Adhiyamaan College of Engineering (Autonomous), Hosur

Department of Biotechnology

Academic year: 2017-18

1.1.3 Average percentage of courses having focus on employability/ entrepreneurship/ skill development offered by the institution

Program name	Course name	Course code	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development	Year of Introduction
B.Tech Biotechnology	Pollution Control In Bioprocess Industries	515CHO05	Employability - The course offers skills like design and analysis of idelal and non -ideal reactors, also provides insight into the skills like Bioreactor assembly and manufacturing	2017-2018
B.Tech Biotechnology	Health & Pharmaceutical Biotechnology	615BTT04	Employability - The Course provides skills like design, manufacturing of drugs. The course also provides insight into the standard protocols to be followed in a drug manufacturing facility	2017-2018
B.Tech Biotechnology	Process Dynamics And Control	615EIO01	Employability - The course provides the students with the skill of basics of biological safety measures, industrial process dymanics and its control	2017-2018
B.Tech Biotechnology	Health & Pharmaceutical Biotechnology	711BTT04	Employability - The Course provides skills like design, manufacturing of drugs. The course also provides insight into the standard protocols to be followed in a drug manufacturing facility	2014-2015

B.Tech Biotechnology	Clinical Research And Database Management	711BTE06	Employability - The Course provides skills like design, manufacturing of drugs. The course also provides insight into the standard protocols to be followed in a drug manufacturing facility	2014-2015
B.Tech Biotechnology	Mini Project	711BTP10	Employability - The Project work provides the student with the skill set of managing project, planing and execution. In addition they provides the skill like report preparation, and presentation	2014-2015
B.Tech Biotechnology	Molecular Pathogenesis	811BTE04	Employability - Offers the student with therapeutics of diseases	2014-2015
B.Tech Biotechnology	Medical Coding	811BTE09	Employability - The course provides the students with the skill of basics of medical codes and transcripts	2014-2015
B.Tech Biotechnology	Project Work	811BTP03	Employability - The Project work provides the student with the skill set of managing project, planing and execution. In addition they provides the skill like report preparation, and presentation	2014-2015

ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department BIOTECHNOLOGY **Programme** B. TECH. - BT **Regulation** 2015

Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
615BTT04	HEALTH AND PHARMACEUTICAL BIOTECHNOLOGY	3	0	0	3	50	50	100

Prerequisite Biochemistry

Course Objectives

At the end of the course ,the students should be able to:

- *To have the basic knowledge of pharmacology*
- *To gain knowledge in various dosage forms and bio pharmaceutics*
- *To be able to understand in pharmacokinetics and drug discovery*
- *To understand the pharmaceutical dosage forms and applications*
- *To gain the knowledge about the various biopharmaceuticals*

UNIT I INTRODUCTION TO PHARMACOLOGY **9**

Historical outlines of drugs, classifications of drugs, physico-chemical properties of drugs, Routes ofadministration of drugs, drugs metabolism, controlled release drug delivery system, drug stability, Sources: plant, marine and microorganisms

UNIT II DRUG DISCOVERY **9**

Drug discovery an introduction, basic clinical evolution of new drugs, bioavailability of drugs, quantitative and qualitative assay of drugs by biological testing, packing techniques like compression of tablets, wet & dry granulation, direct compression, tablet presses and coating

UNIT III PHARMACOKINETICS AND BIOTRANSFORMATION **9**

Pharmacokinetics: introduction, absorption, distribution, elimination and metabolism of drugs, site of action, Phase I and Phase II reactions, prodrugs, adverse drug effects, Role of Enzymes in drug metabolism

UNIT IV PHARMACEUTICAL DOSAGE FORMS AND APPLICATIONS **9**

Oral solid dosage forms, compressed tablets, types, pills, solutions, syrups, juices, nasal solutions, emulsions, lotions and extracts. Applications of various drugs in human body and site of action

UNIT V BIO PHARMACEUTICALS **9**

Various categories of therapeutics like vitamins, laxatives, analgesics, contraceptives, common drugs which are abused, Antibiotics, human insulin, interferon, somatostalim, somatotropin - itspreservation and analytical methods

Total Hours **45**

Upon Completion of this course, students will be able to get :

Course Outcomes

CO1:Drugs, drugs action, drug metabolism

CO2:Various dosage forms of Biopharmaceuticals

CO3:The recent evolution in pharmaceutical biotechnology

CO4:evaluate different pharmaceutical parameters for the current and future biotechnology related products on the market.

CO5: gained the knowledge about the various biopharmaceuticals

Text Books

1. Remington, "The science and practice of pharmacy", Lippincott Williams and Wilkins, 20th edition,2001
2. Gareth Thomas, Medicinal Chemistry an Introduction", John Wiley, New Delhi, 2000
3. RamI.Mahato,AjitS.Narang,"PharmaceuticalDosageFormsandDrugDelivery",2nd EditionC RC Press,2011
4. Mohsen A. Hedaya"Basic Pharmacokinetics", 2nd Edition,Routledge, 2012

Reference Books

1. Katzung, B.G. "Basic and Clinical Pharmacology", Prentice Hall of India, New Delhi., 1995
2. Tripathi, K.D. "Essentials of Medical Pharmacology", Jaypee Brothers Medical Publishers (P) Ltd, 6th edition, John Wiley, New Delhi, 2000

Chairman, Board of Studies
Faculty of Biotechnology (UG)
Adhiyamaan College of Engineering (Autonomous)
Hosur - 635130
Krishnagiri (DT), Tamilnadu.

ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department BIOTECHNOLOGY **Programme** B. TECH. - BT **Regulation** 2011

Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
711BTT04	HEALTH AND PHARMACEUTICAL BIOTECHNOLOGY	3	0	0	3	50	50	100

Prerequisite Biochemistry

Course Objectives

At the end of the course ,the students should be able to:

- *To have the basic knowledge of pharmacology*
- *To gain knowledge in various dosage forms and bio pharmaceutics*
- *To be able to understand in pharmacokinetics and drug discovery*
- *To understand the pharmaceutical dosage forms and applications*
- *To gain the knowledge about the various biopharmaceuticals*

UNIT I INTRODUCTION TO PHARMACOLOGY **9**

Historical outlines of drugs, classifications of drugs, physico-chemical properties of drugs, Routes ofadministration of drugs, drugs metabolism, controlled release drug delivery system, drug stability, Sources: plant, marine and microorganisms

UNIT II DRUG DISCOVERY **9**

Drug discovery an introduction, basic clinical evolution of new drugs, bioavailability of drugs, quantitative and qualitative assay of drugs by biological testing, packing techniques like compression of tablets, wet & dry granulation, direct compression, tablet presses and coating

UNIT III PHARMACOKINETICS AND BIOTRANSFORMATION **9**

Pharmacokinetics: introduction, absorption, distribution, elimination and metabolism of drugs, site of action, Phase I and Phase II reactions, prodrugs, adverse drug effects, Role of Enzymes in drug metabolism

UNIT IV PHARMACEUTICAL DOSAGE FORMS AND APPLICATIONS **9**

Oral solid dosage forms, compressed tablets, types, pills, solutions, syrups, juices, nasal solutions, emulsions, lotions and extracts. Applications of various drugs in human body and site of action

UNIT V BIO PHARMACEUTICALS **9**

Various categories of therapeutics like vitamins, laxatives, analgesics, contraceptives, common drugs which are abused, Antibiotics, human insulin, interferon, somatostalim, somatotropin - itspreservation and analytical methods

Total Hours **45**

Upon Completion of this course, students will be able to get :

Course Outcomes

CO1:Drugs, drugs action, drug metabolism

CO2:Various dosage forms of Biopharmaceuticals

CO3:The recent evolution in pharmaceutical biotechnology

CO4:evaluate different pharmaceutical parameters for the current and future biotechnology related products on the market.

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1. Remington, "The science and practice of pharmacy", Lippincott Williams and Wilkins, 20th edition,2001
2. Gareth Thomas, Medicinal Chemistry an Introduction", John Wiley, New Delhi, 2000
3. RamI.Mahato,AjitS.Narang,"PharmaceuticalDosageFormsandDrugDelivery",2nd EditionC RC Press,2011
4. Mohsen A. Hedaya"Basic Pharmacokinetics", 2nd Edition,Routledge, 2012

Reference Books

1. Katzung, B.G. "Basic and Clinical Pharmacology", Prentice Hall of India, New Delhi., 1995
2. Tripathi, K.D. "Essentials of Medical Pharmacology", Jaypee Brothers Medical Publishers (P) Ltd, 6th edition, John Wiley, New Delhi, 2000

Chairman, Board of Studies
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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. – BT	Regulation	2011

Semester VIII

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
811BTE04	MOLECULAR PATHOGENESIS	3	0	0	3	50	50	100

Prerequisite Basic Knowledge of Animal Biotechnology required

Course Objectives

At the end of the course ,the students should be able:

- *To understand about the microbial toxins and modern molecularpathogenesis.*
- *To know about the host pathogen interaction and identifying virulencefactors.*
- *To control pathogens by modernapproaches.*
- *To know about the pathogenic strategies*
- *To understand the concept of the host defense mechanism*

UNIT I OVERVIEW **9**

Historical perspective - discovery of microscope, Louis Pasteur's contributions, Robert Koch's postulates, early discoveries of microbial toxins, toxic assays, vaccines, antibiotics and birth of molecular genetics and modern molecular pathogenesis studies, *Introduction to pathogenesis, components of microbial pathogenicity.*

UNIT II HOST-DEFENSE AGAINST PATHOGENS AND PATHOGENIC STRATEGIES **9**

Hostdefenseagainstpathogens,clinicalimportanceofunderstandinghostdefense,componentsofthehostsurface defences systems like skin, mucosa, eye, mouth, respiratory tract, physical movements, limitation of free iron,antimicrobial compounds, mechanism of killing by humoral and cellular defense mechanisms, complements,inflammation process, general disease symptoms, Pathogenic adaptationsto overcome the above defenses.

UNIT III MOLECULAR PATHOGENESIS (WITH SPECIFIC EXAMPLES) **9**

Virulence, virulence factors, virulence-associated factors and virulence lifestyle factors, molecular genetics and gene regulation in virulence of pathogens, molecular pathogenesis of Vibrio Cholerae: E.coli,Shigella, influenza virus,plasmodium.

UNIT IV EXPERIMENTAL STUDIES ON HOST-PATHOGEN INTERACTIONS **9**

Virulence assays: adherence, invasion, cytopathic, cytotoxic effects. Criteria & tests in identifying virulence factors, attenuated mutants, molecular characterization of virulence factors, signal transduction & host responses, *virulence factors damaging the host tissues, virulence genes and regulation of the virulence genes.*

UNIT V MODERN APPROACHES TO CONTROL PATHOGENS **9**

Classical approaches based on serotyping. Modern diagnosis based on highly conserved virulencefactors, immuno& DNA-based techniques. New therapeutic strategies based on recent findings on

molecular pathogenesis of a variety of pathogens, Vaccines - *modulation of immune response byvaccines, properties of vaccines, other immuno modulators.*

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to get :

CO1: Knowledge Of Different Disease- Host Interactions Mechanisms In Organisms

CO 2: Concept About Modern Approaches To Control Pathogens

CO 3: Knowledge About Different Molecular-Molecular Pathogen Interaction

CO 4: Concept of different drug and pathogen interaction

CO 5: Idea of different vaccines to different pathogen

Text Books

1 Clark V L and Bavoil P M, "Bacterial Pathogenesis", Academic Press, 1997.

2 Williams and Peter et al., "Bacterial Pathogenesis", (Methods in Microbiology Vol. 27), 1998.

3 Groisman and Eduardo A, "Principles of Bacterial Pathogenesis", Academic Press, 2001.

4 Nester, Anderson, Roberts, Pearsall, Nester, "Microbiology: A Human Perspective",3rd Edition,McGraw-Hill, 2001.

References

1 Salyers, Abigail A and Dixie D.Whitt, "Bacterial Pathogenesis: A Molecular Approach", 2nd Edition,ASM, 2002.

2 McClane, Bruce A and Timothy A. Mietzner, "Microbial Pathogenesis: A Principles-OrientedApproach", Fence Creek Publishing, 1999.

3 Subramanian MA, "Toxicology: Principles and Methods", MJP Publishers, 2017.

4 "Bergey's Manual of Systematic Bacteriology", Vol. 1-3, 2nd Edition, Springer, 2005.

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Adhiyamaan College of Engineering (Autonomous)
Hosur - 635130
Krishnagiri (DT), Tamilnadu.

ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2011
		Semester VIII			

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
811BTE09	MEDICAL CODING	3	0	0	3	50	50	100

Prerequisite NIL

Course Objectives

At the end of the course ,the students should be able to:

- *Develop comprehensive knowledge in the area of Human Anatomy & Physiology,Medical Coding, and CPT Coding.*
- *Understand the knowledge of HCPCS Coding RCM, Coding Compliance, andHIPAA Laws.*
- *Gain knowledge in anatomy*
- *To improve skills in coding*
- *Enhance the work activity related to physiology*

UNIT I HUMAN ANATOMY & PHYSIOLOGY PART I **9**

Cardiovascular System, Blood & its Components, Integumentary System, Endocrine System, Urology, MaleReproductive System. Location, Shape, Size, Structure, Physiology, Pathology, Diagnostic Test, Terminologies

UNIT II HUMAN ANATOMY & PHYSIOLOGY PART II **9**

Female Reproductive Systems, Nervous System, Gastro Intestinal System, Pulmonology, Special Sciences, Orthopedics, Lymphatic System - Location, Shape, Size, Structure, Physiology, Pathology, Diagnostic Test, Terminologies

UNIT III CURRENT PROCEDURE TERMINOLOGY CODING (CPT) **9**

CPT Codes, CPT Description, Medical Record Format, Speciality Listings and its Format, *Usage of CPT Manuals, Software usage*, Examples of CPT Speciality Code Practice, *HCPCS Coding, Basic steps of HCPCScoding, Differentiation of CPT and HCPCS Coding.*

UNIT IV INTERNATIONAL CLASSIFICATION OF DISEASE CODING (ICD) **9**

ICD Codes, ICD 9 CM – ICD 10 Transition, Diagnosis Interpretation, Usage of ICD Manuals, Index Listings, Tabular Listings, Software usage, Examples of Dx Code Practice.

UNIT V MODIFIERS, E&M CODING, MEDICAL BILLING CYCLE & OVERVIEW **9**

Modifiers Listing, Usage and Indexing, E & M codes, classification, Application of E&M, Tabulation, Listings, Software usage, Examples of E&M Code Practice

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to get

Co1: Familiarize in the medical coding procedures for various treatment process.Co2: Acquire knowledge about ICD coding and medical billing process.

Co3: Acquire knowledge about human anatomy &physiology.Co4: Familiarize in the software usage.

Co5: Acquire knowledge about E&M Code Practice.

Text Books

1 Current Procedural Terminology(*CPT*®)2013 American Medical Association: I & II, Professional Edition (American Medical Association), CPT AMA Professional Edition, London, UK, 2013.

2 ICD-9 CM Physicians Volume I and Volume II Contexo, A division of Access Intelligence, London, UK, Medicine & Health Science Books, CPT 2009 Professional Edition,2013.

References

1 David N. Shier, Jackie Butler and Ricki Lewis, "Hole's Human Anatomy and Physiology Paperback – Import", McGraw Hill Higher Education, 12th edition, 2009.

2 Mader, "Understand Human Anatomy and Physiology Paperback", McGraw-Hill Education, 9thedition, 2006.

3 Carol J. Buck, "Step-by-Step Medical Coding 2014 Text + Workbook Paperback – Import", W BSaunders Co, CSM edition December, 2013.

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Adhiyamaan College of Engineering (Autonomous), Hosur

Department of Biotechnology

Academic year: 2017-18

1.1.3 Average percentage of courses having focus on employability/ entrepreneurship/ skill development offered by the institution

Program name	Course name	Course code	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development	Year of Introduction
B.Tech Biotechnology	Bioethics, IPR and Entrepreneurship	811BTT01	Entrepreneurship - The course provides entrepreunership-based skills like managing a firm, small business and to startups. The course provides the student in promoting the Entrepreneurship with the basics of IPR generation and filing, biobusiness management and group presentation among the peers	2014-2015

ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department BIOTECHNOLOGY Programme B. TECH. - BT **Regulation** 2011

Semester VIII

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
811BTT01	BIOETHICS, IPR AND ENTREPRENEURSHIP	3	0	0	3	50	50	100

Prerequisite

Course Objectives

At the end of the course ,the students should be able to:

- *To create awareness about IPR and Engineering ethics*
- *To follow professional ethics and practices in their careers*
- *To create awareness and responsibilities about the environment and society*
- *To learn the present work related to trade marketing*
- *To create the view with respect to ethics in biotechnology*

UNIT I HISTORY OF BIOETHICS 9

Bioethics as a discipline – philosophical reflections on experimenting with human subjects - active andpassive euthanasia; culture assumption in the history of Bioethics– medical ethics in India and America.

UNIT II METHODS OF ETHICAL ANALYSIS 9

Ethical reasoning- philosophical, clinical and cultural dimensions; challenge of ethical relativism; methods of philosophical theories and principles- Equality and its implications; methods of casuistry and methodsof narrative approaches

UNIT III ETHICS IN *BIOTECHNOLOGY* 9

Ethics committee (hospital) – Inner working of an ethics committee; ethics consultation – skills, roles andtraining;Biosafetyregulation-nationalandInternationalguidelines;rDNAguidelines-guidelinesforrDNA researchactivities, mechanism of implementation of biosafety guidelines

UNIT IV PATENTING, IPR AND APPLICATIONS 9

Introduction to Intellectual property rights, types: patents, copy right, trade mark, trade secret, geographical indications, importance of IPR, Patenting and non patenting life, TRIPS

UNIT V ENTREPRENEURSHIP IN BIOTECHNOLOGY 9

The Significance of the Biotechnology Entrepreneur; The Integration of Two Distinctly Different Disciplines Biotechnology Entrepreneurship Versus General Entrepreneurship ; Entrepreneurship and Intrapreneurship Essential Biotechnology Entrepreneurial Characteristics; Four Backgrounds of Biotechnology Entrepreneurs

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO: 1 Touches on fundamental values, such as human dignity and the genetic integrity ofhumanity.

CO:2 Serve basic human needs such as human health, food and a safe environment, CO:3 Raise human rights issues such as access to health and benefits from scientificprogress

CO: 4 Concerns over equitable access to the fruits of new technologies, the consent of thoseinvolved in research, and protection of the environment.

CO:5 Obtaining a clear information on the entreneurship and understand their economic values

Text Books

1 Bioethics , second edition , Nancy S.Jecker , Albert R.Jonsen,RobertA,Pearlman.Jones and Bartlett Publishers,2003.

2 Singh K, " Intellectual Property Rights on Biotechnology", BCIL, New Delhi,2001.

3 M.K. Sateesh, "Bioethics and Biosafety", I.K. International Publishing House pvt. Ltd, 2008.

References

1 Entrepreneurship Development – Poornima.M.Charantimath – Small Business Enterprises – PearsonEducation – 2006

2 Sasson A, " Biotechnologies and Development", UNESCO Publications, 1998

3 Sasson A, " Biotechnologies in Developing countries present and future", UNESCOPublishers, 1993

E-Books

1 Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech by Craig Shimasaki

Chairman, Board of Studies
Faculty of Biotechnology (UG)
Adhiyamaan College of Engineering (Autonomous)
Hosur - 635130
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Adhiyamaan College of Engineering (Autonomous), Hosur

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Academic year: 2017-18

1.1.3 Average percentage of courses having focus on employability/ entrepreneurship/ skill development offered by the institution

Program name	Course name	Course code	Activities/Content with direct bearing on Employability/ Entrepreneurship/ Skill development	Year of Introduction
B.Tech Biotechnology	Technical English-I	115ENT01	Skill Development - This course enhances increase students' efficiency in their academic and general reading, pronunciation in real-lifesituations, pronunciation in real-lifesituations and augmenting the technical writing skills like writing letters in formal and business situations	2015-2016
B.Tech Biotechnology	Engineering Mathematics-I	115MAT02	Skill Development - This course enable basic skills on the eigen value problems and differential equations of certain types, including systems ofdifferential equations	2015-2016
B.Tech Biotechnology	Engineering Physics	115PHT03	Skill Development - This course provides skills on the concept of properties of matter, the properties of sound and principles of quantization of energy and coherent light and its importance	2015-2016
B.Tech Biotechnology	Engineering Chemistry	115CYT04	Skill Development - The students can understand and apply the concepts in electrochemistry and Energy storage devices, the chemistry of Corrosion, concepts of thermodynamics and phase	2015-2016

			equilibrium	
B.Tech Biotechnology	Engineering Graphics	115EGT05	Skill Development - The students will learn graphics skill for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technicaldrawings.	2015-2016
B.Tech Biotechnology	Basics Of Computing And C Programme	115ESE02	Skill Development - This course enable the student to learn about the basics of computer and problem solving methods.	2015-2016
B.Tech Biotechnology	Engineering Chemistry Lab	115CYP07	Skill Development - The students can understand and apply the concepts in electrochemistry and Energy storage devices, the chemistry of Corrosion, concepts of thermodynamics and phase equilibrium	2015-2016
B.Tech Biotechnology	Computer Practices Lab	115ESP01	Skill Development - This course enable the student to learn about the basics of computer and problem solving methods.	2015-2016
B.Tech Biotechnology	Language Lab	115HSP08	Skill Development - This course equip students of engineering and technology with effective speaking, listening, reading and writing skills in English, specifically, presentation, group discussion and report writing skills.	2015-2016

B.Tech Biotechnology	Technical English-II	215ENT01	Skill Development - This course facilitate students amplify suitable language skills for academic and professional purposes, vocabulary power, different functions of technical and scientific English	2015-2016
B.Tech Biotechnology	Engineering Mathematics-II	215MAT02	Skill Development - This course facilitates double and triple integration concepts and apply to study vector calculus comprising of surface and volume integrals along with the classical theorems involvingthem.	2015-2016
B.Tech Biotechnology	Applied Physics	215PHT03	Skill Development - This course enable students to understand the structure of solids andproperties, classical theory and quantum theory and semiconductor materials	2015-2016
B.Tech Biotechnology	Applied Chemistry	215CYT04	Skill Development - This course make the students conversant with basics of polymer chemistry, photo physical and photochemical processes and spectroscopy.	2015-2016
B.Tech Biotechnology	Engineering Mechanics	215EMT05	Skill Development - This course make the students understand the vectorial and scalar representation of forces and moments, static equilibrium of particles and rigid bodies both in twodimensions	2015-2016
B.Tech Biotechnology	Biochemistry	215ESE02	Skill Development - This course provides students to get skill in various metabolic pathways and its regulation	2015-2016
B.Tech Biotechnology	Engineering Physics Laboratory	215PHP07	Skill Development - This course make students understand the practical concepts of Interference anddiffraction, the practical concepts of Interference anddiffraction, modulus ofelasticity and viscosities ofliquid	2015-2016

B.Tech Biotechnology	Engineering Practices Laboratory	215EPP08	Skill Development - This course provide exposure to the students with various basic engineering practicesin mechanicalengineering	2015-2016
B.Tech Biotechnology	Biochemistry Laboratory	215ESP03	Skill Development - This course provides basic skills on qualitative and quantitative identification of biomolecules	2015-2016
B.Tech Biotechnology	Cell Biology	315BTT03	Skill Development - This course enables students skill in cellular signalling mechanisms, cellular regulations and cell culture techniques	2016-2017
B.Tech Biotechnology	Microbiology	315BTT04	Skill Development- This course provides skills in microbial classification, identification and control	2016-2017
B.Tech Biotechnology	Instrumental Methods of Analysis	315BTT05	Skill Develoment - This course provides basic skills on biolgical instumentation	2016-2017
B.Tech Biotechnology	Cell Biology Lab	315BTP07	Skill Development - This course provides basic skills on identification of cellular mechanisms	2016-2017
B.Tech Biotechnology	Microbiology Lab	315BTP08	Skill Development - This course enables skills on microbial culture techniques and idnetification of microorganisms	2016-2017
B.Tech Biotechnology	Instrumental Methods of Analysis Lab	315BTP09	Skill Development - This course provides basic skills on biolgical instumentation	2016-2017
B.Tech Biotechnology	Basic Industrial Biotechnology	315BTE01	Skill Develoment - This course provides skills on production of biologically important products such as antibiotics, vitamins, alcohol, etc.,	2016-2017
B.Tech Biotechnology	Probability And Statistics	415PST01	Skill Development - This course enables skills on design of experiments and research methodologies	2016-2017

B.Tech Biotechnology	Molecular Biology	415BTT02	Skill Development - This course provide skills on genomic and plasmid DNA and RNA isolation, PCR based techniques and cloning and expression of vectors	2016-2017
B.Tech Biotechnology	Instrumental Methods of Analysis	415BTT03	Skill Development - This course provide skills on stoichiometric calcultions for various industrial operations	2016-2017
B.Tech Biotechnology	Fundementals of Unit Operations	415BTT04	Skill Develoment - This course provide skills on bioreactor and heat transfer operations	2016-2017
B.Tech Biotechnology	Enzyme Technology	415BTT05	Skill Develoment - This course provide skills on industriallly important enzyme production and activity determination	2016-2017
B.Tech Biotechnology	Molecular Biology Lab	415BTP07	Skill Development - This course provide skills on genomic and plasmid DNA and RNA isolation, PCR based techniques and cloning and expression of vectors	2016-2017
B.Tech Biotechnology	Enzyme Technology Lab	415BTP08	Skill Development - This course provide skills on industriallly important enzyme production and activity determination	2016-2017
B.Tech Biotechnology	Chemical Engineering Lab	415BTP09	Skill Develoment - The course offers the students with the skill set of handling equipment related to heat transfer. The course offers a insight into the basic skill sets like understanding the thermodynamics of the reaction, thermodynamics related to the microbial growth and the product formation	2016-2017
B.Tech Biotechnology	Environmental Biotechnology	415BTE01	Skill Develoment - This course provide skills on environmental studies, bioremediation and waste management	2016-2017

B.Tech Biotechnology	Immunology	515BTT01	Skill Development - The course provides the students with the skillset of raising antigen and antibodies aganist the various disease, and the detection procedure.	2016-2017
B.Tech Biotechnology	Genetic Engineering	515BTT02	Skill Development - This course provide skills on genomic and plasmid DNA and RNA isolation, PCR based techniques and cloning and expression of vectors	2017-2018
B.Tech Biotechnology	Bioprocess Engineering I	515BTT03	Skill Development - The course offers the students with the skill set of handling equipment related to heat transfer. In addition, the course provides the students with an deeper insight into the diffusion, distillation, adsorption, extraction and leaching which is most important skills as a chemical process engineer	2017-2018
B.Tech Biotechnology	Fundamentals of Mass Transfer	515BTT04	Skill Develoment - The course offers the students with the skill set of handling equipment related to heat transfer. In addition, the course provides the students with an deeper insight into the diffusion, distillation, adsorption, extraction and leaching which is most important skills as a chemical process engineer	2017-2018
B.Tech Biotechnology	Chemical Thermodynamics &Biothermodynamics	515BTT05	Skill Develoment - The course offers the students with the skill set of handling equipment related to heat transfer. The course offers a insight into the basic skill sets like understanding the thermodynamics of the reaction, thermodynamics related to the microbial growth and the product formation	2017-2018

B.Tech Biotechnology	Immunology Lab	515BTP07	Skill Develoment - The course provides the students with the skillset of raising antigen and antibodies aganist the various disease, and the detection procedure.	2017-2018
B.Tech Biotechnology	Genetic Engineering Lab	515BTP08	Skill Develoment - The course provides the students with the skill set of generating a recombinant DNA, cloning and expression of vectors, genome mapping and sequencing and PCR based skills	2017-2018
B.Tech Biotechnology	Bioprocess Engineering Lab I	515BTP09	Skill Develoment - The course offers a clear insight into the basic skills required for a Bioprocess Engineers. The course offers the students with the skill set of handling equipment related to chemical process engineer	2017-2018
B.Tech Biotechnology	Bioinformatics	615BTT01	Skill Development - The course provides the students with the skill of basics of database in biological system, sequence alignment, phylgogeny and CADD	2017-2018
B.Tech Biotechnology	Chemical Reaction Engineering	615BTT02	Skill Develoment - The course offers skills like design and analysis of idelal and non - ideal reactors, also provides insight into the skills like Bioreactor assembly and manufacturing	2017-2018
B.Tech Biotechnology	Bioprocess Engineering-II	615BTT03	Skill Develoment - The course focusses on the preparation, sterilization of media, design and optimization of media. Understand the basic of the different kinds of the fermenter and the kinetics of product formation	2017-2018
B.Tech Biotechnology	Plant Biotechnology	615BTT05	Skill Develoment - The course is focussed in the manner to provide indepth application oreinted skills like gene transfer in plants,	2017-2018

			transgenic and commercialization	
B.Tech Biotechnology	Bioprocess Engineering Laboratory -II	615BTP07	Skill Development - The course focusses on the preparation, sterilization of media, design and optimization of media. Understand the basic of the different kinds of the fermenter and the kinetics of product formation	2017-2018
B.Tech Biotechnology	Plant Biotechnology Laboratory	615BTP08	Skill Develoment - The course is focussed in the manner to provide indepth application oreinted skills like gene transfer in plants, transgenic and commercialization	2017-2018
B.Tech Biotechnology	Technical Seminar	615BTP09	Skill Develoment - The course will help the students to enhance their language skills to the next level and will hone their presentation skills, active participation in GD, critical thinking and leadership skills.	2017-2018
B.Tech Biotechnology	Animal Biotechnology	711BTT01	Skill Develoment - The course provides the students with the skill of animal diseaes, treatment, micromanipulation and transgenics anilmal technology	2014-2015
B.Tech Biotechnology	Plant Biotechnology	711BTT02	Skill Develoment - The course is focussed in the manner to provide indepth application oreinted skills like gene transfer in plants, transgenic and commercialization	2014-2015
B.Tech Biotechnology	Downstream Processing	711BTT03	Skill Develoment - The course provides the students with the skill of choice of different downstream processing like filteration, chromatography, and othe size-based methods	2014-2015

B.Tech Biotechnology	Disaster Management	711BTE05	Skill Development - Aseismic desgin is mandatory as per IS recommendations. This course develops the skill set required for aseismic desgin of structures	2014-2015
B.Tech Biotechnology	Plant & Animal Biotechnology Laboratory	711BTP07	Skill Develoment - The course is focussed in the manner to provide indepth application oreinted skills like gene transfer in plants, transgenic and commercialization	2014-2015
B.Tech Biotechnology	Downstream Processing laboratory	711BTP08	Skill Develoment - The course provides the students with the skill of choice of different downstream processing like filteration, chromatography, and othe size-based methods	2014-2015
B.Tech Biotechnology	Communication Skills Laboratory	711BTP09	Skill Develoment - The course will help the students to enhance their language skills to the next level and will hone their presentation skills, active participation in GD, critical thinking and leadership skills.	2014-2015

ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
115ENT01	TECHNICAL ENGLISH –I	3	0	0	3	50	50	100

Prerequisite Nil

Course Objectives

At the end of the course ,the students should be able to:

- To facilitate students widen proper listening skills for academic andprofessional purposes.
- To inculcate and develop strategies to understand and to increase students' efficiencyin their academic and general reading.
- To train the students in the techniques of acquiring the ability to speak effectivelyin English with received pronunciation in real-life situations.
- To strengthen students' vocabulary power.
- To familiarize students with different functions of technical and scientific English.

UNIT I **9**

General Vocabulary – definition, synonyms - antonyms – parts of speech – nouns, pronouns, verbs, adjectives,adverbs, articles, preposition & conjunction, - prefixes & suffixes - reading - skimming and scanning – writing -formal letter writing – complaint letter relating to business - general essay writing – listening and practicing shortspeeches.SuggestedActivities:Matchingwords&meanings-usingwordsincontext–makingsentences,changing words from one form to other forms - nouns - adjectives, -verb- adverb, same words as different parts of speech,intensifiers, articles, prepositions, parallelism, word building with prefixes & suffixes - identifying the rightusage of tenses, reading comprehension–skimming - scanning - cloze exercises, essay writing argumentativeessays, letter to the editor / business concerns

UNIT II **9**

Jumbledwords-verbalanalogy-singlesentencedefinition–onewordsubstitute-typesofsentences,determiners, demonstratives - tenses - active and passive voice - reading for understanding contextual meaning – formal letterwriting – permission letter – descriptive essay writing - listening and practicing short presentations. Suggestedactivities: Jumbled words - verbal analogy - expanding a word - nominal compound (noun + noun), numericaladjectives-tagquestions-gapfillingexerciseswithsuitabletenseforms,transformationofsentencesfromactive to passive voice & vice versa, permission letter - asking permission for Industrial visit/In – plant training, reading comprehension - identifying key points ofatext - essay writing – descriptive type

UNIT III **9**

Compound nouns – abbreviations and acronyms - editing - intensive reading - formal letter writing - transfer of information from graphical to written – transcoding - listening and transfer of information – paragraph writing - (cause and effect – compare and contrast) Suggested Activities: Singular and plural of nouns, exercises - compound nouns, connecting sentences with apt conjunctions - common errorexercise, making reading comprehension, requisition (OD)/acceptance/declining letter, writing conclusive ideas convincingly, pie charts and tables, exercises using questions – asking & answering questions, listening guided note-taking - writing paragraphs using notes

UNIT IV **9**

Modal verbs and probability – concord – phrasal verbs - cause and effect expressions – extended definition –transferofinformation–readingcomprehension-contrastingandcomparativeessays–checklist–creatingblogs – e-mail writing Suggested activities: Making sentences using modal verbs to express probability, gap filling using relevant grammatical form of words, identifying the meaning of phrasal verbs, connecting sentences showing cause and effect relationship, flow charts and bar diagrams, reading comprehension, check list, extempore and paragraph writing (analytical and narrative)

UNIT V **9**

'If' conditionals–gerunds–idiomsandphrases–punctuation-intensivereading–listening-formalletterwriting – invitationletter—errorcorrection-writinginstructionsandrecommendations–speaking - short presentations on topics (technical and non-technical)Suggested activities: Sentence completion exercises using 'if' conditionals, correcting sentences (punctuation), essay writing, writing instructions and recommendations, role play, discussion, debating, discussing, etc..

Total Hours **45**

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Write, test, and debug simple Python programs.

CO2: Implement Python programs with conditionals and loops.

CO3: Develop Python programs step-wise by defining functions and calling them.CO4: Use Python lists, tuples, dictionaries for representing compound data.

CO5: Read and write data from/to files in Python ability to carry out extempore discussions, document and elucidate ideas.

Text Books

1 A.Edwin Jeevaraj & Priya Philip, "Technical English", (with work book), Coimbatore, Sahana Publications, Coimbatore, 2011.

Reference Books

1 Department of English, Anna University. Mindscapes: English for Technologists and Engineers Orient Blackswan, Chennai. 2012

2 Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011

3 English for Engineers and Technologists "Combined Edition (Volumes 1 & 2)", Chennai: Orient Longman Pvt. Ltd., 2006. Themes 1 – 4 (Resources, Energy, Computer, Transport).

4 Andrea, J. Rutherford, "Basic Communication Skills for Technology", Second Edition, Pearson Education, 2007.

5 Extensive Reading: 1. A.P.J.Abdul Kalam with Arun Tiwari, "Wings of Fire" An Autobiography, University Press (India) Pvt. Ltd.,1999, 30th Impression 2007.

Note: The book given under Extensive Reading is meant for inculcating the reading habit of the students. They need not be used for testing purposes.

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Faculty of Biotechnology (UC)
Adhiyamaan College of Engineering (Autonomous)
Hosur - 635109
Krishnagiri (DT), Tamilnadu.

ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department BIOTECHNOLOGY **Programme** B. TECH. - BT **Regulation** 2015

Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
115MAT02	ENGINEERING MATHEMATICS - I	3	0	1	4	50	50	100

Prerequisite Nil

Course Objectives

At the end of the course ,the students should be able to:

- To understand the eigen value problems.
- To solve differential equations of certain types, including systems of differentialequations that they might encounter in the same or higher semesters.
- To understand the concepts of curvatures, evolutes and envelopes and to study themaxima and minima of any function.
- To learn the partial derivations and apply the same to find maxima and minima.
- To understand various methods to solve the partial differential equations

UNIT I MATRICES **9+3**

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

UNIT II ORDINARY DIFFERENTIAL EQUATIONS **9+3**

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-Applications to Engineering problems-Electric Circuits, Simple Harmonic Motions and bending of beams.

UNIT III DIFFERENTIAL CALCULUS **9+3**

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes – Evolutes as envelope of normals.

UNIT IV FUNCTIONS OF SEVERAL VARIABLES **9+3**

Partialderivatives–Euler'stheoremforhomogenousfunctions–Totalderivatives– Jacobians– Taylor's expansion– Maxima and Minima – Method of Lagrangian multipliers.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS **9+3**

Solutions of first order partial differential equations – Standard types – Singular solutions - Lagrange's Linear equation – Solution of homogeneous and non-homogenous linear equations of second and higher order with constant coefficients.

Total Hours **45+15**

Course Outcomes

Upon Completion of this course, students will be able to :
CO1: Write, test, and debug simple Python programs.
CO2: Implement Python programs with conditionals and loops.
CO3: Develop Python programs step-wise by defining functions and calling them.C04: Use Python lists, tuples, dictionaries for representing compound data.
CO5: Read and write data from/to files in Python and engineering problems.

Text Books

1 T.Veerarajan, "Engineering Mathematics " Tata McGraw-Hill Publishing company, New Delhi, (2014).
2 Grewal. B.S, "Higher Engineering Mathematics", Khanna Publications, Delhi, (2012).

Reference Books

1 Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley India, (2012

2 Kandasamy.P, Thilagavathy,K., &Gunavathi.K., "Engineering Mathematics for first year "., S.Chand & Company Ltd., New Delhi.(2013)
3 V.Prameelakaladharan and G.Balaji, "Engineering Mathematics-I", Amrutha marketing, Chennai. (2014).

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department BIOTECHNOLOGY **Programme** B. TECH. - BT **Regulation** 2015

Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
115PHT03	ENGINEERING PHYSICS	3	0	0	3	50	50	100

Prerequisite Nil

Course Objectives

At the end of the course ,the students should be able to:

- To understand the concept of properties of matter.
- To understand the properties of sound and principles of quantization of energy.
- To understand the properties of coherent light and its importance.

UNIT I PROPERTIES OF MATTER 9

Elasticity – Stress – Strain diagram – Factors affecting elasticity – Twisting couple on a wire – Torsion pendulum – Young's modulus - cantilever - Heavy cantilever – Uniform and Non uniform bending (theory and experiment)–Viscosity- Poiseuille's method for Coefficient of Viscosity

UNIT II ACOUSTICS AND ULTRASONICS 9

Classification of sound, loudness, intensity – Decibel – Weber Fechner Law – Reverberation and Reverberation time –derivation of Sabine's formula for Reverberation time (Growth and Decay)– Absorption coefficientand its determination. Introduction of Ultrasonics – Production – magnetostriction effect – magnetostriction generator – piezoelectric effect–piezoelectricgenerator– Detectionofultrasonicwaves,properties–Cavitation–Applications–SONAR – Non Destructive Testing – pulse echo system.

UNIT III QUANTUM PHYSICS 9

Blackbodyradiation–Planck'stheory(derivation)–DeductionofWien'sdisplacementlawandRayleigh–jeans' Law from Planck's theory – Compton Effect – Theory and experimental verification – Matter waves – Schrödinger's wave equation – Time independent and time dependent equations– Physical significance of wave function – Particle in a one dimensional box – Electrons in a metal.

UNIT IV LASER 9

Introduction – Principle of Spontaneous emission and stimulated emission – Population inversion – pumping – Einstein's A and B coefficients – derivation – Types of lasers – He-Ne, CO2, Nd-YAG, Semiconductorlasers – homojunction – Applications of Laser.

UNIT V WAVE OPTICS & FIBRE OPTICS 9

Interference – Air wedge (theory & experiment) – Polarization– Methods of polarizing light-Theory of planecircularly and elliptically polarized light.

Principle and propagation of light in optical fibers – Numerical aperture and Acceptance angle – Types of opticalfibers (material, refractive index, and mode) – Fiber optical communication system (Block diagram) – Fiber optic sensors – Temperature & Displacement sensors.

Total Hours 45

	Upon Completion of this course, students will be able to :
Course Outcomes	*CO1: Understand the types of matter and their physicalproperties.* *CO2: Gain fundamental knowledge about the sound waves in the field of industrial production, architecture, medicine andmore.* *CO3: Understand the properties of light waves which can be used in communicationsystems*

Text Books

1 R.K. Gaur and S.C. Gupta, 'Engineering Physics' Dhanpat Rai Publications, New Delhi (2003)

2 Jayaprakash R.N, 'Engineering Physics - I', Dhanam Publications, Chennai, (2007).

Reference Books

1 Serway and Jewett, 'Physics for Scientists and Engineers with Modern Physics', 6th Edition, Thomson Brooks/Cole, Indian reprint (2007).

2 Rajendran, V and Marikani A, 'Engineering Physics' Tata Mc Graw Hill Publications Ltd, III Edition, New Delhi, (2004).

3 Palanisamy, P.K., 'Engineering Physics' Scitech publications, Chennai, (2007).

4 Jayakumar. S, 'Engineering Physics', R.K. Publishers, Coimbatore, (2003).

5 M.N.AvadhanuluandPGKshirsagar,'ATextbookofEngineeringPhysics',S.Chand and company, Ltd., New Delhi, 2005

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
115CYT04	ENGINEERING CHEMISTRY	3	0	0	3	50	50	100

Prerequisite NIL

Course Objectives

At the end of the course ,the students should be able to:

- To understand and apply the concepts in electrochemistry and Energy storage devices
- To understand the chemistry of Corrosion
- To apply the basic concepts of thermodynamics for engineering stream
- To understand the basic concepts of phase equilibrium
- To understand the chemistry behind water technology

UNIT I Electrochemistry and Energy storage devices **9**

Electrochemical cell-single electrode potential-standard electrode potential-electrochemical series and itssignificance-EMFofacell-Nernstequation-Electrodes-Referenceelectrodes-hydrogen,calomel,quinhydroneand glasselectrodes.DeterminationofpHofasolutionusingaglasselectrode.Batteries-primaryandsecondarycells, dry cell,alkaline, lead acid storage cell, Ni-Cd battery andlithiumnano battery. Clean energy fuel cells - H2-O2 fuel cell

UNIT II Corrosion and its Control **9**

Basic concepts - mechanism of chemical, electrochemical corrosion - Pilling Bedworth rule – Types of Electrochemical corrosion - galvanic corrosion - differential aeration corrosion –Measurement of corrosion (wt. loss method only) - factors influencing corrosion. Corrosion control: Cathodic protection - sacrificial anodic method and impressive cathode current method – corrosion inhibitors. Electroplating (Copperplating) and Electrolessplating (Nickel plating).

Chemical Thermodynamics

UNIT III Chemical Thermodynamics **9**

Terminologies- System, Surroundings-First law of thermodynamics-Internal energy and enthalpy of system- Second law of Thermodynamics-entropy of a system-entropy change for an ideal gas- entropy change accompanying change of phase-Gibbs Helmholtz equation-Clausius –clapeyron equation-applications-Chemical potential; Gibbs-Duhem equation – variation of chemical potential with temperature and pressure

UNIT IV Phase Equilibria **9**

Gibbs phase rule-definition of terms involved- Thermal analysis-application of phase rule to one Componentsystem-water system. Reduced Phase rule-application of phase rule to two Component system- lead-silver system- Zinc-cadmium system- KI-water system and Ferric Chloride water system.

UNIT V Water Technology **9**

Physical, Chemical & Biological characteristics -Hardness of water - estimation of hardness (EDTA method) - Dissolved oxygen –determination, Alkalinity - determination - disadvantages of using hard water in boilers- Internal conditioning - phosphate, calgon and carbonate conditioning methods – External treatment: Zeolite, ion exchange methods - desalination – reverse osmosis and electrodialysis - domestic
water treatment.

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Understand the concepts of electrochemistry and Energy storage devicesCO2: Understand the chemistry of Corrosion

CO3: Apply the basic concepts of thermodynamics for engineering stream

CO4: Understand the basic concepts of phase equilibrium

CO5: Understand the chemistry behind water technology

Text Books

1 P.C. Jain and Monika Jain, Engineering Chemistry, DhanpatRai and Sons, NewDelhi 2004.

2 N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry,2nd edition.PHI Learning PVT., LTD, New Delhi, 2008.

Reference Books

1 S. S. Dara, A Textbook of Engineering Chemistry, S. Chand & Co., Ltd. NewDelhi.

2 B. K. Sharma, Engineering Chemistry, 3rd edition Krishna Prakashan Media (P)Ltd., Meerut, 2001.

3 3. ArunBhal, B.S. Bhal, G. D. Tuli, Essentials of Physical Chemistry, S. Chand & Co., Ltd. New Delhi.

4 P. W. Atkins & Julio de Paula, Atkins' Physical Chemistry, Oxford University Press York, 7thEdn, 2002

5 ShashiChawla, A Text Book of Engineering Chemistry, 3rd Edition, DhanpatRai&New Delhi, 2007.

6 S. Vairam, P. Kalyani&Suba Ramesh, Engineering Chemistry, IstEdn, John Wiley &Sons, India, 2011.

7 Lee J.D., Concise Inorganic Chemistry, 7th Edn, Blackwel Science Publications Oxford, London, 2004

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015
		Semester	I		

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
115EGT05	ENGINEERING GRAPHICS	3	0	0	3	50	50	100

Prerequisite NIL

Course Objectives

At the end of the course ,the students should be able to:

- The students will learn graphics skill for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.
- To understand the basic principles of technical / engineering drawing.
- To understand the different steps in producing drawings according to BISconvention.

Concepts and conventions (Not for Examination) **3**

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

UNIT I PLANE CURVES AND FREE HAND SKETCHING **9+6**

Curves used in engineering practices:

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

Free hand sketching:

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES **9+6**

Projectionofpointsandstraightlineslocatedinthefirstquadrant–Determinationoftruelengthsand true inclinations – Projection of polygonal surface and circular lamina inclined to both referenceplanes.

UNIT III PROJECTION OF SOLIDS **9+6**

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **9+6**

Sectioning of above solids in simple vertical position by cutting planes inclined to one reference plane andperpendicular to the other – Obtaining true shape of section.

Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones – Development of lateral surfaces of solids with cylindrical cutouts, perpendicular to the axis.

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS **9+3**

Principles of isometric projection – isometric scale – isometric projections of simple solids, truncated prisms,pyramids, cylinders and cones.

Perspective projection of prisms, pyramids and cylinders by visual ray method.

Total Hours 45+27

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: The student will be able to perform free hand sketching of basic geometricalconstructions and multiple views ofobjects.

CO2: The student will be able to do orthographic projection of lines and plane surfaces. CO3: The student will be able to draw projections of solids, section of solid and developmentofsurfaces.

CO4: The student will be able to prepare isometric and perspective sections of simplesolids.

Text Books

1 G.Ranganath, Channankaiah and Halesh Koti, "Engineering Graphics", Second Edition, Sahana Publishers 2011

2 Bhatt. N.D., "Engineering Drawing" Charotar Publishing House, 46th Edition, 2003.

Reference Books

1 Dhananjay A.Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGraw Hill Publishing Company Limited, 2008.

2 Gopalakrishnana. K. R, "Engineering Drawing" (Vol. I & II), Subhas Publications, 1998.

3 Natrajan K. V, "A Text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2006.

Publication of Bureau of Indian Standards:

i. IS10711–2001:TechnicalproductsDocumentation–Sizeandlayoutofdrawingsheets.

ii. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation –Lettering.

iii. IS10714(Part20)–2001&SP46–2003:Linesfortechnicaldrawings.

iv. IS11669–1986&SP46–2003:DimensioningofTechnicalDrawings.

v. IS 15021 (Parts 1 to 4) – 2001: Technical drawings –ProjectionMethods.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
115ESE02	BASICS OF COMPUTING AND C PROGRAMME	3	0	0	3	50	50	100

Prerequisite Nil

Course Objectives

At the end of the course ,the students should be able to:

- To enable the student to learn about the basics of computer and problem solvingmethods.
- To learn the basics of Clanguage.
- To learn the various features of C programminglanguage.

UNIT I INTRODUCTION **9**

Introduction-CharacteristicsofComputers-BasicComputerorganization-NumberSystem–ComputerSoftware
–Types - Problem-Solving Techniques-Program Control Structures-Programming Paradigms – Characteristics ofGood Program-programming Language - Compiler, Interpreter, Linker, Loader - Internet Basics.

UNIT II C LANGUAGE BASICS **9**

Introduction to C Programming – Fundamentals – Structure of a C Program – Compilation and Linking Processes
– Constants,Variables–DataTypes–ExpressionsUsingOperatorsInC–ManagingInputandOutputOperations – Decision Making and Branching – Looping Statements – Solving SimpleScientific and StatisticalProblems.

UNIT III ARRAYS AND STRINGS **9**

Arrays – Initialization – Declaration – One Dimensional and Two Dimensional Arrays - Strings- String Operations – String Arrays. Simple Programs - Sorting- Searching – Matrix Operations-Preprocessor Directives.

UNIT IV FUNCTIONS, STORAGE CLASSES AND POINTERS **9**

Functions: Definition of function – Declaration of function – Pass by value – Pass by reference – Recursion.

Storage classes – auto, static, extern, register- scope rules.

Pointers: Definition – Initialization – Pointers arithmetic – Pointers and arrays - Dynamic memory allocation -Example Problems

UNIT V STRUCTURES, UNIONS AND FILES **9**

Structures and Unions: Introduction – Need for structure data type – Structure definition – Structure declaration –Structure within a structure - Union - Programs using Structures and Unions.
Files: Introduction – Using files in C - Working with text files.

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Able to acquire knowledge in Computer, Internet basics and problem solvingmethods.CO2: Abletounderstandandimplementtheprogramsin Cusingarrays,functionsand

	structures. *CO3:* *Abletodesignanddevelopapplicationsusingpointerconceptsandfilehandlingmechanism.*
Text Books	
1	Ashok.N.Kamthane, —Computer Programming, Pearson Education (India), 2008.
2	E.Balagurusamy, —Computing fundamentals and C Programming, Tata McGraw-Hill Publishing Company Limited, 2008.
Reference Books	
1	Pradip Dey, Manas Ghoush, —Programming in , Oxford University Press, 2012.
2	Byron Gottfried, —Programming with C, 2nd Edition, (Indian Adapted Edition), TMH publications, 2006
3	Stephen G.Kochan, —Programming in C, Third Edition, Pearson Education India, 2005.
4	Brian W.Kernighan and Dennis M.Ritchie, —The C Programming Language, Pearson Education Inc., 2005.
5	Behrouz A.Forouzan and Richard.F.Gilberg, —A Structured Programming Approach Using C,II Edition, Brooks-Cole Thomson Learning Publications, 2007.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
115CYP07	ENGINEERING CHEMISTRY LAB	0	0	4	2	50	50	100

Prerequisite NIL

Course Objectives

At the end of the course ,the students should be able to:

- Students will be conversant with the estimation of various compounds usingvolumetric and instrumental analysis

LIST OF EXPERIMENTS (A minimum of TEN experiments shall be offered)

1. Estimation of Total hardness byEDTA
2. Determination of percentage of calcium in Lime Stone by EDTA
3. Estimation of chloride in water sample
4. Estimation of alkalinity of Water sample
5. Determination of DO in Water (Winkler'sMethod)
6. Determination of Rate of Corrosion of the given steel specimen by weight loss method (Withoutinhibitor)
7. Determination of Rate of Corrosion of the given steel specimen by weight loss method (Withinhibitor)
8. Conduct metric titration (Simple acidbase)
9. Conduct metric titration (Mixture of weak and strongacids)
10. Conduct metric titration using $BaCl_2$vs Na_2SO_4
11. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
12. PH titration (acid &base)
13. Determination of water of crystallization of a crystalline salt –Copper sulphate

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Carry out the volumetric experiments and improve the analyticalskills.

CO2: Understand the maintenance and usage of analytical instruments and therebydevelop theirskills in the field of engineering.

CO3: Understand the principle and handling of electrochemical instrumentsandSpectrophotometer.

Reference Books

1 Arthur I. Vogel's, "Quantitative Inorganic Analysis including Elementary Instrumental Analysis",ELBS, Group, 5th Edition, 1989.

2 Dr. P.Neeraja, "Engineering Chemistry lab manual", S.S publishers, 2014.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
	COMPUTER PRACTICES LAB							
115ESP01		**0**	**0**	**4**	**2**	**50**	**50**	**100**

Prerequisite Nil

Course Objectives

At the end of the course ,the students should be able to:

- To enable the students to prepare the documents, presentation using office automationtools.
- To enable the students to write programs using C.

Word Processing

1. a) Preparation of Bio – Data with header and Footer optionsb)Preparation of News-Bulletin with formatting options
2. a) Business Letter using Mail Merge concept

   b) Typing Equations and inserting Symbols
3. Table creation with formula & protecting a word document

Spread Sheet

4. Mark-Sheet preparation using formula editor
5. Preparation of various charts (Bar, Pie, Line)
6. Import/Export of excel file & protection of Excel file

Presentation

7. PrepareapresentationinPowerpointshowingthefeaturesofMSOFFICEandalsosettimings to viewit.
8. Prepare a presentation for showing the types of computers with the following settings:

a) Set different slide transitions

b) Give header & footer for each slide

c) Hiding and Showing the slides access

9. a) Prepare a presentation with a text, picture & graph expressing the introduction of new product. b)Prepare apresentation with a text and picture for various courses offered in our college with Animation effect.

C-Programming

10. Generation of Fibonnacci series.
11. Finding factorial of given number.

12. Printing multiplication table using Whilestatement.
13. Program to evaluate Sineseries.
14. Creating menu option withSwitch-Case.
15. Programs using Function (with, without arguments).
16. Program using Recursivefunctions.
17. Program using 1-D,2-DArrays.
18. Program usingString.
19. Program using Structure and Unionconcept.
20. Program withPointers.
21. Program using File Handlingfunctions.
22. Program using 1-D,2-DArrays.
23. Program usingString.
24. Program using Structure and Unionconcept.
25. Program withPointers.
26. Program using File Handlingfunctions.

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Able to efficientlyapplyofficeautomationtoolsforprofessionalrequirements.CO2: Able to solves implemathematical &logical problems using Cprograms.

C03: Able to build program in C for any computing problems.

LIST OF EQUIPMENTS AND SOFTWARE FOR A BATCH OF 30 STUDENTS

1	Hardware: LAN System with 30 Nodes (OR) Stand_alone PCs -30 No's. Printer – 3 No's.
2	Software: OS: Windows / Linux. Application Package - Office Suite.Turbo C.

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Adhiyamaan College of Engineering (Autonomous)
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Krishnagiri (DT), Tamilnadu.

ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester I

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
115HSP08	LANGUAGE LAB	0	0	4	2	50	50	100

Prerequisite

Aim

To equip students of engineering and technology with effective speaking, listening, readingand writing skills in English, specifically, presentation, group discussion and report writing skills.

Course Objectives

At the end of the course ,the students should be able to:

- To equip students of engineering and technology with effective speaking and listeningskills in English.
- To help them develop their soft skills and interpersonal skills, which will make thetransition from college to workplace smoother and help them excel in their career.
- ToenhancetheperformanceofthestudentsatPlacementInterviews,GroupDiscussions andother recruitment exercises.

Globalization has brought in numerous opportunities for the teeming millions, with more focus on thestudents' overall capability apart from academic competence. Many students, particularly those from non-English medium schools, find it difficult to enter corporate world due to their inadequacy of
communication skills and soft skills, despite possessing sound knowledge in their subject area along withtechnical capability. Keeping this necessity of pre-employment coaching for career developments of the students in view, this course on Communication Skills Laboratory is designed to prepare the students to adapt themselves with ease to the industry environment, and make them rendering as prospective assets to industries. The course will equip the students with the necessary communication skills that would go along way in helping them in their profession.

Lecture – Practice – PC based

A. English Language Lab

1. Listening: (3+3)

Listening - Barriers to listening – Types of listening – Fill in the blanks – ListeningComprehension – Note taking.

2. Reading: (1+6)

Reading – Techniques – Skimming and Scanning – Note making
Review (book – journal – essay – movie etc.,)
Newspaper
ReadingCloze
Reading

3. Speaking:(5+15)

Practicing Short Dialogues – Speeches – Interpreting pictures – objects –

cartoons –Telephone etiquette
Tongue twisters

Presentation skills – Elements of effective presentation – Structure of presentation - Presentation tools – Voice Modulation – Audience analysis - Body language – Video samples
Group discussion – Structure of GD – Strategies in GD - Moderator – led and other GDs – Team work - Body Language - Mock GD -Video samples
Phonetics – Stress and intonation - Common Errors in Spoken English

4. Writing:(2+4)
Jumbled words Jumbled Paragraph Preposition Concord Error Spotting Editing
Letter writing (Covering letter – Follow up letter - Letter of thanks giving - appreciation – gratitude) E-mail Etiquettes

5. Soft Skills (2+4)
Team building – strategies - stages- blocks of an assertive team Assertiveness , Articulateness
Time management Stress management Psychometrics

Total Hours 45

Text Books

1 Anderson, P.V, Technical Communication, Thomson Wadsworth, 6th Edition, New Delhi, 2007.
2 Prakash, P, Verbal and Non-Verbal Reasoning, Macmillan India Ltd., 2nd Edition, New Delhi, 2004.

References:

1 Dhanavel S. P., English and Soft Skills, Orient BlackSwan Pvt. Ltd. Hydrabad, 2010.
2 Evans, D, Decision maker, Cambridge University Press, 1997.
3 John Seely, The Oxford Guide to Writing and Speaking, Oxford University Press, New Delhi, 2004.
4 Thorpe, E, and Thorpe, S, Objective English, Pearson Education, Second Edition, New Delhi, 2007.
5 Turton, N.D and Heaton, J.B, Dictionary of Common Errors, Addison Wesley Longman Ltd., Indian reprint 1998.

Lab Requirements:

1 Teacher console and systems for students.
2 English Language Lab Software
3 Career Lab Software

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Krishnagiri (DT), Tamilnadu.

ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
215ENT01	Technical English - II	3	0	0	3	50	50	100

Prerequisite Technical English I

Course Objectives

At the end of the course ,the students should be able to:

- To facilitate students amplify suitable language skills for academic and professionalpurposes
- To inculcate and develop strategies to understand and to increase students' efficiencyin their academic and general reading
- To strengthen students' vocabulary power
- To familiarize students with different functions of technical and scientific English
- To coach the students in augmenting the technical writing skills for writing letters andreports in formal and business contexts

UNIT I Basics of Technical Communication 9

Technical Communication – features - Distinction between General and Technical communication - Language asa tool of communication - Levels of communication: Interpersonal, Organizational, Mass communication - The flow of Communication: Downward, Upward, Horizontal, Diagonal - Importance of technical communication - Barriers to Communication.

UNIT II Constituents of Technical Written Communication 9

Wordformation-SynonymsandAntonyms–Acronyms–Homonyms-WordPower-Selectvocabularyofabout 500-
1000Newwords–OddmanOut–JumbledWordsandSentences-CreativeandCriticalThinking-Requisites of Sentence Construction - Paragraph Development: Techniques and Methods - Inductive, Deductive, Spatial, Linear, Chronological etc; Essay Writing – Narrative – Argumentative - Reading and Interpretation.

UNIT III Forms of Technical Communication 9

Business Letters: - Letter of Sales and Credit, Letter of Quotation, Order, Letter of Enquiry - Job application and Resumes - Reports: Types – Significance – Structure - Style & Writing of Reports –
Agenda – Minutes of Meeting – Advertisement – Fliers – Brochures – Faxes – Internet Websites –Intranet Websites – Extranet Websites – Blog writing.

UNIT IV Presentation Strategies 9

Defining Purpose, Analyzing Audience & Locale - Organizing Contents - Modes of Delivery: Extemporaneous, Manuscript, Impromptu, Memorization - Kinesics – proxemics – Paralinguistics – Chronemics.

UNIT V Value- Based Text Readings 9

My vision of India 2020 AD by A P J Abdul Kalam Of Truth by Francis BaconOf Innovations by Francis Bacon Dream Children by Charles Lamb

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to

: CO1: The ability to strengthen technical writing and speaking

CO2: The ability to be proactively read, listen, speak and present facts in a persuasivemanner in both oral and writtenmedium

CO3: The ability to interact, translate and delegate information,

CO4: The ability to face various levels of competitive examinations to upgrade educationaland career options

Text Books

1 A. Edwin Jeevaraj & Priya Philip, "Technical English", (with work book), Sahana Publications, Coimbatore, 2011.

2 Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, New Delhi.

3 Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma,Oxford Univ. Press, 2007, New Delhi.

Reference Books

1 Effective Technical Communication by Barun K. Mitra, Oxford Univ. Press, 2006, New Delhi.

2 How to Build Better Vocabulary by M.Rosen Blum, Bloomsbury Pub. London

3 Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. & Distributors; Delhi.

4 Developing Communication Skills by Krishna Mohan, Meera Banerji- Macmillan India Ltd.

5 Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., New Delhi.

6 Manual of Practical Communication by L.U.B. Pandey & R.P. Singh; A.I.T.B.S. Publications India Ltd., Krishan Nagar, Delhi.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
215MAT02	ENGINEERING MATHEMATICS-II	3	0	1	4	50	50	100

Prerequisite Engineering Mathematics – I

At the end of the course ,the students should be able to:

Course Objectives

- To understand double and triple integration concepts and apply to study vector calculus comprising of surface and volume integrals along with theclassical theorems involving them.
- To learn analytic functions and their properties and also conformal mappingswith few standard examples that have direct applications.
- To grasp the basics of complex integration and application to contour integration which is important for evaluation of certain integrals encountered in engineering problems.
- To introduce the concept of improper integrals through Beta and Gamma functions.

UNIT I MULTIPLE INTEGRALS **9+3**

Double integration – Cartesian and polar co-ordinates – Change of order of integration – Change of variablesbetween Cartesian and polar coordinates –Triple integration in Cartesian co-ordinates – Area as double integral – Volume as triple integral.

UNIT II VECTOR CALCULUS **9+3**

Gradient Divergence and Curl – Directional derivative – Irrotational and solenoidal, vector fields – Vector integration – Green's theorem in a plane, Gauss divergence theorem and Stokes' theorem (Statement andapplications only) – Simple applications involving cubes and rectangular parallelepipeds

UNIT III ANALYTIC FUNCTIONS **9+3**

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy– Riemann equation andSufficient conditions (Statement and applications only) – Harmonic and orthogonal properties of analytic function (Statement and applications only) – Harmonic conjugate – Construction of analytic functions – Conformal mapping : w= z+c, cz, 1/z, and bilinear transformation

UNIT IV COMPLEX INTEGRATION **9+3**

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

UNIT V IMPROPER INTEGRALS **9+3**

Improper integrals of the first and second kind and their convergence – Evaluation of integrals involvinga parameter by Leibnitz rule – Beta and Gamma functions – Properties – Evaluation of integrals using Beta and Gamma functions.

Total Hours **45+18**

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Determining the area and volume in 2-dimension and 3-dimension respectively usingmultiple integrals and also extending the concept to vector fields.

CO2: Learning the basic concepts of analytic functions and transformations of complexfunctions.

CO3: Mastering the integration in complexdomain.

CO4: Understanding the use of improper integrals applications in the coresubject.

Text Books

1 T.Veerarajan, "Engineering Mathematics I and II", Tata McGraw-Hill Publishing Company, New Delhi, (2014).

2 Grewal. B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi, (2012).

Reference Books

1 V.Prameelakaladharan and G.Balaji, "Engineering Mathematics-II",1st Edition, Amrutha marketing, Chennai. (2014).

2 P.Kandasamy, K.Thilagavathy, K.Gunavathy, "Engineering Mathematics for first year", S.Chand& Company Ltd., 9th Edition, New Delhi,(2013).

3 Erwin Kreyszig, "Advanced Engineering Mathematics", seventh edition, Wiley India, (2012).

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
215PHT03	APPLIED PHYSICS	3	0	0	3	50	50	100

Prerequisite Engineering physics

Course Objectives

At the end of the course ,the students should be able to:

- To enable students to understand the structure of solids and properties.
- To understand the concept of classical theory and quantum theory.
- To get the better knowledge of semiconductor materials.
- Properties of magnetic materials and superconductors.
- Recent development in new engineering materials.

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation ofnumber of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC, HCP and diamond structure – NaCl, ZnS structures (qualitative).

UNIT II CONDUCTING MATERIALS 9

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

UNIT III SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – Carrier concentration derivation – Fermi level – Variation of Fermi level withtemperature – Electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentrationderivationinn-typeandp-typesemiconductor– VariationofFermilevelwithtemperatureand impurity concentration – Electrical conductivity of extrinsic semiconductors.

UNIT IV DIELECTRIC MATERIALS AND NANO MATERIALS 9

Electrical susceptibility – Dielectric constant – Electronic, ionic, orientational and space charge polarization – Frequencyandtemperaturedependenceofpolarization–internalfield–Claussius–Mosottirelation(derivation). Nanomaterials: Synthesis – Plasma arcing – Chemical vapour deposition, Electro deposition – Ball milling – Properties of nanoparticles andapplications.

UNIT V NUCLEAR AND THERMAL PHYSICS 9

Nuclear fission-Nuclear fusion-Stellar energy-conditions to be satisfied for sustained nuclear reactions-nuclear reactors-classification-general features-efficiency-coolants moderations thermal reactors. Heatconduction-Expressionforthermalconductivity-Amountofheatflowthrougha planewallinone direction- Heatconductionthroughacompoundmediaoftwolayers-Determinethermalconductivity-Lee'sdiscmethodfor bad conductors

Total Hours 45

Text Books

1 Jayaprakash R.N, 'Engineering Physics - II', Dhanam Publications, Chennai, (2007)
2 Jayakumar, S. 'Materials science', R.K. Publishers, Coimbatore, (2008).

Reference Books	
1	Rajendran, V, and Marikani A, 'Materials science' TMH publications, (2004) New delhi.
2	Palanisamy P.K, 'Materials science', Scitech publications (India) Pvt. LTd., Chennai,
3	M.Arumugam, 'Materials Science' Anuradha publications, Kumbakonam, (2006).
4	Charles Kittel, 'Introduction to Solid State Physics', John Wiley & sons, 7th edition, Singapore (2007)
5	Charles P. Poole and Frank J. Ownen, 'Introduction to Nanotechnology', Wiley India (2007)

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
215CYT04	APPLIED CHEMISTRY	3	0	0	3	50	50	100

Prerequisite Engineering chemistry

Course Objectives

At the end of the course ,the students should be able to:

- To make the students conversant with basics of polymer chemistry.
- To acquaint the student with concepts of important photo physical and photochemicalprocesses and spectroscopy.
- To develop an understanding of the basic concepts of engineering materials and itsapplications.
- To acquaint the students with the basics of fuels, and chemistry behind combustionprocess.
- To make the student acquire sound knowledge of adsorption and its industrialapplication

UNIT I POLYMER CHEMISTRY 9

Introduction:Classificationofpolymers–Naturalandsynthetic;Functionality–Degreeofpolymerization.Types and mechanism of polymerization: Addition (Free Radical, cationic and anionic); condensation and copolymerization. Plastics-Thermoplastics and Thermosetting. Preparation, properties and uses of Nylon 6,6, Terylene, polyurethane, BuNa-S, BuNa-N and Epoxy resin. Rubber – Vulcanization ofrubber.

UNIT II PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry - Grotthuss–Draper law, Stark–Einstein law and Lambert-Beer Law. Quantum efficiency –Photophysical process- Fluorescence, Phosphorescence, Chemiluminescence and Photo- sensitization. Spectroscopy: Electromagnetic spectrum - Absorption of radiation – Electronic, Vibrational and rotational transitions. UV-visible and IR spectroscopy – principles, instrumentation – applications (any 2).

UNIT III ENGINEERING MATERIALS 9

Refractories: definition, characteristics, classification, properties – refractoriness, RUL, dimensional stability, thermal spalling, porosity; Manufacture of alumina, magnesite and Zirconia.

Lubricants: Functions of' lubricant – Types of Lubricants – solid lubricants-use of water as a lubricant-plastic lubricant-gaseous lubricants. Mechanism of lubrication- Fluid or Hydrodynamic Lubrication, Thin film or Boundarylubrication&Extremepressurelubrication.Propertiesoflubricants–Viscosity–ViscosityIndex-Flash and Fire point – Cloud and Pour point – Oiliness - Aniline point-Neutralization number-Mechanicalstability.

UNIT IV UNIT IV FUELS AND COMBUSTION 9

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coal-analysis ofcoal (proximate and ultimate)- carbonization- manufacture of metallurgical coke (Otto Hoffmann method) – petroleum – Fractional distillation - manufacture of synthetic petrol (Bergius process)-

knocking- octane number - diesel oil- cetane number - natural gas- compressed natural

gas(CNG)- liquefied petroleum gases(LPG). Combustion of fuels – (simple problems) flue gas analysis (ORSATMethod).9

UNIT V ADSORPTION 9

MechanismofAdsorption-TypesofAdsorption-AdsorptionofGasesbySolids-AdsorptionIsotherms-Freundlich Adsorption equation-Langmuir Adsorption Isotherm - Adsorption of Solutes from Solutions. Application ofadsorption- gas masks, heterogeneous catalysis, froth floatation process, removalof
colouring matter from solutions, Chromatographic analysis (Thin layer and column only).

Total Hours 45

Upon Completion of this course, students will be able to :

Course Outcomes *CO1: The knowledge gained on Polymer chemistry, Photochemistry & Spectroscopy, Engineering materials, fuels and adsorption will facilitate better understanding of engineering processes and applications for furtherlearning.*

Text Books

1 P.C. Jain and Monika Jain, Engineering Chemistry, DhanpatRai and Sons, NewDelhi 2004. 16th Edition.

2 N. Krishnamurthy, P. Vallinayagam and D. Madhavan, Engineering Chemistry, 2nd Edition. PHI Learning PVT., LTD, New Delhi, 2008. 3rd Edition.

3 K. Sivakumar, Applied Chemistry, Sahana Publishers, Coiambatore 2016.1st Edition.

Reference Books

1 S. S. Dara, A Textbook of Engineering Chemistry, S. Chand & Co., Ltd. NewDelhi. 2008. Reprint edition.

2 B. K. Sharma, Engineering Chemistry, 3rd edition Krishna Prakashan Media (P)Ltd., Meerut, 2001.

3 ArunBhal, B.S. Bhal, G. D. Tuli, Essentials of Physical Chemistry, S. Chand & Co., Ltd. New Delhi. 26th Edition.

4 P. W. Atkins & Julio de Paula, Atkins' Physical Chemistry, Oxford University Press York, 7thEdn, 2002.

5 ShashiChawla, A Text Book of Engineering Chemistry, 3rd Edition, DhanpatRai&New Delhi, 2007.

6 S. Vairam, P. Kalyani&Suba Ramesh, Engineering Chemistry, IstEdn, John Wiley &Sons, India, 2011.

7 Lee J.D., Concise Inorganic Chemistry, 7th Edn, Blackwel Science Publications Oxford, London, 2004.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
215EMT05	ENGINEERING MECHANICS	3	1	0	4	50	50	100

Prerequisite Knowledge of Engineering Physics I and II are required

Course Objectives

At the end of the course ,the students should be able to:

- To understand the vectorial and scalar representation of forces and moments, staticequilibrium of particles and rigid bodies both in two dimensions
- To understand the principle of work and energy.
- Toenablethestudentstocomprehendtheeffectoffrictiononequilibrium

UNIT I BASICS & STATICS OF PARTICLES **9+3**

Introduction-Units and Dimensions-Laws of mechanics - Lame's theorem, Parallelogram and Triangular law offorces,Polygonforce,ResolutionandCompositionofforces,Equilibriumofaparticle-Forcesinspace-Equilibrium ofaparticleinspace-Equivalentsystemsofforces-Principleoftransmissibility-Single
equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES **9+3**

Free body diagram-Types of supports and their reactions-Requirements of stable equilibrium-Moments and Couples, Moment of a force about a point and about an axis-Vectorial representation of couples- Varignon's theorem-Equilibrium of Rigid bodies in two dimensions- Equilibrium of Rigid bodies in three
dimensions – Examples.

UNIT III PROPERTIES OF SURFACES AND SOLIDS **9+3**

DeterminationofAreasandVolumes-Firstmomentofareaandthecentroidofsections-rectangle,circle,triangle fromintegration-
Tsection,Isection,anglesection,hollowsectionbyusingstandardformula,Secondandproduct moments of plane area - Rectangle, triangle, circle from integration-T section, I section, angle section, hollow sectionbyusingstandardformula,Parallelaxistheoremandperpendicular
axis theorem.

UNIT IV DYNAMICS OF PARTICLES **9+3**

Displacements, Velocity and acceleration, their relationship, Relative motion- Rectilinear motion-Curvilinear motion, Newton's law-Work Energy Equation of particles-Impulse and Momentum-Impact of elasticbodies

UNIT V FRICTION **9+3**

Frictional force - Laws of Coloumb friction - Simple contact friction - Rolling resistance - Belt friction,
- Ladder friction - wedge friction

Total Hours **45+15**

Upon Completion of this course, students will be able to :

Course Outcomes

CO1: Abilitytoexplainthedifferentialprinciplesappliestosolveengineeringproblems dealing with force, displacement, velocity andacceleration.
CO2: Ability to solve the Moment of inertia for different 2-D planefigures.CO3: Ability to analyse the forces in anystructures.
CO4: Ability to solve rigid body subjected to dynamicforces.

Text Books

1 Beer, F.P and Johnson Jr. E.R. "Vector Mechanics for Engineers", Vol. 1 Statics and Vol.2 Dynamics, McGraw-Hill International, 8th Edition, 2009.

2 Ferdinand P. Beer, E. Russell Johnston Jr., Phillip J. Cornwell "Vector Mechanics for Engineers: Dynamics", 9th Edition, 2006.

Reference Books

1 Rajasekaran, S, Sankarasubramanian, G., "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt. Ltd., 2009.

2 Hibbeler, R.C., "Engineering Mechanics", Vol. 1 Statics, Vol. 2 Dynamics, Pearson Education Asia Pvt. Ltd., 2010.

3 Palanichamy, M.S., Nagam, S., "Engineering Mechanics - Statics & Dynamics", Tata McGraw-Hill, 2001.

4 Irving H. Shames, "Engineering Mechanics - Statics and Dynamics", IV Edition - Pearson Education Asia Pvt. Ltd., 2003.

5 Ashok Gupta, "Interactive Engineering Mechanics - Statics - A Virtual Tutor (CDROM)", Pearson Education Asia Pvt., Ltd., 2002.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
215ESE02	BIOCHEMISTRY	3	0	0	3	50	50	100

Prerequisite Engineering chemistry

Course Objectives

At the end of the course ,the students should be able to:

- To provide the basic knowledge of various biomolecules.
- Top understand the concept of structure and properties of important biomolecules.
- To learn metabolism concepts and its regulation mechanisms.
- Gain knowledge about the metabolism
- Learn in detail about the bioenergetics

UNIT I INTRODUCTION TO BIOMOLECULES **5**

Basic principles of organic chemistry, types of functional groups, biomolecules, chemical nature, water, pH andbiological buffers.

UNIT II Structure and properties of Important Biomolecules **12**

Carbohydrates: Mono, Di, Oligo &Polysaccharides-Starch-Glycogen-Cellulose and their derivatives-Chitin- Proteoglycans- glucosaminoglycans-mutarotation-glycosidicbond- Test for reducing sugars.

Lipids: fatty acids, glycerol, saponification, iodination, hydrogenation, phospholipids, glycolipids,sphingolipids,cholesterol, steroids,prostaglandins.

Proteins: Amino Acids, Peptides, Polypeptides, Measurement, Structures, Hierarchy of organizationPrimary, Secondary, Tertiary and Quaternary structures, Glycoproteins, Lipoproteins. Determine of primary structure.Functions of Protein-Hemoglobin-Myoglobin

UNIT III METABOLISM CONCEPTS **7**

Metabolicpathways,primaryandsecondarymetabolites.Enzymes-introductiontobiocatalysts,conceptsofligand- Enzyme binding interactions-Activation Energy-Michaelis menten formalisms-Inhibition andAllostery.

UNIT IV INTERMEDIARY METABOLISM AND REGULATION **15**

Glycolysis, TCA cycle, Gluconeogenesis, Pentose phosphate shunt, Glyoxalate shunt, Fatty acid synthesis and oxidation, Reactions of amino acids, Deamination, Transamination and Decarboxylation, Urea cycle, Interconnection of pathways and metabolic regulation. Case study on overproduction of glutamic acid, threonine,lysine, methionine, isoleucine and ethanol.

UNIT V BIOENERGETICS **6**

High energy compounds, electronegative potential of compounds, Introduction of energy yielding and energy requiring reactions-Respiratory chain, ATP cycle, calculation of ATP yield during oxidation of glucose and fatty acids.

Total Hours 45

Upon Completion of this course, students will be able to :

Course Outcomes

CO1: Basic principles of chemical bonding isknown.

CO2: Acquireknowledgerelatedtofunctionsandinterrelationshipsofbiomoleculesin clinical research andindustry.

CO3: Idea about the consequences of interpreting and solving clinicalproblems.

Text Books

1. Nelson, D.L. and M.M. Cox, "Lehninger's Principles of Biochemsitry", 4th Edition, W.H. Freemen& Co., 2005.
2. Stryer, L., "Biochemsitry", 4th Edition, W.H. Freeman & Co., 2000.
3. Voet, D. and Voet, J.G., "Biochemistry", 3rd Edition, John Wiley & Sons Inc., 2004.
4. Murray, R.K., et al "Harper's Biochemistry", 23rd Edition, Prentice Hall International, 1993.

Reference Books

1. Voet, D. and Voet, J.G., "Biochemistry", 3rd Edition, John Wiley & Sons Inc., 2004.
2. Murray, R.K., etal "Harper's Biochemistry", 23rd Edition, Prentice Hall International,1993

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
215PHP07	ENGINEERING PHYSICS LABORATORY	0	0	4	2	50	50	100

Prerequisite Nil

Course Objectives

At the end of the course ,the students should be able to:

- To understand the practical concepts of Interference and diffraction.
- To understand the concept of velocities of sound in different liquids.
- To get better knowledge of modulus of elasticity.
- To understand the concepts of thermal conductivity.
- To understand the concepts of viscosities of liquid.

LIST OF EXPERIMENTS

1. (a) Determination of laser parameters – Wavelength.
   (b) Particle size determination using Diode Laser.
2. Determination of thickness of a thin wire-Air wedge method.
3. Determination of velocity of sound and compressibility of liquid- Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum-Spectrometer grating.
5. Determination of thermal conductivity of a bad conductor-Lee's disc method.
6. Determination of Young's modulus of the material –Non uniform bending.
7. Determination of viscosity of liquid – Poiseuille'smethod.
8. Spectrometer- Dispersive power of prism.
9. Determination of Young's modulus of the material - Uniform bending.
10. Torsional pendulum- Determination of Rigidity modulus.

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Verifythetheoreticalideasandconceptscoveredinlecturebycompleting hostof experiments.

CO2: Developproceduresandobservationskillsasdataistakenandgainfundament alunderstandingofsimpleandcomplexapparatususedintheexperiment.

C03: Acquire and interpret experimental data to examine the physical law.

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Adhiyamaan College of Engineering (Autonomous)
Hosur - 635130
Krishnagiri (DT), Tamilnadu.

ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department BIOTECHNOLOGY **Programme** B. TECH. - BT **Regulation** 2015

Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
215EPP08	ENGINEERING PRACTICES LABORATORY	0	0	3	2	50	50	100

Prerequisite Nil

Course Objectives

At the end of the course ,the students should be able to:

- To provide exposure to the students with various basic engineering practicesinmechanicalengineering
- To provide exposure to the students with basic electrical, electronics andcomputerengineeringpractices

LIST OF EXPERIMENTS

WELDING:

Study of electric Arc welding and Gas welding tools and equipments.

Preparation of Arc welding and Gas welding models :

i) Buttjoint ii) Lapjoint iii) T -joint.

FITTING:

Study of fitting tools and operations.

Preparation offittingmodels: i) V-fitting ii) Square fitting

SHEET METAL WORK:

Study of sheet metal tools and operations

Preparation of sheet metalmodels: i) Tray ii)Funnel

PLUMBING WORKS:

Study of pipeline joints and house hold fittings.

Preparation ofplumbingmodels: Basic pipe connections with PVC and GI pipefittings.

CARPENTRY:

Study of wooden joints and tools used in roofs, doors, windows, furniture.

Preparation of carpentry models :

i)Lapjoint ii)Dovetailjoint iii) T-Joint

DEMONSTRATION ON:

ELECTRICAL ENGINNEERING PRACTICE

Study of Electrical components and equipment's

Residential house wiring using switches, fuse, indicator, lamp and energy meter.

ELECTRONICS ENGINNEERING PRACTICE

Study of Electronic components –Resistor, color coding, capacitors etc

Soldering practice – components soldering in simple electric circuit & testing continuity

COMPUTER HARDWARE AND SOFTWARE PRACTICE

Study of PC Hardware, Internet & World Wide Web and Productivity tools including Word, Excel,PowerPoint and Publisher.

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Students will be able to prepare the pipe connections and identify the variouscomponents used inplumbing.

CO2: An ability to prepare simple wooden joints using wood workingtools.

CO3: Anabilitytopreparesimplelap,buttandteejointsusingarcweldingequipments.

CO4: Ability to demonstrate basic electrical electronic and computer components basedontheir physical parameters anddimensions.

Text Books

1 Ranganath. G, & Channankaiah, "Engineering Practices Laboratory Manual" S.S. publishers, 2014.

2 Jeyapoovan.T &, S Gowri "Engineering Practice Lab Manual" Vikas publishing house pvt.ltd, 2014.

References:

1 Ramesh Babu.V., "Engineering Practices Laboratory Manual", VRB Publishers Private Limited, Chennai, Revised Edition, 2014.

2 Bawa. H.S, "Workshop Practice", Tata McGraw – Hill Publishing Company Limited, 2009.

3 Kannaiah.P & Narayana.K.L, "Manual on Workshop Practice", Scitech Publications, 2004.

4 Introduction to Computers, Peter Norton, 6/e Mc Graw Hill, 2006.

5 IT Essentials PC Hardware and Software Companion Guide,Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education, 2008.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department BIOTECHNOLOGY **Programme** B. TECH. - BT **Regulation** 2015

Semester II

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
215ESP03	BIO CHEMISTRY LABORATORY	0	0	4	2	50	50	100

Prerequisite Nil

Course Objectives

At the end of the course ,the students should be able to:

- To understand the principle of qualitative analysis of variousbiomolecules.
- To understand the concept of quantitative estimation ofbiomolecules.
- To understand the preparation of standard buffer solution

LIST OF EXPERIMENTS

1. Preparation and measurement of pH of standard of buffers (Phosphate, carbonate, TRISetc.).
2. Qualitative analysis of carbohydrates (monosaccharide's, disaccharides, polysaccharidesetc.).
3. Qualitative analysis of proteins and aminoacids.
4. Qualitative analysis of lipids (triglycerides, cholesterol, phospholipidsetc.).
5. Quantitative analysis of carbohydrates (Benedict's methodetc.)
6. Quantitative estimation of bloodglucose.
7. Protein estimation by Lowry'smethod.
8. Protein estimation by Biuretmethod.
9. Quantitative estimation of amino acids by Ninhydinmethod.
10. Estimation of DNA by Diphenylamine method.
11. Estimation of RNA by Orcinolmethod
12. Quantitative analysis of lipids (Benedict's methodetc.).
13. Enzymatic assay ofphosphates.
14. Hydrolysis of starch by anenzyme.

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Learning the principles behind the qualitative estimation ofbiomolecules. CO2: Understanding the principles behind quantitative estimation ofbiomolecules. CO3: Understanding the analysis of the same in the body fluids professionalcareer.

Reference Books

1 Wilson and Walker "Principles and Techniques of Practical Biochemistry" 4 Edn., Cambridge Knew pros 1997.

2 Plummer DT "An Introduction to Practical Biochemistry" III Edn., Tata McGrawhill.

LIST OF EQUIPMENTS

1. UV-VisibleSpectrometry
2. PHmeter
3. Waterbath
4. Centrifuge

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Adhiyamaan College of Engineering (Autonomous)
Hosur - 635130
Krishnagiri (DT), Tamilnadu.

ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department BIOTECHNOLOGY **Programme** B. TECH. - BT **Regulation** 2015

Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
315GET02	ENVIRONMENTAL SCIENCE AND SUSTAINABILITY	3	0	0	3	50	50	100

Prerequisite NIL

Course Objectives

At the end of the course, the students should be able to:

- *The student should be conversant with the evolution of environmentalism and theimportance of environmental studies.*
- *Various natural resources and the current threats to their sustainability*
- *Significance and protection of biodiversity and various forms of environmental*
- *Degradation international conventions*
- *Protocols for the protection of environment and concept of sustainability.*

UNIT I INTRODUCTION TO ENVIRONMENT AND ECOSYSTEM **9**

Definition, scope and importance of environment – need for public awareness. Atmosphere – composition of atmosphere (troposphere, stratosphere, mesosphere and thermosphere) Biosphere – Hydrosphere – Lithosphere. Concept of ecosystem – structure and functions of ecosystem- producers, consumers and decomposers - Energy flow –Ecological succession-Food chains-Food webs- Ecological pyramids-Introduction, types, characteristic features -structures and function of forest, grassland and aquatic ecosystems (ponds and rivers) - Case Studies in current scenario.

UNIT II UNITII NATURAL RESOURCES ANDBIODIVERSITY **9**

Forest resources-Water resources-Mineral resources-Food resources-Energy resources-Land resources. Introduction to biodiversity definition: genetic, species and ecosystem diversity– biogeographically classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threatstobiodiversity:habitatloss,poachingofwildlife,man-wildlifeconflicts– endangeredandendemicspecies of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity

UNIT III ENVIRONMENTAL POLLUTION **9**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marinepollution (e)Noisepollution (f)Thermalpollution (g)Nuclearhazards–solid waste management:

causes

, effects and control measures of municipal solid wastes–role of an individual in prevention of pollution–pollution casestudies – disaster management: floods, earthquake, cyclone and Landslides

UNIT IV SOCIAL ISSUES, HUMAN POPULATON AND THE ENVIRONMENT **9**

Fromunsustainabletosustainabledevelopment–urbanproblemsrelatedtoenergy–water conservation, rainwater harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, casestudies role of non-governmental organization environmental ethics: Issues and possible solutions – climatechange, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. –Wasteland reclamation – consumerism and waste products – environment protection act —environmentallegislation- central and state pollution control boards.

UNIT V CONCEPT OF SUSTAINABLE DEVELOPMENT **9**

Definition of sustainability -Components of sustainability History and emergence of the concept of sustainabledevelopment–Our Common Future-Objectives of Sustainable Development- Millennium Development Goals- Environment and Development linkages – Globalization and environment-Sustainability indicators-Hurdles to Sustainability.

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: To understand & appropriate the structure of ecosystem and its impact on environment.CO2: To understand the various natural resources and boidiversity.

CO3: To recognize the environmental problems caused due to pollution.

CO4: To understand the concept of sustainable development.

CO5: To understand the types of pollution.

Text Books

1 Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

2 Benny Joseph, 'Environmental Science and Engineering', Tata McGraw- Hill,NewDelhi, 2006.

Reference Books

1 R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.

2 Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.

3 Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.

4 Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press 2005.

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Krishnagiri (DT), Tamilnadu.

ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
315BTT03	CELL BIOLOGY	2	1	0	3	50	50	100

Prerequisite NIL

Course Objectives

At the end of the course, the students should be able to:

- *To provide knowledge on the fundamentals of cell biology*
- *To help students understand the signalling mechanisms*
- *To understand how organisms function and the structure and functions of the plasma membraneand the major organelles that occurring prokaryotic and eukaryotic cells.*
- *To understand how cellular organelles work together to carry out life functions.*
- *To protect cells to prevent infection and other harmful effects.*

UNIT I CELL STRUCTURE AND FUNCTION OF THE ORGANELLES 9

Eukaryotic and prokaryotic cells, principles of membrane organization, membrane proteins, cytoskeletalproteins, types of cell division, mitosis & meiosis, extra cellular matrix, cell cycle and molecules that control cell cycle

UNIT II TRANSPORT ACROSS CELL MEMBRANES 9

Passive & active transport, permeases, sodium potassium pump, Ca2+ ATPase pumps, lysosomal and vacuolarmembrane ATPdependentprotonpumps,cotransportsymport,antiport,transportintoprokaryotic cells, endocytosis and exocytosis, Entry of viruses and toxins intocells

UNIT III RECEPTORS AND MODELS OF EXTRA CELLULAR SIGNALLING 9

Cytosolic, nuclear and membrane bound receptors, examples of receptors, autocrine, paracrine and endocrine models of action, Intracellular surface receptors, quantitation and characterisation of receptors

UNIT IV SIGNAL TRANSDUCTION 9

Signal amplification, different models of signal amplifications, cyclic amp, role of inositol phosphates as messengers,biosynthesisofinositoltriphosphates,cyclicGMPandgproteins,roleinsignal transductio n, calcium ion flux and its role in cell signaling, current models of signal amplification, phosphorylation of protein kinases, regulation of protein kinases, serine –threonine kinases, tumor necrosis factor receptor families

UNIT V CELL CULTURE 9

Techniques for the propagation of eukaryotic and prokaryotic cells. Cell lines, generation of cell lines,maintenance of stock cells, characterization of cells, morphological analysis techniques in cell culture,
ex-plant cultures primary cultures, contamination, differentiation, three dimensional cultures, role of matrix in cell
growth.

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: To develop integral knowledge on cell structure, molecular organization and function of cell organelles.

CO2: To learn the cell is the basic unit of life in the entireliving world..

CO3: To Understand the basic knowledge on cell structure and function as well as on the molecular basis of chromatin organization

CO4: Understandcellatstructuralandfunctionallevel.

CO5:Understandthemolecularinteractionbetweencellsabdsignaltransduction,secondarym essengers.

Text Books

1. *"Molecular Cell Biology", Darnell J, Lodish H, Baltimore D W.H.Freeman 6TH Edition 2005.*
2. *"Cell Biology" Kimball T.W., Wesley Publishers, 3rd Edition, 2007.*
3. *"The Cell" Georeffy Cooper, ASM Press, 2nd Edition 2007.*
4. *"Molecular Biology of the Cell", James D.Watson, Wilkins, a Wolters Kluwer Business Publishers 8thEdition,2013.*

Reference Books

1. *"Cell Biology" De Robertis & De Robertis, ASM Press and Sinauer Associates 4th Edition, 2006*
2. "Cell and Molecular Biology" Ajoy paul ,Books and Allied (P) Ltd 2007.
3. "Cell and Molecular Biology " Gerald Karp ,Wiley Publishers, 7th Edition, 2013.
4. *E Books:* https://www.scribd.com/.../Karp-Cell-and-Molecular-Biology-Concepts.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
315BTT04	MICROBIOLOGY	3	0	0	3	50	50	100

Prerequisite NIL

Course Objectives

At the end of the course ,the students should be able to:

- *To introduce structure and functional of Microbiology to emphasize structureand biochemical aspects of various microbes.*
- *To understand the basic principles of microbiology and various aspects*
- *To solve the problems in microbial infection and their control.*
- *To enable students to learn the production process and preservation techniques*
- *Todevelopskillsofthestudentsintheareaofindustrialandenvironmentalmicrobiology*

UNIT I INTRODUCTION **9**

Basicofmicrobialexistence;historyofmicrobiology,classificationandnomenclatureofmicroorganisms, microscopic examination of microorganisms, light and electron microscopy - phase contrast and fluorescencemicroscopy,principlesofdifferentstainingtechniqueslikegramstaining,acidfast,capsular staining, flagellar staining

UNIT II MICROBES-STRUCTURE AND MULTIPLICATION **9**

Structural organization and multiplication of bacteria, viruses, algae and fungi with a special emphasis of lifehistory of actinomycetes, yeast, mycoplasma and bacteriophage. Reproduction of microorganisms-sexual and asexual

UNIT III MICROBIAL NUTRITION, GROWTH AND METABOLISM **9**

Nutritional requirements of bacteria and different types of media used for bacterial culture; growth curve and different methods to quantitate bacterial growth, aerobic and anaerobic bioenergetics and utilization of energy for biosynthesis of important molecules, nutritional types and requirements

UNIT IV CONTROL OF MICROORGANISMS **9**

Physical, chemical and radiation control of microorganisms; Indicators of sterilization & host-microbe interactions; anti-bacterial, anti-fungal and anti-viral agents, mode of action and resistance to antibiotics;clinically important microorganisms, sanitization, disinfection

UNIT V INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY **9**

Primary metabolites; secondary metabolites and their applications; preservation of food; production ofpenicillin, alcohol, vit.b-12; biogas; bioremediation; leaching of ores by microorganisms; bio-fertilizers and bio-pesticides.

Total Hours 45

Course Outcomes	*Upon Completion of this course, students will be able to* *CO1:Students attains knowledge on the principles of Microbiology and biochemical aspects of various microbes* *CO2:Knowledgeonthemicroorganismstructureanditsdifferenttypes,growthandmetabolism CO3:The interactions between contaminants, soil, water and microorganisms and its control CO4:Knowledge on the production process and preservation techniques* *CO5:An ability to conduct experiments, as well as to analyze and interpret data*

Text Books

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

2 Pelzer MJ, Chan ECS and Krein NR, Microbiology, Tata McGraw-Hill Edition, New Delhi, India.1999

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

Reference Books

1 General Microbiology by Powar and Daginawala, Himalaya Publishing House.

2 Micro Biology : Laboratory Theory and applications, M.J. Heboffee aw BE Pierce Morten Publishing House, 2006.

3 Alcamo's Fundamentals of Microbiology9th Edition. *Jeffrey C. Pommerville.* Jones & Bartlett *Publishers*; 2012.

E books

1 *www.bestebooksworld.com/cat/microbiology*

2 http://www.microbiologyinfo.com/top-and-best-microbiology-books/

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
315BTT05	INSTRUMENTAL METHODS OF ANALYSIS	3	0	0	3	50	50	100

Prerequisite Biochemistry

Course Objectives

At the end of the course ,the students should be able to:

- *To have a fundamental knowledge about the Light spectrum, Absoprtion, FluorescenceNMR, Massspectroscopy*
- *To acquire knowledge on the different chromotographic methods for separationof biological products*
- *To gain knowledge on basics of measurement*
- *To acquire knowledge on the different chromatographic methods for separation of biological products and surface microscopy*
- *To gain knowledge about separation of biological products.*

UNIT I BASICS OF MEASUREMENT **9**

Classification of methods – types of noise- calibration of instrumental methods – electrical components and circuits – signal to noise ratio – signal – noise enhancement.

UNIT II OPTICAL METHODS **9**

Generaldesign–sourcesofradiation–wavelengthselectors–samplecontainers–radiationtransducers –typesofopticalinstruments-Calorimeter,Flourimeter,Nephlometry–Fouriertransformmeasurements.

UNIT III MOLECULAR SPECTROSCOPY **9**

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

UNIT IV THERMAL METHODS **9**

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

UNIT V SEPARATION METHODS

Introduction to chromatography – van deemter equation –Thin Layer Chromatography) Paper Chromatography - gas chromatography – stationary phases – detectors – HPLC – pumps – columns – detectors – ion exchange chromatography – size exclusion chromatography – Agarose Electrophroresis, capillary electrophoresis-Adsorption Chromatography.

Total Hours **45**

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Knowledge on separation techniques used for biological products

CO2: Knowledge on different chromatographic methods for separation of biologicalproducts

CO3: Understand principle of surface microscopy and its application

CO4: Acquire knowledge on separation techniques used for biological products

CO5: Acquire knowledge on different chromatographic methods for separationof biological products

Text Books

1 Instrumental Methods of Analysis; Willard & H.Merrit, Phi, 1999 7th Edition CBS Publishers.
2 Instrumental Methods of Analysis, D. Skoog, 2000 5th Edition College Publishers.
3 Instrumental Methods of Chemical Analysis Galen N .Ewing 5th Edition Mc Graw Hill International 2006.

Reference Books

1 Introduction to Instrumental Analysis by Robert D Braun, Pharma Book Syndicate 2005.
2 Instrumental Methods of Chemical Analysis by H Kaur PPM Publishers 1999.
3 Biophysical Chemistry by Upadhyay 4th Edition by Himalaya Publishing House 2007.
4 Electrochemical Methods by Bard Faulkner 2nd Edition Wiley Publishers 2006.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department BIOTECHNOLOGY **Programme** B. TECH. - BT **Regulation** 2015

Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
315BTE01	BASIC INDUSTRIAL BIOTECHNOLOGY	3	0	0	3	50	50	100

Prerequisite Nil

Course Objectives

At the end of the course ,the students should be able to:

- *To make the students aware of the overall lindustrial bioprocess so as to help them to Manipulate the process to the requirement of the industrial needs.*
- *The course prepares the students for the bulk production of commercially important ModernBio products, Industrial Enzymes, Products of plant and animal cell cultures.*
- *To understand the production and purification of industrial enzymes.*
- *To gain knowledge about products of plant, animal and fungal cell cultures.*
- *To understand the production and purification of therapeutic proteins*

UNIT I INTRODUCTION TO INDUSTRIAL BIOPROCESS **9**

A historical overview of industrial fermentation process, Definition and scope of Industrial Biotechnology, Stockculture, A brief survey of organisms, processes. Growth curve of microorganisms (Bacteria), Process flow sheeting – block diagrams, pictorial representation.

UNIT II PRODUCTION OF PRIMARY METABOLITES

A brief outline of processes for the production of some commercially important organic acids(e.g.citric acid,lacticacid,aceticacid);amino acids(glutamicacid,asparticacid)and alcohols(ethanol, butanol)

UNIT III PRODUCTION OF SECONDARY METABOLITES **9**

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

UNIT IV PRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS **9**

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

UNIT V PRODUCTION MODERN BIOTECHNOLOGY PRODUCTS **9**

Production of recombinant proteins and diagnostic applications, production of vaccines. Production of monoclonal antibodies.

Total Hours **45**

Course Outcomes

Upon Completion of this course, students will be able to :

Co1: Understanding of the steps involved in the production ofbioproducts

Co2: Understand the basic biotechnological engineering principles and models to do tasksCo3: Understand the Design and deliver useful modern biotechnology products tothe society

CO4: Understand the bulk production of commercially important modern bioproducts.

CO5:Understand the production and purification of Industrial Enzymes and products of plant

and animal cell cultures.

Text Books

1 Satyanarayana, U. "Biotechnology" Books & Allied (P) Ltd., 2005
2 Kumar, H.D. "A Textbook on Biotechnology" 2nd Edition. Affiliated East West Press Pvt.Ltd.,1998.
3 Balasubramanian, D. *et.al.*, "Concepts in Biotechnology" Universities Press Pvt.Ltd.,2004.
4 Ratledge, Colin and Bjorn Kristiansen "Basic Biotechnology" 2nd Edition Cambridge
5 University Press, 2001.
6 Dubey, R.C. "A Textbook of Biotechnology" S.Chand & Co. Ltd., 2006.

Reference Books

1 Casida, L.E. "Industrial Microbiology", New Age International (P) Ltd, 1968.
2 Presscott, S.C. and Cecil G. Dunn, "Industrial Microbiology", Agrobios (India), 2005.
3 Cruger,Wulf and Anneliese Crueger, "Biotechnology: A Textbook of Industrial Microbiology", 2ndEdition, Panima Publishing, 2000.
4 Moo-Young, Murrey, "Comprehensive Biotechnology", 4 Vols. Pergamon Press, (An Imprint of Elsevier)2004.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
315BTP07	CELL BIOLOGY LABORATORY	0	0	4	2	50	50	100

Prerequisite Nil

Course Objectives

At the end of the course ,the students should be able to:

- *To learn the morphology, identification and propagation of cells*
- *To understand the basic techniques to work with cells*
- *To understanding and perform cell staining techniques*
- *To learn working principles of Microscopy*
- *To understand isolation of plasmids, nucleus or other organelles and cell division*

LIST OF EXPERIMENTS

1. Introduction to principles of sterile techniques and cell propagation.
2. Identification of plant, animal and bacterial cells and their components by microscopy.
3. Grams Staining.
4. Leishman Staining.
5. Determination of cell mobility- Hanging Drop method
6. Giemsa Staining.
7. Lactophenol Cotton Blue Staining
8. Osmosis and Tonicity.
9. Simple Staining.
10. Negative Staining
11. Staining for different stages of mitosis in *Allium Cepa*(Onion).

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to get :

CO 1 To learn the basic skills in light microscopy, cell fractionation, and spectroscopy.
CO 2 To be able to perform light microscopy techniques, to isolate plastids, nucleus orotherorganelles and celldivision.
CO 3 To be able to identify the various stages of mitosis. CO 4 To understand the basic techniques to work with cellsCO5To understandandperform cellstainingtechniques

Text Books

1. "Laboratory Investigations in Cell and Molecular Biology", Allen Bregman Wiley publishers, 4th Edition, 2001.

2. "General Microbiology" Powar and Daginawala, Himalaya Publishing House, *8th edition* 2012.

3. *"Cell Biology: A Laboratory Handbook Volume", Julio E. Celis,Tony HunterElsevier Academic Press, 3rd Edition, 2006.*

Reference Books

1 "Cell Biology: A Laboratory Handbook: 004", Julio E. Celis , Academic Pr; 2 edition, 3rdEdition, 2005.

2 "Laboratory Exercises and Techniques in Cellular Biology", Anthony Contento, Wiley Publishers, 1st Edition 2012

3 "Laboratory Methods in Cell Biology" S.Jha Academic Press, 1st Edition, 2012.

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Krishnagiri (DT), Tamilnadu.

ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
315BTP08	MICROBIOLOGY LABORATORY	0	0	4	2	50	50	100

Prerequisite Nil

Course Objectives

At the end of the course ,the students should be able to:

- *The course aims to develop the skills of students in different arreas of microbiology*
- *To demonstrate various techniques to learn the morphology, identificationand propagation of microbes*
- *To solve the problems in microbial infection and their control*
- *To enable students learn the basic structure, growth and metabolism of microorganisms*
- *To demonstrate various techniques on effect of physical factors*

LIST OF EXPERIMENTS

1. Laboratory safety and sterilization techniques-Dry heat sterilization (Autoclave, hot air oven)
2. Microscopic methods in the identification of microorganisms
3. Preparation of culture media – nutrient broth and nutrient agar
4. culturing of microorganisms – in broth and in plates (pour plates, streak plates, spread plates isolation and preservation of bacterial cultures)
5. Staining techniques – Grams' and differential, lactophenol cotton blue
6. Quantification of microorganisms-serial dilution and plating
7. Effect of disinfectants on microbial flora
8. Isolation of microorganisms from different sources – soil, water and milk
9. Antibiotic sensitivity assay
10. Growth curve – observation and growth characteristics of bacteria.
11. Effect of different parameters on bacterial growth (pH, temperature, and substrate concentration)

Total Hours 45

Upon Completion of this course, students will be able to get :

Course Outcomes

CO1:Understand the advanced technical information pertaining to laboratory bio-safety and preventive measures from pathogenic microorganism.
CO2:Know the various aseptic techniques and sterilization methods
CO3: Understand the interactions between contaminants, soil, waterand microorganisms and its control
CO4:Gain knowledge on the microorganism structure and its different types, growth and metabolism
CO5:Developtheskillstoworkonseveralimportanttechniquesforthestudyofmicroorganismsin the laboratory

Reference Books

1 Microbiology: Laboratory Theory and applications, M.J. Heboffee aw BE Pierce Morten Publishing House, 2006.

2 Laboratory Investigations in Cell and Molecular Biology, Allen Bregman Wiley.

3 General Microbiology. Powar and Daginawala, Himalaya Publishing House. 2nd Ed. 2011.

4 *Microbiology: Laboratory Theory and Application 4th Edition. by Michael J. Leboffeand Burton E. Pierce; Ring-bound;* Publisher *2015*

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester III

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
315BTP09	INSTRUMENTAL METHODS OF ANALYSIS LABORATORY	0	0	4	2	50	50	100

Prerequisite Nil

Course Objectives

At the end of the course ,the students should be able to:

- *To gain knowledge on the basis of measurements and instruments.*
- *To have a practical hands on experience on absorption spectroscopic methods.*
- *To gain knowledge about separation of biological products.*
- *To acquire experience in the purification by performing chromatography.*
- *To validate and analyze using spectrometric and microscopic techniques.*

LIST OF EXPERIMENTS

1. Ultraviolet and visible spectrometry Instrumentation
2. Determination of maximum wave length of $KMnO_4$
3. Finding the maximum wave length of Fe (1,10 phenanthroline)3 using UV spectrometry.
4. Absorption spectrum of plant pigments.
5. UV spectra of nucleic acids.
6. Estimation of SO_4 - by Nephelometer.
7. Estimation of Al^{3+} by flourimetry.
8. Separation and Identification of amino acids using paper chromatography.
9. Separation and Identification of amino acids using TLC.
10. Chromatography analysis using gel chromatography.
11. Determination of maximum wave length for copper sulphate

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to get :

CO1: Understand calibration of instruments;

CO2:Acquireknowledgeonseparationtechniques used for biological products;

CO3: Understand and apply optical methods;

CO4:Acquireknowledgeondifferentchromatographicmethodsforseparationofbiologicalproduct

CO5: Acquire knowledge of purification by chromatography.

Reference Books

1 Textbook of Quantitative Inorganic Analysis, AI Vogal, ELBS edition 1987.

2 A Biologist guide to principles and techniques of practical biochemistry keith Wilson,Kenneth HGouicing 3rd ed.ELBS Series.

3	Hobert H WillardD.L.Merrit$J.R.J.A Publisers$Distributors1992.	Dean instrumental methods Analysis, CBS

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department BIOTECHNOLOGY **Programme** B. TECH. - BT **Regulation** 2015

Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
415PST01	PROBABILITY AND STATISTICS	3	1	0	4	50	50	100

Prerequisite Engineering mathematics-I,II &III

Course Objectives

At the end of the course ,the students should be able to:

- *To impart the knowledge of basic probabilistic theory.*
- *To learn one dimensional discrete and continuous probability distributions occurring innatural phenomena*
- *To extend the probability theory to two dimensional random variable and to study thestatistical measures.*
- *To introduce the notion of sampling distributions and have acquired knowledge ofstatistical techniques useful in making rational decision in management problems.*
- *To expose to statistical methods designed to contribute to the process of makingscientific judgments in the face of uncertainty and variation.*

UNIT I PROBABILITY AND RANDOM VARIABLE **9+3**

Axioms of probability - Conditional probability - Total probability – Baye's theorem- Random variable - Probability mass function - Probability density function - Properties - Moments - Moment generating functionsand their properties

UNIT II PROBABILITY DISTRIBUTIONS **9+3**

Binomial, Poisson, Geometric, Uniform, Exponential, and Normal distributions and their properties - Functions of a random variable-simple applications

UNIT III TWO-DIMENSIONAL RANDOM VARIABLES **9+3**

Joint distributions – Marginal and Conditional distributions – Covariance – Correlation and Linear regression –
Central limit theorem (Statement and applications only for independent and identicallydistributed random variables)0

UNIT IV TESTING OF HYPOTHESIS **9+3**

Sampling distributions - Tests for single mean, Proportion, Difference of means (large and small samples)
– Tests for single variance and equality of variances – Chi-square test for goodness of fit –Independence of attributes.

UNIT V DESIGN OF EXPERIMENTS **9+3**

Analysis of variance – One way classification – CRD - Two – way classification – RBD - Latin square -

control charts for measurements ($\bar{x}$ and R charts

Total Hours **45+15**

Course Outcomes

Upon Completion of this course, students will be able to :

CO 1: Imbibing the knowledge of basicprobability improves the quality of interpretationand decisionmakingin real time problems of uncertainity.

CO 2: Understanding the real time application of probabilitydistributions.

CO 3: Learning the concept of two dimensional random variables helps to understand andanalyse the statistical measures which describe an outcome of a random experiment.

CO 4: Drawing inference & decision making through hypothesis testing.

CO 5: learning the statistical methods designed to contribute to the process of making scientificjudgments in the face of uncertainty and variation

Text Books

1 Ibe, O.C.,"Fundamentals of Applied Probability and Random Processes", Elsevier, U.P., 1st Indian Reprint, 2007.

2 Gupta.S.C.,& Kapoor,V.K., "Fundamentals of mathematical statistics", 11th edition, SultanChand & Sons publishers, New Delhi, 2013.

Reference Books

1 Miller and Freund., "Probability and Statistics for Engineers", Pearson Education, Asia, 7th edition, 2012.

2 Spiegel, M.R, Schiller, J and Alu Srinivasan, R, "Schaum's Outlines Probability and Statistics", Tata McGraw-Hill Publishing Company Ltd. New Delhi , 2010.

3 Veerarajan.T., "Probability, Statistics and Random Processes", Tata McGraw-Hill publishing companyLimited, New Delhi, 2014.

4 Kandasamy.P,Thilagavathy,K.,&Gunavathi.K., "Probability, Statistics and Queueing Theory"., S.Chand& Company Ltd., New Delhi, 2014.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department BIOTECHNOLOGY **Programme** B. TECH. - BT **Regulation** 2015

Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
415BTT02	MOLECULAR BIOLOGY	3	0	0	3	50	50	100

Prerequisite Cell biology, microbiology

Course Objectives

At the end of the course ,the students should be able to:

- *Study the structural and functional organization of nucleic acids.*
- *Learn molecular tools for studying activity of genes.*
- *Learn the structure and properties of biomolecules and their functions.*
- *Understand the genetics of prokaryotes and eukaryotes.*
- *Acquire basic fundamental knowledge and explore skills in molecular biology and become aware of the complexity and harmony of cells.*

UNIT I CHEMISTRY OF NUCLEIC ACIDS 9

Introductiontonucleicacids:Nucleicacidsasgeneticmaterial,Structureandphysicochemicalproperties of elements in DNA and RNA, Biological significance of differences in DNA and RNA. Primary structure of DNA:Chemical and structural qualities of 3',5'-Phosphodiester bond. Secondary Structure of DNA: Watson & Crick model, Chargaff's rule, Tertiary structure of DNA:DNA supercoiling. Reversible denaturation and hyperchromiceffect.

UNIT II DNA REPLICATION & REPAIR 9

OverviewofCentraldogma.Organizationofprokaryoticand eukaryoticchromosomes.DNAreplication: Meselson & Stahl experiment, bi–directional DNA replication, Okazaki fragments, Proteomics of DNA replication, Fidelity of DNA replication, Inhibitors of DNA replication, Overview of differences in prokaryotic andeukaryoticDNAreplication,Telomerereplicationineukaryotes.D-loopandrollingcirclemodeofreplication.

Mutagens, DNA mutations and their mechanism, varioustypes of repair mechanisms.

UNIT III TRANSCRIPTION 9

Structure and function of mRNA, rRNA and tRNA. Characteristics of promoter and enhancer sequences. RNA synthesis: Initiation, elongation and termination of RNA synthesis, Proteins of RNA synthesis, Fidelity of RNA synthesis, Inhibitors of transcription, Differences in prokaryotic and eukaryotic transcription. Basic concepts in RNA world: Ribozymes, RNA processing: 5'-Capping,Splicing-

Alternative splicing, Poly 'A' tail addition and basemodification.

UNIT IV TRANSLATION 9

Introduction to Genetic code: Elucidation of genetic code, Codon degeneracy, Wobble hypothesis and its importance, Prokaryotic and eukaryotic ribosomes. Steps in translation: Initiation, Elongation and termination of protein synthesis. Inhibitors of protein synthesis. Posttranslational modifications and its

Importance

UNIT V REGULATION OF GENE EXPRESSION 9

Organization of genes in prokaryotic and eukaryotic chromosomes, Hierarchical levels of gene regulation,

Prokaryoticgeneregulation–

*lac*and*trp*operon,Regulationofgeneexpressionwithreference to λphage lifecycle

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO 1: The background and scope of molecular biology, Genetics and gene therapy. CO 2: Theinformationgainedwillhelpthestudentstounderstandthebeneficialroleofcell molecularlevel.

CO 3: After successful completion of this subject the students will get an overall view aboutgenetic makeup of organisms and can take up a career inresearch.

CO4:Understandmetabolicregulation andintermediatecompounds;

CO 5:Understand gene organization and mechanisms of control of the gene andexpressionin various organisms

Text Books

1 Phundan Singh, "Principles of Genetics", Kalyani Publishers, 2012.

2 David Freifelder, "Molecular Biology", 4th revised Jones & Bartlett Publisher. 2005.

3 Dr. P.K. Gupta, "Molecular Biology and Genetic Engineering"; 2nd Reprint. Rastogi Publications, 2011.

Reference Books

1 Dr. P. K. Gupta, "A Text Book of Cell & Molecular Biology" 4th Revised Edition, Rastogi Publications, 2015.

2 Robert Brooker, "Genetics: Analysis and Principles" 5th Edition, Publishing Pennsylvania Plazapublisher, 2014,

3 Dr. P.S. Vermaand V K Agarwal, "Genetics", S. Chand publishing, 2010.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
415BTT03	STOICHIOMETRIC AND PROCESS CALCULATIONS	3	1	0	4	50	50	100

Prerequisite Engineering mathematics III, Microbiology, Cell Biology

Course Objectives

At the end of the course ,the students should be able to:

- *To learn the basic principles of process calculations;*
- *To understand the calculations of mass flow rate in different processes employed in bio-chemical industries;*
- *Topredicttheenergyconsumptionandenergyefficiencyinchemicalprocessingindustries;*
- *To develop skills in the area of chemical engineering wit the mphasis on fluid mechanics*
- *To study the techniques and skills underlying fluid flow measurement.*

UNIT I BASIC PRINCIPLES OF MATERIALBALANCES AND ENERGY BALANCES **9+3**

Importance of material balance and energy balance in process industry-Dimensions, Units,Conversion factors and their uses; applied mathematics for experimental curve fitting; numerical differentiation; *Numerical Integration*

UNIT II MATERIAL BALANCES **9+3**

Overall and component balances; material balances without chemical reaction; material balances withchemical reactions-stoichiometric coefficient;degrees of freedom; recycle ratio calculations, purge ratio calculations; humidity calculations

UNIT III ENERGY BALANCES **9+3**

Overall and component balances; Calculation of heat capacity, specific heat capacity; partial pressure-calculations; Latent heats- calculations, energy balances- calculations. Sensible heat calculations; vapour pressure-calculations

UNIT IV FLUID MECHANICS **9+3**

Fluid – properties – compressible, incompressible fluids, Newtonian and Non Newtonian Fluids, Fluid statics for compressible & incompressible fluids- applications in chemical engineering, Fluid pressure dropcalculations. Pressure measuring devices.

UNIT V FLOW THROUGH PACKINGS AND FLUIDZATION **9+3**

FlowMeasurement-OrificeMeter,Venturimeter,Pitottube;Flowinpackedcolumns,flowinfluidizationcolumns, settlingphenomena-sedimentation,centrifugalpumps,*centripetalpumps*andpistonpumps-characteristics, working and its applications

Total Hours 45+15

Upon Completion of this course, students will be able to :

Course Outcomes

CO 1: Knowledge of mathematics, science, and engineering

CO 2: Design and conduct experiments, as well as to analyze and interpret data

CO 3: Designasystem,component,orprocesstomeetdesiredneedswithinrealisticconstraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability

CO4: Applytheirknowledgeindescribingthephysicalpropertiesoffluidandcalculatingthe pressure distribution for incompressible fluids and

CO5: Designasystem,component,or process to meet desired needs with in realistic constraints such aseconomic, manufacturability, and sustainability.

Text Books

1 McCabe, W.L., J.C. Smith and P.Harriot "Unit Operations of Chemical Engineering", 6th Edition,Mc Graw Hill, *2014.*

2 Bhatt, B.I. and S.M. Vora "Stoichiometry (SI Units)", 3rd Edition, Tata McGraw-Hill, *2014.*

3 K.A.Gavhane , "Introduction to process calculations" ,22 nd edition, Nirali Prakashan 2012

Reference Books

1 Himmelblau, D.M. "Basic principles and calculations in Chemical Engineering", 8thEdition,PHI,2013.

2 Geankoplis, C.J. "Transport Processes and Separation process Principles", 7th Edition, PHI,2012.

3 Foust, A.S. etal., " Principles of Unit Operations", 2nd Edition, John Wiley & Sons, *2014.*

4 Narayanan, K.V. and Lakshmi Kutty "Stoichiometry and Process Calculations",PHI, 2006.

5 Coulson, J.M. and etal. "Coulson & Richardson's Chemical Engineering", 7th Edition, Vol. I & II,Butterworth – Heinman (an imprint of Elsevier), 2011.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department BIOTECHNOLOGY **Programme** B. TECH. - BT **Regulation** 2015

Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
415BTT04	FUNDAMENTALS OF UNIT OPERATIONS	3	0	0	3	50	50	100

Prerequisite Basic Industrial Biotechnology, Microbiology

Course Objectives

At the end of the course ,the students should be able to:

- *To understand about dimensional analysis and empirical methods governing the transport ofmomentum (fluid flow) in chemical and biotechnology engineering systems;*
- *To analyze the scale-up of equipments for the production of biochemical products;*
- *To assimilate the basic concepts of solid-liquids preparation gained in earlier courses;*
- *To predict various modes of heat transfer and exchange operations in transportation of fluids*
- *To understand the techniques of unit operations involved in designing a heat transfer in bioprocess equipment applications.*

UNIT I MIXING AND AGITATION 9

Dimensional analysis- Rayleigh and Buckingham's method; principles of agitation, impellers, flow patterns: power consumption and power correlationin Newtonian liquids. Blending and mixing, agitator selectionand scale up

UNIT II BASICS OF FILTRATION 9

Theory of filtration and equations; constant pressure, constant volume, constant rate filtration, discontinuous filter, continuous vacuum filter: rotary drum filters, centrifugal filter: batch centrifuges

UNIT III MECHANISM OF HEAT TRANSFER 9

Introduction to modes of heat transfer, Fourier's law of heat conduction, thermal conductivity, steady state conduction; compound resistances in series, extended surfaces; combined conductionandConvection

UNIT IV CONVECTION HEAT TRANSFER 9

Convection-Forced and natural convection, heat flux, individual heat transfer coefficients, overall heat transfercoefficients and fouling factors, application of dimensional analysis for convection,heat transfer through boiling and condensation in pipes

UNIT V HEAT EXCHANGERS 9

Heat exchange equipment; counter current and parallel-current flows, LMTD correction factor, heat exchangers: single-pass 1-1 exchanger, 1-2 parallel-counter flow exchanger, 2-4 exchanger, multipass exchanger,enthalpy balances, and condensers- shell-tube condensers

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO 1: To be familiar about dimensional analysis and empirical methods governing thetransportof momentum (fluid flow) in chemical engineering systems.

CO 2: Ability to improve the knowledge in techniques of agitation, mixing of liquids,filtration operations and sedimentation separation.

CO 3: To understand modes of heat transferring techniques during extraction, distillation, evaporation

CO4Evaluate effects of process variables while scaling up the bioprocess equipment

CO5Comprehend the important mechanical aspects while designing bioprocess equipment.

Text Books

1 McCabe W.L., Smith J.C. Unit Operations in Chemical Engineering.7th Edition. Mcgrawhill2014.

2 Dutta B.K, "Heat: Principles & applications", PHI publication 2000.

3 Gavahne.K.A., Unit Operations-I Fluid flow & mechanical separations, Nirali prakasan,2011.

4 Gavahne.K.A., Unit Operations-II Heat & Mass Transfer,Nirali prakasan,25th edition,2012.

Reference Books

1 Geankoplis C.J. Transport Processes and Unit Operations.4thedition,Prentice Hall India.2003.

2 Coulson J.M., Richardson J.F., Backhurst J.R. and Harker J.M., "Coulson & Richardson's Chemical Engineering", 6th Edition,Vol. I& II, Butterworth – Heinman (an imprint of Elsevier), 2004.

3 Donald Q. Kern, "*Process Heat Transfer*", Tata McGraw Hill Book Co., New Delhi, 1997.

4 Foust, A.S. "Principles of Unit Operations", 2nd Edition, John Wiley & Sons, 1999.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
415BTT05	ENZYME TECHNOLOGY	3	0	0	3	50	50	100

Prerequisite Biochemistry, Cell Biology

Course Objectives

At the end of the course ,the students should be able to:

- *To provide knowledge and application of working principles and their mechanism of action onenzymes;*
- *To learn theoretical and practical aspects of kinetics;*
- *To improve knowledge in the area of immobilization techniques;*
- *To learn enzyme reactions and their characteristics along with the production- and purification process*
- *To understand about the principles of Biosensors.*

UNIT I INTRODUCTION TO ENZYMES **9**

Classification of enzymes. Mechanisms of enzyme action- Lock and key and Induced fit model,; concept of active site, specificity of enzyme action; Enzyme units; principles of catalysis – collision theory, transition statetheory; role of entropy in catalysis

UNIT II KINETICS OF ENZYME ACTION **9**

Kinetics of single substrate reactions; Michelis – Menten equations, signification of Michelis – Menten equations,The lineweaver-burk plot, Eadie-hofstee and hanes plots: turnover number; types of inhibition

– Competitive, uncompetitive and uncompetitive inhibition; Allosteric regulation of enzymes; Monod , wyman

model; pH and temperature effect on enzymes ; Deactivation kinetics.

UNIT III ENZYME IMMOBILIZATION **9**

Physical and chemical techniques for enzyme immobilization – adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding etc., - examples, advantages and disadvantages of enzymeimmobilization, overview of applications of immobilized enzyme systems

UNIT IV PURIFICATION AND CHARACTERIZATION OF ENZYMES FROM NATURAL SOURCES **9**

Production and purification of crude enzyme extracts from plant, animal and microbial sources; methods

of characterization of enzymes; development of enzymatic assays

UNIT V ENZYME BIOSENSORS **9**

Enzyme biosensors; Definition and Main component of biosensor, Advantages and disadvantages of enzyme biosensors, Example of an Enzyme biosensor- Electrochemical Biosensor, Blood Glucose Biosensor,Applications of biosensors in industry, healthcare and environment

Total Hours 45

Upon Completion of this course, students will be able to :

Course Outcomes

CO 1: Knowledge on enzyme and enzyme reactions will be key step towards variousconcepts in biotechnology

CO 2: Ideas on processing, production and purification of enzymes at an industrialscale

CO 3: Theoretical and practical aspects of kinetics will provide the importance towards theresults

CO4: Implement ideas on processing, production and

- *purification ofenzymes on a nindustrial scale and*

CO5: Design and novel biosensor products with better quality and wide commercialapplication.

Text Books

1 Harvey W. Blanch, Douglas S. Clark, "Biochemical Engineering", Marcel Dekker, .2006

2 James M. Lee, "Biochemical Engineering", PHI, USA.2001

3 Nicholas C.Price and Lewis Stevens, "Fundamentals of Enzymology",Oxforduniversity pres s1999

4 Trevor Palmer "Enzymes: Biochemistry, Biotechnology and Clinical Chemistry" Horwood,2001

Reference Books

1 James. E. Bailey & David F. Ollis, "Biochemical Engineering Fundamentals", McGraw- Hill.2001

2 Wiseman, "Enzyme Biotechnology", Ellis Horwood Pub.2003

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
415BTE01	ENVIRONMENTAL BIOTECHNOLOGY	3	0	0	3	50	50	100

Prerequisite Environmental Science and Sustainability, Microbiology

Course Objectives

At the end of the course ,the students should be able to:

- *To understand the fundamentals of biotechnological concepts;*
- *To develop the skills in the are of environmental biotechnology and its pre-requisite(s)for PGstudies in Biotechnology;*
- *To know the conversion of waste into energy using microorganisms;*
- *To understand about the eco-friendly bioproducts from renewable sources and*
- *To improve the skills in the area of wastewater treatment technology.*

UNIT I BIOGEOCHEMICAL ROLE OF SOIL MIC ROORGANISMS **9**

Microbial flora of soil – Interactions among soil microorganisms – Nitrogen cycle – Carboncycle – Sulfur cycle – Phosphorous cycle

UNIT II BIODEGRADATION **9**

Aerobic degradation of recalcitrant organic compounds by microorganisms – Growth associated degradation of aliphatic – Diversity of aromatic compounds – Co-metabolic degradation of organopollutants – Degradative capacities of fungi.Anaerobic degradation of organic compounds – Degradation of hydrocarbons – Alkyl compounds – ketones – Aromatic compounds – Halogenated organics – Sulfonates –Nitroorganics.

UNIT III BIOREMEDIATION TECHNOLOGIES **9**

Remediation technologies – Bioventing – Biosparging and bioslurping – Phytoremediation, Biodesulphurization of coal and oil – Microbial transformation of heavy metals –Bioleaching, bioaccumulation –Biosorption and bioprecipitation of heavy metals

UNIT IV ECO-FRIENDLY BIOPRODUCTS FROM RENEWABLE SOURCES **9**

Fundamentals of composting process – Composting technologies – Composting systems –Compost quality – Biofertilizers – Biopesticides – Scientific aspects and prospects of biofuelproduction – Bioethanol –Biohydrogen and biodiesel

UNIT V BIOLOGICAL TREATMENT OF WASTEWATER **9**

Biological processes for wastewater treatment – Physico-chemical characteristics of wastewater– Activatedsludge process – Trickling filter – Rotating biological contactors – Fluidized bed reactor –

Upflow anaerobic sludge blanket reactor (UASB) – High-rate anaerobic wastewatertreatment – Comparisonbetween aerobic and anaerobic processes

Total Hours **45**

Course Outcomes *Upon Completion of this course, students will be able to :*

CO 1: Development and improvement in standard ofliving
CO 2: Understand the dynamic process integrated themes related to biodiversityandwaste management
CO 3: Envisionthesurroundingenvironmentitsfunctionwithtechnology
CO4:Understandthestructureandbiochemicalaspectsofvariousmicrobesand
CO5:Acquirekknowledgeabouttherenewableformsofenergyanditsfeaturesofbiomassand itsutilization

Text Books

1 Jordening, H.J. and Winter, J., "Environmental Biotechnology: Concepts andApplication", Wiley-VCH Verlag, 2005.

2 Evans, G.M. and Furlong, J.C., "Environmental Biotechnology: Theory andApplication", JohnWiley and Sons, 2003.

3 Bhattacharya, B.C. and Banerjee, R., "Environmental Biotechnology", OxfordUniversity Press,2007.

Reference Books

1 Pelczar, M.J., Chan, E.C.S. and Krieg, N.R., "Microbiology", Tata McGraw-Hill, 2005.

2 . Rittmann, B.E. and McCarty, P.L., "Environmental Biotechnology: Principles and Applications",McGraw-Hill, 2001.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department BIOTECHNOLOGY **Programme** B. TECH. - BT **Regulation** 2015

Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
415BTP07	MOLECULAR BIOLOGY LABORATORY	0	0	4	2	50	50	100

Prerequisite Cell biology and microbiology Lab

Course Objectives

At the end of the course ,the students should be able to:

- *Gain knowledge on the basis of measurements and instruments used in MolecularBiology;*
- *Provide hands-on experience in performing basic molecular biology techniques;*
- *Understand the theory behind each technique and to describe common applications of each methodology in biological research;*
- *Gain knowledge about separation of biological products;*
- *Take up specialized projects in Molecular biology which is a pre-requisite for research work*

List of experiments

1. Preparationofreagents,handlingequipmentsandlabsafetyinmolecularbiologylab
2. Agarose gelelectrophoresis
3. Isolation of genomic DNA-Plant Cells
4. Isolation of genomic DNA-Yeast Cells
5. Quantification of DNA using UVspectrophotometer
6. Transformation forrecombinants
7. Isolation of bacterial plasmid DNA
8. Competent cellspreparation
9. Southernblotting
10. Westernblotting

List of equipments needed

- Electrophoresis Kit
- Polymerase chain Research(PCR)
- Incubators
- MicroCentrifuge
- LightMicroscopes
- IncubatorShaker
- Spectrophotometer
- Laminar FlowChamber

Others: Glassware, Chemicals, Media

Course Outcomes

Upon Completion of this course, students will be able to get :

CO 1: Demonstrate knowledge and understanding techniques in molecularbiology

CO 2: Use genetic and biotechnological techniques to manipulate geneticmaterials and develops new and improved living organisms

CO 3: Present advanced knowledge in the specialized fields of molecular and Genetics

CO 4: Demonstrate the ability to carry out laboratory experiments and interpret the results;

CO5: Understandand be aware of hazardous chemicals and safety precautions incase of an emergency.

Reference Books

1 Michael P. Weiner "Genetic Variation: A Laboratory Manual" RainDance Technologies, 2007.

2 Robert Schleif "Genetics and Molecular Biology" 2nd Edition. The Johns Hopkins University Press.1993.

3 Carson, Susan, "Molecular Biology Techniques" 3rd Edition, Elsevier. 2012.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester IV

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
415BTP08	ENZYME TECHNOLOGY LABORATORY	0	0	4	2	50	50	100

Prerequisite Biochemistry

Course Objectives

At the end of the course ,the students should be able to:

- *To study about various parameters affecting the natural properties of enzymes.*
- *To provide hands on experience in enzyme production and purification techniques.*
- *Provide hands-on experience in performing enzyme production and purification techniques.*
- *To understand the students on enzyme characterization and immobilization methods.*
- *Introduce students to the theory behind in each technique and to describe common applications of each methodology in biological research. This will facilitate the students to takeup specialized project in enzyme production and purification will be a pre-*
  Requisite for research work..

LIST OF EXPERIMENTS

1. Determination of activities of industrial enzymes.
2. Estimation of Vmax andKm.
3. Effect of pH on enzyme activity.
4. Effect of temperature on enzyme activity
5. Effect of substrate concentration on enzyme activity
6. Determination of stability of enzyme activity.
7. Production of microbial enzymes
8. Partial purification of enzymes
9. Characterization of enzymes
10. Immobilization techniques such as adsorption, entrapment and encapsulation.
11. Immobilization of yeast cells as biocatalyst for the production of ethanol from sugar.
12. Assaying of alkaline phosphatase activity

TOTAL PERIODS: 45

Upon Completion of this course, students will be able to get :

Course Outcomes

CO 1: Demonstrate the activity of enzyme with various factorsCO 2: Learnt the various process of enzyme immobilization CO 3: Awareness about various kinetic studies on enzymes
CO4Demonstratetheabilitytocarryoutlaboratoryexperimentsandinterprettheresults.
CO5 Explain about Enzyme kinetics and characterization and how to use them for

Reference Books

1 1. Practical Enzymology, 2nd Edition , By Hans Bisswange , Wiley-VCH Verlag GmbH & Co. KGaA, 2012.

2 2. Practical Biochemistry for Colleges by E. J. Wood, 1st Edition, Elsevier,1989.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015
		Semester IV			

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
415BTP09	CHEMICAL ENGINEERING LABORATORY	0	0	4	2	50	50	100

Prerequisite Nil

Course Objectives

At the end of the course ,the students should be able to:

- *To provide basic understanding of chemical engineering principles*
- *Course will enable the students to apply the principles in other chemicalengineering and biotechnology subjects offered in higher semesters*
- *To provide basic understanding of chemical engineering preparations*
- *To gain knowledge related to distillation*
- *To provide the overview about the heat exchanger*

LIST OF EXPERIMENTS

1. Flow measurement – a) Orifice meter b) Venturimeter
2. Pressure drop in flow through packed column
3. Pressure drop in pipes
4. Filtration – Vacuum leaf filter
5. Filtration – Plate and Frame filter press
6. Heat transfer characteristics in heat exchanger
7. Horizontal Condenser
8. Simple distillation
9. Steam distillation
10. HETP in packed column
11. Liquid-liquid equilibria in extraction
12. Adsorption equilibrium
13. Drying Characteristics in Tray Dryer

TOTAL PERIODS: 45

Course Outcomes

Upon Completion of this course, students will be able to get :

CO 1: Ability to apply the skill of unit process of chemical engineering andbiotechnology.

CO 2: Ability to analyse the principles of chemical engineering and its application on biological perspectives.

CO 3: Design and working principles of fluid moving machinery and transport phenomenon.CO 4: gained knowledge related to distillation

CO 5: Learned the overview about the heat exchanger

Reference Books

1 Geankoplis C.J. Transport Processes and Unit Operations. 4rd Edition, Prentice Hall India,2003.

1. McCabe

2 W.L.,SmithJ.C.UnitOperationsInChemicalEngineering.7thEditionMcgrawhill, 2014..

3 Dutta.B.K , Principles of Mass Transfer Separation processes, Prentice Hall India, 2000

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
515BTT01	IMMUNOLOGY	3	0	0	3	50	50	100

Prerequisite Microbiology

Course Objectives

At the end of the course ,the students should be able to:

- *To discuss the structure, functions and integration of immune system.*
- *To mechanisms involved in immune system development and responsiveness*
- *To explain various techniques of monoclonal and engineered antibodies*
- *To understand of activation of system of a complement. Receptors. Negative immuneregulation.*
- *To explain the antigen-antibody interactions and how the immune system isprotecting the body from foreign pathogens.*

UNIT I Introduction **9**

Cells and tissues of immune system; hematopoiesis; innate and acquired immunity; types of immune responses;antigens: chemical and molecular nature; haptens; adjuvants. Immunization and vaccines, Immunotechniques

UNIT II Humoral Response **12**

Development, maturation, activation and differentiation of B cells: Clonal purification theory; Structure andfunctions of antibodies: Genes and generation of diversity; Hybridoma technology for production of monoclonal antibodies- Antibody engineering, Kinetics of antibody response

UNIT III Cellular Response **10**

Development, maturation, activation and differentiation of T cells; and CMI (Cell mediate immunity), TCR;

Clonal Anergy; Antigen presenting cells: Macrophage, langerhan's cells and B cells- Antigen processing and presentation; Classes of MHC; MHC/HLA genetic loci; HLA alleles and diseases

UNIT IV Immunity to Infection and Hypersensitivity Reactions **7**

Immune response to infections: viruses, bacteria, fungi and parasites; Cytokines; Complement systems; Hypersensitivity and their types.

UNIT V Immunology of Transplantation, Autoimmunity And Tumor **7**

Transplantation: types of graft; mechanism of graft rejection; HVG and GVH rejection; immunologicalstrategies to prevent graft rejection; *Autoimmune diseases and their mechanism*Tumor immunity.

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to get :

CO1: Awareness of immune system structure and function

CO2: Awareness of immunity to various pathogens

CO3: Awareness of cellular and molecular aspects of lymphocyte activation, homeostasisdifferentiation, and memory.

CO4: Awareness of molecular basis of complex, cellular processes involved ininflammation and immunity, in states of health and disease

CO5: Awareness of tumour allergy and hypersensitivity reactions

Text Books

1 Ashim K. Chakravarthy," Immunology", Tata McGraw- Hill, 2010

2 Richard A Goldsby, Thomas J Kindt, Barbara A Osborne and Janis Kuby. "Immunology" 5th Edition, W.H. Freeman & Co., 2005

3 Benjamin E. and Leskowitz S. Immunology A short Course, Wiley Liss NY, 2010

4 William E. Paul "Fundamental Immunology", 7th edition, Library of congress cataloguing inpublications, 2013

Danny Altmann "Immunology", 12 th edition, British Society of Immunology, 2017.

5

Reference Books

1 Roitt I Male, Brostoff. "Immunology", Mosby Publ., 2017

2 Janeway,Travers, Walport and Shlomichik,(2001),"Immunobiology",Garland Publ.,2011

3 Ian R. Tizard." Immunology- An Introduction" 4th Edition. Thomson Publ., 2013

4 Andrew H. Lichtman,Shiv Pilla,Abul K. Abbas, Cellular & Molecular Immunology, 7th edition, south AsiaPublication, 2011

5 Dr.S.K.Gupta, "Essentials of Immunology", 2nd edition, Arya Publications, 2010.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
515BTT02	GENETIC ENGINEERING	3	0	0	3	50	50	100

Prerequisite Molecular Biology

Course Objectives

At the end of the course ,the students should be able to:

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

UNIT I BASICS OF RECOMBINANT DNA TECHNOLOGY 9

Introduction of recombinant DNA into host cells, manipulation of DNA – Restriction and modification enzymes, Design of linkers and adaptors; Characteristics of cloning and vectors; prokaryotic and eukaryotic host systems.

UNIT II POLYMERASE CHAIN REACTION TECHNIQUES 9

Principle of polymerase chain reaction (PCR) - Components of PCR reaction and optimization of PCR - Gene specific primer and degenerate primer – Inverse PCR, Hot-start PCR, Loop mediated PCR -, Reversetranscription PCR and Real time PCR.

UNIT III PROTEIN TECHNIQUES 9

Electrophoresis of protein – native and denaturing conditions, capillary and gel electrophoresis, 2D gel electrophoresis, Enzyme-linked immunosorbent assay, yeast hybrid system – one hybrid system – two hybrid system, phage display.

UNIT IV TESTING OF GENETIC HYPOTHESIS 9

Probability in the prediction of progeny distributions using Binomial distribution, Genetic hypothesis, Chi-squaremethod, Genetic analysis of quantitative traits using Statistics (Mean, Variance, Standard deviation, Correlation, Regression), Heritability is useful in predicting the phenotypes of offspring.

UNIT V TRANSGENIC TECHNOLOGY 9

Principles of Transgene Technology. Scope of Transgenetic Technology. Gene tagging (T-DNA tagging andTransposon tagging) in gene analysis (identification and isolation of gene), Transgenic and Gene Knockouts Technologies-Targeted gene replacement, Chromosome engineering.

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO:1. Understand the basics of biotechnology

CO:2 Understand the value of and the processes involved with the polymerase chainreaction (PCR).

CO:3 Understand the concept of recombinant DNA technology or genetic engineeringCO:4 Analyze a research problem and step-by-step instructions for conducting experiments or testing hypothesis

CO:5 Explain the general principles of generating transgenic plants, animals and Genetically modified organisms.

Text Books

1 Klug, Cummings and Spencer. "Concepts of Genetics" published Pearson, 2016.

2 Daniel L. Hartl, Maryellen Ruvolo. "Genetics: Analysis of Genes and Genomes" 8th Edition, PublishedLaxmi (Pvt. Ltd). 2011.

Reference Books

1 Gardner,Simmonsand Snustad. "Principles of Genetics" 8th Edition, Published, Wiley.2006

2 Benjamin A. Pierce. "Genetics: A Conceptual Approach" 4th Edition, Published, W H Freeman &Co. 2010.

3 Scott F. Gilbertand Susan R. Singer. "Developmental Biology (Developmental Biology DevelopmentalBiology)"9th Edition, Published, Sinauer Associates, 2010.

4 Robert J. Brooke, "Genetics: Analysis and Principles" 4th Edition, McGraw-Hill Higher Education, 2012.

5 Smita Rastogiand Neelam Pathak. "Genetic Engineering (Oxford Higher Education)" 1st Edition, OxfordUniversity Press, 2009.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
515BTT03	BIOPROCESS ENGINEERING I	3	0	0	3	50	50	100

Prerequisite Microbiology, Basic Industrial Biotechnology

Course Objectives

At the end of the course ,the students should be able to:

- *To study the historical development of bio process technology, design of fermenter andtypes of fermentation process*
- *To gain knowledge about formulation, optimization of medium and principles of sterilization*
- *To inculcate the stoichiometry and energetics of cell growth and product formation*
- *To evaluate the kinetics and mechanism of microbial growth*
- *To gain knowledge related to the processing of fermentor*

UNIT I OVERVIEW OF FERMENTATION PROCESSES **9**

Introduction to bioprocessing: Historical development of Bioprocess technologies, General requirements of fermentation processes, Basic design and construction of fermenters and ancillaries, Main parameters to be monitored and controlled in fermentation processes. Solid-state fermentation and its applications.

UNIT II RAW MATERIALS AND MEDIA DESIGN FOR FERMENTATION PROCESS **9**

Criteria for good medium, medium requirements for fermentation processes, carbon, nitrogen, minerals, vitamins and other complex nutrients, oxygen requirements, Medium Formulation: Types of media – media design and usage of various commercial media for industrial fermentations, Medium optimization.

UNIT III STERILIZATION KINETICS **8**

Thermaldeathkineticsofmicroorganisms,Batchandcontinuousheatsterilizationofliquidmedia,Filter sterilization ofliquid media, Air sterilization and design of sterilizationequipment.

UNIT IV METABOLIC STOICHIOMETRY AND ENERGETICS **10**

Stoichiometry of cell growth and product formation: Elemental balances, degrees of reduction of substrate and biomass, available electron balances, yield coefficients of biomass and product formation, maintenance coefficients. Energetic analysis of microbial growth and product formation: Oxygen consumption and heat evolution in aerobic cultures, Thermodynamic efficiency of growth.

UNIT V KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION **10**

PhasesofCellgrowthinbatchcultures,Simpleunstructuredkineticmodelsformicrobialgrowth,growthof filamentousorganisms, product formation kinetics – Leudeking - Piret models, substrate andproduct inhibition on cell growth and product formation.

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to :

CO1:Develop skills of the students in the area of bioprocess technology with the emphasis andbioprocess principles

CO 2:Discuss and distinguish the medium requirements and optimization methodsCO 3:Explain the sterilization kinetics of medium and equipments

CO 4:Learn about fermentation processes, metabolic stoichiometry, energetics, kinetics of microbialgrowth etc

CO 5:Understand the kinetics of microbial growth that plays a vital role in the fermentation process

Text Books

1 Pauline. M. Doran, "Bioprocess Engineering Principles", Academic press, 2012.

2 Stanbury. P. F, Whitaker. A and Hall. S. J, "Principles of Fermentation Technology", 2nd Edition,Butterworth– Heinemann, 1995.

Reference Books

1 Najafpour. G. D, "Biochemical Engineering and Biotechnology", Elsevier, 2007.

2 Shuler. M. L and Kargi. F, "Bioprocess Engineering: Basic Concepts" 2nd Edition, Pearson, 2002.

3 Bailey. J. E and Ollis. D. F, "Biochemical Engineering Fundamentals", 2nd Edition, McGraw-Hill,2010.

4 Blanch. H. W and Clark. D. S, "Biochemical Engineering". Marcel & Dekker, Inc., 2007.

5 Rao. D. G, "Introduction to Biochemical engineering"", 2nd Edition, McGraw-Hill, 2010.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR- 635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester V

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
515BTT04	Fundamentals of Mass Transfer	3	1	0	4	50	50	100

Prerequisite Fundamentals of Unit Operations

Course Objectives

At the end of the course ,the students should be able to:

- *Explain the basic principles of mass transfer operations and other separationprocesses with examples.*
- *Impart knowledge on how certain substances undergo the physical change withdiffusion/mass transfer of components from one phase to other phases.*
- *Focus on absorption and distillation operations and the process design aspects ofthe same operations.*
- *Understand extraction and leaching operations and their applications inbioprocessing industry.*
- *Understand adsorption and drying operations and the process design aspects ofthe same operations.*

UNIT I DIFFUSION AND MASS TRANSFER 9+3

Diffusion: Molecular diffusion, Fick's law of diffusion, steady state molecular diffusion in gases and liquid one component transferring to non diffusing component and equimolar diffusivity estimation, Inter phase Mass Transfer; Mass Transfer coefficients, Concept of overall mass transfer coefficient for liquids and gases, diffusivity measurement and prediction.

UNIT II GAS LIQUID OPERATIONS 9+3

Principles of gas absorption; Single component absorption in single and multistage operation; selection criteria forsolvents, material balance, minimum gas-liquid ratio, Design principles of packed absorbers-HETP, HTU and NTU concepts, Industrial absorbers.

UNIT III VAPOUR LIQUID OPERATIONS 9+3

V-L Equilibria, P-x-y and T-x-y diagrams, relative volatility, Raoult's law; Ideal behavior of fluids, types ofDistillation-Simple,SteamandFlashDistillation;Continuousdistillation;Designcalculations-McCabe–Thiele method,Conceptofminimum,totalandoptimumrefluxratio,deviations from ideality - Extractive distillation and Azeotropic distillation.

UNIT IV EXTRACTION OPERATIONS 9+3

Liquid- liquid extraction: distribution coefficient, ternary systems and triangular diagrams, solvent selection criteria for extraction, single stage and multistage extraction – immiscible system, extraction equipments. Solid- liquid equilibria, Leaching Principles, constant underflow staged processes - Single stage leaching, multistage counter current leaching, Leaching equipments – Batch and continuoustypes.

UNIT V SOLID FLUID OPERATIONS 9+3

Types of adsorption, Nature of adsorbents, Langmuir and Freundlich isotherm, calculation of staged processes, adsorption equipments – Batch and fixed bed adsorption; Drying - Mechanism, Drying curves-Time of Drying calculation; Batch and continuous drying equipments.

Total Hours 60

Course Outcomes

Upon Completion of this course, students will be able to :

CO1:definethebasicprinciplesofmasstransferoperationsandthemeasurementofdiffusivity, masstransfer coefficient;

CO2:understandtheimportanceofmasstransferphenomenainthedesignofprocessequipment in distillation operations;

CO 3: understand the HETP, NTU and HTU concepts of various gas absorption packed towercolumns;

CO 4: understand the design aspects of extraction and various leaching equipments and

CO 5:understand the importance of adsorption and drying processes and their industrial applications.

Text Books

1 Geankoplis C J. "Transport process and separation process principles", 4th edition, Prentice Hall ofIndia. 2003

2 Anantharaman N. and Meera Sheriffa Begum K.M. "Mass Transfer - Theory and Practice", New Delhi: PHI Learning Private Limited. 2011

3 Treybal R.E. Mass Transfer Operations.3rd edition. McGraw-Hill, 1981.

Reference Books

1 Warren L.Mc Cabe, Julian C.Smith, Peter Harriot. "Unit Operations of Chemical Engineering", 7thedition, New Delhi: McGraw Hill. 2012

2 Ghosal, S. K., Sanyal S. K. & Datta S.. "Introduction to Chemical Engineering", New Delhi: Tata McGraw Hill. 2006

3 Benitez J, Principles and modern applications of Mass Transfer Operation, Wiley, 2009.

4 Coulson and Richardson, *"Chemical Engineering"*. Vol I & II, New Delhi:Asian Books Pvt Ltd, 1998.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	**BIOTECHNOLOGY**	**Programme**	**B. TECH. - BT**			**Regulation**		**2015**
		Semester V						
	CHEMICAL	**Hours/Week**			**Credit**	**Maximum Marks**		
515BTT05	**THERMODYNAMICS AND BIOTHERMODYNAMICS**	**L**	**T**	**P**	**C**	**CA**	**EA**	**Total**
		3	**0**	**0**	**3**	**50**	**50**	**100**

Prerequisite Stoichiometry and process calculations

Course Objectives

At the end of the course the students should able to

- *To study about the ideal and non-ideal behavior properties of fluids*
- *To understand about the determination of solution on thermodynamic properties*
- *To deal thermodynamic properties of fluids on its equilibrium in phase change*
- *To deal thermodynamic properties of fluids on its chemical reaction under equilibriumcondition*
- *To analyse the energy in process on behavior with its properties*

UNIT I THERMODYNAMIC PROPERTIES OF FLUIDS **9**

Basics concepts in thermodynamics, Volumetric properties of fluids exhibiting non ideal behaviour; residual properties; estimation of thermodynamic properties using equations of state; calculations involving actualproperty exchanges; Gibbs Helmhotz Equation, Maxwell's relations and applications.

UNIT II SOLUTION THERMODYNAMICS **9**

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

UNIT III PHASE EQUILIBRIA **9**

Criteria for phase equilibria; v-l-e calculations for binary and multi component systems; Bubble point, Dew point Calculation, liquid-liquid equilibria and solid-solid equilibria.

UNIT IV CHEMICAL REACTION EQUILIBRIA **9**

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

UNIT V THERMODYNAMIC ANALYSIS OF PROCESSES **9**

Concept of lost work; entropy generation; calculation of real irreversible processes; power cycle; liquefaction, Carnot Cycle, Biothermodynamics.

Total Hours **45**

Course Outcomes

Upon completion of this course, students will be able to

CO:1 Knowledge on ideal and non-ideal behaviour in thermodynamics on properties offluids

CO:2 Knowledge on solutions thermodynamics to determine the properties in the processes.

CO:3 Description of properties criteria in order to maintain the phase change coexistin equilibrium

CO:4Description of properties criteria in order to maintain the chemical

reactionscoexist in equilibrium

CO: 5 Knowledge on energy utilization and to interpret thermodynamic properties data in thebio processing operations.

Text Books

1 Narayanan K.V. A Text Book Of Chemical Engineering Thermodynamics. Prentice Hall India,Eighth Edition 2013.

2 Smith J.M., Van Ness H.C., Abbot M.M. Chemical Engineering Thermodynamics. 6th Edition.McGraw-Hill, 2005

Reference Books

1 Sandler S.I. Chemical and Engineering Thermodynamics. John Wiley, 3 edition 1998.

2 B.G.Kyle,"Chemical process thermodynamics",2nd Edn., Prectice Hall of India Pvt.Ltd.,New Delhi 2000.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015
		Semester V			

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
515BTP07	IMMUNOLOGY LABORATORY	0	0	4	2	50	50	100

Prerequisite Microbiology, cell biology lab

Course Objectives

At the end of the course ,the students should be able to:

- *To state the principle of the routine immunologic procedures performed in theclinical laboratory.*
- *To describe the immunologic responses involved in preventing andcombating infections.*
- *To understand the role of antibodies in the immune response*
- *To understand the molecular specificity of antibodies for specificantigens*
- *To simulate the spread of an infectious disease and determine it'ssource with an ELISA assay*

LIST OF EXPERIMENTS

1. Handling of animals, immunization and raising antisera
2. Identification of Blood cells
3. Differential count of white blood cells
4. Blood grouping (ABO & Rh factor)
5. Widal Test (Slide & Tube Test)
6. Ouchterlony doubles immune diffusion technique (ODD)
7. Radial immune diffusion (RID)*(mancini method)*
8. Immunoelectrophoresis
9. Isolation of monocytes from blood
10. Isolation of peripheral blood mononuclear cells Identification of T cells by T cell resetting using sheep RBC.
11. Enzyme Linked Immuno Sorbent Assay
12. Western Blotting

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to get :

CO 1: Awareness of basic and state-of-the-art experimental methods and technologies CO2: Awareness to develop an ability to summarize, integrate and organize informationand relate it to disease outcomes

CO3: Awareness to evaluate the potential for current research and new discoveries toimprove our understanding of immunology and its relevance to human health and to our society.

CO4: Awareness to use medical case reports, identify "disease defects" and definemolecular or cellular targets for therapeutic intervention:

CO5: Awareness to understand basic mechanisms and preventive therapeutic implications

Text Books

1. Ashim K. Chakravarthy," Immunology", Tata McGraw- Hill, 2010
2. Richard A Goldsby, Thomas J Kindt, Barbara A Osborne and Janis Kuby. "Immunology" 5th Edition, W.H. Freeman & Co., 2005
3. Benjamin E. and Leskowitz S. "Immunology A short Course", Wiley Liss NY, 2010
4. Mark Peakman and Leonie Taams, "Clinical & Experimental Immunology", 12th edition, British Societyfor Immunology, 2017.
5. Frank C. Hay,Olwyn M. R. Westwood"Practical Immunology", 4th Edition Wiley BlackwellPublications, 2010

Reference Books

1 Talwar, G.P and Gupta, S.K. 2004" A Handbook of practical and immunology", CBS Publishers & Distributors.

2 Janeway,Travers, Walport and Shlomichik,(2001),"Immunobiology",Garland Publ.,2011

3 Ian R. Tizard." Immunology- An Introduction. 4th Edition". Thomson Publ., 2013

4 J Ochei and A.Kolhatlkar "Medical Laboratory Science Theory and Practice" by PPM Publishers. 1999.

5 Barbara Detrick, Robert G. Hamilton, John L. Schmitz "Manual of Molecular and Clinical LaboratoryImmunology", 8th edition ASM Press, 2016

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	**BIOTECHNOLOGY**	**Programme**	**B. TECH. - BT**			**Regulation**	**2015**
		Semester V					
Course Code	**Course Name**	**Hours/Week**			**Credit**	**Maximum Marks**	
		L	**T**	**P**	**C**	**CA**	**EA**	**Total**
515BTP08	**GENETIC ENGINEERING LABORATORY**	**0**	**0**	**4**	**2**	**50**	**50**	**100**

Prerequisite Molecular biology lab

Course Objectives

At the end of the course ,the students should be able to:

- *To illustrate creative use of modern tools and techniques for manipulation andanalysis of genomic sequences.*
- *To expose students to application of recombinant DNA technology inbiotechnological research.*
- *To understand research methodologies employing genetic engineeringtechniques.*
- *To understand the principles of PCR and their uses in genetic engineering.*
- *To understand the principles of blotting*

LIST OF EXPERIMENTS

1.	Isolation of plasmid DNA	
2.	Restriction enzyme digestion	
3.	Purification of digested DNA- Gel Elution	
4.	Preparation of competent cells	
5.	Transformation and screening in *E. coli*	
6	β-galactosidase assay	
7.	DNA cloning	
8.	PCR	
9.	DNA finger printing	
10.	SDS-PAGE	
11.	Western blotting	
12.	Southern blotting	
	Total Hours	**45**

Course Outcomes

Upon Completion of this course, students will be able to :

CO1: Technical know-how on versatile techniques in recombinant DNA technology.*CO2: An ability to design and conduct experiments, as well as to analyze and interpretdata*

CO3: Apply of genetic engineering techniques in basic and applied experimentalbiology.

CO4: Develop proficiency in designing and conducting experiments involving geneticmanipulation.

CO5:An ability to use the techniques, skills, and modern engineering tools necessary forengineering practice.

Text Books

Isil Aksan Kurnaz, "Techniques in Genetic Engineering" Published, CRC Press, 2015

David Micklos "Genome science a practical and conceptual introduction to molecular genetic analysis in eukaryotes" 1st Edition, Published, Cold Spring. 2013
Rolf H. J. Schlegel, "Rye: Genetics, Breeding, and Cultivation" Published, CRC Press. 2013
T A Brown "Introduction to Genetics: A Molecular Approach" Published, Garland Science. 2011.
Setlow, Jane K. "Genetic Engineering- Principles and Methods" Published, Plenum. 2003

Reference Books

1 Isil Aksan Kurnaz, "Techniques in Genetic Engineering" Published, CRC Press. 2015.
2 DR. P.S. VERMA and V K Agarwal. "Genetic Engineering" Publishded, S. Chand Publishing. 2009.
3 Utpal Roy and Vishal Saxena. "A Handbook of Genetic Engineering" 47th, Edition, Published, Kalyani. 2007.
4 Vennisonand S John. "Laboratory Manual for Genetic Engineering" published, Prentice Hall India Learning Private Limited. 2009.
5 C.C. GiriandArchana Giri. "Plant Biotechnology: Practical Manual" Published, I K International Publishing House Pvt. Ltd. 2007

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	**BIOTECHNOLOGY**	**Programme**	**B. TECH. - BT**				**Regulation**		**2015**
		Semester V							
	BIOPROCESS ENGINEERING	**Hours/Week**			**Credit**	**Maximum Marks**			
515BTP09	**LABORATORY - I**	**L**	**T**	**P**	**C**	**CA**	**EA**	**Total**	
		0	**0**	**4**	**2**	**50**	**50**	**100**	

Prerequisite **Bioprocess principles theory**

Course Objectives

At the end of the course the students should able

- *To develop basic experimental skills for preparing medium and sterilization.*
- *To provide practical understanding of effect on parameters on cell growth*
- *To provide training on upstream processes technology*
- *To provide knowledge on preparation and utilization offer mentor*
- *To provide knowledge on production primary and secondary metabolite.*

LIST OF EXPERIMENTS

1. Preparation of bioreactor, utilizes for bioreactor
2. Medium preparation and sterilization
3. Effect of temperature on cell growth
4. Effect of pH on cell growth
5. Monod kinetics
6. Growth of bacteria-Estimation of biomass, calculations of specific growth rate, yield coefficient
7. Growth of Yeast-Estimation of biomass, calculations of specific growth rate, yield coefficient
8. Effect of substrate inhibition on cell growth
9. Production of primary metabolites
10. Production of secondary metabolites
11. Medium optimization-Plackett burmandesign
12. Medium optimization-Response surface methodology
13. Single cell protein (SCP) production by continuous culture

TOTAL HOURS 45

Course Outcomes

Upon completion of this course, students will be able to have

CO:1 Knowledge on preparation of medium and sterilization in upstream processesCO:2 Knowledge on optimization of cell growth

CO:3 Exposure to upstream processes and preparation before the fermentation

CO:4 Knowledge on preparation and utility of bioreactor

CO:5 Knowledge on production of metabolites in lab scale fermentor

Text Books

1 S. Kulandaivelu and S. Janarthanan,"Practical Manual on Fermentation Technology" IK International publishling house, NewDelhi ,2012

2 Palvannan T, Shanmugam S, Satish Kumar T,"Laboratory Manual On Biochemistry, Bioprocess & Microbiology", Scitech Publications (India) Pvt Lt ,2006

Reference Books

1 Sarfaraz K. Niazi, Justin L. Brown," Fundamentals of Modern Bioprocessing"CRC Press, 2015

2 Pauline Doran, "Bioprocess Engineering Calculation", Blackwell Scientific Publications, 1998.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
615BTT01	BIOINFORMATICS	3	0	0	3	50	50	100

Prerequisite Basics of computing and C programming

Course Objectives

At the end of the course ,the students should be able to:

- *To develop interdisciplinary skills in the applications of computers in biotechnology.*
- *To navigate through internet-based biological databases and genomic browsers*
- *To let the students know the recent evolution in biological science.*
- *To develop the knowledge related to phylogenetic tree*
- *To gain knowledge related to tools used in bioinformatics*

UNIT I INTRODUCTION **9**

Introduction to Bioinformatics – applications, Operating systems- types, Elementary UNIX commands,TCP/IP, Telnet, FTP, Protocols, Hardwares, Network topology, Search engines.

UNIT II BIOLOGICAL DATABASES **9**

Introduction to databases – Data life cycle Biological databases; Primary nucleotide databases (EMBL, GeneBankand DDBJ); Primary protein databases (SwissProt) Secondary protein databases (PROSITE); Structural databases – SCOP and CATH. Sequence retrieval from database

UNIT III PATTERN MATCHING AND DYNAMIC PROGRAMMING **9**

Introduction to pairwise sequence alignment – local vs. global; Dynamic programming – Needleman – Wunsch algorithm & Smith – Waterman algorithm; Dot matrix analysis; substitution matrices,BLAST – FASTA-
– Statistical methods – Hidden Markovmodels.

UNIT IV PHYLOGENY **9**

Introduction to multiple sequence alignment, Introduction; mutations; mutations as a measure of time;PhylogeneticanalysisDistance matrix methods, character based methods.Molecular clock theory, Bootstrapping.

UNIT V ADVANCED TOPICS IN BIOINFORMATICS **9**

Introduction to Systems Biology and Synthetic Biology, Microarray analysis - types andapplications, Bioinformatics approaches for drug discovery.

Total Hours 45

Upon Completion of this course, students will be able to get :

Course Outcomes

CO1: Develop bioinformatics tools with programming skills.
CO2: Apply computational based solutions for biological perspectives
.CO3: Pursue higher education in this field.
CO4: Practice life-long learning of applied biological science.
CO5: Developed the knowledge related to phylogenetic tree

Text Books

1 Lesk, A. K., "Introduction to Bioinformatics" 4th Edition, Oxford University Press, 2013

2 Dan Gusfield, "Algorithms on Strings, Trees and Sequences: Computer Science andComputationalBiology" Cambridge University Press, 1997.

3 Durbin, R., Eddy, S., Krogh, A., and Mitchison, G., "Biological Sequence AnalysisProbabilisticModels of proteins and nucleic acids" Cambridge, UK: CambridgeUniversity Press, 1998.

4 Mount, D.W., "Bioinformatics Sequence and Genome Analysis" 2nd Edition, Cold SpringHarborLaboratory Press, 2004

5 Bergeron.B. Bioinformatics Computing, 2nd Edition, Prentice Hall of India Learning Pvt (Ltd), India,(2009).

Reference Books

1 Attwood, T.K and ParrySmith.D.J. Introduction to Bioinformatics, 1st Edition, Pearson EducationAsia, India, (2002).

2 Uri Alon, An Introduction to Systems Biology: Design Principles of Biological Circuits,Chapman&Hall, 2006.

3 Andreas D. Baxevanis, B. F. Francis Ouellette: Bioinformatics: A Practical Guide to the AnalysisofGenes and Proteins, Volume 39, John Wiley, 1998

4 Baldi, P. and Brunak, S., "Bioinformatics: The Machine Learning Approach" 2nd Edition,MITPress, 2001.

5 J. Pevsner, Bioinformatics and Functional Genomics, 2nd Edn.,Wiley-Blackwell, 2009.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
615BTT02	CHEMICAL REACTION ENGINEERING	3	1	0	4	50	50	100

Prerequisite Stoichiometric and process calculations

Course Objectives

At the end of the course ,the students should be able to:

- *To impart the basic concepts in reaction kinetics*
- *To provide the information about different reactor systems and deriving the performance equations for different reactor systems.*
- *To develop knowledge for design of ideal reactors and RTD studies*
- *To acquire knowledge in heterogeneous reactions and reactor types.*
- *To gain knowledge related to various types of reactor*

UNIT I SCOPE OF CHEMICAL KINETICS & CHEMICAL REACTION ENGINEERING **9+3**

Introduction to Chemical kinetics; rate equation, rate constant, elementary and non- elementary reactions; concentration and temperature dependence; development of rate equations for different homogeneous reactions,
Search for reaction mechanism; Interpretation of batch reactor data-Integral and differentialmethod of analysis (constant volume batch reactor).

UNIT II IDEAL REACTORS **9+3**

Isothermal batch, flow, semi-batch reactors; performance equations for single reactors - batch, plug flowand mixed flow reactors; space time and space velocity; multiple reactor systems; multiple
reactions.

UNIT III IDEAL FLOW AND NON IDEAL FLOW **9+3**

Basics of non ideal flow; RTD function and measurement, RTD in plug flow and mixed flow reactor, relationamong E, F and C curve, conversion in non ideal flow, non-ideal flow models- tank in series and dispersion models; reactor performance with non-ideal flow.

UNIT IV UNIT IV GAS-SOLID, GAS-LIQUID REACTIONS **9+3**

Resistances and rate equations; heterogeneous catalysis; reactions steps; selection of a model, unreactedcore models for spherical particles - progressive conversion model and shrinking core model , determination of rate controlling step.

UNIT V FIXED BED AND FLUID BED REACTORS **9+3**

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

Total Hours 60

Course Outcomes

Upon Completion of this course, students will be able to get :CO1: Write the rate equation for any type of chemical reaction.

CO 2: Relate and calculate theconversions,concentrations and rates in a reaction and identify, formulate and solve chemical engineering problems.

CO 3: Design reactors for heterogeneous reactions and optimize operating conditions.

CO 4 understood the concept of RTD

CO 5 gained knowledge about the reaction catalysis

Text Books

1 Levenspiel O. Chemical Reaction Engineering. 3rd Edition. John Wiley.1999.

2 Fogler H.S. Elements of Chemical Reaction Engineering. Prentice Hall India.2002

3 Mark E.Davis and Robert J.Davis, Fundamentals of Chemical Reaction Engineering, McGraw-Hill HigherEducation; 1st edition 2002

Reference Books

1 MissenR.W.,MimsC.A.,SavilleB.A.IntroductiontoChemicalReactionEngineeringandKinetics. JohnWiley.1999

2 Dawande, S.D., "Principles of Reaction Engineering", I st Edition, Central Techno Publications, 2001.

3 Richardson, J.F. and Peacock, D.G., "Coulson Richardson - Chemical Engineering", Vol.III, III rdEdition, Butterworth- Heinemann- Elsevier, 2006.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
615BTT03	BIOPROCESS ENGINEERING-II	3	1	0	4	50	50	100

Prerequisite Bioprocess Engineering – I and Fundamentals of Mass Transfer

Course Objectives

At the end of the course ,the students should be able to:

- *To impart the basic of different operational modes of bioreactors*
- *Todevelopknowledgefordesignaspectsofbioreactorscaleupforvarioussystems*
- *Toacquireknowledgeinrectorconsiderationforenzymesystemsandmodel ingand simulation of bioprocess.*
- *To develop knowledge in recombinant cultivation systems.*
- *To gain knowledge about the scale up process*

UNIT I OPERATIONAL MODES OF BIOREACTORS **9+3**

Fed batch cultivation, Cell recycle cultivation, Cell recycle cultivation in waste water treatment, twostage cultivation Packed bed reactor, airlift reactor, fluidized bed reactor bubble column reactors.

UNIT II BIOREACTOR SCALE – UP **9+3**

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

UNIT III BIOREACTOR CONSIDERATION IN ENZYME SYSTEMS **9+3**

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

UNIT IV MODELLING AND SIMULATION OF BIOPROCESSES **9+3**

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

UNIT V RECOMBINANT CELL CULTIVATION **9+3**

Different host vector system for recombinant cell cultivation strategies and advantages. E.coli, yeast *Pichiapastoris/ Saccharomyces cereviseae*, Animal cell cultivation, plant cell cultivation, Insect cell cultivation. High cell density cultivation, process strategies, reactor considerations in the above system

Total Hours 45+15

Course Outcomes

Upon Completion of this course, students will be able to get :CO1: Analyze various operational modes of bioreactor systems

CO 2: Capability to design bioreactor system for various industrial applications.

CO 3: Understand and modeling different bioreactor systems with advanced modeling concepts.

CO 4: Demonstrate recombinant cultivation of various plant, animal and systems for industrial applications.

CO 5 understood the concept of cultivation technologies

Text Books

1 James E. Bailey & David F. Ollis, "Biochemical Engineering Fundamentals", McGraw-Hill 2000

2 Anton Moser, "Bioprocess Technology", Kinetics and Reactors", Springer Verlag.1999

3 Shuler and Kargi, "Bioprocess Engineering ", Prentice Hall, 1992.

Reference Books

1 James M. Lee, "Biochemical Engineering", PHI, USA 2002.

2 Pauline Doran, "Bioprocess Engineering Calculation", Blackwell Scientific Publications 1998.

3 Harvey W. Blanch, Douglas S. Clark, "Biochemical Engineering", Marcel Decker Inc 2001.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
615BTT05	PLANT BIOTECHNOLOGY	3	0	0	3	50	50	100

Prerequisite Molecular Biology

Course Objectives

At the end of the course ,the students should be able to:

- *Tointroducestudentstotheprinciples,practicesandapplicationofplanttissueculture*
- *Learn about the transformationinscience,agricultureandindustry.*
- *Toacquaintstudentswithexperimentaldesignandanalysisofplant biotechnology experiments.*
- *Togivestudentshandsonexperienceandtraininginrepresentativeplanttissueculture and geneticengineering techniques.*
- *To give student wide knowledge related to practical aspects of gene transfer*

UNIT I INTRODUCTION TO PLANT BIOTECHNOLOGY: AN OVERVIEW **9**

History of plant Biotechnology, Scope and significance of Plant Biotechnology, Plant Tissue Culture as atechnique to produce novel plants and hybrids, Different types of tissue culture medium and their constituents. Plant growth hormones.

UNIT II PLANT CELL AND TISSUE CULTURE **9**

Types of cell culture: culture of single cells, cell and organ differentiation. Stages of micropropagation. Choice of plant species for micropropagation, production of virus free plants:protoplast isolation, micropropagation work inIndia

UNIT III GENE TRANSFER TO NUCLEAR GENOME **9**

Time line for utilization of gene transfer technology (event). Target cells for transformation: vector for genetransfer technology. Ti and Ri plasmids of *Agrobacterium*. Gene transfer methods: Agro-infection and gene transfer, physical delivery method.

UNIT IV PLANT BIOTECHNOLOGY FOR AGRICULTURAL PRACTICES **9**

Biopesticides and Bioinsecticides, Integrated pest management. A total system or ecological approach of IPM. Present status and future needs for making biopesticides and IPR popular. Biofertilizers and integratednutrients management.

UNIT V PLANT BIOTECHNOLOGY FOR ENVIRONMENT **9**

Environment, bioenergy and biofuels, bioremediation, types of biodiversity and their applications, plantbiotechnology: reasons of concern for loss of biodiversity, plant biotechnology and climate change

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to get :

CO1: acquaint with principles, technical requirement, scientific and commercial applications inPlantBiotechnology,

CO 2: support methodologies in plant tissue/cell culture toplantimprovement,aswellas DNA handling with PCR-based detection diagnostic tools,

CO 3: becomemotivatedtosetgoalstowardspursuinggraduateschoolandhigherlevel positions,such as la manager and keyscientistinplantbiotechnological research institutes and industries.

CO 4 acuquired knowledge relted to tissue culture

CO5 gained knowledge about the gene transfer

Text Books

1 Slater A, NW Scott, MR Fowler. Plant Biotechnology, 2nd ed. Oxford University Press, 2008.

2 Hopkins, W. Gand Huner, N.P.A. Introduction to Plant Physiology. 3rded.John Wiley&Sons Inc.New York, 2004.

3 Balasubramanian,Bryce,Dharmalingam,Green,Kunthalajayaraman.ConceptsinBiotechnology,revisededition. Universities Press,2007.

4 Karvita B Ahluwalia. Genetics. New age international Pvt. Ltd. Publishers. New Delhi. 2002.

Reference Books

1 Bhojwani and Bhatnagar. Embryology of Angiosperms, vikar Publishing House Pvt. Ltd, New Delhi. 1981.

2 Sharpiro. Mobil Genetic Elements, Academic press, New York. 1983.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015
		Semester VI			

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
615BTP07	BIOPROCESS ENGINEERING LABORATORY -II	0	0	4	2	50	50	100

Prerequisite Bioprocess Engineering lab–I

Course Objectives

At the end of the course ,the students should be able to:

- *To impart practical knowledge in sterilization and preparation for bioreactor*
- *To develop practical knowledge of bioreactor operations in lab scale*
- *To develop knowledge in mass transfer rate in bioreactor*
- *To develop practical knowledge of reactor*
- *To learn about the RTD process*

1. Batch sterilization kinetics
2. Batch cultivation with exhaust gasanalysis
3. Estimation of KLa- Dynamic gassing out method
4. Estimation of KLa- Sulphite oxidation method
5. Estimation of KLa-Power correlation method
6. Fed batch cultivation kinetics
7. Algal cultivation
8. Residence time distribution-CSTR
9. Residence time distribution-PFR
10. Estimation of overall Heat transfer coefficient
11. Estimation of mixing time in reactor

Course Outcomes

Upon Completion of this course, students will be able to

get CO1:

Analyzevariousoperationalmodesofbioreactorsystems

CO 2: Capabilitytohandlebioreactorsystemforvariousindustrialapplications.

CO 3: Abilitytoinvestigate,designandconductexperimentsonbioprocessengineering problems

CO 4: ability to investigate about the RTD process

CO 5 understood the concept of various reactor

Text Books

1 James E. Bailey & David F. Ollis, "Biochemical Engineering Fundamentals", McGraw-Hill 2000

2 Anton Moser, "Bioprocess Technology", Kinetics and Reactors", Springer Verlag.1999

Reference Books

1 James M. Lee, "Biochemical Engineering", PHI, USA 2002.

2 Pauline Doran, "Bioprocess Engineering Calculation", Blackwell Scientific Publications 1998.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department BIOTECHNOLOGY **Programme** B. TECH. - BT **Regulation** 2015

Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
615BTP08	PLANT BIOTECHNOLOGY LABORATORY	0	0	3	2	50	50	100

Prerequisite Molecular Biology

Course Objectives

At the end of the course ,the students should be able to:

- *To introduce students to the principles, practices and application of plant tissue culture andtransformation in science, agriculture and industry.*
- *To acquaint students with experimental design and analysis of plant biotechnologyexperiments.*
- *Togivestudentshands-onexperienceandtraininginrepresentativeplanttissue culture and genetic engineering techniques.*
- *To introduce the concept of culture techniques*
- *To gives handson experience related to embryogenesis*

1. Introduction to plant tissue culture
2. Preparation of Tissue culture medium (Murashige andskoog)
3. Effect of Plant growth regulator of various explants for callus induction and cell suspensionculture
4. *In vitro* seeds germination
5. Micropropagation of *Moringaolifera* or*concanensis* plant by leaf disc culture
6. Organogenesis and somatic embryogenesis
7. Artificial seed preparation
8. Shoot tip and nodal sector culture
9. Callus culture
10. Meristem Culture for Virus-FreePlants
11. *Agrobacterium tumefaciens*-mediated plant transformation

Course Outcomes

Upon Completion of this course, students will be able to get :

CO1: Understandingofthetheoreticalbackgroundknowledgeinplantsciencesneededforan understandingofplantbiotechnology.

CO2: Workingknowledgeoflaboratorytechniquesusedinplantbiotechnology.

CO 3: Acapacitytoundertakeresearchinplantbiotechnology.

CO 4 introduced the concept of culture techniques

CO 5 gaine the knowledge and experience related to embryogenesis

Text Books

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2015

Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
615BTP09	TECHNICAL SEMINAR	0	0	2	1	50	50	100

Prerequisite Microbiology, Biochemistry, Molecular biology, Genetic Engineering

Course Objectives

At the end of the course ,the students should be able to:

- Tobgainbtheknowledgeofvariousrecentlydevelopedbiotechnologytopics.This will helpstudents in their PGstudies

1. Biochips
2. Nanotechnology inmedicine
3. Forensicscience
4. Genetically modified organisms (Bt cotton and Btbrinjaletc.)
5. Bioinstrumentation
6. Biosensors
7. Upstream processTechnology
8. Bioprocess Control &automation
9. Biomaterials
10. Protein engineering &inslico drugdesigns
11. Artificialorgans

Course Outcomes

Upon Completion of this course, students will be able to get :C01: Analyze various techniques in Biotechnology

Co2: Capability to handle various Instruments in the field of Biotechnology.

Reference Books

1 James M. Lee, "Biochemical Engineering", PHI, USA 2002.

2 Pauline Doran, "Bioprocess Engineering Calculation", Blackwell Scientific Publications 1998.

3 IsilAksanKurnaz, "Techniques in Genetic Engineering" Published, CRC Press, 2015

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department BIOTECHNOLOGY **Programme** B. TECH. - BT **Regulation** 2011

Semester VI

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
711BTT02	PLANT BIOTECHNOLOGY	3	0	0	3	50	50	100

Prerequisite Molecular Biology

Course Objectives

At the end of the course ,the students should be able to:

- *Tointroducestudentstotheprinciples,practicesandapplicationofplanttissueculture*
- *Learn about the transformationinscience,agricultureandindustry.*
- *Toacquaintstudentswithexperimentaldesignandanalysisofplant biotechnology experiments.*
- *Togivestudentshandsonexperienceandtraininginrepresentativeplanttissueculture and geneticengineering techniques.*
- *To give student wide knowledge related to practical aspects of gene transfer*

UNIT I INTRODUCTION TO PLANT BIOTECHNOLOGY: AN OVERVIEW 9

History of plant Biotechnology, Scope and significance of Plant Biotechnology, Plant Tissue Culture as atechnique to produce novel plants and hybrids, Different types of tissue culture medium and their constituents. Plant growth hormones.

UNIT II PLANT CELL AND TISSUE CULTURE 9

Types of cell culture: culture of single cells, cell and organ differentiation. Stages of micropropagation. Choice of plant species for micropropagation, production of virus free plants:protoplast isolation, micropropagation work inIndia

UNIT III GENE TRANSFER TO NUCLEAR GENOME 9

Time line for utilization of gene transfer technology (event). Target cells for transformation: vector for genetransfer technology. Ti and Ri plasmids of *Agrobacterium*. Gene transfer methods: Agro-infection and gene transfer, physical delivery method.

UNIT IV PLANT BIOTECHNOLOGY FOR AGRICULTURAL PRACTICES 9

Biopesticides and Bioinsecticides, Integrated pest management. A total system or ecological approach of IPM. Present status and future needs for making biopesticides and IPR popular. Biofertilizers and integratednutrients management.

UNIT V PLANT BIOTECHNOLOGY FOR ENVIRONMENT 9

Environment, bioenergy and biofuels, bioremediation, types of biodiversity and their applications, plantbiotechnology: reasons of concern for loss of biodiversity, plant biotechnology and climate change

Total Hours 45

Course Outcomes

Upon Completion of this course, students will be able to get :

CO1: acquaint with principles, technical requirement, scientific and commercial applications inPlantBiotechnology,

CO 2: support methodologies in plant tissue/cell culture toplantimprovement,aswellas DNA handling with PCR-based detection diagnostic tools,

CO 3: becomemotivatedtosetgoalstowardspursuinggraduateschoolandhigherlevel positions,such as la manager and keyscientistinplantbiotechnological research institutes and industries.

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1 Slater A, NW Scott, MR Fowler. Plant Biotechnology, 2nd ed. Oxford University Press, 2008.

2 Hopkins, W. Gand Huner, N.P.A. Introduction to Plant Physiology. 3rded.John Wiley&Sons Inc.New York, 2004.

3 Balasubramanian,Bryce,Dharmalingam,Green,Kunthalajayaraman.ConceptsinBiotechnology,revisededition. Universities Press,2007.

4 Karvita B Ahluwalia. Genetics. New age international Pvt. Ltd. Publishers. New Delhi. 2002.

Reference Books

1 Bhojwani and Bhatnagar. Embryology of Angiosperms, vikar Publishing House Pvt. Ltd, New Delhi. 1981.

2 Sharpiro. Mobil Genetic Elements, Academic press, New York. 1983.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2011
		Semester VII			

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
711BTT01	ANIMAL BIOTECHNOLOGY	3	0	0	3	50	50	100

Prerequisite Genetic Engineering

Course Objectives

At the end of the course ,the students should be able to:

- *To provide the fundamentals of animal cell culture, details of the diseases and therapy*
- *To offer the knowledge about the micromanipulation and transgenic animals*
- *Know about transgenic animals*
- *Learn about large scale production of animal cell cultures*
- *Learn about the therapy activities*

UNIT I ANIMAL CELL CULTURE 9

Introduction to basic tissue culture techniques; Natural media, Nutritional requirement of media; chemically defined and serum free media; commonly used cell lines & their origin, various types of cultures- suspension cultures, immobilized cultures; somatic cell fusion; cell cultures as a source of valuable products; animal cell cultures and their applications, their maintenance and preservation; organ cultures. Measurement of cell viability,contact inhibition.

UNIT II ANIMAL DISEASES, DIAGNOSIS AND THEIR THERAPY 9

Bacterial and viral diseases in animals; diagnosis of animal diseases using monoclonal antibodies, molecular diagnostic techniques - like PCR, in-situ hybridization; northern and southern blotting, RFLP. Animal diseases; Treatment of animal diseases through recombinant cytokines, monoclonal antibodies, vaccines and gene therapy.

UNIT III MICROMANIPULATION OF EMBRYO'S 9

Introduction to micromanipulation technology; equipments used in micromanipulation; artificial insemination

in vitro fertilization and embryo transfer; micromanipulation technology and intracytoplasmic sperminjection.

UNIT IV TRANSGENIC ANIMALS 9

Conceptsoftransgenicanimaltechnology;stemcellculturesinthe productionoftransgenicanimals.DNAmicro injection, lipofection, production of dolly, embryonic stem cells, retro viral method of gene insertion, calcium phosphate DNA uptakemethod.

UNIT V SCALING UP OF ANIMAL CELL CULTURES 9

Tissue culture as a screening system, cytotoxicity and diagnostic tests, mass production of important biological molecules, Harvesting of products, applications of cell culture technology in production of human andanimal viral vaccines, cell culture fermenters.

Total Hours 45

Upon Completion of this course, students will be able to get :

Course Outcomes

Co1: Understand the animal cell culture, animal diseases and its diagnosisCo2: Gain the knowledge of therapy of animal infections
Co3: Know the concepts of micro manipulation technology and transgenic animaltechnology
C04 Know the concepts of micro manipulation technology and transgenic animal technologyCo5 The concepts of transgenic animals
Bulk production of animal cell cultures

Text Books

1 Ranga M.M. Animal Biotechnology. Agrobios India Limited, 2002

2 Ramadass P, Meera Rani S. Text Book of Animal Biotechnology. Akshara Printers,1997

Reference Books

1 Masters J.R.W. Animal Cell Culture: Practical Approach. Oxford University Press, 2000

2 Johnson A and Holland.A, Animal Biotechnology and ethics, Chapmara & Hall Madras 1998

3 CultureofAnimalCells:AManualofBasicTechniqueandSpecializedApplications,6thEdition, R.Ian Freshney,September2010,Wiley-Blackwellpublications

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR-635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2011

Semester VII

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
711BTT03	DOWNSTREAM PROCESSING	3	0	0	3	50	50	100

Prerequisite Fundamentals of Unit Operation, Instrumental Methods of Analysis

Course Objectives

At the end of the course ,the students should be able to:

- *Understand the methods to obtain pure proteins, enzymes and in general aboutproduct development R &D*
- *Have depth knowledge and hands on experience with onDownstreamprocessesUnderstandtheconceptsinpurificationofbiomolecules*
- *Have depth knowledge in drying and crystallization*
- *Gain knowledge about the finishing operation*
- *Understand the method related to purification*

UNIT I **DOWNSTREAM PROCESSING** **9 Hrs**

Introductiontodownstreamprocessing,principlescharacteristicsofbiomoleculesandbioprocesses.Cell disruption for product release- mechanical, enzymatic and chemical methods. Pretreatment ofproducts..

UNIT II **PHYSICAL METHODS OF SEPERATION** **9 Hrs**

Unit operations for solid-liquid separation: filtration- Batch and continuous filtration, Microfiltration:centrifugation- Types of centrifuge and sedimentation

UNIT III **ISOLATION OF PRODUCTS** **9 Hrs**

Adsorption, liquid-liquid extraction, aqueous two-phase extraction, supercritical extraction membrane separation – ultrafiltration and reverse osmosis, dialysis, precipitation of proteins by different methods.

UNIT IV **PRODUCT PURIFICATION** **9 Hrs**

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

UNIT V **FINAL PRODUCT FORMULATION AND FINISHING OPERATIONS** **9 Hrs**

Crystallization – Basic Concept, Crystal size distributions, Batch Crystallization, Recrystallization. Drying – Basic concept, Drying Equipments, Conduction drying, Adiabate Drying, lyophilization ofFinal product **45 Hrs**

Upon Completion of this course, students will be able to :

Course Outcomes

CO1: Abilityto define the fundamentals of downstream processing for product recoveryCO 2: Understand the requirements of successful operations of downstream processingCO 3: Describe the process of downstream equipments and explain the techniques in multifactorial manufacturing
CO 4: Ability to understood the knowledge in finishing operation inDSPCO 5: Understood the concept related to purification

Text Books

1 P.A. Belter, E.L. Cussler And Wei-Houhu – Bioseparations – Downstream Processing For Biotechnology, Wiley Interscience Pub. (2002).

2 R.O. Jenkins, (Ed.) – Product Recovery In Bioprocess Technology – Biotechnology By Open LearningSeries, Butterworth-Heinemann (1998).

Reference Books

1 E L V Harris and S. Angal, Protein Purification Methods, Ed. IRL Press at Oxford University Press, 2004.

2 J. E. Bailey and D. F. Ollis, Biochemical Engineering Fundamentals, 2nd Edition, Mc-Graw Hill, Inc., 2001.

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ADHIYAMAAN COLLEGE OF ENGINEERING (AUTONOMOUS), HOSUR - 635 109

Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2011

Semester VII

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
711BTE05	DISASTER MANAGEMENT	3	0	0	3	50	50	100

Prerequisite Environmental Science and Sustainability

Course Objectives

At the end of the course ,the students should be able to:

- *To ensure that students begin to understand the relationship between Vulnerability, disasters, disaster prevention and riskreduction*
- *To gain a preliminary understanding of approaches of Disaster Risk Reduction(DRR)*
- *To enhance awareness of institutional processes in the country*
- *Todeveloprudimentaryabilitytorespondtotheirsurroundingswithpotentialdisaster response in areas where they live,with due sensitivity*
- *To gain concept of the disaster management*

UNIT I INTRODUCTION TO DISASTERS **9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial, etc.- Differential impacts- in terms of caste, class, gender, age, location, disability - Global trends in disasters: urban disasters, pandemics, complex emergencies, Climate change- Dos and Don'ts during various types of Disasters.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) **9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community based DRR,Structural-nonstructuralmeasures,Rolesandresponsibilitiesof-community,PanchayatiRajInstitutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processes and Framework atStateandCentralLevel-StateDisasterManagementAuthority(SDMA)
– Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT **9**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the contextof India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA **9**

HazardandVulnerabilityprofileofIndia,ComponentsofDisasterRelief:Water,Food,Sanitation,Shelter,Health
,
WasteManagement,Institutionalarrangements(Mitigation,ResponseandPreparedness,DisasterManagement Act andPolicy - Other related policies, plans, programmes and legislation – Role of GIS and Information TechnologyComponentsinPreparedness,RiskAssessment,Responseand
Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V **DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS** **9**

Landslide Hazard Zonation: Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure:
CaseStudies,DroughtAssessment:CaseStudies,CoastalFlooding:StormSurgeAssessment,Floods:FluvialandPluvialFlooding:CaseStudies;ForestFire:Case Studies,ManMade disasters:CaseStudies,Space BasedInputs forDisaster Mitigation and Management and fieldworks
related to disaster management.

Total Hours 45

Upon Completion of this course, students will be able to :

Course Outcomes

CO 1: Differentiate the types of disasters, causes and their impact on environment andsociety.
CO 2: Assess vulnerability and various methods of risk reduction measures as well asmitigation.
CO 3:Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management.
CO 4: learned about the disaster management
CO5: variation occur with respect to atmospheric change.

Text Books

1 Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012.
2 Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi,2011
3 Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.
4 Singhal J.P. "Disaster Management", Laxmi Publications, 2010.

Reference Books

1 Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2 Government of India, National Disaster Management Policy, 2009.

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Department	BIOTECHNOLOGY	Programme	B. TECH. - BT	Regulation	2011

Semester VII

Course Code	Course Name	Hours/Week			Credit	Maximum Marks		
		L	T	P	C	CA	EA	Total
711BTP08	DOWNSTREAM PROCESSING LABORATORY	0	0	4	2	50	50	100

Prerequisite Bioprocess Engineering lab–I and Bioprocess Engineering lab -II

Course Objectives

At the end of the course ,the students should be able to:

- *To understand the nature of the end product, its concentration, stability and degree of purification required*
- *To design processes for the recovery and subsequent purification of target biological products*
- *To gain knowledge on sonication*
- *To learn about the chromatography techniques*
- *To learn about the drying equipment*

1. Solid liquid separation – Centrifugation
2. Precipitation – Ammonium sulphite precipitation
3. Aqueous two phase extraction of biologicals
4. Cell disruption techniques – Ultrasonication
5. Cell disruption techniques –Batch and continuous
6. Ultra filtration separation
7. High resolution purification – Affinity chromatography
8. High resolution purification – Size exclusion chromatography
9. High resolution purification – Ion exchange chromatography
10. Product polishing – Spray drying

Course Outcomes

Upon Completion of this course, students will be able to get :

CO1: Acquired knowledge for the separation of whole cells and other insoluble ingredients from the culture broth.

CO2: Learned various techniques like extraction, precipitation, membrane separation for concentrating biological products

CO3: Learned the basic principles and techniques of chromatography to purify the biological products and formulate the products for different end uses

Co4: learned about the drying equipment

Co5: Gained knowledge on sonication

Text Books

1 R.O. Jenkins, (Ed.) – Product Recovery In Bioprocess Technology – Biotechnology By Open Learning Series, Butterworth-Heinemann (1992).

2 P.A. Belter, E.L. Cussler And Wei-Houhu – Bioseparations – Downstream Processing For Biotechnology, Wiley Interscience Pun. (1988).

Reference Books

1 J.C. Janson And L. Ryden, (Ed.) – Protein Purification – Principles, High Resolution Methods And Applications, VCH Pub. 1989.

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