MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC, NBA & Affiliated to Anna University)
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Curriculum/Syllabus

Programme Code : BT

Programme Name : B.Tech-Biotechnology

Regulation : R-2016

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Rasipuram - 637 408, Namakkal Dt, Tamil Nadu.

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INSTUTION VISION & MISSION

INSTUTION VISION

To be a Centre of Excellence in Engineering, Technology and Management on par with International Standards.

INSTUTION MISSION

- To prepare the students with high professional skills and ethical values
- To impart knowledge through best practices
- To instill a spirit of innovation through Training, Research and Development
- To undertake continuous assessment and remedial measures
- To achieve academic excellence through intellectual, emotional and social stimulation

INSTUTION MOTTO

Rural upliftment through Technical Education.

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DEPARTMENT VISION & MISSION

DEPARTMENT VISION

To produce competent biotechnologists with advanced skills and knowledge to contribute the society.

DEPARTMENT MISSION

- To establish the advance laboratories to enable the students to face the challenges in pharma companies
- To enable collaborative research in contemporary and sustainable technologies in biotechnology
- To produce biotechnology graduates with quest for excellence, enthusiasm for continuous learning, ethical behavior, integrity and exceptional leadership

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DEPARTMENT PROGRAM EDUCATIONAL OBJECTIVES, PROGRAM OUTCOMES & PROGRAM SPECIFIC OUTCOMES

PROGRAM EDUCATIONAL OBJECTIVES

The Biotechnology Graduates should be able to

PEO1: Practice as an Engineer in the pharma companies and become an entrepreneur

PEO2: Pursue higher education and research for professional development

PEO3: Exhibit the leadership skills and ethical value for society

PROGRAM OUTCOMES

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and Engineering sciences.
3. **Design/Development solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Lifelong learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

PSO1: Apply mathematical and engineering knowledge for performinglab experiments

PSO2: Derive sustainable solutions for complete problems related to diseases and treatment

PSO3: Use modern software tools and techniques related to Biotechnology and industry

GROUPING OF COURSES

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B.Tech. - Biotechnology

GROUPING OF COURSES

Humanities and Social Sciences [HS]

S. No.	Course Code	Course Title	Category	Contact Hours	Instructions Hours/Week			C
					L	T	P	
1	16SHA01	Technical English	HS	5	3	2	0	4
2	16SHA02	Communicative English	HS	7	3	0	4	5
3	16SHA03	Business English	HS	5	3	2	0	4
4	16SHA04	Basics of Japanese	HS	5	3	2	0	4
5	16SHA05	Functional Japanese	HS	5	3	2	0	4
6	16SHA06	Basics of German	HS	5	3	2	0	4
7	16SHA07	Functional German	HS	5	3	2	0	4
8	16SHA08	Principles of Management and Engineering Ethics	HS	3	3	0	0	3

Basic Sciences [BS]

S. No.	Course Code	Course Title	Category	Contact Hours	Instructions Hours/Week			C
					L	T	P	
1	16SHB01	Matrix, Calculus and Ordinary Differential Equation	BS	5	3	2	0	4
2	16SHB02	Complex Variables, Laplace Transforms and Vector Calculus	BS	5	3	2	0	4
3	16SHB03	Transforms Partial and Differential Equations	BS	5	3	2	0	4
4	16SHB04	Random Processes	BS	5	3	2	0	4
5	16SHB05	Probability and Queuing Theory	BS	5	3	2	0	4
6	16SHB06	Numerical Methods	BS	5	3	2	0	4
7	16SHB07	Statistics and Numerical Methods	BS	5	3	2	0	4
8	16SHB08	Discrete Mathematics	BS	5	3	2	0	4
9	16SHB09	Operations Research	BS	5	3	2	0	4
10	16SHB21	Engineering Physics	BS	6	2	0	4	4

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11	16SHB22	Material Science	BS	3	3	0	0	3
12	16SHB23	Physics for Electrical Engineering	BS	3	3	0	0	3
13	16SHB24	Physics for Mechanical Engineering	BS	3	3	0	0	3
14	16SHB31	Engineering Chemistry	BS	6	2	0	4	4
15	16SHB32	Environmental Science and Engineering	BS	3	3	0	0	3

Engineering Science [ES]

S. No.	Course Code	Course Title	Category	Contact Hours	Instructions Hours/Week			C
					L	T	P	
1	16BTC01	Fundamental of Computing and Programming	ES	6	2	0	4	4
2	16BTC02	Advanced C Programming	ES	6	2	0	4	4
3	16BTC03	Basics of Civil and Mechanical Engineering	ES	4	4	0	0	4
4	16BTC04	Basics of Electrical and Electronics Engineering	ES	3	3	0	0	3
5	16BTC05	Engineering Graphics	ES	5	1	0	4	3
6	16BTC06	Engineering Practices for Mechanical Sciences	ES	4	0	0	4	2
7	16BTC07	Engineering Geology	ES	3	3	0	0	3
8	16BTC08	Engineering Mechanics	ES	5	3	0	0	4
9	16BTC09	Construction Materials	ES	3	3	0	0	3
10	16BTC10	Object Oriented Programming	ES	6	2	0	4	4
11	16BTC11	Bio Mechanics	ES	3	3	0	0	3
12	16BTC12	Measurements and Instrumentation	ES	3	3	0	0	3
13	16BTC13	Renewable energy resources	ES	3	3	0	0	3
14	16BTC14	Fundamentals of Nanotechnology	ES	3	3	0	0	3
15	16BTC15	Remote Sensing and GIS	ES	3	3	0	0	3

Professional Core [PC]

S. No.	Course Code	Course Title	Category	Contact Hours	Instructions Hours/Week			C
					L	T	P	
1	16BTD01	Biochemistry	PC	6	3	0	4	5
2	16BTD02	Bioorganic Chemistry	PC	6	3	0	4	5
3	16BTD03	Basic Industrial Biotechnology	PC	3	3	0	0	3
4	16BTD04	Cell & Microbiology	PC	3	3	0	0	3
5	16BTD05	Immunology	PC	7	4	0	4	5

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6	16BTD06	Bioprocess Principles	PC	3	3	0	0	3
7	16BTD07	Fundamentals of Unit Operation	PC	4	3	1	0	4
8	16BTD08	Instrumental methods of analysis	PC	6	3	0	4	5
9	16BTD09	Bioprocess Engineering	PC	6	3	0	4	5
10	16BTD10	Protein Engineering	PC	3	3	0	0	3
11	16BTD11	Molecular Biology	PC	6	3	0	4	5
12	16BTD12	Mass Transfer Operations	PC	4	4	0	0	4
13	16BTD13	Genetic Engineering	PC	6	3	0	4	5
14	16BTD14	Bioinformatics	PC	3	2	1	0	3
15	16BTD15	Applied Chemical Reaction Engineering	PC	6	3	0	4	5
16	16BTD16	Biopharmaceutical Technology	PC	3	3	0	0	3
17	16BTD17	Downstream Processing	PC	6	3	0	4	5
18	16BTD18	Cancer Biology	PC	3	3	0	0	3
19	16BTD19	Disaster Management	PC	3	3	0	0	3

Professional Elective [PE]

S. No.	Course Code	Course Title	Category	Contact Hours	Instructions Hours/Week			C
					L	T	P	
1	16BTE01	Food technology	PE	3	3	0	0	3
2	16BTE02	Animal Biotechnology	PE	3	3	0	0	3
3	16BTE03	Chemistry of Medicines	PE	3	3	0	0	3
4	16BTE04	Life Style Diseases	PE	3	3	0	0	3
5	16BTE05	Intellectual Property Rights	PE	3	3	0	0	3
6	16BTE06	Biofuel	PE	3	3	0	0	3
7	16BTE07	Fundamentals of Nanoscience	PE	3	3	0	0	3
8	16BTE08	Plant Biotechnology	PE	3	3	0	0	3
9	16BTE09	Process Equipments and Plant Design	PE	3	3	0	0	3
10	16BTE10	Neurobiology and Conginitive sciences	PE	3	3	0	0	3
11	16BTE11	Tissue Engineering	PE	3	3	0	0	3
12	16BTE12	Biosafety and Hazard Management	PE	3	3	0	0	3
13	16BTE13	Stem cell Technology	PE	3	3	0	0	3
14	16BTE14	Biophysics	PE	3	3	0	0	3
15	16BTE15	Biological Spectroscopy	PE	3	3	0	0	3
16	16BTE16	Bioentrepreneurship	PE	3	3	0	0	3
17	16BTE17	Professional Ethics in Engineering	PE	3	3	0	0	3
18	16BTE18	Marine Biotechnology	PE	3	3	0	0	3
19	16BTE19	Metabolic Engineering	PE	3	3	0	0	3
20	16BTE20	Human Rights	PE	3	3	0	0	3

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Employability Enhancement Courses [EEC]

S. No.	Course Code	Course Title	Category	Contact Hours	Instructions Hours/Week			C
					L	T	P	
1	16BTF01	Interpersonal Skills / Listening and Speaking	EEC	2	0	0	2	1
2	16BTF02	Advanced Reading and Writing	EEC	2	0	0	2	1
3	16BTF03	Professional Communication	EEC	2	0	0	2	1
4	16BTF04	Mini Project	EEC	2	0	0	4	2
5	16BTF05	Project Work	EEC	20	0	0	20	10

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MODEL CURRICULUM

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Department	Biotechnology	
Programme	B.Tech. - Biotechnology	

SEMESTER – I

Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit	Contact Hrs
				L	T	P	C	
1.	16SHA01	Technical English	HS	3	2	0	4	5
2.	16SHB01	Matrices, Calculus and Differential Equations	BS	3	2	0	4	5
3.	16SHB22	Material Science	BS	3	0	0	3	3
4.	16BTC03	Basic of Civil and Mechanical Engineering	ES	4	0	0	4	4
5.	16BTC15	Fundamentals of Computing and Programming	ES	2	0	4	4	6
6.	16BTC05	Engineering Graphics	ES	0	0	4	2	4
7	16SHB31	Engineering Chemistry	BS	3	0	2	4	5
Total Credits							**25**	

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SEMESTER – II

Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit	Contact Hrs
				L	T	P	C	
1.	16SHA02	Communicative English	HS	3	0	4	5	7
2.	16SHB02	Laplace Transforms and Vector Calculus	BS	3	2	0	4	5
3.	16SHB21	Engineering Physics	BS	2	0	4	4	6
4.	16SHB32	Environmental Science and Engineering	BS	3	0	0	3	3
5	16SHA08	Principles of Management and Engineering Ethics	HS	3	0	0	3	3
6	16BTC02	Advanced C Programming	ES	2	0	4	4	6
7	16BTC06	Engineering Practices For Electrical Sciences	ES	0	0	4	2	4
Total Credits							**25**	

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SEMESTER – III

Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit	Contact Hrs
				L	T	P	C	
1.	16SHB03	Transforms and Partial Differential Equations	BS	3	2	0	4	5
2.	16BTD01	Biochemistry	PC	3	0	4	5	6
3.	16BTD02	Bioorganic Chemistry	PC	3	0	4	5	6
4.	16BTD03	Basic Industrial Biotechnology	PC	3	0	0	3	3
5	16BTD04	Cell & Microbiology	PC	3	0	0	3	3
6.	16BTC10	Object Oriented Programming	ES	2	0	4	4	6
Total Credits							**24**	

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SEMESTER – IV

Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit	Contact Hrs
				L	T	P	C	
1.	16SHB06	Numerical Methods	BS	3	2	0	4	5
2.	16BTD05	Immunology	PC	3	0	2	4	5
3.	16BTD06	Bioprocess Principles	PC	3	0	0	3	3
4.	16BTD07	Fundamentals of Unit Operation	PC	3	2	0	4	5
5.	16BTD08	Analytical Methods and Instrumentation	PC	3	0	2	4	5
6.	16BTC08	Engineering Mechanics	ES	3	0	0	4	5
7.	16BTF01	Interpersonal Skills / Listening and Speaking	EEC	0	0	2	1	2
Total Credits							**24**	

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SEMESTER – V

Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit	Contact Hrs
				L	T	P	C	
1	16BTD09	Bioprocess Engineering	PC	3	0	2	4	5
2	16BTD10	Protein Engineering	PC	3	0	0	3	3
3	16BTD11	Molecular Biology	PC	3	0	2	4	5
4	16BTD12	Mass Transfer Operations	PC	3	0	0	3	3
5		Professional Electives - I	PE	3	0	0	3	3
6		Professional Electives - II	PE	3	0	0	3	3
7		Open Electives - I	OE	3	0	0	3	3
Total Credits							**23**	

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SEMESTER – VI

Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit	Contact Hrs
				L	T	P	C	
1.	16BTD13	Genetic Engineering	PC	3	0	2	4	5
2.	16BTD14	Bioinformatics	PC	2	2	0	3	4
3.	16BTD15	Applied Chemical Reaction Engineering	PC	3	0	2	4	5
4.	16BTD16	Biopharmaceutical Technology	PC	3	0	0	3	3
5.		Professional Electives - III	PE	3	0	0	3	3
6.		Professional Electives – IV	PE	3	0	0	3	3
7.		Open Electives-II	OE	3	0	0	3	3
Total Credits							**23**	

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SEMESTER – VII

Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit	Contact Hrs
				L	T	P	C	
1.	16BTD17	Downstream Processing	PC	3	0	2	4	5
2.	16BTD18	Cancer Biology	PC	3	0	0	3	3
3.	16BTC13	Renewable energy resources	ES	3	0	0	3	3
4.		Professional Electives - V	PE	3	0	0	3	3
5.		Professional Electives - VI	PE	3	0	0	3	3
6.		Open Electives-III	OE	3	0	0	3	3
7.	16BTF04	Mini project	EEC	0	0	12	6	12
Total Credits							**25**	

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SEMESTER – VIII

Sl. No.	Course Code	Course Name	Category	Hours/ Week			Credit	Contact Hrs
				L	T	P	C	
1.	16BTF05	Project work	EEC	0	0	24	12	24
Total Credits							**12**	

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Total Credits: 181

Semester	I	II	III	IV	V	VI	VII	VIII	Total	%
Total	**25**	**25**	**24**	**24**	**23**	**23**	**25**	**12**	**181**	**100**
HS	4	8							12	7
BS	11	11	4	4					30	17
ES	10	6	4	4			3		27	15
PC			16	15	14	14	7		66	36
PE					6	6	6		18	10
EEC				1			6	12	19	10
OE					3	3	3		9	5

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16SHA01 TECHNICAL ENGLISH

L	T	P	C
3	2	0	4

COURSE OBJECTIVES

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.
- To make the learners to use the phrase and clauses error free.

COURSE OUTCOMES

- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
- listen/view and comprehend different spoken discourses/excerpts in different accents
- use the phrases and sentences clearly in their written communication

UNIT I GRAMMAR & VOCABULARY 9+6

Word formation with prefixes and suffixes – synonyms and antonyms – verb patterns- subject-verb agreement – tenses – voices – use of conditionals – comparative adjectives (affirmative and negative) – expanding– nominal compounds – articles – use of prepositions - phrasal verbs – British and American vocabulary – error detection – abbreviations and acronyms.

UNIT II LISTENING 9+6

Extensive listening – listening for general content – listening to fill up gapped texts – intensive listening – listening for specific information: retrieval of factual information – listening to identify topic, context, function, speaker's opinion, attitude, etc. – global understanding skills and ability to infer, extract gist and understand main ideas – note-taking: guided and unguided

UNIT III SPEAKING 9+6

Verbal and non verbal communication – speech sounds – syllables – word stress (structures and content words) – sentences stress – intonation – pronunciation drills, tongue twisters – formal and informal English – oral practice – developing confidence – introducing oneself – asking for or eliciting objects – expressing opinions (agreement / disagreement) – giving instructions

UNIT IV READING 9+6

Exposure to different reading techniques – reading for gist and global meaning – predicting the content – text – identifying the topic sentence and its role in each paragraph – scanning – inferring / identifying lexical and contextual meanings – reading for structure and detail – transfer of information / guided note-making – understanding discourse coherence – sequencing of sentences – cloze reading.

UNIT V WRITING 9+6

Introductions to the characteristics of technical style – writing definitions and descriptions –paragraph writing (topic sentence and its role, unity, coherence and use of cohesive expressions) – process description (use of sequencing connectives) – comparison and contrast – classifying the data – analyzing / interpreting the data – formal letter writing (letter to the editor, letter for seeking practical training, and letter for undertaking project works in industries) – editing (punctuation, spelling and grammar)

TOTAL: 45+30

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Raman, Meenakshi & Sangeetha Sharma.	Technical Communication: Principles and Practice. Oxford University Press,	Oxford University Press, New Delhi.	2011
2	Rizvi, Ashraf. M.	Effective Technical Communication.	Tata McGraw-Hill, New Delhi.	2005

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Regional Institute of English	English for Engineers.	Cambridge University Press, New Delhi.	2006
2	Mindscapes:	English For Technologists and Engineers	Department of English, Anna University, Chennai,	2012
3	Rutherford, Andrea.	J Basic Communication Skills for Technology	Pearson, New Delhi.	2001
4	Viswamohan , Aysha.	English for Technical Communication.	Tata McGraw-Hill, New Delhi.	2008
5	Raman, Meenakshi & Sangeetha Sharma.	Technical Communication: Principles and Practice. Oxford University	Press, New Delhi.	2011

WEB URLs

1. http://www.usingenglish.com
2. http://www.uefap.com
3. http://usefulenglish.ru/phonetics
4. http://study.com/academy/lesson/characteristics-of-technical-communication.html
5. https://letterpile.com/writing/Four-Types-of-Writing

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16SHA02 **COMMUNICATIVE ENGLISH** L T P C
3 0 4 5

COURSE OBJECTIVES

- To understand the importance of listening and speaking in language acquisition process
- To engage in conversation intelligibly
- To use English accurately, appropriately and fluently in different situations (academic, social and professional) and familiarize themselves with all speech sounds in English
- To write academic, communicative and creative pieces of writing
- To devise different tasks / methods to enhance their learners' communication skills

COURSE OUTCOMES

- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
- listen/view and comprehend different spoken discourses/excerpts in different accents
- Communicate with others confidently

UNIT I GRAMMAR & VOCABULARY 9

Phrases & Clauses- Kinds of Sentences - Types of sentences and sentence patterns – GRE Vocabulary - Synonyms - Antonyms - Word Formation- Error Spotting- Sentence Correction- Word Analogy- Idioms and Phrases- Direct and Indirect Speech- 'If' Conditionals

UNIT II LISTENING 9

Listening processes: top-down and bottom-up skills - Listening strategies - Sounds of English: Consonants, vowels and diphthongs - Phonemic transcription, tongue twisters, words often mispronounced - Word stress and sentence stress: content words, structural words, strong forms, weak forms - Intonation patterns - Language functions : [Inviting-accepting/declining invitation - Offering /accepting/ refusing help - Thanking/ responding to thanks - Congratulating , Complimenting - Apologizing/ accepting an apology - Asking for / giving / refusing permission - Asking for advice / giving advice - Asking about likes, preferences / expressing likes / dislikes - Asking for information / giving information

UNIT III SPEAKING 9

Greeting - Introducing Oneself -Invitation - Making Request - Expressing Gratitude - Complimenting and Congratulating - Expressing Sympathy - Apologizing - Asking for Information - Seeking Permission - Complaining and Expressing Regret - Using English in Real Life Situation [At the Bank/ post office/ College office - At the Green Grocer - At the Temple - At the College Canteen or Restaurant - At the Police station - At the Railway Station/ Bus Station - At the Medical Shop - At the Library - Interviews - Booking a Room in a Hotel - At the Travel Agency

UNIT IV READING 9

Importance of Reading - Why develop reading habits among students and How - Reading techniques [Skimming , Scanning , Intensive reading , Extensive] Question types [Inferring , Assumption, Evaluative , Extrapolative], Reading different text types [Menu ,Email , Letters , Cartoons , Advertisements, Recipe , Articles , Literary texts – stories, plays, poems, Biographies] – identifying lexical and Contextual meaning- Understanding Discourse Coherence – sequencing of sentences- Cloze Reading - Academic Reading

UNIT V WRITING 9

Developing Proficiency in Writing - Text Types - Academic Writing [Paragraphs , Essays]

- Writing for communicative purposes [Letters – official and personal , Messages / Notices, Reports , Emails , Advertisements ,Application for a job (covering letter and CV) - Creative Writing (Stories, Poems , Dialogues)

TOTAL : 45

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Raman, Meenakshi & Sangeetha Sharma.	Technical Communication: Principles and Practice.	Oxford University Press, New Delhi.	2011
2	Rizvi, Ashraf. M	Effective Technical Communication.	Tata McGraw-Hill New Delhi.	2005

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Regional Institute of English	English for Engineers. Cambridge University Press	New Delhi.	2006.
2	Dr.Gunasekaran, Vishu "	Technical English Work Book.	Vishnu "Print Media, Krishna Publications	2011
3	Rutherford, Andrea.	J Basic Communication Skills for Technology.	Pearson, New Delhi.	2001
4	Viswamohan, Aysha.	English for Technical Communication.	Tata McGraw-Hill, New Delhi.	2008
5	Raman, Meenakshi & Sangeetha Sharma.	Technical Communication: Principles and Practice.	Oxford University Press, New Delhi	2011

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1. http://www.usingenglish.com
2. http://www.uefap.com
3. www.brainboxx.co.uk/A3_ASPECTS/pages/reading.htm
4. www.sparklebox.co.uk/literacy/vocabulary/word-lists/connectives/#.V613NH195kg
5. www.letterwritingguide.com/

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16SHA03 **BUSINESS ENGLISH** L T P C
3 2 0 4

COURSE OBJECTIVES

- To enable learners of Engineering and Technology develop their basic Business communication skills.
- To Understand the formal and informal communication in the business organization
- To ensure that learners to understand the fundamentals of Business writing
- To inculcate the effective email writing skills for better business communication.
- To make the learners to use the phrase and clauses error free.

COURSE OUTCOMES

- Communicate with one or many by using appropriate communicative strategies.
- Write business correspondence by constructing clear sentences and paragraphs using the appropriate selection of words
- Use economized words and emphasis in Sentence Design.
- Able to use electronic technology in business communication
- use the phrases and sentences clearly in their written communication

UNIT I FUNDAMENTALS OF BUSINESS WRITING 9+6

Adaptation and the selection of words- Non Discriminatory writing- economizing on words- giving sentences unity-arranging sentences for clarity- Accent on positive Language- Coherence- Transitional words

UNIT II BASIC PATTERNS OF BUSINESS LETTERS 9+6

Asking for Information- Asking for Action- Orders-Inquiries about people-claims –Refusing Request-Adjustment Refusals- Credit Refusal- Structure of the Sales Letter- Letter of Authorization- Letter of Recommendation

UNIT III FUNDAMENTALS OF REPORT WRITING 9+6

Determining the Report Purpose- Determining the Components-Gathering the Information Needed-Interpreting and Applying the Findings- Organizing the Report Information- Writing the Report

UNIT IV OTHER FORMS OF BUSINESS COMMUNICATIO 9+6

Public Speaking and Oral Reporting- Overcome Nervousness- Making Formal Speech-Audience Analysis-Use of Voice- Use of Visual Aids- Conducting and Participating in Meetings- Interviewing People- Using Telephone- Email Writing

UNIT V CORRECTNESS OF COMMUNICATION 9+6

Standards of Punctuation – Apostrophe, Brackets, Colon, Comma etc…Standards for Grammar- Adjective-Adverb Confusion, Subject-Verb Agreement, Dangling Modifier, Parallelism, word use etc…

TOTAL : 45+30

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Lesikar, Bamford	Basic Business Communication"	1st Canadian Edition (IRWIN DORSEY), Von Hoffmann Press,	1993

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2.	Rizvi, Ashraf. M.	Effective Technical Communication.	Tata McGraw-Hill New Delhi.	2005

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Regional Institute of English	English for Engineers.	Cambridge University Press New Delhi.	2006.
2	Mindscapes	English For Technologists and Engineers	Department of English, Anna University, Chennai,	2012
3	Rutherford, Andrea.	J Basic Communication Skills for Technology.	Pearson New Delhi.	2001
4	Viswamohan , Aysha.	English for Technical Communication	Tata McGraw-Hill, New Delhi.	2008
5	Raman, Meenakshi & Sangeetha Sharma.	Technical Communication: Principles and Practice	Oxford University Press, New Delhi.	2011.

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2. www.businessenglishpod.com/category/communication-skills
3. www.bbc.co.uk/worldservice/learningenglish/business/talkingbusiness
4. www.teachingenglish.org.uk/teaching-adults/resources/english-business
5. www.businessenglish.com/index_en.html

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16SHA04 **BASICS OF JAPANESE** L T P C
3 2 0 4

COURSE OBJECTIVES

- To teach pronunciation and intonation of Japanese sounds and to enable students to comprehend and speak simple sentences in Japanese
- To introduce Japanese language at the basic level, to enable students to read and write the phonetic scripts, *Hiragana* and *Katakana,* and approx.100 *Kanji,*
- To teach some aspects of Japanese society and culture.
- To enable students to comprehend and write simple sentences in Japanese.
- To enable students to comprehend and make simple conversation in different situations using basic sentence patterns

COURSE OUTCOMES

- Communicate with one or many by using appropriate communicative strategies.
- Write Japanese correspondence by constructing clear sentences and paragraphs using the appropriate selection of words
- Use economized words and emphasis in Sentence Design.
- Able to use Japanese language for communication
- use Japanese phrases and sentences clearly in their written communication

UNIT I INTRODUCTION TO LETTERS **9+6**

Introduction of the Japanese writing system, i.e. Hiragana, Katakana and Kanji (100-120), word-building, writing foreign names and loan words in Katakana

UNIT II BASIC WORDS **9+6**

Japanese Greetings; Basic sentence patterns to be applied in self introduction, identifying things; time of the day; calendar; counting using Japanese numerical classifiers

UNIT III BASIC PHRASES & CLAUSES **9+6**

Describing things; making comparisons; talking of daily activities; kinship terms used for address and reference; seasons; giving and receiving; shopping; making requests; talking of one's likes and dislikes

UNIT IV BASIC TENSES **9+6**

Making Sentences – Present, Past and Future, Progressive & Perfect Tenses

UNIT V CULTURE AND SOCIETY **9+6**

An introduction to some aspects of Japanese culture such as festivals, Japanese seasons, Japanese people and their love for nature; Japanese food, sports; society; geography; education system; Japan and the world etc. The objective is to create general awareness in students about life in Japan.

TOTAL: 45+30

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	George Trombley , Yukari	Japanese from Zero! 1: Proven Techniques to Learn Japanese for Students and	Volume 1) 6th Edition Bay Foreign Language	2015

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	Takenaka	Professionals	Books Ltd	
2	Living Language Japanese, Complete Edition	Japanese reading & writing guide, and free online learning Paperback	Unabridged	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Pimsleur	Japanese Level 1 CD: Learn to Speak and Understand Japanese with Pimsleur Language Programs Pimsleur;	3rd edition (Comprehensive)	2002
2	Pimsleur	Japanese Level 2 CD: Learn to Speak and Understand Japanese with Pimsleur Language Programs Pimsleur;	Pimsleur; 3 edition	October 1, 2002
3	Pimsleur	Japanese Level 3 CD: Learn to Speak and Understand Japanese with Pimsleur Language Programs Pimsleur	Pimsleur; 3 edition	October 1, 2002
4	Eriko Sato	Practice Makes Perfect Basic Japanese 1st Edition, McGraw-Hill Education	Pimsleur; 1 edition	April 1, 2014
5	Mr Tae K Kim,	A Guide to Japanese Grammar: A Japanese approach to learning Japanese grammar	CreateSpace Independent Publishing Platform	January23, 2014

WEB URLs

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3. www.coscom.co.jp
4. www.japanese-online.com
5. http://nihongo-e-na.com/eng

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16SHA05 FUNCTIONAL JAPANESE L T P C

3 2 0 4

COURSE OBJECTIVES

- Students will be introduced to the basic structures of Japanese and encouraged to utilize them in appropriate situations.
- Students will be able to talk about themselves, their family, their likes and dislikes, their immediate happenings, etc. in simple sentences.
- Students will be able to complete basic communicative tasks in different social contexts such as shopping, ordering food, inviting others to do something with you.
- Students will be able to write short passages on the similar topics.
- Students will also learn aspects of Japanese culture that relate to the lesson topics.

COURSE OUTCOMES

- Communicate with one or many by using appropriate communicative strategies.
- Write Japanese correspondence by constructing clear sentences and paragraphs using the appropriate selection of words
- Use economized words and emphasis in Sentence Design.
- Able to use Japanese language for communication
- use Japanese phrases and sentences clearly in their written communication

UNIT I BASIC GRAMMATICAL STRUCTURE 9+6

Expressing State-of-Being, Conjugating to the negative state-of-being, conjugating to the past state-of-being, Polite Form and Verb Stems Addressing People, Questions in polite form, relative clauses

UNIT II BASIC VOCABULARY

9 +6

Vocabulary- Family, Friends, Room, Home, Health, School, Hobbies, Student's Life Shopping etc…

UNIT III BASIC PHRASES – I 9+6

Simple conversation in situations such as describing things, making comparisons, talking of daily activities, giving and receiving of gifts, talking of illnesses and visit to a doctor

UNIT IV BASIC PHRASES-II 9+6

Simple conversation in situations such as shopping, making requests, talking of one's likes and dislikes, talking on telephone etc. and Asking Questions

UNIT V CULTURE AND SOCIETY 9+6

An introduction to some aspects of Japanese culture such as festivals, Japanese seasons, Japanese people and their love for nature; Japanese food, sports; society; geography; education system; Japan and the world etc. The objective is to create general awareness in students about life in Japan.

TOTAL : 45+30

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	George Trombley , Yukari Takenaka "	Japanese from Zero! 1: Proven Techniques to Learn Japanese for Students and Professionals (Volume 1) 6th Edition"	Bay Foreign Language Books Ltd	2015
2	Living Language Japanese, Complete Edition:	Beginner through advanced course, including 3 coursebooks, 9 audio CDs, Japanese reading & writing guide, and free online learning Paperback	Unabridged	February 7, 2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Pimsleur ,	Japanese Level 1 CD: Learn to Speak and Understand Japanese with Pimsleur Language Programs Pimsleur;	3 edition (Comprehensive) 3rd Edition	October 1, 2002
2	Pimsleur ,	Japanese Level 2 CD: Learn to Speak and Understand Japanese with Pimsleur Language Programs Pimsleur;	3 edition	October 1, 2002
3	Pimsleur	Japanese Level 3 CD: Learn to Speak and Understand Japanese with Pimsleur Language Programs Pimsleur;	3 edition	October 1, 2002
4	Eriko Sato,	Practice Makes Perfect Basic Japanese 1st Edition, McGraw-Hill Education;	1 edition	April 1, 2014
5	Mr Tae K Kim,	A Guide to Japanese Grammar: A Japanese approach to learning Japanese grammar , CreateSpace	Independent Publishing Platform	January 23, 2014

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1. https://nihongoshark.com/links/
2. www.guidetojapanese.org/learn/
3. www.coscom.co.jp/
4. www.japanese-online.com/
5. http://nihongo-e-na.com/eng

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16SHA06 **BASIC GERMAN** L T P C
3 2 0 4

COURSE OBJECTIVES

- To teach pronunciation and intonation of German sounds and to enable students to comprehend and speak simple sentences in German
- To introduce German language at the basic level, to enable students to read and write the phonetic scripts of German,
- To teach some aspects of German society and culture.
- To enable students to comprehend and write simple sentences in German.
- To enable students to comprehend and make simple

COURSE OUTCOMES

- Communicate with one or many by using appropriate communicative strategies.
- Write German correspondence by constructing clear sentences and paragraphs using the appropriate selection of words
- Use economized words and emphasis in Sentence Design.
- Able to use German language for communication
- use German phrases and sentences clearly in their written communication

UNIT I BASIC GERMAN 9+6

Alphabet - Numbers - Personal pronouns - Verb endings in the present tense - Verbs with vowel change - Possessive adjectives - Plural of nouns - The accusative case - The imperative - Seperable verbs - Modal verbs: können, müssen - Word order

UNIT II BASIC GRAMMAR – I 9+6

Nouns and Articles : Nouns gender: masculine (der Mann) feminine (die Frau neuter das Kind) plural (die Leute) formation of the feminine (die Lehrerin, die Direktorin)compound nouns (das Mineralwasser die Geburtstagsparty) case: nominative (Der Mathelehrer heißt Herr Lenz). accusative (Hast du den Mantel gekauft?) dative(Wir fahren mit dem Bus) and Articles

UNIT III BASIC GRAMMAR – II 9+6

Pronouns- Personal, Nominative, accusative, dative, reflexive, interrogative; Adjectives- attributive, possessive, comparative, superlative; Adverbs; Numbers- cardinal and ordinal

UNIT IV BASIC TENSES 9+6

Making Sentences – Present, Past and Future, Progressive & Perfect Tenses and conditional, frequently used Prepositions and Conjunctions

UNIT V CULTURE AND SOCIETY 9+6

An introduction to some aspects of German culture such as festivals, German people, German food, sports; society; geography; education system; German and the world etc.

TOTAL: 45+30

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication

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1	Adams Media;	Edward Swick M.A The Everything Learning German Book: Speak, write, and understand basic German in no time	2 edition	November 18, 2009
2	Eugene Jackson	German Made Simple: Learn to Speak and Understand German Quickly and Easily	Revised Edition Made Simple Press; Revised edition	May 16, 2006

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Living Language German,	Complete Edition: Beginner through advanced course, including 3 coursebooks, 9 audio CDs, and free online learning Audio CD	Unabridged, Living Language; Com/Pap/Ps edition	August 9, 2011
2	Ultimate German Beginner	Intermediate (Coursebook) (Ultimate Beginner-Intermediate) Revised & enlarged Edition Living Language;	Revised & enlarged edition	September 21, 2004
3	Jolene Wochenske:	Practice Makes Perfect Basic German (Practice Makes Perfect Series) McGraw-Hill Education	1 edition	June 7, 2011
4	Ed Swick :	Practice Makes Perfect German Conversation (Practice Makes Perfect Series) McGraw-Hill Education;	1 edition	August 7, 2012
5	Astrid Henschel:	Practice Makes Perfect German Verb Tenses, 2nd Edition: With 200 Exercises + Free Flashcard App	2nd Edition McGraw-Hill Education; 2 edition	June 11, 2013

WEB URLs

1. https:/babbel.com/learn-german-free
2. http://deutsch-lernen.com/
3. http://learning-german-online.org/
4. http://fluentin3months.com/german-learning-resources/
5. https://goethe.de/en/spr/ueb.html

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16SHA07 **FUNCTIONAL GERMAN** L T P C
3 2 0 4

COURSE OBJECTIVES

- Students will be introduced to the basic structures of German and encouraged to utilize them in appropriate situations.
- Students will be able to talk about themselves, their family, their likes and dislikes, their immediate happenings, etc. in simple sentences.
- Students will be able to complete basic communicative tasks in different social contexts such as shopping, ordering food, inviting others to do something with you.
- Students will be able to write short passages on the similar topics.
- Students will also learn aspects of German culture that relate to the lesson topics

COURSE OUTCOMES

- Communicate with one or many by using appropriate communicative strategies.
- Write German correspondence by constructing clear sentences and paragraphs using the appropriate selection of words
- Use economized words and emphasis in Sentence Design.
- Able to use German language for communication
- use German phrases and sentences clearly in their written communication

UNIT I BASIC PRONUNCIATION **9+6**

How To Pronounce German Vowels, German Consonants, German Diphthongs (Gliding Vowels)

UNIT II BASIC VOCABULARY **9+6**

Vocabulary- Family, Friends, Room, Home, Health, School, Hobbies, Student's Life, Shopping etc…

UNIT III BASIC PHRASES - I **9+6**

Basic German Words / Phrases, Saying Hello in German / Introducing Yourself / Saying Goodbye in German, Simple conversation in situations such as describing things, making comparisons, talking of daily activities, giving and receiving of gifts, talking of illnesses and visit to a doctor,

UNIT IV BASIC PHRASES-II **9+6**

Simple conversation in situations such as shopping, making requests, talking of one's likes and dislikes, talking on telephone etc. and Asking Questions

UNIT V CULTURE AND SOCIETY **9+6**

An introduction to some aspects of German culture such as festivals, seasons, German people and their lifestyle; German food, sports; society; geography; education system; German and the world etc.

TOTAL: 45+30

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Edward Swick M.A	The Everything Learning German Book: Speak, write, and understand basic German in no time , Adams Media;	2 edition	November 18, 2009
2	Eugene Jackson	German Made Simple: Learn to Speak and Understand German Quickly and Easily Revised Edition Made Simple Press	Revised edition	May 16, 2006

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Living Language German,	Complete Edition: Beginner through advanced course, including 3 coursebooks, 9 audio CDs, and free online learning Audio CD –	Unabridged, Living Language; Com/Pap/Ps edition	August 9,2011
2	Ultimate German Beginner	Intermediate (Coursebook) (Ultimate Beginner-Intermediate) Revised & enlarged Edition Living Langua	Revised & enlarged edition	September 21, 2004
3	Jolene Wochenske	Practice Makes Perfect Basic German (Practice Makes Perfect Series)	McGraw-Hill Education 1 edition	June 7, 2011
4	Ed Swick	Practice Makes Perfect German Conversation (Practice Makes Perfect Series)	McGraw-Hill	2011
5	Astrid Henschel	Practice Makes Perfect German Verb Tenses, 2nd Edition: With 200 Exercises + Free Flashcard App 2nd Edition	McGraw-Hill Education; 2 edition	June 11, 2013

WEB URLs

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2. http://deutsch-lernen.com/
3. http://learning-german-online.org/
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16SHA08 PRINCIPLES OF MANAGEMENT AND ENGINEERING ETHICS L T P C 3 0 0 3

COURSE OBJECTIVES

- To create an exposure to the students regarding the basic concepts of management.
- To inculcate the significance of Planning in decision making
- To create an awareness about the organization structure adopted by different firms.
- To make them understand the code of ethics
- To make them aware of the responsibilities ensuring safety

COURSE OUTCOMES

- Capable of applying the functions of management relevant to the present Scenario.
- Able to take appropriate decisions under different circumstances.
- Able to implement different strategies to manage the employees.
- Able to follow the ethics in their profession
- Aware of all the rights and safety measures

UNIT I INTRODUCTION 9

Introduction – Definition of Management – Management significance – Management as an Art or Science - Roles of Managers – Functions of Management – Principles of Management – Current trends and issues of Management

UNIT II PLANNING AND ORGANIZING 9

Nature and Importance of Planning – Methods of Planning – Organisation Structure – Job design – Recruitment and selection – Training methods

UNIT COMMUNICATION AND CONTROL 9

Meaning – Objectives – Importance – Process of Communication – Barriers to communication – Effective Communication – Control: definition – Objectives and process of control – types of control –and Information Technology

UNIT IV ENGINEERING ETHICS 9

Introduction of Engineering Ethics – Code of ethics – Individual, professional and Institutional values – Leadership in Engineering and Industry – Commitment – Empathy - Self Confidence – Models of Professional roles

UNIT V SAFETY RESPONSIBILITIES AND RIGHTS 9

Assessment of Safety and Risk – Risk Benefit analysis – Occupational crime – Professional rights – Environmental Ethics – Engineers as Managers – Code of Conduct – Corporate Social Responsibility.

TOTAL HOURS: 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	L.M.Prasad	Principles and Practice of Management	Sultan Chand & Sons	2007
2	V.S.Senthilkumar	Engineering Ethics	Prentice Hall India Learning Private Limited	2014

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	A.C.Tripathi	Principles of Management	Tata McGraw Hill Education	2012
2	Andrew J.Dubrin	Essential of Management	Thomson Southwestern	2012
3	Stephen P. Robbins,David A .De Cenzo and mary Coutler	Fundamentals of Management	Prentice Hall of India	2012.
4	Charless B. Fleddermann	Engineering Ethics	Prentice Hall India Learning Private Limited	2012
5	John R Boatright	Ethics and the Conduct of Business	Pearson Education-New Delhi	2013

WEB URLs

1. https://www.youtube.com/watch?v=g1r5vBJnJAE
2. https://www.youtube.com/watch?v=azrUt008Uf0
3. https://www.youtube.com/watch?v=mDZrBxzfmOg
4. https://www.youtube.com/watch?v=upUN460U56A
5. https://www.youtube.com/watch?v=dguYC_qlF48

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16SHB01 | MATRICES , CALCULUS & ORDINARY DIFFERENTIAL EQUATIONS | L T P C 3 2 0 4

COURSE OBJECTIVES

- To realize the use of matrix algebra techniques in engineering applications and to develop for future applications.
- To familiarize the student with differential calculus concepts. this is needed in almost all branches of engineering.
- To learn the functions with several variables which finds applications in many engineering branches
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

COURSE OUTCOMES

- This course equips students to have basic knowledge in matrix algebra techniques with its engineering applications
- This course helps students in understanding the concepts of differential calculus.
- The students will have knowledge on functions with several variables.
- The knowledge gained on ordinary differential equations will provide a strong platform to solve the research problems in model engineering
- The students will have the ability to solve the real time engineering problems with multiple integrals and their usage

UNIT - I MATRICES 9+6

Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley-Hamilton Theorem (Without Proof) – Orthogonal transformation of a symmetric matrix to Diagonal form – Reduction of a quadratic form to canonical form by orthogonal transformation

UNIT – II APPLICATIONS OF DIFFERENTIAL CALCULUS 9+6

Curvature in Cartesian co-ordinates – Centre and radius of curvature – Circle of curvature – Evolutes – Envelopes –Properties of envelope and evolutes

UNIT – III FUNCTIONS OF SEVERAL VARIABLES 9+6

Functions of two variables – Taylor series - Partial derivatives – Maxima and minima – Constrained maxima and minima – Lagrange's multipliers method – Jacobians

UNIT – IV ORDINARY DIFFERENTIAL EQUATIONS 9+6

Linear differential equations of second and higher order with constant coefficient when the R.H.S is e^{ax}, x^n $n>0$, sin ax, cos ax, $e^{ax}x^n$, e^{ax}sinbx, e^{ax}cosbx – Cauchy's and Legendre's linear equations – simultaneous first order linear equations with constant co-efficients – Method of variation of parameter when the R.H.S is sec ax, cosec ax, tan ax, cot ax – Applications of ODE related simple harmonic motion.

UNIT – V MULTIPLE INTEGRALS 9+6

Double integrals in Cartesian coordinates – Change of order of integration – Area between two curves – Area of double integral - Triple integration in Cartesian coordinates – Volume as triple integrals

TOTAL: 45 + 30

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bali N. P Manish Goyal	A Text book of Engineering Mathematics, 9th edition	Laxmi Publications Pvt Ltd.	2016
2.	Grewal. B.S	Higher Engineering Mathematics, 43rd Edition	Khanna Publications, Delhi	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Glyn James	Advanced Modern Engineering Mathematics, 4th Edition	Pearson Education	2016
2.	Erwin Kreyszig	Advanced Engineering Mathematics, 9th Edition	John Wiley and Sons, New Delhi	2014
3.	Jain R.K. , Iyengar S.R.K.	Advanced Engineering Mathematics, 4th edition	Alpha Science International Ltd	2014
4.	Dass, H.K. , Er. RajnishVerma	Higher Engineering Mathematics, 3rd Revised Edition	S. Chand Private Ltd	2014
5.	Peter V. O.Neil	Advanced Engineering Mathematics, 7th Edition	Cengage learning	2012

WEB URLs

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2. nptel.ac.in/courses/111108081/
3. www.youtube.com/watch?v=FmhMUTmUjhM
4. www.analyzemath.com/appliedmath.html
5. nptel.ac.in/courses/122104017/

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16SHB02 COMPLEX VARIABLES , LAPLACE TRANSFORMS & VECTOR CALCULUS **L T P C**
3 2 0 4

COURSE OBJECTIVES

- To construct relatively simple quantitative models of change, and to deduce their consequences.
- To develop an understanding of the standard techniques of complex variable theory
- To enable the student to apply complex integration theory with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow of electric current.
- To make the student appreciate the purpose of using transforms to create a new domain in which it is easier to handle the problem that is being investigated
- To learn the inverse Laplace transformations for solving real time Engineering problems.
- This course equips students to have basic knowledge in matrix algebra techniques with its engineering applications

COURSE OUTCOMES

- The knowledge gained on vector calculus provides a framework for modeling systems in which there is change, and a way to deduce the predictions of such models.
- Using analytical functions for real world problems, engineer makes models of projects and then simulates its models in real world conditions.
- To enable the student to apply complex integration theory in fluid dynamics, aero dynamics, signal processing and flow of electric current
- The students will have the ability for the analysis of linear time-invariant systems such as electrical circuits, harmonic oscillators, optical devices, and mechanical systems.
- This course equips students to have basic knowledge in inverse Laplace transforms with its engineering applications

UNIT - I VECTOR CALCULUS **9+6**

Gradient, divergence and curl – Line, surface and volume integrals – Green's, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Verification of the above theorems and evaluation of integrals using them

UNIT – II ANALYTIC FUNCTIONS **9+6**

Functions of a complex variable – Analytic function: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w =az, 1/z and bilinear transformation.

UNIT – III COMPLEX INTEGRATION **9+6**

Cauchy's integral theorem (excluding proof) and Cauchy's integral formula(excluding proof) – Taylor's and Laurent's series expansions(excluding proof) – Singular points – Classifications – Cauchy's residue theorem – Contour integration- circle and semi-circle Contour (excluding poles on the real axis).

UNIT – IV LAPLACE TRANSFORMS **9+6**

Laplace transforms – Sufficient condition for existence – Transforms of elementary functions – Basic properties - Derivatives and integrals of transforms – Transforms of derivatives and integrals of functions - – Initial and final value theorems - Problems - Transform of periodic functions

UNIT – V INVERSE LAPLACE TRANSFORMS AND IT'S APPLICATIONS **9+6**

Inverse Laplace transforms – convolution - convolution theorem - Problems – Partial fraction method – Problems – Applications of Laplace transforms – Solution of linear ODE of second order with constant coefficients – Solution of Boundary Value Problems – Solution of Integro Differential Equations.

TOTAL: 45 +

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Glyn James	Advanced Modern Engineering Mathematics, 4th Edition	Pearson Education	2016
2.	Grewal. B.S	Higher Engineering Mathematics, 43rd Edition	Khanna Publications, Delhi	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bali N. P Manish Goyal	A Text book of Engineering Mathematics, 9th edition	Laxmi Publications Pvt Ltd.	2016
2.	Erwin Kreyszig	Advanced Engineering Mathematics, 9th Edition	John Wiley and Sons, New Delhi	2014
3.	Tony Croft, Anthony Croft, Robert Davison, Martin Hargreaves, James Flint	Engineering Mathematics: A Foundation for Electronic, Electrical, Communications and Systems Engineers, 4th Revised Edition	Pearson Education	2012
4.	Peter V. O.Neil	Advanced Engineering Mathematics, 7th Edition	Cengage learning	2012
5.	J.Sureshkumar	Engineering Mathematics – II, 4th Edition	SK..JSK…,Publishers	2016

WEB URLs

1. http://mathinsight.org/
2. http://nptel.ac.in/courses/111107056/7
3. www.nptelvideos.in/2012/11/mathematics-ii.html
4. http://freevideolectures.com/Course/2349/Networks-and-Systems/23
5. http://nptel.ac.in/courses/122104018/node87.html

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16SHB03 TRANSFORMS & PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	2	0	4

COURSE OBJECTIVES

- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To develop Z transform techniques for discrete time systems
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes
- To introduce Fourier series analysis which is central to many applications in engineering
- To develop the basic knowledge in solving the boundary value problems

COURSE OUTCOMES

- This course enables the students to apply Fourier transform techniques to many engineering problems.
- Using this course, a student develops Z transform techniques for discrete time systems for real world problems.
- It equips students to find the solutions of partial differential equations that model real time processes
- Provides the students to have sound knowledge Fourier series analysis.
- The students will have the ability to solve boundary value problems.

UNIT - I FOURIER SERIES **9+6**

Dirichlet"s conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval"s identity – Harmonic analysis

UNIT – II FOURIER TRANSFORMS **9+6**

Statement of Fourier integral theorem - Fourier transforms pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity–Problems .

UNIT – III Z - TRANSFORMS AND DIFFERENCE EQUATIONS **9+6**

Z- transforms - Elementary properties – Initial and final value theorem – Inverse Z - transforms – Partial fraction method – Residue method – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transforms

UNIT – IV PARTIAL DIFFERENTIAL EQUATIONS **9+6**

Formation of partial differential equations – Singular integrals – Solutions of standard types of first order partial differential equations - Lagrange"s linear equation - Linear partial differential equations of second and higher order with constant coefficients of homogeneous when the R.H.S is e^{ax+by}, $x^m y^n$ m,n>0, sin (ax+by), cos (ax+by)

UNIT – V BOUNDARY VALUE PROBLEMS **9+6**

Classification of PDE - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Fourier series solution in Cartesian coordinates – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges) on finite square plates (excluding circular plates).

TOTAL: 45 + 30

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Erwin Kreyszig	Advanced Engineering Mathematics, 9th Edition	John Wiley and Sons, New Delhi	2014
2.	Grewal. B.S	Higher Engineering Mathematics, 43rd Edition	Khanna Publications, Delhi	2014

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Glyn James	Advanced Modern Engineering Mathematics, 4th Edition	Pearson Education	2016
2.	Bali N. P Manish Goyal	A Text book of Engineering Mathematics, 9th edition	Laxmi Publications Pvt Ltd.	2016
3.	Datta.K.B.	Mathematical Methods of Science and Engineering	Cengage Learning India Pvt Ltd, Delhi	2013
4.	Ray Wylie. C, Barrett.L.C	Advanced Engineering Mathematics, 6th Edition	Tata Mc Graw Hill Education Pvt Ltd, New Delhi	2012
5.	Ramana.B.V.	Higher Engineering Mathematics	Tata Mc Graw Hill Publishing Company, New Delhi	2008

WEB URLs

1. www.thefouriertransform.com/
2. www.tutorialspoint.com/signals_and_systems/z_transforms_properties.htm
3. nptel.ac.in/courses/111103021/
4. www.fourier-series.com
5. www.youtube.com/watch?v=Fh8m6ZdFaqU
6. www.jirka.org/diffyqs/htmlver/diffyqsse31.html

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16SHB04 **PROBABILITY & RANDOM PROCESSES**

L	T	P	C
3	2	0	4

COURSE OBJECTIVES

- To develop probabilistic models. This can be used in several areas of science and engineering.
- To improve the ability to understand the importance of special continuous Distributions.
- To Acquire the knowledge the concept of convergence of random sequence and the study of random signals
- To gain knowledge in the application of family of random variables in real life situations.
- To be familiar with application of auto correlation and cross correlation functions.

COURSE OUTCOMES

- The students will have a fundamental knowledge of the probability concepts.
- It helps to use standard distributions to the real life problems.
- It also helps to understand and characterize phenomenon which evolve with respect to time in a probabilistic manner.
- Gained knowledge in the application of family of random variables helps to solve problems in real life situations
- Provides the required mathematical support in real life problems

UNIT - I PROBABILITY AND RANDOM VARIABLES **9+6**

Axioms of probability–conditional probability– Baye's theorem, random variables– Discrete and continuous random variables – MGF

UNIT – II STANDARD DISTRIBUTIONS **9+6**

Discrete distributions : Binomial, Poisson, Geometric, Negative Binomial and their properties – Continuous distributions : Uniform, Exponential, Gamma, Normal distributions and their properties

UNIT – III TWO - DIMENSIONAL RANDOM VARIABLES **9+6**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and regression – Transformation of random variables

UNIT – IV RANDOM PROCESSES **9+6**

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations

UNIT – V CORRELATION AND SPECTRAL DENSITIES **9+6**

Auto correlation - Cross correlation - Properties – Power spectral density – Cross spectral density - Properties – Wiener-Khintchine relation – Relationship between cross power spectrum and cross correlation function

TOTAL: 45 + 30

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Oliver. C Ibe.	Fundamentals of Applied Probability and Random Processes, 2nd Edition	Academic Press	2014
2.	Stark. H., Woods. J.W.	Probability and Random Processes with Applications to Signal Processing, 4th Edition	Pearson Education, Asia	2014

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	HweiP.Hsu	Schaum"s Outline of Theory and Problems of Probability, Random Variables and Random Processes	Mc Graw Hill Publishing Company, New Delhi	2014
2.	Henry Stark , John W. Woods	Probability, Statistics, and Random Processes for Engineers" , 2nd Edition	Pearson Education	2014
3.	Miller. S.L., Childers. D.G.	Probability and Random Processes with Applications to Signal Processing and Communications , 2nd Edition	Academic Press (Elsevier)	2012
4.	Yates. R.D., Goodman. D.J.	Probability and Stochastic Processes, 2nd Edition	Wiley India Pvt. Ltd., Bangalore	2012
5.	Peyton Peebles	Problems and Solutions in Probability, Random Variables and Random Signal Principles (SIE), 1st Edition	Mc Graw Hill Publishing Company, New Delhi	2012

WEB URLs

1. www.khanacademy.org/math/probability/random-variables-topic/random-variables-prob-dist/v/random-variables
2. www.mathsisfun.com
3. http://nptel.ac.in/courses/105103027/13
4. http://nptel.ac.in/courses/117105085/
5. https://www.youtube.com/watch?v=AeRQG6bg51Y

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16SHB05 **PROBABILITY AND QUEUEING THEORY** L T P C
3 2 0 4

COURSE OBJECTIVES

- To provide the required mathematical support in real life problems
- To develop probabilistic models. This can be used in several areas of science and engineering.
- To improve the ability to understand the importance of special continuous Distributions.
- To Acquire the knowledge the concept of convergence of random sequence and the study of random signals
- To gain knowledge in the application of family of random variables in real life situations.
- To provide knowledge objects and operations scheduling.

COURSE OUTCOMES

- The students will have a fundamental knowledge of the probability concepts.
- It helps to use standard distributions to the real life problems.
- It also helps to understand and characterize phenomenon which evolve with respect to time in a probabilistic manner.
- Gained knowledge in the application of family of random variables helps to solve problems in real life situations
- Acquire skills in analyzing queueing models.

UNIT - I PROBABILITY AND RANDOM VARIABLES **9+6**

Axioms of probability–conditional probability– Baye's theorem, random variables– Discrete and continuous random variables – MGF

UNIT – II STANDARD DISTRIBUTIONS **9+6**

Discrete distributions : Binomial, Poisson, Geometric, Negative Binomial and their properties – Continuous distributions : Uniform, Exponential, Gamma, Normal distributions and their properties

UNIT – III TWO - DIMENSIONAL RANDOM VARIABLES **9+6**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and regression – Transformation of random variables

UNIT – IV RANDOM PROCESSES **9+6**

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations

UNIT – V QUEUEING MODELS **9+6**

Markovian queues M/M/1 , M/M/C , Finite and infinite capacity M/G/1 queue – Pollaczek Khinchin formula.

TOTAL: 45 + 30

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Oliver. C Ibe.	Fundamentals of Applied Probability and Random Processes, 2nd Edition	Academic Press	2014
2.	John F. Shortle, James M.Thompson, Carl M. Harris Donald Gross	Fundamentals of Queueing Theory, 4th Edition	Wiley	2012

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	HweiP.Hsu	Schaum"s Outline of Theory and Problems of Probability, Random Variables and Random Processes	Tata Mc Graw Hill Edition, New Delhi	2014
2.	Hamdy ATaha	Operations Research	Pearson Education, Asia	2014
3.	Robertazzi	Computer Networks and Systems: Queueing Theory and performance evaluation, 3rd Edition	Springer	2013
4.	Yates. R.D., Goodman. D.J.	Probability and Stochastic Processes, 2nd Edition	Wiley India Pvt. Ltd., Bangalore	2012
5.	Trivedi.K.S.,	Probability and Statistics with Reliability, Queueing and Computer Science Applications, 2nd Edition	John Wiley and Sons	2008

WEB URLs

1. www.khanacademy.org/math/probability/random-variables-topic/random-variables-prob-dist/v/random-variables
2. www.mathsisfun.com
3. http://nptel.ac.in/courses/105103027/13
4. http://nptel.ac.in/courses/117105085/
5. www.eventhelix.com/RealtimeMantra/CongestionControl/m_m_1_queue.htm#.V6riiPR0gwQ
6. http://nptel.ac.in/courses/117103017/4

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16SHB06 NUMERICAL METHODS

L	T	P	C
3	2	0	4

COURSE OBJECTIVES

- To learn the methods of solving Eigenvalue problems
- To deal with interpolation and approximation for the application of finite element analysis
- To enhance the ability of applying effective mathematical tools to solve practical problems.
- To introduce numerical tools for the solutions of partial differential equations that model several physical processes
- To study the numerical methods for solving boundary value problems

COURSE OUTCOMES

- The students will have a clear perception of the power of numerical techniques
- Students would be able to demonstrate the applications of numerical techniques to problems drawn from industry, management and other engineering fields.
- It equips students to solve fluid dynamics problems.
- The students will have the ability to do finite element analysis of mechanical structural analysis problems.
- This course makes students easy in solving boundary value problems

UNIT - I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+6

Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method – Solution of linear system of a equations - Gauss elimination method –Gauss Jordon method - Iterative methods of Gauss Jacobi and Gauss-Seidel - Horner's Method – Eigen value of a matrix by power method

UNIT – II INTERPOLATION AND APPROXIMATION 9+6

Interpolation with unequal intervals – Lagrange's interpolation – Newton's divided difference interpolation – Interpolation with equal intervals – Newton's forward and backward difference formulae.

UNIT – III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+6

Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 rule – Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by trapezoidal and Simpsons's 1/3 rules

UNIT – IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+6

Single step methods – Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations – Multi step methods – Milne's and Adams-Bash forth predictor corrector methods for solving first order equations.

UNIT – V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+6

Finite difference methods for solving two-point linear boundary value problems – Finite difference techniques for the solution of two Laplace's and Poisson's equations on rectangular domain – one dimensional heat equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL: 45 + 30

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S. K. Gupta	Numerical Methods for Engineers , 3rd Edition	New Age International Pvt Ltd Publishers	2015
2.	Chapra. S.C., Canale.R.P.	Numerical Methods for Engineers, 6th Edition	Tata McGraw Hill, , New Delhi	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Grewal. B.S.	Numerical Methods in Engineering & Science: with Programs in C and C++, 10th Edition	Khanna Publishers, New Delhi	2010
2.	M.K. Jain	Numerical Methods for Scientific & Engineering Computation, 6th Edition	New Age International Publishers	2010
3.	Sankara Rao. K.	Numerical methods for Scientists and Engineers, 3rd Edition	Prentice Hall of India Private, New Delhi	2007
4.	Brian Bradie	A friendly introduction to Numerical analysis	Pearson Education, Asia, New Delhi	2007
5.	Gerald. C. F. Wheatley. P. O.	Applied Numerical Analysis,6th Edition	Pearson Education, Asia, New Delhi	2006

WEB URLs

1. http://nptel.ac.in/courses/122102009/
2. http://nptel.ac.in/courses/111101003/
3. https://www.youtube.com/watch?v=m2p6hrQGaxQ
4. https://mat.iitm.ac.in/home/sryedida/public_html/caimna/ode/rk/rk.html
5. https://mat.iitm.ac.in/home/sryedida/public_html/caimna/pde/fifth/example.html

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16SHB07 STATISTICS AND NUMERICAL METHODS

L	T	P	C
3	2	0	4

COURSE OBJECTIVES

- To understand concepts of testing of hypothesis
- To develop design of experiments model for research problems
- To learn the methods of solving Eigenvalue problems
- To deal with interpolation and approximation for the application of finite element analysis
- To enhance the ability of applying effective mathematical tools to solve practical problems.

COURSE OUTCOMES

- Provides knowledge to apply testing of hypothesis to real life problems.
- This chapter enhances the students to do a systematic and scientific research.
- The students will have a clear perception of the power of numerical techniques
- Students would be able to demonstrate the applications of numerical techniques to problems drawn from industry, management and other engineering fields.
- The students will have the ability to do finite element analysis of mechanical structural analysis problems.

UNIT - I TESTING OF HYPOTHESIS 9+6

Sampling distributions - Tests for single mean, 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 – II DESIGN OF EXPERIMENTS 9+6

Completely randomized design – Randomized block design – Latin square design – One way- Two way Classification.

UNIT – III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+6

Newton-Raphson method- Gauss Elimination method – Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Horner's Method – Eigen values of a matrix by Power method .

UNIT – IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9+6

Lagrange's and Newton's divided difference interpolation –Newton's forward and backward difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal and Simpson's 1/3 rules

UNIT – V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+6

Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations – Adam's and Milne's predictor corrector methods for solving first order equations

TOTAL: 45 + 30

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S. K. Gupta	Numerical Methods for Engineers , 3rd Edition	New Age International Pvt Ltd Publishers	2015
2.	Walpole. R.E., Myers. R.H., Myers. S.L., Ye. K.	Probability and Statistics for Engineers and Scientists, 8th Edition	Pearson Education, Asia	2013

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Douglas C. Montgomery, George C. Runger	Applied Statistics and Probability for Engineers (International Student Version)", 6th Edition	John Wiley & Sons, Inc.	2016
2.	Spiegel. M.R., Schiller. J., Srinivasan.R.A.	Schaum's Outlines on Probability and Statistics, 4th Edition	Tata McGraw Hill Education	2013
3.	Chapra. S.C., Canale.R.P.	Numerical Methods for Engineers, 6th Edition	Tata McGraw Hill, , New Delhi	2012
4.	Johnson. R.A., and Gupta. C.B.	Miller,Freund's Probability and Statistics for Engineers,11th Edition	Pearson Education, Asia	2011
5.	Grewal. B.S.	Numerical Methods in Engineering & Science: with Programs in C and C++, 10th Edition	Khanna Publishers, New Delhi	2010

WEB URLs

1. http://stattrek.com/tutorials/statistics-tutorial.aspx
2. http://nptel.ac.in/courses/111104075/5
3. http://nptel.ac.in/courses/122102009/
4. http://nptel.ac.in/courses/111101003/
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16SHB08 **DISCRETE MATHEMATICS** **L T P C**
3 2 0 4

COURSE OBJECTIVES

- To extend student's Logical and Mathematical maturity
- To learn discrete objects and their properties.
- To deal with abstraction and the counting principles
- To introduce most of the basic terminologies used in computer science courses
- To study the concepts and properties of algebraic structures

COURSE OUTCOMES

- Have knowledge of the concepts needed to test the logic of a program.
- Have an understanding in identifying structures on many levels.
- Be aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
- Be aware of the counting principles.
- Be exposed to concepts and properties of algebraic structures such as groups, rings and fields.

UNIT - I LOGIC AND PROOFS 9+6

Propositional Logic – Propositional equivalences-Predicates and quantifiers-Nested Quantifiers -Rules of inference-introduction to Proofs-Proof Methods and strategy.

UNIT – II COMBINATORICS 9+6

Mathematical inductions-Strong induction and well ordering-.The basics of counting-The pigeonhole principle – Permutations and combinations-Recurrence relations-Solving Linear recurrence relations-generating functions-inclusion and exclusion and applications.

UNIT – III GRAPHS 9+6

Graphs and graph models-Graph terminology and special types of graphs-Representing graphs and graph isomorphism - connectivity-Euler and Hamilton paths.

UNIT – IV ALGEBRAIC STRUCTURES 9+6

Algebraic systems-Semi groups and monoids-Groups-Subgroups and homomorphisms- Cosets and Lagrange'sTheorem - Ring & Fields (Definitions and examples)

UNIT – V LATTICES AND BOOLEAN ALGEBRA 9+6

Partial ordering-Posets-Lattices as Posets- Properties of lattices-Lattices as Algebraic systems –Sub lattices –direct product and Homomorphism-Some Special lattices- Boolean Algebra

TOTAL: 45 + 30

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Narsingh Deo	Graph Theory with Applications to Engineering and Computer Science, Reprint edition	Dover Publications Inc.	2016
2.	Tremblay J.P, Manohar R	Discrete Mathematical Structures with application to computer science,30th Reprint	Tata Mc Graw Hill Pub.Co.Ltd,New Delhi,	2011

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bernard Kolman , Robert C.Busby, Sharan Culter Ross	Discrete Mathematical Structures, 6th Edition	Pearson Education Pvt Ltd. ,New Delhi	2015
2.	Richard Johnsonbaugh	Discrete Mathematics , 7th Edition	Pearson Education Asia, New Delhi	2014
3.	Seymour Lipschutz, Mark Lipson, Varsha H. Patil	Discrete Mathematics Schaum's Outlines , Revised 3rd Edition	Mc Graw Hil Pub.Co.Ltd.,New Delhi	2013
4.	Ralph. P.Grimaldi	Discrete and combinatorial Mathematics : An Applied Introduction, 5th Edition	Pearson Education Asia,Delhi	2012
5.	Kenneth H. Rosen	Discrete Mathematics and its Applications, 7th Edition	Tata Mc Graw Hill Pub . co.Ltd.,New Delhi,Special Indian Edition	2011

WEB URLs

1. www.dmtcs.org/dmtcs-ojs/index.php/dmtcs
2. www.tutorialspoint.com/discrete_mathematics/
3. http://nptel.ac.in/courses/106106094/#
4. www.artofproblemsolving.com/articles/discrete-math
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16SHB09 OPERATIONS RESEARCH L T P C
3 2 0 4

COURSE OBJECTIVES

- To provide knowledge and training in using optimization techniques.
- To learn about the transportation and assignment models
- To know the basics of integer programming and its applications.
- To develop an understanding of classical optimization theory.
- To provide knowledge objects and operations scheduling.

COURSE OUTCOMES

- The knowledge gained on this course helps the students to do engineering optimization.
- Enable the students to prepare transportation and assignment model for business enterprise.
- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems.
- This course equips students to have basic knowledge in classical optimization theory.
- It provides the knowledge to do production planning, inventory control and management.

UNIT - I LINEAR PROGRAMMING MODELS 9+6

Mathematical Formulation - Graphical Solution of linear programming models – Simplex method – Artificial variable Techniques- Variants of Simplex method

UNIT – II TRANSPORTATION AND ASSIGNMENT MODELS 9+6

Mathematical formulation of transportation problem- Methods for finding initial basic feasible solution – optimum solution - degeneracy – Mathematical formulation of assignment models – Hungarian Algorithm – Variants of the Assignment problem

UNIT – III INTEGER PROGRAMMING 9+6

Cutting plan algorithm – Branch and bound methods, Multistage(Dynamic) programmimg .

UNIT – IV CLASSICAL OPTIMISATION THEORY 9+6

Unconstrained external problems,Newton – Ralphson method –Equality constraints –Jacobian methods – Lagrangian method – Kuhn-Tucker conditions – simple problems

UNIT – V OBJECT SCHEDULING 9+6

Network diagram representation – Critical Path Method – Time charts and resource leveling –PERT.

TOTAL: 45 + 30

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	D.S. Hira , P.K. Gupta	Operations Research, 7th Revised Edition (Reprint)	S.Chand & Co. Pvt.Ltd	2015
2.	Hamdy ATaha	Operations Research, 9th Edition	Pearson Education Asia	2014

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Mital.K.V. Mohan , Chander	Optimization Methods in Operations Research and Systems Analysis, 4th Edition	New Age International Publishers	2016
2.	Anand Sharma	Operation Research, 1st Edition	Himalaya Publishing House	2014
3.	Srinivasan. G	Operations Research: Principles and applications, 2nd Edition	PHIL Learning Private Limited	2010
4.	Paneer Selvam	Operation Research	Prentice Hall of India , 2nd Edition	2009
5.	N D Vohra	Quantitative Techniques in Management, 4th Edition	Tata Mc Graw Hill	2009

WEB URLs

1. www.maths.adelaide.edu.au/matthew.roughan/Lecture_notes/OORII/03lecture_notes.html
2. nptel.ac.in/courses/110106059/
3. www.youtube.com/watch?v=a2QgdDk4Xjw&list=PL849A8B56B8320421
4. www.math.utah.edu/~cherk/teach/opt/course.html
5. www.youtube.com/watch?v=vUMGvpsb8dc

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16SHB21	ENGINEERING PHYSICS	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES

- To understand the concepts in elasticity and transfer of heat energy through materials
- To acquire the knowledge in acoustical engineering and ultrasonic
- To enrich the principles involved in laser technology and its applications
- To understand the concept and significance in fiber optics
- To educate the basic concepts in quantum physics

COURSE OUTCOMES

- An ability to apply knowledge in elasticity and heat transfer
- A knowledge of contemporary issues on ultrasonic studies
- An ability to apply knowledge in laser technology for engineering practice
- An ability to solve problems in fiber optics technology
- An ability to apply knowledge in wave theory

UNIT PROPRERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity – Hook's law – Relationship between three modulii of elasticity (Qualitative) – stress and strain diagram – Poisson's ratio – factors affecting elasticity – bending moment – depression of a cantilever – young's modulus by uniform bending – I shaped girders. Modes of heat transfer – thermal conductivity – Newton's law of cooling – linear heat flow – lee's disc method – radial heat flow – rubber tube method – conduction through compound media (series and parallel method)

UNIT II ACOUSTICS AND ULTRASONICS 9

Introduction of acoustics – Classification of sound-Weber-Fechner law- Reverberation – Reverberation time – Factors affecting acoustics of building and its remedy - Absorption coefficient – Measurement of Absorption coefficient.

Introduction– properties - Detection of ultrasonic waves, Magnetostriction effect - Magnetostriction generator – piezoelectric effect - piezoelectric generator– Cavitations - Velocity measurement – acoustic grating method – SONAR - Non Destructive Testing – pulse echo system, through transmission and reflection modes.

UNIT III LASERS 9

Introduction – Principle of Spontaneous emission and stimulated emission. Population inversion - pumping methods. Einstein's A and B coefficients – derivation - Types of lasers – He-Ne, CO_2, Nd-YAG, Semiconductor lasers (homojunction & heterojunction) - Industrial Applications - Lasers in welding, cutting, heat treatment – Medical applications - Holography (construction & reconstruction).

UNIT IV FIBRE OPTICS AND ITS APPLICATIONS 9

Principle and propagation of light in optical fibers – Numerical aperture and Acceptance angle - Classification based on materials, refractive index profile – Double crucible technique of fibre drawing – Splicing - Loss in optical fiber – attenuation, dispersion, bending - Fibre optical communication system (Block diagram) – Fiber optic Light sources - Detectors - sensors – temperature & displacement - Endoscope.

UNIT V QUANTUM PHYSICS AND APPLICATION 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jean's Law from Planck's theory – Compton effect - experimental verification – Matter waves – de Broglie's theory - Schrödinger's wave equation– Time independent and time dependent equations – Particle in one dimensional box - Physical significance of wave function - Electron Microscope – Scanning Electron Microscope (SEM) - Transmission Electron Microscope (TEM) – Advantages, disadvantages and application.

TOTAL: 45

LIST OF EXPERIMENTS:

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1. (a) Determination of Wavelength and particle size using Laser
   (b) Determination of acceptance angle in an optical fiber.
2. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer
3. Determination of wavelength of mercury spectrum – spectrometer grating
4. Determination of thermal conductivity of a bad conductor – Lee's Disc method.
5. Determination of Young's modulus by uniform bending method
6. Determination of Young's modulus by Non uniform bending method
7. Determination of Coefficient of viscosity of a liquid –Poiseuille's method
8. Determination of Dispersive power of a prism – Spectrometer
9. Determination of thickness of a thin wire – Air wedge method
10. Determination of Rigidity modulus – Torsion pendulum

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B.N.Sankar & S.O.Pillai,	Engineering Physics I	New Age International Publishers	2015
2	Rajagopal K	Engineering Physics	PHI, New Delhi	2011

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Tamilarasan.K &Prabhu.K	Engineering Physics-I	Mc Graw Hill Education	2015
2	Palanisamy P.K	Engineering Physics	SCITECH Publications	2011
3	Senthilkumar G	Engineering Physics I	VRB Publishers	2011
4	Gaur R.K. and Gupta S.L.	Engineering Physics	Dhanpat Rai publishers	2009
5	Sudarmozhi.G.	Engineering Physics I	Bharathi Publishers	2015

WEB URLs

1. www.slideshare.net/shafie_sofian/thermal
2. www.slideshare.net/7878131049/final
3. www.slideshare.net/7878131049/laser
4. www.slideshare.net/RNBAJIYA/optical
5. www.slideshare.net/kumartvl/quantum

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16SHB22 **MATERIAL SCIENCE** L T P C
3 0 0 3

COURSE OBJECTIVES

- To understand the types of atomic structures in crystalline materials
- To understand the basic concepts in magnetism and superconductivity
- To impart knowledge on conducting and semiconducting materials
- To educate the concept of dielectric materials
- To understand the basic concepts in modern engineering materials

COURSE OUTCOMES

- An ability to identify the types crystalline structure
- An ability to apply properties on magnetism and superconducting materials
- An ability to apply knowledge on superconducting materials and its applications
- An ability to apply knowledge on dielectric materials
- An ability to use the synthesis techniques in modern materials

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius –Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and Graphite structures (Qualitative) – Crystal growth techniques – Bridgeman technique and Czochralski method.

UNIT II CONDUCTORS AND SEMICONDUCTORS 9

Classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann-Franz law – Quantum theory - Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

Properties of semiconductors - classification – Elemental and Compound semiconductors – Intrinsic and Extrinsic semiconductors - carrier concentration derivation in intrinsic semiconductors - band gap determination - Hall effect – Determination of Hall coefficient –Experimental method - Applications of Hall Effect.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Types – Dia, para, Ferro, anti ferromagnetic materials – Domain theory – Hysteresis – Soft and hard magnetic materials – Ferrites – preparation, properties and applications.

Properties of superconducting materials - BCS theory of superconductivity (Qualitative) - Types of super conductors – High T_c superconductors – Applications of superconductors – SQUID, Cryotron, Magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Basic definitions - Electrical susceptibility – dielectric constant – Types of polarization - electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius –Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials(capacitor and transformer) – ferroelectricity and applications

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: Preparation, properties and applications – metallic glasses as transformer cores.

Shape memory alloys (SMA): Types and Characteristics - properties of NiTi alloy- advantages and disadvantages of SMA - applications.

Nanomaterials: Synthesis– Eleectro deposition, Plasma arcing - properties of nanoparticles and applications.

Carbon nanotubes: Types - Single walled and multi walled nanotubes – Synthesis of carbon nanotube - pulsed laser deposition, chemical vapour deposition – Properties and applications

TOTAL: 45

TEXT BOOKS:

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Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B.N.Sankar & S.O.Pillai	Engineering Physics I	New Age International Publishers	2015
2	Rajagopal K.	Engineering Physics	PHI, New Delhi	2011

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M.S.Vijaya	Material Science	**Tata McGraw Hill publications,**	**2012**
2	William Smith	Material science	Tata McGraw Hill publications	2012
3	Raghavan	Material science	Prentice Hall India Ltd.	2005
4	O.P.Kanna	Material Science and Metallurgy	Dhanpat Rai Publications	2012
5	Arumugam,	Material Science	Anuradha Publications	2010

WEB URLs

1. www.lehigh.edu/~jdg4/classwork/crystalstructure.ppt
2. www.slideshare.net/shkrairo/superconductivity-and-its-applications
3. www.powershow.com/view/1d2c15-YTU3Y/
4. www.slideshare.net/vaishnavibathina/unit-3-35590134
5. www.slideshare.net/saurabhnandy007/carbon-nanotubes-25272300

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16SHB23 PHYSICS FOR ELECTRICAL ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

To enable the students to,

- Define and explain electrical and thermal conductivity of conducting materials.
- Explain the theory of semi-conducting materials and its applications.
- Explain the properties and applications of magnetic and superconducting materials.
- Explain polarization process in dielectric materials and their temperature and frequency dependence and the causes of dielectric breakdown.
- Recognize the novel properties of new engineering materials.

COURSE OUTCOMES

- An ability to identify the types crystalline structure
- An ability to apply properties on magnetism and superconducting materials
- An ability to apply knowledge on superconducting materials and its applications
- An ability to apply knowledge on dielectric materials
- An ability to use the synthesis techniques in modern materials

UNIT I 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 –band theory of solids (qualitative treatment only) - Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals – conducting materials in thermal relay and themostats

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductors – Energy band diagram – direct and indirect band gap semiconductors - Carrier concentration in intrinsic semiconductors - Fermi level – Variation of Fermi level with temperature – Electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in N-type and P-type semiconductors (Qualitative Treatment only) – Variation of Fermi level with temperature and impurity concentration – Compound semiconductors – Hall effect – Determination of Hall coefficient – Hall effect applications – Ohmic contacts – Schottky diode.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – Dia and para and Ferromagnetic materials – Domain theory – Hysteresis – Soft and hard magnetic materials – Ferrites – applications of ferrites in telecommunication, radar and magnetic hard disc. Superconductivity - Properties - Types of super conductor – BCS theory of superconductivity (Qualitative) - High Tc superconductors – Applications of superconductors: SQUID, cryotron, magnetic levitation in trains

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – Dielectric constant – Electronic, ionic, orientational and space charge polarization – Frequency and temperature dependence of polarization – Internal field – Clausius – Mosotti relation (derivation) – Physical significance of Maxwell's equations - Dielectric loss – Dielectric breakdown – Uses of dielectric materials in capacitor and transformer – application of dielectrics in microwave oven and dielectric strain gauge.

UNIT V NEW ENGINEERING MATERIALS 9

Metallic glasses - preparation, properties and applications

Shape memory alloys (SMA) - characteristics, properties of NiTi alloy, applications, advantages and disadvantages of SMANanoscience and Nanotechnology – significance of the nanoscale - different types of nanostructures (Confinement Dimensions 0-D, 1-D, 2-D and 3-D) - Categories of nanomaterials - Fabrication of nonomaterials - Ball milling method and Chemical vapour deposition technique - Carbon nanotubes - Types of carbon nanotubes - CNT structure – properties and applications.

Biomaterials (metals and alloys, ceramics) - classification and applications

TOTAL: 45

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B.N.Sankar& S.O.Pillai	Engineering Physics I	New Age International Publishers	2015
2	M. Arumugam,	Materials Science	Anuradha Publications	2006

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B. K. Pandey and S. Chaturvedi	Engineering Physics	Cengage Learning India Pvt. Ltd., Delhi,	2012
2	Rajendran, V, and Marikani A	Materials science	TMH Publications	2004
3	Jayakumar, S.	Materials science	R.K. Publishers, Coimbatore	2008
4	Palanisamy P.K	Materials science	Scitech Publications (India) Pvt. Ltd	2007
5	Sudarmozhi.G.	Engineering Physics II.	Bharathi Publishers,	2015

WEB URLs

1. www.lehigh.edu/~jdg4/classwork/crystalstructure.ppt
2. www.slideshare.net/shkrairo/superconductivity-and-its-applications
3. www.powershow.com/view/1d2c15-YTU3Y/
4. www.slideshare.net/vaishnavibathina/unit-3-35590134
5. www.slideshare.net/saurabhnandy007/carbon-nanotubes-25272300

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16SHB24 PHYSICS FOR MECHANICAL ENGINEERING L T P C
3 0 0 3

COURSE

- Define the various moduli of elasticity and explain streamline and turbulent flow of liquid and apply Poiseuille's formula to determine the coefficient of viscosity of a liquid.
- Describe experimental methods to determine thermal conductivity and state the laws of thermodynamics and their applications in the field of Engineering.
- Define and explain electrical and thermal conductivity of conducting materials.
- Explain the theory of semi-conducting materials and its applications.
- Recognize the novel properties of new engineering materials

COURSE OUTCOMES

- An ability to identify the types crystalline structure
- An ability to apply properties on magnetism and superconducting materials
- An ability to apply knowledge on superconducting materials and its applications
- An ability to apply knowledge on dielectric materials
- An ability to use the synthesis techniques in modern materials

UNIT I PROPERTIES OF MATTER AND HYDRODYNAMICS 9

Elasticity - Poisson's ratio and relation between moduli (qualitative) - Stress-strain diagram- Factors affecting elasticity - Bending of beams - Cantilever - expression for bending moment – Measurement of Young's modulus by uniform and non-uniform bending - I shaped girders - Stream line flow - Turbulent flow- Poiseuille's formula for flow of liquid through a capillary tube – Determination of coefficient of viscosity of a liquid

UNIT II HEAT AND THERMODYNAMICS 9

Thermal conductivity - Forbe's and Lee's disc methods- Radial and cylindrical flow of heat -Thermal conductivity of rubber and glass - Thermal insulation of buildings - Thermal insulating materials - Thermal equilibrium - Zeroth law of thermodynamics - Internal Energy - First law of thermodynamics - Indicator diagram - Isothermal process - Work done in an isothermal expansion - Adiabatic process - Work done in an adiabatic expansion – Reversible and irreversible processes - Second law of thermodynamics - Carnot engine - Efficiency of Canot's cycle - Carnot's cycle as heat engine and refrigerator - Carnot's theorem - Comparative study of Ideal Otto and diesel engines and their efficiency (no derivation) - Entropy - temperature diagram of Carnot's cycle.

UNIT III CONDUCTING MATERIALS 9

Conductors - classical free electron theory of metals - Electrical and thermal conductivity - Wiedemann-Franz law - Lorentz number - Drawbacks of classical theory - Quantum theory -band theory of solids(qualitative treatment only) - Fermi distribution function - Effect of temperature on Fermi Function - Density of energy states - Carrier concentration in metals - application of conducting materials in induction furnace

UNIT IV SEMICONDUCTING MATERIALS 9

Intrinsic semiconductors – Energy band diagram – direct and indirect band gap semiconductors -Carrier concentration in intrinsic semiconductors - Fermi level – Variation of Fermi level with temperature – Electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in N-type and P-type semiconductors (Qualitative Treatment only) – Variation of Fermi level with temperature and impurity concentration – Compound semiconductors – Hall effect – Determination of Hall coefficient – Hall effect applications - application of semiconductors in strain measurements

UNIT V NEW ENGINEERING MATERIALS 9

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Metallic glasses: Preparation - properties - applications

Shape memory alloys: Characterisitics - properties of Ni-Ti alloy – application- advantages and disadvantages of SMA

Advanced Ceramics: Introduction – characteristics – structural ceramics

Nanoscience and Nanotechnology – significance of the nanoscale - different types of nanostructures (Confinement Dimensions 0-D, 1-D, 2-D and 3-D) - Categories of nanomaterials - Fabrication of nonomaterials - Ball milling method and Chemical vapour deposition technique - Carbon nanotubes - Types of carbon nanotubes - CNT structure – properties and applications. Biomaterials (metals and alloys, ceramics) - classification and applications.

TOTAL: 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B.N.Sankar& S.O.Pillai	Engineering Physics I	New Age International Publishers	2015
2	M. Arumugam,	Materials Science	Anuradha Publications	2006

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B. K. Pandey and S. Chaturvedi	Engineering Physics	Cengage Learning India Pvt. Ltd., Delhi,	2012
2	Rajendran, V, and Marikani A	Materials science	TMH Publications	2004
3	Jayakumar, S.	Materials science	R.K. Publishers, Coimbatore	2008
4	Palanisamy P.K	Materials science	Scitech Publications (India) Pvt. Ltd	2007
5	Sudarmozhi.G.	Engineering Physics II.	Bharathi Publishers,	2015

WEB URLs

1. www.lehigh.edu/~jdg4/classwork/crystalstructure.ppt
2. www.slideshare.net/shkrairo/superconductivity-and-its-applications
3. www.powershow.com/view/1d2c15-YTU3Y/
4. www.slideshare.net/vaishnavibathina/unit-3-35590134
5. www.slideshare.net/saurabhnandy007/carbon-nanotubes-25272300

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16SHB31 ENGINEERING CHEMISTRY L T P C
3 0 0 3

COURSE OBJECTIVES

- The students familiar with characteristics of water and know the specification of boiler feed water. To understand the softening of hard water by using various purification techniques.
- To understand the principles involved in corrosion. The students able to apply these principles towards the prevention of corrosion.
- The students will understand the basic concepts of polymers chemistry and its applications. The students have sound knowledge of plastics and rubbers.
- The students understand the reaction of nuclear fission and fusion reaction and promote the knowledge about process of nuclear reactors. To understand various chemical reactions involved in the batteries.
- The students will have knowledge on industrial important abrasives and refractories.

COURSE OUTCOMES

- The students will understand characteristics of water and softening of hard water by using various purification techniques.
- The students able to apply principles of corrosion towards the prevention of corrosion.
- The students have sound knowledge of polymers chemistry, plastics and rubbers and its applications.
- The students have adequate knowledge about process of nuclear reactors and various chemical reactions involved in the batteries.
- The students know industrial important abrasives, refractories and its applications.

UNIT I WATER TECHNOLOGY 9

Characteristics – Domestic water treatment – disinfection methods (chlorination, ozonation and UV treatment) – Boiler feed water-requirements-disadvantages of using hard water in boilers – internal conditioning (phosphate, calgon, colloidal and carbonate conditioning methods)-external conditioning – zeolite and demineralization process – desalination and reverse osmosis.

UNIT II CORROSION AND CORROSION CONTROL 9

Corrosion – chemical corrosion- electrochemical corrosion – types-galvanic corrosion – differential aeration corrosion – factors influencing corrosion - corrosion control – sacrificial anodic method and impressed current cathodic protection method – corrosion inhibitors – paints-constituents and functions – electroplating of copper and electroless plating of nickel.

UNIT III POLYMERS 9

Polymers – definition – polymerization – types and mechanism of polymerization – addition polymerization (free radical mechanism), condensation polymerization and copolymerization – properties of polymers - Plastics, classification – preparation, properties and uses of PVC, Teflon, nylon-6,6 and PET-Rubber – vulcanization of rubber – butyl rubber, SBR .

UNIT IV NON CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear energy – fission and fusion reactions – nuclear chain reactions – characteristics – light water nuclear reactor for power generation – breeder reactor – solar energy conversion – solar cells – wind energy-Fuel cells – hydrogen and oxygen fuel cell – batteries – alkaline battery – lead acid battery, nickel-cadmium battery and lithium battery.

UNIT V ENGINEERING MATERIALS 9

Refractories – classification - acidic, basics and neutral refractories – properties – manufacture of alumina, magnesite and zirconia bricks-Abrasives – natural and synthetic abrasives – manufacture ,properties and uses of silicon carbide and boron carbide- application of abrasives- Glass-manufacture, types, properties and uses

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TOTAL: 45

LIST OF EXPERIMENTS:

1. Determination of hardness of water by EDTA method
2. Determination of alkalinity in water sample
3. Determination of dissolved oxygen content of water sample by Winkler's method.
4. Estimation of chloride content of water sample by argentometric method
5. Estimation of hydrochloric acid by pH meter
6. Determination of strength of CH_3COOH and HCl in a mixture using conductivity meter
7. Conductometric titration of HCl vs NaOH
8. Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4
9. Determination of molecular weight of polyvinylalcohol using Ostwald viscometer
10. Estimation of iron content of the given solution using potentiometer

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr.P.Santhi & S.Elavarasan	Engineering Chemistry	Sri Kandhan Publications	Aug 2016
2.	Dr.A.Ravikrishnan	Engineering Chemistry I & II	Sri Krishna Hitech Publishing Company Pvt. Ltd	June 2016

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B P.C.Jain and Monica Jain	Engineering Chemistry	Dhanpat Rai Pub, Co., New Delhi	2013
2.	S.S. Dara	A text book of engineering chemistry	S.Chand & Co.Ltd., New Delhi	2013
3.	Shradha Sinha	Advanced Engineering Chemistry	Krishna Prakasan Media (P) Ltd., Meerut	2015
4.	B.Sivasankar	Engineering Chemistry	Tata McGraw-Hill Publishing Company,Ltd.,New Delhi	2008
5.	V.R.Gowariker N.V.Viswanathan and JayadevSreedhar	Polymer Science	New Age International P (Ltd.,),Chennai	2006

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1.www.bbc.co.uk/schools/gcsebitesize/science/triple_aqa/water/hard_soft_water/revision/4/
2.www.nace.org/Corrosion-101/
3.www2.chemistry.msu.edu/faculty/reusch/virttxtjml/polymers.htm
4.www.nei.org/Knowledge-Center/How-Nuclear-Reactors-Work
5.www.vidyarthiplus.in/2012/01/engineering-chemistry1abrasives.html

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16SHB32 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES

- To give a comprehensive insight into ecosystem, biodiversity and natural recourses.
- To create an awareness on the various environmental pollution aspects and issues and to educate the ways and means to protect the environment from various types of pollution.
- To import some fundamental knowledge on human welfare measures.
- To understand the role of government and non-government organization in environment managements.
- Discuss the impact of human population on the environment

COURSE OUTCOMES

- The students can understand ecosystem, biodiversity and natural recourses.
- The students have knowledge about various environmental pollution and can able to protect the environment from pollution.
- The students have fundamental knowledge on human welfare and its measures.
- The students have adequate knowledge about various government and non-government organization in environment managements.
- The students know the impacts of human population on the environment.

UNIT I ECOSYSTEMS AND BIODIVERSITY 9

Definition, scope and importance of environment – need for public awareness – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction to biodiversity definition – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and exsitu conservation of biodiversity.

UNIT II NATURAL RESOURCES 9

Forest resources: Use and over-exploitation, deforestation, cause – effect-control measures – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

UNIT III ENVIRONMENTAL POLLUTION 9

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution(c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – disaster management: floods, earthquake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people – environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Forest conservation act – role of nongovernmental organization- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 9

Population growth, variation among nations – population explosion – family welfare programme – environment and

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human health – human rights – value education – HIV /AIDS – women and child welfare – role of information technology in environment and human health.

TOTAL: 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr.A.Ravikrishnan	Environmental Science and Engineering	Sri Krishna Hitech Publishing Company Pvt.Ltd	June 2016
2.	Gilbert M. Masters	Introdution to Environmental Engineering and Science	Pearson Education Pvt., Ltd., Second Edition. ISBN 81-297-0277-0	2004

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dharmendra S. Sengar	Environmental Law	Prentice hall of India PVT LTD, New Delhi	2007
2.	R.K.Trivedi	Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol-I and II,	BS Publications	2010
3.	R.Rajagopalan	Environmental Studies	From Crisis to Cure, Oxford University Press	2015
4.	Benny Joseph	Environmental Science and Engineering	Tata McGraw-Hill,NewDelhi	2006
5.	T.G.Miller	Environmental Science	Wadsworth Publishing Co.	2004

WEB URLs

1. www.yourarticlelibrary.com/environment/ecosystem/ecosystems-concept-structure-and-functions-of-ecosystems-with-diagram/28211/
2. www.importantindia.com/12331/types-of-natural-resources-in-india/
3. www.conserve-energy-future.com/causes-and-effects-of-environmental-pollution.php
4. http://agritech.tnau.ac.in/agriculture/agri_majorareas_watershed_rainwaterharvesting.html
5. www.yourarticlelibrary.com/essay/role-of-information-technology-in-environment-and-human-health/30230/

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16BTC03 BASICS OF CIVIL AND MECHANICAL ENGINEERING

L	T	P	C
4	0	0	4

COURSE OBJECTIVES:

- To posses knowledge about different type of surveying and Civil Engineering materials.
- To recognize the building components and structures.
- To explore various types of power generation, pumps and turbines.
- To realize about IC Engines and Boilers.
- To classify Refrigeration and Air Conditioning.
- To outline the basics of Civil and Mechanical Engineering.

COURSE OUTCOMES

- Demonstrate field measurement in surveying.
- Explore basic ideas of building components and structures.
- Illustrate examples of real life applications of civil construction material.
- Familiar about the power generation, pumps and turbines.
- Outline basic ideas among the IC Engines and Boilers.
- Familiar about Refrigeration and Air Conditioning.

A.CIVIL ENGINEERING

UNIT I: SURVEYING AND CIVIL ENGINEERING MATERIALS **12**

Surveying: Objects – types – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples. Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections.

UNIT II: BUILDING COMPONENTS AND STRUCTURES **12**

Foundations: Types, Bearing capacity – Requirement of good foundations. Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – Mechanics – Internal and external forces – stress – strain – elasticity – Types of Bridges and Dams – Basics of Interior Design and Landscaping.

B. MECHANICAL ENGINEERING

UNIT III: POWER PLANT ENGINEERING **12** Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps and turbines – working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT IV: IC ENGINES **12**

Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler as a power plant.

UNIT V: REFRIGERATION AND AIR CONDITIONING SYSTEM **12**

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

TOTAL: L: 60=60

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16BTC06 ENGINEERING PRACTICES FOR MECHANICAL SCIENCES **L T P C**
0 0 4 2

COURSE OBJECTIVES:

- To choose the pipe connections in PVC and G.I pipes.
- To prepare various joints using carpentry tools and power tools.
- To interpret fitting tools and prepare various metal joints.
- To understand and practice different welding joints by arc and gas welding machine.
- To dismantle and identify the parts of Air conditioners and explain its working.
- To experiment different types of domestic wiring.

COURSE OUTCOMES

- Make pipe connections in PVC and G.I pipes.
- Prepare various joints using carpentry tools and power tools.
- Interpret fitting tools and prepare various metal joints.
- Understand and practice different welding joints by arc and gas welding machine.
- Dismantle and identify the parts of Air conditioners and explain its working.
- Experiment different types of domestic wiring.

UNIT I: CIVIL ENGINEERING PRACTICE **25**

1. PLUMBING WORKS

Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, Elbows and household fittings.

1. Basic pipe connections (PVC) involving the fittings like Valves, Taps, and Bends.
2. Mixed pipe (PVC and G.I) connections involving the fitting like Valves, Taps, and Bends

2. CARPENTRY WORKS

Study of Carpentry Tools

1. Preparation of T-Joint
2. Preparation of Lap joint
3. Preparation of Dovetail Joint

UNIT II: MECHANICAL ENGINEERING PRACTICE **25**

FITTING WORK

1. Study of Fitting work Tools
2. Preparation of L joint
3. Preparation of V joint

WELDING

1. Study of Welding Equipments and Tools
2. Preparation of Butt joint
3. Preparation of Lap joint
4. Preparation of Tee joint

MACHINE ASSEMBLY PRACTICE

1. Air conditioner repair and maintenance
2. Assembly and Dismantling for the two wheeler wheel.

UNIT III: ELECTRICAL ENGINEERING PRACTICE **10**

1. Residential house wiring
2. Fluorescent lamp wiring.
3. Staircase Wiring and Door bell wiring

TOTAL:P: 60=60

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kannaiah P. & Narayana K.L	Manual on Workshop Practice	Scitech Publications	2014
2.	Bawa H.S	Workshop Practice	Tata McGraw – Hill Publishing Company Limited,	2007

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jeyachandran K., Natarajan S. & Balasubramanian S	A Primer on Engineering Practices Laboratory	Anuradha Publications	2014
2.	Jeyapoovan T., Saravanapandian M. & Pranitha S	Engineering Practices Lab Manual	Vikas Puplishing House Pvt.Ltd.	2015
3.	Gowri S and Jeyapoovan T	Engineering Practices Lab Manual	Vikas Publishing House	2009
4.	Dash S S	Electrical Engineering Practice Lab Manual	Vijay Nicole Imprints P Ltd.-Chennai	2013
5.	Rajput R.K	Workshop Practice	Laxmi Publications	2016

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9. https://www.youtube.com/watch?v=Wsx6pK-RIZM
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16BTC05 ENGINEERING DRAWING

L T P C
1 0 4 3

COURSE OBJECTIVES

- To construct various curves in engineering applications.
- To draw the projection of three dimensional objects representing machine structure.
- To analyze the principles of projection of various planes by different angle to project points, lines and planes.
- To draw the projection of simple solid when axis is inclined to one reference plane by change of position method.
- To identify the interior components of machinery (or) buildings by sectioning the solid, and to study the development of simple solids for fabrication of sheet metals.
- To transform the manual drawings to CAD drawings.

COURSE OUTCOMES

- Construct various curves in engineering applications.
- Draw the projection of three dimensional objects representing machine structure.
- Analyze the principles of projection of various planes by different angle to project points, lines and planes.
- Draw the projection of simple solid when axis is inclined to one reference plane by change of position method.
- Identify the interior components of machinery (or) buildings by sectioning the solid, and to study the development of simple solids for fabrication of sheet metals.
- Transform the manual drawings to CAD drawings.

CONCEPTS AND CONVENTIONS (Not for Examination) **4**
Importance of graphics in engineering applications, Use of drafting instrument, BIS conventions and specifications - Size, layout and folding of drawing sheets, Lettering and dimensioning.
COMPUTER AIDED DRAFTING (Not for Examination) **6**
Importance 2d Drafting, sketching, modifying, transforming and dimensioning.

UNIT I: PLANE CURVES **13**
Curves used in engineering practices, Conics, Construction of ellipse, Parabola and hyperbola by eccentricity method, Construction of cycloid, construction of involutes of square and circle, Drawing of tangents and normal to the above curves.

UNIT II: ISOMETRIC TO ORTHOGRAPHIC VIEWS **13**
Representation of three dimensional objects, General Principles of Orthographic projection, Need for importance of multiple views and their placement, First angle projection, layout of views, Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT III: PROJECTION OF POINTS, LINES AND PLANE **13**
(Free hand sketching) Projection of points, Projection of straight lines located in the first quadrant, Determination of true lengths and true inclinations, Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT IV: PROJECTION OF SOLIDS **13**
(Free hand sketching) 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 V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **13**
(Free hand sketching) Sectioning of simple solids like prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other, (Obtaining true shape of section is not required). Development of lateral surfaces of simple and truncated solids, Prisms, pyramids, cylinders and cones.

TOTAL: L: 15 + P: 60 = 75

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Natrajan K.V	A text book of Engineering Graphics	Dhanalakshmi Publishers, Chennai	2015
2.	Basant Agrawal and C.M. Agrawal	Engineering Drawing	McGraw Hill Education; Second edition	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gopalakrishnan K.R	Engineering Drawing (Vol. I&II combined)	Subhas Stores Bangalore	2007
2	Luzzader, Warren.J. and Duff,John M	Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production	Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi	2005
3	Shah M.B., and Rana B.C	Engineering Drawing	Pearson, 2nd Edition	2009
4	Venugopal K. and Prabhu Raja V	Engineering Graphics	New Age International (P) Limited	2008
5	Bhatt N.D. and Panchal V.M	Engineering Drawing	Charotar Publishing House, 50th Edition	2010

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4. https://www.youtube.com/watch?v=OSISqnclmWA
5. https://www.youtube.com/watch?v=ruu5yHoxcek

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16BTC08 ENGINEERING MECHANICS **L T P C**
3 2 0 4

COURSE OBJECTIVES

- To generalize the scalar and vector representation of forces and moments.
- To explore truss, beam, frame and cable problems and respond to the distributed force systems.
- To predict Centroid and Moment of Inertia.
- To realize the Laws of Motion, Principle of Work and Energy, Kinematics & Kinetics of Motion and the interrelationship.
- To recognize the effect of impact of elastic bodies.
- To comprehend the effect of friction on equilibrium.

COURSE OUTCOMES

- Generalize the scalar and vector representation of forces and moments.
- Explore truss, beam, frame and cable problems and respond to the distributed force systems.
- Predict Centroid and Moment of Inertia.
- Realize the Laws of Motion, Principle of Work and Energy, Kinematics & Kinetics of Motion and the interrelationship.
- Recognize the effect of impact of elastic bodies.
- Comprehend the effect of friction on equilibrium.

UNIT I: BASICS AND STATICS OF PARTICLES **15**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces – additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

UNIT II: EQUILIBRIUM OF RIGID BODIES **15**

Free body diagram – Types of supports – Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III: PROPERTIES OF SURFACES AND SOLIDS **15**

Centroids and centre of mass – Centroids of lines and areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Theorems of Pappus – Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem – Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia

UNIT IV: DYNAMICS OF PARTICLES **15**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's laws of motion – Work Energy Equation – Impulse and Momentum – Impact of elastic bodies.

UNIT V: FRICTION **15**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction – Rolling – resistance.

TOTAL:L : 45 + T :30 = 75

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Beer, F.P and Johnston. E.R.,	Vector Mechanics for Engineers: Statics and Dynamics	Tata McGraw-Hill Publishing company, New Delhi	2013
2.	S. Timoshenko, D.H. Young, J.V. Rao and Sukumar Pati	Engineering Mechanics	McGraw Hill Education; 5 edition	2013

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hibbeller, R.C and Ashok Gupta	Engineering Mechanics: Statics and Dynamics	Pearson Education	2010
2	Irving H. Shames and Krishna Mohana Rao. G	Engineering Mechanics – Statics and Dynamics	Pearson Education	2006
3	Meriam J.L. and Kraige L.G	Engineering Mechanics	John Wiley & Sons	2013
4	Rajasekaran S and Sankarasubramanian G	Engineering Mechanics	Vikas Publishing House Pvt. Ltd	2005
5	Bhavikatti, S.S	Engineering Mechanics	New Age International (P) Limited Publishers	2015

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2. https://ecourses.ou.edu/cgi-bin/ebook.cgi?doc=&topic=st&chap_sec=05.2.
3. https://web.iit.edu/sites/web/files/departments/academic.../Moment_Inertia.pdf
4. https://www.khanacademy.org/...momentum/momentum.../what-are-momentum-
5. https://www.svce.ac.in/departments/mech/lessonplan/evenlp/GE6253.doc

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16BTC09 CONSTRUCTION MATERIALS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To introduce students to various materials commonly used in civil engineering construction and their properties.
- To select suitable type of stones, bricks, lime and ceramic.
- To study about the concrete design mix.
- To know about the procedures in concreting.
- To understand special concrete and their use.
- To know about the manufacture of cement.

COURSE OUTCOMES

- Able to demonstrate knowledge of construction materials and their usages in building projects.
- Able to apply learning to further research in advancement of civil engineering materials field.
- Identify the materials including their sources and production and properties.
- Understood characteristics of conventional building materials like stone, brick, wood etc.
- Learned about new and composite materials and their value adding characteristic of being lightweight, energy efficient, speedy construction among others.
- Identify the materials including their properties.

UNIT I: STONES – BRICKS – CONCRETE BLOCKS 9

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – brick earth – composition and harmful constituents – Efflorescence – Bricks for special use –Refractory bricks – Cement, Concrete blocks – Light weight concrete blocks.

UNIT II : CEMENT – AGGREGATES – MORTAR 9

Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration – Tests on cement– Industrial byproducts – Fly ash Aggregates – Natural stone aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – abrasion Resistance – Grading – Sand Bulking.

UNIT III : CONCRETE 9

Concrete – Ingredients – Manufacturing Process – RMC – Tests on fresh and hardened concrete – Modulus of rupture – Mix specification – Mix proportioning – BIS method –Admixtures and their functions – High Strength Concrete and HPC – Other types of Concrete – Durability of Concrete – Corrosion – Causes and effects – remedial measures – Thermal properties of concrete – Micro cracking of concrete – Quality of Water for mixing and curing – use of sea water for mixing concrete.

UNIT IV : TIMBER AND OTHER MATERIALS 9

Timber – Market forms – Industrial timber– Plywood – Veneer – Thermacole – Panels of laminates .
Ferrous metals: Iron and steel, basic metallurgy, composition and grades, market forms and heat treatment 0 Steel as reinforcement – Corrosion of metals and protection.
Non –ferrous metals: Aluminum, copper, brass and glass products – properties – applications.

UNIT V : MODERN MATERIALS 9

Glass – Ceramics – Sealants for joints – Fiber glass reinforced plastic – Clay products – Refractory's – Composite materials – Types – Applications of laminar composites – Fiber textile – Geo membranes and Geotextiles for earth reinforcement – polymers and plastics: walls, pipes and sanitary ware, glues and mastics – acid and chemical resistant products.

TOTAL:L : 45 = 45

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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Duggal.S.K	Building Materials	4th Edition, New Age International	2016
2	Edward Allen and Joseph Iano	Fundamentals of Building Construction: Materials and Methods	Wiley, 6th Edition	2013

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Varghese. P.C	Building construction	Prentice Hall of India Pvt. Ltd, New Delhi	2012
2	Shetty.M.S	Concrete Technology (Theory and Practice)	S. Chand and Company Ltd	2014
3	Arora S.P. and Bindra S.P	The Text Book of Building Construction	Dhanpat Rai and Sons	1999
4	G.S.Birdie, T.D.Ahuja	Building Construction and construction materials	Dhanpat Rai publishing company, New Delhi.	2007
5	Gambhir.M.L	Concrete Technology	3rd Edition, Tata McGraw Hill Education	2009

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2. http://nptel.ac.in/courses/105102088/9
3. http://nptel.ac.in/courses/105102012/10
4. http://nptel.ac.in/courses/105102088/9
5. http://nptel.ac.in/courses/105102012/36

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16BTC15 REMOTE SENSING AND GIS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To introduce the basic concepts of remote sensing.
- To provide an exposure about the types of platforms and sensors .
- To introduce the types of data products and image interpretation.
- To give knowledge on various types of map analysis.
- To provide an exposure about DBMS and its practical applications.
- To give knowledge on GIS.

COURSE OUTCOMES

- Ability to understand the basic concept of remote sensing .
- They will be able to select and finalize the remote sensing satellite data for different applications.
- They will be able to extract the different type of information from different remote sensing data products using various image processing techniques.
- Learned GIS for analysis of spatial and non spatial data.
- To apply problem specific remote sensing data for civil engineering applications.
- Ability to understand the basic concept of GIS.

UNIT I : PRINCIPLES AND CONCEPTS 9

Definition – Historical Background, Components of Remote Sensing – Electromagnetic spectrum, Visible, Infra Red, NIR, Thermal IR, Microwave – Radiation Principle and Energy equations – Active and Passive Remote Sensing – platforms – Aerial and Space Platforms – Balloons – Helicopters, Aircrafts and satellites – Significance of Remote Sensing.

UNIT II : ENERGY INTERACTION WITH ATMOSPHERE AND EARTH SURFACE MATERIALS 9

Atmospheric Characteristics – Atmospheric interference – Scattering of EMR – Rayleigh, Mie and Non Selective Scattering – Absorption – Atmospheric Windows – Spectral Signature interaction of EMR with atmosphere, earth surface, soils, water and vegetation.

UNIT III : SATELLITE REMOTE SENSING AND DIGITAL IMAGE PROCESSING 9

Satellites – Classification – Based on orbits – Based on purpose – Remote sensing satellites – LANDSAT, SPOT, IRS and IKONOS – Their orbital characteristics – Sensors onboard – Characteristics of thermal imagery and radar imagery – Comparison with image types – Characteristics of digital image processing – Pre – processing – Image enhancement – Filtering – Classification.

UNIT IV : GEOGRAPHIC INFORMATION SYSTEM 9

GIS – Components of GIS – Hardware, Software and organizational set up – Data – Spatial and Non spatial – Maps – Types of maps – Map Projection – Types of projection – Data input – Digitization – Editing – Raster and Vector data structures – Comparison – Analysis using Raster and Vector data – Retrieval, Reclassification, Overlying, Buffering – Data output – Printers and plotters.

UNIT V : APPLICATIONS OF REMOTE SENSING AND GIS 9

Data Base Management systems (DBMS) – Remote Sensing data attribute data analysis – integrated data analysis – data compression – modeling in GIS – DEM, DGM and DTM applications – transport, water resources, land information system & disaster management.

TOTAL:L : 45 = 45

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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Anji Reddy, M	Textbook of Remote Sensing and Geographical Information System	Second edn. BS Publications, Hyderabad	2014
2	Lillesand, T.M., Kiefer, R.W. and J.W.Chipman	Remote Sensing and Image Interpretation	V Edn. John Willey and Sons (Asia) Pvt. Ltd., New Delhi	2011

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Lo.C.P.and A.K.W.Yeung	Concepts and Techniques of Geographic Information Systems	Prentice0Hall of India Pvt. Ltd., New Delhi	2012
2	Peter A.Burrough, Rachael A.McDonnell	Principles of GIS	Oxford University Press	2007
3	Ian Haywood	An Introduction to GIS"	Pearson Education Asia	2010
4	Chang.T.K.	Geographic Information Systems	Tata McGrawHill	2008
5	Chrisman N R	Exploring Geographic Information Systems	2nd Edition, John Wiley & Sons, New York	2009

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3. www.ida.liu.se/~746A27/Literature/Lecture_4.pdf
4. http://ydrologie.org/hsj/410/hysj_41_04_0593.pdf
5. https://www.law.berkeley.edu/files/Reddix0Smalls_Brenda_IPSC_paper_2014.pdf

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16BTC07 ENGINEERING GEOLOGY

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To impart the concepts of geological agents and their processes.
- To provide knowledge on various properties of minerals and their engineering significance.
- To give knowledge on various classifications of rocks.
- To understand the importance of geological investigations and mapping.
- To understand the applications of geological surveys in civil engineering structures.
- To give knowledge on various minerals.

COURSE OUTCOMES

- Understand the application of geology knowledge to Civil Engineering construction.
- Understand the concepts of various geological materials.
- Understand the properties, behaviour and engineering significance of different type of rocks and minerals.
- Learned the interpretation skills of geological maps having different type of geological features.
- Learned consideration and importance of geological aspects in civil engineering related infrastructure projects.
- Understand the concepts of various weathering processes.

UNIT I : PHYSICAL GEOLOGY 9

Role of Geology in civil engineering – Branches of geology – Earth structures and composition – Elementary knowledge on continental drift and plate tectonics – Earth processes – weathering – soils – Geological work of river, wind and sea – Engineering importance – Earthquake belts in India – Ground water – Mode of occurrence – Prospecting .

UNIT II : MINEROLOGY 9 Elementary knowledge on symmetry elements of important crystallographic systems – Physical properties of minerals – Study of the rock forming minerals – Quartz family – Feldspar family – Mica – Pyroxene family minerals – Fundamentals of process of formation of ore minerals – Properties, behaviour and engineering significance of clay minerals – Coal and petroleum – Their origin and occurrence in India.

UNIT III : PETROLOGY 9

Classification of rocks – Distinction between igneous, sedimentary and metamorphic rocks – Occurrence, Engineering properties and distribution – Igneous rocks – Granite, syenite, diorite, gabbro, pegmatite, dolerite and basalt – sedimentary rocks – Sandstone, limestone, shale, conglomerate and breccias – Metamorphic rocks – Quartzite, marble, slate, phyllite, gneiss and schist.

UNIT IV : STRUCTURAL GEOLOGY AND MAP 9

Attitude of beds – Outcrops – Contours – Introduction to geological maps – Folds – Faults and joints – Their bearing on engineering construction – Seismic and electrical methods for civil engineering investigations. Study of structures.

UNIT V : GEOLOGICAL INVESTIGATION 9

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings. Causes and preventions – Sea erosion and Coastal protection.

TOTAL: (L:45):45

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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Parbin Singh.	A Text book of Engineering and General Geology	Katson publishing house, Ludhiana.	2010
2	Varghese, P.C	Engineering Geology for Civil Engineering	PHI Learning Private Limited, New Delhi	2012

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Muthiayya, V.D	A Text of Geology	Oxford IBH Publications, Calcutta.	2010
2	Blyth F.G.H. and De Freitas M.H	Geology for Engineers	Edward Arnold, London	2010
3	F.G.Bell.	Fundamentals of Engineering Geology	B.S. Publications. Hyderabad	2011
4	Dobrin, M.B	An introduction to geophysical prospecting	McGraw0Hill, New Delhi	2010
5	KVGK Gokhale	Principles of Engineering Geology	BS Publications, Hyderabad	2011

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2. https://www.youtube.com/watch?v=MWs5id2_0sY&list=PL4328D0CC955E24CB&index=5
3. https://www.youtube.com/watch?v=kVopWFgOcrU&list=PL4328D0CC955E24CB&index=8
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PROFESSIONAL CORE

(PC)

16BTD01 **BIOCHEMISTRY** L T P C
3 0 4 5

Course Objectives

- To provide the basic knowledge of various biomolecules.
- To understand the concept of structure and properties of important biomolecules
- To learn metabolism concepts
- To know the metabolism and its regulation
- To enable students learn the fundamentals of Biochemical Processes and Biomolecules.

Course Outcomes

1. Demonstrate the structure and reactions of Biomolecules.
2. Identify the metabolic pathways of the major biomolecules and relevance to clinical conditions.
3. Gain knowledge about Biochemical processes with Biotechnology applications.
4. Acquire knowledge related to functions and interrelationships of biomolecules in clinical research and industry.
5. Idea about the consequences of interpreting and solving clinical problems.

UNIT I INTRODUCTION TO BIOMOLECULES – CARBOHYDRATES 9

Introduction to biochemistry, types of functional groups, biomolecules, water as biological solvent, pH, biological buffers, Handerson - hasselbalch equation. Carbohydrates: Mono, Di, Oligo and Polysaccharides (Starch, Glycogen, Cellulose and Chitin). Proteoglycans, glucosaminoglycans. Hyaluronic acid, Chondroitin sulfate.

UNIT II STRUCTURE AND PROPERTIES OF OTHER BIOMOLECULES 9

Lipids: Fatty acids, glycerol, saponification, iodination, phospholipids, glycolipids, sphingolipids, cholesterol, steroids.

Proteins: Amino Acids, Peptides, Polypeptides, Primary, Secondary, Tertiary and Quaternary structures, Glycoproteins, Lipoproteins.

Nucleic acids: Purines, Pyrimidines, nucleoside, nucleotide, RNA, DNA-Watson and Crick structure of DNA

UNIT III METABOLISM CONCEPTS AND CARBOHYDRATE METABOLISM 9

Metabolic pathways, primary and secondary metabolites. Enzymes-introduction to biocatalysts, Glycolysis, TCA cycle, Gluconeogenesis, Pentose phosphate shunt, Glyoxalate shunt

UNIT IV METABOLISM AND REGULATION 9

Fatty acid synthesis and oxidation, Reactions of amino acids, Deamination, Transamination and Decarboxylation, Urea cycle, Metabolic disorders of carbohydrate metabolism (pathophysiology, clinical symptoms and treatment): Diabetes mellitus. Metabolic disorders of lipid metabolism: familial hypercholesterolemia. Metabolic disorders of amino acid metabolism: Phenyl ketonuria, Albinism Metabolic disorders of nucleic acid metabolism: Lesch-Nyhan syndrome, Gout

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UNIT V BIOENERGETICS 9

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

Total Hours 45

LIST OF EXPERIMENTS

1. General guidelines for working in biochemistry lab (theory)
2. Units of volume, weight, density and concentration measurements and their range in biological measurements. Demonstration of proper use of volume and weight measurement devices.
3. Accuracy, precision, sensitivity and specificity (theory)
4. Preparation of buffer –titration of a weak acid and a weak base.
5. Qualitative tests for carbohydrates – distinguishing reducing from non-reducing sugars andketo from aldo sugars.
6. Quantitative method for amino acid estimation using ninhydrin – distinguishing amino from imino acid.
7. Protein estimation by Biuret and Lowry's methods.
8. Protein estimation by Bradford and spectroscopic methods.
9. Extraction of lipids and analysis by TLC.
10. Estimation of nucleic acids by absorbance at 260 nm and hyperchromic effect (demo).
11. Enzymatic assay: phosphatase from potato.
12. Enzymatic assay: estimation of glucose by GOD-POD method after hydrolysis of starch with acid and specificity of the enzymatic method.

TOTAL: 45 PERIODS

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Lehninger	Principles of Biochemistry	W.H. Freeman,	2008
2.	Satyanarayana, U. and U. Chakerapani	Biochemistry	Books & Allied (P) Ltd	2006

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rastogi, S.C	Biochemistry	Tata McGraw-Hill	2003
2.	Conn, E.E	Outlines of Biochemistry	John Wiley & Sons	1987
3.	Berg, Jeremy M	Biochemistry	W.H. Freeman	2006
4.	Murray, R.K	Harper's Illustrated Biochemistry	McGraw-Hiil	2006
5.	Voet, D. and Voet, J.G	Biochemistry	John Wiley & Sons	2004

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2. https://www.uwyo.edu/molecbio/courses/molb-3610/files/3610%20chpts%201-2%20notes
3. https://home.apu.edu/~jsimons/Bio101/biochem.htm
4. https://www.youtube.com/watch?v=BsEW6iK_IcQ
5. https://www.youtube.com/watch?v=-fy8-owt6sk

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16BTD02 **BIOORGANIC CHEMISTRY** **L T P C**
3 0 4 5

COURSE OBJECTIVES:

- To know in detail about the elements of atom, charges and their bonding rule
- To understand the various kinetic properties and types of reaction mechanism
- To study the kinetics and mechanism of biomolecules
- To gain knowledge of catalysis
- To identify the possible bio-organic reactions involved in biosynthesis

COURSE OUTCOMES:

1. Ability to learn the basic principle of chemical bonding
2. Ability to understand the mechanism of substitution
3. Ability to describe the kinetics and mechanism
4. Ability to understand the mechanisms of catalysis
5. Ability to explain the bioorganic reactions

UNIT I BONDING AND STEREOCHEMISTRY **9**

Atoms Electrons and orbitals - Covalent Bonds - Octet rule - Polar covalant Bonds - Electronegativity- formal charge - Resonance Acids and Bases - Arrhenius and Bronsted Lowry Theories - Acid Base equilbria - SP3 hybridization - Conformations analysis ethane, butane and cyclohexane - Cis- trans isomerism

UNIT II MECHANISMS OF SUBSTITUTION AND ADDITION REACTIONS **9**

SN1 and SN2 reactions on tetrahedral carbon- nucleophiles- mechanism steric effects – nucleophilic addition on Acetals and ketals -Aldehyde and ketone groups – reactions of carbonyl group with amines- acid catalyzed ester hydrolysis – Saponification of an ester-hydrolysis of amides. R,S notation , re-si faces , e1 and e2 reactions

UNIT IIIKINETICS AND MECHANISM **9**

Kinetic method – Rate law and mechanism – Transition states- Intermediates – Trapping of intermediates – Microscopic reversibility – Kinetic and thermodynamic reversibility – Isotopes for detecting intermediates. Primary and secondary isotopes – the Arrhenius equation Eyring equation - ΔG, ΔS, ΔH, Thermodynamics of coupled reactions

UNIT IV CATALYSIS **9**

Reactivity – Coenzymes – Proton transfer – metal ions – Intra molecular reactions – Covalent catalysis – Catalysis by organized aggregates and phases. Inclusion complexation

UNIT V BIOORGANIC REACTIONS **9**

Timing of Bond formation and fission – Acyl group transfer – C-C bond formation and fission – Catalysis of proton transfer reactions – Transfer of hydride ion – Alkyl group. Transfer – Terpene biosynthesis – Merrifield state peptide synthesis – Sanger method for peptide and DNA sequencing

Total Hours **45**

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LIST OF EXPERIMENTS

1. Synthesis of aspirin
2. Hydrolysis of sucrose
3. Preparation of pyruvic acid.
4. Preparation of oleic acid
5. Preparation of alpha D- glucopyranose pentaacetate
6. Preparation of 1,2,5,6 dicyclohexylnoine alpha D glucofuranose
7. Isolation of lycopene from tomato paste
8. Preparation of L-proline
9. Preparation of L-cysteine from hair
10. Preparation of S-ethyl hydroxybutonate from ethyl acetoacetate using yeast
11. Resolution of S-ethyl hydroxybutonate using 3,5 dinitrobenzoate.
12. Preparation of 5,10,15,20-tetrakisphenyl porphyrin.

TOTAL: 30 PERIODS

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Carey, Francis A	Organic Chemistry	Tata MCGraw Hill	2009
2.	Page, M.I. and Andrew Williams	Organic and Bio-organic Mechanisms	Pearson	2010

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dugas, Hermann	Bioorganic Chemistry: A Chemical Approach to Enzyme Action	Springer	2003
2.	McMurry, J. E	Organic Chemistry with Biological Applications	Cengage Learning	2014
3.	Kalsi, P. S., & Jagtap, S	Pharmaceutical, medicinal and natural product chemistry	Alpha Science	2013
4.	Davis, J.S	Amino acids, peptides and proteins	Davies, Royal Society of Chemistry	2006
5.	Silverman R B	The organic chemistry of enzyme-catalyzed reactions	Academic Press, San Diego	2000

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1. https://nptel.ac.in/downloads/104103018/
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5905184/

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3. https://www.youtube.com/watch?v=jz0wzuPwCFg&list=PLpO5bWSfzj3mDoCTG2FbBrl8ElPYNhXR3
4. https://www.youtube.com/watch?v=91CylOf187A
5. https://www.youtube.com/watch?v=dOADSOEvWuo&list=PLykBd3LSjfsSqAB8FrJjfiXk05t-N37HQ

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16BTD03 **BASIC INDUSTRIAL BIOTECHNOLOGY** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To make the students aware of the overall industrial bioprocess
- To evaluate the process to the requirement of the primary metabolites.
- To gain the knowledge about the secondary metabolites.
- To study the production of enzymes
- To understand the modern biotechnology products

COURSE OUTCOMES:

1. To explain the steps involved in the production of bioproducts and methods to improve modern biotechnology.
2. To apply basic biotechnological principles, methods and models to solve biotechnological tasks.
3. To identify and debate the ethical, legal, professional, and social issues in the field of biotechnology.
4. To explain the industrial application of bioproducts.
5. To design and deliver useful modern biotechnology products to the Society.

UNIT I INTRODUCTION TO INDUSTRIAL BIOPROCESS 9

Fermentation - Bacterial, Fungal and Yeast, Traditional and Modern industrial biotechnology, Basic concepts of Upstream and Downstream processing in Bioprocess, Process flow sheeting – block diagrams, pictorial representation.

UNIT II PRODUCTION OF PRIMARY METABOLITES 9

Primary Metabolites- Production of commercially important primary metabolites like organic acids (Citric acid, lactic acid), amino acids (glutamic acid, aspartic acid) and alcohols (ethanol, butanol)

UNIT IIIPRODUCTION OF SECONDARY METABOLITES 9

Secondary Metabolites- Production processes for various classes of secondary metabolites: Antibiotics (Penicillin), Vitamins and Steroids

UNIT IVPRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS 9

Production of Industrial Enzymes (amalyase, lipase), Biopesticides, Biofertilizers, Biopreservatives (nisin), Biopolymers (PHB), Single Cell Protein, Cheese.

UNIT V PRODUCTION MODERN BIOTECHNOLOGY PRODUCTS 9

Production of recombinant proteins having diagnostic applications, vaccines. Production of monoclonal antibodies.

Total Hours 45

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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Satyanarayana, U	Biotechnology	Books & Allied (P) Ltd	2005
2.	Kumar, H.D	A Textbook on Biotechnology	Affiliated East West Press Pvt.Ltd	1998

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
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	Panima Publishing	2000
4.	Moo-Young, Murrey	Comprehensive Biotechnology	Pergamon Press	2004
5.	Stanbury, P.F., A. Whitaker and S.J. Hall	Principles of Fermentation Technology	Butterworth – Heinemann	1995

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2. https://www.edx.org/course/industrial-biotechnology-delftx-ib01x-0
3. https://online-learning.tudelft.nl/courses/industrial-biotechnology/
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16BTD04 **CELL AND MICROBIOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To provide knowledge on fundamentals of microbiology
- To study the microbial nutrition and growth metabolism
- To gain knowledge on cell division
- To make students to know about cell signaling
- To study the various techniques used in cell biology

COURSE OUTCOMES:

1. Ability to describe the basics of microorganism.
2. Ability to explain the nutrition, growth and metabolism of microorganism
3. Ability to demonstrate the fundamentals of cellbiology
4. Ability to explain cell signaling
5. Ability to describe the techniques used in cell biology

UNIT I INTRODUCTION **9**

Basics of microbial existence, Classification of microorganism, Principles of staining techniques- Gram staining, acid fast staining, Capsular and flagella staining. Control of microorganisms physical and chemical control of microorganisms, host -microbe interactions, Basics of Microscopy.

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

Nutritional requirements of bacteria, different media used for bacterial culture. Growth curve and different methods to quantify growth. Aerobic and anaerobic energetic

UNIT III FUNDAMENTALS OF CELL BIOLOGY **9**

Prokaryotic and eukaryotic cell structure, sub cellular organs and functions, membrane organization, cyto skeletal proteins, Extra cellular matrix, Cell Junction, Cell cycle-Mitosis and Meiosis, cell culture and immortalization of cells and its applications

UNIT IV CELL SIGNALING AND CELL REGULATION **9**

Signaling molecules and their receptor ligand interaction. Cell death-Apoptosis – programmed cell death. Cell inhibition Stem cells and therapeutic cloning

UNIT V TECHNIQUES USED TO STUDY CELLS **9**

Cell fractionation, Flow cytometry, Morphology and identification of cell using microscopic studies like SEM and TEM, confocal microscopy. Localization of proteins in cells – Immunostaining, cryopreservation.

Total Hours **45**

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sadava, D.E	Cell Biology: Organelle Structure and Function	Panima Publishing	2004
2.	L. M. Prescott, J. P. Harley and D. A. Klein	Microbiology	Wm. C. Brown Publishers	2004

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Campbell, N.A., J.B. Recee and E.J. Simon	Essential Biology	Pearson International	2007
2.	Gerald Karp and Nancy L. Puritt	Cell and Molecular Biology	John Wiley and Sons Inc	2004
3.	H. Lodish, A. Berk, S. L. Zipurursky, P. Matsudaria, D. Baltimore and J. Darnell	Molecular Cell Biology	W. H. Free Man and Company	2000
4.	M. J. Pelczar, E. C. S. Chan and N. R. Krein	Microbiology	Tata McGraw-Hill	2002
5.	G. J. Tortora, B. R. Funke and C. L. Case	Microbiology	Addison Wesley Longman, Inc	2001

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1. http://faculty.washington.edu/korshin/Class-486/MicrobiolTechniques.pdf
2. http://www.microbiologybook.org
3. http://www.textbookofbacteriology.net/
4. https://www.youtube.com/watch?v=LFyjJBiltFI
5. https://www.youtube.com/watch?v=OBej7rFyN7U

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16BTD05 **IMMUNOLOGY** L T P C
3 0 2 4

COURSE OBJECTIVES:

- 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 immune regulation.
- To explain the antigen-antibody interactions and how the immune system is protecting the body from foreign pathogens.

COURSE OUTCOMES:

1. Ability to explain about immune system structure and functions.
2. Ability to describe immunity to various pathogens
3. Ability to know the concepts and mechanism behind tumour development, allergy and hypersensivity reactions.
4. Ability to understand the principles behind the production of therapeutic/diagnostic molecules.
5. Ability to explain about monoclonal antibodies

UNIT I INTRODUCTION TO IMMUNE SYSTEM 9

Organisation and classification of immune system – immune cells and organs; innate and acquired immunity; Toll receptors and responses, classification of a ntigens – chemical and molecular nature; haptens, adjuvants; cytokines; complement pathway, antigen presenting cells; major histocompatibility complex

UNIT II HUMORAL AND CELLULAR IMMUNITY 9

Development, maturation, activation, regulation, differentiation and classification of T-cells and Bcells, antigen processing and presentation, theory of clonal selection, TCR; antibodies: structure and functions; antibodies: genes and generation of diversity; antigen-antibody reactions

UNIT III IMMUNITY AGAINST PATHOGENS AND TUMORS 9

Inflammation; protective immune responses to virus, bacteria, fungi and parasites; tumor antigens, tumor immune response, tumor diagnosis, tumor immunotherapy

UNIT IV IMMUNE TOLERANCE AND HYPERSENSITIVITY 9

Immune tolerance, Immuno deficiencies; Transplantation – genetics of transplantation; laws of transplantation; Allergy and hypersensitivity – Types of hypersensitivity, Autoimmunity, Auto immune disorders and diagnosis

UNIT V APPLIED IMMUNOLOGY 9

Monoclonal antibodies, engineering of antibodies; Classification of Vaccines, methods of vaccine development, immunodiagnostic methods (Immuno diffusion ELISA, FACS), immune modulatory drugs

Total Hours 45

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LIST OF EXPERIMENTS

1. Identification of immune cells in a blood smear
2. Identification of blood group
3. Testing for typhoid antigens by Widal test
4. Immunodiffusion – Ouchterlony Double Diffusion
5. Immunoelectrophoresis – Rocket or Counter Current immunoelectrophoresis
6. Enzyme Linked ImmunoSorbent Assay (ELISA)
7. Isolation of peripheral blood mononuclear cells
8. Isolation of monocytes from blood
9. Immunofluorescence
10. Identification of t cells by T-cell rossetting using sheep RBC.

TOTAL: 30 PERIODS

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Peter J Delves, Seamus J Martin, Dennis R Burtn and Ivan M Roitt	Roitts Essential Immunology	Wiley –Blackwell	2016
2.	Judith a Owen, Jenni Punt and Sharon A Stranford, Kuby	Immunology	Macmillan International	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Coico, Richard	Immunology: A Short Course	John Wiley	2008
2.	Khan, Fahim Halim	Elements of Immunology	Pearson Education	2009
3.	Abbas. A., Lichman, A.H., Pillai, S	Cellular and Molecular Immunology	Elsevier Health Services	2017
4.	Pillai, A	A Textbook of Immunology and Immunotechnology	S.Chand & Co. New Delhi	2008
5.	Tizard, R.I	Immunology: An Introduction	Brooks/Cole publisher	2007

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1. http://www.raymondcheong.com/Year1/immuno.html
2. https://www.mooc-list.com/course/bioc3721x-fundamentals-immunology-part-1-edx?static=true
3. http://nptel.ac.in/courses/102103038/download/module1.pdf
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16BTD06 BIOPROCESS PRINCIPLES L T P C
3 0 0 3

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

1. Ability to develop skills of the students in the area of bio process technology with emphasis an bioprocess principles
2. Ability to discuss and distinguish the medium requirements and optimization methods
3. Ability to explain the sterilization kinetics of medium and equipments
4. Ability to learn about fermentation processes, metabolic stoichiometry, energetics, kinetics of microbial growth etc
5. Ability to understand the kinetics of microbial growth that plays a vital role in the fermentation process

UNIT I OVERVIEW OF FERMENTATION PROCESSES 9

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

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 of optimal growth and product formation, examples of simple and complex media, design of various commercial media for industrial fermentations – medium optimization methods

UNIT III STERILIZATION KINETICS 9

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

UNIT IV METABOLIC STOICHIOMETRY AND ENERGETICS 9

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

UNIT V KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION 9

Batch cultivation and continuous cultivation. Simple unstructured models for microbial growth, Monod model, growth of filamentous organisms, product formation kinetics - Leudeking- Piret models, substrate and product inhibition on cell growth and product formation.

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Total Hours 45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Shuler, Michael L. and Fikret Kargi	Bioprocess Engineering	Prentice Hall	1992
2.	Doran, Pauline	Bioprocess Engineering Principles	Elsevier	1995

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Lydersen, Bjorn K	Bioprocess Engineering Systems, Equipment and Facilities	John Wiley	1994
2.	Bailey, James E. and David F. Ollis	Biochemical Engineering Fundamentals	McGraw Hill	1986
3.	Peter F. Stanbury, Stephen J. Hall & A. Whitaker	Principles of Fermentation Technology	Science & Technology Books	1995
4.	Harvey W. Blanch, Douglas S. Clark	Biochemical Engineering	Marcel Dekker, Inc	1997
5.	P. A. Belter, E. L. Cussler and Wei-Shou Hu	Bioseparations - Downstream Processing for Biotechnology	Wiley Interscience	1988

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2. https://nptel.ac.in/courses/103101004/
3. https://nptel.ac.in/courses/103104043/
4. https://www.youtube.com/watch?v=5eKdZ0dVCCo
5. https://www.youtube.com/watch?v=-BFRwlgB2QQ

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16BTD07 FUNDAMENTALS OF UNIT OPERATIONS L T P C
3 2 0 4

COURSE OBJECTIVES:

- To explain the basic principles of mass transfer operations and other separation processes with examples.
- To impart knowledge on how certain substances undergo the physical change with diffusion/mass transfer of components from one phase to other phases.
- To focus on absorption and distillation operations and the process design aspects of the same operations.
- To understand extraction and leaching operations and their applications in bioprocessing
- To industry. understand adsorption and drying operations and the process design aspects of the same operations

COURSE OUTCOMES:

1. Ability to define the basic principles of mass transfer operations and the measurement of diffusivity, mass transfer coefficient
2. Ability to understand the importance of mass transfer phenomena in the design of process equipment in distillation operations
3. Ability to understand the HETP, NTU and HTU concepts of various gas absorption packed tower columns
4. Ability to understand the design aspects of extraction and various leaching equipments
5. Ability to understand the importance of adsorption and drying processes and their industrial applications.

UNIT I MIXING AND AGITATION 8

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

UNIT II FILTRATION 8

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

UNIT IIIMECHANISM OF HEAT TRANSFER 10

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

UNIT IVCONVECTION HEAT TRANSFER 10

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

UNIT V HEAT EXCHANGERS 9

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

Total Hours 45

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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Geankoplis C.J	. Transport Processes And Unit Operations	Prentice Hall India	2002
2.	McCabe W.L., Smith J.C	Unit Operations In Chemical Engineering	Mcgrawhill	1993

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Incropera F.P	Fundamentals Of Heat And Mass Transfer	John Wiley	1998
2.	Gavhane, K.A	Unit Operations-I [Fluid Flow and Mechanical Operations]	Nirali Prakashan	2016
3.	Frank M. White	Fluid mechanics	McGraw-Hill Education	2015
4.	R.K.Bansal	A Textbook of Fluid Mechanics and Hydraulic Machines	Laxmi publications (P) Ltd	2009
5.	Badger W.L. and Banchero J.T	Introduction to Chemical Engineering	TataMcGraw Hill	1997

WEB URLs

1. https://nptel.ac.in/courses/103104043/
2. https://nptel.ac.in/courses/103107127/
3. https://www.youtube.com/watch?v=-Qx5k3BMVPQ
4. https://www.youtube.com/watch?v=0CWCo2PV3Eg
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16BTD08 **ANALYTICAL METHODS AND INSTRUMENTATION** L T P C
3 0 2 4

COURSE OBJECTIVES:

- To enable the students to have a fundamental knowledge about the Light spectrum, Absorption
- To expose students with electrical and electronic components used in the analytical instruments
- To learn and understand the principles and operation of different instrumentation techniques
- To acquire knowledge on the different chromatographic methods for separation of biological products
- To know the different molecular spectroscopic techniques and their analytical applications

COURSE OUTCOMES:

1. Ability to analyze the function of electrical and optical component in analytical instruments and their calibration
2. Ability to apply the spectroscopic techniques to identify, estimate and characterize analytes
3. Ability to analyze the thermal behavior of materials using thermal analysis
4. Ability to apply chromatographic and electrophoretic techniques to separate, purify and quantify molecules
5. Ability to analyze different types of electrodes and electroanalytical techniques for sensing and quantifying analytes.

UNIT I INTRODUCTION TO SPECTROMETRY 9

Properties of electromagnetic radiation- wave properties – components of optical instruments – Sources of radiation – wavelength selectors – sample containers – radiation transducers – Signal process and read outs – signal to noise ratio - sources of noise – Enhancement of signal to noise - types of optical instruments – Principle of Fourier Transform optical Measurements.

UNIT II MOLECULAR SPECTROSCOPY 9

Molecular absorption spectrometry – Measurement of Transmittance and Absorbance – Beer's law – Instrumentation - Applications -Theory of fluorescence and Phosphorescence – Instrumentation – Applications – Theory of Infrared absorption spectrometry – IR instrumentation – Applications – Theory of Raman spectroscopy – Instrumentation – applications.

UNIT III MAGNETIC RESONANCE SPECTROSCOPY AND MASS SPECTROMETRY 9

Theory of NMR – environmental effects on NMR spectra – chemical shift- NMR-spectrometers – applications of 1H and 13C NMR- Molecular mass spectra – ion sources – Mass spectrometer. Applications of molecular mass - Electron paramagnetic resonance- g values –instrumentation

UNIT IV SEPARATION METHODS 9

General description of chromatography – Band broadening and optimization of column performance- Liquid chromatography – Partition chromatography – Adsorption chromatography – Ion exchange chromatography -size exclusion chromatography- Affinity chromatography principles of GC and applications – HPLC- Capillary electrophoresis – Applications

UNIT V ELECTRO ANALYSIS AND SURFACE MICROSCOPY 9

Electrochemical cells- Electrode potential cell potentials – potentiometry- reference electrode – ion selective and molecular selective electrodes – Instrument for potentiometric studies – Voltametry – Cyclic

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and pulse voltametry- Applications of voltametry . Study of surfaces – Scanning probe microscopes – AFM and STM.

Total Hours **45**

LIST OF EXPERIMENTS

1. Precision and validity in an experiment using absorption spectroscopy .
2. Validating Lambert-Beer's law using KMnO4
3. Finding the molar absorbtivity and stoichiometry of the Fe (1,10 phenanthroline)3 using absorption spectrometry.
4. Finding the pKa of 4-nitrophenol using absorption spectroscopy.
5. UV spectra of nucleic acids.
6. Chemical actinometry using potassium ferrioxolate.
7. Estimation of SO4-- by nephelometry.
8. Estimation of Al3+ by Flourimetry.
9. Limits of detection using aluminium alizarin complex.
10. Chromatography analysis using TLC.
11. Chromatography analysis using column chromatography.

TOTAL: 30 PERIODS

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Skoog, D.A. F. James Holler, and Stanky, R.Crouch	Instrumental Methods of Analysis	Cengage Learning	2007
2.	Willard, Hobart	Instrumental Methods of Analysis	CBS	1986

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Braun, Robert D	Introduction to Instrumental Analysis	Pharma Book Syndicate	1987
2.	Ewing,G.W	Instrumental Methods of Chemical Analysis	McGraw-Hill	1985
3.	Sharma, B.K	Instrumental Methods of Chemical Analysis: Analytical Chemistry	Goel Publishing House	1972
4.	Haven, Mary C	Laboratory Instrumentation	John Wiley	1995
5.	Arthur I. Vogel	Quantitative Inorganic Analysis including Elementary Instrumental Analysis	ELBS, Group	1989

WEB URLs

1. http://nptel.ac.in/courses.php
2. http://nptel.ac.in/downloads/102103044/
3. http://nptel.ac.in/courses.php?disciplineId=102
4. https://www.youtube.com/watch?v=dAM0CVa8IkQ
5. https://www.youtube.com/watch?v=vrlR4oBslV8

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16BTD09 **BIOPROCESS ENGINEERING** L T P C
3 0 2 4

COURSE OBJECTIVES:

- To provide the students with the basics of bioreactor engineering.
- To develop bioengineering skills for the production of biochemical product using integrated biochemical processes
- To understand the role of biotechnologists in bioprocess industry.
- To apply the engineering concepts for biological conversion of raw materials
- To perform simulations of reactors and model the kinetics of product formation

COURSE OUTCOMES:

1. Ability to select appropriate bioreactor configurations and operation modes based upon the nature of bioproducts and cell lines and other process criteria.
2. Ability to plan a research career or to work in the biotechnology industry with strong foundation about bioreactor design and scale-up.
3. Ability to perform in enzyme systems
4. Ability to apply modeling and simulation of bioprocesses so as to reduce costs and to enhance the quality of products and systems.
5. Ability to integrate research lab and Industry; identify problems and seek practical solutions for large scale implementation of Biotechnology.

UNIT I CONFIGURATION OF BIOREACTORS 9

Ideal reactors and its characteristics Fed batch cultivation, Cell recycle cultivation, Cell recycle cultivation in waste water treatment two stage cultivation Packed bed reactor, airlift reactor, introduction to fluidized bed reactor bubble column reactors

UNIT II BIOREACTOR SCALE – UP 9

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

UNIT III BIOREACTOR CONSIDERATION IN ENZYME SYSTEMS 9

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

UNIT IV MODELLING AND SIMULATION OF BIOPROCESSES 9

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

UNIT V RECOMBINANT CELL CULTIVATION 9

Different host vector system for recombinant cell cultivation strategies and advantages. E.coli, yeast Pichia pastoris / 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

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LIST OF EXPERIMENTS:

1. Enzyme kinetics – Determination of Michaelis - Menten parameters
2. Enzyme activity – Effect of Temperature and Deactivation Kinetics
3. Enzyme activity – Effect of pH
4. Enzyme inhibition kinetics
5. Enzyme immobilization – Gel entrapment
6. Enzyme immobilization –Cross-linking
7. Enzymatic conversion in Packed bed Column
8. Growth of Bacteria – Estimation of Biomass, Calculation of Specific Growth Rate, Yield Coefficient
9. Optimization by Plackett Burman Design
10. Optimization by Response Surface Methodology

TOTAL: 30 PERIODS

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Michael L. Shuler and Fikret Kargi	Bioprocess Engineering, Basic Concept	Prentice Hall PTR	2002
2.	Pauline Doran	Bioprocess Engineering Calculation	Academic Press	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bailey and Ollis	Biochemical Engineering Fundamentals	McGraw-Hill	2010
2.	Rajiv Dutta	Fundamentals of Biochemical Engineering	Ane Books India	2008
3.	Lee, J. M	Biochemical Engineering	NJ: Prentice Hall	2010
4.	Blanch H. W. And Clark D. S	Biochemical Engineering	CRC Press	2007
5.	Stanbury P. F., Hall, S., and Whitaker A	Principles of Fermentation Technology	Butterworth-Heinesmann	2016

WEB URLs

1. http://www.nptel.ac.in/syllabus/syllabus.php?subjectId=102107029
2. http://users.ox.ac.uk/~dplb0149/publication/NPRBiocatalysisRev.pdf 4
3. https://www.youtube.com/watch?v=V0BzQQCCwgo&list=PL9lnBEiCe6o60eSoHRlT_rwpZKJfnFY-W
4. https://www.youtube.com/watch?v=5eKdZ0dVCCo&t=3s
5. https://www.youtube.com/watch?v=D73_DzPqJU0

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16BTD10 PROTEIN ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To identify the importance of protein biomolecules.
- To realize the structure-function relationships in proteins
- To provide students with a basic understanding of classification, nomenclature, mechanism and specificity of enzyme-coenzyme action, extraction, purification and characterization of enzymes
- To understand enzyme immobilization methods , kinetics of free, immobilized and allosteric enzymes
- To learn the stability, dynamics, structure/function relationships, folding of proteins and rational drug design

COURSE OUTCOMES:

1. Ability to analyze the various interactions in protein makeup.
2. Ability to be familiar with different levels of protein structure.
3. Ability to apply the theoretical and practical aspects of enzyme kinetics for promoting research
4. Ability to analyze the tertiary and quaternary structure of proteins
5. Ability to practice the latest application of protein science in their research.

UNIT I BONDS, ENERGIES, BUILDING BLOCKS OF PROTEINS 9

Covalent, Ionic, Hydrogen, Coordinate, hydrophobic and Vander walls interactions in protein structure. Amino acids and their molecular properties (size, solubility, charge, pKa), Chemical reactivity in relation to post-translational modification.

UNIT II PROTEIN ARCHITECTURE 9

Primary structure: peptide mapping, peptide sequencing - automated Edman method & mass spec. High-throughput protein sequencing setup Secondary structure: Alpha, beta and loop structures and methods to determine Super-secondary structure: Alpha-turn-alpha, beta-turnbeta (hairpin), beta-sheets, alpha-beta-alpha, topology diagrams.

UNIT III TERTIARY STRUCTURE 9

Tertiary structure: Domains, folding, denaturation and renaturation, overview of methods to determine 3D structures. Quaternary structure: Modular nature, formation of complexes.

UNIT IV STRUCTURE-FUNCTION RELATIONSHIP 9

DNA-binding proteins: prokaryotic transcription factors, Helix-turn-Helix motif in DNA binding, Trp Repressor, Eukaryotic transcription factors, Zn fingers, helix-turn helix motifs in homeodomain, Leucine zippers. Membrane proteins: General characteristics, Transmembrane segments

UNIT V PROTEOMICS 9

Introduction to the concept of proteome, components of proteomics, proteomic analysis, importance of proteomics in biological functions, protein-protein interactions, protein arrays, cross linking methods, affinity methods, yeast hybrid systems.

Total Hours 45

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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Branden C. and Tooze J	Introduction to Protein Structure	Garland Publishing	1999
2.	Creighton T.E	Proteins	W.H. Freeman	1993

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Pennington, S.R and M.J. Dunn	Proteomics: Protein Sequence to Function	Viva Books	2002
2.	Liebler	Introduction to Proteomics	Humana Press	2002
3.	Voet D. and Voet G	Biochemistry	John Wiley and Sons	2008
4.	Haggerty, Lauren M	Protein Structure: Protein Science and Engineering	Nova Science Publications	2011
5.	Williamson, Mike	How Proteins Work	Garland Science	2012

WEB URLs

1. http://www.novozymes.com/en/about-us/our-business/what-areenzymes/Pages/default.aspx
2. https://nptel.ac.in/courses/104105076/7
3. https://www.youtube.com/channel/UC0wRhswnu-wnxbxGfN4FqAA
4. https://www.youtube.com/watch?v=UdZURJ1IXJg
5. https://www.youtube.com/watch?v=v3ucL72TPIg

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16BTD11 **MOLECULAR BIOLOGY** L T P C
3 0 2 4

COURSE OBJECTIVES:

- To familiarize with the molecular biology of both Prokaryotes and Eukaryotes.
- To understand the replication process
- To familiarize students on macromolecule's properties, structures and functions
- To expose students to various molecular events in prokaryotes
- To create deeper understanding on regulation of genes activities

COURSE OUTCOMES:

1. Analyze three major macromolecules and their properties in living organisms.
2. Organize the mechanism of DNA replication.
3. Analyze the mechanism of transcription and universal genetic.
4. Analyze the process of translation and DNA repair system.
5. Apply the concept of gene regulation and its significance

UNIT I CHEMISTRY OF NUCLEIC ACIDS 9

Introduction to nucleic acids: Nucleic acids as genetic material, Structure and physicochemical properties of elements in DNA and RNA, Biological significance of differences in DNA and RNA. Primary structure of DNA: Chemical and structural qualities of 3',5'-Phosphodiester bond. Secondary Structure of DNA: Watson & Crick model, Chargaff's rule, X–ray diffraction analysis of DNA, Forces stabilizes DNA structure, Conformational variants of double helical DNA, Hogsteen base pairing, Triple helix, Quadruple helix, Reversible denaturation and hyperchromic effect. Tertiary structure of DNA: DNA supercoiling

UNIT II DNA REPLICATION & REPAIR 9

Overview of Central dogma. Organization of prokaryotic and eukaryotic chromosomes. DNA replication: 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 and eukaryotic DNA replication, Telomere replication in eukaryotes. D-loop and rolling circle mode of replication. Mutagens, DNA mutations and their mechanism, various types of repair mechanisms.

UNIT IIITRANSCRIPTION 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 base modification.

UNIT IVTRANSLATION 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.

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UNIT V REGULATION OF GENE EXPRESSION 9

Organization of genes in prokaryotic and eukaryotic chromosomes, Hierarchical levels of gene regulation, Prokaryotic gene regulation –lac and trp operon, Regulation of gene expression with reference to λ phage life cycle.

Total Hours 45

LIST OF EXPERIMENTS:

1 Electrophoresis -Agarose and Polyacrylamide Gel
2 Isolation of microbial DNA
3 Isolation of genomic DNA
4 Quantification of DNA (UV/ Vis) and analysis of purity
5 Restriction enzyme digestion & Ligation
6 Competent cells preparation
7 Transformation
8 Selection of recombinants – Antibiotic sensitivity assay
9 Plating of λ phage
10 Lamda phage lysis of liquid cultures

Total Hours 30

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Friefelder, David	Molecular Biology	Narosa Publications	1999
2.	Weaver, Robert F	Molecular Biology	Tata McGraw-Hill	2003

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Karp, Gerald	Cell and Molecular Biology: Concepts and Experiments	John Wiley	2005
2.	Friefelder, David and George M. Malacinski	Essentials of Molecular Biology	Panima Publishing	1993
3.	Tropp, Burton E	Molecular Biology: Genes to Proteins	Jones and Bartlett	2008
4.	Glick, B.R. and J.J. Pasternak	Molecular Biotechnology: Principles and Applications of Recombinant DNA	ASM	2010
5.	Harvey Lodish, Arnold Berk, S.L Zipursky, Paul Matsudaira,	Molecular Cell Biology	W.H Freeman	2016

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	David Baltimore and James Danell			

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1. http://leadingstrand.cshl.edu/Course/Keynote/2013/A-MEMBRANE/93
2. http://leadingstrand.cshl.edu/Course/Keynote/2012/A-SYSTEM/83
3. https://www.youtube.com/watch?v=HgTXc4ZESB8&list=PLyjWMictIvv2D2gV4bknO8D-HLkqjG-Jr
4. https://www.youtube.com/watch?v=ZYhQZXtRCks
5. https://www.youtube.com/watch?v=tJVIFTS1YN0&list=PLrl4F_rRUyHuxM3NyTlyvHiK4IK9F_glj

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16BTD12 **MASS TRANSFER OPERATIONS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To explain the basic principles of mass transfer operations and other separation processes with examples.
- To impart knowledge on how certain substances undergo the physical change with diffusion/mass transfer of components from one phase to other phases.
- To focus on absorption and distillation operations and the process design aspects of the same operations.
- To understand extraction and leaching operations and their applications in bioprocessing industry.
- To understand adsorption and drying operations and the process design aspects of the same operations

COURSE OUTCOMES:

1. Ability to define the basic principles of mass transfer operations and the measurement of diffusivity, mass transfer coefficient
2. Ability to understand the importance of mass transfer phenomena in the design of process equipment in distillation operations
3. Ability to understand the HETP, NTU and HTU concepts of various gas absorption packed tower columns
4. Ability to understand the design aspects of extraction and various leaching equipments
5. Ability to understand the importance of adsorption and drying processes and their industrial applications.

UNIT I DIFFUSION AND MASS TRANSFER **9**

Molecular diffusion in fluids and solids; Interphase Mass Transfer; Mass Transfer coefficients; Analogies in Transport Phenomenon.

UNIT II GAS LIQUID OPERATIONS **9**

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

UNIT IIIVAPOUR LIQUID OPERATIONS **9**

V-L Equilibria; Simple, Steam and Flash Distillation; Continuous distillation; McCabe-Thiele & Ponchon-Savarit Principles; Industrial distillation equipments, HETP, HTU and NTU concepts.

UNIT IVEXTRACTION OPERATIONS **9**

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

UNIT V SOLID FLUID OPERATIONS **9**

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

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Total Hours 45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Treybal R.E	Mass Transfer Operations	Mcgraw Hill	2017
2.	Geankoplis C.J	Transport Processes and Unit Operations	Prentice Hall of India	2002

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Coulson and Richardson's	Chemical Engineering. Vol I & II	Asian Books Pvt Ltd	1998
2.	Rajput, R.K	Heat and Mass Transfer	S. Chand and Co	2008
3.	G. K. Roy	Fundamentals of Heat and Mass Transfer	Kanna Publications	2004
4.	W. L. McCabe, J.C. Smith and P. Harriott	Unit Operations in Chemical Engineering	Tata McGraw-Hill Professional	2005
5.	Gavahne. K.A., Unit Operations-II	Heat & Mass Transfer	Nirali prakasan	2012

WEB URLs

1. http://nptel.ac.in/courses/103103032
2. http://nptel.ac.in/courses/103103035
3. https://www.youtube.com/watch?v=Yc2eSffzhBI&list=PLwdnzlV3ogoVX_S_8DyKa7RudEazDL0o_
4. https://www.youtube.com/watch?v=HlHyEcP_7SU&list=PL38769A2045D58D20
5. https://www.youtube.com/watch?v=EG4ZoVTSA5I&list=PLvpgTFzUKO4_51rEIT6AbggF1UYYkLg2X

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16BTD13 **GENETIC ENGINEERING** L T P C
3 0 2 4

COURSE OBJECTIVES:

- To discuss the gene cloning methods and the tools
- To understand the techniques involved in gene cloning and genome analysis and genomics.
- To explain the heterologous expression of cloned genes in different hosts.
- To apply types of host-vector systems and steps in creating a recombinant DNA molecule
- To gain knowledge on various recombinant DNA techniques and their applications

COURSE OUTCOMES:

1. Ability to know how to clone commercially important genes.
2. Ability to know how to produce the commercially important recombinant proteins.
3. Ability to know about gene and genome sequencing techniques.
4. Ability to know about microarrays, Analysis of Gene expression and proteomics
5. Ability to know about genome sequencing

UNIT I BASICS OF RECOMBINANT DNA TECHNOLOGY 9

Manipulation of DNA – Restriction and Modification enzymes, Design of linkers and adaptors. Characteristics of cloning and expression vectors based on plasmid and bacteriophage, Vectors for insect, yeast and mammalian system, Prokaryotic and eukaryotic host systems, Introduction of recombinant DNA in to host cells and selection methods.

UNIT II DNA LIBRARIES 9

Construction of genomic and cDNA libraries, Artificial chromosomes – BACs and YACs, Chromosomal walking, Screening of DNA libraries using nucleic acid probes and antisera.

UNIT IIISEQUENCING AND AMPLIFICATION OF DNA 9

Maxam Gilbert's and Sanger's methods of DNA sequencing. Inverse PCR, Nested PCR, AFLP PCR, Allele specific PCR, Assembly PCR, Asymmetric PCR, Hot start PCR, inverse PCR, Colony PCR, single cell PCR, Real-time PCR/qPCR – SYBR green assay, Taqman assay, Molecular beacons. Site directed mutagenesis.

UNIT IV ORGANIZATION AND STRUCTURE OF GENOMES 9

Organization and structure of genomes, Genome sequencing methods, Conventional and shotgun genome sequencing methods, Next generation sequencing technologies , Ordering the genome sequence, Genetic maps and Physical maps, STS content based mapping, Restriction Enzyme Finger Printing, Hybridization mapping, Radiation Hybrid Maps, Optical mapping. ORF finding and functional annotation.

UNIT V CURRENT STATUS OF GENOME SEQUENCING PROJECTS 9

Current status of genome sequencing projects, Introduction to Functional genomics, Microarrays, Serial Analysis of Gene expression (SAGE), Subtractive hybridization, DIGE, TOGA, Yeast Two hybrid System, Comparative Genomics, Proteogenomics, Web resources for Genomics, Applications of genome analysis and genomics.

Total Hours 45

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LIST OF EXPERIMENTS:

1 Preparation of plasmid DNA
2 Elution of DNA from agarose gels
3 Restriction digestion
4 Ligation of DNA into expression vectors
5 Transformation& Selection of recombinants – Blue white screening assay
6 Optimisation of time of inducer for recombinant protein expression
7 Expression of protein profiling by SDS - PAGE
8 Western blotting, Southern blotting
9 PCR amplification of genes
10 Colony lysate PCR.

Total Hours 30

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Brown T.A	Genomes	Bios Scientific Publishers Ltd	2017
2.	Primrose S.B., Twyman RM	Principles of Gene Manipulation and Genomics	Blackwell Science	2006

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Glick B.R.,and Pasternick J.J	Molecular Biotechnology: Principles and Applications of Recombinant DNA	ASM press	2017
2.	Sathyanarayana U	Biotechnology	Books & Allied (p) ltd	2008
3.	Howe C. J	Gene Cloning and Manipulation	Cambridge University Press	2007
4.	Watson.J.D	Recombinant DNA	Scientific American Book	1993
5.	T A Brown	Gene Cloning and DNA Analysis: An Introduction	Wiley – Blackwell Publications.	2006

WEB URLs

1. http://nptel.ac.in/courses/102103013/
2. http://www.lsic.ucla.edu/ls3/tutorials/gene_cloning.html
3. https://ocw.mit.edu/courses/biology/7-01sc-fundamentals-of-biology-fall-2011/recombinant-dna/
4. https://www.youtube.com/watch?v=WwFwDGkGPlc
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16BTD14	BIOINFORMATICS	L T P C 2 2 0 3

COURSE OBJECTIVES:

- To understand the theory and background of commonly available bioinformatics tools
- To navigate through internet-based biological databases and genomic browsers
- To use online resources for biological applications
- To navigate through internet-based biological databases and genomic browsers
- To let the students know the recent evolution in biological science.

COURSE OUTCOMES:

1. Ability to understand the importance of bioinformatics and their basic requirements
2. Ability to apply the knowledge of bioinformatics in analysis of biological databases
3. Ability to analyze the concepts of dynamic programming
4. Ability to analyze the evolutionary concepts to build phylogenetic tree
5. Ability to evaluate the drug designing techniques with online resources

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 IIBIOLOGICAL DATABASES **9**

Introduction to databases – Data life cycle Biological databases; Primary nucleotide databases (EMBL, GeneBank and 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; Phylogenetic analysis Distance 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 and applications, Bioinformatics approaches for drug discovery.

Total Hours **45**

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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Lesk, A. K	Introduction to Bioinformatics	Oxford University Press	2013
2.	Dan Gusfield	Algorithms on Strings, Trees and Sequences: Computer Science and Computational Biology	Cambridge University Press	1997

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Durbin, R., Eddy, S., Krogh, A., and Mitchison, G	Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids	Cambridge, UK: Cambridge University Press	1998
2.	Mount, D.W	Bioinformatics Sequence and Genome Analysis	Cold Spring Harbor Laboratory Press	2004
3.	Bergeron.B	Bioinformatics Computing	Prentice Hall of India Learning Pvt (Ltd)	2009
4.	Attwood, T.K and Parry Smith. D.J	Introduction to Bioinformatics	Pearson Education	2002
5.	Uri Alon	An Introduction to Systems Biology: Design Principles of Biological Circuits	Chapman & Hall	2006

WEB URLs

1. http://bioconductor.org/
2. https://onlinecourses.science.psu.edu/statprogram/r
3. https://www.youtube.com/watch?v=w-uk-_TOgR0
4. https://www.youtube.com/watch?v=K9MqvU298uE
5. https://www.youtube.com/watch?v=w-uk-_TOgR0&list=PLb0WW0k29aHrF8aZzK17ORTesZsd-lING

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16BTD15 APPLIED CHEMICAL REACTION ENGINEERING L T P C
3 0 2 4

COURSE OBJECTIVES:

- 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 non ideal reactors
- To develop knowledge for design of ideal reactors
- To acquire knowledge in heterogeneous reactions and reactor types.

COURSE OUTCOMES:

1. Ability to elucidate the basic laws on chemical kinetics and its application on different types of reactions
2. Ability to apply the various ideal reactors and their design equations
3. Ability to elaborate the non-ideal behaviour of reactors
4. Ability to conceptualize the basic of heterogeneous reacting systems
5. Ability to identify and analyse the various multiphase reactors

UNIT I SCOPE OF CHEMICAL KINETICS & CHEMICAL REACTION ENGINEERING 9

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

UNIT II IDEAL REACTORS 9

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

UNIT IIINON IDEAL REACTORS 9

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

UNIT IV IDEAL FLOW AND NON IDEAL FLOW 9

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

UNIT VFIXED BED AND FLUID BED REACTORS 9

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

Total Hours 45

LIST OF EXPERIMENTS:

1 Flow measurement - Orifice meter
2 Flow measurement - Venturimeter,
3 Flow measurement - Rotameter
4 Pressure drop in flow through pipes

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5 Pressure drop in flow through packed column
6 Pressure drop in flow through fluidized beds
7 Characteristics of centrifuge pump
8 Filtration through plate and frame filter press
9 Filtration in leaf filter
10 Heat transfer characteristics in heat exchanger
11 Simple and steam distillation

Total Hours
30

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Levenspiel O	Chemical Reaction Engineering	John Wiley	2006
2.	Fogler H.S	Elements Of Chemical Reaction Engineering	Prentice Hall India	2002

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Missen R.W., Mims C.A., Saville B.A	Introduction to Chemical Reaction Engineering and Kinetics	John Wiley	1999
2.	Dawande, S.D	Principles of Reaction Engineering	Central Techno Publications	2001
3.	Richardson, J.F. and Peacock, D.G, Coulson Richardson	Chemical Engineering Vol.III	Butterworth-Heinemann-Elsevier	2006
4.	Walker, D	Chemical Reactions	Evans Brothers	2007
5.	Forment G F and Bischoff K B	Chemical Reactor Analysis and Design	John Wiley	2010

WEB URLs

1. https://nptel.ac.in/courses/103108097/
2. https://www.youtube.com/watch?v=DpLAsVcofao&list=PLwdnzlV3ogoUC9IWVOPTGqV5eEVNRAfGa
3. https://www.youtube.com/watch?v=OGWwdT6UGVM&list=PLwdnzlV3ogoUC9IWVOPTGqV5eEVNRAfGa&index=2
4. https://www.youtube.com/watch?v=WcHd7yFvp6Q&list=PLgzsL8klq6DLxhjPKpyF9aHjxSbykVvQ3
5. https://www.youtube.com/watch?v=IkqoqF-keiE&list=PLOzRYVm0a65cyrKMms9dQtcMnMK-rQ6DX

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16BTD16 **BIOPHARMACEUTICAL TECHNOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To provide core responsibilities for the development and monitoring of the drug and the preparation of medicines according to the norms.
- To gain knowledge in physicochemical properties, pharmacology and the formulation of commonly used biopharmaceuticals.
- To Introduce diverse sources and classes of biopharmaceuticals
- To Expose students to various modes of drug delivery
- To Build deeper understanding of application of biotechnology tools in the world of medicine

COURSE OUTCOMES:

1. Ability to understand the difference between chemical and bio-based pharmaceuticals
2. Ability to apply the knowledge of biological effects of bioactive substances for their use as therapeutics
3. Ability to analyze the need for formulation of biopharmaceuticals
4. Ability to analyze various criteria for selection of drug carriers that result in effective drug delivery
5. Ability to evaluate drug action based on the difference in physiological functions of a host

UNIT I INTRODUCTION **9**

Pharmaceutical industry & development of drugs; types of therapeutic agents and their uses; economics and regulatory aspects.

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

Mechanism of drug action; physico-chemical principles of drug metabolism; radioactivity; pharmacokinetics.

UNIT IIIMANUFACTURE OF DRUGS, PROCESS AND APPLICATIONS **9**

Types of reaction process and special requirements for bulk drug manufacture.

UNIT IVPRINCIPLES OF DRUG MANUFACTURE **9**

Compressed tablets; dry and wet granulation; slugging or direct compression; tablet presses; coating of tablets; capsule preparation; oval liquids – vegetable drugs – topical applications; preservation of drugs; analytical methods and other tests used in drug manufacture; packing techniques; quality management; GMP.

UNIT V BIOPHARMACEUTICALS **9**

Various categories of therapeutics like vitamins, laxatives, analgesics, contraceptives, antibiotics, hormones and biologicals.

Total Hours **45**

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ansel H.C	Pharmaceutical dosage	Lippincott Williams	2007

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		forms and drug delivery systems	& Wilkins	
2.	Gary Walsh	Biopharmaceutical technology-biochemistry and biotechnology	John Wiley	2005

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Remington	Pharmaceutical sciences	Mack publishing and Co	2000
2.	Brahmankar, D.M. and Jaiswal, S.B	Biopharmaceutics and Pharmacokinetics	Vallabh Prakashan Publication	2009
3.	Finkel, Richard	Lippincott's Illustrated Reviews Pharmacology	Wolters Kluwer / Lippincott Williams & Wilkins,	2009
4.	Gareth Thomas	Medicinal Chemistry. An introduction	John Wiley	2000
5.	Katzung B.G	Basic and Clinical Pharmacology	Prentice Hall of Intl	1995

WEB URLs

1. http://onlinelibrary.wiley.com/book/10.1002/9780470259818
2. https://ocw.mit.edu/courses/health-sciences-and-technology/hst-151-principles-ofpharmacology-spring-2005/lecture-notes/
3. https://www.youtube.com/watch?v=pE_mYQqKM1o
4. https://www.youtube.com/watch?v=8VpUsUaLpyw
5. https://www.youtube.com/watch?v=e0CsGPYI5Zo

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16BTD17 **DOWNSTREAM PROCESSING** L T P C
3 0 2 4

COURSE OBJECTIVES:

- To introduce the methods of separation technology
- To expose students to techniques of product fractionation
- To gain knowledge about isolation of products
- To create deeper understanding of final product purification
- To understand the methods to obtain pure proteins, enzymes

COURSE OUTCOMES:

1. Apply separation techniques used in downstream process for the purification of biomolecules
2. Analyze techniques of insoluble removal and predict the parameters for large scale operations
3. Analyze the techniques used in bulk product isolation
4. Evaluate the techniques of high-resolution product purification based on product characteristics and cost effectiveness
5. Evaluate the techniques of final product formulation

UNIT I INTRODUCTION 9

Introduction to downstream processing, principles, characteristics of bio-molecules and bioprocesses. Cell disruption for product release – mechanical, enzymatic and chemical methods. Pre treatment and stabilisation of bio-products.

UNIT II PHYSICAL METHODS OF SEPARATION 9

Unit operations for solid-liquid separation - filtration and centrifugation.

UNIT IIIISOLATION OF PRODUCTS 9

Adsorption, liquid-liquid extraction, aqueous two-phase extraction, membrane separation – ultrafiltration and reverse osmosis, dialysis, precipitation of proteins by different methods.

UNIT IVPRODUCT PURIFICATION 9

Chromatography – principles, instruments and practice, adsorption, reverse phase, ion exchange, size exclusion, hydrophobic interaction, bio-affinity and pseudo affinity chromatographic techniques

UNIT V PRODUCT FORMULATION AND FINISHING OPERATIONS 9

Crystallization, drying and lyophilization in final product formulation.

Total Hours 45

LIST OF EXPERIMENTS:

1 Solid liquid separation – centrifugation.
2 Solid liquid separation - microfiltration
3 Cell disruption techniques – ultrasonication or French pressure cell or Dyno mill
4 Precipitation – ammonium sulphite precipitation
5 Ultra filtration separation
6 Aqueous two phase extraction of biologicals
7 High resolution purification – affinity chromatography

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8 High resolution purification – ion exchange chromatography
9 Product polishing – spray drying or freeze drying
10 Size exclusion chromatography

Total Hours 30

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Belter, P.A., E.L. Cussler and Wei-Houhu	Bioseparations – Downstream Processing for Biotechnology	John Wiley	1988
2.	Sivasankar, B	Bioseparations: Principles and Techniques	PHI	2005

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Asenjo, Juan A	Separation Processes in Biotechnology	CRC / Taylor & Francis	1990
2.	Ghosh, Raja	Principles of Bioseparations Engineering	World Scientific	2006
3.	R. G. Harrison, P. Todd, S. R. Rudger and D. P. Petrides	Bioseparation Science and Engineering	Oxford University Press	2003
4.	Nooralabetta Krishna Prasad	Downstream Process Technology – A new horizon in Biotechnology	PHI Learning Private Limited	2010
5.	Ajay Kumar	Bioseparation Engineering	IK Intl.Ltd	2006

WEB URLs

1. http://nptel.ac.in/courses/102106022/
2. https://www.class-central.com/tag/bioprocess
3. https://www.youtube.com/watch?v=Uut1cUs6GpA
4. https://www.youtube.com/watch?v=6wY480YHxF4
5. https://www.youtube.com/watch?v=VKpthcW1llU

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16BTD18 **CANCER BIOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To Compute about the diagnosis and prevention of cancer and to Assess the recent techniques in cancer treatment
- To Develop new techniques in identification and mitigation of cancer based on high throughput screening
- To learn about the fundamentals of carcinogenesis and role of oncogenes
- To understand the regulation of cell cycle in cancer and mechanism of cancer metastasis
- To know about the strategies for cancer diagnosis and therapy

COURSE OUTCOMES:

1. Apply profound knowledge in molecular biology of cancer
2. Analyze the role of signaling pathways in causing cancer
3. Analyze the relationship between genes and cancer
4. Evaluate the recent advancements in cancer diagnosis
5. Develop new strategies for the treatment of cancer

UNIT I FUNDAMENTALS OF CANCER BIOLOGY **9**

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

UNIT II PRINCIPLES OF CARCINOGENESIS **9**

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

UNIT IIIPRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER **9**

Signal targets and cancer, activation of kinases; Oncogenes, identification of oncogenes, retroviruses and oncogenes, detection of oncogenes. Oncogenes/proto oncogene activity. Growth factors related to transformation. Telomerases.

UNIT IVPRINCIPLES OF CANCER METASTASIS **9**

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

UNIT V NEW MOLECULES FOR CANCER THERAPY **9**

Different forms of therapy, chemotherapy, radiation therapy, detection of cancers, prediction of aggressiveness of cancer, advances in cancer detection. Use of signal targets towards therapy of cancer; Gene therapy.

Total Hours **45**

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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Weinberg, R.A	The Biology of Cancer	Garland Science	2007
2.	McDonald.,	Molecular Biology of Cancer	Taylor & Francis	2004

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	King, Roger J.B	Cancer Biology	Addison Wesley Longman	1996
2.	Ruddon, Raymond W	Cancer Biology	Oxford University Press	1995
3.	Pelengaris S and Khan M	The Molecular Biology of cancer	Blackwell Scientific Publications	2006
4.	Robin Hesketh	Introduction to Cancer Biology	Cambridge University Press	2013
5.	Kufe, DW, Pollock, RE, Weichselbaum, RR, Bast R.C, Gansler TS, Holland JF Frei, E	Cancer medicine	BC Deckker Inc., Toranto	2003

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1. http://www.cyclacel.com/research_science_cell-cycle.shtml
2. http://www.cancer.org/treatment/treatmentsandsideeffects/treatmenttypes/
3. http://www.cancer.gov/about-cancer/treatment/types
4. https://www.youtube.com/watch?v=jjfYQMW_nek
5. https://www.youtube.com/watch?v=A-hmvyep7zk

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16BTD19 **DISASTER MANAGEMENT** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To provide students an exposure to disasters, their significance and types.
- To ensure that students begin to understand the relationship between vulnerability, disasters, disaster prevention and risk reduction
- To gain a preliminary understanding of approaches of Disaster Risk Reduction (DRR)
- To enhance awareness of institutional processes in the country and
- To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live, with due sensitivity

COURSE OUTCOMES:

1. Ability to differentiate the types of disasters, causes and their impact on environment and society.
2. Ability to assess vulnerability and various methods of risk reduction measures as well as mitigation.
3. Ability to analyze the relation between disaster and development
4. Ability to draw the hazard and vulnerability profile of India, Scenarios in the Indian context
5. Ability to analyze the disaster damage assessment and 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- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), States, Centre, and other stake-holders- Institutional Processess and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT IIIINTER-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 context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IVDISASTER RISK MANAGEMENT IN INDIA 9

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Hazard and Vulnerability profile of India, Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, Disaster Management Act and Policy - Other related policies, plans, programmes and legislation – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and 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: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.

Total Hours **45**

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Singhal J.P	Disaster Management	Laxmi Publications	2010
2.	Tushar Bhattacharya	Disaster Science and Management	McGraw Hill India Education Pvt. Ltd	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gupta Anil K, Sreeja S. Nair	Environmental Knowledge for Disaster Risk Management	NIDM, New Delhi	2011
2.	Kapur Anu	Vulnerable India: A Geographical Study of Disasters	IIAS and Sage Publishers, New Delhi	2010
3.	R Rajagopalan	Environmental Studies –From Crisis to Cure	Oxford Publisher	2005
4.		Govt. of India: Disaster Management Act	Government of India, New Delhi	2005
5.		National Disaster Management Policy	Government of India, New Delhi	2009

WEB URLs

1. https://www.youtube.com/watch?v=9WIwlljva_s
2. https://www.youtube.com/watch?v=DExlZTfKZAM&list=PLC4PaTsQiLcbejXqJR7S59Ohk2OK1rgEG
3. https://www.youtube.com/watch?v=-e_jireqahY
4. https://www.youtube.com/watch?v=HMPBf5rkcb0
5. https://www.youtube.com/watch?v=Qe2UZ2zm0Ik

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PROFESSIONAL ELECTIVE

(PE)

16BTE01 **FOOD TECHNOLOGY** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To acquire knowledge about food and energy
- To know about the general aspects in food.
- To gain knowledge about the production of food products
- To know the fundamentals of preservation methods.
- To know different packing materials for the preservation of foods.

COURSE OUTCOMES:

1. Ability to differentiate the constituents present in food
2. Ability to understand the processing methods
3. Ability to distinguish the production and utilization of food.
4. Ability to know the preservation methods
5. Ability to understand the concept of food packing materials.

UNIT I FOOD CONSTITUENTS AND DERIVATIVE FACTORS 9

Constituents of food – carbohydrates, lipids, proteins, vitamins and minerals, food additives; deteriorative factors and their control.

UNIT II GENERAL ENGINEERING ASPECTS AND PROCESSING METHODS 9

Preliminary processing methods; conversion and preservation operations

UNIT III PRODUCTION AND UTILISATION OF FOOD PRODUCTS 9

Cereal grains; pulses; vegetables; fruits; spices; fats and oils; bakery; confectionery and chocolate products; soft and alcoholic beverages; dairy products; meat; poultry and fish products.

UNIT IV PRESERVATION METHODS 9

Preservation by heat and cold; Dehydration; Frying; Drying; Irradiation; Microwave heating sterilization and pasteurization; fermentation and pickling

UNIT V FOOD PACKAGING 9

Basic packaging materials, types of packaging materials used for different kinds of foods, HACCP Introduction and Principles, Introduction to Food Labeling.

Total Hours 45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B. Sivasanker	Food Processing & Preservation	Prentice-Hall Of India Pvt. Ltd.	2002
2.	Potter N.N.	Food Science	The AVI Publishing Co., Westport	2006

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	W.C. Frazier & D.C. Westhoff	Food Microbiology	Mcgraw-Hill Book Co.,	1988
2.	J.M. Jay	Modern Food Microbiology	Cbs Publications	1987
3.	Barbosa-Canovas, G. V., & Ibarz, A	Introduction to food process engineering	CRC Press	2014
4.	Sahu, J. K	Introduction to advanced food process engineering	CRC Press	2014
5.	P. Coultate	Food – The Chemistry Of Its Components	Royal Society, London	1992

WEB URLs

1. www.fao.org/wairdocs/x5434e/x5434e00.htm
2. https://www.mooclist.com/course/food-security-and-sustainability-crop-production-edx?static=true
3. https://www.mooclist.com/course/nutrition-and-health-part-3-food-safety-edx?static=true
4. https://www.youtube.com/watch?v=1JbnRA-Hpwg
5. https://www.youtube.com/watch?v=fr1nzF9AMXs

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16BTE02 **ANIMAL BIOTECHNOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To provide the fundamentals of animal cell culture
- To gain knowledge in animal diseases
- To know the fundamental therapies for animal diseases
- To offer the knowledge about the micromanipulation
- To provide the basics of transgenic animals

COURSE OUTCOMES:

1. Ability to understand the animal cell culture
2. Ability to know the animal diseases and its diagnosis
3. Ability to gain the knowledge for therapy of animal infections
4. Ability to know the concepts of micromanipulation technology and transgenic animal technology
5. Ability to use the knowledge gained in this section to apply in the field of clinical research

UNIT I ANIMAL CELL CULTURE **9**

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

UNIT II ANIMAL DISEASES ANDTHEIR DIAGNOSIS **9**

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

UNIT IIITHERAPY OFANIMAL DISEASES **9**

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

UNIT IVMICROMANIPULATION OF EMBRYO'S **9**

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

UNIT V TRANSGENIC ANIMALS **9**

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

Total Hours **45**

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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	RangaM.M	Animal Biotechnology	Agrobios India Limited	2002
2.	Ramadass P, Meera Rani S	Text Book Of Animal Biotechnology	Akshara Printers	1997

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Masters J.R.W	Animal Cell Culture: Practical Approach	Oxford University Press	2000
2.	Freshney R I	Culture of Animal Cells	Wiley-Liss	2005
3.	Spier RE and Griffiths JB	Animal Cell Biotechnology	Academic Press	1988
4.	Channarayappa	Molecular Biotechnology: Principles and Practices	University Press (India) Pvt. Ltd	2006
5.	Murray Moo-Young	Animal Biotechnology	Pergamon Press	1989

WEB URLs

1. http://link.springer.com/book/10.1385%2F0896035476
2. http://store.elsevier.com/Animal-Biotechnology/isbn-9780124160026/
3. http://ocw.mit.edu/courses/biology/7-342-developmental-andmolecular-biology-of-regeneration-spring-2008/#
4. https://www.youtube.com/watch?v=OBagQf8_lZM&list=PLpAtEo7BAHrlqWLECZwRW0wAGVpXwokTM
5. https://www.youtube.com/watch?v=Mktxmj41cR8&list=PLLA34Ra3DpcxPYYEhf3db5Nvlv3ZIYdXY

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16BTE03 **CHEMISTRY OF MEDICINES** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To impart comprehensive understanding of the chemical basis of drug action including physicochemical and steric properties of drug.
- To gain knowledge about the drugs acting on central nervous system
- To study the classification, chemical nomenclature, generic names and synthesis of various medicinal agents.
- To understand the structure activity relationship, biochemical / molecular basis of mechanism of action and uses of drug.
- To gain knowledge about the drugs acting on cardiovascular system

COURSE OUTCOMES:

1. Ability to gain an appreciation of importance of the physical properties of drugs with respect to the ionization, solubility and efficacy of drugs
2. Ability to understand how changes in the chemical structure of drugs affect efficacy.
3. Ability to obtain a working knowledge of chemical structures and nomenclature
4. Ability to to develop the ability to suggest suitable techniques to synthesis different drug molecules.
5. Ability to understand how current drugs were developed and demonstrate the importance of chemistry in the development and application of therapeutic drugs.

UNIT I PRINCIPLES OF MEDICINAL CHEMISTRY 9

Physicochemical properties in relation to biological action: Ionization, Drug distribution and pKa values and their relation to drug transport, hydrogen bonding, redox potential, surface activity and chelation. Steric properties of drugs: optical and geometrical isomerism. Functional group and their effects of on drug action: steric effect, concept of isosterism, bioisosterism, homologs and analogs.

UNIT II DRUGS ACTING ON SYNAPTIC AND NEURO-EFFECTOR JUNCTION SITES 9

Classification, biochemical/molecular basis of mechanism of action, structure activity relationship including stereo chemical aspects, physiochemical properties and synthesis of selected drugs belonging to the class of Cholinergics, Anticholinergics, Anticholinesterases and Adrenergics

UNIT IIIDRUGS ACTING ON THE CENTRAL NERVOUS SYSTEM 9

Classification, biochemical/molecular basis of mechanism of action, structure activity relationship and synthesis of Hypnotics and Sedatives, Opioid analgesics, Anticonvulsants and Psychopharmacological agents (neuroleptics, antidepressants, anxiolytics).

UNIT IVDRUGS ACTING ON CARDIOVASCULAR SYSTEM 9

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Structural basis of mechanism of action, structure activity relationship including stereo chemical aspects, physiochemical properties, and synthesis of selected drugs belonging to the class of anti-anginal, vasodilators, calcium channel blockers and cardiac glycosides.

UNIT V AUTOCOIDS **9**

Synthetic procedures, mode of action, uses, structure activity relationship including physicochemical properties of the following classes of drugs Antihistamines, Eicosanoids, Analgesic-antipyretics, Anti-inflammatory (non-steroidal) agents.

Total Hours **45**

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ashutosh Kar	Medicinal Chemistry	New Age International (P) Ltd.	2015
2.	Graham L. Patrick	An introduction to Medicinal Chemistry	Oxford University Press	2017

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ilango, K. and Valentina, P	Text book of Medicinal Chemistry	Keerthi Publishers	2007
2.	Donald J. Abraham, Burger's	Medicinal Chemistry and Drug Discovery	John Wiley and Sons	2003
3.	Oliver Kayser and Heribert Warzecha	Pharmaceutical Biotechnology: Drug Discovery and Clinical Applications	John Wiley and Sons	2012
4.	Gary Walsh	Biopharmaceutical technology-biochemistry and biotechnology	John Wiley and Sons	2005
5.	Remington	Pharmaceutical sciences	Mack publishing and Co	2000

WEB URLs

1. http://onlinelibrary.wiley.com/book/10.1002/9780470259818
2. https://ocw.mit.edu/courses/health-sciences-and-technology/hst-151-principles-ofpharmacology-spring-2005/lecture-notes/
3. https://www.youtube.com/watch?v=lUxkcEoGkVg
4. https://www.youtube.com/watch?v=RY7uS9bm3Zk
5. https://www.youtube.com/watch?v=IOf-z0D1mHk

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16BTE04 **LIFE STYLE DISEASES** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand different types of diseases caused by life style
- To acquire in depth knowledge about cancer
- To know about the cardiovascular diseases
- To understand about diabetes and obesity
- To familiarize about respiratory disease

COURSE OUTCOMES:

1. Ability to explain about the diseases caused by life style
2. Ability to identify the types of cancer
3. Ability to describe about the cardiovascular diseases
4. Ability to explain about diabetes and obesity
5. Ability to identify the respiratory diseases

UNIT I INTRODUCTION **9**

Lifestyle diseases – Definition ; Risk factors – Eating, smoking, drinking, stress, physical activity, illicit drug use ; Obesity, diabetes, cardiovascular diseases, respiratory diseases, cancer; Prevention – Diet and exercise.

UNIT II CANCER **9**

Types - Lung cancer, Mouth cancer, Skin cancer, Cervical cancer, Carcinoma oesophagus; Causes Tobacco usage, Diagnosis – Biomarkers, Treatment

UNIT III CARDIOVASCULAR DISEASES **9**

Coronoary atherosclerosis – Coronary artery disease; Causes -Fat and lipids, Alcohol abuse — Diagnosis - Electrocardiograph, echocardiograph, Treatment, Exercise and Cardiac rehabilitation

UNIT IV DIABETES AND OBESITY **9**

Types of Diabetes mellitus; Blood glucose regulation; Complications of diabetes – Paediatric and adolescent obesity – Weight control and BMI

UNIT V RESPIRATORY DISEASES **9**

Chronic lung disease, Asthma, COPD; Causes - Breathing pattern (Nasal vs mouth), Smoking – Diagnosis - Pulmonary function testing

Total Hours **45**

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R.Kumar and	Guide to Prevention	Deep & Deep	2003

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	Meenal Kumar	of Lifestyle Diseases	Publications	
2.	Gary Eggar	Lifestyle Medicine	Academic Press	2017

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Akira Miyazaki	New Frontiers in Lifestyle-Related Disease	Springer	2008
2.	William O Foye, Thomas L Lemke, David A Williams Foye's	Principles of Medicinal Chemistry	Wolters Kluwer Health Adis (ESP) Publisher	2012
3.	James M.R	Lifestyle Medicine	CRC Press	2006
4.	David E. B, Edward R. A. and Carl A. B	Fundamentals of Molecular Diagnostics	Saunders Group	2007
5.	Betty A. F., Daniel F. S., Alice S. W. and Ernest A. T	Bailey & Scott's Diagnostic Microbiology	Mosby Inc	2007

WEB URLs

1. https://www.sciencedirect.com/topics/medicine-and-dentistry/molecular-diagnostics
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1214554/
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4375750/
4. https://www.youtube.com/watch?v=NY_JNh_duKc
5. https://www.youtube.com/watch?v=LB9SAPsCH14

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16BTE05 **INTELLECTUAL PROPERTY RIGHTS** L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the basics of IPR
- To acquire in depth in registration of IPR
- To know the agreements and legislations
- To develop skills about digital products and law
- To familiarize about enforcement of IPR

COURSE OUTCOMES:

1. Ability to explain about IPR
2. Ability to identify the registration of IPR
3. Ability to describe about agreements and legislations
4. Ability to explain about digital products
5. Ability to describe about enforcement of IPR

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 9

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 9

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 9

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies

Total Hours 45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	V. ScopleVinod	Managing Intellectual Property	Prentice Hall of India pvt Ltd	2012
2.	S. V. Satakar	Intellectual Property Rights and Copy Rights	Ess Ess Publications	2002

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Deborah E. Bouchoux	Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets	Cengage Learning	2012
2.	Prabuddha Ganguli	Intellectual Property Rights: Unleashing the Knowledge Economy	McGraw Hill Education	2011
3.	Derek Bosworth and Elizabeth	The Management of Intellectual Property	Edward Elgar Publishing Ltd	2013
4.	Singh. K	Intellectual Property Rights in Biotechnology	BCLI, New Delhi	2010
5.	Deepa Goel and Shomini Parashar	IPR, Biosafety and Bioethics	Pearson Education publisher	2013

WEB URLs

1. http://ces.iisc.ernet.in/hpg/cesmg/iprdoc.html
2. http://www.who.int/csr/resources/publications/biosafety/Biosafety
3. https://www.youtube.com/watch?v=qGPwcm4yAAs
4. https://www.youtube.com/watch?v=BGSgZ1J8-yQ
5. https://www.youtube.com/watch?v=hHQWCFE0J84

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16BTE06 **BIOFUEL** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To gain knowledge about the biofuels
- To understand the production process of biodiesel
- To acquire knowledge about bioethanol
- To familiarize the concepts of biomethane and biohydrogen
- To gain knowledge about modern biofuels

COURSE OUTCOMES:

1. Ability to explain about the need of biofuels
2. Ability to describe about the production of biodiesel
3. Ability to demonstrate about bioethanol
4. Ability to explain the biomethane and biohydrogen
5. Ability to describe about the modern biofuels

UNIT I OVERVIEW OF BIOFUELS **9**

Generation of biofuels – Development of biological conversion technologies – Integration of biofuels into biorefineries – Energy security and supply – Environmental sustainability of biofuels – Economic sustainability of biofuels.

UNIT II BIODIESEL **9**

Biodiesel – Microorganisms and raw materials used for microbial Oil production – Treatment of the feedstocks prior to production of the Biodiesel – Current technologies of biodiesel production – Purification of biodiesel; Industrial production of biodiesel – Biodiesel production from single cell oil.

UNIT IIIBIOETHANOL **9**

Bioethanol – Properties – Feedstocks – Process technology – Pilot plant for ethanol production from lignocellulosic feedstock – Environmental aspects of ethanol as a biofuel.

UNIT IVBIOMETHANE AND BIOHYDROGEN **9**

Biomethanol – Principles, materials and feedstocks – Process technologies and techniques – Advantages and limitations – Biological hydrogen production methods – Fermentative hydrogen production – Hydrogen economy – Advantages and limitations.

UNIT V OTHER BIOFUELS **9**

Biobutanol production – Principles, materials and feedstocks – Process technologies – Biopropanol – Bioglycerol – Production of bio-oils via catalytic pyrolysis – Life-Cycle environmental impacts of biofuels and Co-products.

Total Hours **45**

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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sunggyu Lee and Y T Shah	Biofuels and Bioenergy- Process and Technology	CRC Press	2014
2.	Caye M. Drapcho, N.P. Nhuan and T. H. Walker	Biofuels Engineering Process Technology	Mc Graw Hill Publishers	2008

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Luque, R., Campelo, J.& Clark, J	Handbook of biofuels production	Woodhead Pub Limited	2011
2.	Gupta, V, K. and Tuohy, M, G	Biofuel Technologies	Springer	2013
3.	Moheimani, N. R., Boer, M, P, M, K, ParisaA. And Bahri	Biofuel and refining Technologies	Springer	2015
4.	Eckert, C, A. and Trinh, C	Biotechnology for Biofuel Production and Optimization	Elsevier	2016
5.	Bernardes, M	Biofuel production – recent developments and prospects	InTech	2011

WEB URLs

1. https://www.energy.gov/eere/bioenergy/biofuels-basics
2. https://www.greenfacts.org/en/biofuels/l-2/1-definition.htm
3. https://www.renewableenergyworld.com/types-of-renewable-energy/tech/biofuels/
4. https://www.youtube.com/watch?v=ZGmwtDffc74
5. https://www.youtube.com/watch?v=v2ZxmdYwk1E

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16BTE07 FUNDAMENTALS OF NANOSCIENCE L T P C
3 0 0 3

COURSE OBJECTIVES:

- To learn about basis of nanomaterial science
- To gain knowledge in nano material preparation method
- To familiarize with nano materials
- To acquire knowledge about nanomaterial characterization
- To learn about various applications of nano science.

COURSE OUTCOMES:

1. Ability to familiarize about the science of nanomaterials
2. Ability to demonstrate the preparation of nanomaterials
3. Ability to develop knowledge in characteristic nanomaterials
4. Ability to explain about nano material characterization
5. Ability to demonstrate about appilications of nano science

UNIT I INTRODUCTION 9

Nano scale Science and Technology - Implications for Physics, Chemistry, Biology and Engineering-Classifications of nano structured materials- nano particles- quantum dots, nano wires-ultra-thin films-multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).

UNIT II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis -Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT III NANOMATERIALS 9

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc- growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications- Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays- functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications

UNIT IV CHARACTERIZATION TECHNIQUES 9

X- ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA,SIMS-Nanoindentation

UNIT V APPLICATIONS 9

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS)- Nanosensors, nano crystalline silver for bacterial inhibition, Nanoparticles for sunbarrier products - In Photostat, printing, solar cell, battery.

Total Hours 45

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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Niemeyer, C. M., and CA Mirkin, C. A	NanoBiotechnology II – More concepts and applications	Wiley –VCH publications	2010
2.	Rosenthal, S.J. and Wright, D.W	Nanobiotechnology Protocols	Humana Press	2010

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Oded shoseyov and Ilan Levy	Nanobiotechnology – Bioinspired and materials of the future	Humana press	2008
2.	Jain, K. K	NanoBiotechnology in molecular diagnostics – current technique and applications	Taylor and Francis	2006
3.	S. Edelstein and R.C. Cammearata	Nanomaterials: Synthesis, Propertiesand Applications	Institute of Physics Publishing, Bristol and Philadelphia	1996
4.	N JohnDinardo	Nanoscale Charecterisation of surfaces & Interfaces	Weinheim Cambridge, Wiley-VCH	2000
5.	G Timp	Nanotechnology	AIP press/Springer	1999

WEB URLs

1. http://www.understandingnano.com
2. https://libguides.alfaisal.edu/mnt520
3. https://www.youtube.com/channel/UCbln6q0a-uXWhYVFofOPobw
4. https://www.youtube.com/watch?v=qPHOv5RUxUQ
5. https://www.youtube.com/watch?v=ItuBwC7CiLA

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16BTE08	PLANT BIOTECHNOLOGY	L T P C 3 0 0 3

COURSE OBJECTIVES:

- To give the details of plant cells and its functions
- To provide the basics of agro bacterium and applications of plant biotechnology
- To introduce students to the principles, practices and application of plant tissue culture and transformation in science, agriculture and industry.
- To acquaint students with experimental design and analysis of plant biotechnology experiments.
- To give students hands-on experience and training in representative plant tissue culture and genetic engineering techniques.

COURSE OUTCOMES:

1. Ability to explain the fundamentals of plant cells, structure and functions
2. Ability to demonstrate the nitrogen fixation mechanism
3. Ability to familiarize about viral vectors
4. Ability to describe about the plant tissue culture and transgenic plants
5. Ability to explain the development of therapeutic products

UNIT I ORGANIZATION OF GENETIC MATERIAL **9**

Genetic material of plant cells – nucleosome structure and its biological significance; junk and repeat sequences; outline of transcription and translation

UNIT II CHLOROPLAST&MITOCHONDRIA **9**

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

UNIT IIINITROGEN FIXATION **9**

Nitrogenase activity, nod genes, nif genes, bacteroids.

UNIT IV AGROBACTERIUM &VIRAL VECTORS **9**

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

UNIT V APPLICATION OF PLANT BIOTECHNOLOGY **9**

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

Total Hours **45**

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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M. K. Razdon	Introduction to Plant Tissue Culture	Oxford & IBH Publishing Company	2006
2.	S. Narayanaswamy	Plant Cell & Tissue Culture	Tata Mc Graw-Hill	2008

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	A. Slater, N. Scott and M	Fowler, Plant Biotechnology: The genetic manipulation of plants	Oxford University Press	2003
2.	Gamburg OL, Philips GC	Plant Tissue & Organ Culture fundamental Methods	Narosa Publications	1995
3.	Singh BD	Text Book of Biotechnology	Kalyani Publishers	1998
4.	Heldt HW	Plant Biochemistry & Molecular Biology	Oxford University Press	1997
5.	Ignacimuthu .S	Applied Plant Biotechnology	Tata McGraw Hill	1996

WEB URLs

1. https://www.etipbioenergy.eu/value-chains/feedstocks/plant-biotechnology
2. https://www.frontiersin.org/journals/plant-science/sections/plant-biotechnology
3. https://www.youtube.com/watch?v=EDReGW95EGk
4. https://www.youtube.com/watch?v=HHYDmfj4ojk
5. https://www.youtube.com/watch?v=zReRlJfMjsE&list=PLLA34Ra3DpcxTYUBTvVRCfVWxZNqm1Vk6

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16BTE09	PROCESS EQUIPMENTS AND PLANT DESIGN	L	T	P	C
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COURSE OBJECTIVES:

- To develop key concepts and techniques to design, process equipment in a process plant.
- To train the students to utilize these key concepts to make design and operating decisions.
- To develop key concepts and techniques to design a extractor, distillation and absorption tower in a process plant
- To acquire knowledge about pumps and seals
- To gain knowledge about piping

COURSE OUTCOMES:

1. Ability to explain the working principles of heat exchanger, condensers and evaporators and develop a datasheet
2. Ability to draw and design of storage vessel and pressure vessel as per ASME and ISI codes
3. Ability to demonstrate the construction and assembly drawing of extraction towers, distillation towers and absorption towers
4. Ability to explain the working principles, constructions, usage of various pump, seals , valves.
5. Ability to demonstrate about piping design

UNIT I HEAT EXCHANGERS, CONDENSERS, EVAPORATORS 9

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

UNIT II STORAGE VESSEL FOR VOLATILE AND NON VOLATILE FLUIDS, PRESSURE VESSEL STRUCTURE 9

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

UNIT III EXTRACTOR, DISTILLATION AND ABSORPTION TOWER 9

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

UNIT IV PUMPS, MECHANICAL SEALS, VALVES AND SWITCHES 9

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

UNIT V PIPING, PLANT LAY OUT AND DESIGN 9

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

Total Hours 45

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Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M. V. Joshi and V.V.Mahajani	Process Equipment Design	Macmillan India Ltd	2000
2.	Kern D.Q	Heat Transfer	McGraw Hill	1985

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	McCabe, W.L., J.C. Smith and P. Harriott	Unit Operations of Chemical Engineering	McGraw-Hill	2001
2.	Robert H. Perry and Don W. Green (eds.)	Perry's Chemical Engineers' Handbook	McGraw Hill	1997
3.	Michael R. Ladisch	Bioseparations Engineering: Principles, Practice and Economics	Wiley	2001
4.	Roger Harrison	Bioseparations Science and Engineering	Oxford University Press	2003
5.	Tapobrata Panda	Bioreactors: Analysis and Design	Tata McGraw Hill	2011

WEB URLs

1. http://nptel.ac.in/courses/103103027/
2. https://online-learning.tudelft.nl/courses/industrial-biotechnology/
3. http://nptel.ac.in/courses/102106022/16
4. https://www.youtube.com/watch?v=7ETk7HzUuJ4
5. https://www.youtube.com/watch?v=BzPTGWKLP7c

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16BTE10 NEUROBIOLOGY AND COGNITIVE SCIENCES

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COURSE OBJECTIVES:

- To know the general organization of brain and physiological and cognitive processes.
- To apply the molecular, cellular, and cognitive bases of learning and memory.
- To learn about the neuroanatomy and neurophysiology
- To understand the concept of synaptic transmission and mechanism of action of neurotransmitters
- To gain insight into the mechanism of sensations and disorders related to nervous system

COURSE OUTCOMES:

1. Ability to explain the anatomy and organization of nervous systems.
2. Ability to demonstrate the function of nervous systems.
3. Ability to analyze how drugs affect cellular function in the nervous system.
4. Ability to describe the basic mechanisms associated with behavioral science.
5. Ability to evaluate mechanism of sensations and skeletal muscle contraction.

UNIT I NEUROANATOMY **9**

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

UNIT II NEUROPHYSIOLOGY **9**

Resting and action potentials; Mechanism of action potential conduction; Voltage dependent channels; nodes of Ranvier; Chemical and electrical synaptic transmission; information representation and coding by neurons.

UNIT IIINEUROPHARMACOLOGY **9**

Synaptic transmission, neurotransmitters and their release; fast and slow neuro transmission; characteristics of neurites; hormones and their effect on neuronal function.

UNIT IV APPLIED NEUROBIOLOGY **9**

Basic mechanisms of sensations like touch, pain, smell and taste; neurological mechanisms of vision and audition; skeletal muscle contraction.

UNIT V BEHAVIOUR SCIENCE **9**

Basic mechanisms associated with motivation; control of feeding, sleep, hearing and memory; Disorders associated with the nervous system.

Total Hours **45**

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Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Striedter, G. F	Neurobiology: a functional approach	Oxford University Press	2015
2.	Squire, L., Berg, D., Bloom, F.E., du Lac, S., Ghosh, A., Spitzer, N.C	Fundamental Neuroscience	UK: Academic Press	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Abel, L. & Sylvester, E.V	Handbook of Neurochemistry and Molecular Neurobiology: Neurotransmitter systems	Springer	2008
2.	Bear, M., Connors, B., & Paradiso, M	Neuroscience – Exploring the Brain	Lippincott Williams & Wilkins	2006
3.	Mathews G G	Neurobiology: Molecules, cells and systems	Blackwell Science	2000
4.	Nelson, Charles A., Kathleen M. Thomas, and Michelle de Haan.. Hoboken, NJ	Neuroscience of Cognitive Development: The Role of Experience and the Developing Brain	John Wiley & Sons	2006
5.	Mason P	Medical Neurobiology	Oxford University Press	2011

WEB URLs

1. https://ocw.mit.edu/courses/brain-and-cognitive-sciences/9-01-introduction-to-neuroscience-fall-2007/lecture-notes/
2. https://ocw.mit.edu/courses/brain-and-cognitive-sciences/9-01-neuroscience-and-behavior-fall-2003/study-materials/
3. https://www.youtube.com/watch?v=dKLkXQEN9XU
4. https://www.youtube.com/watch?v=mb0cQFJdQ5Y&list=PLAXSVuGaw0Kz_FW4VzH9eKJiNE26_J0HV
5. https://www.youtube.com/watch?v=oV5LTOPO7rc

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16BTE11	TISSUE ENGINEERING	L T P C 3 0 0 3

COURSE OBJECTIVES:

- To make the student gain knowledge in stem cell basics.
- To learn growing of ES cells in lab
- To understand the basic concept behind tissue engineering focusing on biomaterials and its applications
- To learn the fundamentals of tissue engineering and tissue repairing and differentiation of stem cells and application of stem cells
- To acquire knowledge on clinical applications of tissue engineering

COURSE OUTCOMES:

1. Ability to explain the concept of tissue engineering application for regenerative medicines
2. Ability to demonstrate the process carried out for tissue engineering application
3. Ability to know the techniques used for tissue engineering
4. Ability to grow ES in lab
5. Ability to explain the fundamentals of tissue repairing

UNIT I INTRODUCTION 9

Introduction to tissue engineering: Basic definition; current scope of development; use in therapeutics, cells as therapeutic agents, cell numbers and growth rates, measurement of cell characteristics morphology, number viability, motility and functions. Measurement of tissue characteristics, appearance, cellular component, ECM component, mechanical measurements and physical properties.

UNIT II TISSUE ARCHITECTURE 9

Tissue types and Tissue components, Tissue repair, Engineering wound healing and sequence of events. Basic wound healing Applications of growth factors: VEGF/angiogenesis, Basic properties, Cell-Matrix& Cell-Cell Interactions, telomeres and Self-renewal, Control of cell migration in tissue engineering.

UNIT IIIBIOMATERIALS 9

Biomaterials: Properties of biomaterials, Surface, bulk, mechanical and biological properties. Scaffolds & tissue engineering, Types of biomaterials, biological and synthetic materials, Biopolymers, Applications of biomaterials, Modifications of Biomaterials, Role of Nanotechnology.

UNIT IVBASIC BIOLOGY OF STEM CELLS 9

Stem Cells: Introduction, hematopoietic differentiation pathway Potency and plasticity of stem cells, sources, embryonic stem cells, hematopoietic and mesenchymal stem cells, Stem Cell markers, FACS analysis, Differentiation, Stem cell systems- Liver, neuronal stem cells, Types & sources of stem cell with characteristics: embryonic, adult, haematopoetic, fetal, cord blood, placenta, bone marrow, primordial germ cells, cancer stem cells induced pleuripotent stem cells.

UNIT V CLINICAL APPLICATIONS 9

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Stem cell therapy, Molecular therapy, In vitro organogenesis, Neurodegenrative diseases, spinal cord injury, heart disease, diabetes, burns and skin ulcers, muscular dystrophy, orthopedicapplications, Stem cells and Gene therapy Physiological models, issue engineered therapies, product characterization, components, safety, efficacy. Preservation –freezing and drying. Patent protection and regulation of of tissue-engineered products, ethical issues.

Total Hours **45**

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	D. Shi	Biomaterials and Tissue Engineering	Springer	2004
2.	Bernhard O. Palsson, Sangeeta N. Bhatia	Tissue Engineering	Pearson Publishers	2009

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B. Joon Park, D.B. Joseph and Boca Ration	Biomaterials: principles and applications	CRC, press	2003
2.	L. Hench and J. Jones	Biomaterials, Artificial Organs and Tissue Engineering	Woodhead Publishing in Materials	2002
3.	Ratner, B. D	Biomaterials Science: An Introduction to Materials in Medicine	Academic Press	2004
4.	Bernard N. Kennedy	Stem cell transplantation, cancer applications	Nova Science	2008
5.	J B Park	Biomaterials - Science and Engineering	Plenum Press	1984

WEB URLs

1. http://nptel.ac.in/syllabus/syllabus.php?subjectId=113104009
2. http://nptel.ac.in/syllabus/syllabus.php?subjectId=102106036
3. https://www.class-central.com/mooc/494/coursera-introduction-to-tissue-engineering
4. http://oyc.yale.edu/biomedical-engineering/beng-100/lecture-22
5. http://genome.tugraz.at/biomaterials.shtml

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16BTE12 **BIOSAFETY AND HAZARD MANAGEMENT** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To get acquainted to the principles of Biosafety and gain knowledge on laboratory safety
- To be aware of research guidelines and quality checks
- To gain knowledge about risk analysis
- To get familiarize with safety audits
- To acquire knowledge on hazardous operations

COURSE OUTCOMES:

1. Ability to describe various risk assessments and associated biosafety practices at industrial level.
2. Ability to demonstrate quality checks
3. Ability to elucidate various risk analysis.
4. Ability to assess safety audits
5. Ability to acquire knowledge on hazardous operations.

UNIT I INTRODUCTION **9**

Need for safety in industries; Safety Programmes – components and realization; Potential hazards –extreme operating conditions, toxic chemicals; safe handling

UNIT II QUALITY CHECKS **9**

Implementation of safety procedures – periodic inspection and replacement; Accidents – identification and prevention; promotion of industrial safety.

UNIT IIIRISK ANALYSIS **9**

Overall risk analysis--emergency planning-on site & off site emergency planning, risk management ISO 14000, EMS models case studies. Quantitative risk assessment – rapid and comprehensive risk analysis; Risk due to Radiation, explosion due to over pressure, jet fire-fire ball.

UNIT IVSAFETY AUDITS **9**

Hazard identification safety audits, checklist, what if analysis, vulnerability models event tree analysis fault tree analysis, Hazan past accident analysis Fix borough-Mexico-Madras- Vizag Bopal analysis.

UNIT V HAZARDOUS OPERATIONS **9**

Hazop-guide words, parameters, derivation-causes-consequences-recommendation-coarse Hazop study-case studies-pumping system-reactor-mass transfer system.

Total Hours **45**

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication

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1.	Deepa Goel and Ms.Shomini Parashar	IPR, Biosafety and Bioethics	Pearson Education	2013
2.	Sateesh, M. K	Bioethics and biosafety	IK International Pvt Ltd	2010

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Fleming, D.A., Hunt, D.L	Biological safety Principles and practices	ASM Press, Washington	2000
2.	Fawatt, H.H. and Wood, W.S	Safety and Accident Prevention in Chemical Operation	Wiley Inter science	1965
3.	Marcel, V.C	Major Chemical Hazard	Ellis Harwood Ltd., Chi Chester	1987
4.	Handley, W	Industrial Safety Hand Book	McGraw-Hill Book Company	1969
5.	Heinrich, H.W. Dan Peterson, P.E. and Rood	Industrial Accident Prevention	McGraw-Hill Book Company	1980

WEB URLs

1. http://blink.ucsd.edu/safety/research-lab/biosafety/
2. http://ces.iisc.ernet.in/hpg/cesmg/iprdoc.html
3. https://www.fic.nih.gov/RESEARCHTOPICS/BIOETHICS/Pages/teachers-students.aspx
4. https://www.omicsonline.org/open-access/biosafety-issues-of-genetically-modified-organisms-2167-0331.1000e150.php?aid=27764&view=mobile
5. http://www.who.int/csr/resources/publications/biosafety/Biosafety

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16BTE13 **STEM CELL TECHNOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To gain knowledge on the basics of stem cells and their origin
- To learn the methods of stem cell identification and various sources
- To give way to the therapeutic treatment using stem cells
- To acquire knowledge about stem cell differentiation
- To gain knowledge about the ethical issues

COURSE OUTCOMES:

1. Ability to compare the characteristics of different types of stem cells and their origin
2. Ability to analyze the differentiation process of premature stem cells
3. Ability to compare the characteristic features of Embryonic and adult stem cells
4. Ability to evaluate the methods of stem cell identification and various sources
5. Ability to implement the therapeutic applications of stem cells in human diseases

UNIT I STEM CELLS AND TYPES **9**

Stem cells: Definition, Classification, Sources and Properties –Types of stem cells: methods of isolation, study of stem cells and their viability IPSC, embryonic stem cells, cancer stem cells. – Preservations of Stem cell. Embryonic stem cell: Isolation, Culturing, Differentiation, Properties – Adult stem cell: Isolation, Culturing, Differentiation, Trans-differentiation, Plasticity, and Properties.

UNIT II STEM CELLS IN PLANTS AND ANIMALS **9**

Stem cell and founder zones in plants –particularly their roots – stem cells of shoot meristems of higher plants. Skeletal muscle stem cell – Mammary stem cells – intestinal stem cells – keratinocyte stem cells of cornea – skin and hair follicles –tumour stem cells.

UNIT IIISTEM CELLS DIFFERENTIATION **9**

Factors influencing proliferation, physical, chemical and molecular methods for differentiation of stem cells – hormonal role in differentiation.

UNIT IVREGENERATION AND EXPERIMENTAL METHODS **9**

Germ cells, hematopoietic organs, and kidney, cord blood transplantation, donor selection, HLA matching, patient selection, peripheral blood and bone marrow transplantation, - Stem cell Techniques: fluorescence activated cell sorting (FACS), time lapse video, green fluorescent protein tagging.

UNIT V APPLICATION AND ETHICAL ISSUES **9**

Stem cell Therapy for neuro degenerative diseases, spinal cord injury, heart disease, diabetes, burns, skin ulcers, muscular dystrophy and orthopaedic applications. Stem cell policy and ethics, stem cell research: Hype, hope and controversy.

Total Hours **45**

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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	C.S Potten	Stem cells	Elsevier	2006
2.	Robert Lanza., fourth edition	Essentials of Stem Cell Biology	Elsevier	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Peter Quesenberry., First Edition	Stem cell biology and Gene Therapy	Wiley-Liss	1998
2.	Kursad Turksen	Embryonic Stem cells – Protocols	Humana Press	2002
3.	Ariff Bongso, Eng Hin Lee	Stem Cells: From Bench to Bedside	World Scientific Publishing Company	2005
4.	Ali Gholam rezanezhad	Stem cells in clinic and Research	Intech	2013
5.	MD. Steward Sell	Stem cells	Human Press Inc	2004

WEB URLs

1. https://www.mayoclinic.org/tests-procedures/bone-marrow-transplant/in-depth/stem-cells/art-20048117
2. https://www.yourgenome.org/facts/what-is-a-stem-cell
3. https://www.closerlookatstemcells.org/learn-about-stem-cells/types-of-stem-cells/
4. https://www.youtube.com/watch?v=i2pyDBMglfM
5. https://www.youtube.com/watch?v=-8xHWhg6YQA

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16BTE14 **BIOPHYSICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To gain structural knowledge of biological systems.
- To understand transport and dynamic properties of biological systems.
- To expose students to the basics of membrane biophysics and molecular electrophysiology
- To learn the mechanism involved in activation and inactivation of ion channels
- To make students learn about the patch clamping technique

COURSE OUTCOMES:

1. Ability to analyze the various forces responsible for biological molecular structure.
2. Ability to be familiar with different levels of conformation in nucleic acids
3. Ability to explain about the levels of conformation in proteins.
4. Ability to gain the knowledge of cellular permeability and ion transport.
5. Ability to understand the dynamics of biological systems.

UNIT I MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEMS **9**

Intra molecular bonds – covalent – ionic and hydrogen bonds – biological structures –general features – water structure – hydration – interfacial phenomena and membranes – self assembly and molecular structure of membranes.

UNIT II CONFORMATION OF NUCLEIC ACIDS **9**

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

UNIT III CONFORMATION OF PROTEINS **9**

Conformation of the peptide bond – secondary structures – Ramachandran plots – use of potential functions – tertiary structure – folding – hydration of proteins – hydropathy index.

UNIT IV CELLULAR PERMEABILITY AND ION –TRANSPORT **9**

Ionic conductivity – transport across ion channels – mechanism - ion pumps- proton transfer – nerve conduction – techniques of studying ion transport and models.

UNIT V ENERGETICS & DYNAMICS OFBIOLOGICALSYSTEMS **9**

Concepts in thermodynamics – force and motion – entropy and stability – analyses of fluxes – diffusion potential – basic properties of fluids and biomaterials – laminar and turbulent flows.

Total Hours **45**

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication

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1.	Andrey B. Rubin	Fundamental of Biophysics	Scrivener publishing	2014
2.	Raymond A. Serway and John W. Jewett, Jr	Physics for scientists and engineers	Thomson books	2008

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Cantor R. and Schimmel P.R	Biophysical Chemistry	W. H. Freeman and Company	1980
2.	R. Glaser	Biophysics	Springer Verlag	2000
3.	R. Duane	Biophysics: Molecules In Motion	Academic Press	1999
4.	Creighton, Freeman N	Proteins – Structure & Molecular Properties	Springer Verlag	1997
5.	Rodney Cotterill	Biophysics – An Introduction	Wiley Student Edition	2003

WEB URLs

1. http://nptel.ac.in/courses/102107028/
2. http://nptel.ac.in/courses/102103044/
3. https://0b9411cb7057497b22db0cd9f69e827bce11ede8.googledrive.com/host/0B5XjjBGDoIrhNlFVcVhQWjA2a1k/Biophysical-Techniques-Iain-Campbell-ebook-51iBvNTIHhL.pdf
4. https://www.youtube.com/watch?v=jFZHIPhmNTs&list=PLFn7fvIP7CbMun4daH24AZzX3r7ETT6aD
5. https://www.youtube.com/watch?v=V20prBPihF4

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16BTE15 **BIOLOGICAL SPECTROSCOPY** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To deliver the knowledge of spectroscopic techniques and its functions
- To provide the technical information of spectroscopy for biological applications.
- To learn the various spectroscopic techniques, the physical principles, experimental and instrumentation techniques
- To use the various atomic and molecular spectroscopic techniques to estimate and analyze the structure and dynamics of biomacromolecules
- To learn the applications of X-ray crystallography, x-ray spectroscopy, mass spectrometry, electron spectroscopy etc in analysis of chemical and crystalline structure, molecular weight of biomolecules.

COURSE OUTCOMES:

1. Ability to explain the basics of optical rotary dispersion methods
2. Ability to describe the types nuclear magnetic resonance
3. Ability to explain principles and applications of mass spectrometry and X-ray diffraction
4. Ability to demonstrate microscopic techniques and its applications
5. Ability to describe spectroscopic techniques for various biological applications

UNIT I OPTICAL ROTATORY DISPERSION **9**

Polarized light – optical rotation – circular dichroism – circular dichroism of nucleic acids and proteins.

UNIT II TYPES OF NUCLEAR MAGNETIC RESONANCE **9**

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

UNIT IIITYPES OFMASS SPECTROMETRY **9**

Ion sources sample introduction – mass analyzers and ion detectors – bimolecular mass spectrometry – peptide and protein analysis – carbohydrates and small molecules – specific applications.

UNIT IVX-RAY DIFFRACTION **9**

Scattering by x- rays – diffraction by a crystal – measuring diffraction pattern – Bragg reflection – unit cell – phase problem – anomalous diffraction – determination of crystal structure – electron and neutron diffraction.

UNIT V SPECIAL TOPICS AND APPLICATIONS **9**

Electron microscopy – transmission and scanning electron microscopy – scanning Tunneling and atomic force microscopy – combinatorial chemistry and high throughput screening methods.

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Total Hours 45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Banwell, Colin N. and E.M. McCash	Fundamentals of Molecular Spectroscopy	Tata McGraw-Hill	2017
2.	Aruldas, G	Molecular Structure and Spectroscopy	Prentice Hall of India	2007

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Pavia, D.L., G.M. Lampman and G.S. Kriz	Introduction to Spectroscopy	Thomson, Brooks/ Cole	2001
2.	Siuzdak, Gary. “”.,	Mass Spectrometry for Biotechnology	Academic Press /Elsevier	1996
3.	Atkins P.W	Physical Chemistry	Oxford University Press India	2014
4.	Hammes, Gordon G	Spectroscopy for the Biological Sciences	John Wiley	2005
5.	Campbell I.D and Dwek R.A	Biological Spectroscopy	Benjamin Cummins and Company	1986

WEB URLs

1. https://www.isa.au.dk/research/bio-research.asp
2. https://serc.carleton.edu/research_education/geochemsheets/techniques/XRD.html
3. https://www.youtube.com/watch?v=MW4PwJxxyt0
4. https://www.youtube.com/watch?v=kHZbkty8YBo
5. https://www.youtube.com/watch?v=t5stvnKNXbg

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16BTE16 **BIO ENTREPRENEURSHIP** **L T P C**
3 0 0 3

Course Objectives:

- To deliver the knowledge about marketing and its functions.
- To Identify the problems in ownership and economy wise processes.
- To learn about the factors, attributes and indicators of bio-entrepreneurship.
- To learn the business strategies and technology transfer in biotech companies.
- To study the various concepts on creativity, innovation, product development and technology transfer

COURSE OUTCOMES:

1. Ability to learn about the factors, attributes and indicators of bio-entrepreneurship.
2. Ability to learn business strategies and technology transfer in biotech companies.
3. Ability to illustrate the components of biotechnology companies
4. Ability to impart the knowledge on Creativity, Innovation and New product development.
5. Ability to inculcate novel strategies on identifying market demands, establishing market niche.

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 forBusiness
- Market Your Business
- Hire and Manage a Staff

UNIT IV **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 Hours **45**

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TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jogdand, S.N	Entrepreneurship and Business of Biotechnology	Himalaya Publishing Home	2007
2.	Branson R	Business Stripped Bare: Adventures of a Global Entrepreneur	Virgin Books	2009

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S.S. Khanka	Entrepreneurship Development	S.Chand & Co	2006
2.	Robers Lusier	Management Fundamentals - Concepts, Application, Skill Development	Cengage Learning	1996
3.	Poornima M Charanthimath	Entrepreneurship Development	Pearson Education	2006
4.	Shashi k Gupta	Entrepreneurship and management	Kalyani publishers	2005
5.	Stephen P Robbins, Timothy A. Judge, Neharika Vohra	Organizational behaviour	Pearson	2012

WEB URLs

1. http://www.rishibiotech.com/bioentrepreneurship
2. https://birac.nic.in/webcontent/jk.pdf
3. https://www.nationalbioentrepreneurship.in/
4. https://www.youtube.com/watch?v=tL8nbKjPi3c
5. https://www.youtube.com/watch?v=VOJ8cOh6mQ0

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16BTE17 PROFESSIONAL ETHICS IN ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

- 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.
- To understand Human Values and ethical theory.
- To understand codes of ethics, work place responsibilities, rights, engineering experimentation, global issues and contemporary ethical issues.
- To understand personal ethics, legal ethics, cultural ethics and engineers responsibility.

COURSE OUTCOMES:

1. Articulate engineering ethics theory with sustained lifelong learning.
2. Adopt a good character and follow high professional ethical life.
3. Contribute to shape a better character by following ethical actions.
4. Confront and resolve moral issues occurred during technological activities.
5. Resolve moral and ethical problems through exploration and assessment by established experiments.

UNIT I HUMAN VALUES 9

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 ASSOCIAL 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 9

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 Hours 45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Mike W. Martin and Roland Schinzinger	Ethics in Engineering	Tata McGraw Hill, New Delhi	2003
2.	M Govindarajan, S Natarajan and V S Senthil Kumar	Engineering Ethics	PHI Learning Private Ltd, New Delhi	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
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– Concepts and Cases	Cengage Learning	2009
3.	John R Boatright	Ethics and the Conduct of Business	Pearson Education, New Delhi	2003
4.	Edmund G Seebauer and Robert L Barry	Fundamentals of Ethics for Scientists and Engineers	Oxford University Press, Oxford	2001
5.	R S Naagarazan	A text book on professional ethics and human values	New age international (P)limited, New Delhi	2006

WEB URLs

1. www.slideworld.org/slidestag.aspx/human-values-and-Professional-ethics
2. https://courses.lumenlearning.com/atd-epcc-introethics-1/chapter/professional-ethics/
3. https://www.tutorialspoint.com/professional_ethics/ethics_in_profession.htm
4. https://www.youtube.com/watch?v=O-e6-bV3oCY
5. https://www.youtube.com/watch?v=SMTjf_D4Crw

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16BTE18 **MARINE BIOTECHNOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To understand the economically important marine animals and their potency as toxins and drugs.
- To learn the knowledge on the degradation process for discharged wastes.
- To know the diseases of aquaculture animals and its management.
- To acquire knowledge about marine pharmacology
- To understand about aquaculture technology

COURSE OUTCOMES:

1. Ability to explain the biology of marine micro-macro flora and fauna.
2. Ability to describe the techniques for detection of marine organism and bio-augmentation.
3. Ability to comprehend on the marine food processing, product and safety.
4. Ability to screening and purification of bioactive compounds from marine flora and fauna.
5. Ability to demonstrate aqua culture technology

UNIT I INTRODUCTION TO MARINE ENVIRONMENT **9**

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

UNIT II IMPORTANT MARINE ORGANISMS **9**

Phytoplanktons – zooplantons – nektons – benthos – marine mammals – marine algae – mangroves – coral reefs – deep sea animals and adaptation – intertidal zone – fauna and flora.

UNIT III MARINE ENVIRONMENTAL BIOTECHNOLOGY **9**

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

UNIT IV MARINE PHARMACOLOGY **9**

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

UNIT V AQUACULTURE TECHNOLOGY **9**

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

Total Hours **45**

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M. Fingerman, R. Nagabhushanam Mary –	Recent advances in marine biotechnology volume 3	Frances Thomson	2008
2.	Powers D.A	New frontiers in marine biotechnology: Opportunities for the	Marine Biotechnology in the	1993

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		21st century	Asian Pacific Region	

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Attaway D.H. and Zaborsky O.R	Marine Biotechnology: Volume I, Pharmaceuticals and Bioactive Natural Products	New York: Plenum	1993
2.	M. Fingerman, R. Nagabhushanam Mary	Recent advances marine biotechnology volume 2	Frances Thomson	2008
3.	Milton Fingerman and Rachakonda Nagabhushanam	Recent Advances in Marine Biotechnology (Series) Biomaterials and Bioprocessing	Science Publishers	2009
4.	Le Gal, Y., Ulber, R	Marine Biotechnology I & II: Advances in Biochemical Engineering/Biotechnology	Springer-Verlag Berlin Heidelberg	2005
5.	Rheinhemer, G	Aquatic Microbiology	Johnwiley & Sons	1980

WEB URLs

1. www.mooclist.com/course/marine-and-antarctic-science-open2study?static=true
2. https://www.youtube.com/watch?v=hv1U19J3yfw
3. https://www.youtube.com/watch?v=trg3_9lAKgk
4. https://www.youtube.com/watch?v=KTy_0dzLiu8
5. https://www.youtube.com/watch?v=wVcIGaBZW1A

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16BTE19 METABOLIC ENGINEERING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To provide a quantitative basis, based on thermodynamics, enzyme kinetics, for the understanding of metabolic networks in single cells and at the organ level.
- To enable the students to use organisms to produce valuable substances on an industrial scale in cost effective manner.
- To introduce the basic concepts of metabolic engineering
- To expose transport mechanisms and models to regulate enzymes
- To utilize the tools used for metabolic pathway manipulation

COURSE OUTCOMES:

1. Ability to apply cellular metabolism in growth regulation.
2. Ability to analyze the need and scope of metabolic engineering
3. Ability to analyze the scheme of regulatory pathways
4. Ability to evaluate the tools used in metabolic engineering
5. Ability to evaluate the strategies used in metabolic pathway manipulation

UNIT I INTRODUCTION TO EXAMPLES OF PATHWAY MANIPULATION – QUALITATIVE TREATMENT 9

Enhancement of Product Yield and Productivity, Extension of substrate Range, Extension of Product spectrum and Novel products, Improvement of Cellular properties, Xenobiotic degradation.

UNIT II MATERIAL BALANCES AND DATA CONSISTENCY 9

Comprehensive models of cellular reactions; stoichiometry of cellular reactions, reaction rates, dynamic mass balances, yield coefficients and linear rate equations, analysis of over determined systems-identification of gross measurement errors. Introduction to MATLAB.

UNIT III METABOLIC FLUX ANALYSIS 9

Theory, over determined systems, underdetermined systems- linear programming, sensitivity analysis, methods for the experimental determination of metabolic fluxes by isotope labeling, applications of metabolic flux analysis.

UNIT IV METABOLIC CONTROL ANALYSIS 9

Fundamentals of Metabolic Control Analysis, control coefficients and the summation theorems, Determination of flux control coefficients, MCA of linear pathways, branched pathways, theory of large deviations.

UNIT V ANALYSIS OF METABOLIC NETWORKS 9

Control of flux distribution at a single branch point, Grouping of reactions, case studies, extension of control analysis to intermetabolite, optimization of flux amplifications, consistency tests and experimental validation.

Total Hours 45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication

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1.	G.N. Stephanopoulos, A.A. Aristidou, J. Nielsen	Metabolic Engineering. Principles and Methodologies	Academic Press	1998
2.	S. Y. Lee and E.T. Papoutsakis	Metabolic Engineering	Marcel Dekker, New York	1999

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R.Heinrich and S. Schuster	The Regulation of Cellular Systems	Chapman & Hall	1996
2.	James E. Bailey and David F. Ollis	Biochemical Engineering Fundamentals	McGraw-Hill	1986
3.	Gregory N. Stephanopoulos, Aristos A. Aristidou, Jens Nielsen	Metabolic Engineering: Principles and Methodologies	Academic Press	1998
4.	Eberhard O. Voit	Computational Analysis of Biochemical Systems: A Practical Guide for Biochemists and Molecular Biologists	Cambridge University Press	2000
5.	Zoltan Szallasi, Jorg Stelling and Vipul Periwal MIT	Systems Modeling in Cellular Biology: From Concepts to Nuts and Bolts	Press Cambridge	2006

WEB URLs

1. http://www.nptel.ac.in/syllabus/102103014/
2. https://books.google.co.in/books/about/Metabolic_Engineering.html?id=9mGzkso4NVQC
3. https://www.youtube.com/watch?v=mL6NwbmEum4
4. https://www.youtube.com/watch?v=R_Ir1X7hl-c
5. https://www.youtube.com/watch?v=tHFp2mcaOtU

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16BTE20 **HUMAN RIGHTS** **L T P C**
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COURSE OBJECTIVES:

- To gain knowledge about the human rights
- To understand the theories of human rights
- To acquire knowledge about UN laws
- To familiarize the concepts of human rights
- To gain knowledge about commission and judiciary

COURSE OUTCOMES:

1. Ability to explain about the need of human rights
2. Ability to describe about the evolution of human rights
3. Ability to demonstrate about UN laws
4. Ability to explain the constitutional provisions
5. Ability to describe about the commission and judiciary

UNIT I **9**

Human Rights – Meaning, origin and Development. Notion and classification of Rights – Natural, Moral and Legal Rights. Civil and Political Rights, Economic, Social and Cultural Rights; collective / Solidarity Rights.

UNIT II **9**

Evolution of the concept of Human Rights Magana carta – Geneva convention of 1864. Universal Declaration of Human Rights, 1948. Theories of Human Rights.

UNIT III **9**

Theories and perspectives of UN Laws – UN Agencies to monitor and compliance.

UNIT IV **9**

Human Rights in India – Constitutional Provisions / Guarantees.

UNIT V **9**

Human Rights of Disadvantaged People – Women, Children, Displaced persons and Disabled persons, including Aged and HIV Infected People. Implementation of Human Rights – National and State Human Rights Commission – Judiciary – Role of NGO's, Media, Educational Institutions, Social Movements.

Total Hours **45**

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kapoor S.K	Human Rights under International law and Indian Laws	Central Law Agency, Allahabad	2014
2.	Chandra U	Human Rights	Allahabad Law Agency, Allahabad	2014

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Upendra Baxi, ,	The Future of Human Rights	Oxford University Press, New Delhi	2004
2.	Shubham Singles, Charles E. Haries	Constitution of India, Professional Ethics and Human Rights	Cengage Learning India	2018
3.	M. Govindarajan, S. Natarajan, V. S. Senthilkumar	Engineering Ethics	Prentice –Hall,	2004
4.	Alfred Basta	Cyber Security and Cyber Laws	Cengage Learning India	2018
5.	Durga Das Basu	Introduction to the Constitution of India	Prentice –Hall,	2008

WEB URLs

1. https://www.un.org/en/sections/issues-depth/human-rights/
2. https://www.un.org/en/universal-declaration-human-rights/
3. https://www.youtube.com/watch?v=6XXGF_V8_7M
4. https://www.youtube.com/watch?v=mT1oavOmaYE
5. https://www.youtube.com/watch?v=nDgIVseTkuE

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