And Their Properties – Hard And Soft Magnetic Material – Domain Theory Of Ferromagnetism – Hysteresis – Energy Product of Magnetic Materials – Ferrites and Their Applications – Various Polarization Mechanisms In Dielectric – Frequency and Temperature Dependence – Internal Field and Detection of Clausius – Mosotti Equation – Dielectric Loss- Dielectric Breakdown.

UNIT IV - NEW ENGINEERING MATERIAL

9

Shape memory Alloys- Types- General Characteristics- Applications – Metallic Glasses- Properties- Applications – transformer as a Core Material – Nano Phase Materials – Properties – Production – Ball Milling Technique – Sol- Gel Method – Chemical Vapour Deposition - Applications.

UNIT V - OPTICAL MATERIALS & OPTIC FIBERS

9

Light Interaction With Solids- Classification of Optical Material – Optical Properties of Metals, Insulator And Semiconductors – Traps – Colour Centers – Luminescence – phosphorescence – LED – LCD – Construction and Working – Advantages and Disadvantages – Applications. Principle and Propagation of Light In Optical Fibres- Numerical Aperture And Acceptance Angle- Types Optical Fibre(Material, Refractive Index, Mode)- Double Crucible Technique of Fibre Drawing

TOTAL NO.OF PERIODS:45

Text Books

1. Avadhanulu. M.N.; Engineering Physics - II; S.Chand And Company Ltd, 2010.
2. Jeyaraman, D. 'Engineering Physics – II' Global Publishing House, 2014

Reference Books

1. Rajendran V and Marikani a, 'material science' tata mcgraw hill publications Ltd, 3rd edition
2. Mukunthan .A., Usha.S.,; science of engineering materials; SciTech publications (india) Pvt Ltd; chennai, (2007).
3. M.Arumugam, 'material science', anuradha publications, kumbakonam (2006).

OBJECTIVES

- To impart a sound knowledge about the industrial applications of surface chemistry
- To make them understand the industrial importance of Phase rule and alloys
- The lectures are to be given in such a way as to make the students to be well versed with Analytical techniques and their importance
- To impart knowledge to the Students about the Chemistry of engineering materials and
- To make the students to have a deep knowledge of the Chemistry of Fuels and combustion

COURSE OUTCOMES:

CO1 – Having a knowledge of industrial applications of Surface Chemistry

CO2 – Having the thinking of industrial importance of Phase rule and alloys

CO3 – Having a deep knowledge with Analytical techniques and their importance

CO4 – With a true wisdom about Chemistry of Engineering materials

CO5 – Having a well-versed knowledge of the Chemistry of Fuels and Combustion

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M									M		
CO2			S		M							
CO3		M		S								
CO4				W								
CO5	S	M				S						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I - SURFACE CHEMISTRY

9

INTRODUCTION:

Adsorption, absorption, desorption, adsorbent, adsorbate and sorption – (definition only) - Differences between adsorption and absorption. Adsorption of gases on solids – factors affecting

adsorption of gases on solids – Adsorption isotherms – Freundlich adsorption isotherm and Langmuir adsorption isotherm. Role of adsorbents in catalysis (in heterogeneous catalysis , Ion-exchange adsorption and pollution abatement.

UNIT II - PHASE RULE AND ALLOYS

9

INTRODUCTION :

Statement of Phase Rule and explanation of terms involved – one component system – water system – Construction of phase diagram by thermal analysis - Condensed phase rule [Definition only]

Two Component System: Simple eutectic systems (lead-silver system only) – eutectic temperature – eutectic composition – Pattinsons Process of desilverisation of Lead

Alloys :

Importance, ferrous alloys – nichrome and stainless steel – 18/8 stainless steel - heat treatment of steel – annealing –hardening – tempering - normalizing – carburizing - nitriding .

Non- ferrous alloys: Brass and Bronze

UNIT III - ANALYTICAL TECHNIQUES

9

INTRODUCTION:

Types of spectroscopy - Atomic spectroscopy – molecular spectroscopy – Explanation – differences between Atomic spectra – molecular spectra

Absorption spectrum and Emission spectrum

Photo physical laws - Lambert's law - Beer-Lambert's law –applications (determination of unknown concentration)

IR spectroscopy

Principle – instrumentation (block diagram only) – working - finger print region

UV-visible spectroscopy

Principle – instrumentation (block diagram only) – working – estimation of iron by colorimetry Beer-Lambert's law

Flame photometry– principles – instrumentation (block diagram only) – working - estimation of sodium ion by Flame photometry

UNIT IV - FUELS

9

INTRODUCTION :

Calorific value – types of Calorific value - gross calorific value – net calorific value

Analysis of Coal – Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke – manufacture by Otto-Hoffmann method

Petroleum processing and fractions – cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number (definition only)

Synthetic petrol – Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG (definition and composition only)

Flue gas analysis – importance - Orsat apparatus

INTRODUCTION :

Refractories ;

Definition - characteristics - classification – acidic, basic and neutral Refractories – properties - refractoriness- measurement of refractoriness (Segar Cone Test) ,refractoriness under load measurement of refractoriness under load , dimensional stability- reversible and irreversible dimension stability - porosity, thermal spalling – definition – reason for spalling – points to decrease the spalling)

Manufacture of Refractories : alumina bricks and Magnesite bricks,

Lubricants :

Characteristics - Classification - Liquid lubricants - Properties – viscosity index (definition , determination), flash and fire points, cloud and pour points, oiliness)

Solid lubricants – graphite and molybdenum sulphide

TOTAL NO.OF PERIODS: 45**Text books:**

1. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara “A text book of Engineering Chemistry” S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, “Engineering Chemistry, Volume 1”, Crystal Publications, Chennai, (2007).

References:

1. B.K.Sharma “Engineering Chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).

BCS201**INTERNET PROGRAMMING****2 0 0 2****OBJECTIVE**

To get knowledge about internet programming

COURSE OUTCOMES:

CO1- to make the students to understand the concepts of Internet Programming

CO2- To learn about internet related programming

CO3- to get idea about scripting languages

CO4- to learn about web design

CO5- to get knowledge about the applications of internet

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						S				M		
CO2	M		S		M							S
CO3		M		S				W				
CO4				W						M		
CO5	S	M				S				M		

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I Basic Internet Concepts

6

Internet principles-IP addressing-Internet Service Provider (ISP)-URL-Basic web concepts-World Wide Web (WWW)-Intranet and Extranet-Internet Protocols: TTP,TCP,UDP,FTP,Telnet-Domain Name System(DNS)-E mail-Next generation internet.

UNIT II Web Design Basics

6

Introduction to HTML – Structure of HTML Document – Tags-Headings – Links – Images – Lists – Tables – Forms – Frames - Style sheets and its types.

UNIT III Dynamic HTML

6

Introduction to Dynamic HTML-Object model and collections-Event model-Filters and transition-Data binding-Data control-Activex control.

UNIT-IV Client and Server Side Programming

6

VB Script & Java Script:Introduction-Operators –Data type-Control structures-Looping – Classes and Objects – Arrays-Functions-Events-Example programs.

UNIT-V Internet Applications

6

Online database-functions of online database-Merits and Demerits-Internet Information Systems (IIS)-EDI applications in business and its types-Internet commerce-Types and Applications.

Total No. of Periods: 30

Text books:

1. Deitel, Deitel and Nieto, “ Internet and World Wide Web-How to program”, Pearson Education Publishers,5thedition, 2008.
2. Elliotte Rusty Harold , “Java Network Programming”, O’Reilly Publishers,2010
3. JavaScript: A Beginners Guide John Pollock 4th Edition, TMH Edition(2013)
4. VB Script Beginners Guide, JyotiB.Giramkar,Create Space Independent Publishing(2014)

Reference Books:

1. R.Krishnamoorthy& S.Prabhu, “ Internet and Java Programming”, New Age International Publishers, 2010.
2. ThomnoA.Powell, ”The Complete Reference HTML and XHTML”, fourth edition, Tata McGraw Hill, 2012.
3. E Commerce KamleshK.Bajaj, DebjaniNag, TataMcGrawHill, Second edition,2010

BBT 201**PRINCIPLES OF GENETICS****2 0 0 2****OBJECTIVE**

To provide a fundamental knowledge on genetics, its laws, genes and chromosomes, inheritance, heredity, causes of genetic disorders and the methods of gene transfer.

COURSE OUTCOMES:

The Students will be able to

CO1- To understand the fundamentals of genetics and the Mendelian laws

CO2- To differentiate between the structure and organization of chromosomes in prokaryotes and eukaryotes

CO3- To understand the concept of alleles in blood grouping and sex determination

CO4- To know the concept of linkage and crossing over of genes

CO5- To get a basic knowledge of the methods of gene transfer

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M					M				M		
CO2			S									
CO3		S						W				
CO4				M						M		
CO5	S	M				S				M		M

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey

3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I BASICS OF GENETICS

6

Classical genetics, Mendelian Laws- Mendel's experiment-mono hybrid cross-phenotype, genotype, Dihybrid inheritance, Interaction of genes, Fine structure of Genes

UNIT II CHROMOSOMES

6

Chromosome structure and organization in prokaryotes and eukaryotes, unusual chromosomes-chromosome banding, chromosome abnormalities- genetic disorders

UNIT III ALLELES

6

Classical concepts of Pleomorphism, Multiple alleles, ABO blood groups, Rh factor, sex linkage in Drosophila, linkage in human beings, mechanism of sex determination, XX-XY mechanisms of sex determination, sex determination in Drosophila, environmental factors and sex determination, sex differentiation.

UNIT IV CROSSING OVER

6

Coupling and Repulsion-Hypothesis, Test cross in maize and crossing over, theory of crossing over, molecular mechanism of crossing over, sex chromosomes and sex linked inherited disorders, colour blindness, hemophilia, Muscular dystrophy.

UNIT V GENE TRANSFER

6

Transformation, Transduction, Conjugation, Plasmids and Episomes

TOTAL NO. OF PERIODS: 30

Text Books:

1. Principles of Genetics, Gardner, Simmons and Snustad, John Wiley and Sons (Asia), 2002
2. Genes VIII, Lewin, International Edition, Prentice Hall, 2004

Reference Books:

1. Instant Notes in Genetics, P.C. Winter, G.I. Hickey and H.L. Fletcher, Viva Books Private Limited, 2003

BEE201 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING 2 0 0 2

OBJECTIVE:

To get basic knowledge about electrical and electronics engineering

COURSE OUTCOMES:

CO1- to know about basics about circuits

CO2- to get idea about electrical machines and its working principle

CO3- to understand about measurement systems

CO4- to know about semi conductor devices

CO5- to get knowledge about digital electronics

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M									M		
CO2			S		M			W				
CO3		M		S				W				
CO4				W						M		
CO5	S	M				S				M		M

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT – I D.C. AND A.C CIRCUITS

6

Ohm's law – Kirchoff's Laws, V – I Relationship of Resistor (R) Inductor (L) and capacitor (C). Series parallel combination of R, L&C – Current and voltage source transformation – mesh current & node voltage method –superposition theorem – Thevenin's and Norton's Theorem - Problems.

UNIT – II ELECTRICAL MACHINES

6

Construction, principle of operation, Basic Equations and applications - D.C.Generators and D.C.Motors. -Single phase Induction Motor - Single Phase Transformer.

UNIT – III BASIC MEASUREMENT SYSTEMS

6

Introduction to Measurement Systems, Construction and Operating principles of PMMC, Moving Iron, Dynamometer Wattmeter, power measurement by three-watt meter and two watt method – and Energy meter.

UNIT IV – SEMICONDUCTOR DEVICES

6

Basic Concepts of semiconductor devices – PN Junction Diode Characteristics and its Application – HWR, FWR – Zener Diode – BJT (CB, CE, CC) configuration & its characteristics.

UNIT V – DIGITAL ELECTRONICS

6

Number system – Logic Gates – Boolean Algebra – De-Morgan's Theorem – Half Adder & Full Adder – Flip Flops.

TOTAL NO. OF PERIODS: 30

Text books:

1. N.Mittle “Basic Electrical Engineering”. Tata McGraw Hill Edition, New Delhi, 1990.
2. A.K. Sawhney, ‘A Course in Electrical & Electronic Measurements & Instrumentation Dhanpat Rai and Co, 2004.
3. Jacob Millman and Christos C-Halkias, “Electronic Devices and Circuits”, Tata McGraw Hill

Reference books:

1. Edminister J.A. “Theory and problems of Electric Circuits” Schaum’s Outline Series. McGrawHill Book Compay, 2nd Edition, 1983
2. Hyatt W.H and Kemmerley J.E. “Engineering Circuit Analysis”, McGraw Hill Internatinal Editions, 1993.
3. D. P. Kothari and I. J. Nagrath“ Electric machines”Tata McGraw-Hill Education, 2004
4. Millman and Halkias, “Integrated Electronics”, Tata McGraw Hill Edition,2004.

BCS 2L1**INTERNET PRACTICE****0 0 2 1****OBJECTIVE**

To get knowledge about internet programming

COURSE OUTCOMES:**CO1-** to make the students to understand the concepts of Internet Programming**CO2-** To learn about internet related programming**CO3-** to get idea about scripting languages**CO4-** to learn about web design**CO5-** to get knowledge about the applications of internet**CO/PO Mapping****S – Strong, M – Medium, W – Weak**

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2			S		M							
CO3		M		S								
CO4	S		M	W								
CO5					W							

Course Assessment Methods:

Direct		Indirect	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Model Examination	3	Industry
4	End Semester Examinations	4	Alumni

LIST OF EXERCISES

1. HTML (Hypertext Mark-up Language):

Basics of HTML.

How to create HTML Document

Steps for creating a simple HTML Program.

- a) Favorite Personality
- b) Resume Preparation

2. Advanced HTML:

Advanced Topics of HTML

- a) Time Table
- b) Table Creation

3. JavaScript:

Script Basics.

Incorporating JavaScript into Web page.

- a) Star Triangle
- b) Temperature Converters

4. VBScript:

VBScript Basics.

Incorporating VBScript into HTML.

- a) Changing Background Color
- b) Simple Calculator

5. Web Design:

Inserting External Media in the Web Page.

- a) Forms and Links
- b) Frames with Links and Lists

To export a Dream weaver Document as XML File, checking entries, working in frames, windows control, the java script URL.

BCS 2L2

COMPUTER PRACTICE LABORATORY I

0 0 2 1

OBJECTIVE:

To get knowledge about computer practices

COURSE OUTCOMES:

CO1- to know about word processing

CO2- to know about spread sheet

CO3- to get idea about C programming

CO4- to get knowledge on C++ programmes

CO5- to know the fundamentals of computer programme

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M						S					
CO2			S		M							
CO3				S								
CO4	S		M									
CO5		S			W							

Course Assessment Methods:

Direct		Indirect	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Model Examination	3	Industry
4	End Semester Examinations	4	Alumni

LIST OF EXERCISES

A) Word Processing

11

Document creation, Text manipulation with Scientific Notations.
Table creation, Table formatting and Conversion.
Mail merge and Letter Preparation.
Drawing-Flow Chart

B) Spread Sheet

12

Chart – Line, XY, Bar and Pie
Formula – Formula Editor
Spread Sheet-Inclusion of Object , Picture and Graphics, Protecting the document and sheet
Sorting and Import / Export features.

C) Simple C Programming *

11

Data types, Expression Evaluation, Condition Statements.
Arrays
Structures and Unions
Functions

D) Simple C++ Programming

11

Classes and Objects
Constructor and Destructor

*For Programming exercises Flow chart and Pseudo code are essential.

TOTAL NO. OF PERIODS: 45

**BEE2L1 BASIC ELECTRICAL AND ELECTRONICS ENGINEERING PRACTICES
LAB**

002/21

OBJECTIVE:

To get basic knowledge about electrical and electronics engineering lab practices

COURSE OUTCOMES:

CO1- to know about basics about circuits

CO2- to get idea about electrical machines and its working principle

CO3- to understand about measurement systems

CO4- to know about semi conductor devices

CO5- to get knowledge about digital electronics

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						S						
CO2			S		M							
CO3		M		S								
CO4	S		M									
CO5		M			W							

Course Assessment Methods:

Direct		Indirect	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Model Examination	3	Industry
4	End Semester Examinations	4	Alumni

I - List of Experiments for Electrical Engineering Lab

1. Fluorescent lamp wiring
2. Stair case wiring
3. Measurement of electrical quantities-voltage current, power & power factor in RLC circuit
4. Residential house wiring using fuse, switch, indicator, lamp and energy meter
5. Measurement of energy using single phase energy meter
6. Measurement of resistance to earth of electrical equipment

I - List of Experiments for Electronics Engineering Lab

1. Study of electronic components and equipments.
 - A. Resistor colour coding using digital multi-meter.
 - B. Assembling electronic components on bread board.
2. Measurement of ac signal parameters using cathode ray oscilloscope and function

generator.

3. Soldering and desoldering practice.
4. Verification of logic gates (OR, AND, OR, NOT, NAND, EX-OR).
5. Implementation of half adder circuit using logic gates.

TOTAL NO. OF PERIODS: 45

BPC 2L1 PHYSICS AND CHEMISTRY LABORATORY

00 2/2 1

OBJECTIVE:

To give basic knowledge on physics and chemistry experiments

COURSE OUTCOMES:

CO1 - To Know about Ultrasonics and its application in NDT.

CO2 - To Know the principle of Laser and its application in Engineering and medicine.

CO3 – Having a deep knowledge about the Principles of electrochemistry

CO4 – With a true wisdom about Corrosion

CO5 - Having a sound knowledge in the Field of the Conventional and non-conventional energy.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2			S		M					S		
CO3		M		S								
CO4	S		M	W				M				
CO5					W							

Course Assessment Methods:

Direct		Indirect	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Model Examination	3	Industry
4	End Semester Examinations	4	Alumni

I- LIST OF EXPERIMENTS – PHYSICS

1. Determination of resistivity of high resistance alloys and temperature coefficient
2. Study of Hall effect – Hall coefficient determination
3. Determination of electrical conductivity of good conductors
4. Study of magnetic hysteresis and energy product

5. Determination of Band gap of a semiconductor
6. Determination of Dispersive power of a prism – Spectrometer

II - LIST OF EXPERIMENTS – CHEMISTRY

1. Conducto metric titration (Simple acid base)
2. Conducto metric titration (Mixture of weak and strong acids)
3. Conducto metric titration using BaCl_2 vs Na_2SO_4
4. Potentiometric Titration (Fe^{2+} / KMnO_4 or $\text{K}_2\text{Cr}_2\text{O}_7$)
5. PH titration (acid & base)
6. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
7. Estimation of Ferric iron by spectrophotometer.

BGE 301

ENZYME TECHNOLOGY

3104

OBJECTIVES:

1. To understand the basics of enzymes and classification and enzyme kinetics
2. To study the production, purification and characterization of enzymes
3. To study the Instrumental Techniques In Enzymatic Analysis

COURSE OUTCOMES :

- CO1** Understand the basics of enzymes, nomenclature and classification
CO2 Apply the knowledge to derive the kinetics for enzymes
CO3 Learn and apply the different techniques for immobilization of enzymes and kinetics
CO4 Study and apply the knowledge on design of enzyme reactors
CO5 Discuss the applications of enzymes in Instrumental Techniques In Enzymatic Analysis

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

COURSE ASSESSMENT METHODS:

DIRECT		INDIRECT	
1	Internal Tests	1	Course Exit Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I – INTRODUCTION**12**

Structure and functions of Enzymes. Classification of enzymes. Specificity of enzyme action – monomeric and oligomeric enzymes,-Factors modifying enzyme activity, biotechnological applications of enzymes and applications of enzymes in various industries.

UNIT II – CHEMICAL NATURE OF ENZYME CATALYSTS**12**

Structural Components of Enzymes – Structure, apoenzymes, prosthetic group, cofactors, Mechanisms of reactions catalysed by enzymes – Metal activated enzymes – metalloenzymes – involvement of coenzymes.

UNIT III – FREE AND IMMOBILISED ENZYME KINETICS**12**

Classification of enzymes, Kinetics of single substrate reactions, turnover number, Enzyme Inhibition, presteady state kinetics, Kinetics of multi-substrate reactions, Allosteric enzymes – The Monad – Changeux – Wymanmodel (MCW) and The Koshland – Nemethy – Filmer (KNF) model, Temperature and pH effects on enzyme activity. Methods of immobilization of enzymes, Kinetics of immobilized enzymes – Effects of external mass transfer and intra – particle diffusion.

UNIT IV – EXTRACTION AND PURIFICATION OF ENZYMES**12**

Methods of production of enzymes, Extraction of Enzymes –soluble enzymes – membrane bound enzymes –Nature of extraction medium – purification of enzyme – criteria of purity – Determination of molecular weight of enzymes.

UNIT V – INSTRUMENTAL TECHNIQUES IN ENZYMATIC ANALYSIS**12**

Principles – Manometry – Spectrophotometry – Spectrofluorimetry – Electrochemical methods – Enthalpimetry– Radio chemical methods – Automation in enzymatic analysis.

Total Periods: 60**REFERENCE BOOKS**

1. Principles of Fermentation technology – Stanbury, 2nd edition, 2003
2. Enzyme technology by Martin F. Chaplin, C. Bucke
3. Methods in Enzymology vol. 152 by S.L. Berger and A.R. Kimmel

TEXT BOOKS

1. *Enzymes* by Trevor palmer
2. *Enzymes* by Robert A. Copeland, 2nd edition.

OBJECTIVES:

1. To learn various types of vector-host systems and steps in creating a recombinant DNA molecule
2. To gain knowledge on various recombinant DNA techniques and their applications.

COURSE OUTCOMES :

CO1 : Understand the steps in Biopharmaceutical industries

CO2 : Explain the features of Transformation and selection of recombinants

CO3 : characterization of recombinant proteins

CO4 : Chromosome engineering, Gene Therapy, Strategies of gene delivery, gene replacement/ augmentation

CO5 : Role of Genetic Engineering in Forensic Medicine

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

COURSE ASSESSMENT METHODS:

DIRECT		INDIRECT	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT-I SCOPE OF GENETIC ENGINEERING**12**

Basics of Genetic Engineering. Milestones in Genetic Engineering, Biosafety issues – Genetic engineering guidelines. Molecular Tools in Genetic Engineering – Medical Genetics, Gene Therapy, Human Genome Project, Plant Genetic Engineering. Applications of Genetic Engineering in Biopharmaceutical industries. Recombinant DNA technology. Restriction mapping of DNA fragments and Map construction, Nucleic acid Amplification (PCR analysis) and its applications. Real time PCR.

UNIT-II GENE CLONING STRATEGIES**12**

Restriction enzymes and DNA Modifying enzymes (Polymerases, Reverse Transcriptase, Ligases, Alkaline phosphatase, Terminal deoxynucleotide transferases, Nucleases - S1 nucleases

etc.). Gene Cloning vectors (Plasmids, bacteriophages, cosmids, phagemids, Artificial chromosomes), Gene Cloning strategies, Transformation and selection of recombinants; Construction of DNA libraries (Genomic library and cDNA library preparations –mRNA enrichment, reverse transcription, use of linkers and adaptors); and their screening; Alternative strategies of Gene cloning; Cloning of differentially expressed genes. Site directed Mutagenesis and Protein Engineering.

UNIT-III GENE EXPRESSION

12

Basics of Gene expression – hybridization techniques, Northern blot analysis, Primer extension, S1 mapping, RNAase protection assays, Reporter assays), Nucleic acid microarrays. Gene expression in bacteria and Yeast, expression in insects and insect cells, expression in mammalian cells, expression in plants – characterization of recombinant proteins, stabilization of proteins; Phage display, Yeast Two- and three Hybrid system.

UNIT-IV TRANSGENIC TECHNOLOGY

12

Principles of Transgene Technology. Scope of Transgenetic Technology . Gene tagging (T-DNA tagging and Transposon tagging) in gene analysis (identification and isolation of gene), Transgenic and Gene Knockouts Technologies - Targeted gene replacement, Chromosome engineering, Gene Therapy, Strategies of gene delivery, gene replacement/ augmentation, gene correction, gene editing and silencing, Transgenic plants.

UNIT- V GENONIMCS AND FORENSICS

12

Role of Genetic Engineering in Forensic Medicine. Nucleic acid sequencing, Structure and functions of Enzymes.NGS, Genetic defects and detection; DNA profiling.

Total Periods: 60

TEXT BOOKS:

1. Gene Cloning and DNA Analysis, An Introduction. T.A.Brown, Wiley –Blackwell publication, 2010.
2. Principles of Gene Manipulation and Genomics, Sandy B. Primrose, Richard M. Twyman, Blackwell Scientific Publication, 2009

REFERENCE BOOKS:

1. Molecular and Cellular Methods in Biology and Medicine, P.B. Kaufman, W. Wu. D. Kim and L.J; Cseke, CRC Press, Florida.
2. Molecular Cloning: a Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.
3. DNA Cloning: a Practical Approach, .M. Glover and B.D. Hames, IRL Press, Oxford.
4. Methods in Enzymology vol. 152, Guide to Molecular Cloning Techniques, S.L. Berger and A.R. Kimmel, Academic Press, Inc. San Diego.
5. Methods in Enzymology Vol 185, Gene Expression Technology, D.V. Goeddel, Academic Press, Inc., San Diego.

OBJECTIVES:

- 1.To learn about the general concepts of immune system and immune organs
2. To understand the properties of antigens and antibodies and the concept of antigen-antibody interactions
- 3.To know about the mechanisms related to cell mediated immunity, complement system, hypersensitivity and transplantation immunology.

COURSE OUTCOMES :

- CO1 :** Outline the general concepts of immune system and describe the cells and organs of the immune system
- CO2 :** Basic structures of Immunoglobulins – Ig classes and biological activities,
- CO3 :** Antibody Affinity and activity – Antibody specificity - Precipitation reactions
- CO4 :** Explain the concept of Structure and functions of T and B lymphocytes
- CO5 :** Illustrate the Basics of Immune disorders and inflammation.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

COURSE ASSESSMENT METHODS:

DIRECT		INDIRECT	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - OVERVIEW OF THE IMMUNE SYSTEM**9**

Types of Immune responses. Innate Immunity, adaptive immunity, comparative immunity cells and organs of the immune system – Antigens. Cellular immunity.HLA antigens, MHC antigens

UNIT II -IMMUNOGLOBULIN STRUCTURE AND FUNCTIONS 9

Basic structures of Immunoglobulins – Ig classes and biological activities, Antigenic determinants on Ig, Plasma cells and B Cell receptors, Monoclonal antibodies – cytokines – complement system.

UNIT III -ANTIGEN – ANTIBODY INTERACTIONS 9

Antibody Affinity and activity – Antibody specificity - Precipitation reactions- agglutination reactions-Immunological network, Immunological techniques, Radio immunoassay- ELISA Western blotting, Immunoprecipitation, Immunofluorescence, immunoelectron microscopes, Flow cytometers-MHC Antigen processing & presentations.

UNIT IV -T & B CELL MATURATION, ACTIVATION & DIFFERENTIATION 9

Structure and functions of T and B lymphocytes. Bone marrow and Hematopoietic stem cells. T Cell receptor, T Cell maturation, Dendritic cells, Lymphocyte activation and differentiation of B cells, activation and differentiation of cell mediated immune responses.

UNIT V-IMMUNE SYSTEM IN HEALTH & DISEASE 9

Basics of Immune disorders and inflammation, hypersensitive reactions, immune responses to infectious diseases, vaccines. Cancer immunology. Immunoinformatics, Clinical Immunology, Immunological databases.

Total Periods: 45

TEXT BOOK:

- 1.Kuby Immunology by Richard A. Golds by Tharmas J. kindt fourth edition 2000 and Barbara Osborne.W.H.freeman and company
2. Text of Microbiology – Tortora , 10th edition

REFERENCE BOOKS

1. Roitt, Ivan. Essential Immunology, 9thed., Blackwell Scientific, 1997
2. Roitt I., Brostoff J. and Male D. Immunology, 6thed. Mosby, 2001
3. Goldsby , R.A., Kindt, T.J., Osborne, B.A. and Kerby J. Immunology, 5thed., W.H.Freeman, 2003
4. Weir, D.M. and Stewart, J. Immunology, 8thed., Cheerchill, Linvstone, 1997

BGE305 PRINCIPLES OF BIOCHEMISTRY 3 1 0 4

OBJECTIVES:

To be able to employ biochemical and Biomolecules, structure of water & its importance.

COURSE OUTCOMES :

CO1 : Understand Classification, structure & properties of carbohydrates

CO2 : Identify synthetic strategies Classification of Enzymes, Chemical nature, Active Site, Specificity of Enzyme catalyzed reactions

CO3 : Identify the role of enzymes in organic synthesis

CO4 : Understand the Hormones as chemical messengers: General assay of hormones – Bio assay, chemical assay & immuno assays.

CO5 : Explain importance and influence of metal ions on protein function

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

COURSE ASSESSMENT METHODS

DIRECT		INDIRECT	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I

12

Introduction to biochemistry – Biomolecules, structure of water & its importance – Important noncovalent forces – Hydrogen bonds, electrostatic, hydrophobic & Vanderwaals forces – Acid, base & buffers – pH, Henderson Hasselbalch equation. Biological buffers and their significance – Principle of viscosity – surface tension, adsorption, diffusion, osmosis & their applications in biological systems.

UNIT II

12

Classification, structure & properties of carbohydrates – mono, di, oligo & polysaccharides. Classification, structure & properties of amino acids & proteins. Classification, structure & properties of Lipids – Simple lipids, Phospholipids, glycolipids & steroids. Transport of lipids: Lipoproteins Structure & functions of nucleic acids – Nucleosides, nucleotides – Cyclic AMP, cyclic GMP, ATP, GTP – DNA & RNA

UNIT III

12

Classification of Enzymes, Chemical nature, Active Site, Specificity of Enzyme catalyzed reactions, Regulation: Feedback, Allosteric, Covalent modification, Hormonal regulation, co-enzymes. Assay of enzymes, enzymes in clinical diagnosis of diseases.

Introduction to Metabolism: Carbohydrate metabolism, Glycolysis Lipid metabolism: fatty acid, beta oxidation, ketogenesis and cholesterol metabolism. TCA cycle: Structure of biological membranes, electron transport & Oxidative phosphorylation.

UNIT IV

12

Liver function and liver function tests, Kidney function and kidney function tests, normal & abnormal constituents of urine and their clinical significance. General characteristics of hormones. Structure, functions & disorders of thyroid, parathyroid, pituitary, adrenal and pancreatic hormones. Hormones as chemical messengers: General assay of hormones – Bio assay, chemical assay & immuno assays.

UNIT V

12

Analytical techniques: Principle and applications of electrophoresis – PAGE, SDS PAGE, Isoelectric focusing, Two Dimensional Electrophoresis. Chromatography: Principle of adsorption & partition chromatography, Size exclusion, Ion exchange & affinity chromatography. Spectro photometry, fluorimetry, flame photometry, manometry, microcalorimetry, electrochemical methods, biosensors, automation in clinical laboratory, use of radio isotopes in biochemistry.

Total Periods: 60

TEXT BOOKS :

1. Harper's review of biochemistry By David.W.Martin, Peter.A.Mayes, Victor.W.Rodwell. LANGE medical publications.
2. Practical Biochemistry – Principles & Techniques By Keith Wilson & John Walker. Oxford university press.

REFERENCE BOOKS :

1. Understanding Enzymes By Trevor palmer. Published by Ellis Horwood LTD.
2. Biochemistry Lippincott's Illustrated Reviews By Pamela.C.Champe & Richard.A.Harvey. Lippincott-Raven publishers.

BMA 302

BIO-STATISTICS

3 1 0 4

OBJECTIVES:

To be able to employ for numerical problems

COURSE OUTCOMES:

CO1 : To Biostatistics and Basics of BioStatistics. Applications of Biostatistics

CO2 : Identify synthetic strategies Probability concepts – conditional probability – Baye's theorem

CO3 : Introduction – Large sample tests based on normal distribution

CO4 : Understand the ANOVA– one –way classification, Two-way classification.

CO5: Understand the Statistical Quality Control.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

COURSE ASSESSMENT METHODS

DIRECT				INDIRECT			
1	Internal Tests			1	Course and Survey		
2	Assignments			2	Faculty Survey		
3	Seminar			3	Industry		
4	Online test			4	Alumni		
5	Quiz						
6	End Semester Examinations						

UNIT I - INTRODUCTION TO BIO-STATISTICS (numerical problems only) 12

Introduction to Biostatistics and Basics of BioStatistics. Applications of Biostatistics. Handling univariate and bivariate data – Measures of central tendency – Measures of dispersion – Skewness&Kurtosis – Correlation and Regression .

UNIT II - PROBABILITY & THEORETICAL DISTRIBUTIONS 12

Probability concepts – conditional probability – Baye’s theorem – one – dimensional random variables –expectation, variance, moments.Theoretical distributions : Binomial, Poisson, Normal (Problems only).

UNIT III - TESTING OF HYPOTHESIS 12

Introduction – Large sample tests based on normal distribution - Test for single mean, difference between means, proportion, difference between p roportion, standard deviation, difference between standard deviation.Chi-square test for goodness of fit, independence of attributes.

UNIT IV - ANALYSIS OF VARIANCE 12

Small sample tests based on T and F distribution - Test for, single mean, difference between means, Paired t-test,test for equality of variances. ANOVA– one –way classification, Two-way classification.

UNIT V- STATISTICAL QUALITY CONTROL

12

Introduction – Process control – control charts for variables - X and R, X and s charts control charts for attributes : p chart, np chart, c chart.

Total Periods: 60

TEXT BOOKS

1. S.C.Gupta&V.K.Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi ,2003.
2. Kapur J.N. And Saxena H.C. 'Mathematical Statistics'. S. Chand and Co., New Delhi 2004.
3. Veerarajan T. “Probability Statistics and Random Process” Tata McGraw Hill, New Delhi 2003.
4. S.C. Gupta and V.K. Kapoor, “Applied Statistics”. S. Chand and Sons, New Delhi 2004.
5. W.W. Daniel, “Biostatistics-A foundation for analysis of health sciences”, John Wiley and Sons, New Delhi 2000.

REFERENCE BOOKS:

1. Biostatistics, second edition: A Guide to Design, Analysis and Discovery by Ronald N. Forthofer, Fun Sel Lee, and Mike Hernandez (Hardcover-Dec 28,2006)
2. Biostatistics: Principles and Practice by B. Antonisamy Solomom Christopher, Prasanna Samuelson 1st edition Pub Date 14 Sep 09.
3. PN.Arora and S. Arora, 'Statistics for Management', S.Chand and sons, New Delhi 2003

BGE 3L1

MICROBIOLOGY LABORATORY

0 0 4 2

OBJECTIVE(S):

1. Understand explicitly the concepts
2. Develop their skills in the preparation, identification and quantification of microorganisms

COURSE OUTCOMES :

CO1 : Understand and demonstrate the working principles, procedures of microbiology Lab experiments and equipments

CO2 : Observe and practice different types of culture media and broth for microbial cultivation

CO3 : Differentiate microbes using different staining methods

CO4 : Estimate and evaluate the microbial screening, identification and characterization

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12

CO1	S											
CO2		W	S		M		M					
CO3		M		S			M		S			
CO4	S		M	W								

COURSE ASSESSMENT METHODS

DIRECT				INDIRECT			
1	Internal Tests	1	Course and Survey				
2	Assignments	2	Faculty Survey				
3	Seminar	3	Industry				
4	Online test	4	Alumni				
5	Quiz						
6	End Semester Examinations						

LIST OF EXPERIMENTS

1. Sterilization techniques
2. Media preparation
3. Preparation of nutrient broth
4. Preparation of nutrient agar media
5. Staining Techniques (Simple, Gram staining, spore staining)
6. Pure culture techniques (a) streak plate method (b) pour plate method
(c) spread plate method
7. Acid fast technique
8. Antibiotic Assay - Antimicrobial Sensitivity Test (Disc Diffusion Method)
9. Biochemical Characterization of Bacteria
 - i)Oxidation/Fermentation Test
 - ii)Catalase, Oxidase and Urease Tests
10. Lethal effect of bacteria
11. Motility test by hanging drop method

TEXT BOOK

1. Microbiology Bio 204 Laboratory Manual
2. Laboratory Manual in general Microbiology (1916)
3. Microbiology Bio1 2421L Laboratory Manual (Donna Cain, Hershell Hanks, Mary Weis, Carroll Bottoms, and Jonathan Lawson)
4. Basic Practical Microbiology (John Grainger)

OBJECTIVES

1. Provides an opportunity to experimentally verify the theoretical concepts already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner.
2. Understand explicitly the concepts
3. Develop their skills in the preparation, qualitative and quantitative analysis.

COURSE OUTCOMES :

CO1. Determination of saponification number of lipids.

CO2. Estimation of Amino acids.

CO3. Separation of amino acids - Thin layer chromatography.

CO4. Separation of sugars - Paper chromatography

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

COURSE ASSESSMENT METHODS

DIRECT		INDIRECT	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

LIST OF EXPERIMENTS

1. pH measurements and preparation of buffers.
2. Qualitative tests for Carbohydrates.
3. Estimation of sugars.
4. Estimation of proteins by Lowry's method / Biuret method.
5. Estimation of cholesterol by Zak's method.
6. Determination of saponification number of lipids.
7. Estimation of Amino acids.

8. Separation of amino acids - Thin layer chromatography.
9. Separation of sugars - Paper chromatography
10. Biochemical estimation of DNA /RNA using Spectrophotometer

TEXT BOOK

1. Biochemistry Laboratory Manual - Mark Brandt, Ph.D. 3rd edition , 2002
2. Biochemistry Laboratory Manual – Dr. Dennis Welsh, 2013
3. Biochemistry Laboratory Manual Che 4350. Andrew J. Bonham, Ph.D, 2013

BGE 401

RECOMBINANT DNA TECHNOLOGY

3 1 0 4

OBJECTIVES:

1. To learn various types of vector-host systems and steps in creating a recombinant DNA molecule
2. To gain knowledge on various recombinant DNA techniques and their applications.

COURSE OUTCOMES :

CO1 : Understand the steps in recombinant DNA/RNA modifying enzymes

CO2 : Explain the features of various types of gene cloning vectors

CO3 : Strategies for cloning PCR products

CO4 : construction subtractive cDNA library

CO5 : Plasmid expression vectors-general features, promoters used in expression vectors

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

COURSE ASSESSMENT METHODS:

DIRECT		INDIRECT	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - MOLECULAR TOOLS FOR GENE CLONING

12

Restriction enzymes- Dam, Dcm and CpG methylation sensitivity of restriction enzymes-star activity of restriction enzymes. modifying enzymes, DNA and RNA polymerases, reverse transcriptase, terminal transferase, DNA/RNA modifying enzymes-methylases-CpGmethylase (M.Sss I), dam methylase, M.EcoR I. Ligases – Ecoli DNA ligase, T4 DNA ligase, T4 RNA ligase. RNases-RNaseI, RNaseA, RNaseH - Nucleases – RNase free DNase-Exonuclease I, Exonucelase III, Mung Bean Nuclease. Kinases - T4 polynucleotide kinase. Phosphatases-Topoisomerase.

UNIT II - VECTORS FOR GENE CLONING

12

Introduction to cloning vectors, plasmid vectors (high copy and low copy), phage vectors, cosmid vectors, phasmid vectors, BAC vectors and YAC vectors

UNIT III - CLONING TECHNIQUES

12

Cloning after restriction digestion - blunt and cohesive end ligation – creation of restriction sites by PCR- cloning using linkers and adapters - cloning after homopolymer tailing. Strategies for cloning PCR products – TA cloning -TOPO-TA cloning-TOPO-Blunt cloning-cloning blunt end PCR product using SfrI restriction enzyme and T4 DNA ligase (PCR-Script Amp Cloning Kit from Stratagene).

UNIT IV - CONSTRUCTION OF GENE LIBRARIES

12

Construction of cDNA library- construction subtractive cDNA library – construction of genomic DNA library – BAC library – YAC library

UNIT V - EXPRESSION OF RECOMBINANT PROTEIN IN E.COLI

12

Plasmid expression vectors-general features, promoters used in expression vectors -cloning of genes in correct reading frame in expression vector- purification of recombinant protein using Histidine tag, GST tag, chitin binding domain and intein. Codon use in different organisms-codon usage database-codon optimization to increase the expression of recombinant protein.

Total Periods: 60

TEXT BOOKS:

1. Principles of gene manipulation by Old and Primrose
2. Molecular Cloning – A Laboratory Manual by Sambrook and Russell

REFERENCE BOOKS

1. Molecular and Cellular Methods in Biology and Medicine, P.B. Kaufman, W. Wu. D. Kim and L.J; Cseke, CRC Press, Florida.
2. Molecular Cloning: a Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.

OBJECTIVE(S):

1. To understand cellular organization, transport of molecules cell interactions and signaling
2. To describe DNA replication, gene expression at transcriptional and translational level gene regulation and DNA repair mechanisms

COURSE OUTCOMES :

CO1 : Scope and History. Structure of DNA-Nucleoside,.

CO2 : Types and functions of DNA polymerases in Prokaryote and Eukaryote. Replication in prokaryote and Eukaryote.

CO3 : Fine structure of prokaryotic and eukaryotic gene, structure and function of the promoters in mRNA, rRNA,tRNAgenes

CO4 : Genetic code and Wobble hypothesis.Translation in prokaryote and eukaryote

CO5 : Understand the Principles of gene regulation- Transcriptional and post transcriptional gene regulation-activators, co-activators, suppressors, co-suppressors, moderators, silencers, insulators, enhancers

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

COURSE ASSESSMENT METHODS:

DIRECT		INDIRECT	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - INTRODUCTION TO MOLECULAR BIOLOGY - DNA AND RNA 12

Scope and History. Structure of DNA-Nucleoside, Nucleotide, Base pairing, Base stacking, Double Helix, features of Watson and Crick model, major and minor groove, Supercoiling- twist, writhe and linking number. Forms of DNA- A, B, Z. Structure and function of mRNA, rRNA, tRNA. Secondary structures in RNA.

UNIT II - REPLICATION AND REPAIR

12

Types and functions of DNA polymerases in Prokaryote and Eukaryote. Replication in prokaryote and Eukaryote. Proof reading activity, 5'–3' exonuclease activity, topoisomerase activity, Telomeric DNA replication and Plasmid Replication-theta model, strand displacement model and rolling circle model. DNA Repair- Nucleotide excision repair, base excision repair, mismatch repair, photo-reactivation, recombination repair and SOS repair.

UNIT III - TRANSCRIPTION AND POST TRANSCRIPTIONAL MODIFICATIONS

12

Fine structure of prokaryotic and eukaryotic gene, structure and function of the promoters in mRNA, rRNA, tRNA genes. RNA polymerases in prokaryote and eukaryote, types and function. Transcription of mRNA, rRNA, and tRNA genes in Prokaryote and eukaryote. Post transcriptional processing of mRNA – 5' capping, splicing (including different types), polyadenylation and RNA editing.

UNIT IV - TRANSLATION AND POST TRANSLATIONAL PROCESSING

12

Genetic code and Wobble hypothesis. Translation in prokaryote and eukaryote. Post translational modifications. Principles protein sorting and targeting into endoplasmic reticulum, mitochondria, chloroplast, and nucleus.

UNIT V - GENE REGULATION

12

Principles of gene regulation- Transcriptional and post transcriptional gene regulation-activators, co-activators, suppressors, co-suppressors, moderators, silencers, insulators, enhancers. Operon- *lac* operon, *trp* operon, *ara* operon and *gal* operon.

Total Periods: 60

TEXT BOOKS:

1. S.S. Purohit “Cell and Molecular biology”, 2008 Agrobios (India)
2. Harvey Ladish “Cell Biology” W.H. Freeman 2007
3. Molecular Biology of Gene - Watson
4. Molecular and Cellular Biology- Stefan Wolfe

REFERENCE BOOKS

1. Molecular and Cellular Methods in Biology and Medicine, P.B. Kaufman, W. Wu. D. Kim and L.J; Cseke, CRC Press, Florida.
2. Molecular Cloning: a Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.
3. Molecular biology of Gene, fifth edition Author James D. Watson 2004 Benjamin Cummings (Publisher)

OBJECTIVE(S):

1. Genetic, Species And Ecosystem Diversity - Value Of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic And Option Values
2. To describe Environmental ethics -issues and possible solutions

COURSE OUTCOMES :

CO1: Scope of Environmental education

CO2: Endangered And Endemic Species Of India, Conservation Of Biodiversity: In-Situ And Ex-Situ Conservations.

CO3 : Hazardous Waste, Bio Medical Waste - Process Of Waste Management.

CO4: Environmental ethics -issues and possible solutions- population explosion, climatic change, ozone layer depletion, global warming, acid rain and green house effect.

CO5: Understand the wild life conservation and forest act – functions of central and state pollution control boards

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

COURSE ASSESSMENT METHODS:

DIRECT		INDIRECT	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - ENVIRONMENT AND ECOSYSTEMS**9**

Environmental education: definition - scope - objectives and importance. Concept of an ecosystem – types (terrestrial and aquatic ecosystems) – structure and function – ecological succession - food chains, food webs and ecological pyramids

UNIT II - BIODIVERSITY**9**

Introduction: definition - genetic, species and ecosystem diversity - value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - threats to

biodiversity: habitat loss, poaching of wildlife - endangered and endemic species of India, Conservation of biodiversity: in-situ and ex-situ conservations.

UNIT III - POLLUTION AND WASTE MANAGEMENT **9**

Air and water pollution – classification of pollutants and their effects – control measures of air pollution. Waste water treatment (general) – primary, secondary & tertiary stages. Solid waste management: causes - effects of municipal waste, hazardous waste, bio medical waste - process of waste management.

UNIT IV - CURRENT ENVIRONMENTAL ISSUES **9**

Environmental ethics -issues and possible solutions- population explosion, climatic change, ozone layer depletion, global warming, acid rain and green house effect. Sustainable development: definition, objectives and environmental dimensions of sustainable development- environmental audit for sustainable development.

UNIT I - ENVIRONMENTAL PROTECTION **9**

National and international concern for environment: Important environmental protection acts in India – water, air (prevention and control of pollution) act, wild life conservation and forest act – functions of central and state pollution control boards - international effort – key initiatives of Rio declaration, Vienna convention, Kyoto protocol and Johannesburg summit.

Total Periods: 45

TEXT BOOKS

1. Sharma.B.K. and Kaur, “Environmental Chemistry”“ Goel Publishing House, Meerut, 1994.
2. De.A.K., “Environmental Chemistry”, New Age International (p) It., , New Delhi, 1996.
3. Kurian Joseph & R. Nagendran, “Essential of Environmental Studies”“ Pearson Education, 2004.

REFERENCE BOOKS

1. Dara S.S., A Text Book of Environmental Chemistry and pollution control, S.Chand& Company Ltd., New Delhi, 2004.
2. Jeyalakshmi.R, Principles of Environmental Science, 1st Edition, Devi Publications, Chennai 2006.
3. Kamaraj.P&Arthanareeswari.M, Environmental Science – Challenges and Changes, 1st Edition, Sudhandhira Publications, 2007.
4. Arivalagan.K, Ramar.P&Kamatchi.P, Principles of Environmental Science, 1st Edition, Suji Publications, 2007.

OBJECTIVE(S):

1. Coding, non-coding chromosomes
2. To Applications of Proteome analysisi- Proteomics in drug discovery

COURSE OUTCOMES :

CO1 : Organisation and structure of genomes, Genome Size

CO2 : Chromosomes Microdissection.Chromosomal mapping techniques.

CO3 : To understand the Functional Genomics .

CO4 : .To understand the principle of Mass spectrometry

CO5 : Understand the Phosphoprotein analysis- Genomics Vs Proteomics.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

COURSE ASSESSMENT METHODS:

DIRECT				INDIRECT			
1	Internal Tests			1	Course and Survey		
2	Assignments			2	Faculty Survey		
3	Seminar			3	Industry		
4	Online test			4	Alumni		
5	Quiz						
6	End Semester Examinations						

UNIT I – INTRODUCTION TO GENOMICS**9**

Organisation and structure of genomes, Genome Size – Genome structure in Viruses and microbes, Coding, non-coding chromosomes and high order structures – Genomes relatedness.

UNIT II - PHYSICAL MAPPING TECHNIQUES**9**

Chromosomes Microdissection.Chromosomal mapping techniques. 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.

UNIT III FUNCTIONAL GENOMICS**9**

Gene finding – Annotation – ORF and functional prediction – Subtractive DNA library, screening –DNA sequencing –Hybridization techniques– Differential display and

representational difference analysis – SAGE – TOGA., Analysis of RNA expression - Comparative genomics . Bioinformatic tools used in Genomics-

UNIT IV - PROTEOMICS TECHNIQUES

9

Proteome – Bridging Genomics and Proteomics - Analysis of Proteome - Protein level estimation – Edman protein microsequencing – Protein cleavage – 2D 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 - PROTEIN PROFILING

9

Post translational modification – Protein-protein interaction –Protein Chips – Applications of Proteome analysis- Proteomics in drug discovery- Phage antibodies as tools – Proteomics in plant genetics and breeding - Glycoprotein analysis –Phosphoprotein analysis- Genomics Vs Proteomics.

Total Periods: 45

TEXT BOOKS

1. Primrose, S.B. and Twyman, R.H., “Principles of Genome Analysis and Genomics”, Blackwell Publishing Co., 2003.
2. Liebler, D.C., “Introduction to Proteomics”, Humana Press, 2002

REFERENCES

1. Pennington, S.R. and Dunn, M.J., “Proteomics”, BIOS Scientific Publishers, 2001.
2. Hunt, S.P., Livesey, R. and Livesey, F.J., “Functional Genomics: A Practical Approach” Oxford University Press, 2000.
3. Suhai S., “Genomics and Proteomics: Functional and Computational Aspects”, Springer, 2000.
4. Cantor, C.R. and Smith, C.L., “Genomics: The Science and Technology Behind the Human Genome Project”, Wiley and Sons, 1999.
5. Discovering Genomics, Proteomics, & Bioinformatics. Campbell & Heyer (2003) Pearson Education, ISBN:0-8053-4722-4.
6. Bioinformatics, Methods of Biochemical Analysis Series Vol. 43, Baxevanis & Ouellette (2001) John Wiley & Sons, ISBN 0-471-38391-0
7. Computational Molecular Biology. Pevzner, P.A. (2000) MIT Press, ISBN: 0262

OBJECTIVE(S):

- To enable understanding chemical principles governing biochemical reactions

COURSE OUTCOMES :

CO1 : Understand molecular interaction and chemical reactions of biomolecules

CO2 : Identify synthetic strategies for proteins and oligonucleotides

CO3 : Identify the role of enzymes in organic synthesis

CO4 : Understand the orchestration of events during enzyme catalysis and the role of coenzymes

CO5 : Explain importance and influence of metal ions on protein function

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

COURSE ASSESSMENT METHODS:

DIRECT		INDIRECT	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT-1: AMINO ACIDS AND PROTEINS**12**

Structure, classification, synthesis and properties of amino acids, isoelectric point, biosynthesis of amino acids. Peptides: oligo- and polypeptides, geometry of peptide linkage, N-terminal and C-terminal residue analysis, synthesis of peptides-amino and carboxyl protecting groups-solid phase peptide synthesis. Proteins: classification and properties (denaturation, isoelectric point and electrophoresis), collagen and triple helix.

UNIT-2: Enzymes and Cofactors**12**

Mechanism of enzyme catalysis, Factors influencing enzyme action, Examples of typical enzyme mechanisms: chymotrypsin, ribonuclease and lysozyme, Enzyme-catalyzed addition, elimination, condensation, carboxylation and decarboxylation, isomerisation, group transfer and

rearrangement reactions-structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD⁺, NADP⁺, FMN, FAD, lipoic acid and Vitamin B12. Mechanisms of reactions catalysed by the above cofactors.

UNIT-III: Nucleic Acids and Protein Synthesis **12**

Nucleotides and nucleosides, DNA: primary and secondary structure-replication of DNA. RNA and protein synthesis: Messenger RNA synthesis-transcription, Ribosomes-rRNA, Transfer RNA, genetic codetranslation. Determination of base sequence of DNA.Polymerase Chain Reaction (PCR).Antisense technology in chemotherapy and other nucleic acid-targeted drugs-intercalaters, sequence specific drugs.A brief account of ribosome and iRNA.

UNIT-IV: Lead and Analogue Synthesis-1 **12**

Designing organic synthesis-disconnection approach-synthons and synthetic equivalents-one group disconnections: alcohol, olefin, ketone, acids-two group disconnections:1,2-, 1,3-, 1,4- and 1,5-difunctional compounds-convergent synthesis-functional group interconversions- functional group additions-carbonheteroatom bonds-methods for 3- to 6-membered rings.

UNIT-V: Lead and Analogue Synthesis-2 **12**

Combinatorial synthesis in medicinal chemistry: Solid phase techniques-methods of parallel synthesis-mix and split techniques-dynamic combinatorial chemistry-screening and deconvolution-limitations of combinatorial synthesis.Assymmetric synthesis: basic principles- stereoselective and stereospecific reactions and catalysts and their applications(whenever applicable)

Total periods: 60

TEXT BOOKS

1. Designing Organic Synthesis: The Disconnection Approach by Stuart Warren, Wiley, 2nd edition, 1984.
2. Asymmetric Synthesis by H. B. Kagan, Thieme Medical Publishers, 2003.

REFERENCE BOOKS

- 1.Bioorganic Chemistry: A Chemical approach to Enzyme action, Hermann Dugas and C.Penny, Springer-Verlag.
- 2.Fundamentals of Enzymology,N.C. Price and L.Stevens, Oxford University Press.
- 3.Enzymatic Reaction Mechanisms, C. Walsh, W.H.Freeman.
- 4.Asymmetric Synthesis by H. B. Kagan, Thieme Medical Publishers, 2003.

OBJECTIVE(S):

1. To understand the significance of string alignment
2. To construct the phylogenetic tree
3. To understand the fundamentals of protein structure prediction and microarray analysis

COURSE OUTCOMES:

CO1 : Explain various types of network protocols and biological databases

CO2 : Demonstrate and interpret the string matching and dynamic program algorithms of macromolecular strings

CO3 : Apply, solve and interpret the heuristics based pairwise and multiple sequence analysis of macromolecules

CO4 : Construct and interpret the molecular phylogenetic trees

CO5 : Predict and understand the gene and protein structures, and microarrays

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

COURSE ASSESSMENT METHODS:

DIRECT		INDIRECT	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT II – Introduction to Bioinformatics and Basics of Internet**12**

Biology in the computer age - Introduction to Bioinformatics, Basics of computers-Servers, workstations, operating systems. Unix, Linux, WWW. Search Engines, PubMed, Public Biological databases. Connecting to internet; Connecting to internet; Email; FTP; www; The NCBI data model: Introduction, BIOSEQ's, BIOSEQ- sets, SEQ- ANNOT, SEQ- DESCR.

UNIT II - BIOLOGICAL DATABASES**12**

Biological databases-primary sequence databases- Composite sequence databases- Secondary databases-composite protein pattern databases-structure classification databases. Genome

Information Resources: DNA sequence databases-specialized genomic resources, GRAIL, GENSCAN.NCBI databases and PUBMED tools.

UNIT III - ALIGNMENT TECHNIQUES

12

Pairwise Alignment Technique: Database searching-algorithms and programs-comparing two sequences identity and similarity-global and local alignment- pairwise database searching. Multiple sequence Alignment: Goal of multiple sequence alignment-Computational Complexity- Manual methods-Simultaneous methods-Progressive methods-Databases of multiple alignment-Secondary database searching-Analysis packages.

UNIT IV - PROTEIN ANALYSIS

12

Protein Chips, Bioinformatics tools in proteomics - Protein identity based on composition, Motifs and patterns, secondary structure prediction, specialized secondary structures, tertiary structure

UNIT V - INTRODUCTION TO PERL

12

Using PERL to facilitate biological analysis-Strings, numbers, variables -Basic input & output-File handles-Conditional Blocks & loops- Pattern matching- Arrays-Hashes.

Total Periods: 60

TEXT BOOKS

1. Andreas D Baxevanis & B F Francis, "Bioinformatics- A practical guide to analysis of Genes & Proteins", John Wiley, 2002.
2. T K Attwood, D J Parry-Smith, "Introduction to Bioinformatics", Pearson Education, 1st

REFERENCE BOOKS

1. Introduction to Bioinformatics", T.K. Attwood & D.J. Parry-Smith, Prentice Hall 2000.
2. "Instant notes on Bioinformatics", D.R. West head. J.H. Parish R.M. Twyman, Liva Books, New Delhi, 2003
3. "Bioinformatics Sequence and Genome analysis", David W. Mount 2003.
4. "Bioinformatics Basics 'Applications in Biological science and Medicine" Hooman H. Rashidi & Lukas K. Buehie 2001.
5. Introduction to bioinformatics: A theoretical and practical approach by Stephen A Wetz and David. D Woumble Publication: Humana Press. 2003
6. Sequence and Genome analysis. David W. Mount, 2004 Cold spring harbor laboratory press Newyork.

OBJECTIVE(S):

1. To familiarize with cell counting and cell separation techniques.
2. To acquire practical skills related to DNA/ RNA isolation methods
3. To gain hands on experience with action of restriction endonucleases and ligase on DNA

COURSE OUTCOMES :

CO1 : Demonstrate cell counting and cell separation techniques

CO2 : Experiment to isolate DNA and RNA from various biological tissues.

CO3 : Analyse and interpret DNA and RNA data.

CO4 : Explain the activity of restriction enzymes and ligation of DNA.

CO5 : Demonstrate bacterial genetics through conjugation experiment and Execute the effect of UV irradiation on bacterial genome

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

COURSE ASSESSMENT METHODS:

DIRECT		INDIRECT	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Vivo voce	3	Industry
4	Model Exam	4	Alumni
5	Quiz		
6	End Semester Examinations		

LIST OF EXPERIMENTS

1. Isolation of DNA from plant tissue
2. Isolation of DNA from animal tissue
3. Agarose gel electrophoresis
4. Effects of antibiotics by gradient method
5. UV induced metagenesis
6. SDS page

7. Quantification of nucleic acids
8. Competent cell preparation
9. Transformation
10. Competent cell preparation
11. Polymerase Chain Reaction

TEXT BOOK

1. Laboratory Manual
2. Molecular biology laboratory manual - Hikmet Geckil
3. Molecular Cloning – A Laboratory Manual by Sambrook and Russell

BGE 4L1

CELL BIOLOGY LABORATORY

0042

OBJECTIVES

To give hands-on training in basic molecular biology techniques

COURSE OUTCOMES :

CO1 : Demonstrate cell counting and cell separation techniques

CO2 : Experiment to isolate DNA and RNA from various biological tissues.

CO3 : Analyse and interpret DNA and RNA data.

CO4 : Explain the activity of restriction enzymes and ligation of DNA.

CO5 : Demonstrate bacterial genetics through conjugation experiment and Execute the effect of UV irradiation on bacterial genome

CO/PO Mapping S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

COURSE ASSESSMENT METHODS:

DIRECT		INDIRECT	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Vivo voce	3	Industry
4	Model Exam	4	Alumni
5	Quiz		
6	End Semester Examinations		

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. Cell viability by Trypan Blue assay
5. Estimation of chlorophyll from plant tissue
6. Lacto phenol cotton blue staining
7. Haematology experiments
 - (a) blood smear (b) blood count
8. Cell component (a) isolation of chloroplast (b) isolation of protoplast
9. Cryo preservation
10. Spotters
 - (a) plant cell (b) animal cell (c) blood cell (d) valvox (e) oscillatoria
 - (f) spirillum (g) chlamydomonas (h) nostoc

REFERENCE:

1. Laboratory Investigations in Cell and Molecular Biology, Allen Bregman Wiley, 2001.
2. Laboratory manual for Cell biology - E. Eugene Williams

BGE 501 PRINCIPLES OF MANAGEMENT & PROFESSIONAL ETHICS 3 0 0 3

OBJECTIVES

1. Prepare students to recognize and evaluate ethical challenges that they will face in their engineering academic and professional careers.
2. Through knowledge and exercises that deeply challenge their decision making processes and ethics.
3. Help students to understand the foundation of moral theory
4. The concepts of values-based leadership and ethical leadership, and frameworks for engineering ethics-based decision making.

OUTCOMES

At the end of the course, student would

CO01 - Have a knowledge of management fundamental and their guidelines.

CO02 - Explore historic and scientific knowledge on the management with different experiments

CO03 - Idea on the planning and organizing the management system.

CO04 - know the directing and control of the management system in deep view

CO05 - Understand the concept management issue and human values.

CO/PO Mapping
S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - FOUNDATIONS OF MANAGEMENT

9

Nature of Management, Management Science of Art, Management as profession Universality of Management, Technical, Human and Conceptual Requirements-Managers Vs Enterprener' Vs-Managers Vs Leaders-Guide lines for Managerial Excellence and success.

UNITII - HISTORICAL EVOLUTION OF MANAGEMENT

9

Taylor and Scientific Management-Principles of Scientific Management-Contributions of Henry Fayol, Barmard, Betbet Simon, PeterDrucker, Hawthome Experiments and Human Relations.

UNITIII - PLANNING AND ORGANIZING

9

Planning: Importance-Steps-Types-Objectives-MBO-SWOT- Concept and features of strategy-Policy and strategy-forecasting-decision making-Creativity and decision making-Organizing: Organization Structure-Organization charts-span of Management, authority and responsibility-delegation of authority-measures for effective delegation-centralization and decentralization-line and Staff relationships

UNIT IV - DIRECTING AND CONTROL

9

Direction: Concept of Direction-Effective-Supervision-Concept of Leadeship-Control: Concept of controlling-Types of Control-Quantilative and qualitative measures of control-TQM-Quality Circle-ISO 9000 Quality system-PCMM Levels.

UNIT V - CONTEMPORARY MANAGEMENT ISSUES AND HUMAN VALUES

9

Social responsibilities of Managers-Benefits of Professional Codes-Values-Value Systems of Indian managers-Ethics: Business ethics Nature importance in organization-managing Ethical

Dilemmas-shaping and maintaining the ethical culture-protection of stakeholders-Whistle Blowing

Total Periods: 45

TEXT BOOK

1. A study in Business ethics”-Rita paina Raj-Himalaya Publishing House 2001.

REFERENCE BOOKS:

1. L.M. Prasad-Principles and practice of Management-Sultan Chand & Sons 2004.
2. Koontz-”Essentials of Management-Tat MC Graw Hill 2003.
3. Principles of Management-T. Ramasamy Himalaya Publications 2000.

BGE 502

RESEARCH METHODOLOGY

3 1 0 4

OBJECTIVES

1. Early entry graduate-level survey of research methods with an emphasis on comprehension of the educational research literature.
2. Course includes scientific method, locating.
3. Summarizing published research, sampling, measurement, statistics.
4. Increase the knowledge on research design, and critique of published research.

OUTCOMES

At the end of the course, student would

- CO01. Basic descriptive statistics including measures of central tendency, dispersion, and relationships.
- CO02. Basic measurement concepts including validity and reliability and the role of measurement in inquiry.
- CO03. Common and differentiating features of basic, applied, and evaluation research.
- CO04. Common and differentiating features of typical research designs (e.g. quantitative vs. qualitative, experimental vs. non-experimental, group vs. single-case).
- CO05. Quality indicators in published research.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I**12**

Introduction: Definition and objectives of Research – Types of research, Various Steps in Research process, Mathematical tools for analysis, Developing a research question-Choice of a problem, Literature review, Surveying, synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code.

UNIT II**12**

Quantitative Methods for problem solving: Statistical Modeling and Analysis, Time Series Analysis Probability Distributions, Fundamentals of Statistical Analysis and Inference, Multivariate methods, Concepts of Correlation and Regression, Fundamentals of Time Series Analysis and Spectral Analysis, Error Analysis, Applications of Spectral Analysis.

UNIT III**12**

Tabular and graphical description of data: Tables and graphs of frequency data of one variable, Tables and graphs that show the relationship between two variables, Relation between frequency distributions and other graphs, preparing data for analysis

UNIT IV**12**

Soft Computing: Computer and its role in research, Use of statistical soft ware SPSS, GRETL etc in research. Introduction to evolutionary algorithms - Fundamentals of Genetic algorithms, Simulated Annealing, Neural Network based optimization, Optimization of fuzzy systems.

UNIT V**12**

Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report, referencing in academic writing.

Total Periods: 60**TEXT BOOKS**

1. C.R. Kothari, Research Methodology Methods and Techniques, 2/e, VishwaPrakashan, 2006
2. Donald H.McBurney, Research Methods, 5th Edition, Thomson Learning, ISBN:81-315-0047- 0,2006

REFERENCE BOOKS

1. Donald R. Cooper, Pamela S. Schindler, Business Research Methods, 8/e, Tata McGraw-Hill Co. Ltd., 2006.
2. Fuzzy Logic with Engg Applications, Timothy J. Ross, Wiley Publications, 2nd Ed[d]
3. Simulated Annealing: Theory and Applications (Mathematics and Its Applications, by P.J. van Laarhoven & E.H. Aarts[e])
4. Genetic Algorithms in Search, Optimization, and Machine Learning by David E. Goldberg

BGE -503

CYTOGENETICS

3 0 0 3

OBJECTIVES

To introduce and discuss the

1. Fundamental laws of genetics
2. Types of blood groups and antigen GN – 07-08 – SRM – E&T 26
3. Concept of sex chromosome, links, disorders and gene mapping
4. Methods of identification of genetic material and types of genetic transfer

OUTCOMES

CO01. Introduces and knowledge the fundamentals of genetics.

CO02. Have discusses the basics laws of chromosome structure sex linked chromosomes

CO03. Explore inherited disorders, identification of genetic material and genetic transfer.

CO04. Understanding the concept of variation in chromosome structure and number

CO05. Know recombination in bacteria through different methods.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I- MENDELIAN GENETICS**9**

Genetic inheritance, Mendelian Genetics, Mendel's experiments, principles of segregation – monohybrid cross – Independent Assortment, Gene interaction, multiple alleles.

UNIT II - CHROMOSOME STRUCTURE AND ORGANIZATION**9**

Chromosome structure and organization in prokaryotes and eukaryotes, Giant chromosomes – polytene and lampbrush– sex determination and sex linkage, techniques in cytogenetics.

UNIT III -LINKAGE AND CROSSING OVER**9**

Linkage, Crossing over – cytological basis of crossing over, chromosome mapping – two and three factor cross – interference, somatic cell hybridization.

UNIT IV - VARIATION IN CHROMOSOME STRUCTURE AND NUMBER**9**

Deficiencies – duplication –inversion- translocation – positive effects-human chromosome techniques (karyotyping)- chromosome aberration in humans-classification of mutation-classification of ploidy, -variation in chromosome number-extra chromosomal inheritance-cytogenetical abnormalities in humans

UNIT V - RECOMBINATION IN BACTERIA**9**

Bacterial Genomics, Transformation, Transduction, Conjugation – mapping, fine structure mapping in merozygotes- plasmids and episomes.

Total Periods: 45**TEXT BOOK:**

1. Principles of Genetics by Gardner, Simmons, Snustad, 8th edition – John Wiley and Sons, Inc., 2003.
2. The Cell: A molecular approach by Geoffrey M.Cooper.ASM Press, Pages:673

REFERENCE BOOKS

1. Molecular Cell Biology, Sixth Edition., by HarveyLodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Anthony Bretscher, HiddePloegh, Paul Matsudaira Bioenergetics at a Glance: An Illustrated Introduction D. A. Harris, 1995 John Wiley & Sons Publishers, Inc
2. Biology of Microorganisms – Michael T.Madigan

OBJECTIVES

1. This course provides the fundamental knowledge on upcoming field of metabolomics
2. The metabolic engineering in post genomic era.
3. Understand Regulation of metabolic pathways and examples of pathway manipulations
4. Provides knowledge metabolic engineering in database.

OUTCOMES

- CO01. Metabolic engineering
 CO02. Comprehensive models cellular reactions
 CO03. Metabolic flux analysis and its applications
 CO04. Metabolomics and its study
 CO05. Applications of metabolomics

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT-I**12**

Introduction to metabolic engineering-Metabolism-Stoichiometry, reaction rates and dynamic mass balances-Growth Energetic-Yield coefficients and linear rate equations-Material balances and data consistency. Permeability control passive diffusion, active transport group transportation

UNIT-II**12**

Regulation of metabolic pathways-Examples of pathway manipulations. Metabolic engineering in practical Metabolic pathway synthesis. Alteration of feedback regulation, limiting

accumulation of end products. Induction-jacob & monod model, catabolic regulation. Strain selection, improving fermentation,

UNIT-III

12

Metabolic flux analysis-Methods for the experimental determination of Metabolic flux using isotope labelling-Applications of Metabolic flux labelling. Metabolic control analysis-Regulation of Metabolic network

UNIT-IV

12

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

12

Metabolic Engineering in plants- Metabolomics and Metabolic engineering-Introduction to Databases on the web.

Total Periods: 60

TEXT BOOKS

1. 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.
2. Harper's review of biochemistry By David.W.Martin ,Peter.A.Mayes , Victor.W.Rodwell LANGE medical publications.
3. Practical Biochemistry – Principles & Techniques By Keith Wilson & John Walker. Oxford University press.
4. Gregory N.Stephanopoulos,Aristos A.Aristidou, Jens Neilsen, Metabolic engineering: Principles and Methodologies San Diego: Academic Press,1998.

BGE 505

BIOPHYSICS

3 1 0 4

OBJECTIVES

1. To introduce the theories and concepts of biophysics of biomolecules
2. To provide important of biotechnology applications.
3. To explore the basic electronics devices and their applications.
4. To have idea on atomic and nuclear physics

OUTCOMES

- CO01. Idea about the structures of biological molecules
- CO02. Understand the concept of structural analysis

- CO03. Learnt the techniques for analysis and determination of structure of bio molecules.
 CO04. Determination of the charge and mass of an electron.
 CO05. Quantum mechanics and diagnosis of x ray

CO/PO Mapping
S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - LIGHT AND OPTICS

12

Light: Reflection and Refraction; Wave nature; Interference; Diffraction; Polarization; Geometrical Optics: Thick lenses and lens defects; Focussing action of human eye; Fiber optics and insect eyes. Optical and Acoustical Wave Interference: Diffraction from a circular aperture; applications in animal vision; Interference in thin films; Polarization of light; Acoustic diffraction; use by bats for echolocation. The eye and optical instruments – Microscopes.

UNIT II - ELECTRICITY AND MAGNETISM

12

The nature of electric charge; Electric field; Capacitance; Electric energy; Emf; Ohm's law; Resistivity; Electrical power; Direct current; Electric circuits; Alternating current circuits; Electromagnetic wave; Relevance to biology; Dynamic electrical properties of biological membranes; The electric organ of eels.

UNIT III - ELECTROMAGNETIC WAVES: ABSORPTION OF RADIATION

12

The electromagnetic spectrum; Blackbody radiation; Radiant emission from a human; The greenhouse effect; Infrared radiation and ultraviolet radiation in biology.

UNIT IV - BASIC ELECTRONICS

12

Overview of vacuum tube technology; Solid state electronics devices and their applications; Diodes; Transistors and amplifiers; oscillators; Introduction to operational amplifiers; Integrated

circuits; Digital electronics; Special electronics devices like photocells; photomultipliers; Cathode ray tubes.

UNIT V - ATOMIC AND NUCLEAR PHYSICS

12

Determination of the charge and mass of an electron; The photoelectric effect; De Broglie waves; The Heisenberg uncertainty principle; Electron microscopy; The nuclear atom model; The Bohr model for the hydrogen atom; Quantum mechanics; Characteristic X-rays: X-ray diffraction; Absorption spectra and colour vision; Radiation effect in biology; Radiation dosage; Diagnostic use of X-ray.

Total Periods: 60

TEXT BOOK:

1. Biophysical Chemistry, Cantor and Schimmel, part I and II, W.H. Freeman and co 1997
2. "Biophysics" by Dr.S.Thiraviaraj Saras publications 2004 (pg no 1- 71, 88 – 137, 147 – 209).
3. "Biochemistry and Biophysics" by N.Arumugam& Annie Ragland by saras publications 2004 (pg no. 248 – 297).

REFERENCE BOOKS:

1. "Essentials of Biophysics" by P.Narayanan New age international publishers second edition 2007 (pg no. 2 -12, 168 -186, 192 – 216,340 – 368).
2. "Biophysical chemistry" by UpadhyayNath Himalaya publishing house Delhi Reprint 2003. (pg no. 90 – 280).
3. "Biophysics"Vasanthapattabhi and N. GauthamNarosa publishing house. Reprint 2004 (pg no. 2-140).

BGE 506 PLANT TISSUE CULTURE AND TRANSGENIC TECHNOLOGY 3 0 0 3

OBJECTIVES

1. This course deals with engineering gene of interest to produce transgenic animals and plants for human welfare
2. To make the students to understand the basic concepts and applications of plant tissue culture.
3. To impart knowledge on production of transgenic plants and exploiting it as bioreactors.
4. To improve awareness on the applications of transgenic plants

OUTCOMES

- CO01. Acquired the concept and basics of plant tissue culture.
- CO02. Improved the experience in preparation of tissue culture media.
- CO03. To know the working principles of tissue culture techniques.
- CO04. understood the plant transformation methods and its uses
- CO05. Improved idea about the applications in transgenic plants.

CO/PO Mapping
S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

Course Assessment Methods:

Direct				Indirect			
1	Internal Tests			1	Course and Survey		
2	Assignments			2	Faculty Survey		
3	Seminar			3	Industry		
4	Online test			4	Alumni		
5	Quiz						
6	End Semester Examinations						

UNIT I - BASICS OF PLANT TISSUE CULTURE 9

History of plant tissue culture- totipotency- organising a tissue culture lab-sterilization techniques- callus differentiation of cell and organs - clonal propagation- Regeneration and hardening-somatic clonal variation

UNIT II - PREPARATION OF TISSUE CULTURE MEDIA 9

Different media used for plant tissue culture-Composition of MS, Gamborg, White media-Use of hormones-Auxins- Cytokinins

UNIT III - TISSUE CULTURE TECHNIQUES 9

Callus culture- suspension culture -micropropagation-somatic embryogenesis- embryo culture – protoplastfusion- synthetic seeds- anther culture. Applications of tissue culture.

UNIT IV - PLANT TRANSFORMATION 9

Agrobacterium – mechanism of T-DNA transfer -Ti plasmids derived vector system – biolistic gene transfer –reporter genes-GUS—marker genes-selectable and scorable markers-constitutive and tissue specific promotersstrategiesfor developing marker free transgenic plants-chloroplast transformation

UNIT V - APPLICATIONS OF TRANSGENIC PLANTS 9

Bttransgenics – virus resistant plants (coat protein, anisense RNA) – glyphosate resistant transgenics – Genetic manipulation of flower pigmentation (Blue Rose)– Vitamin A and iron fortified rice – Plant-made antibodies and edible vaccines.

TEXT BOOKS

1. Molecular Biotechnology by Bernard R. Click and Jack. J. Pasternek
2. Plant Biotechnology by S. Ignacimuthu.
3. Text book of Plant tissue culture – Sathyanarayana

REFERENCE BOOKS

1. Introduction to Plant tissue culture – M.k. Razdan
2. Plant tissue culture – PR white
3. Plant propagation by plant tissue culture – EF George

BGE 5L1

IMMUNOLOGY LABORATORY

0 0 2 1

OBJECTIVES

1. The students should be able to develop their skills.
2. Provides an opportunity to experimentally verify the theoretical concepts already studied.
3. It also helps in understanding the theoretical principles in a more explicit and concentrated manner.
4. Explore the antigen and antibody reaction methods.

OUTCOMES

- CO01. Understood the blood grouping and types of blood groups.
CO02. Experienced in leucocytes count and PBMC preparation and their enumeration.
CO03. Production of polyclonal antibodies using immunization.
CO04. Antigen and Antibody reaction - types.
CO05. Blotting Techniques and ELISA types.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

Course Assessment Methods:

DIRECT		INDIRECT	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Vivo voce	3	Industry
4	Model Exam	4	Alumni
5	Quiz		
6	End Semester Examinations		

LIST OF EXPERIMENTS

1. Blood grouping
2. Leukocyte count
3. PBMC preparation and their enumeration
4. Production of polyclonal antibodies – preparation of antigen – protocol for immunization in rabbits /mice
5. Antigen-antibody reaction-Haemagglutination, precipitation-Widal and VDRL
6. Immunodiffusion, Immunoelectrophoresis.
7. Affinity chromatography for antibody purification.
8. ELISA-DOT and plate ELISA
9. Immuno Blotting techniques
10. Agglutination reactions (a) direct (b) indirect

REFERENCE BOOK

1. Immunology Laboratory methods manual, 2009
2. Cell biology and immunology manual, Dr. Bea Holton

BGE 5L2 PLANT GENETIC ENGINEERING LABORATORY 0021

OBJECTIVES

1. Provides an opportunity to understand the basic practices of plant tissue culture.
2. It also helps in understanding the theoretical principles of producing transgenic plants in a more explicit and concentrated manner.
3. The students should be able to Understand explicitly the concepts.
4. To develop their skills in the plant tissue culture techniques

OUTCOMES

- CO01. Acquired the knowledge and experience on preparation of Tissue Culture Media.
- CO02. Understood the callus induction, using rice embryo/endosperm culture and Transformation of Agrobacterium into plant
- CO03. Selection and sub-culture of algal species
- CO04. Bacterial antibiotic sensitivity and replica plate method
- CO05. Transgene Analysis by PCR

CO/PO Mapping S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

Course Assessment Methods:

DIRECT		INDIRECT	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Vivo voce	3	Industry
4	Model Exam	4	Alumni
5	Quiz		
6	End Semester Examinations		

LIST OF EXPERIMENTS

1. Preparation of Tissue Culture Media
2. Callus Induction, using rice embryo/endosperm culture
3. Transformation of Agrobacterium
4. Selection and sub-culture of algal species
5. Bacterial antibiotic sensitivity
6. Isolation of mutant clones by replica plate method – MSGEN208
7. Collection and culture of marine alga
8. Identification of bio-fertiliser activity using marine alga
9. GUS assay
10. Transgene Analysis by PCR

REFERENCE BOOK

1. Plant biotechnology Laboratory Manual (Dr. Lingaraj Sahoo).
2. Principles of Plant Genetics and Breeding - George Acquaah, 2007

SEMESTER – VI

BGE 601

AGRI,VETERINARY AND MEDICAL INFORMATICS

3 1 0 4

OBJECTIVES

This subject gives the students an idea on the applications of information technology in medical field.

1. Hospital management and information system
2. Computer assisted instructions
3. Computer assisted surgical techniques
4. Telecommunications based systems

OUTCOMES

- CO01. Analysis of plant genome sequence using Agricultural informatics
CO02. Genome analysis for identification of diseases using Veterinary informatics
CO03. Medical informatics provide the Internet and Medicine
CO04. Computerised patient record provides the patient information in detail
CO05. Recent trends in medical informatics - Virtual reality applications in medicine

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I – AGRICULTURAL INFORMATICS

12

Introduction – plant genome, and Analysis of plant genome sequence, analysis of metabolites in plants, targeting study of compound against plant pathogens using bioinformatic tools.

UNIT II – VETERINARY INFORMATICS

12

Introduction - history of pathogens, interaction between pathogens and host cell molecules using bioinformatic tools. Genome analysis for identification of diseases. Study of molecules and functional domain structure using bioinformatics tools

UNIT III - MEDICAL INFORMATICS

12

Introduction - Structure of Medical Informatics –Internet and Medicine -Security issues , Computer based medical information retrieval, Hospital management and information system, Functional capabilities of a computerized HIS, e-health services, Health Informatics – Medical Informatics, Bioinformatics

UNIT IV - COMPUTERISED PATIENT RECORD

12

Introduction - History taking by computer, Dialogue with the computer, Components and functionality of CPR, Development tools, Intranet, CPR in Radiology- Application server provider, Clinical information system, Computerized prescriptions for patients.

UNIT V - RECENT TRENDS IN MEDICAL INFORMATICS

12

Virtual reality applications in medicine, Computer assisted surgery, Surgical simulation, Telemedicine - Tele surgery computer aids for the handicapped, computer assisted instrumentation in Medical Informatics - Computer assisted patient education and health –

Total Periods: 60

TEXT BOOKS:

1. R.D. Lele Computers in medicine progress in medical informatics, Tata Mcgraw Hill Publishing computers Ltd,2005, New Delhi
2. Mohan Bansal, Medicl informatics Tata Mcgraw Hill Publishing computers Ltd, 2003 New Delhi

REFERENCE BOOKS

1. Role of bioinformatics in agricultural - Santosh Kumar, 2014
2. Bioinformatics Sequence and Genome analysis - David W. Mount, 2003.
3. Bioinformatics Basics 'Applications in Biological science and Medicine” Hooman H. Rashidi & Lukas K. Buehie 2001.

BGE 602

BIOPHARMACEUTICAL TECHNOLOGY

3 0 0 3

OBJECTIVES

1. This programme will provide students with a solid foundation in Pharmaceutical Chemistry.
2. Pharmacology and Pharmacognosy as per the requirement of Pharmaceutical Industries, and also to pursue higher studies.
3. This programme will facilitate the students to acquire knowledge in fields such as genetic engineering.
4. It will also empower the students to have advanced focus on the molecular pathogenesis of infectious diseases and necessary pharmacological approach.

OUTCOMES

- CO01. Graduates of the program will be having fundamental knowledge in biosciences
 CO02. Chemical engineering and strong background in pharmaceutical technology
 CO03. And be able to use these tools in industry and/or institutes where ever necessary.
 CO04. It will also help the students to know about the pharmacokinetics of drug, its metabolism
 CO05. Its immunopharmacological response through in depth understanding about the Human physiology.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - INTRODUCTION**9**

Pharmaceutical industry & development of drugs; types of therapeutic agents and their uses; economics and regulatory aspects. Various steps in new drug developments

UNIT II - DRUG ACTION, METABOLISM AND PHARMACOKINETICS**9**

Mechanism of drug action; physico-chemical principles of drug metabolism; radioactivity; Pharmacology, pharmacogenomics and pharmacokinetics.

UNIT III - MANUFACTURE OF DRUGS, PROCESS AND APPLICATIONS**9**

Types of reaction process and special requirements for bulk drug manufacture. Toxicology. Fermentation technology. Bioprocess technologies.

UNIT IV - 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.

UNIT V - BIOPHARMACEUTICALS**9**

Various categories of therapeutics like Vaccines, life saving drugs, antibodies, vitamins, laxatives, analgesics, contraceptives, antibiotics, hormones and biologicals.

Total Periods: 45**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.
3. Brahmankar, D.M., "Biopharmaceutical and Pharmacokinetics: A Treatise", VallabhPrakashan, 1995.

REFERENCE BOOKS

1. Niazi, Sarfaraz K. "Handbook of Biogenic Therapeutic Proteins: Regulatory, Manufacturing, Testing, and Patent Issues". CRC Press, 2006.
2. Ho, Reedney J. Y., MiloGibaldi. "Biotechnology & Biopharmaceuticals Transforming Proteins and Genes into Drugs". Wiley Liss, 2003.

OBJECTIVES

To understand the genes that control or influence the heritable human diseases

1. To understand the pattern of inheritance of heritable diseases
2. To learn about the genetics of most prevalent cancers in India
3. To learn about the genetics of metabolic disorders and disease of nervous system
4. To learn about the genetics of ear, eye and blood disorders

OUTCOMES

1. Mechanism of Genetic Diseases.
2. Genetics of metabolic disorders
3. Genetics of the diseases of nervous system
4. Genetics of ear, eye and blood disorders
5. Congenital disorders and Neonatal diseases

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I**9**

Introduction to the diseases due to defective genes. Genomics and Health. Mechanism of Genetic Diseases, Types of Mutations. Dominance, recessive, codominance, autosomal and sex linked inheritance of diseases. Chromosomal maps.

UNIT II**9**

Single Gene disorders, X-linked recessive, Y-linked and Mitochondrial disorders. Multifactorial and polygenic (complex) disorders. FINDbase (the Frequency of Inherited Disorders database). Genetic epidemiology. Inborn errors of metabolism. List of genetic disorders. Medical genetics. Population groups in biomedicine. Mendelian error

UNIT III**9**

Genetic Testing, Genetic diseases prevention, Genetic Counselling. Pharmacogenomics. Public Health Genomics at CDC. OMIM — Online Mendelian Inheritance in Man, a catalog of human genes and genetic disorders. Genetic and Rare Diseases Information Center (GARD) Office of Rare Diseases (ORD), National Institutes of Health (NIH). CDC's National Center on Birth Defects and Developmental Disabilities. Genetic Disease Information from the Human Genome Project. Global Genes Project, Genetic and Rare Diseases Organization

UNIT IV**9**

Genetic diseases of Blood and lymph diseases, cancers, diseases of the digestive system. Diseases of ear, nose and throat, Diseases of the eye, female-specific diseases, diseases of glands and hormones. Diseases of heart and blood vessels, diseases of the immune system, male specific diseases, disease of muscle and bone

UNIT V**9**

Congenital disorders and Neonatal diseases, Diseases of the nervous system, nutritional and metabolic diseases. Respiratory diseases, diseases of skin and connective tissue, Chromosome map. Prognosis and treatment of genetic disorders

Total Periods: 45**TEXT BOOKS**

1. Genes and Diseases, NCBI Bookshelf, free e-book.
<http://www.ncbi.nlm.nih.gov/books/bookres.fcgi/gnd/tocstatic.html>
2. The principles of gene manipulation (Primrose – sixth edition).

REFERENCE BOOK

1. Genes, Benjamin and Lewin, 8th edition. Pearson Prentice Hall, 2004
2. Rodney J Y Ho, MILO Gibaldi, Biotechnology & Biopharmaceuticals Transforming proteins and genes into drugs, 1st Edition, Wiley Liss, 2003.
3. Human Genetics and Genomics, Third Edition - Bruce R. Korf
4. Human Genetics: Principles and Approaches - Friedrich Vogel and Arno G. Motulsky

BGE 604**GENE THERAPY****3 0 0 3****OBJECTIVES**

1. The course imparts advanced knowledge on gene therapy
2. Detailed study of various types of gene therapy and its applications
3. To impart basic knowledge on various methods of gene therapy
4. To give knowledge gene therapy and its applications

OUTCOMES

CO01. Principles of Gene Therapy

CO02. Somatic and Germ line Gene Therapy

CO03. Viral and Non Viral Vectors for Gene Therapy

CO04. Classical Gene Therapy

CO05. Applications of Gene Therapy

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - PRINCIPLES OF GENE THERAPY

9

Gene therapy – concepts- Principals of Gene therapy- Basics and Advanced techniques in Gene therapy- vector for gene therapy- ex vivo and in vivo gene therapy somatic gene therapy – germ line gene therapy.

UNIT II - SOMATIC AND GERMLINE GENE THERAPY

9

Prenatal somatic gene therapy- embryo somatic gene therapy-fetal somatic gene therapy- postnatal somatic gene therapy- germ line gene therapy.

UNIT III - VIRAL AND NON VIRAL VECTORS FOR GENE THERAPY

9

Gene transfer agents – Viral- Retro, adeno, adeno associated and herpes virus-non-viral agents- modes of gene delivery

UNIT IV - CLASSICAL GENE THERAPY

9

Increasing gene dose in deficient cell- on suppressor genes – Disease with recessive heredity- direct killing by suicide gene therapy- indirect killing – secretion gene therapy

UNIT V - APPLICATIONS OF GENE THERAPY

9

Gene repair- stem cells and gene therapy- application – treatment of genetic diseases – cancer- bone regeneration – cardiovascular gene therapy – neurological diseases

Total Periods: 45

TEXT BOOK

1. Gene therapy by Keith Green berg
2. Stem cells biology and gene therapy by Peter J. QuesenHorry
3. Medical Genetics 3rd Edition- Jorde, Carey, Bamshad & White.

REFERENCE BOOKS

1. Pamela Greenwell, Michelle McCulley, Molecular Therapeutics: 21st century medicine, 1st Edition, Sringer, 2008.
2. Winnacker E.L. Frome Genes to clones: Introduction to Gene Technology, Panima, 2003.
3. Lemonie, N.R. and Cooper, D.N. Gene therapy, BIOS Scientific, 1996

BGE 605

CANCER BIOLOGY

3 1 0 4

OBJECTIVES

1. To provide knowledge about biological aspects of cancer.
2. To impart basic concepts of cancer biology.
3. Various stages in carcinogenesis, molecular cell biology of cancer.
4. Cancer metastasis, and cancer therapy.

OUTCOMES

CO01. Fundamentals Of Cancer Biology

CO02. Principles Of Carcinogenesis

CO03. Principles Of Molecular Cell Biology Of Cancer

CO04. Principles Of Cancer Metastasis

CO05. New Molecules For Cancer Therapy

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - FUNDAMENTALS OF CANCER BIOLOGY**12**

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. Cancer Epidemiology

UNIT II - PRINCIPLES OF CARCINOGENESIS**12**

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**12**

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. Telomerases.

UNIT IV - PRINCIPLES OF CANCER METASTASIS**12**

Clinical significances of invasion, heterogeneity of metastatic phenotype, metastatic cascade, basement membrane disruption, three step theory of invasion, proteinases and tumour cell invasion.

UNIT V - NEW MOLECULES FOR CANCER THERAPY**12**

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 Periods: 60**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.

REFERENCE

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

2. Molecular Cell Biology, Sixth Edition., by Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Matthew.
3. An Introduction to Molecular Biotechnology: Molecular Fundamentals, Methods and Applications in Modern Biotechnology Michael Wink (Editor) 2006, John Wiley & Sons Publishers, Inc

BGE 6L1

GENE CLONING LABORATORY

0 0 4 2

OBJECTIVES

1. The practical deals with creating recombinant DNA molecules
2. To give hands-on training in creating recombinant DNA molecules
3. Molecular analysis indirectly by restriction digestion and PCR as well as directly by DNA sequencing.
4. To give hands-on training Ligation and transformation

OUTCOMES

CO01: The student can able to isolate total DNA, Plant DNA and plasmid DNA.

CO02: The student can able to do molecular digestion and gel elution of vector and inserts and Ligation and transformation.

CO03: The student can able to do plasmid isolation from PCR positive colonies

CO04: The student can able to do Confirmation of cloning by restriction digestion

CO05: The student can able to do Ligation and transformation

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S						M	W				
CO2		W	S		M			M	W	M		
CO3		M		S								
CO4	S		M	W								

Course Assessment Methods:

DIRECT		INDIRECT	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Vivo voce	3	Industry
4	Model Exam	4	Alumni
5	Quiz		
6	End Semester Examinations		

LIST OF EXPERIMENTS

1. Isolation of total DNA.
2. Isolation of plasmid DNA.

3. Microbial cultures
4. Digestion and gel elution of vector and inserts
5. Ligation and transformation
6. Verification of cloning by colony PCR and patching the positive colonies
7. Plasmid isolation from PCR positive colonies
8. Confirmation of cloning by restriction digestion
9. Set up DNA sequencing reaction
10. Cleaning the sequencing reaction product

REFERENCE BOOK

1. Molecular Cloning - A Laboratory Manual. 4th ed, 2012 - Cold Spring Harbor Laboratory Press.
2. Molecular Biology I Biochemistry Level II: Practical Manual. Dr Peter Kille.
3. Molecular cloning – A laboratory manual. Joseph sambrook and David w. Russell

BGE 6L2

BIOINFORMATICS LABORATORY

0042

OBJECTIVES

1. To know about databases and their use
2. To understand sequence alignment and programming
3. To analyze the protein sequence using bioinformatics tools
4. To understand the use of PERL, Python in programming and executing research

COURSE OUTCOMES(COs)

CO01: The student can able to perform Sequence retrieval from biological database

CO02: The student can able to perform Identification of protein sequence

CO03: The student can able to perform Sequence similarity searching of protein sequences

CO04: The student can able to perform dynamic programming method- global and local alignment

CO05: The student can able to perform Phylogenetic analysis with Clustal W and Blast software

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

Course Assessment Methods:

DIRECT		INDIRECT	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Vivo voce	3	Industry
4	Model Exam	4	Alumni
5	Quiz		
6	End Semester Examinations		

LIST OF EXPERIMENTS

1. Knowledge of different biological database
2. Sequence retrieval from biological database
3. Identification of protein sequence
4. Sequence similarity searching of protein sequences
5. Variants of Blast
6. Multiple sequence alignment
7. Dynamic programming method- local alignment
8. Dynamic programming method- global alignment
9. Pattern finding in proteins
10. Phylogenetic analysis with Clustal W and Blast software

REFERENCE BOOK

1. "Introduction to Bioinformatics", T.K. Attwood & D.J. Parry-Smith, Prentice Hall 2000.
2. "Instant notes on Bioinformatics", D.R. West head. J.H. Parish R.M. Twyman, Luviva Books, New Delhi, 2003
3. "Bioinformatics Sequence and Genome analysis", David W. Mount 2003.
4. "Bioinformatics Basics 'Applications in Biological science and Medicine'" Hooman H. Rashidi & Lukas K. Buehie 2001.

BGE 701 BIOSAFETY, BIOETHICS, IPR & PATENTS**3 1 0 4****OBJECTIVES:**

To enable understanding chemical principles governing biochemical reactions

COURSE OUTCOMES :

- CO1 :** Understand Handling of recombinant DNA process and products.
CO2 : Biosafety assessment of biotech pharmaceutical products.
CO3 : Understand the moral status of animal
CO4 : Understand the intellectual property rights.
CO5 : understand the patent registration

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M					M			S		S	
CO2	S	S		M	S					M		M
CO3	S	M	S							S		
CO4				S	S	M			M		M	
CO5	S	M		M								

Course Assessment methods:

DIRECT		INDIRECT	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Vivo voce	3	Industry
4	Model Exam	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I

12

Introduction to Biosafety. Laboratory associated infections and other hazards, assessment of biological hazards and levels of biosafety, Handling of recombinant DNA processes and products in institutions and industries, biosafety assessment procedures in India and abroad.

UNIT II

12

Bioethics: Legality, morality and ethics, the principles of bioethics: autonomy, human rights, beneficence, privacy, justice, equity etc. Transgenics and Bioethics: Ecological safety assessment of recombinant organisms and transgenic crops, case studies of relevance (Eg. Bt cotton). Biosafety assessment of biotech pharmaceutical products such as drugs / vaccines etc.

UNIT III

12

Chronology of Biotechnological studies on animals – Law & legislation on animal experimentation in India and world Moral status of animals as objects of experiments –Moral responsibility of scientists over animal experiments. Personhood – Abortion – Bioethical issues in reproduction, population explosion and control – Voluntary euthanasia & physician assisted suicide – Organ donation & Transplantation.

UNIT IV

12

Intellectual property rights (IPR), sovereignty rights, CBD, bioethics and patenting General agreement on trade and tariffs Indian sui-generis system for animal variety and farmer's rights protection act. WTO with reference to biotechnological affairs, TRIPs.

UNIT V

12

General Introduction: Patent claims, the legal decision, Basic Requirements of Patentability: Patentable subject matter, novelty and the public domain, non obviousness Special issues in Biotechnology Patents: Disclosure requirements, Collaborative research, Competitive research, Recent Developments in Patent System and Patentability of biotechnological inventions.

Total Periods :60

TEXT BOOKS

1. BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2007
2. Kankanala C., Genetic Patent Law & Strategy, 1st Edition, Manupatra, Information Solution Pvt. Ltd., 2007
3. S.S.Kanka Entrepreneurship Development, S.Chand and Co, New Delhi 1997

REFERENCE BOOKS

1. Beier, F.K., Crespi, R.S. and Straus, T. Biotechnology and Patent protection-Oxford and IBH Publishing Co. New Delhi.
2. Sasson A, Biotechnologies and Development, UNESCO Publications.
3. Singh K, Intellectual Property rights on Biotechnology, BCIL, New Delhi
4. Regulatory Framework for GMOs in India (2006) Ministry of Environment and Forest, Government of India, New Delhi
5. Cartagena Protocol on Biosafety (2006) Ministry of Environment and Forest, Government of India, New Delhi

BGE 702 ANIMAL CELL CULTURE AND TRANSGENIC TECHNOLOGY 3 1 0 4

OBJECTIVES:

- To enable understanding chemical principles governing biochemical reactions

COURSE OUTCOMES:

CO1 : Understand Importance of aseptic techniques

CO2 : Preservation And Characterization Of Cell Lines.

CO3 : Understand the Cell quantification

CO4 : Understand the Methodology of production of transgenic animals.

CO5 : understand the the production of recombinant proteins

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M					M			S		S	
CO2	S	S		M	S					M		M
CO3	S	M	S							S		
CO4				S	S	M			M		M	
CO5	S	M		M								

Course Assessment methods:

DIRECT		INDIRECT	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Vivo voce	3	Industry
4	Model Exam	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - BIOLOGY OF CULTURED ANIMAL CELLS 12

Cell culture-Introduction-the use, advantages & disadvantages-Cell types & its characters, differentiation- Growth of cells in culture-Importance of aseptic techniques. Culture media & culture conditions-Maintenance and storage of cell cultures- Biosafety and biohazards.

UNIT II - PRESERVATION AND CHARACTERIZATION OF CELL LINES 12

Primary culture, subculture, and cell lines-Cloning and selection-Cell separation and characterization- Differentiation -Transformation and Immortalization-Contamination- Cryopreservation techniques.

UNIT III - SCALING UP OF ANIMAL CELL CULTURE 12

Cell quantification methods-Cell viability measurements-Growth kinetics-Scale up of suspension & monolayer cultures-Air lift bioreactors.

UNIT IV - PRODUCTION OF TRANSGENIC ANIMALS 12

Methodology of production of transgenic animals – Retroviral vector method – DNA micro injection – Engineered embryonic stem cell method, Oocyte culture and Transgenic animals-Dolly – Transgenic Cattle – Transgenic Goat and Pigs – Transgenic Birds.

UNIT V - APPLICATIONS OF ANIMAL CELL CULTURE AND TRANSGENIC ANIMALS 12

Animals cells as bioreactors – therapeutic proteins – Enzymes – Vaccines– applications of transgenic animals for the production of recombinant proteins, better nutrition, bioindicator-ornamental transgenic fish.

Total Periods:60

TEXT BOOKS

1. Culture of Animal cells by R.I. Freshney, Fifth edition
2. Culturing of Animal cells. Biotol publications
3. Molecular Biotechnology by Bernard R. Click and Jack. J. Pasternek

REFERENCE BOOKS

1. Davis J.M. Basic Cell Culture: A Practical Approach, IRL Press, 1998
2. Freshney R.I. Animal Cell Culture- a practical approach, 1987
3. BernhardPalsson and Sangeeta N Bhatia, Tissue Engineering, 2nd Edition, Prentice Hall, 2004.
4. Pamela Greenwell, Michelle McCulley, Molecular Therapeutics: 21st century medicine, 1st Edition, Sringer, 2008.

BGE 703

NANOBIOTECHNOLOGY IN HEALTHCARE

3 0 0 3

OBJECTIVES:

To enable understanding chemical principles governing biochemical reactions

COURSE OUTCOMES:

- CO1 :** Understand Behavior of molecules in solution
- CO2 :** DNA based computation
- CO3 :** Understand the polymers quantification
- CO4 :** Understand the polymer and Nano containers .
- CO5 :** understand the Targeted drug delivery

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M					M			S		S	
CO2	S	S		M	S					M		M
CO3	S	M	S							S		
CO4				S	S	M			M		M	
CO5	S	M		M								

Course Assessment methods:

DIRECT		INDIRECT	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Vivo voce	3	Industry
4	Model Exam	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I – BASICS

9

Behavior of molecules in solution; DNA machines; Molecular motors; Patterning single molecules; Nanostructured surfaces – applications in cell engineering; Optical and electronic measurements of charge transport in biomolecules; Membrane Proteins; Nanopore engineering; Bilayer Techniques.

UNIT II - DNA NANOSTRUCTURE AND CHARACTERIZATION

9

Introduction, DNA Arrays; DNA nano mechanical devices; DNA for coding & information storage; DNA based computation; Atomic Force Microscopy; Scanning Tunnelling Microscopy; Confocal Microscopy.

UNIT III - MICROFLUIDICS AND LAB-ON-A-CHIP

9

Introduction; concepts and advantages of microfluidic devices; Fluidic transport; Stacking and Scaling; Materials for the Manufacture (silicon, glass, polymers); Fluidic Structures; Fabrication Methods; Surface Modifications; Spotting; Detection Mechanisms.

UNIT V - POLYMER NANOCONTAINERS

9

Introduction, Liposomes in Biotechnology, Polymer Nanocontainers in Therapy, Dendrimers, Layer-by-layer deposition, block copolymers self-assembly and nanocontainers; Polymer nanocontainers with controlled permeability; block copolymer protein hybrid system, stimuli responsive nanocapsules, biomaterials and Gene therapy.

UNIT V - DRUG DELIVERY

9

Nano materials synthesis and characterization; Different Methodology Used in the targeted Drug delivery; Bio Marker Using Nano Materials; Targeted delivery for Disease Diagnosis and therapeutics; Different Detection Methods for Targeted Delivery.

Total Periods :45

TEXT BOOKS

1. Nanobiotechnology: Concepts, Applications and Perspectives, Christof M. Niemeyer (Editor), Chad A. Mirkin (Editor) , Wiley-VCH; 1 edition , 2004.
2. NanoBioTechnology: BioInspired Devices and Materials of the Future by OdedShoseyov And Ilan Levy, Humana Press; 1 edition 2007.

REFERENCE BOOKS

1. NanoBiotechnology Protocols (Methods in Molecular Biology) by Sandra J Rosenthal and David W. Wright , Humana Press; 1 edition, 2005.
2. Bio-Nanotechnology_ Concepts and applications. Madhuri Sharon, Maheshwar Sharon, Sunil Pandey and Goldie Oza, Ane Books Pvt Ltd, 1 edition 2012
3. Microscopy Techniques for Material Science. A. R. Clarke and C. N. Eberhardt (Editors) CRC Press. 1st Edition, 2002.

BGE 704

STEM CELL BIOLOGY

3 0 0 3

OBJECTIVES:

To enable understanding chemical principles governing biochemical reactions

COURSE OUTCOMES :

CO1 : Understand Unique properties of stem cells.

CO2 : Invitrofertilization

CO3 : Understand the Somatic stem cells

CO4 : Understand the Target identification differentiation pathways.

CO5 : understand the production of complete organ

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M					M			S		S	
CO2	S	S		M	S					M		M
CO3	S	M	S							S		
CO4				S	S	M			M		M	
CO5	S	M		M								

Course Assessment methods:

DIRECT		INDIRECT	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Vivo voce	3	Industry
4	Model Exam	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - STEM CELL BASICS

9

Unique properties of stem cells – embryonic stem cells - adult stem cells – umbilical cord stem cells – similarities and differences between embryonic and adult stem cells. Properties of stem cells – pluripotency – totipotency – multipotency.

UNIT II - EMBRYONIC STEMCELLS

9

In vitro fertilization – human embryonic stem cells – blastocyst – inner cell mass – growing ES cells in lab – laboratory tests to identify ES cells – stimulation ES cells for differentiation – properties of ES cells – human ES cells – Monkey and Mouse ES cells.

UNIT III - ADULT STEM CELLS

9

Somatic stem cells – test for identification of adult stem cells – adult stem cell differentiation – trans differentiation – plasticity – different types of adult stem cells.

UNIT IV - STEM CELL IN DRUG DISCOVERY AND TISSUE ENGINEERING

9

Target identification – Manipulating differentiation pathways – stem cell therapy Vs cell protection - stem cell in cellular assays for screening – stem cell based drug discovery platforms, drug screening and toxicology.

UNIT V - GENETIC ENGINEERING AND THERAPEUTIC APPLICATION OF STEM CELLS

9

Gene therapy – genetically engineered stem cells – stem cells and Animal cloning – transgenic animals and stem cells – Biomarkers in Cancer – Therapeutic applications – parkinson disease - Neurological disorder – limb amputation – heart disease - spinal cord injuries – diabetes – burns Matching the stem cell with trans plant recipient - HLA typing Alzheimers disease – spinal cord injuries tissue engineering application – production of complete organ - kidney – eyes - heart – brain.

Total Periods :45

TEXT BOOKS

1. Stem cells Hand Book by Stewart Sell
2. Stem cell Research by Nancy E. Snow

REFERENCE BOOKS

1. Human Embryonic Stem cells by Ann.A. Kiessling
2. Stem cell and future of regenerative medicine. National Academic press
3. Stem cell and Cloning by David A. Prentice and Michael A. Palladin.

OBJECTIVES:

To enable understanding chemical principles governing biochemical reactions

COURSE OUTCOMES :

CO1 : Understand Unique properties of stem cells.

CO2 : Invitrofertilization

CO3 : Understand the Somatic stem cells

CO4 : Understand the Target identification differentiation pathways.

CO5 : Understand the production of complete organ

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M					M			S		S	
CO2	S	S		M	S					M		M
CO3	S	M	S							S		
CO4				S	S	M			M		M	
CO5	S	M		M								

Course Assessment methods:

DIRECT		INDIRECT	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Vivo voce	3	Industry
4	Model Exam	4	Alumni
5	Quiz		
6	End Semester Examinations		

LIST OF EXPERIMENTS

1. Sequence retrieval from biological database
2. Knowledge on variants of BLAST
3. Gene prediction
4. Translation the sequences and ORF finding
5. Splice site junction prediction
6. Protein targeting signal sequence prediction
7. Pattern searching
8. Comparative genome analysis
9. Phylogeny analysis
10. FASTA Variance analysis

REFERENCE BOOK

1. Basics of Molecular Cloning – promega
2. Sequence and Genome analysis David W. Mount, 2004. Cold spring harbor laboratory press Newyork.
3. Molecular cloning – A laboratory manual. Joseph sambrook and David w. Russell

BGE 7L2

ANIMAL CELL CULTURE LABORATORY

0 0 4 2

OBJECTIVES:

To enable understanding chemical principles governing biochemical reactions

COURSE OUTCOMES :

CO1 : Understand Unique properties of stem cells.

CO2 : Invitrofertilization

CO3 : Understand the Somatic stem cells

CO4 : Understand the Target identification differentiation pathways.

CO5 : understand the production of complete organ

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium, W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M					M			S		S	
CO2	S	S		M	S					M		M
CO3	S	M	S							S		
CO4				S	S	M			M		M	
CO5	S	M		M								

Course Assessment methods:

DIRECT		INDIRECT	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Vivo voce	3	Industry
4	Model Exam	4	Alumni
5	Quiz		
6	End Semester Examinations		

LIST OF EXPERIMENTS

1. Preparation of culture media
2. Sterilization techniques of cell and tissue culture labwares/Glasswares
3. Adaptation of Animal virus in cell lines.

4. Study of effect of anti cancer agent in cell culture.
- 5 Organ Culture
5. MTT Assay
6. Live cell counting
7. Leukocyte culture
8. Culturing of spleen cells
9. PBMC or Myeloma cell culture
10. Fusion of cells by PEG

REFERENCE BOOK

1. Basics of Cell Culture - A student laboratory manual By Golnar Afshar PhD Laboratory Manual
2. Introduction to animal Cell Culture, John A Ryan

BGE 802

NEURAL NETWORKS &FUZZY LOGIC

3 0 0 3

OBJECTIVES:

- To enable understanding chemical principles governing biochemical reactions.

COURSE OUTCOMES :

- CO1** : Understand Neural networks
CO2 : back propagation learning methods.
CO3 : Understand the Fuzzy controller
CO4 : Understand the Fuzzy algorithms.
CO5 : understand the Genetic Algorithm

CO/PO Mapping

(S/M/W indicates strength of correlation) S-Strong, M-Medium,W-Weak

COs	Programme Outcomes(POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M					M			S		S	
CO2	S	S		M	S					M		M
CO3	S	M	S							S		
CO4				S	S	M			M		M	
CO5	S	M		M								

Course Assessment methods:

DIRECT		INDIRECT	
1	Observation Book	1	Course and Survey
2	Record Book	2	Faculty Survey
3	Vivo voce	3	Industry
4	Model Exam	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT-I - NEURAL NETWORKS-1(INTRODUCTION & ARCHITECTURE) 9

Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory.

UNIT-II - NEURAL NETWORKS-II (BACK PROPOGATION NETWORKS) 9

Architecture: perceptron model, solution, single layer artificial neural network, multilayer perception model; back propagation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting back propagation training, applications.

UNIT-III - FUZZY LOGIC-I (INTRODUCTION) 9

Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion.

UNIT-IV - FUZZY LOGIC –II (FUZZY MEMBERSHIP, RULES) 9

Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzifications, Fuzzy Controller, Industrial applications.

UNIT-V - GENETIC ALGORITHM(GA) 9

Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Mutation, Generational Cycle, applications.

Total Periods :45

TEXT BOOKS:

1. S. Rajsekaran& G.A. VijayalakshmiPai, “Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications” Prentice Hall of India.
2. N.P.Padhy,”Artificial Intelligence and Intelligent Systems” Oxford University Press.

REFERENCE BOOKS:

1. SimanHaykin,”Neural Netowrks”Prentice Hall of India
2. Timothy J. Ross, “Fuzzy Logic with Engineering Applications” Wiley India.
3. Kumar Satish, “Neural Networks” Tata McGraw Hill

ELECTIVES

BGE 001

HUMAN GENETICS

3 0 0 3

OBJECTIVE:

1. To understand fundamental laws of genetics.
2. To know techniques in in situ genetic analysis for mutation and aberration studies.
3. To identify and relate phenotype to changes in chromosome structure and number.
4. To perform linkage analysis and recombination mapping.
5. To study population and analyse quantitative characters.

COURSE OUTCOMES:

CO01-This course introduces the principles of genetics.

CO02- It discusses the basics laws of inheritance.

CO03- It gives chromosome structure and cytological techniques.

CO04 - Properties of chromosome variation, linkage mapping and population genetics.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S											
CO2		W	S		M							
CO3		M		S								
CO4	S		M	W								

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - GENOME ORGANIZATION AND INHERITANCE

9

Organization, Human multigene families and repetitive coding DNA, Extragenic repeated DNA sequences and transposable elements, Inheritance-Autosomal Dominant Inheritance-Autosomal Recessive Inheritance- Factors that May Complicate Inheritance Patterns- Consanguinity in Human Populations, Sex-Linked and Mitochondrial Inheritance, X inactivation- Sex-Linked Inheritance- Sex-Limited and Sex-Influenced Traits- Mitochondrial Inheritance.

UNIT II - GENOME MAPPING AND DEVELOPMENTAL GENETICS 9

Physical Mapping - Low resolution physical mapping, High resolution physical mapping, Genetic mapping- Two-point mapping, Multipoint mapping, Parametric linkage analysis, Nonparametric linkage analysis, Development genetics- Genetic Mediators of Development, the Molecular Toolbox- Pattern Formation.

UNIT III - MEDICAL GENETICS 9

The Chromosomal Basis of Human Disease- Nomenclature-Abnormalities of Chromosome Number- Abnormalities of Chromosome Structure- Pregnancy Loss- Cancer genetics- Cancer Genes- Oncogenes, Activation of proto-oncogenes, Tumor suppressor genes, Molecular Basis of Cancer, Control of the cell cycle, Defects of Metabolic Processes- Pharmacogenetics.

UNIT IV - IDENTIFICATION OF DISEASE GENES 9

Identifying human disease genes - Principles and strategies in identifying disease genes, Position-independent strategies for identifying disease genes, positional cloning, Positional candidate strategies to identify candidate genes by a combination of their map position and expression, function or homology, confirming a candidate gene

UNIT V - THE GENETICS OF COMMON DISEASES 9

Genetic Screening, Genetic Diagnosis, and Gene Therapy, Population Screening for Genetic Diseases, Molecular Tools for Screening and Diagnosis, Prenatal Diagnosis of Genetic Disorders and Congenital Defects, Fetal Treatment, Pedigree analysis and Genetic Counseling.

Total Periods: 45

TEXT BOOKS

1. Human Molecular Genetics – Tom Strachan and Andrew P. Read
2. Medical Genetics 3rd Edition- Jorde, Carey, Bamshad& White.

REFERENCE BOOKS

1. Human Genetics and Genomics, Third Edition - Bruce R. Korf
2. Human Genetics : Principles and Approaches - Friedrich Vogel and Arno G. Motulsky
3. Watson, J.D., Gilman, M., Witowski J.and Zoller, M. Recombinant DNA, 2nded., Scientific American Books, 1983

BGE 002 PROTEIN ENGINEERING 3 0 0 3

OBJECTIVE:

1. To understand the principle of nucleic acid isolation.
2. To understand the principles of PCR and their uses in genetic engineering.
3. To gain a thorough knowledge about nucleic acid hybridization.
4. To learn history of DNA sequencing and current methods and gene synthesis.

COURSE OUTCOMES:

CO01-This course imparts the knowledge on the principles on nucleic acid isolation and purification.

CO02- It also gives knowledge on history and latest methods of DNA sequencing..

CO03- It deals with the protein – protein interaction.

CO04 - It imparts protein sequencing methods.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				S								
CO2			S	W			M					
CO3	M					S						
CO4		S	W			M						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - INTRODUCTION TO PROTEIN ENGINEERING**9**

Introduction to proteins. Genes and proteins. Proteomics. Basics of protein synthesis. Types and classification of proteins. Primary structure, secondary structure, tertiary structure, quaternary structure, Ramachandran plots.

UNIT II- PROTEIN STRUCTURE PREDICTION**9**

Strategies for design of novel proteins-strategies for the design of structure and function, computer methods in protein modelling. Bioinformatics tools in protein studies.

UNIT III - PRODUCTION OF NOVEL PROTEINS**9**

Site and strategies for heterologous expressions, methods for expressing recombinant proteins in yeast, invitro mutagenesis. Yeast two Hybrid system.

UNIT IV - CHARACTERIZATION OF PROTEINS**9**

Traditional and advanced methods in protein characterizations. NMR spectroscopy, crystallography, spectroscopic and calorimetric methods.

UNIT V - APPLICATIONS OF PROTEIN ENGINEERING

9

Application of protein engineering in industries. Design of polymeric biomaterials, nicotinic acetylcholine receptors as a model for a super family of ligand - gated ion channel proteins

Total Periods: 45

TEXT BOOK:

1. Protein engineering and design by Paul R.carey, academic press, 1996, 361 pages
2. Baxevanis A.D. and Oullette, B.F.F. A Practical Guide to the Analysis of Genes and Proteins, 2nd ed., John Wiley, 2002
3. Models of Proteins and Nucleic Acids. Cambridge University Press, 1998

REFERENCE BOOKS

1. Proteomics from protein sequence to function: Edited by S.R.Pennington and M.J.Dunn, Taylor and Francis Group, 2001.
2. Biophysical Chemistry, Cantor and Schimmel, part I and II, W.H. Freeman and co 1997.

BGE 003

INDUSTRIAL MICROBIOLOGY

3 0 0 3

OBJECTIVE:

1. To develop their practical skills in microbial fermentation techniques.
2. To evaluate enzyme kinetics.
3. To carry out enzyme immobilized reaction.
4. To develop the practical skills in solid substrate fermentation in wine production..

COURSE OUTCOMES:

CO01- Enables the student to develop their skills in the field of microbial fermentation technology.

CO02- It also gives knowledge on history and latest methods of enzyme kinetics.

CO03- It deals with the antibiotic production.

CO04- It imparts anaerobic fermentation methods.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S										
CO2			S	W			M					
CO3	M					S						
CO4		S	W			M						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - INTRODUCTION AND HISTORY**9**

Definition, scope and roles of microbiology and its relation to other disciplines; fundamentals and characteristics of the roles of microbes in bioprocess technology; nomenclature and classification of microbes; review of microbes commonly used in bioprocess industries: bacteria, actinomycetes, yeasts, fungi, viruses and algae; history of industrial microbiology; Role of microorganisms in petroleum degradation and bioleaching.

UNIT II - MICROORGANISMS OF INDUSTRIAL IMPORTANCE**9**

Selection of Microorganisms; Primary and Secondary Screening; Types of stock culture, Strain Improvement Strategies; Strain Identification & Strain Preservation of Industrial Microorganisms for overproduction of Primary and Secondary metabolites; Medium requirements for fermentation process-carbon, nitrogen, minerals, vitamins and other nutrients-examples of simple and complex media.

UNIT III - PRODUCTION OF PRIMARY AND SECONDARY METABOLITES**9**

A brief outline of processes for the production of some commercially important Organic acids (citric acid, taconic acid, lactic acid, acetic acid, gluconic acid) and amino acids (glutamic acid, lysine, aspartic acid, phenylalanine etc.) and Alcohols (ethanol, 2,3,-butanediol etc.) Study of production process for various classes of low molecular weight secondary metabolites: Antibiotics-beta-lactams (Penicillins, Cephalosporins etc.), Aminoglycosides (streptomycin, kanamycin etc.), macrolides (erythromycin), quinines, aromatics etc.; Vitamins and Steroids.

UNIT IV - PRODUCTION OF COMMERCIALLY IMPORTANT ENZYMES AND PROTEINS**9**

Proteases, Amylases, Lipases, Cellulases, Pectinases, Isomerases and other commercially important enzymes for the food and pharmaceutical industries; Production of recombinant proteins having therapeutic and diagnostic applications; production of vaccines.

UNIT V - FERMENTATION**9**

Definition of fermentation; fermentor/bioreactor; fermentation media; raw materials – molasses and types, corn steep liquor, sulphite waste liquor and whey. Buffers, precursors, inhibitors, and antifoam agents. inoculum preparation. Types of Fermentation Processes: Surface, Submerged and Solid state fermentation, Batch and Continuous fermentation. Down stream processing – Precipitation, filtration, centrifugation, distillation, cell disruption, solvent recovery, drying.

Total Periods: 45

TEXT BOOKS

1. L. E. Casida, Jr.; Industrial Microbiology. Wiley Eastern Ltd., 1989.
2. Text book of microbiology by Tortara, 2005

REFERENCE BOOK

1. G. Reed (Ed.); Prescott and Dunn's Industrial Microbiology (4th Ed.). CBS Publishers, 1987.
2. H. J. Rehm, G. Reed and H. Pape (Eds.) Biotechnology (A Comprehensive Treatise vols. 1-8). VCH, 1986
3. Crueger and A. Crueger; Biotechnology: A Textbook of Industrial Microbiology (Eng. Ed. T. D. Brook). Sinaeur Associates, 1990.

BGE 004

INDUSTRIAL MANAGEMENT

3 0 0 3

OBJECTIVE:

1. To understand the principle of nucleic acid isolation.
2. To understand the principles of PCR and their uses in genetic engineering.
3. To gain a thorough knowledge about nucleic acid hybridization.
4. To learn history of DNA sequencing and current methods and gene synthesis

COURSE OUTCOMES:

- CO01- Enables the student to develop their skills in the field of microbial fermentation technology.
- CO02- It also gives knowledge on history and latest methods of enzyme kinetics.
- CO03- It deals with the antibiotic production.
- CO04 - It imparts anaerobic fermentation methods.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S										
CO2			S	W			M					
CO3	M					S						
CO4		S	W			M						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - PRINCIPLES OF MANAGEMENT 9

Principles of management-Management functions-planning-organizing-organization structures-span of control-Delegation-Directing-Leadership and motivation-Controlling-Decision making-Single stage decision making under risk-Multistage decision making, decision making under uncertainty-equally likely-minimax and maximum criteria.

UNIT II - OPERATION MANAGEMENT 9

Operation management-production systems and functions-product design and selection, concept of total quality management and ISO 9000 system of standards-concept of supply chain management,

UNIT III - PROJECT MANAGEMENT 9

Project management-projects and management-network analysis-critical path method (CPM) network-finding critical path-slacks-crashing (time-cost trade off)-PERT network.

UNIT IV - MARKETING MANAGEMENT 9

Marketing management-Concept of market and marketing-marketing function, marketing mix-market research- Advertising and sales promotion-human resource management-manpower requirement analysis-recruitment and training-job analysis-job evaluation, wages and incentives

UNIT V - FINANCIAL MANAGEMENT 9

Financial management-objectives/functions-concept of time value of money-basics of financial accounting, profit and loss account, balance sheet, costing, elements of costs-cost sheet, allocation of overheads. Break even analysis depreciation, significance and methods of depreciation.

Total Periods: 45

TEXT BOOKS

1. Mazda F, Engineering Management, Addison Wesley
2. Buffa E.S. & Sarin R.K. Modern Production/Operations Management, John Wiley

REFERENCE BOOKS

1. BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2007
2. Kankanala C., Genetic Patent Law & Strategy, 1st Edition, Manupatra, Information Solution Pvt. Ltd., 2007
3. S.S.Kanka Entrepreneurship Development, S.Chand and Co, New Delhi 1997

OBJECTIVE:

1. To study the historical development of bio process technology ,design of fermenter and types of fermentation process.
2. To gain knowledge about formulation of medium and principles of sterilization.
3. To study the stoichiometry and energetics of cell growth and product formation.
4. To evaluate the kinetics and mechanism of microbial growth.

COURSE OUTCOMES:

CO01- Enables the student to develop their skills in the field of hydrodynamics.

CO02- It also gives knowledge on Kinetics of cell growth in batch culture.

CO03- It deals with the temperature measurement control.

CO04 - It imparts determination of biomass and application of biosensors.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					S							
CO2			S	W			M					
CO3		M			S							
CO4			W	S		M						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - BIOREACTOR DESIGN**9**

Introduction to Bioreactor and Fermentor. Types of Bioreactor, Heat transfer, Scale – up, Airlift Bioreactors, Introduction, Design and construction of the airlift – loop reactor, Hydrodynamics, Three – phase flow, Mixing, Oxygen transfer.

UNIT II - BATCH AND CONTINUOUS GROWTH**9**

Growth, Measurement of microbial growth (direct), Measurement of microbial growth (indirect), Kinetics of cell growth in batch culture, Continuous culture.

UNIT III - MIXING, MASS TRANSFER AND INSTRUMENTATION CONTROL OF BIOREACTORS **9**

Introduction, Mass transfer, Theory of mixing, Rheological properties, Bioreactor sensor characterizes, Temperature measurement control, principles of dissolved oxygen measurement and control, principles of PH / redox measurement and control, deduction and prevention of foam, determination of biomass and application of biosensors.

UNIT IV - BIOREACTOR OFF – GAS ANALYSIS **9**

Introduction, generalized gas balance equations, Steady – state balancing, Derived quantities based on combined gas analysis and gas mass balancing techniques, Gas analysers.

UNIT V - MODELING OF PLANT AND ANIMAL CELL BIOREACTORS **9**

Modelling, digital simulation, formulation and solution of problems by simulations, digital simulation programming languages, ISIM (interactive simulation language) Plant cells, Animal cells.

Total Periods: 45

TEXT BOOK:

1. “Bioreactors in Biotechnology”, Ellis Horwood series, 1991. A. H. SCRAGG.
2. Peter, Max S. and Timmerhaus, Klaus D. Plant Design and Economics for Chemical Engineers, 4th ed., McGraw Hill, 1991.

REFERENCE BOOKS

1. Bailey, J.E. and Ollis, D.F. Biochemical Engineering Fundamentals", 2nd ed., McGraw Hill 1986.
2. Stanbury, P.F., Stephen J. Hall & A. Whitaker, Principles of Fermentation Technology, Science & Technology Books.
3. Nielsen, J. and Villadsen, J. “Bioreaction Engineering Principles”. Springer, 2007.

BGE 006

BIOMEDICAL ENGINEERING

3 0 0 3

OBJECTIVE:

1. To understand the working principle of various equipments.
2. To analyze the results of different spectrophotometer and identify the chemical nature of the samples.
3. To analyze the results of MS spectrophotometer and able to calculate the mass by interpreting the results.
4. To understand the differences in the application of different microscopic methods.

COURSE OUTCOMES:

CO01- Enables the student to develop their skills in the medical devices.

CO02- It also gives knowledge on rehabilitation biomechanics.

CO03- It deals with bio signal analyzer.

CO04 - It imparts determination of ultrasound in diagnosis.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					S							
CO2			S	W			M					
CO3		M			S							
CO4			W	S		M						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I – INTRODUCTION

9

Anatomy of human-various bones-functions-muscles-types-function. Medical devices. Medical imaging. Implants. Bionics. The improvement of diagnosis and therapy; biomedical information storage and retrieval.

UNIT II - MUSCLE STRUCTURE AND ITS FUNCTIONS

9

Muscle structure and its attachment with skeleton-rate of contraction and force generation-Activation contraction-locomotion-stability-forces on ground-forces on muscles-energy requirement-mechanisms of walking, running and trotting-sports.

UNIT III – BIOMECHANICS

9

Mechanical analysis of performance-rehabilitation biomechanics-mechanics of prosthetics and orthotics biomechanics of human injury and orthopaedics fixation-mechanics of bones and joint-dynamics of man machine interaction.

UNIT IV - BIOSYSTEM MODELING

9

Electrical impedance cephalography-biotelemetry-biosignalanalyzer-biosystem modelling.

UNIT V - ULTRASOUND IN DIAGNOSIS

9

Ultrasound in diagnosis-limb prosthetics and orthotics-sensory aids for the blinds-assisting the heart and kidney- ECG-EEG-Physiological equipments.

Total Periods: 45

TEXT BOOKS:

1. Atilla Hincal A., Suheylakas, H, Biomedical Science & Technology, Plenum Press New York.
2. Albert D. Helfrick and William D. Cooper. Modern Electronic Instrumentation and Measurement Techniques”, Prentice Hall of India, 2007.

REFERENCES BOOKS

1. Ernest o Doebelin and dhanesh N manik, Measurement systems, Application and design, 5th edition, McGraw-Hill, 2007.
2. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, New Delhi, 2003.
3. Standard Handbook of Biomedical Engineering & Design – Myer Kutz, McGraw-Hill Publisher, 2003.

BGE 007

CHEMICAL REACTION ENGINEERING

3 0 0 3

OBJECTIVE:

1. To understand the basic concepts of bioreactor design.
2. To learn about the Air-driven bioreactors and bioreactors for plant and animal cell cultivation.
3. To study about the solid state bioreactors and instrumentation control of bioreactors.

COURSE OUTCOMES:

The course imparts advanced knowledge on bioreactor design

CO01- The course imparts advanced knowledge on bioreactor design.

CO02- It also gives knowledge on efficient utilization of the principles in bioprocess technology.

CO03- It deals with biocatalyst conversion.

CO04 - It imparts determination of steady-state plug flow reactors.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S										
CO2	S			W			M					
CO3		M		S								
CO4			W	S		M						

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - BASICS OF REACTOR DESIGN**9**

Kinetics of homogeneous reactions: concentration-dependent term of a rate equation, temperature-dependent term of a rate equation, predictability of reaction rate from theory. Interpretation of batch reactor data: constant volume batch reactor, varying-volume batch reactor, temperature and reaction rate, search for a rate equation.

UNIT II - IDEAL REACTORS**9**

Introduction to reactor design. Ideal reactors for a single reaction: ideal batch reactors, steady-state mixed flow reactors, steady-state plug flow reactors.

UNIT III - SINGLE REACTIONS**9**

Design for single reactions: size comparison of single reactors, multiple-reactor systems, recycle reactor.

UNIT IV - NON-IDEAL FLOW**9**

Basics of non-ideal flow: E-age distribution of fluid-RTD, conversion in non-ideal flow reactors. Dispersion model: axial dispersion, chemical reaction and dispersion. Tanks-in-series model: pulse response experiments and the RTD, chemical conversion.

UNIT V - SOLID CATALYSTS**9**

Determination of surface area, void volume and solid density, pore-volume distribution, catalyst preparation, promoters and inhibitors, catalyst deactivation,

Total Periods: 45**TEXT BOOK**

1. Warren L. McCabe, Julian C. Smith and Peter Harriott, "Unit Operations of Chemical Engineering", 6th Edn., McGraw Hill International Edition, New York 2001.
2. Bhatt B.I., Vora S.M. Stoichiometry. 3rd ed., Tata McGraw-Hill, 1977.
3. McCabe W.L., et al., Unit Operations In Chemical Engineering. 6th ed., McGraw-Hill Inc., 2001.

REFERENCE BOOKS

1. Smith J.M, “Chemical Engineering Kinetics”,3rdedn.,McGraw Hill International Editions, NewDelhi,1981.
2. Scott Fogler H., “Elements of Chemical Reaction Engineering”,2ndEdn.,Prentice Hall of India, New Delhi,1995.
3. Octave Levenspiel, “Chemical Reaction Engineering”,3rdEdn., John Wiley & Sons, Singapore, 1999.
4. Geankoplis C.J. Transport Processes And Unit Operations. 3rded., Prentice Hall India, 2003.

BGE 008 BIOCONFINEMENT OF GENETICALLY MODIFIED ORGANISMS 3 0 0 3

OBJECTIVE:

1. Gain knowledge on basic developmental aspects of plant that can be transformed into research application.
2. Apply the modular approach and regulatory networks present in a cell.
3. Possess requisites for plant signal transduction research.

COURSE OUTCOMES:

- CO01- The course imparts advanced knowledge on genetically modified organisms.
CO02- It also gives knowledge on efficient utilization of the principles of bioconfinement.
CO03- It deals with transgenic algae.
CO04 - It imparts determination of bioconfinement research.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		S		M								
CO2	S				W		M					
CO3		M		S		S						
CO4			W	S		M	M					

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - INTRODUCTION TO BIOCONFINEMENT 9

Genetically Engineered Organisms – Applications of Genetically modified organisms in medicine and Agriculture. Bio confinement - Methods of Bio confinement, International Aspects - History of Confinement - Social Acceptability of Bio confinement Methods,

UNIT II - NEED FOR BIOCONFINEMENT 9

Risk factors - Effects on Non-target Species - Delaying the Evolution of Resistance - Food Safety and Other Issues - Need for Bio confinement

UNIT III - BIOCONFINEMENT OF PLANTS AND ANIMALS 9

Genetically Engineered Trees - Transgenic Grasses - Transgenic Algae-Effectiveness at Different Spatial and Temporal Scales - Monitoring and Managing Confinement Failure -bio confinement of fish, and insects.

UNIT IV BIOCONFINEMENT OF VIRUSES, BACTERIA, AND OTHER MICROBES 9

Introduction - Potential Effects or Concerns, and Need for Bio confinement in Viruses, Fungi, and Bacteria

UNIT V - BIOLOGICAL AND OPERATIONAL CONSIDERATIONS FOR BIOCONFINEMENT 9

Execution of Confinement - International Aspects - Bio confinement - Bio confinement Research

Total Periods: 45

TEXT BOOK

1. Biological confinement of genetically engineered organisms by national research council: NationalAcademic press
2. Piefzer F.M. Food Microbiology, Academic Press, 1989

REFERENCE BOOKS

1. Sasson A, Biotechnologies and Development, UNESCO Publications

BGE 009

MOLECULAR MEDICINE

3 0 0 3

OBJECTIVE:

1. To gain knowledge of basic cytogenetic techniques.
2. To learn about biochemical method used to detect metabolic changes.
3. To learn about molecular methods to detect changes in the DNA.
4. To learn about molecular methods to detect changes in the RNA and protein.

COURSE OUTCOMES:

To learn about various diagnostic strategies to detect large deletions in chromosomes, , changes in gene expression at RNA and protein level, protein truncation, and splicing variants.

CO01- To learn about various diagnostic strategies to detect large deletions in chromosomes.

CO02- It also gives knowledge on efficient utilization of changes in gene expression at RNA and protein level.

CO03- It deals with protein truncation.

CO04 - It imparts determination of splicing variants.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			M		M						
CO2		S			W		M					
CO3		M		S		S						
CO4	S		W	S		M	M					

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - INTRODUCTION TO MOLECULAR MEDICINE

9

Introduction to Molecular Medicine : Overview of the subject -Molecular mechanisms in development and differentiation -Molecular and biomedical aspects of ageing

UNIT II - GENE EXPRESSION AND PROTEIN FUNCTIONAL DEFECTS IN DISEASE

9

Vesicle trafficking in cells -Abnormal protein function and disease -Diseases of DNA repair and genomic instability -RNA processing and disease-Oncology-Chromosomal translocations and leukaemia: identification of novel therapeutic targets -Lymphoma -Skin cancer-Solid tumours: renal carcinoma-Lung and circulatory disease-Coagulation and haemophilia -Atherosclerosis -Cystic fibrosis -Molecular aspects of neurodegenerative disease-Prion proteins -Alzheimer's and Huntington's diseases

UNIT III - MOLECULAR PHARMACOLOGY

9

Pharmacogenetics -Drug discovery -Drug design and development -Molecular aspects of infectious diseases- Intracellular pathogens: Bacillary dysentery Extracellular pathogens: Botulism and tetanus -Viral pathogens: Dengue haemorrhagic fever

UNIT IV - IMMUNOLOGICAL ASPECTS OF MOLECULAR MEDICINE

9

Autoimmunity and transplantation -Human genome and predisposition to autoimmunity - Transgenic models of autoimmunity-Lessons from animal models for manipulation of the immune system

UNIT V - MOLECULAR BIOTECHNOLOGY

9

Recombinant proteins; state of the art, problems, new developments -Antibodies, design production, engineering -Peptides and derivatives as therapeutic agents-Gene therapy and delivery – Nanotechnology and pharmaceuticals – Drug delivery systems-Commercialisation - Clinical trials/ethics

Total Periods: 45

TEXT BOOKS

1. Medical Genetics 3rd Edition- Jorde, Carey, Bamshad& White.
2. Molecular pharmacology A short course by Jerry Kenatin : John Wiley and Sons publications.

REFERENCES:

1. Gary Walsh – “Proteins – Biochemistry and Biotechnology” Robert A. Meyers - Encyclopedia of Molecular Cell Biology and Molecular Medicine (Ed) – Vol I, II ed.
2. Barry Halliwell - Free Radicals in Health and Disease

BGE 010

COMPUTER SKILLS

3 0 0 3

OBJECTIVE:

1. To understand the general scientific concepts required for technology
2. To apply the Physics concepts in solving engineering problems
3. To educate scientifically the new developments in engineering and technology
4. To emphasize the significance of Green technology through Physics principles

COURSE OUTCOMES:

- CO01- To learn about various DBMS System Structure .
- CO02- It also gives knowledge on Tabular Representation of Various ER Schema
- CO03- It deals with entity and entity set.
- CO04 - It imparts determination of functional dependency Set.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			M		M						
CO2		S			W		M					
CO3		M		S		S						
CO4	S		W	S		M	M					

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I – INTRODUCTION

9

DBMS- Data model- Data Independence- Data Catalog- DBMS Architecture & Data Abstraction- DBMS Languages- DBMS System Structure- ER Model: Objects, Attributes and its Type, Entity and Entity Set, Relationship & Relationship.

UNIT II - DATABASE DESIGN

9

Design Issues in choosing attributes or entity set or relationship set- Constraints- Super Key- Candidate Keys- Primary Key- ER Diagram Notations- Goals of ER Diagram- Weak Entity Set- ER Diagram Construction- Tabular Representation of Various ER Schema- Views

UNIT III - STRUCTURED QUERY LANGUAGE

9

SQL: Overview, the Form of Basic SQL Query, UNION, INTERSECT, and EXCEPT- Nested Queries- Aggregate Functions- Null Values.

UNIT IV - RELATIONAL MODEL DESIGN TECHNIQUE

9

Pitfalls in relational database-1NF- Super Key & Functional dependency: Closure of Functional Dependency Set- Closure of Attribute Set- Minimal Functional Dependency

UNIT V - SEQUENCING DATABASES

9

Sequencing Databases-(DNA and proteins Sequencing) - GenBank and Swiss Prot- Derived Databases-Pfam, BLOCKS, etc. Structure Databases-Collection- validation of Structure Data- PDB and NDB- Derived Databases, SCOP, PALI, etc.

Total Periods: 45

TEXTBOOKS

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, *Database System Concepts*, McGraw-Hill, 4th Edition, 2002.
2. Raghuram Ramakrishnan, Johannes Gehrke, *Database Management System*, McGraw Hill, 3rd Edition 2003.
3. David J. Parry-Smith, Teresa K. Attwood, *Introduction to Bioinformatics*, Longman, 1999.

REFERENCE BOOKS

1. Elmasri & Navathe, *Fundamentals of Database System*, Addison-Wesley Publishing, 3rd Edition, 2000.
2. Date C.J., *An Introduction to Database*, Addison-Wesley Pub Co, 7th Edition, 2001.
3. Jeffrey D. Ullman, Jennifer Widom, *A First Course in Database System*, Prentice Hall, AWL 1st Edition, 2001.
4. Peter Rob, Carlos Coronel, *Database Systems – Design, Implementation, and Management*, 4th Edition, Thomson Learning, 2001.

BGE 011

BASIC MOLECULAR TECHNIQUES

3 0 0 3

OBJECTIVE:

1. To know the basics about cell and its evolution.
2. To know about the structure and function of cell organelles
3. To understand the transport systems, molecular motors, cell signaling and regulation of cell 4. To know the basics of cytogenetics.

COURSE OUTCOMES:

The course is aimed to make the students understand the structure and function of cell and its organelles. It also aims to introduce cytogenetic which forms the basis for other courses in genetics

CO01- To learn about various cell organelles .

CO02- It also gives knowledge on SDS-PAGE.

CO03- It deals with native gel and denaturing gel.

CO04 - It imparts determination of DNA and RNA isolation

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			M		M						
CO2		S			W		M					
CO3		M		S		S						
CO4	S		W	S		M	M					

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - AGAROSE GEL ELECTROPHORESIS OF DNA**9**

Agarose gel electrophoresis – agar, agarose, structure of agarose, movement of DNA in agarose gel, staining of DNA in agarose gel – ethidium bromide – structure-binding with DNA and fluorescence, other dyes for DNA staining, DNA loading dyes and their movement in agarose gels- applications of agarose gel electrophoresis.Principle of Pulsed Field Gel Electrophoresis and its applications.

UNIT II - PAGE OF PROTEIN AND DNA**9**

Principle of polyacrylamide gel electrophoresis (PAGE) - native and denaturing PAGE difference and applications.Protein staining – coomossie staining, silver staining, ponceau staining. Enzyme staining – positive staining and negative staining with examples. PAGE for running DNA – native gel and denaturing gel.

UNIT III - DNA AND RNA ISOLATION**9**

Plasmid DNA isolation – principles of plasmid DNA isolation, different methods of plasmid isolation – classical and spin column methods. Principles and protocols for phage DNA isolation. Principles and protocols for genomic DNA isolation from bacteria, plants, animal tissues and blood – classical and spin column methods.Principles and protocols for different RNA isolation method – Guanidiumisothicyanate method, Trizol method, column based method. mRNA purification using oligo-dT cellulose and sepharose column chromatography, mRNA purification using column

UNIT IV - PURIFICATION AND QUANTIFICATION OF NUCLEIC ACIDS**9**

Purification of nucleic acids – the need for purification – phenol chloroform purification followed by ethanol or isopropanol precipitation, purification by LiCl precipitation, gel purification of DNA by freeze-squeeze method, phenol freeze-thaw method, spin column method. Quantification of nucleic acids visual estimation, spectrophotometric method, fluorimetricmethod.Concentration of nucleic acids by precipitation and redissolving, vacuum concentration and freeze drying (Lyophilization).

UNIT V - COMMONLY USED *E.COLI* STRAINS AND TRANSFORMATION**9**

Genetic markers and genotype of *E. coli* strains that are commonly used in molecular biology.Selection markers, screening markers, principle of blue-white selection using

LacZ gene. Principles and protocols for preparation of chemically competent cell by calcium chloride method and Hanahan's method. Principles and protocols for preparation of electro-competent cell. Principles and protocols for transformation of bacteria by using chemically competent cells and electro-competent cell.

Total Periods: 45

REFERENCES BOOKS:

1. Molecular Cloning – A Laboratory Manual by Sambrook and Russell
2. Principles of Genetics by Gardner, Simmons, Snustad, 8th edition – John Wiley and Sons, Inc., 2003.
3. Mandecki W and Bolling TJ (1988) FokI method of gene synthesis. *Gene* 15:68(1):101-7
4. Stemmer et al (1995) Single-step assembly of a gene and entire plasmid from large number of oligodeoxyribonucleotides. *Gene* 16: 164(1): 49-53

BGE 012

BIOPROCESS PRINCIPLES

3 0 0 3

OBJECTIVE:

1. To familiarize with the basic machine elements
2. To familiarize with the Sources of Energy and Power Generation
3. To familiarize with the various manufacturing processes

COURSE OUTCOMES:

- CO01- To learn about industrially important microorganisms .
 CO02- It also gives knowledge on metabolic stichiometry and statistics.
 CO03- It deals with fermentation process.
 CO04 - It imparts determination of kinetics of microbial growth.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			M		M						
CO2		S			W		M					
CO3		M		S		S						
CO4	S		W	S		M	M					

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - INTRODUCTION TO BIOPROCESS

9

Historical development of bioprocess technologies, role of bioprocess engineer in the biotechnology industry, concept of Bioprocess, outline of an integrated bioprocess and the various (upstream and downstream) unit operations involved in bioprocesses, generalized process flow sheets. A brief survey of organisms, processes, products and market economics relating to modern industrial biotechnology.

UNIT II - FERMENTATION PROCESS

9

General requirements of fermentation processes; Isolation, preservation and improvement of industrially important micro- organisms, development of inocula for industrial fermentations. Different types of fermentations, Basic design and construction of fermentor and ancillaries, An overview of aerobic and anaerobic fermentation processes and their application in the biotechnology industry solid-substrate fermentation and its applications.

UNIT III - 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 coefficient of biomass and product formation, maintenance coefficients, energetics analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

UNIT IV - MEDIA DESIGN AND STERILIZATION FOR FERMENTATION PROCESS

9

Designing of media for fermentation processes, Types of media, design and usage of various commercial media for industrial fermentations, thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid media, air, design of sterilization equipment.

UNIT V - KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION

9

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

Total Periods: 45

TEXT BOOKS

1. Roger G Harrison et al “Bioseparation Science and Engineering” Oxford University Press, 2003
2. Belter PA and Cussler E, “Bioseparations”, Wiley 1985

REFERENCE BOOKS:

1. Pauline.M.Doran ., “Bioprocess Engineering Principles”;Academic press ..
2. Peter F.Stanbury, Allan Whitaker, “Principles of Fermentation Technology”

3. Michael L. Shuler and Fikret Kargi, "Bioprocess Engineering Basic concepts", Prentice Hall, 1992.
4. 2. Asenjo J.M., "Separation processes in Biotechnology" Marcel Dekker Inc. 1993.

BGE 013

ADVANCED MOLECULAR TECHNIQUES

3003

OBJECTIVES:

1. To understand and apply nucleic acids characteristics in research
2. To analyze transcription and regulation of gene expression
3. To know the intricacies of eukaryotic gene expression and design experiments in research

COURSE OUTCOMES:

CO01- To learn about PCR .

CO02- It also gives knowledge on hybridization techniques.

CO03- It deals with DNA sequencing.

CO04 - It imparts artificial DNA synthesis.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			M		M						
CO2		S			W		M					
CO3		M		S		S						
CO4	S		W	S		M	M					

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I – PCR

9

Principle of polymerase chain reaction (PCR). Components of PCR reaction and factors affecting optimization of PCR. Enzymes used in PCR and their properties. Features of an optimum primer, gene specific primer and degenerate primer, RT-PCR, inverse PCR, TAIL PCR, Loop-mediated isothermal amplification (LAMP), Real time PCR

UNIT II - SOUTHERN HYBRIDIZATION

9

Principle of Southern hybridization, probes for Southern hybridization, principle of radioactive probe labeling, hybridization, washing and detection. principle of non-radioactive labeling and detection methods (ECL labeling and DIG labeling).

UNIT III - DNA SEQUENCING

9

DNA Sequencing – Principle of manual and automated sequencing using Sanger method, pyrosequencing, massively parallel sequencing (454 sequencing). History of genome sequencing and genome sequencing strategies– map based approach and shotgun approach. Genome size and number of genes in different species. Prospects of individual genome sequencing and personalized medicine.

UNIT IV - PROTEIN SEQUENCING, SYNTHESIS AND IDENTIFICATION

9

Protein sequencing – Edman degradation method, N-terminal sequencing method and sequencing using mass spectrometry. Peptide synthesis by Solid-phase peptide synthesis method (Robert Bruce Merrifield). Yeast one-hybrid screening, Yeast two-hybrid screening, Phage Display

UNIT V - MANIPULATION OF GENE SEQUENCES AND ARTIFICIAL GENE SYNTHESIS

9

Random mutagenesis, site-directed mutagenesis (Quickchange site directed mutagenesis protocol from Stratagene)- artificial gene synthesis by FokI method and single-step PCR assembly method. Oligonucleotide synthesis by phosphoramidite chemistry.

Total Periods: 45

REFERENCES:

1. Molecular Cloning – A Laboratory Manual by Sambrook and Russell
2. Mandecki W and Bolling TJ (1988) FokI method of gene synthesis. Gene 15:68(1):101-7
3. Stemmer et al (1995) Single-step assembly of a gene and entire plasmid from large number of oligodeoxyribonucleotides. Gene 16: 164(1): 49-53

BGE 014

MOMENTUM TRANSFER

3 0 0 3

OBJECTIVE:

1. To introduce the basic principles of process calculations, Material and Energy balance calculations
2. To understand the basics of First and second laws of thermodynamics
3. To familiarize the students with heat conduction phenomena, convective heat transfer phenomena and heat exchange equipments.

COURSE OUTCOMES:

CO01- To learn about fluid flow phenomena .

CO02- It also gives knowledge on kinematics of flow.

CO03- It deals with transport of fluids.

CO04 - It imparts metering of fluids.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			M		M						
CO2		S			W		M					
CO3		M		S		S						
CO4	S		W	S		M	M					

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - FLUID FLOW PHENOMENA

9

Nature of fluids: incompressible and compressible, hydrostatic equilibrium, manometers, potential flow, boundary layer, the velocity field, laminar flow, Newtonian and non-Newtonian fluids, Newton's-law of viscosity, turbulence, Reynolds number and transition from laminar to turbulent flow, Eddy viscosity, flow in boundary layers, laminar and turbulent flow in boundary layers, boundary-layer formation in straight tubes..

UNIT II - KINEMATICS OF FLOW

9

Streamlines and stream tubes, equation of continuity, Bernoulli equation, pump work in Bernoulli equation. Flow of incompressible fluids in conduits and thin layers: friction factor, relationships between skin-friction parameters, average velocity for laminar flow of Newtonian fluids, Hagen-Poiseuille equation, hydraulically smooth pipe, von Karman equation, roughness parameter, friction-factor chart, equivalent diameter, form friction losses in Bernoulli equation, couette flow.

UNIT III - FLOW PAST IMMERSED BODIES

9

Drag, drag coefficients, drag coefficients of typical shapes, Ergun equation, terminal settling velocity, free and hindered settlings, Stokes' law, Newton's law, criterion for settling regime, fluidization, conditions for fluidization, minimum fluidization velocity.

UNIT IV - TRANSPORTATION OF FLUIDS

9

Introduction to: pipe and tubing, joint and fittings, stuffing boxes, mechanical seals, gate valves and globe valves, plug cocks and ball valves, check valves.-Classification and selection of pumps, blowers and compressors. -Pumps: developed head, power requirement, suction lift and cavitation, NPSH, constructional features and working principle of single suction volute centrifugal pump, characteristic curves of a centrifugal pump, comparison of devices for moving fluids, constructional features and working principle of jet ejectors.

UNIT V - METERING OF FLUIDS

9

Constructional features and working principles of: venturi meter, orifice meter, rotameters, pitot tube, target meters, vortex-shedding meter, turbine meter, magnetic meters.-Application of Bernoulli equation to venturi meter and orifice meter, flow rate calculations from the readings of venturi meter, orifice meter and pitot tube.

Total Periods: 45

TEXT BOOK

1. Warren L. McCabe, Julian C. Smith and Peter Harriott, “**Unit Operations of Chemical Engineering**”, 6th Edn., McGraw Hill International Edition, New York 2001

REFERENCES

1. Coulson J.M., Richardson J.F., Backhurst J.R. and Harker J.M., “**Coulson & Richardson’s Chemical Engineering**”, Vol. I, 6th Edn., Butterworth Heinemann, Oxford, 1999.
2. Noel de Nevers, “**Fluid Mechanical for chemical Engineers**”, 2nd Edn., McGraw Hill International Editions, 1991.

BGE 015

BIOPROCESS ENGINEERING

3 0 0 3

OBJECTIVE:

1. To understand the basic concepts of filtration and agitation and mixing
2. To study the nature of fluids and flow characteristics.
3. To familiarize the mass transfer operations like molecular diffusion
4. To understand the principles extraction and distillation processes involved in industries.

COURSE OUTCOMES:

- CO01- To learn about design and analysis of bioreactors .
- CO02- It also gives knowledge on bioreactor scale up.
- CO03- It deals with modern biotechnological processes.
- CO04 - It imparts modeling and simulation of bioprocesses.

CO/PO Mapping

S – Strong, M – Medium, W – Weak

COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	S			M		M						
CO2		S			W		M					
CO3		M		S		S						
CO4	S		W	S		M	M					

Course Assessment Methods:

Direct		Indirect	
1	Internal Tests	1	Course and Survey
2	Assignments	2	Faculty Survey
3	Seminar	3	Industry
4	Online test	4	Alumni
5	Quiz		
6	End Semester Examinations		

UNIT I - DESIGN AND ANALYSIS OF BIOREACTORS

9

Modelling of Non-ideal Behaviour in Bioreactors-Tanks-in-series and Dispersion models-applications to design of continuous sterilizers; Design and operation of novel bioreactors-Air-lift loop reactors; Fluidized bed bioreactors; Stability analysis of bioreactors.

UNIT II - BIOREACTOR SCALE-UP

9

Transport phenomena in Bioprocess systems, Regime analysis of bioreactor processes, Correlations for oxygen transfer; Scale-up criteria for bioreactors based on oxygen transfer and power consumption.

UNIT III - MONITORING OF BIOPROCESSES

9

On-line data analysis for measurement of important physico-chemical and biochemical parameters; Methods of on-line and off-line biomass estimation; microbial calorimetry; Flow injection analysis for measurement of substrates, products and other metabolites; State and parameter estimation techniques for biochemical processes; computers and interfaces, Computer-based data acquisition, monitoring and control-LABVIEW Software.

UNIT IV - MODERN BIOTECHNOLOGICAL PROCESSES

9

Recombinant cell culture processes, guidelines for choosing host-vector systems, plasmid stability in recombinant cell culture, limits to over expression, Modelling of recombinant bacterial cultures; Bioreactor strategies for maximizing product formation; Bioprocess design considerations for plant and animal cell cultures.

UNIT V - MODELLING AND SIMULATION OF BIOPROCESSES

9

Study of Structured Models for analysis of various bioprocesses; Model simulation using MATLABS IMULINK and ISIM software packages.

Total Periods: 45

TEXT BOOKS

1. Alba S., Humphrey E and Milli N.R., "*Bio Chemical Engineering*" Academic Press, 1973.
2. Scragg.A.H "*Bioreactors in Biotechnology*"- A Practical approach
3. Bailey and Ollis, "*Biochemical Engineering Fundamentals*", McGraw Hill (2nd Ed.). 1986.
Peter F.Stanbury, Allan Whitaker, "*Principles of Fermentation Technology*"