REGULATION 2015

B.TECH - INDUSTRIAL BIO TECHNOLOGY

CURRICULUM AND 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 Practices Laboratory	0	0	3	1
11.	BPC1L1	Physics and Chemistry Laboratory#	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						
SL. 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	0	0	3	1
11.	BEE2L1	Basic Electrical and Electronics Engineering Practices Laboratory	0	0	3	1
12.	BPC2L1	Physics and Chemistry Laboratory#	0	0	3/3	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					
SUB.CODE	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY					
BBT304	Waste Management Technology	3	0	0	3
BBT306	Principles of Chemical Engineering	3	1	0	4
BBT307	General Biochemistry	3	1	0	4
BBT308	General Microbiology	3	0	0	3
BBT309	Instrumentation for Biotechnology	3	0	0	3
BBT310	Immunology	3	0	0	3
PRACTICAL					
BBT3L1	Biochemistry Lab	0	0	4	2
BBT3L2	Instrumental Methods of Analysis Lab	0	0	4	2
BBT3L3	Cell Biology Lab	0	0	4	2
BBT3S1	Technical Seminar I	0	0	3	1
TOTAL HOURS : 35			**CREDITS : 27**		

SEMESTER IV					
SUB.CODE	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY					
BBT401	Bioorganic chemistry	3	0	0	3
BBT403	Introduction to Industrial Biotechnology	3	0	0	3
BBT404	Principles of Chemical Thermodynamics	3	1	0	4
BBT405	Unit Operations	3	1	0	4
BBT406	Introduction to Molecular biology	3	0	0	3
BCE406	Environmental studies	3	0	0	3
PRACTICAL					
BBT4L1	Microbiology Lab	0	0	4	2
BBT4L2	Bioorganic chemistry Lab	0	0	4	2
BBT4L3	Molecular Biology Lab	0	0	4	2
BBT4S1	Technical Seminar II	0	0	3	1
TOTAL HOURS : 35			**CREDITS:27**		

SEMESTER V					
SUB.CODE	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY					
BMA501	Biostatistics	3	1	0	4
BBT501	Genetic Engineering	3	0	0	3
BBT502	Principles of Bioprocess Technology	3	1	0	4
BBT503	Chemical Reaction Engineering	3	1	0	4
BBT505	Plant Biotechnology	3	1	0	4
BBT5E1	Elective -I	3	0	0	3
PRACTICAL					
BBT5L1	Genetic Engineering Lab	0	0	4	2
BBT5L2	Chemical Engineering lab	0	0	4	2
BBT5P1	Mini Project I	0	0	4	2
TOTAL HOURS : 34				**CREDITS : 28**	

SEMESTER VI					
SUB.CODE	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY					
BBT601	Industrial Safety Engineering	3	0	0	3
BBT602	Animal Biotechnology	3	0	0	3
BBT603	Proteogenomics and Bioinformatics	3	0	0	3
BBT604	Bioprocess Engineering	3	1	0	4
BBT 605	Enzyme Engineering and Technology	3	0	0	3
BBT6E2	Elective-II	3	0	0	3
PRACTICAL					
BBT6L1	Bioprocess Engineering Lab I	0	0	4	2
BBT6L2	Plant & Animal Biotechnology Lab	0	0	4	2
BBT6L3	Immunotechnology lab	0	0	4	2
BBT6P1	Mini Project II	0	0	4	2
TOTAL HOURS:35			**CREDITS: 27**		

SEMESTER VII					
SUB.CODE	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY					
BBT701	Research Methodology and Instrumentation	3	0	0	3
BBT702	Stem cell & Tissue Engineering	3	0	0	3
BBT703	Down Stream processing	3	0	0	3
BBT704	Environmental Biotechnology	3	0	0	3
BBT7E3	Elective III	3	0	0	3
BBT7E4	Elective IV	3	0	0	3
PRACTICAL					
BBT7L1	Bioprocess Lab II	0	0	4	2
BBT 7L2	Downstream processing Lab	0	0	4	2
BBT7L3	Environmental Biotechnology lab	0	0	4	2
BBT7L4	Comprehension	0	0	2	1
BBT7V1	Implant Training	0	0	3	1
TOTAL HOURS:35		**CREDITS: 26**			

SEMESTER VIII					
SUB.CODE	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY					
BBT8E5	Major Elective -V	3	0	0	3
BBT8E6	Elective -VI	3	0	0	3
BBT8E7	Elective- VII	3	0	0	3
PRACTICAL					
BBT8P1	Project work and Viva Voce	0	0	18	6
TOTAL HOURS:27		**CREDITS: 15**			
TOTAL CREDITS FOR THE PROGRAMME = 200					

LIST OF ELECTIVE SUBJECTS

BBT050	Metabolic Engineering	3	0	0	3
BBT 051	Developmental Biology	3	0	0	3
BBT052	Cancer biology	3	0	0	3
BBT053	Entrepreneurship Development	3	0	0	3
BBT054	Bioreactor Design	3	0	0	3
BBT055	Engineering Optimization	3	0	0	3
BBT056	Biosensor Technology	3	0	0	3
BBT057	Medical biotechnology	3	0	0	3
BBT058	Protein Engineering	3	0	0	3
BBT059	Concepts in Computing & Programming in C & C++	3	0	0	3
BBT060	Professional Ethics	3	0	0	3
BBT061	Bioprocess Economics & Plant Design	3	0	0	3
BBT062	Fertilizer Technology	3	0	0	3
BBT063	Biopharmaceutical Technology	3	0	0	3
BBT064	Biofuel Technology	3	0	0	3
BBT065	Diary Technology	3	0	0	3
BBT066	Food Process Engineering	3	0	0	3
BBT067	Nano Biotechnology	3	0	03	3
BBT068	Total Quality Management	3	0	0.	3

BEN 101 ENGLISH I **3 1 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- Evolutes as envelope of normals.

UNIT-1V 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 Wi;ey 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- Einstien's A &B Coefficients- Derivation-Condition For Producing Laser Beam- Population Inversion- Pumping- Resonance Cavity- Types Of Lasers- ND-YAG- He-Ne- Co_2 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 embritlement , 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 – HCI 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 2 1 0 3

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 comprehendthe 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 membrance, 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. Coopper, John Wiley and Sons, 2005
3. Cytology,VermaandAggarval, 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,BjarneStroustrop,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 16 th Edition: Prentice Hall.

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" (3rd ed. 2000), TUG Publishers, New Delhi/Tata Mc Graw Hill 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:

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

Carpentry using Hand tools and Power tools:

a) Study of the joints in roofs, doors, windows and furniture.
b) Hands-on-exercise:Wood work, joints by sawing, planning and cutting.
c) 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:

a) Simple Turning and Taper turning
b) Drilling Practice

Sheet Metal Work:

a) Forming & Bending:

b) Model making – Trays, funnels, etc.
c) Different type of joints.
d) Preparation of air-conditioning ducts.

Machine assembly practice:
a) Assembling, dismantling and Study of centrifugal pump
b) Assembling, dismantling and Study of air conditioner
c) Assembling, dismantling and Study of lathe.

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

Fitting:
FittingExercises – 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.Jeyapoovan, 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 0 0 2/2 0

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 olve 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 ploes on boundaries).

UNIT V STATISTICS 12

Mean , Median ,Mode – Moments – Skewness and Kurtosis – correlation – Rank Correlation – Regression –Chi square test – 2 x 2, m x 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.
2. George B. Thomas and Ross L.Finney. "Calculus and Analytical Geometry" 9th Edn. Narosa Indian Student Edition, New Delhi.
3. Grewal .B.S " Higher Engineering Mathematics" , 40th Editon , Khanna Publications , New Delhi , 2007 .
4. Douglas C.Montgomory, 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, SQUIID, 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 Classius – 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).

BCH 201 ENGINEERING CHEMISTRY – II 3 0 0 3

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 – Frendlich 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

UNIT V - ENGINEERING MATERIALS **9**

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, oilyness)

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: HTTP,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,5th edition, 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-monohybrid 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 IIIALLELES **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, Tansduction, 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 MEASURMENT 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. McGraw Hill Book Compay, 2nd Edition, 1983
2. Hyatt W.H and Kemmerlay 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 Sheeet **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 **0 0 2/2 1**

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 0 0 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 $K_2Cr_2O_7$)
5. PH titration (acid & base)
6. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
7. Estimation of Ferric iron by spectrophotometer.

BBT304 WASTE MANAGEMENT TECHNOLOGY 3 0 0 3

OBJECTIVE

- To give a basic knowledge of waste handling.
- To know about waste utilization.

COURSE OUTCOMES

The student will be able

CO1- to understand the various types of waste

CO2- to know the various technologies to handle the waste material

CO3- to know the remedial measures for waste disposal

CO4 - To get idea about industrial waste management

CO5 – To know about bioremediation of waste

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	S		M							S
CO3		M		S				W				
CO4	S		M	W						M		
CO5		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 **9**

INTRODUCTION

Introduction: Definition and Classification- Disposal methods: Land fill and Incineration – Recycling methods: biological reprocessing and Energy recovery-. Avoidance and Reduction Methods- Waste handling and Transport – Waste management Concepts

UNIT II **9**

AGRICULTURAL WASTE

Introduction- Waste Consistency- Waste Management Function: Production ,Collection, Storage, Treatment , Transfer, Utilization- Waste Management system Design – Waste Management System: Dairy Waste, Beef Waste, Swine Waste, Poultry Waste, Other animal – Municipal and Industrial Sludge- Food Processing – Agri Chemical Waste Management- Handling.

UNIT III **9**

BIOMEDICAL WASTE

Introduction- Overview – Characterization of Medical Waste- Waste Generation Methodology – Sterilization- Chemical Disinfection – Thermal Inactivation- Irradiation- Microwave Treatment – Grinding and Shredding – Compaction- Current Practice – Standards .

UNIT IV **9**

INDUSTRIAL WASTE MANAGEMENT

Paper and Pulp Industry – Leather Industry – Cement Industry – Chemical Industry – fertilizer Industry – Pharmaceutical Industry – Textile industry – Iron and Steel industry – Mining Industry – Lignite industry – Petroleum Industry – Nuclear Industry.

UNIT V **9**

REMEDIAL MEASURES

Bioremediation – Phyto-remediation- Recycling of Plastic and Paper

TOTAL NO.OF PERIODS: 45

Text Book:

1. Wang, Shannmas Hung, 2008, "Advanced hazardous industrial waste treatment" CRC Press.

Reference Books

1. Agricultural Waste Management Hand Book by USDA, III Ed,2005
2. Industrial Biotechnology Problems and Remedies by Indu Shekhar Thakur, VI Ed,2006

BBT306 PRINCIPLES OF CHEMICAL ENGINEERING 3 1 0 4

OBJECTIVE

To provide a basic knowledge of Process engineering.

COURSE OUTCOMES

The student will be able

CO1-to understand the various unit operations involved in industry

CO2- to know the material and energy balance for a process.

CO3- to get an idea about fluid mechanics.

CO4- to know about agitation and the types of agitators.

CO5- to know about working principles of 47ermenter

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	S		M							S
CO3		M		S				W				
CO4	S		M	W						M		
CO5		S			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	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNITI 12

OVERVIEWOF PROCESS INDUSTRY

Unit operations & Process - Conservation of mass & Energy -Stoichiometry- SI units & Conversion

UNIT II 12

MATERIAL BALANCES

Overall and component material balances - Conversion -Yield - Selectivity - Material balances without chemical reactions and with chemical reactions

UNIT III **12**

ENERGY BALANCES

Energy - Forms of energy- Energy balances - Entropy - Latent heat -Hess's law- Standard heat of Reactions.

UNIT IV **12**

MOMENTUM TRANSPORT

Fluids-Types- Nature of flow-Momentum balance - Mechanical energy balance - Differential balances - Pressure losses in flow systems.

UNITV **12**

AGITATION AND TRANSPORTATION OF FLUIDS

Mixing and Agitation - Power consumption - Scale up - Pumps and gas moving machinery - Work of consumption.

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

Text book:

1. K.A.Gavhane, 2009, "Introduction to process calculations stoichiometry" Nirali Prakasham Publications 22nd.

Reference Books:

1. K.A. Gavhane, 2009, "Fundamentals of chemical engineering" Nirali Prakasham Publications 22nd.
2. McCabe and Smith,2002, "Unit operations in Chemical Enginering", Tata McHraw Hill Pblications, 6th Ed.
3. K.A. Gavhane, 2009, "Unit operations I Fluid flow & Mechanical operations" Nirali Prakasham Publications, 17th.
4. Bhat & Vora,2001, 'Stoichiometry", Tata McGraw Hill Ltd, III Ed

BBT307 GENERAL BIOCHEMISTRY 3 1 0 4

OBJECTIVE

To provide a basic knowledge of biochemical components and its functions and their Applications from the perspective of engineers

COURSE OUTCOMES

The students will be able

CO1-to understand the fundamentals of biomolecules, their classification,structure and functions.

CO2- to apply the basic concept of carbohydrates, proteins ,lipids, nucleicacids and enzymes in metabolism.

CO3- to know the application of biomolecules in functioning of biological system

CO4- to get a basic knowledge of macromolecules in living organism and its energetic.

CO5- To know basic concepts of enzymes

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	S		M							
CO3		M		S						S		
CO4	S		M	W								
CO5		S			W			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

CARBOHYDRATES: 12

Significance and functions of carbohydrates structure and properties of monosaccharides: Glucose, Fructose, Galactose- Oligosccharides: Sucrose, Lactose, Maltose, Raffinose- Polysaccharides: storage, structural, Homo, Hetero polysaccharides-Metabolism- Glycolysis, TCA cycle and Hexose Mono Phosphate pathway.

UNIT II

LIPIDS: 12

Structure and properties of Fatty acids – classification – Lipids – structure and properties of phospholipids- spingolipids, glucolipids and steroids.Biosynthesis and β oxidation of fatty acid.

UNIT III

PROTEINS: 12

Structure and properties of aminoacids – classification- peptides: chemistry and its properties- proteins: structures – properties – classification based on structure, function and nature. Biosynthesis of amino acid and catbolism-Urea cycle

UNIT IV

NUCLEIC ACIDS: 12

Structure and properties of purine and pyrimidine bases-Nucleosides- Nucleotides – Structure of DNA – various levels of organization of DNA – superhelical DNA – structure and properties of mRNA and rRNA-Biosynthesis and degradation of purine and pyrimidine

UNIT V

ENZYMES: 12

Classification and Nomenclature of enzymes- Properties of enzymes – active site -Factors affecting enzyme activity- Enzyme specificity- Mechanism of enzyme action- Enzyme kinetics related to Michaelis and Menten equation.

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

Text Book:

1. 'Gaw A, 2008, "Clinical biochemistry" Elsevier Health Sciences, 4th.Ed.
2. J.L. Jain, 2008, "Fundamentals of biochemistry" S. Chand.8th Ed

Reference Books:

1. J.L. Jain , , 2007 ,"Text Book Of Biochemistry' ,14th Ed
2. Zubey , 2004 "Biochemistry" III Ed,.
3. Voet &Voet , 2006 , "Biochemistry" V ed,.
4. Lehninger Nelson & Cox , , 2005 "Principles of Biochemistry",4th Ed

BBT308 GENERAL MICROBIOLOGY 3 0 0 3

OBJECTIVE

To provide a basic understanding of microbes and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1- to understand the source of microbes and their role in biotechnology.

CO2- to get the knowledge of microbial diversity classification and morphology

CO3- to know the visualization of microbes by different microscopes

CO4- to know the cause, symptoms, diagnosis and treatment of diseases causing pathogens

CO5- to get a basic knowledge of the microbial nutrition and 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			
CO2		W	S		M							
CO3		M		S					S			S
CO4	S		M	W								
CO5		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	Quiz	4	Alumni
5	Online test		

6	End Semester Examinations		

UNIT I

INTRODUCTION TO MICROBIOLOGY **9**

Definition-Scope and history of microbiology-prokaryotic and eukaryotic cell- different types of classification-Nomenclature-fermentation-pasteurization-role of microorganisms in pharmaceutical, food, agro and cosmetic industries-bioremedial applications-illustrations of genetically engineered strains

UNIT II

GENERAL FEATURES OF MICROORGANISMS **9**

Bacteria: diversity-classification-morphology-life cycle-Fungi: diversity-classification-morphology-life cycle-Algae: diversity-classification-morphology-life cycle-virus: diversity-classification-morphology-life cycle

UNIT III

MICROSCOPY

Introduction- numerical aperture, resolving power-magnification- fixation, dyes and simple staining, differential staining- gram staining, acid-fast staining, Staining specific structures-negative staining, endospore staining, flagella staining-simple-compound-dark field-phase contrast-polarizing-fluorescent-laser optics-electron microscopy-scanning electron microscope-transmission electron microscope, specimen preparation-inverted microscope

UNIT IV

MICROBIAL NUTRITION AND GROWTH **9**

Common nutrient requirements-nutritional types of microorganisms, growth factors-uptake of nutrients by cells- culture media: synthetic or defined media-commonly used media-Types of media-selective-differential-enrichment media-aseptic techniques: disinfection-sterilization-cultivation of microbes: bacteria-fungi-viruses-pure culture: concept of pure culture-methods of pure culture of microorganisms–spread plate, streak plate and pour plate–microbial growth curve-factors affecting growth of microorganisms-measurement of growth

UNIT V

MICROBIAL PATHOGENS AND DISEASES **9**

Bacterial pathogens: *Staphylococcus aureus-Enterobacteriaceae*-Shigellosis-Fungal pathogens: superficial mycosis: Pityriasis versicolor-candidiasis-deep mycosis: Mycetoma-subcutaneous phycomycosis: Cryptococcosis-opportunistic systemic mycosis: aspergillosis, penicilliosis-mycotic poisons-Viral pathogens: Herpes, pox virus, AIDS virus, influenza virus

TOTAL NO.OF PERIODS: 45

Text books:

1. Michael J. Pelezar, J.R.E.C.S Chan, Noel R. Erieg, 2005, “Microbiology “ TATA McGraw Hill, 5thed
2. Anantha Narayan, C.K. Jayaram Paniker, 2009, “Text Book of Microbiology” Orient Blackswan, 7thed

Reference Books:

1. Presscott and Dunn, 2006, “Industrial Microbiology” CBS Publishers& Distributors.
2. Daniel V.Lim, “Microbiology”, Kendall Hunt, 2002 ed

BBT309 INSTRUMENTATION FOR BIOTECHNOLOGY 3 0 0 3

OBJECTIVE

To provide a basic knowledge of the working principle of instruments and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1- to understand the fundamentals of instruments and their different mode of applications

CO2- to know the principle, working concept and its applications

CO3- to find the various laboratory work base on instruments.

CO4- to know the different types of instruments based on various parameters.

CO5- to get a basic knowledge of equipments and their role in biological systems in relevant industries.

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 RADIATION TECHNIQUES 9

Sources of radiation- absorptivity-Lambert Beers law, deviations, detectors, photometric accuracy, Rayleigh scattering, Fourier transform, calibration and standardization, atomisation, flame atomisation, turbidimetric and nephelometric titrations -scattering in gases.

UNIT II ELECTROCHEMICAL TECHNIQUES 9

Principles: redox potential-pH electrode-ion selective and gas sensing electrodes-Clarke oxygen electrode and its application-biosensors.

UNIT III SPECTROSCOPIC TECHNIQUES 9

Colorimetry-UV-visible spectrophotometry-ORD-CD-X-ray spectroscopy-IR spectroscopy-ESR spectroscopy-NMR spectroscopy-Mass spectroscopy

UNIT IV SEDIMENTATION TECHNIQUES 9

Centrifugation principles-centrifuges and its types-differential and density gradient centrifugation-analysis of subcellular fractions-assessment of purity and determination of relative molecular mass

UNITV RADIOISOTOPE TECHNIQUES 9

Nature of radioactivity-Detection and measurement of radioactivity-GM counter-Scintillation counting-photographic emulsions-radiotracer techniques-autoradiography

TOTAL NO.OF PERIODS: 45

Text Book:

1. Willard and Merrit, "Instrumental Methods of Analysis", VI Edition, CBS Publishers and Distributors.
2. Asokan, Practical Biochemistry, IV edition

References:

1. Ewing GW,. "Instrumental Methods of Chemical Analysis", McGraw Hill Book Company, 1989.
2. Braun H., "Introduction to Chemical Analysis", McGraw Hill, 1987.
3. Keith Wilson and Walker, Practical Biochemistry, V edition, Cambridge editions.

BBT310 IMMUNOLOGY 3 0 0 3

OBJECTIVE

To provide a basic understanding of biological defense mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1- to understand the fundamentals of immune system

CO2- to apply the techniques for antigen and antibody reaction

CO3- to give the mechanism of immune response against antigens

CO4- to know the natural barrier against pathogens

CO5- to get a basic knowledge of the applications of immunology in transplantation

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				M							S
CO3		W		S				W				
CO4	S			W						M		
CO5		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 **9**

THE IMMUNE SYSTEM

Introduction, Immunity, antigens &their classification, complement and their biological functions, types of immune responses, anatomy of immune response.

UNIT II **9**

HUMORAL IMMUNITY

B-lymphocytes and their maturation, activation &differentiation, structure and function of immunoglobulin, immunoglobulin classes, antibody production, mono-clonal antibodies and diagnosis major histocompatibility complex

UNIT III **9**

CELLULLAR IMMUNOLOGY

T -Lymphocytes their classification, maturation, activation & differentiation, antigen presenting, cells (APC), macrophages, langerhans cells, their origin and function, mechanisms of phagocytosis, Cytokines and their role in immune response, immunosuppression, immune tolerence.

UNIT IV **9**

ANTIGEN - ANTIBODY INTERACTION AND HYPERSENSITIVITY

Principle and application: Precipitation- immuno diffusion & widal test, Agglutination reactions, radio immuno assay, ELISA, Complement fixation test, Immuno fluorescence technique, Immunoelecctrophoresis-Hypersensitivity reactions

UNITV **9**

TRANSPLANTATION AND AUTO IMMUNITY

Graft rejection, evidence and mechanisms of graft rejection, prevention of graft rejection-immunosuppressive drugs, mechanisms of immunity to tumour antigens. Auto antibodies in humans, pathogenic mechanisms -autoimmune diseases- treatment of auto immune disorders

TOTAL NO.OF PERIODS: 45

Text Books:

1. Janis Kuby,2007, “Immunology” W.H. Freeman & Co. 6th ed.
2. Roitt I, 2001, "Essential Immunology". Blackwell Scientific Publications, Oxford,.

References:

1. Tizard, 1992, "Introduction to Immunology" Saunders collage publication, 3rd ed.
2. Abbas,2009, "Basic Immunology" W.B. Saunders company, 2nd ed.

BBT3L1 BIO CHEMISTRY LAB 0 0 4 2

OBJECTIVE

To provide a basic knowledge of biochemical components and its functions and their Applications from the perspective of engineers

COURSE OUTCOMES

The students will be able

CO1-to understand the fundamentals of biomolecules, their classification,structure and functions.

CO2- to apply the basic concept of carbohydrates, proteins ,lipids, nucleicacids and enzymes in metabolism.

CO3- to know the application of biomolecules in functioning of biological system

CO4- to get a basic knowledge of macromolecules in living organism and its energetic.

CO5- To know basic concepts of enzymes

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 Experiments

1. Preparation of normal, molar and percent solutions.
2. Preparation of different buffer solution and measure pH.
3. Qualitative analysis of Unknown sugar-Monosaccharides,disaccharides and polysaccharides.
4. Estimation of sugar- Benedicts method.
5. Qualitative of unknown protein-Albumin,casein and gelatin.

6. Quantitative test for aminoacids- Ninhydrin method.
7. Quantitative test for protein – Biuret method.
8. Quantitative test for protein –Lowry method.
9. Quantitative test for protein – Bradford method
10. Spectrophotometric analysis of DNA.

TOTAL NO.OF PERIODS: 60

BBT3L2 INSTRUMENTAL METHODS OF ANALYSIS LAB 0 0 4 2

OBJECTIVE

To provide a basic knowledge of the working principle of instruments and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1- to understand the fundamentals of instruments and their different mode of applications

CO2- to know the principle, working concept and its applications

CO3- to find the various laboratory work base on instruments.

CO4- to know the different types of instruments based on various parameters.

CO5- to get a basic knowledge of equipments and their role in biological systems in relevant industries.

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

TOTAL NO.OF PERIODS: 60

BBT3L3 CELL BIOLOGY LAB 0 0 4 2

OBJECTIVE

To provide a basic knowledge about cell biology

COURSE OUTCOMES

The student will be able

CO1- to understand the fundamentals of instruments and their different mode of applications

CO2- to get idea about slide preparation

CO3- to know about blood grouping.

CO4- to get knowledge about mitosis.

CO5- to get a basic knowledge of extraction of plant pigments

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	S			W								
CO5	M											

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 Experiments

1. Study of Microscope
2. Spotters
3. Permanent Slide preparation
4. Killing and Fixing
5. Mitosis on onion root tip
6. Cryopreservation
7. Preparation of Blood smear
8. Separation of plasma and serum from blood sample
9. Total RBC and WBC Count
10. Osmosis
11. Extraction of pigments

TOTAL NO.OF PERIODS: 60

BBT401 BIOORGANIC CHEMISTRY 3 0 0 3

OBJECTIVE

To provide a basic understanding of biochemical reactions, mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1- to understand the fundamentals of biochemical reactions in living organism

CO2- to apply the concept of structural relationship between chemical and biochemical reactions

CO3- to create the drug formulation and its structural analogs in living systemscomprehend genetics and the immune system

CO4- to know the role of metal ions in biological components and their importance in living systems.

CO5- to get a basic knowledge of membrane transport and their permeability

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								
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		

UNITI 9

INTRODUCTION TO BIOORGANIC CHEMISTRY

Basic considerations, Proximity effect, Molecular adaptation, Molecular recognition, supramolecular chemistry, Chemistry of living cells, Analogy between biochemical transformations and bioorganic reactions.

UNIT II 9

BIOORGANIC CHEMISTRY OF AMINO ACIDS AND PEPTIDES

Chemistry of Peptide bond synthesis. Asymmetric synthesis of amino acids - different models, Transition state analogous, chemical mutations, site specific mutagenesis, Molecular recognition and drug design, Catalytic antibodies.

UNIT III **9**

ENZYME CHEMISTRY

Introduction to enzymes, Types of enzymes- Immobilized enzyme- Semi synthetic enzymes- Mechanism of enzyme action- Allosteric regulatory enzymes.

UNIT IV **9**

METAL IONS IN BIOLOGICAL SYSTEMS

Metal ions in proteins -Role on Zinc in carboxy peptidase- Iron and oxygen transport in Haemoglobin- Metal ion act as co-enzymes & Co factors in a biological reaction & Respiratory chain

UNIT V **9**

MEMBRANE CHEMISTRY

Structure- Active & Passive transport- ATP driven pumps – Ligand gated channels – Voltage gated channels.

Text Book

1. Dugas. H, Bio-Organic Chemistry - A chemical approach to enzyme action, Springer Verlag, 2002, revised edition.

Referenece Books:

1. Faber. K, Biotransformations in Organic Chemistry- A text book, 4th Edition, Springer
2. Zubay .G. Bio chemistry, Max well Macmillan Publications, 2003 edition.

TOTAL NO.OF PERIODS: 45

BBT403 INTRODUCTION TO INDUSTRIAL BIOTECHNOLOGY 3 0 0 3

OBJECTIVE

To provide a basic understanding of basic biotechnology concepts

COURSE OUTCOMES

The student will be able

CO1- to understand the objective and scope of biotechnology

CO2- to know the concept of cell culture techniques

CO3- to comprehend DNA and its role in functioning of a cell

CO4- to know the microbial production

CO5- to get an idea about the applications of biotechnology

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								W				

CO4				W								
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 **9**

Introduction to Industrial Biotechnology - Objectives and Scope: Characteristics and comparison of bioprocessing with chemical processing – Strain improvement.

UNIT II **9**

Basics of Cell Culture, Cell culture techniques in microorganisms. Preservation and improvement of industrial microorganisms

UNIT III **9**

Process Technology, Development of inocula for industrial fermentation and some primary metabolites e.g. ethanol, acetone - butanol and citric acid

UNIT IV **9**

Microbial Production- Microbial production of industrial enzymes - glucose isomerase, proteases, Streptokinases Production of Vit B_{12} and secondary metabolites- penicillin, Streptomycin

UNITV **9**

Application Of Biotechnology In Human Welfare - Human health care -insulin, interferon, monoclonal antibodies etc. Development of vaccines for immunity - Bacterial and viral vaccines, Crop improvement- Disease, pest, herbicide resistance

TOTAL NO.OF PERIODS: 45

Text Book:

1. S.N. Joganand, , 2003, "Environmental Biotechnology"Himalaya publishing House, IV ed.

Reference Books:

1. Saha BC,2003, “Fermentation biotechnology” Americal Chemical Society.
2. Vyas SP,2002, “Methods in biotechnology and bioengineering” CBS Publishers & Distributors.
3. Acharya R, 1999, “The emergence and growth of biotechnology” E.Elgar.
4. Jain PC, 2004, “Microbiology and biotechnology for sustainable development” CBS Publishers & Distributors.
5. Stanbury Whittaker, 2002, "Principles of fermentation technology" - II Edn.

BBT404 PRINCIPLES OF CHEMICAL THERMODYNAMICS 3 1 0 4

OBJECTIVE

To provide a basic knowledge of thermodynamics.

COURSE OUTCOMES

The student will be able

CO1- to understand the basic concepts in thermodynamics

CO2- to know the properties of fluid

CO3- to know the to get an idea about application of thermodynamics in various field.

CO4- to get knowledge about reaction equilibrium

CO5- to know about applications of thermodynamics law

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			W				S
CO3	S			S				W				
CO4				W						M		
CO5	S					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		

UNITI **12**

BASIC CONCEPTS IN THERMODYNAMICS

Scope and limitations- Definitions and Fundamental concepts - Calculation of force, pressure and energy - Phase rule -Zeroth law- Heat reservoirs & Heat engine -First law- First law for non flow process- enthalpy- First law for flow process.

UNIT II **12**

PVT BEHAVIOUR AND FIRST LAWOF THERMODYNAMICS

PVT behavior of pure liquids - Equations of state- Constant volume process , constant pressure process and constant temperature process- Vander Waals equation- Virial equation.

Second law- Mathematical statement of second law- Kelvin and Clausius statement- Clausius inequality-

UNIT III **12**

THERMODYNAMIC PROPERTIES OF PURE LIQUIDS

Classification of properties- Helmholtz free energy - Gibb's free energy-Fundamental property relations- Maxwell equations - Clapeyron equation -Relationship between Cp and Cv- Fugacity and fugacity coefficient- Effect of temperature and pressure on fugacity- Activity and Activity coefficient-Effect of temperature and pressure on Activity.

UNIT IV **12**

CHEMICAL REACTION EQUILIBRIUM

Reaction stoichiometry -Equilibrium constant and standard free energy change - Effect of temperature on equilibrium constant- Evaluation of equilibrium constant - Effect of pressure on equilibrium - Other factors affecting equilibrium conversion.

UNITV **12**

APPLICATIONS OF THE LAWS OF THERMODNAMICS

Energy equation - Ejectors - Throttling process - Compressors - Adiabatic and Isothermal compression - Refrigeration - Choice of refrigerant -Absorption refrigeration- COP- Carnot cycle- Heat pumps.

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

Text Book:

1. K.V.Narayanan, 2004, "Chemical engineering thermo dynamics" Prentice Hall of India Pvt Ltd.

Referencce Books:

1. K.A.Gavhane, 2009, "Chemical engineering thermodynamics" Nirali Prakasham Publications, 20th.
2. T.M.Letcher, 2004, "Chemical thermodynamics for industry" R.S.C Publication 3rd.

BBT405 UNIT OPERATIONS 3 1 0 4

OBJECTIVE

To give a knowledge of heat and mass transfer

COURSE OUTCOMES

The student will be able

CO1- to understand the basic concepts in heat transfer

CO2- to know basic concepts evaporation

CO3- to know about mass transfer operations.

CO4- to know about leaching and extraction.

CO5- to know about various drying and size reduction.

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		S		M			M				S
CO3		M		S						S		
CO4				W				W				
CO5	S					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 **12**

Modes of heat transfer- Heat transfer through compound wall- Heat flow through cylinder- Definition of Boiling, condensation and its types.

UNIT II **12**

Heat exchanger- Theory of Shell and Tube heat exchanger and double pipe heat exchanger- Derivation of Overall heat transfer coefficient - LMTD.

Evaporator- Types: falling film- Climbing film. Forced circulation and Agitated film evaporator- Methods of feeding

UNIT Ill **12**

Out line of Mass transfer operations- Diffusion in Gases, Liquids & Solids. Distillation- Theory of Simple, Flash, Steam and Azeotropic distillation-McCabeThiele method

UNIT IV **12**

Leaching- Theory of Moving bed leaching and Dispersed solid leaching. Liquid extraction- Mixer settler- Spray and packed extraction tower-Agitated extraction tower.

UNITV **12**

Drying- Drying equipment: Tray, Screen-conveyor, Rotary and Spray dryer-Selection of drying equipment- Time of drying.

Size reduction -Laws- Work index-Size reduction equipment: Jaw crusher. Smooth roll crusher- Tumbling mill - Fluid energy mill - Knife cutters-open and Closed circuit operation

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

Text Books:

1. Gavahnee, 2009,"Heat & Mass Transfer" Nirali Prakasham Publications, 20th.

Reference Books

1. K.A. Gavhane, 2009, "Unit operations II Heat & Mass Transfer" Nirali Prakasham Pyblications, 23rd.
2. G.S. Sawhney, 2008,"Heat & Mass Transfer" I.K. International Publishing House
3. McCabe W. L & Smith J. C., "Unit operations in chemical Engineering". V.Ed..McGraw HillInt Ed.,
4. Robert e.Treybal,2000, "Mass Transfer Operations", McGraw Hill International III edition.
5. Christie J. Geankoplis,2000 " Transport Processes and Unit Operations", Prentice Hall India PvtLtd, III Edtion,

BBT406 INTRODUCTION TO MOLECULAR BIOLOGY 3 0 0 3

OBJECTIVE

To provide a basic understanding of molecular level of DNA and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1- to understand the fundamentals of central dogma of biological systems

CO2- to know the concept of cell replication ,transcription and translation

CO3- to comprehend DNA and its role in functioning of a cell

CO4- to know the functioning of regulatory factors and its application in maintaining cell activity

CO5- to get a basic knowledge of the DNA,RNA and proteins

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												
CO5	S					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 **9**

DNA as the vehicle of inheritance-structure of DNA-forms of DNA-nucleic acid biosynthesis-experimental evidence: Griffith, McLeod, McCarty and Avery, Hershey–Chase experiments-Definition of gene-organization of genes and non coding DNA in prokaryotes- Eukaryotes–unique, moderately repetitive and highly repetitive DNA sequence-satellite DNA- Cot value-DNA binding proteins

UNIT II **9**

DNA replication in prokaryotes and eukaryotes- modes of replication-semi continuous and semi discontinuous replication- Okazaki fragments- RNA primers – enzymes of replication – DNA

polymerases I, II, III, -DNA modifying enzymes: topoisomerases-helicases- binding proteins and ligases- replication in E.coli–replisomes-events at OriC (initiation), events on the replication fork (elongation) and termination- Fidelity of replication-Sigma or rolling circle mode of replication in Φ x 174-Inhibitors of replication.

UNIT III **9**

Repair of DNA–types of damages- repair by direct reversal of damage- excision repair- recombination repair- SOS repair-Mutation: definition-type of mutations (spontaneous and induced) point mutation-Gene mutation and chromosomal aberrations- Cause of mutations-chemical and physical agent

UNIT IV **9**

Transcription in prokaryotes and eukaryotes: RNA polymerases–enzyme structure- role of sigma factor- promoter-closed and open promoter complexes-Initiation-elongation and termination of RNA synthesis-Post transcriptional modification in prokaryotes and eukaryotes-transcription factors

UNIT V **9**

Genetic code–Basic features of genetic code-Deciphering of genetic code-Wobble hypothesis-Protein biosynthesis-activation of amino acids- initiation-elongation and termination of translation in prokaryotes and eukaryotes-Post translational modifications-Inhibitors of translation.-Regulation of gene expression in prokaryotes and eukaryotes- operon concept

Text Books:

1. Biochemistry by Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, 2006
2. Lehninger, Principles of Biochemistry, David L. Nelson and Michael M. Cox, 2008
3. James D. Watson, Tania A. Baker, Stephen P. Bell, and Alexander Gann, Molecular Biology of the Gene (6th ed), 2007

Reference Books:

1. R.L. Adams, J.T. Knowler, and D.P. Leader, The Biochemistry of the Nucleic Acids, 1992
2. Stephen Neidle, Principles of Nucleic Acid Structure, 2007
3. Robert Weaver, Molecular Biology, 2007

TOTAL NO.OF PERIODS: 45

BCE406 ENVIRONMENTAL STUDIES 3 0 0 3

OBJECTIVE

To provide a knowledge of environmental perspective.

COURSE OUTCOMES

The student will be able

CO1- to understand the basic concepts in ecosystem

CO2- to know basic concepts of biodiversity

CO3- to know about environmental pollution and its control measures

CO4- to know about value education.

CO5- to understand the relation between human population and pollution

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												
CO2	S		M		M							
CO3				S							M	
CO4				W								
CO5	S					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 **9**

THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES Definition, Scope and importance- Need for public awareness.

NATURAL RESOURCES: RENEWABLE AND NON-RENEWABLE RESOURSES

Natural resources and associated problems

a) Forest resources: Use and over exploitation, deforestation, case studies Timber extraction, mining, dams and their effects on forests and tribal people.
b) Water resources: Use and over utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources: World food problems, changes caused by agriculture and .overgrazing, effects of modem agriculture, fertilizer-pesticide problems, water logging and salinity case studies.
e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies.
f) Land resources: Land as resources, land degradation, man induced landsides, soil Erosion and desertification.
g) Role of individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT II **9**

ECOSYSTEMS

Concepts of an ecosystem-Structure and function of an ecosystem- producers, consumers and decomposers-Energy flow in the ecosystem-Ecological-succession-Food chains, food webs and ecological pyramids-introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem. Desert ecosystem, Aquatic ecosystem (Ponds, streams, lakes, rivers, oceans, estuaries)

UNIT III **9**

BIODIVERSITV AND ITS CONSERVATION

Introduction-Definition: genetic, species and ecosystem diversity-Biogeographical classification of India-Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values-Biodiversity at global, national, local levels-India as a mega diversity nation-Hot-spots of biodiversity-Threats to biodiversity: habitat loss, poaching of wild life, man-wildlife Conflicts-Endangered and endemic species of India-Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

ENVIRONMENTAL POLLUTION

Definition, Causes, effects and control measures of:-Air pollution, Water pollution and soil pollution. Marine pollution- Noise pollution- Thermal pollution and nuclear hazards- Solid waste Management-causes effects and control measures of urban and industrial wastes-Role of individuals in prevention of pollution -Pollution case studies-Disaster management-floods, earthquakes, cyclone and landslides.

UNIT IV **9**

SOCIAL ISSUES AND THE ENVIRONMENT

From unsustainable to sustainable development, urban problems related to energy. Water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies- Water land reclamation-Environment Protection Act-Air Pollution (Prevention and Control) Act-Wildlife protection act-Forest Conservation Act-Issues involved in enforcement of environmental legislation-Public awareness.

UNITV **9**

HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations-population explosion -Family welfare Programme-Environment and human health- Human rights-Value Education-HIV/AIDS- and human health-Case Studies

FIELDWORK:

Visit to a local area to document environmental assets- river/Forest/grassland/hill mountain

Visit to a local polluted site-Urban/Rural/lndustrial/Agricultural. Study of common plants, insects, birds.

Study of simple ecosystems-ponds, river, MB slopes, etc. (9)

TOTAL NO.OF PERIODS: 45

Text Book:

1. Vaccari DA, et al.2006, “Environmental biology for engineers and scientist” Wiley-lnter science.

Reference Books:

1. Evans Gm et al.,2003, "Environmental biotechnology-theory and application" John Wiley& sons.
2. Weiner, RF,2003, "Environmental Engineering" Butterworth-Heinemann.
3. Hilgenkamp K,2005, "Environmental health ecological perspectives" Jones & barlett Publisher.
4. Mitchell, R,2009, "Environmental Microbiology" John Wiley & Sons, 2nd.
5. Spencer JFT,2004, "Environmental Microbiology; methods and protocols" Hummana Press.

BBT4L1 MICROBIOLOGY LAB 0 0 4 2

OBJECTIVE

To provide a basic understanding of microbes and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1- to understand the source of microbes and their role in biotechnology.

CO2- to get the knowledge of microbial diversity classification and morphology

CO3- to know the visualization of microbes by different microscopes

CO4- to know the cause, symptoms, diagnosis and treatment of diseases causing pathogens

CO5- to get a basic knowledge of the microbial nutrition and 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											
CO2			M		M							
CO3		M		S								
CO4	M		S	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 Experiments

1. Laboratory rules and regulations
2. Isolation of Bacteria Soil
3. Motility of Bacteria
4. Staining techniques

5. Streak Plate techniques
6. Antibiotic sensitivity test
7. Isolation of Fungi
8. Water analysis by MPN
9. Milk Analysis
10. Biochemical Analysis

TOTAL NO.OF PERIODS: 60

BBT4L2 BIOORGANIC CHEMISTRY LAB 0 0 4 2

OBJECTIVE

To provide a basic understanding of biochemical reactions, mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1- to understand the fundamentals of biochemical reactions in living organism

CO2- to apply the concept of structural relationship between chemical and biochemical reactions

CO3- to create the drug formulation and its structural analogs in living systemscomprehend genetics and the immune system

CO4- to know the role of metal ions in biological components and their importance in living systems.

CO5- to get a basic knowledge of membrane transport and their permeability

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		M							
CO3		S		M								
CO4				W								
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

List of Experiments

1. Preparation of casein from milk.

2. Separation of starch from potato.
3. Extraction of chlorophyll in plant tissue.
4. Extrction of lactose from milk.
5. Estimation of glucose from grapes.
6. Extraction of fructose from honey.
7. Extraction of lycopene from tomato.
8. Acetylation of D-glucose.
9. Preparation of methyl salicylate from aspirin.
10. Preparation of aspirin from salicylic acid.

TOTAL NO.OF PERIODS: 60

BBT4L3 MOLECULAR BIOLOGY LAB 0 0 4 2

OBJECTIVE

To provide a basic understanding of molecular level of DNA and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1- to understand the fundamentals of central dogma of biological systems

CO2- to know the concept of cell replication ,transcription and translation

CO3- to comprehend DNA and its role in functioning of a cell

CO4- to know the functioning of regulatory factors and its application in maintaining cell activity

CO5- to get a basic knowledge of the DNA,RNA and proteins

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									
CO3		M		S								
CO4	S		M									
CO5					M							

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 experiments

1. Extraction of plant genomic DNA.
2. Extraction of Bacterial genomic DNA
3. Extraction of Animal DNA
4. Agarose gel electrophoresis.
5. Restriction Digestion of DNA.
6. Ligation of E-CoR1 digest of (λ) DNA.
7. Isolation of plasmid DNA by alkaline lysis.
8. Effect of uv radiation on bacterial survival (induced mutagenesis.
9. Transformation.
10. Poly acrylamide –SDS slab gel electrophoresis of proteins

TOTAL NO.OF PERIODS: 60

BMA501 BIOSTATISTICS 3 1 0 4

OBJECTIVE

To provide a basic knowledge of probability and statistics.

COURSE OUTCOMES

The student will be able

CO1- to understand the basic concepts various theorem in probability

CO2- to know basic concepts random variables

CO3-to know about sampling concepts

CO4- to know about design of experiments using various test.

CO5- to know about various testing 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		M							
CO3		M		S								
CO4				W								
CO5	S					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		

UNITI **12**

Probability and Random Variables - Probability concepts, Baye's Theorem, Random Variables, Discrete and continuous Function of random variables- Moment generating function of binomial, Poisson, Geometric. Uniform, Exponential Distributions, Normal Distribution (Problems)

UNIT II **12**

Two Dimensional Random Variables - Marginal and conditional Distributions, Expectation and conditional Expectations, Transformation of Two dimensional Random Variables, Central Limit Theorenr(Statement and Problems)

UNIT III **12**

Sampling Concepts - Methods of sampling. Simple random sampling, Stratified random sampling, Systematic sampling, Point and Interval estimators. Properties of Estimators, Sample size determination, testing of hypothesis, Small samples (t test). Large samples (Z test), Confidence limits

UNIT IV **12**

Random Processes - Classification stationary and Markov Process, Poisson Processes, Markovian chains, Markovian Quenching models, infinite and finite with single server

UNITV **12**

Design of Experiment and Non Parametric Test - Completely randomised design, Randomised block design, Latin Square design- Sign Test, Kolmogrov SmirovTest, Mann Whitney U test, Kniskal WallisTest

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

Text Book:

1. Kapur J. N and Saxena H. C, "Mathematical Statistics", S. Chand and Co., New Delhi

Reference Books:

1. Veerarajan T, "Probability Statistics and Random Process" Tata McGrawHill, New Delhi
2. S.C. Gupta and V.K. Kapoor, "Applied Statistics", S. Chand and Sons, New Delhi
3. W. W. Daniel, "Biostatistics- A foundation for analysis of health sciences", John Wiley and Sons, New Delhi
4. P.N. Arora and S. Arora, "Statistics for Management", S. Chand and Sons, New Delhi

BBT501 GENETIC ENGINEERING 3 0 0 3

OBJECTIVE

To provide a basic understanding of recombinant mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1- to understand the fundamentals of genetic engineering

CO2- to apply the concept of recombinant DNA IN plant, animal and microbial systems and growth in real life situations

CO3- to get the knowledge of molecular scissors and its role in creating transgenic products

CO4- to know the techniques related to screen the recombinant products.
CO5- to get a basic knowledge of the applications of transgenes in agriculture, health care and biological products in relevant industries

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				M				
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 **9**

BASICS OF GENETIC ENGINEERING

Introduction to Genetic engineering; Role of genes within cells- method of creating recombinant DNA molecules.-Role of vectors plasmid, cosmid, BAC, YAC etc.-Restriction enzymes and mapping of DNA-Role of Transposons in genetic engineering-Safety guidelines of creating recombinant DNA research.

UNIT II **9**

CONSTRUCTION OF cDNA LIBRARIES

Characterization of recombinant clones by Southern, Northern, Western and PCR analysis. Construction of genomic and cDNA libraries, methods of nucleic acid sequencing, factors involved in expression of cloned genes.

UNIT III **9**

APPLICATION OF RECOMBINANT DNA TECHNOLOGY IN PLANTS

Method of gene transfer to plants- agrobacterium mediated / chemical mediated, Biolistics. Transgenic plants- Ri and Ti plasmids, Screening of recombinants, Biopharmaceuticals, Single cell proteins.

UNIT IV **9**

APPLICATION OF RECOMBINANT DNA TECHNOLOGY IN ANIMALS

Animal cloning, Ethical aspects of animal cloning,-Transgenic animals- sheep, goat, cattle, fish etc-Methods of gene transfer to animals-embryo transfer.

UNITV **9**

APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY IN INDUSTRY

Health care: Vaccines, hormones, antibiotics & pharmaceuticals- Industrial enzymes and agriculture.

TOTAL NO.OF PERIODS: 45

Text Book:

1. Brown TA, 2000, "Gene cloning-and introduction" VNR (U.K) Co Ltd.

Reference Books:

1. Setlow JK,2004, "Genetic engineering: principles and methods" Springer.
2. Fridal R,2006, "Genetic engineering" Lerner publications.
3. LeVine H,2006, "Genetic engineering-A reference handbook" ABC-CLIO.
4. Levine AD,2009, "Cloning" The Rosen publishing group, 1st.

BBT502 PRINCIPLES OF BIOPROCESS TECHNOLOG 3 1 0 4

OBJECTIVE

To provide a basic knowledge of Biological processes.

COURSE OUTCOMES

The student will be able

CO1- to understand the development of bioprocess techniques.

CO2- to know about the instrumentation and control for bioprocess operations

CO3- to get idea about media formulations

CO4- to know about stoichiometry of bioprocess.

CO5- to know about various bioreactors

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			M				
CO3		M		S				W				S
CO4				W						M		
CO5	S	M				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**

INTRODUCTION TO BIOPROCESSES

Historical development of bioprocess technology, An overview of traditional and modern applications of biotechnological processes, Biotechnology & Bioprocess engineering- outline of Unit Operations involved in Upstream and Downstream processing, generalized process flow sheets.

UNIT II **12**

OPERATION AND CONTROL OF BIOREACTOR

Overview of reactor- -General requirements of fermentation processes, Basic design and construction of fermentor and ancillaries. Main parameters to be monitored and controlled in fermentation processes- solid-substrate fermentation and its applications

UNIT III **12**

GROWTH MEDIA AND STERILIZATION

Medium requirements for fermentation, Carbon, Nitrogen, Minerals, Vitamins, and other complex nutrients, Oxygen requirements, medium formulation - Simple and complex media- Batch and continuous heat sterilization of liquid media, filter sterilization of liquid media.

UNIT IV **12**

STOICHIOMETRY OF MICROBIAL GROWTH

Stoichiometry of Cell growth and product formation- elemental balances- degrees of reduction of substrate and biomass-available electron balances-yield coefficients of biomass and product formation

UNITV **12**

BIOREACTOR DESIGN

Reactor engineering in perspective- Cost determining factor in design- Bioreactor configuration- Practical consideration for bioreactor construction- inoculation and sampling from fermentor- materials of construction- Steps involved in fermentor design.

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

Text Book:

1. Shuler and Kargi, 2005 "Bioprocess Engineering", ,Prentice Hall,

Reference books:

1. Bailey and Ollis, 2000, "Biochemical Engineering Fundamentals", McGraw Hill 3rd ed.
2. Stanbury PF,1984, “Principles of fermentation technology” SS Hall, 2nd.
3. Dr.Mansi El Mansi.2003 “Fermentation Microbiology & Biotechnology”.IVEd.
4. P.T. Kalaichelvan and I. Arul Pandi. 2007 “Bioprocess technology” MJP Pub, 1st ed.

BBT503 CHEMICAL REACTION ENGINEERING 3 1 0 4

OBJECTIVE

To provide a basic knowledge of Reaction engineering.

COURSE OUTCOMES

The student will be able

CO1- to understand basic concepts in homogenous reactions.

CO2- to know about various order reaction

CO3- to know about the plug flow and mixed flow reactor

CO4- to know about multiple reactors

CO5- to know about design of bioreactors

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		W							M		
CO2				S		M		W				
CO3			M					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		

UNITI **12**

KINETICS OF HOMOGENEOUS REACTIONS:

Single and multiple reaction- Elementary and Non elementary reaction-Order & Molecularity-rate constant - Kinetics models for non elementary reaction- searching mechanism for Irreversible and Enzyme catalyzed reaction- Theories of chemical reaction.

UNIT II **12**

INTERPRETATION OF BATCH REACTOR DATA

Methods: Integral and Differential – Constant Volume Batch reactor – Analysis of total pressure data in constant volume system- Rate Equation: Irreversible Unimolecular I and II order and irreversible bimolecular II order – half life period – variable volume batch reactor.

UNIT III **12**

DESIGN OF SINGLE IDEAL REACTORS

Constant Density & Changing Density Batch and Flow system – Design of ideal batch reactor – Space time and Space velocity – Design of MFR & PFR

UNIT IV **12**

MULTIPLE REACTION AND NON IDEAL FLOW REACTOR

Comparision of MFR with PFR I order & II order – Reactor in series: CSTR in series –Unequal size CSTR in series, Equal size CSTR in series – PFR in series.

UNITV **12**

BIOREACTOR

Biochemical reaction: Bioprocess & Bioreaction- Cell multiplication kinetics- types of bioreactors- Some industrial application of bioprocess: Aerobic and anaerobic bioprocess.

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

Text book:

1. K.A.Gavhane, 2009, "Chemical Reaction Engineering I" Nirali Prakasham Publications, 19th.
2. Octave Levenspiel, 2006, "Chemical Reaction engineering" Wiley-India, 3rd

Reference Books:

1. K.A.Gavhane, 2009, "Chemical Reaction Engineering II" 21st ed.

BBT505 PLANT BIOTECHNOLOGY 3 1 0 4

OBJECTIVE

To provide a basic knowledge about plant tissue culture and its applications.

COURSE OUTCOMES

The student will be able

CO1- to understand basic concepts in organization of plant genome

CO2- to know about the genetic engineering concepts involved in plant.

CO3- to know about plant tissue culture

CO4- to know about bioremediation.

CO5- to understand the various applications of plant tissue culture

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		S		S						M		
CO4				W								
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 **12**

Plant Molecular biology

Plant genome organization – mitochondrial genome – cytoplasmic male sterility – chloroplast genome – post transcriptional modifications – transcription factors – gene silencing – regulation of gene expression – transposable elements

UNIT II **12**

Plant genetic Engineering

Plant viral vectors – Ri & Ti plasmid vectors – promoters used in plant vectors – methods of gene transfer- Agrobacterium mediated gene transfer – biolistics – latest methods of gene transfer in plants – Transposon tagging – selection of transformants / recombinants – RFLP, RAPD – plant pathogen interactions.

UNIT III **12**

Plant tissue culture

Basic terminologies – requirements of a plant tissue culture laboratory – Types of culture – selection of explants – sterilization techniques – Types of media – direct and indirect regeneration – micropropagation – haploid culture – protoplast culture – somatic hybridization and cybridization – embryo rescue – artificial seeds.

UNIT IV **12**

Biocontrol, Bioremediation & Biofertilizers

Biochemistry and molecular biology of nitrogen fixation – transfer of nif genes – biocontrol of insect pests – genetic engineering of biocontrol agents – microbial pesticides – biofertilizers; types and applications – effluent treatment and using plant materials – phyto remediation.

UNIT V **12**

Applications

Transgenic plants for insect, disease, stress & herbicide resistance – edible vaccines and antibodies – methods of crop improvement through genetic engineering - DNA finger printing – production of secondary plant metabolites through suspension cultures.

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

Text Books:

1. Adrian Slater, 2006, "Plant biotechnology", 3rd Ed,.
2. Fr. S. Ignacimuthu, 2000 Plant biotechnology IV ed.

Reference Books

1. C. B. Nirmala, G. Rajalakshmi, Chandra Karthick. 2009," Plant Biotechnology"
2. Veereshem C, 2006, "Medicinal plant biotechnology" CBS Publishers & Distributors.

BBT5L1 GENETIC ENGINEERING LAB 0 0 4 2

OBJECTIVE

To provide a basic understanding of recombinant mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1- to understand the fundamentals of genetic engineering

CO2- to apply the concept of recombinant DNA IN plant, animal and microbial systems and growth in real life situations

CO3- to get the knowledge of molecular scissors and its role in creating transgenic products

CO4- to know the techniques related to screen the recombinant products.

CO5- to get a basic knowledge of the applications of transgenes in agriculture, health care and biological products in relevant industries

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		W								
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 Experiments

1. Extraction of DNA
2. Agarose gel electrophoresis
3. Restriction digestion of DNA
4. Ligation of digested DNA
5. Preparation of competent cell
6. Transformation
7. Southern hybridization
8. AFLP
9. GFP cloning

10. Polymerase Chain reaction

TOTAL NO.OF PERIODS: 60

BBT5L2 CHEMICAL ENGINEERING LAB 0 0 4 2

OBJECTIVE

To provide a knowledge about heat, mass transfer and reaction kinetics

COURSE OUTCOMES

CO1- to get knowledge about reactor kinetics

CO2- to know about drying equipment

CO3- to know about mass transfer operations

CO4- to get idea about heat transfer

CO5- to understand about mechanical operations

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			M		
CO2			S		M				M			
CO3		M		S								
CO4	S		M	W					S			S
CO5					W			S				M

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 Experiments

1. Batch Reactor I
2. Batch Reactor II
3. Drying studies in Tray dryer
4. Simple Leaching
5. Adsorption
6. Heat transfer through Natural convection
7. Heat transfer through Forced convection

8. Heat transfer through composite wall
9. Sieve Shaker Analysis
10. Magnetic Separator
11. Analysis of chloride content in Cement
12. Analysis of chlorine content in Bleaching Powder

a. **TOTAL NO.OF PERIODS: 60**

BBT601 INDUSTRIAL SAFETY ENGINEERING 3 0 0 3

OBJECTIVE

To provide a basic knowledge about Safety engineering

COURSE OUTCOMES

The student will be able

CO1- to understand basic concepts in hazard analysis

CO2- to know about safety and its management.

CO3- to know about accidents and its preventive measures

CO4- to understand various personal protective equipments and first aid

CO5- to know about personal protective equipments

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			W				
CO3		M		S				M				
CO4				M						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 **9**

Safety in Process Plants – Hazard Analysis – Types of Hazard – hazard Identification techniques Hazard Evaluation – Important Factories Act.

UNIT II **9**

Hazards in work place: safety in the use of chemicals at work – Chemical hazard - Air-Borne Contaminants – particulate matter – Hazard and safety methods – hazards and Safety measures in Refineries , Paper and Pulp Industries- Safety Conditions in tanneries –Hazards of Pesticide – Sugar industry.

UNIT III **9**

Safety Management & Fire Safety

Introduction- Safety policy- Safety in electrical installation: Electrical shock and prevention-safety precautions for residential and commercial installation - Case study.

Fire Safety

Four stages of Fire- types of Fire Detectors – Fire safety in Industry – chemistry of fire- Types of Combustion- Fire Triangle- Fire extinguishing Technique – Engineering consideration for safety consideration

UNIT IV **9**

Accidents

Industrial accidents – Classification – prevention – accident cost – Steps of investigation – Analysis of Accidents – Remedial Measures – Methods of Prevention – Safety Slogans – Case study

UNIT V **9**

Personal protective Equipment and personal Protection – Aim – Need – Types : Non Respiratory Protective equipments- Respiratory type

First aid – principles and methods – First aid training – Scope of first aid – Golden rules– First aid treatment : for wounds and Hemorrage , Shock , respiration :Schafer's Method, Shock. Fractures, Burns and Scalds , Unconsciousness, Heat exhaustion and Stroke– First aid Kit box A and B.

TOTAL NO.OF PERIODS: 45

Text Book :

1. Nicholas , 2008, "Practical Guidance to Industrial Safety" 3rd ed.
2. Prof.M.H.Fulekar, 2007, "Industrial Hygiene & chemical Safety" 2nd ed.

Reference Books:

1. Rudd,2005, "Strategy of process engineering" Willey
2. Wang, Shannmas Hung, 2008, "Advanced hazardous industrial waste treatment" CRC Press.

BBT602 ANIMAL BIOTECHNOLOGY 3 0 0 3

OBJECTIVE

To provide a basic understanding of biological mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1- to understand the fundamentals of animal cells and culture.

CO2- to apply the techniques for animal cell culture and its types

CO3- to comprehend genetics and the immune system

CO4- to know the large scale of cell cultures in a bioreactor

CO5- to get a basic knowledge of the applications of animal cell in biological systems and in relevant industries

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	M		S		M							
CO3		M		W								
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 **9**

History of animal cell and organ culture-requirements for animal cell and organ culture-characteristics of animal growth in culture-substrates for cell culture and its treatment-culture media-natural and synthetic media- sterilization of glassware, equipment and culture media.

UNIT II **9**

Equipments required for animal cell culture-isolation of animal material- disaggregation of tissue by physical and enzymatic methods- establishment of cell culture-evolution of cell lines-primary and secondary cell culture-types of cell lines-factors affecting subculture in vitro.

UNIT III **9**

Cultivation of animal cells in bioreactor-Suspension cultures-methods of scaling up of cell culture-roller bottle-spinner culture-immobilized cell culture-insect cell culture-somatic and organ cell culture- organ culture on plasma clots, agar and liquid medium-whole embryo culture-production of commercially valuable products obtained from animal and insect cell culture-hybridoma technology.

UNIT IV **9**

Manipulation of reproduction in animals-artificial insemination-semen collection and storage-ovulation control-embryo transfer-multiple ovulation and embryo transfer-embryo splitting and sexing-in vitro fertilization-nuclear transplantation-problems related to test tube babies-infertility in humans.

UNIT V **9**

Techniques of gene transfer in animals-transgenic animals- transgenic sheep and fish-knockout mice-animal bioreactor and molecular farming-diagnosis, elimination and breeding strategies of genetic diseases-PCR based markers-xenotransplantation-mapping of human genome-bioethics in animal genetic engineering.

TOTAL NO.OF PERIODS: 45

Text Book

1. R.C. Dubey, 2005, "A textbook of Biotechnology", 3rd ed.

Reference Book

1. Stewart Sell, 2004, "Stem Cells Hand Book" Humana Press.
2. John R.W. Masters, 2000, "Animal Cell culture a practical approach" Oxford University Press, 3rd ed.
3. Yoshito Ikada, 2006, "Tissue engineering fundamentals and applications" Academic Prees, 3rded.
4. John P. Fisher et al, 2007, "Tissue engineering" CRC Press.
5. Nigel Jenkins,2007, "Animal Cell Biotechnology" Hamana press, 2nd ed.
6. P. Ramadass. 2008 "Animal Biotechnology", MJP Pub.

BBT603 PROTEOGENOMICS AND BIOINFORMATICS 3 0 0 3

OBJECTIVE

To provide a basic understanding of genomics and proteomics using softwares and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1- to understand the classification of biological databases and its role in research

CO2- to apply the concept of genomics of different organism, gene expression and mapping situations

CO3- to know the tools for gene identification and prediction

CO4- to know the structural elucidation and prediction of proteins

CO5- to get a basic knowledge of techniques related to 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										M		
CO2	M		S		M							
CO3	M			S			W					
CO4				W						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 **9**

BIO INFORMATICS

Introduction to bioinformatics – Databases, Classification – Biological Databases, and application – Data mining and Applications – Sequence Database search – FASTA – BLAST.

UNIT II **9**

GENOMICS

Genome – Organization of Eukaryotic genome – Mitochondrion and chloroplast genome Mapping strategies – Genetic mapping and physical mapping – Genome mapping – Human genome project – Gene expression – Microarrays

UNIT III **9**

SEQUENCE TECHNOLOGIES

Alignment of multiple sequences – Methods and applications – Phylogenetic analysis – Tools for sequence alignment. Gene identification Methods and applications – Tools for gene prediction – Methods and applications

UNIT IV **9**

PROTEOMICS

Lifecycle of protein – Classification and structure visualization techniques – Protein databases – Prediction of primary and secondary structure – Prediction of 2D and 3D structure

UNIT V **9**

TOOLS OF PROTEOMICS

Protein extraction – Separation and digestion techniques – Mass spectrometry –MALDITOF – Peptide mass finger printing – Peptide sequence analysis – SALSA and TMS

TOTAL NO.OF PERIODS: 45

Text Book:

1. S.C. Rastogi, 2007, “Bioinformatics methods and applications “, Prentice – Hall of India Publication

Reference Book:

1. Lesk AM, 2007, “Introduction to Genomics”, Oxford University Press, IV Ed.
2. Brownstein M.J, 2003, “Functional genomics methods and protocols”, Humana Press, III ed.

BBT604 BIOPROCESS ENGINEERING 3 1 0 4

OBJECTIVE

To provide a knowledge about various bioprocesses and the designing of reactor

COURSE OUTCOMES

The student will be able

CO1- to know basic concepts in bioprocess engineering

CO2- to understand basic concepts in transport phenomena in bioprocessing.

CO3- to get knowledge about bioreactor design

CO4- to know about modern biotechnological processes.

CO5- to know about modeling and simulation of bioprocess technology

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

DESIGN AND ANALYSIS OF BIOPROCESSES **12**

On-line data analysis for measurement of important physico-chemical and biochemical parameters; Methods of on-line and off-line biomass estimation; microbial calorimetre; Flow injection analysis for measurement of substrates- Product and other metabolites: State and parameter estimation techniques for biochemical processes-Biosensor

UNIT II **12**

TRANSPORT PHENOMENA IN BIOPROCESS SYSTEM

Role of diffusion in bioprocess- Film theory- Oxygen uptake in cell culture, factors affecting cellular Oxygen demand, Oxygen transfer from gas bubble to cell, Measuring DO concentration, measurement of KLa .

UNIT III **12**

BIOREACTOR

Basic design consideration for a bioreactor- Batch Bioreactor- Fluidized bed reactor- Air lift bioreactor- Trickle bed bioreactor- Hollow fibre reactor- and wave bioreactor (Disposable bioreactor)

UNIT IV **12**

MODERN BIOTECHNOLOGICAL PROCESSES

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.

UNITV **12**

MODELLING AND SIMULATION OF BIOPROCESSES

Study of Structured models for analysis of various bioprocess; Computer based data acquisition, Monitoring and control- Lab view software, MATLAB-SIMULINK

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

Text Book:

1. Shuler and Kargi, 2004, "Bioprocess Engineering Fundamentals", McGraw Hill 2nd Ed.

References:

1. Sameer A. Zodgkar,2008, “Bioprocess” ICFAI University Press, 1st.
2. P.T. Kalaichelvan and I. Arul Pandi. 2007 “Bioprocess technology” . MJP Pub.
3. Funshang Yabg Juming Tang,2002, “Advances in Bioprocess Engineering” World scientific publishing company 2nd.
4. Syed Tanveer Ahmed Inamdar, 2007, “Biochemical engg principles & concepts” Prenctice Hall of India,2nd

BBT605 ENZYME ENGINEERING AND TECHNOLOGY 3 0 0 3

OBJECTIVE

To provide a knowledge about enzymes and its kinetics.

COURSE OUTCOMES

The student will be able

CO1- to understand the applications of enzymes in various fields.

CO2- to know about kinetics of enzyme.

CO3- to know about immobilization and its applications.

CO4- to get knowledge about transport in cell.

CO5- to get ideas about various bioreactors and its 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						W				M		
CO2			S		M			M			M	
CO3		M		S				W				
CO4	M			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		

UNITI **9**

INTRODUCTION AND INDUSTRIAL APPLICATIONS

Definition and scope of biochemical processes - application of biochemical process in Pharma, food and other industries - comparison of chemical and biochemical processes - development and scope of biochemical engineering.

UNITII

ENZYME KINETICS **9**

Nature and function of Enzymes - Co - Enzymes and cofactor - classification of Enzyme - Practical application of Enzyme in biochemical processes of industrial importance - mechanism of enzymatic reaction - Michaelis Menten Kinetics - Enzyme inhibition – kinetics of competitive and non competitive inhibition-factors affecting the reaction rates - Immobilization Of Enzymes - Characteristics and applications.

UNIT-III **9**

MICROBIAL KINECTICS AND IMMOBILIZATION

Typical growth characteristics of microbial cells: Phase of growth curve, factors affecting growth- Monod Model - Immobilization of cells and characteristics - applications.

UNIT-IV **9**

TRANSPORT IN MICROBIAL SYSTEMS

Transport mechanism- gas liquid mass transfer in cellular system- design parameters affecting O_2 transfer- Measurement of K_La- factors affecting K_La- - Correlation of mass transfer co-efficient- Agitation and Aeration in fermentor- heat transfer- Power consumption using π theorem- sterilization: batch & Continuous.

UNIT-V **9**

BIOREACTORS

Classification- Stirred tank reactor, Bubble column- Air lift rector- Packed bed- fluidized bed- Trickle bed reactor- Industrially important reactor: Photo bio reactor, membrane bio reactor. Comparison of industrially important bioreactor

TOTAL NO.OF PERIODS: 45

Text books:

1. Manjula, 2006, “Bio and Enzyme Engineering”, III Ed.

Reference book:

1. J.B.Bailey and D.F. Ollis, 2005, "Biochemical Engineering Fundamentals" McGraw Hill, New York.
3. Dr.Mansi El Mans, 2006 "Fermentation microbiology and biotechnology" IV Ed,

BBT6L1 BIOPROCESS ENGINEERING LAB 1 0 0 4 2

OBJECTIVE

To provide basic knowledge about bioprocessing

COURSE OUTCOMES

Students will be able

CO1- to get knowledge on biomass

CO2- to know about enzyme kinetics

CO3- to understand about immobilization of enzyme

CO4- to get idea about mass transfer

CO5- to know about death kinetics

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		M						W	
CO3				S				M				
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 EXPERIMENTS

1. Culturing of different types of microorganism
2. Estimation of biomass production.
3. Enzyme kinetics.
4. Effect of temperature on enzyme activity.
5. Effect of pH on enzyme activity.
6. Effect of substrate concentration on growth of *E.coli.*
7. Immobilization of enzyme.

8. Estimation of k_La by sulphite oxidation method.
9. Thermal death kinetics of yeast.
10. Thermal death kinetics of bacteria.

TOTAL NO.OF PERIODS: 60

BBT6L2 PLANT AND ANIMAL BIOTECHNOLOGY LAB 0 0 4 2

OBJECTIVE

To provide a basic understanding of plant and animal cell culture techniques

COURSE OUTCOMES

The student will be able

CO1- to understand the fundamentals of plant biotechnology

CO2- to know about sterilization techniques

CO3- to know about plant tissue culture

CO4- to know about animal cell culture

CO5- to get a basic knowledge of the 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						W					
CO2			M		S							W
CO3						S						
CO4			M	W					M			
CO5	M				W							S

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 Experiments

1. Sterilization techniques.
2. Plant tissue culture techniques.
3. Preparation of culture medium
4. Callus induction in *Daucuscarota.*

5. Nodal bud culture.
6. Micropropagation of rose.
7. Rooting and hardening of regenerated shoots.
8. Isolation and purification of protoplast from *Aloe vera*leaf mesophyll cells.
9. Determination of protoplast viability using Evan's blue staining.
10. Protoplast fusion using PEG.
11. Preparation of synthetic seeds.
12. Isolation of Rhizobium from ground nut nodules.
13. Preparation of Rhizobialbiofertilizer.
14. Aseptic techniques for animal cell culture.
15. Establishment of a primary culture.
16. Resuscitation of frozen cell lines.
17. Subculture of adherent cell lines.

TOTAL NO.OF PERIODS: 60

BBT6L3 IMMUNOTECHNOLOGY LAB 0 0 4 2

OBJECTIVE

To provide a basic understanding of biological defense mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1- to understand the fundamentals of immune system
CO2- to apply the techniques for antigen and antibody reaction
CO3- to give the mechanism of immune response against antigens
CO4- to know the natural barrier against pathogens
CO5- to get a basic knowledge of the applications of immunology in transplantation

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												
CO2	S		M		S							
CO3		M										
CO4			M	W								
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

List of Experiments

1. SDS- Slab gel electrophoresis of immunoglobulins.
2. Western blotting
3. Immunoelectrophoresis
4. Countercurrent Electrophoresis
5. Rocket Immunoelectrophoresis
6. Single radial immunodiffusion
7. Double immunodiffusion
8. Dot- ELISA
9. DEAE cellulose chromatography for IgG.
10. Affinity chromatography for antiserum purification

TOTAL NO.OF PERIODS: 60

BBT701 RESEARCH METHODOLOGY AND INSTRUMENTATION 3 0 0 3

OBJECTIVE

To provide basic knowledge about various instrumentation techniques and data documentation

COURSE OUTCOMES

The student will be able

CO1- to understand the biochemical analysis.

CO2- to know about spectroscopic and microscopic techniques.

CO3- to know about the separation techniques

CO4- to get ideas about ethical issues related to research.

CO5- to know about data documentation

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			M		M							
CO3	S	M		W								
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 **9**

Basic principles for Biochemical Analysis

Introduction – preparation of organ and tissue samples for analysis – cell disruption methods – physiological solutions: buffers and growth media for plants, animals and microbes – Medium standardization - cell sorting, isolation and enumeration techniques – cryopreservation – elucidating metabolic pathways by tracer studies.

UNIT II **9**

Spectroscopic and Microscopy techniques

Introduction – UV – visible spectroscopy – NMR spectroscopy – IR and Raman spectroscopy – atomic spectroscopy - Introduction to microscopy – Election microscopy –ultramicrotome- phase contrast microscopy – Fluorescent and confocal microscopy.

UNIT III **9**

Separation techniques

Introduction to chromatography and electrophoresis – gel filtration – ion exchange – affinity – GC – HPLC - partition chromatography – electrophoresis of proteins and nucleic acids – immunoprecipitation techniques – ELISA.

UNIT IV **9**

Ethical issues in biotechnology

Legal and socio economic impacts of biotech research – bio safety regulation – r-DNA guidelines- issues involved in experimenting with animals – Experimental protocol approvals – contaminant levels and environmental effects- impact of GM organisms and GM foods – IPR and patents.

UNIT V **9**

Data analysis and Documentation

Sampling concepts for statistical analysis – Mean, median, standard deviation, standard error – annova – Guidelines for thesis writing: literature collection methods – writing of abstract, introduction and review of literature – results, discussion and summary – guidelines to publish articles in journals.

TOTAL NO.OF PERIODS: 45

Text books:

1. Keith Wilson and John Walker,2004, Practical biochemistry, Principles and techniques – Cambridge publication
2. Dr. N. Gurumani, 2006, Research methodology for biological sciences, MJP publishers.

Reference Books

1. Dr. P. Ramadass, 2009, Research and writing: Across the disciplines, MJP publishers.

BBT702 STEM CELLS AND TISSUE ENGINEERING 3 0 0 3

OBJECTIVE

To provide a basic understanding of stem cells and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1- to understand the fundamentals of stem cells and its types

CO2- to apply the techniques for preservation of stem cells

CO3- to give the information about embryonic stem cell research.

CO4- to know the role of stem cells in medicine

CO5- to get a basic knowledge of the applications of stem cells in 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		W										
CO2			S		M							
CO3		M		W								
CO4				W								
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 9

ORGAN AND CHARACTERISATION OF HUMAN STEM CELLS AND POTENTIAL APPLICATIONS FOR STEM CELL RESEARCH

Origin and characteristics of human stem cell, plasticity of human somatic stem cells research, Novel stem cell based therapies, Scientific and technical obstacles to overcome before realizing the potential clinical uses of novel human stem cell based therapy, Cord blood,-Stem cell marker.

UNIT II **9**

HUMAN EMBRYONIC STEM CELL RESEARCH

Possible sources for human embryonic stem cell, growing human ESC in laboratoy, Current advantages and limitations of hESC and human somatic cells-Examining the need for new hES cell lines, Developments regarding establishment of human stem cell banks and registries.

UNIT III **9**

PROTOCOLS FOR ISOLATION AND IDENTIFICATION OF STEM CELLS

Preparation of complete human neuroculture, Culturing and subculturing human neurospheres, Differentiation of cells from human, neurospheres into neurons, astrocytes and oligodendrocytes; Immunolabelling procedures

UNIT IV **9**

GENE THERAPY

Possibilities to overcome immuno-rejection responses in stem cell therapy, Haematopoietic stem cell transplantation - A new therapy for autoimmune disease, Prenatal diagnosis of genetic abnormalities using fetal CD34+ stem cells, Stem cells in treatment for major diseases and reparative medicine, ESC a promising tool for cell replacement therapy, germ line therapy.

UNIT V **9**

TISSUE ENGINEERING

Basic principles and consideration - Cell type and source, Metabolic requirements of cells, Reconstruction of connective tissues, Reconstruction of epithelial or endothelial surfaces - cells embedded in extracellular matrix material, Culture on a single surface and sandwich configuration, Bioreactor design on tissue engineering - Hollow fiber systems, Microcarrier based systems-Tissue engineering of the liver

TOTAL NO.OF PERIODS: 45

Text Book

1. R.C.Dubey, 2004, “Text book of Biotechnology” 3rd Ed.

Reference Book:

1. Sudha Gangal , 2002, “Principles and Practice of Animal tissue culture”, IV Ed
2. P. Ramadass , 2008, “ Animal Biotechnology” MJP pub

BBT703 DOWNSTREAM PROCESSING 3 0 0 3

OBJECTIVE

To provide basic knowledge about various separation techniques in bioprocesses

COURSE OUTCOMES

The student will be able

CO1- to understand the unit operations involved in downstream

CO2- to know about various separation processes.

CO3- to know about the product recovery and purification techniques.

CO4- to get basic idea about fractionation

CO5- to know about product polishing technique

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

Role of Downstream Processing In Biotechnology **9**

Role and Importance of downstream processing in biotechnological processes- Problems and requirements of bioproduct purification-Economics of downstream processing in Biotechnology, cost - cutting strategies, characteristics of biological mixtures, process design criteria for various classes of bioproducts (high volume, lowvalue products and lowvolume, high value products), physico- chemical basis of bioseparation processes

UNIT II **9**

Primary Separation And Recovery Processes

Cell distribution methods for intracellular products, removal of insolubles, biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods

UNIT III **9**

Enrichment Operations

Membrane separations (micro and ultrafiltration theory, and configuration of membrane separation equipment) applications, precipitation methods - extractive separations, aqueous two phase extraction, supercritical extraction- insitu product removal, integrated bioprocessing.

UNIT IV

Product Resolution/Fractionation **9**

Adsorptive chromatographic separation processes, electrophoretic techniques.

UNITV

Product Polishing **9**

Gel Permeation Chromatography, dialysis, Crystallisation

TOTAL NO.OF PERIODS: 45

Text Book:

1. SivaShankar , 2004, “BioSeparation” III Ed,

References:

1. Wankat P.C , 2003, "Rare Controlled Separations", Elsevier,.
2. Better PA and Cussier E, 2002,"Bioseparations", Volley,.

BBT704 ENVIRONMENTAL BIOTECHNOLOGY 3 0 0 3

OBJECTIVE

To provide basic knowledge about environmental issues related to bioprocess and its remedial measures

COURSE OUTCOMES

The student will be able

CO1- to understand the microbiological concepts in air, water and soil

CO2- to know about various bioremediation techniques

CO3- to know about biosafety and IPR

CO4- to know about biosafety

CO5- to get idea about microbiology of soil

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				S				W				
CO4				W								
CO5	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	Quiz	4	Alumni
5	Online test		
6	End Semester Examinations		

UNIT I **9**

MICROBIOLOGY OF AIR

Microbial Contamination of air-Enumeration of bacteria in air-Air Sampling devices-Air Sanitation and purification Methods

MICROBIOLOGY OF WATER

Determination of Water quality-Bacteriological examination of water-indicator organisms-Water borne pathogens

UNIT II **9**

MICROBIOLOGY OF SOIL

Microbial flora of soil, Growth, Ecological adaptation, Interaction among soil microorganisms-Microorganisms involved in nitrogen fixation, Positive and negative role of microbes.

UNIT III **9**

DETOXIFICATION

Detoxification of Hazardous chemicals-Biocatalyst for pesticide Detoxification- Bioremediation: Bioremediation of Persistent chemicals,Improving catabolic processes, Biosorption of Heavymetals-Bioremediation of oil spils, Biodeterioration of paper, Textile, sugar distillaries, diary industries.

UNIT IV **9**

BIOWASTE UTILIZATION

Biotechnology for biowaste conversion in to bioresources-Single cell protein, Mushroom, Algal growth for fisheries, and Aqua culture- Industrial waste recycling -Waste fueled furnaces.

UNIT V

BIOSAFETY AND IPR **9**

Intellectual Property, Rights in bioremediation, Biosafety-Microbiology. Medical Laboratory-Medical waste- Bioharzardous waste-Sharps-Pathological waste-Rules and Regulations-Biosafety protocol

TOTAL NO.OF PERIODS: 60

Text book

1. Bruce. E.Rittaman and Perry. L. Mc Carty, 2004, “Environmental Biotechnology-Principles and applications” McGraw Hill.
2. N. Ahmed, F.M. Quershi and D. Y.Khan, 2001, “Industrial Environmental Biotechnology” Horizon press.

Reference Books

1. W.D. Grand, P.E. Long Blakies, “Environmental Microbiology”, Glasgow London.
2. T. Meenambal, 2009, “Environmental Science and Engineering”.

BBT7L1 BIOPROCESS LAB II 0 0 4 2

OBJECTIVE

To provide knowledge about production of bioproducts

COURSE OUTCOMES

Students will be able

CO1- to know about media formulation

CO2- to understand about Solid State Fermentation

CO3- to get basic idea about production of natural wine and biofuel

CO4- to get basic idea about production of soap

CO5- to get basic idea about production of fertilizer

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					W		
CO3		M		S								S
CO4	S		M	W							S	
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 Experiments

1. Plate assay
2. Media optimization by Plackett-Burmann method
3. Solid state fermentation.
4. Production of wine
5. Estimation of alcohol concentration in wine.
6. Estimation of acid concentration in wine.
7. Production of soap and analyze its properties.
8. Production of biodiesel and analyze its properties.
9. Activity of Various Natural Substances on the Growth of *Malassezia furfur*
10. Production of biofertilizer

TOTAL NO.OF PERIODS: 60

BBT7L2 DOWNSTREAM PROCESSING LAB 0 0 4 2

OBJECTIVE

To provide knowledge about purification of bioproducts

COURSE OUTCOMES

Students will be able

CO1- to know about precipitation technique

CO2- to understand about flocculation and settling

CO3- to get basic idea about chromatographic techniques

CO4- to get basic idea cell disruption
CO5- to know about extraction

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		W			M					W		
CO3				S				W				S
CO4			M	W							S	
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 Experiments

1. Isoelectric precipitation
2. Settling characteristics
3. Flocculation (Jar Test)
4. Solids Recovery by Centrifugation
5. Paper chromatography
6. Thin Layer Chromatography
7. Ion –Exchange Chromatography
8. Affinity Chromatography
9. Gel Filtration
10. Desalting of Protein Sample by Gelfiltration
11. Sonication
12. Crystallization
13. Aqueous Two Phase Extraction Of Proteins
14. Enzyme Purification by Salt precipitation Method

TOTAL NO.OF PERIODS: 60

BBT7L3 ENVIRONMENTAL BIOTECHNOLOGY LAB 0 0 4 2

OBJECTIVE

To provide knowledge about environmental science and technology

COURSE OUTCOMES

Students will be able

CO1- to know about analysis of water

CO2- to understand about microbial examination of effluent

CO3- to get basic idea about adsorption of dye

CO4- to know about microbial remediation

CO5- to get basic idea about bioremediation

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					W							
CO3		M		S					M			S
CO4	S		M				M				S	
CO5					S							M

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 Experiments

1. Estimation Of pH
2. Analysis of Alkalinity
3. Estimation of Hardness
4. Analysis of Chloride
5. Analysis of Total Dissolved Solids
6. Estimation of Fluoride
7. Analysis of Iron
8. Analysis of Nitrite
9. Analysis of Nitrate
10. Analysis of Phosphate
11. Analysis of Residual Chlorine
12. Microbiological Examination using Leather Effluents
13. Adsorption of Dye using Charcoal
14. Microbial Degradation of Dye

15. Reduction of Sulphate by biological method
16. Bioremediation of Hexavalent chromium reduction

TOTAL NO.OF PERIODS: 60

LIST OF ELECTIVES

BBT050 METABOLIC ENGINEERING 3 0 0 3

OBJECTIVE

To have a detailed knowledge about the metabolic pathway of carbohydrates, proteins and fat and to engineer them based on industrial requirement

COURSE OUTCOMES

CO1-To learn the basic process of metabolism
CO2-To study the energetic of metabolism
CO3-To learn about metabolic stoichiometry
CO4-To explore the kinetics of metabolism
CO5-To study the various signal transduction pathways

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 **9**

Metabolism- glycolsis, gluconeogenesis-glycogen-HMP shunt-TCA cycle-fatty acid metabolism-urea cycle and metabolism of purine and pyrimidine

UNIT II **9**

Energetics of metabolism, Energy coupling (ATP and NADH), Stoichiometry of cell growth and product formation, Elemental Balances, Degree of reduction, fundamental concepts, yield coefficients, oxygen consumption and heat evolution in aerobic cultures.

UNIT III **9**

Metabolic stoichiometry, Energy of batch and continuous process, Stoichiometry of cell growth and product formation, available electron balances, yield coefficients of biomass and product formation, Maintenance coefficients, Energetic analysis of microbial growth and product formation, Heat evolution in anaerobic culture

UNIT IV **9**

Thermodynamic efficiency of growth, Thermodynamics and kinetics of cell metabolism, metabolic path ways, modeling of EM pathway, Thermal Energetic studies, Activation Energies of reaction and heat of reaction, formation and combustion of biochemical reactions.

UNIT V **9**

Signal transduction- Receptors and Methods of action- Signal amplification and different models, G proteins- Phosphatidyl Inositol – cAMP – Calcium ions – Protein kinase- defects in signaling pathways.

TOTAL NO.OF PERIODS: 45

Text Books:

1. Biochemical Engineering Fundamentals- Bailey and Olis, 2013

Reference Books:

1. Roles JA Kinetics and Energetics in Biotechnology –Elsevier 1983
2. Chemical Reaction Engineering- Octave Levenspiel
3. Chemical process Principles vol III Bioprocess Engineering – Coulson and Richardson Wiley International 1986

BBT051 DEVELOPMENTAL BIOLOGY 3 0 0 3

OBJECTIVE

To provide basic knowledge about biology of human system

COURSE OUTCOMES

The student will be able

CO1-to understand the history and scope of developmental biology

CO2-to know about fertilization

CO3-to know basic concepts on cleavage

CO4-to know about regeneration

CO5-to study the various processes involved in regeneration

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			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 **9**

Developmental biology: its scope, history and special fields-Germ cells: origin of germ cells, its migration and fate-Spermatogenesis: cells in seminiferous tubes, spermiotelosis, nuclear control of spermiotelosis, ultramicroscopic structure of mammalian sperm, types of sperm.

UNIT II **9**

Oogenesis: growth of oocyte, maturation of ovum, formation of yolk, accessory cells, egg cortex and its importance, egg membrane-Fertilization: significance of sperm-egg interaction, acrosome reaction, sperm penetration, behaviour of pronuclei, syngamy, polyspermy, activation of egg-Parthenogenesis: natural and artificial.

UNIT III **9**

Cleavage: definition, early history and concept, geometry of cleavage, types of cleavage, cleavage patterns and factors governing them, laws of cleavage, theories of cytokinesis-Gastrulation: morphogenetic movements, selective affinity and adhesiveness of cells, mechanism of the change of shape of cell during morphogenesis-Embryonic induction: Spemann's primary organizer, nature of induction mechanism of action of inducing substances.

UNIT IV **9**

Organization of the early embryo: polarity, symmetry, regulative development and physiological gradients, mosaic development- Differentiation: equivalence of nuclei, cytoplasmic control of nuclear activity, genetic control of differentiation, isozymes, mass effects-Metamorphosis: insect metamorphosis, amphibian metamorphosis, metamorphosis and evolution.

UNIT V **9**

Regeneration: regeneration in amphibians and planarian, stimulation and suppression of regeneration, histological processes concerned in regeneration, gradient concept, neural and endocrine influences- Developmental aspects of immunology- Teratology: factors inducing abnormal development of tissues and organs.

TOTAL NO.OF PERIODS: 45

Text Book

1. B. Balinsky , 2004, " An introduction to embryology", 5th ed.

References

1. J. Brachet, 2003, "Introduction to molecular embryology".

2. N.J. Berrill, 2005, "Developmental biology".
3. Gene activity in early development, (2005), H. Davidson

BBT052 CANCER BIOLOGY 3 0 0 3

OBJECTIVE

To provide a basic understanding of biological mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1-to understand the fundamentals of cancer cells and its constituents

CO2-to know the concept of carcinogenesis and carcinogenic agents

CO3-to find the environmental factors related to cancer

CO4-to know the cause, symptoms, diagnosis and treatment of cancer

CO5-to give a basic knowledge of the different types of cancer

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 9

Fundamentals of Cancer Biology- Cell Cycle- regulation of cell cycle, modulation in cell cycle in cancer, Changes in signaling molecules- Effects on receptors, signal switches, Classification of stages of cancer- metasis, Metastatic cascade, common features of cancer cells, Tumor suppressor genes, Cancer genetics.

UNIT II 9

Principles of Carcinogenesis- Carcinogens- Targets of carcinogens, Chemical carcinogenesis, Physical carcinogenesis- X-ray radiation and radiation carcinogenesis, Viruses and Cancer, Diet and cancer

UNIT III **9**

Molecular biology of cancer- Oncogenes, Identification of oncogenes, Retroviruses and oncogenes, growth factors and Growth factor receptors as oncogenes.

UNIT IV **9**

Different sites and forms of cancer, Lung, Liver, Breast, Cervical, Blood, Prostrate, Ovarian cancers- Epidemology, causes, mutations, and features

UNIT V **9**

Cancer therapy- Cancer Immunology, Different forms of cancer therapy- Chemotherapy, radiation, Detection of cancers, advances in cancer detection and therapy, Gene therapy.

TOTAL NO.OF PERIODS: 45

Text Books:

1. Lewis J.Kleismith,2006, "Principles of Cancer Biology" Pearson Benjamin Cummings.
2. Raymond W. Ruddon,2007, "Cancer Biology" Oxford University Press, 4th.

Reference Books:

1. G.M. Cooper,2008, "Oncogenes" Jones & barlett Publisher, 1st.
2. 'Molecular Cell Biology' Darnell, Lodish & Baltimore, IV Ed,2004
3. An Introduction to cellular and Molecular Oncology- Oxford University Press, 2003
4. Genes VII and VIII – Benjamin Lewin, 2004

BBT053 ENTREPRENEURSHIP DEVELOPMENT 3 0 0 3

OBJECTIVE

To provide basic knowledge about Entrepreneurship

COURSE OUTCOMES

The student will be able

CO1-to understand the fundamentals of Entrepreneurship

CO2-to know about time management and decision making

CO3-to explore the avenues for financing a business venture

CO4-to know about various company laws

CO5-to understand Entrepreneurship in biotechnology

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 **9**

ENTREPRENEURSHIP FUNDAMENALS

Entrepreneur – Entrepreneurship – Enterprise – Writing good business plan – operations and management.

UNITII **9**

DECISION MAKING AND TIME MANAGEMENT

Entrepreneur psychology – personal decision making style – Decision making process – setting personal and Business goals – Setting time priorities – Business person working at home.

UNIT III **9**

ENTREPRENEURSHIP – FINANCE AND ECONOMIC FEASIBILITY

Financing the business– Raising venture capital – Financing sources – Pricing the product (or) Service – operating expenses Economic Analysis – Basic financial Analysis worksheets

UNIT IV **9**

COMPANY LAWS AND REGULATIONS

Forming a company – Types of companies – Types of market – Proprietary information: Intellectual property, copy right, ownerships, Trademark, Patent – International Trade

UNIT V **9**

ENTREPRENEURSHIP IN BIOTECHNOLOGY

Various business opportunities in Biotechnology – Development of Biotech companies in India – Case studies on Biotech companies and its growth

TOTAL NO.OF PERIODS: 45

Text Book:

1. Exploring Entrepreneurship: D. Allan Barefield and George F. Smith, Ettmae Westbrook, Tennesse State University, 2006

Reference Book:

1. Entrepreneurship fundamentals by Zobias Kollmann International journal of Zechnology management,2007

BBT054 **BIOREACTOR DESIGN** **3 0 0 3**

OBJECTIVE

To provide knowledge about the designing of reactor

COURSE OUTCOMES

The student will be able

CO1-to understand the fundamentals transport phenomena

CO2-to know about various types of reactors

CO3-to know about instrumentation and control of reactors

CO4-to learn the process of modulation and simulation of fermentation process

CO5-to understand plant and animal cell 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	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 **9**

BIOREACTOR DESIGN

Batch reactors; Continuous Stirred Tank Bioreactors (Chemostat); Enzyme Catalysis in Chemostat; Age Distribution Models; Fed Batch Reactors; Recycle Systems, Design of airlift bioreactors

UNIT II **9**

TRANSPORT PHENOMENA & GROWTH MODELS

Rheology; Gas-Liquid Mass Transfer- Measurement of transfer coefficients; Design of bubble columns;. Three-phase flow, mixing, oxygen transfer: isobaric method, non-isobaric model, oxygen transfer in a three-phase flow.

Phases of batch growth cycle; Monod Model; Models of Product Formation and Inhibition; Introduction to structured models

UNIT III **9**

Bioreactor Instrumentation and Control

Introduction, bioreactor sensor characteristics, temperature measurement and control, principles of dissolved oxygen measurement and control, principles of pH/redox measurement and control, detection and prevention of foam, determination of biomass, ion specific electrodes, biosensors.

UNIT IV **9**

FERMENTATION CONTROL

Introduction to control: control loop, analogue and digital control, control algorithm-PID control, time-proportional control. Physical control of fermentation

MODELING AND SIMULATION OF FERMENTATION PROCESSES

Modeling, digital simulation, digital simulation programming languages, ISIM(interactive simulation language).

UNIT V **9**

PLANT AND ANIMAL CELL BIOREACTORS

Introduction, plant cells: plant cell bioreactors, characteristics of plant cell suspensions, plant cell bioreactor requirements, plant cell bioreactor design, plant cell bioreactor operation, alternative cultures for plant cells. Animal cells: Animal cell bioreactors, animal cell bioreactor operation, animal cell bioreactor design

TOTAL NO.OF PERIODS: 45

Text books:

1. Scragg A.H.,2002, "Bioreactors in Biotechnology", Edited by, Ellis Horwood Limited, England
2. Bailey and Ollis, 2000, "Biochemical Engineering Fundamentals", McGraw Hill 3rd ed.

Reference Books :

1. Stanbury PF,1984, "Principles of fermentation technology" SS Hall, 2nd.
2. Dr.Mansi El Mansi.2003 "Fermentation Microbiology & Biotechnology".IVEd.

BBT055 ENGINEERING OPTIMIZATION 3 0 0 3

OBJECTIVE

To provide knowledge about the process optimization

COURSE OUTCOMES

The student will be able

CO1-to understand the fundamentals of process optimization

CO2-to know about various optimization methods

CO3-to know about statistical approach

CO4-to understand the linear programming methos

CO5-to understand about neural network

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 **9**

Introduction to Optimization, Necessity and need for process optimization- Necessary and Sufficient Conditions for Extremum-Maxima and minima- Local maxima, local minima, global maxima, global minima

UNIT II **9**

Optimization of Unconstrained Functions: One-Dimension. Newton Ralpson Method- Bisection Method- Interval Halving Method

UNIT III **9**

Optimization of Unconstrained Functions: Multi-Dimensional

Optimization by Generalized Reduced-Gradient method (deterministic process optimization) -Statistical Modeling (empirical process optimization, experimental design and analysis) -Taguchi Method (process optimization) -Random Search Method -Fuzzy Logic (process optimization, control systems) -Linear Programming (process optimization)

UNIT IV **9**

Linear Programming - Simplex Method-The Nonlinear Problem with Constraints-
Statistical Approaches

UNIT V **9**

Neural Networks (process optimization, control systems) - Genetic Algorithms (process optimization) - Optimization of Systems with Discrete Variables (process design)

TOTAL NO.OF PERIODS: 45

Text Book:

1. Singiresu S. Rao, 2005, “Engineering Optimization Theory and Practice”, Third Edition.

Reference Books:

1. Ananthakrishnan TN,2006, “Animal biodiversity” Scientific publishers(India).
2. Good enough U,1998, “Human biology; personal, environmental and social concerns” Saunders collage publication.

BBT056 BIOSENSOR TECHNOLOGY 3 0 0 3

OBJECTIVE

To provide basic knowledge about the biosensors

COURSE OUTCOMES

The student will be able

CO1-to understand basic principles of biosensor

CO2-to know about various types of biosensor

CO3-to know about applications of biosensors in various fields

CO4-to get some knowledge about transducers in biosensors

CO5-to learn about the applications of transducers in 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	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

Introduction **9**

Biosensor – principle, construction, components, Advantages and limitations; ISFET, ENFET, ISE

UNIT II **9**

Types

Various biological materials used for biosensor construction - Microbial biosensors, Enzyme biosensor, Tissue based biosensor, Affinity biosensor

UNITIII **9**

Transducers in Biosensor-I

Potentiometric, Amperometric biosensors - Principle, constructions, and applications- Generations of biosensor Technology

UNIT IV **9**

Transducers in Biosensor-II

Calorimetric, Optical, Piezo – electric biosensors - Principle, constructions, and applications

UNIT V **9**

Applications

Online/Offline monitoring in bioprocess; Applications in clinical chemistry, medicine, health care, veterinary, agriculture, food and environmental monitoring

TOTAL NO.OF PERIODS: 45

Text Book:

1. Alice Cunningham, 2000, "Introduction to Bioanalytical Sensors",John Wiley& Sons,.
2. Jiri Janata , 2002, "Principles of Chemical Sensors" Plenum Press.

Reference books:

1. F. Schellr, F. Schubert, J. Fedrowitz, Birkhauser Verlag ,1995 "Frontiers in Biosensors"
2. F. Ligler, C. Rowe Taitt , 2002 "Optical Biosensors. Present & Future" Elsevier,.
3. Brian Eggins, 2002 "Chemical Sensors and Biosensors" John Wiley & Sons,.
4. Graham Ramsay ,1998, 'Commercial Biosensors'- , John Wiley& Sons.

BBT057 MEDICAL BIOTECHNOLOGY 3 0 0 3

OBJECTIVE

To provide a basic understanding of biological systems and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1-to understand the fundamentals of genetics and their relationship to hereditary disorders

CO2-to apply the concept of plant, animal and microbial systems in discovery of medicine

CO3-to comprehend genetics and the immune system

CO4-to know the cause, symptoms, diagnosis and treatment of common diseases

CO5-to get a basic knowledge of the applications of diagnosis in finding of disease

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 **9**

HUMAN GENETICS

Genes and Chromosome- structure, function and inheritance- Repetitive DNA in human genome- Alu, LINE and SINE repeats- Congenital abnormalities, Clinical aspects of autosomal and sex chromosomal disorders. Gene therapy and its types

UNIT II **9**

HUMAN PHYSIOLOGY

Structure, types and functions of tissues and muscles-Biological functions and abnormalities of digestive system, circulatory system, excretory system and central nervous system

UNIT III **9**

HORMONES

Hormones- structure, classification, biosynthesis and circulation in blood- Synthesis transport and biological functions of pituitary hormones, thyroid hormones and pancreatic hormones

UNIT IV **9**

CLINICAL BIOCHEMISTRY

Blood sugar level in diabetes mellitus- Blood pressure and cholesterol level in heart attack- Clinical significance of diagnostic enzymology- Evaluation of renal, pancreatic, liver and intestinal function

UNIT V **9**

GERM LINE ENGINEERING

Characterstics and diagnostic applications of stem cell culture, organ culture, embryo culture – Artificial blood- Genetic counseling-Artificial insemination, IVF and embryo transfer in humans- Egg and sperm Preservation banks

TOTAL NO OF PERIODS: 45

Text Books:

1. Lehninger Nelson &Cox., 2009 “priniciples of Biochemistry”,5th edition
2. Chatterjee and Rane shinde ,2009 “Clinical Biochemistry”,7th edition.

References:

1. Guyton,2010 “Medical physiology”, 12th edition
2. Devlin, 2005 “Biochemistry with clinical correlation”, 10th edition

BBT058 **PROTEIN ENGINEERING** **3 0 0 3**

OBJECTIVE

To provide a basic understanding of proteins in biological mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1-to understand the fundamentals of protein structure and classifications

CO2-to apply the concept of protein in biological systems

CO3-to know the techniques for protein structure visualization and characterization

CO4-to know the role of proteomics in drug discovery

CO5-to get a basic knowledge of the applications of software in proteins design

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 **9**

AMINOACIDS AND PROTEINS

Proteins as genetic information – expressing molecules- Protein diversity (Structural and functional)-Building blocks of proteins- Physical and chemical properties of aminoacids- Peptide bond, classification of peptides and proteins

UNIT II **9**

PROTEIN STRUCTURE – I

Primary structure and methods of determination of aminoacid sequencing- Secondary structure (Alpha – helix & Beta – sheets) and super secondary structures

UNIT III **9**

PROTEIN STRUCTURE – II

Three-dimensional structures (tertiary & quaternary) of proteins- Methods of determination of 3-D structure (x-ray crystallography & NMR). Ramachandran Plot.

UNIT IV **9**

PROTEIN FOLDING

Factors condtributing to protein stability- Protein folding (PF) – stages, Determinants and accessory proteins assisting PF, Thermodynamics of PF, protein denaturation (PD) causative agents, types and thermodynamics of PD.

UNIT V **9**

PROTEIN DESIGN

Protein engineering cycle, Approaches to protein design-site-directed mutagenesis concepts of Molecular modeling, contribution of computer software and protein database to it-Designer enzymes

TOTAL NO.OF PERIODS: 45

Text Books:

1. Robertson & Noel,2004, "Protein Engineering" Elsevier academic press.
2. Dugas. H, Bio-Organic Chemistry - A chemical approach to enzyme action, Springer Verlag, 2002, revised edition

Reference Books:

1. Cleland & Craik,1996, "Protein Engineering Principles & Practice" Wiley-Liss.
2. Voet &Voet , 2006 , "Biochemistry" V ed,.
3. Lehninger Nelson & Cox , , 2005 "Principles of Biochemistry",4th Ed

BBT059 CONCEPTS IN COMPUTING & PROGRAMMING IN C& C++ 3 0 0 3

OBJECTIVE

To provide basic knowledge about C & C++

COURSE OUTCOMES

The student will be able

CO1-to understand basic principles of computer hardware

CO2-to know about programming in C

CO3-to know about the functions and program structures

CO4-to know about programming in C++

CO5-to understand looping techniques

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 **9**

Introduction to Computer- Hardware –Input, output devices, CPU, ALU, etc., Software- Types of softwares – Application software Programming Software, Operating System- Function of Operating System- Internet

UNIT II **9**

Introduction to C programming Variables, Constants, Operators, Expressions- Control Flow- If-Else, Loops – While loop, For loop-Goto.

UNIT III **9**

Functions- Program structures- External Variables-C preprocessor-Pointers-Arrays-File Access

UNIT IV **9**

Introduction to C++ Programming- Variables, Constants, Operators, Expressions and Statements- Conditional Statements / Built-In Functions- User-Defined Functions / Local v. Global Variables- Continuation of Functions / Return Values- Introduction to Class / Accessor Methods

UNIT V **9**

Consturctors and Destructors- Looping Techniques- Pointers / CONST and "this" pointers- Overloaded Functions- Initialization of Objects / Copy Constructors- Arrays and String Classes- Linked Lists / Alternative Data Structures- Intro to Polymorphism and Inheritance

Text Books:

1. Peter Norton's, 2004, “Introduction to Computers”, III Ed.
2. Brian W. Kernighan, Dennis M. Rithchie , 2005 , “The C programming language”

Reference Books

1. Bjarne Stroustrup , 2004, “The C++ Programming Language”, IV ed,
2. Andrei Alexandrescu , 2006 “Modern C++ Design”,V Ed,

BBT060 PROFESSIONAL ETHICS 3 0 0 3

OBJECTIVE

To provide basic knowledge about ethics

COURSE OUTCOMES

The student will be able

CO1-to understand basic principles of ethics in engineering

CO2-to know about safety and risk management

CO3-to know about responsibility and rights

CO4-to understand the issues related to environmental ethics

CO5-to have an idea about global issues

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 **9**

ENGINEERING ETHICS

Senses of 'Engineering Ethics' - variety of moral issues - types of inquiry- moral dilemmas - moral autonomy - kohlberg's theory - giligan's theory-consensus and controversy - professions and professionalism-professional ideals and virtues -theories about right action-self-interest-customs and religion - uses of ethical theories

UNIT II **9**

ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as experimentation - engineers as responsible experimenters-codes of ethics-a balanced outlook of law-the challenger case study.

UNIT III **9**

ENGINEER'S RESPONSIBILITY FOR SAFETY

Safety and risk - assessment of safety and risk-risk benefit analysis-reducing risk-the three mile island and Chernobyl case studies.

UNIT IV **9**

RESPONSIBILITIES AND RIGHTS

Collegiality and loyalty - respect for authority - collective bargaining confidentiality - conflicts of-interest - occupational crime - professional rights employee rights - intellectual property rights (IPR)-discrimination.

UNITV **9**

GLOBAL ISSUES

Multinational corporations - environmental ethics-computer ethics-weapon development-engineers as managers-consulting engineers-engineers as expert witnesses and advisors-moral leadership-sample code of conduct

TOTAL NO.OF PERIODS: 45

Text Book:

1. Mike Martin androland Schinzinger, 'Ethics in Engineering', McGraw Hill New York 1996.

References:

1. Charies D. Fleddemann, "Engineering Ethics", Prentice Hall, New Mexico, 2002.
2. Laura Schlesinger, "How Could You Do That The Abdication of Character, Courage, and Conscience", Harper Collins, New York, 2004

BBT061 BIOPROCESS ECONOMICS AND PLANT DESIGN 3 0 0 3

OBJECTIVE

To provide knowledge about process economics and plant design

COURSE OUTCOMES

The student will be able

CO1-to understand basic principles of process design

CO2-to know about marketing of products

CO3-to know about capital and fixed cost

CO4-to study the cost involved in human resources

CO5-to understand about the administration of a plant

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 **9**

PROCESS DESIGN DEVELOPMENT

Technical feasibility survey, process development, flow diagrams, equipment design and specifications

UNIT II **9**

GENERAL DESIGN CONSIDERATION

Marketability of the product, availability of technology, raw materials, equipments, human resources, land and utilities, site characteristics, waste disposal, government, regulations and other legal restrictions, community factors and other factors affecting investment and production cost.

UNIT III **9**

COST ESTIMATION

Capital investment-fixed capital investments including land, building, equipments and utilities, installation cost(including equipments, instrumentation, piping, electrical installation and other utilities), working capital investment.

UNIT IV **9**

COST ESTIMATION

Manufacturing costs-Direct Production cost(including raw materials, human resources, maintenance and repair, operating supplies, power and other utilities, royalties etc.,.) fixed charges (including depreciation, taxes insurance, rental cost etc).,

UNIT V **9**

Plant overheads-Administration, safety and auxiliary services, payroll overheads, ware house and storage facilities etc. Profitability Analysis-return on original investment, interest rate of return, accounting for uncertainty and variations and future developments- Optimization techniques-Linear and Dynamic programming, Opimization strategies

TOTAL NO.OF PERIODS: 45

Text Book

1. Peters and Timmerhaus, "Plant design and Economics for Chemical Engineers ",McGraw Hill 4th Edition, 2002.

References:

1. Rudd and Watson, "Strategy of Process Engineering ", Wiley, 2003.

BBT062 **FERTILIZER TECHNOLOGY** **3 0 0 3**

OBJECTIVE

To provide basic knowledge about fertilizer and its production

COURSE OUTCOMES

The student will be able

CO1-to understand basic principles of fertilizer technology

CO2-to know about various types of fertilizers

CO3-to know about manufacturing of fertilizer

CO4-to learn about potassium based fertilizers

CO5-to study the different formulations of fertilizers

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 **9**

Introduction – production of fertilizer- nitrogenous fertilizer, phosphatic fertilizer - feed stock materials for nitrogenous and phosphatic fertilizer.

UNIT II **9**

Production of fertilizer products: Ammonia by steam reforming process, Nitric acid by ammonia oxidation process – Sulfuric acid by double absorption process – phosphoric acid.

UNIT III **9**

Manufacturing, handling and storage of Ammonium nitrate, Ammonium sulfate, Calcium ammonium nitrate, Urea, Ammonium chloride -single super phosphate – Triple super phosphate.

UNIT IV **9**

Manufacture of Potassic fertilizer – potassium sulfate – complex fertilizer – ammonium phosphate fertilizer – urea ammonium phosphate.

UNIT V **9**

Developments in the technology of complex fertilizer production – pipe reaction – granulation process – fertilizer mixtures – biofertilizers.

TOTAL NO.OF PERIODS: 45

Text Book

1. "Hand book on Fertilizer Technology" Tata McGraw Hill , III Ed, 2004

BBT063 BIOPHARMACEUTICAL TECHNOLOGY 3 0 0 3

OBJECTIVE

To provide a basic understanding of pharmaceutics and their applications from the perspective of engineers

COURSE OUTCOMES

The student will be able

CO1-to understand the fundamentals of drugs and its absorption

CO2-to know the manufacturing process of drugs and its bioavailability

CO3-to comprehend drugs and its binding mechanism

CO4-to know the drug metabolism and biotransformation

CO5-to get a basic knowledge of the applications of prodrugs in biological systems

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 **9**

Introduction to biopharmaceutics – Various route of drug administration- drug absorption, factors influencing drug absorption from the gastrointestinal tract.

UNIT II **9**

Manufacturing Principles - Compressed tablets - wet granulation - Dry granulation or slugging - Direct compression - Tablet presses formulation - Coating - Pills - Capsules - Parental solutions - injections

UNIT III **9**

Binding of drugs to blood components - tissue binding of drugs - factors affecting protein drug binding - significance of protein/tissue binding of drugs - kinetics of protein-drug binding

UNIT IV **9**

Biotransformation - drug metabolizing enzymes - phase I reactions - phase II reactions - first pass effect - factors affecting biotransformation of drugs - bioactivation and tissue toxicity.

UNITV **9**

Bioprecursor prodrugs - carrier prodrugs - application of prodrug design: - enchancement of bioavailability - site specific drug delivery - limitations of prodrug design.

TOTAL NO.OF PERIODS: 45

Text Book:

1. Brahmankar, D.M. "Biopharmaceutical and pharmacokinetics: A Treatise", Vallabh Prakashan, 1995.

Reference Book:

1. Remington's Pharmaceutical Sciences, Mack Publishing and Co.,

BBT064 **BIOFUEL TECHNOLOGY** **3 0 0 3**

OBJECTIVE

To provide a basic understanding of fuel and biofuel concepts and its production techniques

COURSE OUTCOMES

The student will be able

CO1-to understand the fundamentals of biofuel

CO2-to know the various source for biofuel

CO3-to apply the technique in large scale

CO4-to study about lipid derived biofuel

CO5-to give a basic knowledge of the applications biofuel

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 **9**

Introduction – Potential of biomass – biofuel policies : Policy in EU – Biofuel standardization – International Trade of biofuel.

Biofuel Life Cycle – Energy balance -& Efficiency of biofuel – Biofuel emission : Green house gas emission – Vehicle emission standards – other environmental Impacts of Biofuel – economy of biofuel – Consideration of Co-Products.

UNIT II **9**

BioEthanol – Feed stock production: sugar Crops, Starch crops , Cellulosic feed stock – Bioethanol Production : Sugar to ethanol Process, Starch to ethanol process, Cellulose to Ethanol Process – Distillation & Dehydration process – Properties – Application –tandardisation – Energy balance – Bioethanol Emission : Green house gas emission, toxic exhaust emission – Other environmental impacts: water issues, land use & biodiversity, human Health.

UNIT III **9**

Lipid derived Biofuel – Feed stock production -: Oil seed crops, Micro algae , Animal fats, waste oils – Fuel production : Oil Extraction , Oil Refining, Transesterification – Properties & Use : Properties of Pure Plant Oil (PPO) , Properties of Biodiesel – Application – Energy balance – Emissions of lipid biofuel – Other Environmental Impacts – Economy.

UNITIV

BtL Fuel : Feed tock production – BtL production – Gasification, Gas Cleaning – Synthesis process. Biohydrogen : Processing – Use – The Future of Biofuel.

UNIT V **9**

BioMethane – Feed stock Production- BioMethane Production : Digestion Process- Digester types- biogas Purification – Properties & Use – Application – Standardization – BioMethane Emission – Other Environmental Effects – Economy.

Text book:

1. Dominik Rutz & Rainer Janssen , 2007, “Hand Book on BioFuel Technology”, II ED.

Reference Books:

1. Soetaert ErlckI. Vandamme, 2009, “Biofuels” John Wiley & Sons, 1st.
2. Hand Book on “ BioFuel Technology” by Dominik Rutz & Rainer Janssen, 2007
3. “Bioprocess technology” – P.T. Kalaichelvan and I. Arul Pandi. 2007. MJP Pub.

4. Caye Drapcho, John Nghiem, Terry Warker, 2007, "Biofuel Engg & Process technology" Mc-Graw Hill, 1st.

BBT065 DIARY TECHNOLOGY 3 0 0 3

OBJECTIVE

To explore the different techniques involved in diary science

COURSE OUTCOMES

CO1-To study the process involved in the marketing of milk

CO2-To learn about the processing of butter and skim milk powder

CO3-To understand the steps involved in cheese making

CO4-To learn to prepare milk sweets

CO5-To explore the quality control methods involved

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 9

Introduction

Market milk – market milk industry in India – Collection, Transportation of milk- milk reception – Clarification- Chilling – Homogenisation – Sterilization- Pasteurization – UHT processing of fluid milk – aseptic packaging – Special milk – Clean Milk Production – Grading of Milk.

UNIT II 9

Dairy Products

Fat rich Dairy products – Cream, preparation, types, defects – Butter preparation, types, defects – Butter Spreads- Preparation of Ghee , defects in ghee- AGMARG standards- Frozen dairy products – Manufacture of Ice Cream: Ingredients and their role, types and defects, Judging and grading of Cream, Butter and Ice Cream. Concetrated and dried milk Products- Condensed milk – Evaporated milk – BIS standards –defects- Manufacture of milk powder- whole milk, skim milk powder- spray drying – whey powder- whey protein concentrates- biodiesel from whey.

UNIT III **9**

Cheese and Fermented products

Cheese and fermented products- Classification- preparation of cheddar, cottage, mozerella and processed cheese- cheese spreads- ripening – accelerated ripening- action of rennet – microbial rennet – milk coagulating enzymes – defects in cheese, causes and control measures- fermented milk products – Manufacture of Dahi- yogurt- shrikhand- therapeutic effects of fermented milk products- functional foods- probiotics - prebiotic -symbiotic.

UNIT IV **9**

Indigenous milk products

Indigenous milk products and by products – Channa – Chana based products – preparation of Khoa and Khoa based products – peda- Gulab jamun – Rasagolla – preparation of paneer – kulfi – utilization of skim milk – butter milk – whey.

UNIT V **9**

Quality Control & Quality Assurance

Introduction- Cleaning and Sanitation – Sterilization agent- Can Washing- Manual & Mechanical washing – Washing treatments – Cleaning in Place Programmes (CIP) – Packaging of milk & Milk Products – Function- Packaging Material – Filling system – Aseptic Packaging

Text Book

1. Sukumar de, 2000, "Outlines of Dairy Technology" Oxford Univ press
2. Bhattacharya A and Rajan R P , 2002 " An over view on Yogurt, beverage and food world" .

Reference Books:

1. Andrews,2004, "Biochemistry of Milk Products" Black rabbit books, 2nd ed.
2. Ananthakrishnan C P., and Padmanabhan " The technology of milk processing" Shrilakshmi publications

BBT066 FOOD PROCESS ENGINEERING 3 0 0 3

OBJECTIVE

To provide basic technologies involved in food processing

COURSE OUTCOMES

The student will be able

CO1-to understand basic concepts in sterilization of food products

CO2-to know about various dryers

CO3-to know about the mixing equipments for various products

CO4-to know about various preservation techniques for food products

CO5-to understand the microbiological aspects in food process

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 **9**

Thermal, electrical and rheological properties - Heat processing - Methods of applying heat to food - sterilization - Thermo bacteriology - dehydration and drying - free moisture - equilibrium moisture content - water activity - classification of dryers - tray, and freeze dryers, osmotic dehydration - foam mat drying- extrusion coking.

UNIT II **9**

Mixing of solids, Pastes and liquids - Characteristics of mixtures - Blending -emulsification - equipments - liquid, pastes, plastic masses - dry powders - criteria of mixer effectiveness - mixing index.

UNIT III **9**

Concentration - freeze concentration - freezing and storage of frozen products - low temperature preservation - irradiation of food products - microwave heating - dielectric heating of foods.

UNIT IV **9**

Physics and chemical properties of milk and their effect on design - heaters - coolers -heat exchange equipments - storage tanks - can washers - pasteurization - principles and methods - equipments - LTLT - HTST - UHT pasteurization - CIP unit -Homogenization - Theory and working of homogenizers - bottle fillers and cappers -cream separation - principles - types of separator - classifiers - butter churns - cheese plant equipments - ice cream freezers - drying equipments - drum drier and spray drier -membrane concentration equipments.

UNIT V **9**

Food microbiology: food spoilage, food borne diseases, infections, intoxifications, utilization of microorganisms in food industries, Nutraceuticals. Quality control, Case studies on biotechnology in the evaluation of food quality.

TOTAL NO.OF PERIODS: 45

Text Books:

1. Lehninger and Beverlov, 2002, "Food Process Engineering". Reidal Publishing Co. Holland
2. Yin H.Hui, 2006, "Handbook of food science, technology and engineering" Wiley, Newyork, 2nd ed.

Reference Books :

1. Tucker & Woods, 1995, "Enzymes in food processing" Springer, 5thed.
2. Hamm & Hammilton, 2000, "Edible oil processing" Academic Press 5th ed.
3. Fellows, 2009, "Food processing technology" 21th ed.
4. Heldman, 2007,"Hand book of food engineering" CRC Press 2nd ed.
5. P.G. Smith, 2003, "Food Process Engineering" Academic Plenum Pub, New York 1st ed.
6. Srilakshmi,2005, "Food Science" MJP Publiashers, 3rd ed.

BBT067 NANOBIOTECHNOLOGY 3 0 0 3

OBJECTIVE

To provide basic knowledge about nanoscience involved in biotechnology

COURSE OUTCOMES

The student will be able

CO1-to understand the various nano devices

CO2-to know about nano molecules

CO3-to learn the applications of nanotechnology in proteins, lipids and nucleic acids

CO4-to know about the applications of nanotechnology in microbiology

CO5-to know about nano technology involved in drug delivery system

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 **9**

Introduction to nanobiotechnology – nanodevices & techniques – micro & nanosystems – synthesis & characterization of nanoscale molecules – nanoarchitecture – fabrication technologies – self assembly systems

UNIT II **9**

Inorganic nanoscale systems – properties of fullerene carbon nano tubes – quantum dots & wires – gold nanoparticles – nanopores.

UNIT III **9**

Nanomolecules in proteins, lipids RNA & DNA – peptide coupled nanoparticles – proteins nanodevices – cell nanotechnology – cell motility – nanomotors & cellular navigation – chemotaxis – transmembrane signalling – nanoscale artificial platform.

UNIT IV **9**

Nanotechnology & microorganisms – PHA – magnetosomes – cyanophycin inclusions – alginates – bacteriophages – bacterial spores – S – layer proteins – bacteriorhodopsin.

UNIT V **9**

Nanotechnology in drug delivery – nanoscale devices for drug delivery – micelles – protein targeting – protein interaction with other molecule – microarray – genomic chips – nanobiosensors – nanobiochips – Nanotechnology for cancer diagnosis & treatment.

TOTAL NO.OF PERIODS: 45

Text Book:

1. K.K. Jain , 2006, "Nanotechnology in molecular diagnostics – current techniques & applications", Horizon Bioscience publishers

Reference Books:

1. Microbial bionanotechnology: Biological Self-Assembly Systems and Biopolymer-Based Nanostructures ed: Bernd Rehm, Taylor and Francis, 2006
2. Applications of nanoparticles in biology & medicine O.V. Salata, Journal of nanobiotechnology (2004), 2:3

BBT068 **TOTAL QUALITY MANAGEMENT** **3 0 0 3**

OBJECTIVE

To study about the management methods involved in quality assessment of a product

COURSE OUTCOMES

CO1-to study the basic definition of quality

CO2-to study the importance of customer satisfaction

CO3-to study the statistical methods of quality control

CO4-to explore the methods of benchmarking

CO5-to classify the products into quality standards

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 **9**

INTRODUCTION

Definition of Quality, Dimensions of quality, Quality planning, Quality costs- Analysis – Techniques for quality costs, Basic concepts of total Quality Management, Historical Review, Principles of TQM, Leadership- Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II **9**

TQM PRINCIPLES

Customer satisfaction-Customer Perception of Quality, Customer complaints, Service Quality, Customer Retention and, Employee Involvement- Motivation, Empowerment, Teams, Recognition Reward, Performance Appraisal, Benefits, Continuous process improvement- Juran trlogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership- Partnering, sourcing, Supplier selection, Supplier rating, relationship development, Performance measure- Basic concepts, Strategy, Performance measure.

UNIT III **9**

STATISTICAL PROCESS CONTROL (SPC)

The seven tools of quality, Statistical Fundamentals- Measures of central Tendency and Dispersion, Population and sample, Normal curve, Control charts for variables and attributes, Process capability, Concept of six sigma, New seven management tools.

UNIT IV **9**

TQM TOOLS

Benchmarking- Reasons to Benchmark, Benchmarking process, Quality function Deployment (QFD)- House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM)- Concept, Improvement Needs, FMEA- Stages of FMEA.

UNIT V **9**

QUALITY SYSTEMS

Need for ISO 9000 and other Quality Systems, ISO 9000:2000 Quality system- Elements, Implementation of Quality systems, Documentation, Quality Auditing,

QS 9000, ISO 14000- Concept, Requirements and Benefits.

Text Book

1. Prof. R.Ramakrishnan , 2004 , "A Text Book of Total Quality Management" V Ed.

Reference books:

1. Ronald A. Armstrong , 2006, "Total Quality management", Chapman and Hall,
2. Suresh Lulta, 2002"Total Quality management" Vol. I and ll,. ShahTrust, Mumbai