

**ANNA UNIVERSITY, CHENNAI**  
**AFFILIATED INSTITUTIONS**  
**REGULATIONS 2017**  
**B. TECH. BIOTECHNOLOGY**  
**CHOICE BASED CREDIT SYSTEM**

### **1. Program Objectives (POs)**

The primary objective of the Bachelor of Industrial Biotechnology program is to prepare professionals with the skills required to work in the Biotechnology industry with particular emphasis on the engineering aspects of manufacturing and design.

They are trained to

1. Achieve successful professional and technical career.
2. Have a strong foundation in Basic Sciences, Mathematics, Medical Sciences, Bioinformatics and process engineering.
3. Have knowledge on the theory and practices in the field of Biotechnology, especially in the areas of Downstream processing, Medical biotechnology and Bioinformatics and allied areas.
4. Engross in life-long learning to keep themselves abreast of new developments.
5. Practice and inspire high ethical values and technical standards.

The Overall objective of the Program is to promote education and research in biotechnology and provide academic and professional excellence for immediate productivity in industrial, governmental, or clinical settings for an ultimate benefit of society and environment.

As a result of this program, the student will be able to:

1. Recall factual information on broad knowledge based proficiency in core themes, principles and components of Basic Sciences.
2. Create and develop strategies that reflect the interdisciplinary nature of science, regulation and enterprise in the biotechnology industry.
3. Define and solve problems using scientific methods in biotechnology and allied subjects.
4. Consider implications of biotechnology in societal, environmental and educational frameworks.
5. Access current information and literature in science and Prepare and present scientific data.
6. Demonstrate knowledge of biological processes from the molecular and cellular perspectives.
7. Approach and solve biological problems critically with scientific literacy in individual and group settings.
8. Able to understand, analyze and apply the process engineering concepts an incredibly wide diversity of applications including pharmaceutical development, crop and livestock improvement, diagnostic and therapeutic medicine, industrial processing, and bioremediation of contaminated environments.

### SEMESTER VII

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>THEORY</b>								
1	GE8077	Total Quality Management	HS	3	3	0	0	3
2	BT8751	Downstream Processing	PC	3	3	0	0	3
3	BT8791	Immunology	PC	3	3	0	0	3
4		Professional Elective V	PE	3	3	0	0	3
5		Professional Elective VI	PE	3	3	0	0	3
6		Open Elective II *	OE	3	3	0	0	3
<b>PRACTICALS</b>								
7	BT8711	Downstream Processing Laboratory	PC	4	0	0	4	2
8	BT8712	Immunology Laboratory	PC	4	0	0	4	2
<b>TOTAL</b>				<b>26</b>	<b>18</b>	<b>0</b>	<b>8</b>	<b>22</b>

\* - Course from the curriculum of the other UG Programmes

### SEMESTER VIII

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>PRACTICALS</b>								
1	BT8811	Project Work	EEC	20	0	0	20	10
<b>TOTAL</b>				<b>20</b>	<b>0</b>	<b>0</b>	<b>20</b>	<b>10</b>

**TOTAL CREDITS: 179**

### PROFESSIONAL ELECTIVES (PEs)

#### PROFESSIONAL ELECTIVE I, SEMESTER V

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	BT8001	Biophysics	PE	3	3	0	0	3
2.	BT8002	Symbolic Mathematics	PE	3	3	0	0	3
3.	BT8003	Principles of Food Processing	PE	3	3	0	0	3
4.	BT8004	Advanced Biochemistry	PE	3	3	0	0	3
5.	GE8071	Disaster Management	PE	3	3	0	0	3

#### PROFESSIONAL ELECTIVE II, SEMESTER VI

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	BT8005	Animal Biotechnology	PE	3	3	0	0	3
2.	BT8006	Systems Biology	PE	3	3	0	0	3
3.	BT8071	Biological Spectroscopy	PE	3	3	0	0	3
4.	CH8791	Transport Phenomena	PE	3	3	0	0	3
5.	PY8023	Chemistry of Medicines	PE	3	3	0	0	3
6.	GE8075	Intellectual Property Rights	PE	3	3	0	0	3

**PROFESSIONAL ELECTIVE III, SEMESTER VI**

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	BT8007	Cancer Biology	PE	3	3	0	0	3
2.	BT8008	Molecular Pathogenesis of Infectious Diseases	PE	3	3	0	0	3
3.	BT8009	Biopharmaceutical Technology	PE	3	3	0	0	3
4.	BT8010	Bioentrepreneurship	PE	3	3	0	0	3
5.	GE8076	Professional Ethics in Engineering	PE	3	3	0	0	3
6.	BT8011	Marine Biotechnology	PE	3	3	0	0	3

**PROFESSIONAL ELECTIVE IV, SEMESTER VI**

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	BT8012	Bioethics	PE	3	3	0	0	3
2.	BT8013	Metabolic Engineering	PE	3	3	0	0	3
3.	BT8014	Lifestyle Diseases	PE	3	3	0	0	3
4.	BT8015	Structural Biology	PE	3	3	0	0	3
5.	BT8016	Genomics and Proteomics	PE	3	3	0	0	3
6.	BT8017	Biofuel	PE	3	3	0	0	3
7.	GE8073	Fundamentals of Nano Science	PE	3	3	0	0	3

**PROFESSIONAL ELECTIVE V, SEMESTER VII**

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	BT8018	Plant Biotechnology	PE	3	3	0	0	3
2.	BT8019	Process Equipments and Plant Design	PE	3	3	0	0	3
3.	BT8020	Bioconjugate Technology and Applications	PE	3	3	0	0	3
4.	BT8021	Genetics	PE	3	3	0	0	3
5.	PY8071	Clinical Trials	PE	3	3	0	0	3
6.	GE8074	Human Rights	PE	3	3	0	0	3
7.	GE8072	Foundation Skills in Integrated Product Development	PE	3	3	0	0	3

**PROFESSIONAL ELECTIVE VI, SEMESTER VII**

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1.	BT8022	Neurobiology and Cognitive Sciences	PE	3	3	0	0	3
2.	BT8023	Tissue Engineering	PE	3	3	0	0	3
3.	BT8091	Instrumentation and Process Control	PE	3	3	0	0	3
4.	BT8024	Biosafety and Hazard Management	PE	3	3	0	0	3
5.	BT8025	Immunotechnology	PE	3	3	0	0	3

### PROFESSIONAL CORE (PC)

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	BT8251	Biochemistry	PC	3	3	0	0	3
2.	BT8261	Biochemistry Laboratory	PC	4	0	0	4	2
3.	BT8301	Stoichiometry	PC	5	3	2	0	4
4.	BT8302	Applied Thermodynamics for Biotechnologists	PC	3	3	0	0	3
5.	BT8303	Basic Industrial Biotechnology	PC	3	3	0	0	3
6.	BT8304	Biorganic Chemistry	PC	3	3	0	0	3
7.	BT8305	Cell Biology	PC	3	3	0	0	3
8.	BT8361	Microbiology Laboratory	PC	4	0	0	4	2
9.	BT8311	Cell Biology Laboratory	PC	4	0	0	4	2
10.	BT8402	Molecular Biology	PC	3	3	0	0	3
11.	BT8403	Enzyme Technology and Bio-transformations	PC	3	3	0	0	3
12.	BT8404	Bioprocess Principles	PC	3	3	0	0	3
13.	BT8412	Molecular Biology Laboratory	PC	4	0	0	4	2
14.	BT8501	Mass Transfer Operations	PC	3	3	0	0	3
15.	BT8502	Analytical Methods and Instrumentation	PC	3	3	0	0	3
16.	BT8503	Protein Engineering	PC	3	3	0	0	3
17.	BT8511	Bioprocess Laboratory I	PC	4	0	0	4	2
18.	BT8512	Analytical Methods and Instrumentation Laboratory	PC	4	0	0	4	2
19.	BT8651	Bioinformatics	PC	5	3	2	0	4
20.	BT8601	Genetic Engineering	PC	4	4	0	0	4
21.	BT8611	Bioprocess Laboratory II	PC	4	0	0	4	2
22.	BT8612	Genetic Engineering Laboratory	PC	4	0	0	4	2
23.	BT8751	Downstream Processing	PC	3	3	0	0	3
24.	BT8791	Immunology	PC	3	3	0	0	3
25.	BT8711	Downstream Processing Laboratory	PC	4	0	0	4	2
26.	BT8712	Immunology Laboratory	PC	4	0	0	4	2

### EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	HS8381	Interpersonal Skills/Listening and Speaking	EEC	2	0	0	2	1
2.	HS8461	Advanced Reading and Writing	EEC	2	0	0	2	1
3.	HS8581	Professional Communication	EEC	2	0	0	2	1
4.	BT8811	Project Work	EEC	20	0	0	20	10

**OBJECTIVES: The Course will enable learners to:**

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentations.

**UNIT I**

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

**UNIT II**

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

**UNIT III**

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

**UNIT IV**

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

**UNIT V**

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

**TOTAL: 30 PERIODS**

**OUTCOMES: At the end of the course Learners will be able to:**

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

**TEXT BOOKS:**

1. Brooks, Margret. **Skills for Success. Listening and Speaking. Level 4** Oxford University Press, Oxford: 2011.
2. Richards, C. Jack. & David Bholke. **Speak Now Level 3.** Oxford University Press, Oxford: 2010

## REFERENCES:

1. Bhatnagar, Nitin and MamtaBhatnagar. **Communicative English for Engineers and Professionals**. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. **Practical English Classroom**. Oxford University Press: Oxford, 2014.
3. Vargo, Mari. **Speak Now Level 4**. Oxford University Press: Oxford, 2013.
4. Richards C. Jack. **Person to Person (Starter)**. Oxford University Press: Oxford, 2006.
5. Ladousse, Gillian Porter. **Role Play**. Oxford University Press: Oxford, 2014

**MA8391**

**PROBABILITY AND STATISTICS**

**L T P C**

**4 0 0 4**

## OBJECTIVE:

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

## UNIT I PROBABILITY AND RANDOM VARIABLES

**12**

Probability – The axioms of probability – Conditional probability – Baye’s theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

## UNIT II TWO - DIMENSIONAL RANDOM VARIABLES

**12**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and linear regression – Transformation of random variables – Central limit theorem (for independent and identically distributed random variables).

## UNIT III TESTING OF HYPOTHESIS

**12**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

## UNIT IV DESIGN OF EXPERIMENTS

**12**

One way and Two way classifications - Completely randomized design – Randomized block design – Latin square design -  $2^2$  factorial design.

## UNIT V STATISTICAL QUALITY CONTROL

**12**

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

**TOTAL: 60 PERIODS**

7. Transformation
8. Selection of recombinants – Antibiotic sensitivity assay
9. Plating of  $\lambda$  phage
10. Lamda phage lysis of liquid cultures

**TOTAL: 60 PERIODS**

**Equipment Needed for 30 Students**

Electrophoresis Kit	1
PCR	1
Incubators	2
Light Microscopes	4
Incubator Shaker	1
Spectrophotometer	2
Laminar Flow Chamber	2
Glassware, Chemicals, Media as required	

**OUTCOMES:**

By the end of this course, students should be able to:

- Demonstrate knowledge and understanding of the principles underpinning important techniques in molecular biology.
- Demonstrate knowledge and understanding of applications of these techniques.
- Demonstrate the ability to carry out laboratory experiments and interpret the results.
- Students will be aware of the hazardous chemicals and safety precautions in case of emergency

**REFERENCE:**

1. Sambrook, Joseph and David W. Russell “ The Condensed Protocols: From Molecular Cloning: A Laboratory Manual” Cold Spring Harbor , 2006.

**HS8461**

**ADVANCED READING AND WRITING**

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

**OBJECTIVES:**

- Strengthen the reading skills of students of engineering.
- Enhance their writing skills with specific reference to technical writing.
- Develop students’ critical thinking skills.
- Provide more opportunities to develop their project and proposal writing skills.

**UNIT I**

**Reading** - Strategies for effective reading-Use glosses and footnotes to aid reading comprehension- Read and recognize different text types-Predicting content using photos and title

**Writing**-Plan before writing- Develop a paragraph: topic sentence, supporting sentences, concluding sentence –Write a descriptive paragraph

**UNIT II**

**Reading**-Read for details-Use of graphic organizers to review and aid comprehension **Writing**-State reasons and examples to support ideas in writing- Write a paragraph with reasons and examples- Write an opinion paragraph

### UNIT III

**Reading-** Understanding pronoun reference and use of connectors in a passage- speed reading techniques-**Writing-** Elements of a good essay-Types of essays- descriptive-narrative- issue-based-argumentative-analytical.

### UNIT IV

**Reading-** Genre and Organization of Ideas- **Writing-** Email writing- visumes – Job application-project writing-writing convincing proposals.

### UNIT V

**Reading-** Critical reading and thinking- understanding how the text positions the reader- identify  
**Writing-** Statement of Purpose- letter of recommendation- Vision statement

**TOTAL: 30 PERIODS**

**OUTCOMES: At the end of the course Learners will be able to:**

- Write different types of essays.
- Write winning job applications.
- Read and evaluate texts critically.
- Display critical thinking in various professional contexts.

### TEXT BOOKS:

1. Gramer F. Margot and Colin S. Ward **Reading and Writing (Level 3)** Oxford University Press: Oxford, 2011
2. Debra Daise, CharlNorloff, and Paul Carne **Reading and Writing (Level 4)** Oxford University Press: Oxford, 2011

### REFERENCES:

1. Davis, Jason and Rhonda Liss.**Effective Academic Writing (Level 3)** Oxford University Press: Oxford, 2006
2. E. Suresh Kumar and et al. **Enriching Speaking and Writing Skills.** Second Edition. Orient Black swan: Hyderabad, 2012
3. Withrow, Jeans and et al. **Inspired to Write. Readings and Tasks to develop writing skills.** Cambridge University Press: Cambridge, 2004
4. Goatly, Andrew. **Critical Reading and Writing.** Routledge: United States of America, 2000
5. Petelin, Roslyn and Marsh Durham. **The Professional Writing Guide: Knowing Well and Knowing Why.** Business & Professional Publishing: Australia, 2004

**BT8501**

**MASS TRANSFER OPERATIONS**

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

### OBJECTIVES:

- To define the principles of adsorption, absorption, leaching and drying extraction, distillation crystallization operations.
- To begin the concept of membrane separation process and develop skills of the students in the area of mass transfer operations with emphasis on separation and purification of products.

10. Chromatography analysis using TLC.
11. Chromatography analysis using column chromatography.

**TOTAL: 60 PERIODS**

**OUTCOME:**

- The students would visualize and interpret the theory of spectroscopic methods by hands on experiments.

**REFERENCES:**

1. Skoog, D.A. et al. "Principles of Instrumental Analysis", V<sup>th</sup> Edition, Thomson / Brooks – Cole, 1998.
2. Braun, R.D. "Introduction to Instrumental Analysis", Pharma Book Syndicate, 1987.
3. Willard, H.H. et al. "Instrumental Methods of Analysis", VI<sup>th</sup> Edition, CBS, 1986.
4. Ewing, G.W. "Instrumental Methods of Chemical Analysis", V<sup>th</sup> Edition, McGraw-Hill, 1985.

**Equipment Needed for 20 Students**

Colorimeter 2  
Glassware, Chemicals, Media as required

**HS8581**

**PROFESSIONAL COMMUNICATION**

**L T P C**

**0 0 2 1**

**OBJECTIVES:**

**The course aims to:**

- Enhance the Employability and Career Skills of students
- Orient the students towards grooming as a professional
- Make them Employable Graduates
- Develop their confidence and help them attend interviews successfully

**UNIT I**

Introduction to Soft Skills-- Hard skills & soft skills - employability and career Skills—Grooming as a professional with values—Time Management—General awareness of Current Affairs

**UNIT II**

Self-Introduction-organizing the material - Introducing oneself to the audience – introducing the topic – answering questions – individual presentation practice— presenting the visuals effectively – 5 minute presentations

**UNIT III**

Introduction to Group Discussion— Participating in group discussions – understanding group dynamics - brainstorming the topic -- questioning and clarifying –GD strategies- activities to improve GD skills

**UNIT IV**

Interview etiquette – dress code – body language – attending job interviews– telephone/skype interview -one to one interview & panel interview – FAQs related to job interviews

**UNIT V**

Recognizing differences between groups and teams- managing time-managing stress- networking professionally- respecting social protocols-understanding career management-developing a long-term career plan-making career changes

**TOTLA: 30 PERIODS**

## OUTCOMES:

At the end of the course Learners will be able to:

- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace

## Recommended Software

1. Globearena
2. Win English

## REFERENCES:

1. Butterfield, Jeff **Soft Skills for Everyone**. Cengage Learning: New Delhi, 2015
2. **Interact** English Lab Manual for Undergraduate Students,. OrientBlackSwan: Hyderabad, 2016.
3. E. Suresh Kumar et al. **Communication for Professional Success**. Orient Blackswan: Hyderabad, 2015
4. Raman, Meenakshi and Sangeeta Sharma. **Professional Communication**. Oxford University Press: Oxford, 2014
5. S. Hariharanetal. **Soft Skills**. MJP Publishers: Chennai, 2010.

BT8651

BIOINFORMATICS

L T P C  
3 2 0 4

## OBJECTIVES:

- To improve the programming skills of the student
- To let the students know the recent evolution in biological science

## UNIT I INTRODUCTION

(9 + 6)

Introduction to Operating systems, Linux commands, File transfer protocols ftp and telnet, Introduction to Bioinformatics and Computational Biology, Biological sequences, Biological databases, Genome specific databases, Data file formats, Data life cycle, Database management system models, Basics of Structured Query Language (SQL).

## UNIT II SEQUENCE ALIGNMENT

(9 + 6)

Sequence Analysis, Pair wise alignment, Dynamic programming algorithms for computing edit distance, string similarity, shotgun DNA sequencing, end space free alignment. Multiple sequence alignment, Algorithms for Multiple sequence alignment, Generating motifs and profiles, Local and Global alignment, Needleman and Wunsch algorithm, Smith Waterman algorithm, BLAST, PSIBLAST and PHIBLAST algorithms.

## UNIT III PHYLOGENETIC METHODS

(9 + 6)

Introduction to phylogenetics, Distance based trees UPGMA trees, Molecular clock theory, Ultrametric trees, Parsimonious trees, Neighbour joining trees, trees based on morphological traits, Bootstrapping. Protein Secondary structure and tertiary structure prediction methods, Homology modeling, abinitio approaches, Threading, Critical Assessment of Structure Prediction, Structural genomics.

## UNIT IV PROTEIN STRUCTURE ANALYSIS

(9 + 6)

Machine learning techniques: Artificial Neural Networks in protein secondary structure prediction, Hidden Markov Models for gene finding, Decision trees, Support Vector Machines. Introduction to Systems Biology and Synthetic Biology, Microarray analysis, DNA computing, Bioinformatics

- This course paves a ways to the students to acquire knowledge on novel biotechnological and pharmaceutical products, current medicines and their applications in therapeutic and diagnostic fields.
- Demonstrate knowledge and understanding of current topical and newly emerging aspects of pharmaceutical biotechnology.
- Understand the legal steps involved in progressing a new drug to market. Grasping the current regulatory acts and safety norms of the modern pharmaceutical industries.

**TEXT BOOK:**

1. Finkel, Richard, et al., "Lippincott's Illustrated Reviews Pharmacology" IV<sup>th</sup> Edition. Wolters Kluwer / Lippincott Williams & Wilkins, 2009.

**REFERENCES:**

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

**BT8010**

**BIOENTREPRENEURSHIP**

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

**UNIT I**

**9**

- Should You Become an Entrepreneur? What Skills Do Entrepreneurs Need?
- Identify and Meet a Market Need
- Entrepreneurs in a Market Economy
- Select a Type of Ownership

**UNIT II**

**9**

- Develop a Business Plan

**UNIT III**

**9**

- Choose Your Location and Set Up for Business
- Market Your Business
- Hire and Manage a Staff

**UNITIV:**

**9**

- Finance, Protect and Insure Your Business
- Record Keeping and Accounting
- Financial Management

**UNIT V**

**9**

- Meet Your Legal, Ethical, Social Obligations
- Growth in Today's Marketplace

**TOTAL: 45 PERIODS**

**TEXT BOOK**

1. Entrepreneurship Ideas in Action—South-Western, 2000.

**OBJECTIVE:**

- To enable the students to create an awareness on Engineering Ethics and Human Values, to instill Moral and Social Values and Loyalty and to appreciate the rights of others.

**UNIT I HUMAN VALUES****10**

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

**UNIT II ENGINEERING ETHICS****9**

Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

**UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION****9**

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

**UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS****9**

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

**UNIT V GLOBAL ISSUES****8**

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.

**TOTAL: 45 PERIODS****OUTCOME:**

- Upon completion of the course, the student should be able to apply ethics in society, discuss the ethical issues related to engineering and realize the responsibilities and rights in the society.

**TEXT BOOKS:**

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

**REFERENCES:**

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics –

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**PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) :**

- I. To provide students with solid fundamentals and strong foundation in statistical, scientific and engineering subjects required to create and innovate in the field of biotechnology.
- II. To train students with good scientific and technical knowledge so as to comprehend, analyze, design, and create novel products and solutions for developing novel therapeutics and enzymes.
- III. To prepare students to excel and succeed in Biotechnology research or industry through the latest state-of-art post graduate education.
- IV. To sensitize students about scientific temper and the necessity of bioethics, social responsibility and awareness of the environment.
- V. This course enables the student to develop good communication and leadership skills, respect for authority, loyalty and the life-long learning needed for a successful scientific and professional career.

**PROGRAMME OUTCOMES (POs):**

On successful completion of the Masters in Biotechnology graduates will be able to

1. Acquire in depth knowledge of Biological science and Bioengineering for gaining ability to develop and evaluate new ideas
2. Demonstrate Scientific and technological skills to design and perform research through modern techniques for the development of high throughput process and products.
3. Analyze Biotechnological problems and formulate intellectual and innovative vistas for research and development
4. Provide potential solutions for solving technological problems in various domains of Biotechnology considering the societal, public health, cultural environmental factors.
5. Examine the outcomes of Biotechnological issues critically and gain knowledge for composing suitable corrective measures.
6. Create and apply modern engineering tools for the prediction and modeling of complex bioengineering activities
7. Posses self management and team work skills towards collaborative, multidisciplinary scientific endeavors in order to achieve common goals
8. Develop entrepreneurial and managerial skills for the implementation of multidisciplinary projects
9. Demonstrate adherence to accepted standards of professional bioethics and social responsibilities
10. Posses the attitude necessary for lifelong and acquire communication skills relevant to professional positions

### SEMESTER III

S.No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>PRACTICAL</b>								
1	BY5311	Advanced Genetic Engineering Laboratory	PC	6	0	0	6	3
2	BY5312	Bioprocess and Downstream Processing Laboratory	PC	6	0	0	6	3
<b>PROJECT</b>								
4	BY5313	Project Work (Phase I)	EEC	12	0	0	12	6
<b>TOTAL</b>				<b>24</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>

### SEMESTER IV

S.No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>PROJECT</b>								
1	BY5411	Project Work (Phase II)	EEC	24	0	0	24	12
<b>TOTAL</b>				<b>24</b>	<b>0</b>	<b>0</b>	<b>24</b>	<b>12</b>

**TOTAL CREDITS : 75**

### SEMESTER I, PROFESSIONL ELECTIVES I

S.No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1	BY5001	Molecular Concepts in Biotechnology (For Engineering Stream)	PE	3	3	0	0	3
2	BY5002	Principles of Chemical Engineering (For Science Stream)	PE	3	3	0	0	3
3	BY5003	Metabolic Process and Engineering (For Biotechnology Stream)	PE	3	3	0	0	3

### SEMESTER I, PROFESSIONL ELECTIVES II

S.No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
1	BY5004	Animal Biotechnology	PE	3	3	0	0	3
2	BY5005	Computer Aided Learning of Structure and Function of Proteins	PE	4	2	2	0	3
3	BY5006	Analytical Techniques in Biotechnology	PE	3	3	0	0	3
4	BY5007	Bio Thermodynamics	PE	3	3	0	0	3
5	BY5008	Plant Biotechnology	PE	3	3	0	0	3

		Fermentation Technology						
3	BY5103	Bioinformatics and Applications	PC	4	3	2	0	4
4	BY5201	Bio Separation Technology	PC	3	3	0	0	3
5	BY5202	Bioprocess Engineering	PC	4	3	2	0	4
6	BY5203	Bioreactor Design and Analysis	PC	4	4	0	0	4
7	BY5204	Immunotechnology	PC	3	3	0	0	3
8	BY5205	Advanced Genomics and Proteomics	PC	3	3	0	0	3
9	BY5111	Preparative and Analytical Techniques in Biotechnology Laboratory	PC	4	0	0	4	2
10	BY5211	Immunotechnology Laboratory	PC	4	0	0	4	2
11	BY5311	Advanced Genetic Engineering Laboratory	PC	4	0	0	6	3
12	BY5312	Bioprocess and Downstream Processing Laboratory	PC	4	0	0	6	3

### **EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
<b>PROJECT</b>								
1	BY5313	Project Work (Phase I)	EEC	12	0	0	12	6
2	BY5411	Project Work (Phase II)	EEC	24	0	0	24	12

**B.TECH. BIOTECHNOLOGY**

**Regulation - 2020**

**AUTONOMOUS SYLLABUS**

**CHOICE BASED CREDIT SYSTEM (CBCS)**

**CURRICULUM AND SYLLABI**

**(III & IV)**

**SEMESTER III**

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
<b>THEORY</b>								
1	MA1373	Transforms and Partial Differential Equations	BS	3	1	0	4	4
2	BT1301	Cell Biology	PC	3	0	0	3	3
3	BT1302	Microbiology	PC	3	0	0	3	3
4	BT1303	Stoichiometry	PC	3	1	0	4	4
5	BT1306	Thermodynamics for Biotechnologist	ES	3	0	0	3	3
<b>PRACTICAL</b>								
6	BT1311	Cell Biology Laboratory	PC	0	0	4	4	2
7	BT1312	Microbiology Laboratory	PC	0	0	4	4	2
8	HS1321	Interpersonal Skills - Listening and Speaking	EE	0	0	2	2	1
<b>TOTAL</b>				<b>15</b>	<b>2</b>	<b>10</b>	<b>27</b>	<b>22</b>

## 12. Effect of Disinfectants- Phenol Coefficient

**TOTAL: 60 PERIODS**

### **COURSE OUTCOMES**

After successful completion of the course, the students will be able to

- CO1 Prepare different types of media and demonstrate culture techniques
- CO2 Demonstrate the different types of staining for microbe identification.
- CO3 Perform different methods of enumeration of microorganisms in different samples and microbial growth.
- CO4 Evaluate the effect of various physical factors on growth and microbial biochemical efficacy.
- CO5 Carry out antibiotic sensitivity and effect of disinfectant on growth of microorganisms.

### **TEXT BOOK**

1. Cappuccino, J.G. and N. Sherman 2013 —*Microbiology: A Laboratory Manual*, 10th Edition, Addison-Wesley.

### **REFERENCES**

1. Brown, A. and Smith, H., 2014. *Benson's Microbiological Applications, Laboratory Manual in General Microbiology*

<b>HS1321</b>	<b>INTERPERSONAL SKILLS - LISTENING AND SPEAKING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>OBJECTIVES:</b>		<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>

The course will enable learners to:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- Improve general and academic listening skills
- Make effective presentations.

**UNIT I LISTENING AS A KEY SKILL** **6**

Listening as a key skill- its importance- speaking – give personal information – ask for personal information – express ability – enquire about ability – ask for clarification - Improving pronunciation– pronunciation basics — stressing syllables and speaking clearly – intonation patterns – conversation starters: small talk.

**UNIT II LISTEN TO A PROCESS INFORMATION** **6**

Listen to a process information- give information, as part of a simple explanation — taking lecture notes – preparing to listen to a lecture – articulate a complete idea as opposed to producing fragmented utterances - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

**UNIT III LEXICAL CHUNKING** **6**

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk – greet – respond to greetings – describe health and symptoms – invite and offer –accept – decline – take leave – listen for and follow the gist- listen for detail

**UNIT IV GROUP DISCUSSION** **6**

Being an active listener: giving verbal and non-verbal feedback – participating in a group discussion – summarizing academic readings and lectures conversational speech listening to and participating in conversations – persuade- negotiate disagreement in group work.

**UNIT V GROUP & PAIR PRESENTATIONS** **6**

Formal and informal talk – listen to follow and respond to explanations, directions and instructions in academic and business contexts – strategies for presentations and interactive communication – group/pair presentations

**TOTAL: 30 PERIODS**



(An Autonomous Institution - AFFILIATED TO ANNA UNIVERSITY, CHENNAI)

S.P.G.Chidambara Nadar - C.Nagammal Campus

S.P.G.C.Nagar, K.Vellakulam - 625 701, (Near Virudhunagar), Madurai District.

**DEPARTMENT OF BIOTECHNOLOGY**  
**M.TECH BIOTECHNOLOGY**  
**R – 2020 AUTONOMOUS CURRICULUM & SYLLABUS**  
**CHOICE BASED CREDIT SYSTEM**

**VISION:**

To make the Department of Biotechnology, unique of its kind in the field of research and development activities pertaining to the field of biotechnology in this part of the world.

**MISSION:**

To impart highly innovative and technical knowledge in the field of biotechnology to the urban and rural student folks through “Total Quality Education”.

**PROGRAM OUTCOMES:**

- PO1:** An ability to independently carry out research /investigation and development work to solve practical problems
- PO2:** An ability to write and present a substantial technical report/document.
- PO3:** Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

**OPEN ELECTIVE (OFFERING TO OTHER PG DEPARTMENT)**

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	TOTAL CONTACT PERIODS	L	T	P	C
1	OMB1251	Fundamentals of Nutrition	OE	3	3	0	0	3
2	OMB1252	Lifestyle Diseases	OE	3	3	0	0	3
3	OMB1253	Principles of Food Preservation	OE	3	3	0	0	3

**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

S. No.	COURSE CODE	COURSE TITLE	CATEGORY	TOTAL CONTACT PERIODS	L	T	P	C
<b>PROJECT</b>								
1	MB1321	Project Phase - I	EE	12	0	0	12	6
2	MB1421	Project Phase - II	EE	24	0	0	24	12

**SUMMARY:**

Category	SEM 1	SEM 2	SEM 3	SEM 4	TOTAL
Foundation Course	4	-	-	-	4
Professional Core Course	12	12	6	-	30
Professional Elective Course	9	6	-	-	15
Open Elective	-	3	-	-	3
Employability Enhancement Course	-	-	6	12	18
Online Course	-	3	-	-	3
<b>Total Credits</b>	<b>25</b>	<b>24</b>	<b>12</b>	<b>12</b>	<b>73</b>

## REFERENCES

1. Niazi, S.K. and Brown, J.L., 2017. *Fundamentals of modern bioprocessing*. CRC Press.
2. Saha, G., Barua, A. and Sinha, S., 2017. *Bioreactors: Animal Cell Culture Control for Bioprocess Engineering*. CRC Press.
3. Biotech, A.P., 2001. *Protein purification handbook*

**MB1321**

**PROJECT PHASE - I**

L	T	P	C
0	0	12	6

## OBJECTIVES

- To Make the students identify a problem/process relevant to their field of interest that can be carried out
- To Make them equipped to search databases and journals to collect relevant data and identify a solution
- To Plan, learn and perform experiments to verify the solution

## COURSE OUTCOMES:

**At the end of the course students will be able to**

CO 1: Identify the field of interest towards research/industrial problems

CO 2: equip the students to search and think about logical solutions

## SEMESTER IV

**MB1421**

**PROJECT PHASE - II**

L	T	P	C
0	0	24	12

## OBJECTIVES

1. Train students to analyze a problem/ think innovatively to develop new methods/product /process
2. Make them comprehend how to find solutions/ create products economically and in an environmentally sustainable way
3. Enable them to acquire technical and experimental skills to validate the solution, analyze the results and communicate

## COURSE OUTCOMES:

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

CO 1: Formulate problems statement for developing new methods/solutions/processes.

CO 2: Plan experiments in a logical manner/ work out sustainability

CO 3: Execute experiments systematically and collect the data.

CO 4: Assess, interpret and communicate the results