ANNA UNIVERSITY, CHENNAI

UNIVERSITY DEPARTMENTS

B. TECH. INDUSTRIAL BIOTECHNOLOGY

REGULATIONS – 2015

CHOICE BASED CREDIT SYSTEM

PROGRAM OBJECTIVES

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

They are trained to

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

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

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

Cognitive Knowledge

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

Experimental Skills

- Demonstrate ability to perform molecular, cellular, and biochemical techniques used in biotechnology-
- Utilize a wide variety of laboratory techniques with accuracy, precision and safety
- Analyze and report laboratory findings using oral and/or written skills
- Provide opportunities to acquire the knowledge and skills required to comprehend and commercialize these emerging technologies and/or their products
- Have a working knowledge of the various steps in the development of a biotechnology derived product: its inception as intellectual property, to scale-up, to the final product

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Scientific Communication

- Use the terminology, concepts and examples of biotechnology in presentations
- Write scientific information and data using facts and knowledge of biotechnology
- Formulate and evaluate scientific research pertaining to biotechnology in related fields

Professional Attitude

- Establish professional responsibilities pertaining to the workforce
- Interpret current knowledge and skills to new methods in biotechnology
- Ability to understand ethical and professional responsibilities
- Develop and carry out appropriate leadership and management strategies to achieve goals and objectives

	Programme Outcomes							
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
I						✔	✔	
II	✔		✔		✔			
III		✔	✔	✔				
IV			✔	✔	✔	✔	✔	
V						✔	✔	✔

Mapping for B. Tech. Industrial Biotechnology – R2015

			PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
Year 1	SEM 1	Foundation English								
		Mathematics-I	✔	✔						
		Engineering Physics	✔	✔						
		Engineering Chemistry	✔	✔						
		Computing Techniques	✔		✔					
		Engineering Graphics	✔							
		Basic Sciences Laboratory							✔	
		Engineering Practices Laboratory							✔	
	SEM 2	Technical English					✔			
		Mathematics-II	✔	✔						
		Physics of Materials	✔	✔						✔
		Microbiology	✔							✔
		Engineering Mechanics	✔							
		Biochemistry	✔							✔
		Microbiology Laboratory							✔	
		Biochemistry Laboratory							✔	
Year 2	SEM 3	Mathematics for Biotechnologist		✔	✔					
		Applied Thermodynamics for Biotechnologists	✔	✔						✔
		Basic Industrial Biotechnology	✔							

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		Physical and Organic Chemistry	✔	✔						
		Cell Biology	✔					✔		
		Stoichiometry and Fluid Mechanics								✔
		Bioorganic Chemistry Laboratory							✔	✔
		Cell Biology Laboratory						✔	✔	✔
	SEM 4	Probability and Statistics		✔	✔					✔
		Environmental Science and Engineering		✔		✔				✔
		Bioprocess Engineering	✔							
		Enzyme technology and Bio-transformations		✔						✔
		Heat Transfer Operations		✔						✔
		Analytical Methods and Instrumentation		✔						✔
		Instrumentation Method of Analysis Laboratory		✔					✔	
		Chemical Engineering Laboratory			✔				✔	
Year 3	SEM 5	Bioprocess Technology	✔	✔						✔
		Mass Transfer Operations	✔	✔						✔
		Molecular Biology	✔					✔		
		Protein Structure-Function Relationship			✔			✔		✔
		Professional Elective 1								
		Open Elective 1								
		Bioprocess Laboratory 1						✔	✔	
		Molecular Biology Laboratory						✔	✔	✔
	SEM 6	Total Quality Management		✔						✔
		Chemical Reaction Engineering		✔						✔
		Genetic Engineering		✔		✔		✔		
		Professional Elective II								
		Professional Elective III								
		Professional Elective IV								
		Bioprocess Laboratory II	✔						✔	
		Genetic Engineering Laboratory				✔			✔	✔
Year 4	SEM 7	Downstream Processing		✔						✔
		Immunology		✔						
		Bioinformatics			✔					✔
		Professional Elective V								
		Professional Elective VI								
		Open Elective II								
		Downstream Processing Laboratory		✔					✔	✔
		Immunology Laboratory				✔			✔	✔
	SEM 8	Project Work					✔		✔	✔

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CURRICULA AND SYLLABI I – VIII SEMESTERS

SEMESTER I

Sl. No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS7151	Foundational English	HS	4	4	0	0	4
2.	MA7151	Mathematics – I	BS	4	4	0	0	4
3.	PH7151	Engineering Physics	BS	3	3	0	0	3
4.	CY7151	Engineering Chemistry	BS	3	3	0	0	3
5.	GE7151	Computing Techniques	ES	3	3	0	0	3
6.	GE7152	Engineering Graphics	ES	5	3	2	0	4
PRACTICALS								
7.	BS7161	Basic Sciences Laboratory	BS	4	0	0	4	2
8.	GE7162	Engineering Practices Laboratory	ES	4	0	0	4	2
			TOTAL	**30**	**20**	**2**	**8**	**25**

SEMESTER II

Sl. No	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	HS7251	Technical English	HS	4	4	0	0	4
2.	MA7251	Mathematics - II	BS	4	4	0	0	4
3.	PH7257	Physics of Materials	BS	3	3	0	0	3
4.	IB7252	Microbiology	PC	3	3	0	0	3
5.	GE7153	Engineering Mechanics	ES	4	4	0	0	4
6.	IB7251	Biochemistry	PC	3	3	0	0	3
PRACTICALS								
7.	IB7262	Microbiology Lab	PC	4	0	0	4	2
8.	IB7261	Biochemistry Lab	PC	4	0	0	4	2
			TOTAL	**29**	**21**	**0**	**8**	**25**

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SEMESTER III

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	MA7301	Mathematics for Biotechnologists	BS	4	4	0	0	4
2.	IB7301	Applied Thermodynamics for Biotechnologists	PC	3	3	0	0	3
3.	IB7302	Basic Industrial Biotechnology	PC	3	3	0	0	3
4.	IB7303	Bioorganic Chemistry	BS	3	3	0	0	3
5.	IB7304	Cell Biology	PC	3	3	0	0	3
6.	IB7305	Stoichiometry	PC	5	3	2	0	4
PRACTICALS								
7.	IB7311	Bioorganic Chemistry Laboratory	PC	4	0	0	4	2
8.	IB7312	Cell Biology Lab	PC	4	0	0	4	2
			TOTAL	**29**	**19**	**2**	**8**	**24**

SEMESTER IV

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	GE7251	Environmental Science and Engineering	HS	3	3	0	0	3
2.	IB7401	Analytical Methods and Instrumentation	PC	3	3	0	0	3
3.	IB7402	Enzyme Technology and Bio-transformations	PC	3	3	0	0	3
4.	IB7403	Fluid Mechanics and Heat Transfer Operations	ES	4	4	0	0	4
5.	IB7404	Mass Transfer Operations	PC	3	3	0	0	3
6.	MA7357	Probability and Statistics	BS	4	4	0	0	4
PRACTICALS								
7.	IB7411	Chemical Engineering Lab	ES	4	0	0	4	2
8.	IB7412	Instrumentation Method of Analysis Lab	PC	4	0	0	4	2
			TOTAL	**28**	**20**	**0**	**8**	**24**

SEMESTER V

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	IB7551	Bioprocess Engineering	PC	3	3	0	0	3
2.	IB7552	Chemical Reaction Engineering	ES	3	3	0	0	3
3.	IB7501	Molecular Biology	PC	3	3	0	0	3
4.	IB7502	Protein Structure - Function Relationship	PC	3	3	0	0	3
5.		Professional Elective I	PE	3	3	0	0	3
6.		Open Elective I*	OE	3	3	0	0	3
PRACTICALS								
7.	IB7511	Bioprocess Laboratory I	PC	4	0	0	4	2
8.	IB7512	Molecular Biology Laboratory	PC	4	0	0	4	2
			TOTAL	**26**	**18**	**0**	**8**	**22**

*Course from the curriculum of other UG programmes

SEMESTER VI

Sl. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	GE7652	Total Quality Management	HS	3	3	0	0	3
2.	IB7601	Bioprocess Technology	ES	3	3	0	0	3
3.	IB7602	Genetic Engineering	PC	4	4	0	0	4
4.		Professional Elective II	PE	3	3	0	0	3
5.		Professional Elective III	PE	3	3	0	0	3
6.		Professional Elective IV	PE	3	3	0	0	3
PRACTICALS								
7.	IB7611	Bioprocess Laboratory II	PC	4	0	0	4	2
8.	IB7612	Genetic Engineering Laboratory	PC	4	0	0	4	2
			TOTAL	**27**	**19**	**0**	**8**	**23**

SEMESTER VII

Sl. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
THEORY								
1.	IB7751	Bioinformatics	PC	5	3	2	0	4
2.	IB7752	Downstream Processing	PC	3	3	0	0	3
3.	IB7753	Immunology	PC	3	3	0	0	3
4.		Professional Elective V	PE	3	3	0	0	3
5.		Professional Elective VI	PE	3	3	0	0	3
6.		Open Elective II *	OE	3	3	0	0	3
PRACTICALS								
7.	IB7711	Downstream Processing Laboratory	PC	4	0	0	4	2
8.	IB7712	Immunology Laboratory	PC	4	0	0	4	2
			TOTAL	**28**	**18**	**2**	**8**	**23**

*Course from the curriculum of other UG programmes

SEMESTER VIII

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
PRACTICALS								
1.	IB7811	Project Work	EEC	20	0	0	20	10
			TOTAL	**20**	**0**	**0**	**20**	**10**

TOTAL NO. OF CREDITS : 176

PROFESSIONAL ELECTIVES (PE)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	IB7001	Advanced Biochemistry	PE	3	3	0	0	3
2.	IB7002	Animal Biotechnology	PE	3	3	0	0	3
3.	IB7003	Bio-industrial Entrepreunership and IPR	PE	3	3	0	0	3
4.	IB7005	Biopharmaceutical Technology	PE	3	3	0	0	3
5.	IB7006	Biophysics	PE	3	3	0	0	3
6.	IB7008	Cancer Biology	PE	3	3	0	0	3
7.	IB7007	Biosafety and Hazard Management	PE	3	3	0	0	3
8.	IB7019	Symbolic Mathematics	PE	3	3	0	0	3
9.	IB7004	Bioethics	PE	3	3	0	0	3
10.	IB7013	Molecular Modelling	PE	3	3	0	0	3
11.	IB7014	Molecular Pathogenesis of infectious Diseases	PE	3	3	0	0	3
12.	IB7015	Neurobiology and Cognitive Sciences	PE	3	3	0	0	3
13.	IB7016	Plant Biotechnology	PE	3	3	0	0	3
14.	IB7017	Principles of Food Processing	PE	3	3	0	0	3
15.	IB7018	Process Equipments and Plant design	PE	3	3	0	0	3
16.	IB7020	Systems Biology	PE	3	3	0	0	3
17.	IB7021	Tissue Engineering	PE	3	3	0	0	3
18.	IB7071	Bioconjugate Technology and Applications	PE	3	3	0	0	3
19.	IB7072	Biological Spectroscopy	PE	3	3	0	0	3
20.	IB7009	Fundamentals of Nano Science	PE	3	3	0	0	3
21.	CH7072	Instrumentation and Process Control	PE	3	3	0	0	3
22.	CH7751	Transport Phenomena	PE	3	3	0	0	3
23.	IB7010	Genetics	PE	3	3	0	0	3
24.	IB7012	Marine biotechnology	PE	3	3	0	0	3
25.	IB7011	Genomics and Proteomics	PE	3	3	0	0	3
26.	IB7073	Metabolic Engineering	PE	3	3	0	0	3
27.	GE7074	Human Rights	PE	3	3	0	0	3
28.	GE7071	Disaster Management	PE	3	3	0	0	3
29.	GE7072	Foundation Skills in Integrated Product Development	PE	3	3	0	0	3

HUMANITIES AND SOCIAL SCIENCES (HS)

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	HS7151	Foundational English	HS	4	4	0	0	4
2.	HS7251	Technical English	HS	4	4	0	0	4
3.	GE7251	Environmental Science and Engineering	HS	3	3	0	0	3

4.	GE7652	Total Quality Management	HS	3	3	0	0	3

BASIC SCIENCES(BS)

S.No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MA7151	Mathematics	BS	4	4	0	0	4
2.	PH7151	Engineering Physics	BS	3	3	0	0	3
3.	CY7151	Engineering Chemistry	BS	3	3	0	0	3
4.	BS7161	Basic Sciences Laboratory	BS	4	0	0	4	2
5.	MA7251	Mathematics- II	BS	4	4	0	0	4
6.	PH7257	Physics of Materials	BS	3	3	0	0	3
7.	IB7303	Bioorganic Chemistry	BS	3	3	0	0	3
8.	MA7301	Mathematics for Biotechnologists	BS	4	4	0	0	4
9.	MA7357	Probability and Statistics	BS	4	4	0	0	4

ENGINEERING SCIENCES (ES)

S. NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	GE7151	Computing Techniques	ES	3	3	0	0	3
2.	GE 7152	Engineering Graphics	ES	5	3	2	0	4
3.	GE7162	Engineering Practices Laboratory	ES	4	0	0	4	2
4.	GE7153	Engineering Mechanics	ES	4	4	0	0	4
5.	IB7403	Fluid Mechanics and Heat Transfer Operations	ES	3	3	0	0	3
6.	IB7411	Chemical Engineering Laboratory	ES	3	3	0	0	3
7.	IB7552	Chemical Reaction Engineering	ES	3	3	0	0	3
8.	IB7601	Bioprocess Technology	ES	3	3	0	0	3

PROFESSIONAL CORE(PC)

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	IB7251	Biochemistry	PC	3	3	0	0	3
2.	IB7262	Microbiology Laboratory	PC	4	0	0	4	2
3.	IB7261	Biochemistry Laboratory	PC	4	0	0	4	2
4.	IB7301	Applied Thermodynamics for Biotechnologists	PC	3	3	0	0	3
5.	IB7302	Basic Industrial Biotechnology	PC	3	3	0	0	3
6.	IB7304	Cell Biology	PC	3	3	0	0	3
7.	IB7305	Stoichiometry	PC	5	3	2	0	4
8.	IB7311	Bioorganic Chemistry Laboratory	PC	4	0	0	4	2
9.	IB7311	Cell Biology Laboratory	PC	4	0	0	4	2
10.	IB7401	Analytical methods and Instrumentation	PC	3	3	0	0	3
11.	IB7402	Enzyme Technology and Bio-transformations	PC	3	3	0	0	3

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12.	IB7404	Mass Transfer Operations	PC	3	3	0	0	3
13.	IB7412	Instrumentation methods of Analysis Laboratory	PC	4	0	0	4	2
14.	IB7551	Bioprocess Engineering	PC	3	3	0	0	3
15.	IB7501	Molecular Biology	PC	3	3	0	0	3
16.	IB7502	Protein structure-function relationship	PC	3	3	0	0	3
17.	IB7551	Bioprocess laboratory I	PC	4	0	0	4	2
18.	IB7512	Molecular Biology Laboratory	PC	4	0	0	4	2
19.	IB7602	Genetic Engineering	PC	4	4	0	0	4
20.	IB7611	Bioprocess Laboratory II	PC	4	0	0	4	2
21.	IB7612	Genetic Engineering Laboratory	PC	4	0	0	4	2
22.	IB7752	Downstream Processing	PC	3	3	0	0	3
23.	IB7753	Immunology	PC	3	3	0	0	3
24.	IB7751	Bioinformatics	PC	5	3	2	0	4
25.	IB7711	Downstream processing Laboratory	PC	4	0	0	4	2
26.	IB7712	Immunology Laboratory	PC	4	0	0	4	2

EMPLOYABILITY ENHANCEMENT COURSES EEC)

S. No	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	IB7811	Project work	EEC	3	3	0	0	3

SUMMARY

S.No	Subject Area	Credits per Semester								Credits Total
		I	II	III	IV	V	VI	VII	VIII	
1	**HS**	4	4	-	-	-	-	-	-	**8 (4.5%)**
2	**BS**	12	7	7	4	-	-	-	-	**30 (17%)**
3	**ES**	9	4	-	9	3	3	-	-	**28 (17.87%)**
4	**PC**	-	10	17	11	13	8	14	-	**73 (40.22%)**
5	**PE**	-	-	-	-	3	9	6	-	**18 (10.05%)**
6	**OE**	--	-	-	-	3	-	3	-	**6 (3.35%)**
7	**EEC**	-	-	-	-	-	3	-	10	**13 (7.26%)**
	Total	**25**	**25**	**24**	**24**	**22**	**23**	**23**	**10**	**176**
8	**Non-Credit/Mandatory**									

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HS7151 FOUNDATIONAL ENGLISH L T P C
4 0 0 4

COURSE DESCRIPTION:
This course aims at developing the language skills necessary for the first year students of Engineering and Technology.

OBJECTIVES:
- To develop the four language skills – Listening, Speaking, Reading and Writing.
- To improve the students' communicative competence in English.
- To teach students the various aspects of English language usage.

CONTENTS

UNIT I GREETING AND INTRODUCING ONESELF 12

Listening- Types of listening – Listening to short talks, conversations; **Speaking** – Speaking about one's place, important festivals etc. – Introducing oneself, one's family/ friend;**Reading** – Skimming a passage– Scanning for specific information;**Writing**- Guided writing - Free writing on any given topic (My favourite place/ Hobbies/ School life, writing about one's leisure time activities, hometown, etc.); **Grammar** – Tenses (present and present continuous) -Question types - Regular and irregular verbs; **Vocabulary** – Synonyms and Antonyms.

UNIT II GIVING INSTRUCTIONS AND DIRECTIONS 12

Listening – Listening and responding to instructions; **Speaking** – Telephone etiquette - Giving oral instructions/ Describing a process – Asking and answering questions; **Reading** – Reading and finding key information in a given text - Critical reading - **Writing –**Process description(non-technical)- **Grammar** – Tense (simple past& past continuous) - Use of imperatives – Subject – verb agreement – Active and passive voice; - **Vocabulary** – Compound words – Word formation – Word expansion (root words).

UNIT III READING AND UNDERSTANDING VISUAL MATERIAL 12

Listening- Listening to lectures/ talks and completing a task; **Speaking** –Role play/ Simulation – Group interaction; **Reading** – Reading and interpreting visual material;**Writing**- Jumbled sentences – Discourse markers and Cohesive devices – Essay writing (cause & effect/ narrative);**Grammar** – Tenses (perfect), Conditional clauses –Modal verbs; **Vocabulary** –Cause and effect words; Phrasal verbs in context.

UNIT IV CRITICAL READING AND WRITING 12

Listening- Watching videos/ documentaries and responding to questions based on them; **Speaking**Informal and formal conversation;**Reading** –Critical reading (prediction & inference);**Writing**–Essay writing (compare & contrast/ analytical) – Interpretation of visual materials;**Grammar** – Tenses (future time reference);**Vocabulary** – One word substitutes (with meanings) – Use of abbreviations & acronyms – Idioms in sentences.

UNIT V LETTER WRITING AND SENDING E-MAILS 12

Listening- Listening to programmes/broadcast/ telecast/ podcast;**Speaking** – Giving impromptu talks, Making presentations on given topics- Discussion on the presentation;**Reading** –Extensive reading;**Writing**- Poster making – Letter writing (Formal and E-mail) ;**Grammar** – Direct and Indirect speech – Combining sentences using connectives;**Vocabulary** –Collocation;

TEACHING METHODS:
Interactive sessions for the speaking module.
Use of audio – visual aids for the various listening activities.
Contextual Grammar Teaching.

EVALUATION PATTERN:
Internals – 50%

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End Semester – 50%

TOTAL:60 PERIODS

LEARNING OUTCOMES:

- Students will improve their reading and writing skills
- Students will become fluent and proficient in communicative English
- Students will be able to improve their interpersonal communication

TEXTBOOK:

1. Richards, Jack.C with Jonathan Hull and Susan Proctor **New Interchange : English for International Communication. (level2, Student's Book)** Cambridge University Press,New Delhi: 2010.

REFERENCES:

1. Bailey, Stephen. **Academic Writing: A practical guide for students**. New York: Rutledge,2011.
2. Morgan, David and Nicholas Regan. **Take-Off: Technical English for Engineering**. London: Garnet Publishing Limited, 2008.
3. Redston, Chris & Gillies Cunningham **Face2Face** (Pre-intermediate Student's Book& Workbook) Cambridge University Press, New Delhi: 2005
4. Comfort, Jeremy, et al. **Speaking Effectively : Developing Speaking Skillsfor Business English.** Cambridge University Press, Cambridge: Reprint 2011.

MA7151	MATHEMATICS – I	L	T	P	C
		4	0	0	4

(Common to all branches of B.E. /B.Tech. Programmes in I Semester)

COURSE OBJECTIVES

- The goal of this course is for students to gain proficiency in calculus computations. In calculus, we use three main tools for analyzing and describing the behavior of functions: limits, derivatives, and integrals. Students will use these tools to solve application problems in a variety of settings ranging from physics and biology to business and economics.
- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering problems.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

UNIT I DIFFERENTIAL CALCULUS 12

Representation of functions - New functions from old functions - Limit of a function - Limits at infinity - Continuity - Derivatives - Differentiation rules - Polar coordinate system - Differentiation in polar coordinates - Maxima and Minima of functions of one variable.

UNIT II FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives – Homogeneous functions and Euler's theorem – Total derivative – Differentiation of implicit functions – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Errors and approximations – Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT III INTEGRAL CALCULUS 12

Definite and Indefinite integrals - Substitution rule - Techniques of Integration - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals.

UNIT IV MULTIPLE INTEGRALS 12

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals.

UNIT V DIFFERENTIAL EQUATIONS 12

Method of variation of parameters – Method of undetermined coefficients – Homogenous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

TOTAL : 60 PERIODS

COURSE OUTCOMES

- Understanding of the ideas of limits and continuity and an ability to calculate with them and apply them.
- Improved facility in algebraic manipulation.
- Fluency in differentiation.
- Fluency in integration using standard methods, including the ability to find an appropriate method for a given integral.
- Understanding the ideas of differential equations and facility in solving simple standard examples.

TEXT BOOKS

1. James Stewart, "Calculus with Early Transcendental Functions", Cengage Learning, New Delhi, 2008.
2. Narayanan S. and Manicavachagom Pillai T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2007.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 9th Edition, New Delhi, 2014.
4. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCE BOOKS

1. Ramana B.V., "Higher Engineering Mathematics", Tata McGraw Hill Co. Ltd., New Delhi, 11th Reprint, 2010.
2. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
4. Greenberg M.D., "Advanced Engineering Mathematics", Pearson Education, New Delhi, 2nd Edition, 5th Reprint, 2009.
5. Peter V.O'Neil, "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

PH7151 ENGINEERING PHYSICS L T P C

(Common to all branches of B.E / B.Tech programmes) **3 0 0 3**

OBJECTIVE:

- To introduce the concept and different ways to determine moduli of elasticity and applications.
- To instill the concept of sound, reverberation, noise cancellation, and ultrasonic generation, detection and applications
- To inculcate an idea of thermal properties of materials, heat flow through materials and quantum physics

- To promote the basic understanding of interferometers, principles and applications of lasers, optical fibers and sensors
- To establish a sound grasp of knowledge on the basics, significance and growth of single crystals

UNIT I PROPERTIES OF MATTER 9

Elasticity – Poisson's ratio and relationship between moduli (qualitative) - stress-strain diagram for ductile and brittle materials, uses - factors affecting elastic modulus and tensile strength - bending of beams - cantilever - bending moment - Young's modulus determination - theory and experiment - uniform and non-uniform bending - I shaped girders - twisting couple - hollow cylinder - shaft - torsion pendulum - determination of rigidity modulus- moment of inertia of a body (regular and irregular).

UNIT II ACOUSTICS AND ULTRASONICS 9

Classification of sound - loudness and intensity - Weber-Fechner Law - standard intensity and intensity level - decibel - reverberation - reverberation time - calculation of reverberation time for different types of buildings – sound absorbing materials - factors affecting acoustics of buildings : focussing, interference, echo, echelon effect, resonance - noise and their remedies. Ultrasonics: production - magnetostriction and piezoelectric methods - detection of ultrasound - acoustic grating – ultrasonic interferometer - industrial applications – Non-destructive testing - ultrasonic method: scan modes and practice.

UNIT III THERMAL AND MODERN PHYSICS 9

Thermal expansion - thermal stress - expansion joints - bimetallic strips - thermal conductivity- heat conductions in solids – flow of heat through compound media - Forbe's and Lee's disc method: theory and experiment- Black body radiation – Planck's theory (derivation) – Compton effect – wave model of radiation and matter – Schrödinger's wave equation – time dependent and independent equations – Physical significance of wave function – particle in a one dimensional box.

UNIT IV APPLIED OPTICS 9

Interference - Michelson interferometer: construction, working, determination of wave length and thickness - anti-reflection coating - air wedge and its applications - Lasers – principle and applications – Einstein's coefficients – CO_2 and Nd:YAG laser - semiconductor lasers: homo junction and hetro junction - construction and working – applications. Optical fibres - classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperture - fibre optic communication system - active and passive sensors.

UNIT V CRYSTAL PHYSICS 9

Single crystalline, polycrystalline and amorphous materials – Single crystals: unit cell, crystal systems, Bravais lattices, ditections and planes in a crystal, Miller indices - interplanar distance for a cubic crystal - coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures - structure and significance of NaCl, CsCl, ZnS and graphite - crystal imperfections: point defects, line defects – Burger vectors, dislocations and stacking faults – Growth of single crystals: Bridgman and Czochralski methods.

TOTAL: 45 PERIODS

OUTCOME:

- The students will understand different moduli of elasticity, their determination and applications.
- The students will gain knowledge on the properties of sound, noise cancellation, and production, detection and applications of ultrasonics
- The students will acquire sound knowledge on thermal expansion and thermal conductivity of materials. Further they will gain an idea of quantum physics.
- The students will gain knowledge on interferometers, lasers and fiber optics
- The students will secure knowledge on the basics of crystal structures and their significance. Further they gain basic ideas of growing single crystals.

TEXTBOOKS:

1. Gaur R.K. and Gupta S.L., “Engineering Physics”, Dhanpat Rai Publications (2013)
2. Palanisamy P.K., “Engineering Physics”, Scitech Publications (P) Ltd. (2006).
2. Arumugam M., “Engineering Physics”, Anuradha Publications (2000)

REFERENCES:

1. Serway R.A. and Jewett, J.W. “Physics for Scientists and Engineers with Modern Physics”. Brooks/cole Publishing Co. (2010).
2. Tipler P.A. and Mosca, G.P., “Physics for Scientists and Engineers with Modern Physics”. W.H.Freeman, (2007).
3. Markert J.T.,Ohanian, H. and Ohanian, M. “Physics for Engineers and Scientists”. W.W.Norton & Co. (2007).

CY7151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

COURSE OBJECTIVES

- To develop an understanding about fundamentals of polymer chemistry.
- Brief elucidation on surface chemistry and catalysis.
- To develop sound knowledge photochemistry and spectroscopy.
- To impart basic knowledge on chemical thermodynamics.
- To understand the basic concepts of nano chemistry.

UNIT I POLYMER CHEMISTRY 9

Introduction: Functionality-degree of polymerization. Classification of polymers- natural and synthetic, thermoplastic and thermosetting. Types and mechanism of polymerization: addition (free radical, cationic, anionic and living); condensation and copolymerization. Properties of polymers: Tg, tacticity, molecular weight-weight average, number average and polydispersity index. Techniques of polymerization: Bulk, emulsion, solution and suspension.

UNIT II SURFACE CHEMISTRYAND CATALYSIS 9

Adsorption-Types of adsorption-adsorption of gases on solids- adsorption from solutions-Types of isotherms–Frendlich adsorption isotherm,Langmuir adsorption isotherm.Industrial applications of adsorption. Catalysis: Characteristics and types of catalysts-homogeneous and heterogeneous, auto catalysis. Enzyme catalysis -factors affecting enzyme catalysis, Michaelis-Menton equation.Industrial applications of catalysts.

UNIT III PHOTOCHEMISTRY AND SPECTROSCOPY 9

Photochemistry: Laws of photochemistry-Grotthuss-Draper law, Stark-Einstein law and Lambert-Beer Law. Photo processes-internal conversion, inter-system crossing, fluorescence, phosphorescence, chemiluminescence and photo-sensitization. Spectroscopy: Electromagnetic spectrum-absorption of radiation-electronic, vibrational and rotational transitions. Width and intensities of spectral lines.Spectrophotometric estimation of iron.UV-Vis and IR spectroscopy- principles, instrumentation (Block diagram) and applications.

UNIT IV CHEMICAL THERMODYNAMICS 9

Second law: Entropy-entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Free energy and work function: Helmholtzand Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation; Clausius Clapeyron equation; Maxwell relations-Van’t Hoff isotherm and isochore. Chemical potential; Gibbs-Duhem equation- variation of chemical potential with temperature and pressure.

UNIT V NANOCHEMISTRY 9

Basics-distinction between molecules, nanoparticles and bulk materials; size-dependent properties.Preparation of nanoparticles – sol-gel and solvothermal.Preparation of carbon nanotube by chemical vapour deposition and laser ablation.Preparation of nanowires by VLS growth, electrochemical deposition and electro spinning.Properties and uses of

nanoparticles, nanoclusters, nanorods, nanotubes and nanowires.

TOTAL : 45 PERIODS

COURSE OUTCOMES

- Will be familiar with polymer chemistry, surface chemistry and catalysis.
- Will know the photochemistry, spectroscopy and chemical thermodynamics.
- Will know the fundamentals of nano chemistry.

TEXT BOOKS

1. Jain P. C. & Monica Jain., "Engineering Chemistry", DhanpatRai Publishing Company (P) Ltd, New Delhi, 2014.
2. Kannan P., Ravikrishnan A., "Engineering Chemistry", Sri Krishna Hitech Publishing Company Pvt. Ltd. Chennai, 2014

REFERENCE BOOKS

1. Pahari A., Chauhan B., "Engineering Chemistry", Firewall Media, New Delhi, 2012.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2012.
3. AshimaSrivastava. Janhavi N N, Concepts of Engineering Chemistry", ACME Learning Private Limited., New Delhi., 2010.
4. Vairam S., Kalyani P., Suba Ramesh., "Engineering Chemistry", Wiley India Pvt Ltd., New Delhi., 2011.

GE7151 COMPUTING TECHNIQUES L T P C
(Common to all branches of Engineering and Technology) 3 0 0 3

OBJECTIVES:

- To learn programming using a structured programming language.
- To provide C programming exposure.
- To introduce foundational concepts of computer programming to students of different branches of Engineering and Technology.

UNIT I INTRODUCTION 9

Introduction to Computers – Computer Software – Computer Networks and Internet - Need for logical thinking – Problem formulation and development of simple programs - Pseudo code - Flow Chart and Algorithms.

UNIT II C PROGRAMMING BASICS 9

Introduction to C programming – Fundamentals – Structure of a C program – Compilation and linking processes - Constants, Variables – Data Types – Expressions - Operators –Decision Making and Branching – Looping statements – Solving Simple Scientific and Statistical Problems.

UNIT III ARRAYS AND STRINGS 9

Arrays – Initialization – Declaration – One dimensional and two dimensional arrays - Strings- String operations – String Arrays - simple programs- sorting- searching – matrix operations.

UNIT IV POINTERS 9

Macros - Storage classes –Basic concepts of Pointers– Pointer arithmetic - Example Problems - Basic file operations

UNIT V FUNCTIONS AND USER DEFINED DATA TYPES 9

Function – definition of function – Declaration of function – Pass by value – Pass by reference – Recursion –Enumerators – Structures - Unions

TOTAL : 45 PERIODS

OUTCOMES

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

- Write C program for simple applications
- Formulate algorithm for simple problems
- Analyze different data types and arrays
- Perform simple search and sort**.**
- Use programming language to solve problems.

TEXTBOOKS:

1. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", Second Edition, Oxford University Press, 2013
2. Ashok N. Kamthane, "Computer programming", Pearson Education, 2007.
3. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.

REFERENCES:

1. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006
2. Byron S Gottfried, "Programming with C", Schaums Outlines, Second Edition, Tata McGraw-Hill, 2006.
3. R.G. Dromey, "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007

GE7152 ENGINEERING GRAPHICS L T P C

3 2 0 4

OBJECTIVES

• To develop in students, graphic skills for communication of concepts, ideas and design of engineering products and expose them to existing national standards related to technical drawings.

CONCEPTS AND CONVENTIONS (NOT FOR EXAMINATION) 1

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

14

UNIT I PLANE CURVES AND FREE HANDSKETCHING

Basic Geometrical constructions, 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. Visualization concepts and Free Hand sketching: Visualization principles – Representation of Three Dimensional objects – Layout of views- Free hand sketching of multiple views from pictorial views of objects

14

UNIT II PROJECTION OF POINTS, LINES AND PLANE SURFACES

Orthographic projection- principles-Principal planes-First angle projection-Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes-Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS 14

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to both the principal planes by rotating object method and auxiliary plane method.

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 14

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section.
Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes.

15

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems.
Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method and vanishing point method.

COMPUTER AIDED DRAFTING (DEMONSTRATION ONLY) 3

Introduction to drafting packages and demonstration of their use.

L=45+T=30, TOTAL: 75 PERIODS

OUTCOMES:

On Completion of the course the student will be able to

- Perform free hand sketching of basic geometrical shapes and multiple views of objects.
- Draw orthographic projections of lines, Planes and Solids
- Obtain development of surfaces.
- Prepare isometric and perspective views of simple solids.

TEXT BOOK:

1. N.D.Bhatt and V.M.Panchal, “Engineering Drawing”, Charotar Publishing House, 50th Edition, 2010.

REFERENCES:

1. K.R.Gopalakrishna., “Engineering Drawing” (Vol I&II combined) SubhasStores, Bangalore, 2007
2. Luzzader, Warren.J., and Duff,John M.,,’’ Fundamentals of Engineering Drawingwith an introduction to Interactive Computer Graphics for Design and Production”,Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2005
3. M.B.Shah and B.C.Rana, “Engineering Drawing”, Pearson, 2nd Edition, 2009
4. K.Venugopal and V.Prabhu Raja, “Engineering Graphics”, New Age International (P) Limited ,2008.
5. K. V.Natarajan, “A text book of Engineering Graphics”, 28th Edition, Dhanalakshmi Publishers, Chennai, 2015.
6. BasantAgarwal and Agarwal C.M., “Engineering Drawing”, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
7. N.S Parthasarathy and Vela Murali, “Engineering Drawing”, OUP, 2015

Publication of Bureau of Indian Standards:

1. IS10711 – 2001: Technical products Documentation – Size and layout of drawing sheets
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day.

BS7161 **BASIC SCIENCES LABORATORY** **L T P C**

(Common to all branches of B.E. / B.Tech Programmes) **0 0 4 2**

PHYSICS LABORATORY: (Any Seven Experiments)

OBJECTIVE:

- To inculcate experimental skills to test basic understanding of physics of materials including properties of matter, thermal and optical properties.
- To induce the students to familiarize with experimental determination of velocity of ultrasonic waves, band gap determination and viscosity of liquids.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of disc
2. Non-uniform bending - Determination of young's modulus
3. Uniform bending – Determination of young's modulus
4. Lee's disc Determination of thermal conductivity of a bad conductor
5. Potentiometer-Determination of thermo e.m.f of a thermocouple
6. Laser- Determination of the wave length of the laser using grating
7. Air wedge - Determination of thickness of a thin sheet/wire
8. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
9. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.
10. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
11. Post office box -Determination of Band gap of a semiconductor.
12. Spectrometer- Determination of wavelength using gating.
13. Viscosity of liquids - Determination of co-efficient of viscosity of a liquid by Poiseuille's flow

TOTAL: 30 PERIODS

OUTCOME:

Upon completion of the course, the students will be able

- To determine various moduli of elasticity and also various thermal and optical properties of materials.
- To determine the velocity of ultrasonic waves, band gap determination and viscosity of liquids.

CHEMISTRY LABORATORY:

(Minimum of 8 experiments to be conducted)

1. Estimation of HCl using Na_2CO_3 as primary standard and Determination of alkalinity in water sample.
2. Determination of total, temporary & permanent hardness of water by EDTA method.
3. Determination of DO content of water sample by Winkler's method.
4. Determination of chloride content of water sample by argentometric method.
5. Estimation of copper content of the given solution by Iodometry.
6. Determination of strength of given hydrochloric acid using pH meter.
7. Determination of strength of acids in a mixture of acids using conductivity meter.
8. Estimation of iron content of the given solution using potentiometer.
9. Estimation of iron content of the water sample using spectrophotometer (1, 10-Phenanthroline/thiocyanate method).
10. Estimation of sodium and potassium present in water using flame photometer.
11. Determination of molecular weight of poly vinyl alcohol using Ostwald viscometer.
12. Pseudo first order kinetics-ester hydrolysis.

13. Corrosion experiment-weight loss method.
14. Determination of CMC.
15. Phase change in a solid.

TOTAL: 30 PERIODS

TEXTBOOKS

1. Vogel's Textbook of Quantitative Chemical Analysis (8^{TH} edition, 2014)
2. Laboratory Manual- Department of Chemistry, CEGC, Anna University (2014).

GE7162	ENGINEERING PRACTICES LABORATORY	L	T	P	C
	(Common to all Branches of B.E. / B.Tech. Programmes)	0	0	4	2

COURSE OBJECTIVES

• To provide exposure to the students with hands-on experience on various Basic Engineering Practices in Civil, Mechanical, Electrical and Electronics Engineering.

GROUP – A (CIVIL & ELECTRICAL)

1. CIVIL ENGINEERING PRACTICES 15

PLUMBING

- Basic pipe connections involving the fittings like valves, taps, coupling, unions, reducers, elbows and other components used in household fittings. Preparation of plumbing line sketches.
- Laying pipe connection to the suction side of a pump.
- Laying pipe connection to the delivery side of a pump.
- Practice in connecting pipes of different materials: Metal, plastic and flexible pipes used in householdappliances.

WOOD WORK

- Sawing, planing and making joints like T-Joint, Mortise and Tenon joint and Dovetail joint.

STUDY

- Study of joints in door panels and wooden furniture
- Study of common industrial trusses using models.

2. **ELECTRICAL ENGINEERING PRACTICES** 15

- Basic household wiring using Switches, Fuse, Indicator and Lamp etc.,
- Stair case light wiring
- Tube – light wiring
- Preparation of wiring diagrams for a given situation.
  Study of Iron-Box, Fan Regulator andEmergency Lamp

GROUP – B (MECHANICAL AND ELECTRONICS)

3. **MECHANICAL ENGINEERING PRACTICES** 15

WELDING

- Arc welding of Butt Joints, Lap Joints, and Tee Joints
- Gas welding Practice.
- Basic Machining - Simple turning, drilling and tapping operations..
- Study and assembling of the following:
  a. Centrifugal pump
  b. Mixie
  c. Air Conditioner.

DEMONSTRATION ON FOUNDRY OPERATIONS.

4. **ELECTRONIC ENGINEERING PRACTICES** 15

- Soldering simple electronic circuits and checking continuity.
- Assembling electronic components on a small PCB and Testing.
- Study of Telephone, FM radio andLow Voltage Power supplies.

TOTAL : 60 PERIODS

COURSE OUTCOMES

- Ability to fabricate carpentry components and to lay pipe connections including plumbing works.
- Ability to use welding equipments to join the structures
- Ability to do wiring for electrical connections and to fabricate electronics circuits.

HS7251 TECHNICAL ENGLISH L T P C
4 0 0 4

OBJECTIVES

- To enable students acquire proficiency in technical communication.
- To enhance their reading and writing skills in a technical context.
- To teach various language learning strategies needed in aprofessional environment.

CONTENTS

UNIT I ANALYTICAL READING 12

Listening- Listening to informal and formal conversations; **Speaking** – Conversation Skills(opening, turn taking, closing)-explaining how something works-describing technical functions and applications;**Reading** –Analytical reading, Deductive and inductive reasoning; **Writing**- vision statement–structuring paragraphs.

UNIT II SUMMARISING 12

Listening- Listening to lectures/ talks on Science & Technology;**Speaking** –Summarizing/ Oral Reporting, **Reading** – Reading Scientific and Technical articles; **Writing**- Extended definition – Lab Reports – Summary writing.

UNIT III DESCRIBING VISUAL MATERIAL 12

Listening- Listening to a panel discussion; **Speaking** – Speaking at formal situations; **Reading** – Reading journal articles - Speed reading;**Writing**-data commentary-describing visual material-writing problem-process- solution-the structure of problem-solution texts- writing critiques

UNIT IV WRITING/ E-MAILING THE JOB APPLICATION 12

Listening- Listening to/ Viewing model interviews; **Speaking** –Speaking at different types of interviews – Role play practice (mock interview); **Reading** – Reading job advertisements and profile of the company concerned;**Writing**- job application – cover letter –Résumé preparation.

UNIT V REPORT WRITING 12

Listening- Viewing a model group discussion;**Speaking** –Participating in a discussion - Presentation;**Reading** – Case study - analyse -evaluate – arrive at a solution;**Writing**– Recommendations- Types of reports (feasibility report)- designing and reporting surveys- – Report format.- writing discursive essays.

TEACHING METHODS:

Practice writing
Conduct model and mock interview and group discussion.
Use of audio – visual aids to facilitate understanding of various forms of technical communication.
Interactive sessions.

EVALUATION PATTERN:

Internals – 50%
End Semester – 50%

TOTAL : 60 PERIODS

LEARNING OUTCOMES

- Students will learn the structure and organization of various forms of technical communication.
- Students will be able to listen and respond to technical content.
- Students will be able to use different forms of communication in their respective fields.

TEXTBOOK:

1. Craig,Thaine**. Cambridge Academic English: An integrated skills course for EAP(Student's Book)Level: Intermediate** Cambridge University Press, New Delhi: 2012

REFERENCES:

1. Laws, Anne. **Presentations.** Hyderabad: Orient Blackswan, 2011.
2. Ibbotson, Mark. **Cambridge English for Engieering**. Cambridge University Press, Cambridge,New Delhi: 2008
3. Naterop, Jean B. and Rod Revell. **Telephoning in English**. Cambridge: Cambridge University Press, 2004.
4. Rutherford, Andrea J. **Basic Communication Skills for Technology**. New Delhi: Pearson Education, 2001.
5. Bailey, Stephen. **Academic Writing A practical Guide for Students**. Routledge, London: 2004
6. Hewings, Martin**. Cambridge Academic English: An integrated skills course for EAP(Student's Book)Level: Intermediate** Cambridge University Press, New Delhi: 2012.

MA7251	MATHEMATICS – II	L	T	P	C
		4	0	0	4

(Common to all branches of B.E. /B.Tech. Programmes in II Semester)

COURSE OBJECTIVES

- To develop the use of matrix algebra techniques this is needed by engineers for practical applications.
- To acquaint the student with the concepts of vector calculus, needed for problems in all engineering disciplines.
- To develop an understanding of the standard techniques of complex variable theory so as to enable the student to apply them with confidence, in application areas such as heat conduction, elasticity, fluid dynamics and flow the 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.

UNIT I MATRICES 12

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Cayley-Hamilton theorem – Diagonalization of matrices – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II VECTOR CALCULUS 12

Gradient and directional derivative – Divergence and Curl – Irrotational and Solenoidal vector fields – Line integral over a plane curve – Surface integral - Area of a curved surface - Volume integral - Green's, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III ANALYTIC FUNCTION 12

Analytic functions – Necessary and sufficient conditions for analyticity - Properties – Harmonic conjugates – Construction of analytic function - Conformal mapping – Mapping by functions $w = z + c$, az, $\frac{1}{z}$, z^2 - Bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Line integral - Cauchy's integral theorem – Cauchy's integral formula – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour with no pole on real axis.

UNIT V LAPLACE TRANSFORMS 12

Existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Basic properties – Shifting theorems -Transforms of derivatives and integrals – Initial and final value theorems – Inverse transforms – Convolution theorem — Transform of periodic functions – Application to solution of linear ordinary differential equations with constant coefficients.

TOTAL : 60 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

- Evaluate real and complex integrals using the Cauchy integral formula and the residue theorem
- Appreciate how complex methods can be used to prove some important theoretical results.
- Evaluate line, surface and volume integrals in simple coordinate systems
- Calculate grad, div and curl in Cartesian and other simple coordinate systems, and establish identities connecting these quantities
- Use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.

TEXT BOOKS

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 9th Edition, New Delhi, 2014.
2. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.

REFERENCE BOOKS

1. Ramana, B.V. "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 2010.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, New Delhi, 2007.
3. Jain R.K. and Iyengar S.R.K., "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
4. Bali N., Goyal M. and Watkins C., "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
5. Peter V. O'Neil , "Advanced Engineering Mathematics", Cengage Learning India Pvt., Ltd, New Delhi, 2007.

PH7257 PHYSICS OF MATERIALS L T P C

(Common to Chemical, Ceramic, Food, Leather, Textile, Apparel, Industrial Biotechnology, Pharmaceutical and PET) **3 0 0 3**

OBJECTIVE:

- To make the students to understand the basics of phase diagrams and various materials preparation techniques
- To equip the students to have a knowledge on different types of electron theory, basics of quantum mechanics and about superconductors

- To introduce the physics of semiconducting materials and applications of semiconductors in device fabrication
- To familiarize the students with the theory and applications of magnetic and dielectric materials
- To provide the students a sound platform towards learning about advanced materials and their applications.

UNIT I PREPARATION OF MATERIALS 9

Phases - phase rule – binary systems – tie line rule – lever rule – phase diagram – invariant reactions - nucleation – homogeneous and heterogeneous nucleation – free energy of formation of a critical nucleus – Thin films – preparation: PVD, CVD method – Nanomaterials Preparation: wet chemical, solvothermal, sol-gel method.

UNIT II ELECTRICAL AND SUPERCONDUCTING MATERIALS 9

Classical free electron theory - expression for electrical conductivity – thermal conductivity, - Wiedemann-Franz law - Quantum free electron theory – applications of Schrodinger wave equation: particle in a finite potential well – particle in a three-dimensional box- degenerate states – Fermi-Dirac statistics – density of energy states – electron in periodic potential – electron effective mass – concept of hole. Superconducting phenomena, properties of superconductors – Meissner effect and isotope effect. Type I and Type II superconductors, High T_c superconductors – Magnetic levitation and SQUIDS.

UNIT III SEMICONDUCTING MATERIALS 9

Elemental Semiconductors - Compound semiconductors - Origin of band gap in solids (qualitative) - carrier concentration in metals - carrier concentration in an intrinsic semiconductor (derivation) – Fermi level – variation of Fermi level with temperature – electrical conductivity – band gap determination – carrier concentration in n-type and p-type semiconductors (derivation) – variation of Fermi level with temperature and impurity concentration – Hall effect – determination of Hall coefficient – LED - Solar cells.

UNIT IV DIELECTRIC AND MAGNETIC MATERIALS 9

Dielectric, Paraelectric and ferroelectric materials - Electronic, Ionic, Orientational and space charge polarization – Internal field and deduction of Clausius Mosotti equation – dielectric loss – different types of dielectric breakdown – classification of insulating materials and their applications - Ferroelectric materials - Introduction to magnetic materials - Domain theory of ferromagnetism, Hysteresis, Soft and Hard magnetic materials – Anti-ferromagnetic materials – Ferrites, Giant Magneto Resistance materials.

UNIT V NEW MATERIALS AND APPLICATIONS 9

Ceramics – types and applications – Composites: classification, role of matrix and reinforcement – processing of fibre reinforced plastics and fibre reinforced metals – Metallic glasses – Shape memory alloys – Copper, Nickel and Titanium based alloys – grapheme and its properties – Relaxor ferroelectrics - Bio materials – hydroxyapatite – PMMA – Silicone - Sensors: Chemical Sensors - Bio-sensors – Polymer semiconductors – Photoconducting polymers.

TOTAL: 45 PERIODS

OUTCOME:

On completion of the course, the students will be able to

- acquire knowledge of phase diagram, and thin film and nanomaterial preparation techniques
- familiarize with conducting materials, basic quantum mechanics, and properties and applications of superconductors.
- gain knowledge on semiconducting materials based on energy level diagrams, its types, temperature effect. Also, fabrication methods for semiconductor devices will be understood.
- realize with theories and applications of dielectric and ferromagnetic materials

- familiarize with ceramics, composites, metallic glasses, shape memory alloys, biomaterials and their important applications.

.

REFERENCES:

1. Callister W. D. and Rethwisch, D. G., "Materials Science and Engineering", 9th Edition, Wiley (2014).
2. Raghavan V., "Materials Science and Engineering", Prentice Hall of India (2004).
3. Askeland D.R. and Wright, W.J., "Essentials of Materials Science and Engineering", 3rd Edition, Cengage Learning (2014).
4. Pillai, S.O., "Solid State Physics", New Age International, 7th Edition (2015).
5. Viswanathan, B., "Nanomaterials", Narosa Book Distributors Pvt Ltd. (2011).

IB7252 MICROBIOLOGY L T P C
3 0 0 3

OBJECTIVE

To introduce students to the principles of Microbiology ,to emphasize the structure and biochemical aspects of various microbes.

UNIT I INTRODUCTION TO MICROBIOLOGY 9

History (scientists and discoveries) and scope of microbiology (Primary and secondary metabolites), classification and nomenclature of microorganisms, microscopic examination of microorganisms: light, fluorescent, dark field, phase contrast, and electron microscopy. Stains and staining techniques – Definition of auxochrome, chromophores, dyes, Classification of stains, Theories of staining, Mechanism of gram staining, acid fast staining, negative staining, capsule staining, flagella staining, endospore staining.

UNIT II MICROBES- STRUCTURE AND REPRODUCTION 9

Structural organization and multiplication of bacteria, viruses (TMV, Hepatitis B), algae (cyanophyta, rhodophyta) and fungi (Neurospora), life history of actinomycetes (Streptomyces), yeast (Sacharomyces), mycoplasma (M. pneumoniae) and bacteriophages (T4 phage, λ phage)

UNIT III MICROBIAL NUTRITION, GROWTH AND METABOLISM 9

Nutritional classification of microorganisms based on carbon, energy and electron sources
Definition of growth, balanced and unbalanced growth, growth curve and different methods to quantify bacterial growth:(counting chamber, viable count method, counting without equipment, different media used for bacterial culture (defined, complex, selective, differential, enriched) the mathematics of growth-generation time, specific growth rate.

UNIT IV CONTROL OF MICROORGANISMS 9

Physical and chemical control of microorganisms Definition of sterilization, dry and moist heat, pasteurization, tyndalization; radiation, ultrasonication, filtration. Disinfection sanitization, antiseptics sterilants and fumigation. Determination of phenol coefficient of disinfectant. Host-microbe interactions; anti-bacterial, anti-fungal and anti-viral agents; mode of action and resistance to antibiotics; clinically important microorganisms

UNIT V INDUSTRIAL MICROBIOLOGY AND MICROBIAL ECOLOGY 9

Microbes involved in preservation (Lactobacillus,bacteriocins), spoilage of food and food borne pathogens *(E.coli, S.aureus, Bacillus, Clostridium*). Industrial use of microbes (production of penicillin, alcohol, vitamin B-12); biogas; bioremediation(oil spillage leaching of ores by microorganisms ,pollution control); biofertilizers, biopesticides. Biosensors.

TOTAL: 45 PERIODS

OUTCOMES

• To provide to the students the fundamentals of Microbiology , the scope of microbiology and solve the problems in microbial infection and their control,

TEXT BOOKS

1. Pelczar, M.J. “Microbiology”, 5th Edition, Tata McGraw-Hill, 1993.
2. Prescot. Harley, Klein. “ Microbiology “: McGraw-Hill Higher Education, 2008
3. Stanier RY, Ingrahm JI, Wheelis ML and Painter PR. “General Microbiology.” 5th edition, McMillan Press. 1986
4. Ananthanarayanan, R. and C.K. JayaramPaniker, “Textbook of Microbiology”,4th Edition, Orient Longman, 1990.
5. Casida, L.E. “Industrial Microbiology”, New Age International, 1968.
6. Schlegel, H.G. “General Microbiology”, 7th Edition, Cambridge University Press, 1993.

GE7153 ENGINEERING MECHANICS

L	T	P	C
4	0	0	4

OBJECTIVE :

The objective of this course is to inculcate in the student the ability to analyze any problem in a simple and logical manner and to predict the physical phenomena and thus lay the foundation for engineering applications.

UNIT I STATICS OF PARTICLES 12

Fundamental Concepts and Principles, Systems of Units, Method of Problem Solutions, Statics of Particles -Forces in a Plane, Resultant of Forces, Resolution of a Force into Components, Rectangular Components of a Force, Unit Vectors.

Equilibrium of a Particle- Newton’s First Law of Motion, Space and Free-Body Diagrams, Forces in Space, Equilibrium of a Particle in Space.

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Principle of Transmissibility, Equivalent Forces, Vector Product of Two Vectors, Moment of a Force about a Point ,Varignon’s Theorem, Rectangular Components of the Moment of a Force, Scalar Product of Two Vectors, Mixed Triple Product of Three Vectors, Moment of a Force about an Axis, Couple - Moment of a Couple, Equivalent Couples, Addition of Couples, Resolution of a Given Force into a Force -Couple system, Further Reduction of a System of Forces, Equilibrium in Two and Three Dimensions - Reactions at Supports and Connections.

UNIT III DISTRIBUTED FORCES 16

Centroids of lines and areas – symmetrical and unsymmetrical shapes, Determination of Centroids by Integration , Theorems of Pappus-Guldinus, Distributed Loads on Beams, Center of Gravity of a Three-Dimensional Body, Centroid of a Volume, Composite Bodies , Determination of Centroids of Volumes by Integration.

Moments of Inertia of Areas and Mass - Determination of the Moment of Inertia of an Area by Integration , Polar Moment of Inertia , Radius of Gyration of an Area , Parallel-Axis Theorem , Moments of Inertia of Composite Areas, Moments of Inertia of a Mass - Moments of Inertia of Thin Plates , Determination of the Moment of Inertia of a Three-Dimensional Body by Integration.

UNIT IV FRICTION 8

The Laws of Dry Friction. Coefficients of Friction, Angles of Friction, Wedges, Wheel Friction. Rolling Resistance , Ladder friction.

UNIT V DYNAMICS OF PARTICLES 12

Kinematics - Rectilinear Motion and Curvilinear Motion of Particles.

Kinetics- Newton’s Second Law of Motion -Equations of Motions , Dynamic Equilibrium, Energy and Momentum Methods - Work of a Force , Kinetic Energy of a Particle, Principle of Work and Energy, Principle of Impulse and Momentum, Impact, Method of Virtual Work - Work of a Force, Potential Energy, Potential Energy and Equilibrium.

L – 45 + T – 15 TOTAL: 60 PERIODS

OUTCOMES:

- Upon completion of this course, students will be able to construct meaningful mathematical models of physical problems and solve them.

TEXT BOOK

1. Beer,F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers", McGraw-Hill Education (India) Pvt. Ltd. 10th Edition, 2013.

REFERENCES

1. Hibbeller, R.C., Engineering Mechanics: Statics, and Engineering Mechanics: Dynamics, 13th edition, Prentice Hall, 2013.
2. J.L. Meriam & L.G. Karige, Engineering Mechanics: Statics (Volume I) and Engineering Mechanics: Dynamics, 7th edition, Wiley student edition, 2013.
3. P. Boresi & J. Schmidt, Engineering Mechanics: Statics and Dynamics, 1/e, Cengage learning, 2008.
4. Irving H. Shames, G. Krishna Mohana Rao, Engineering Mechanics - Statics and Dynamics, Fourth Edition – PHI / Pearson Education Asia Pvt. Ltd., 2006.
5. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

IB7251 BIOCHEMISTRY L T P C

3 0 0 3

OBJECTIVE

To enable students learn the fundamentals of Biochemical Processes and Biomolecules.

UNIT I INTRODUCTION TO BIOMOLECULES 5

Basic principles of organic chemistry, role of carbon, types of functional groups, biomolecules, chemical nature of water, pH and biological buffers.

UNIT II STRUCTURE AND PROPERTIES OF IMPORTANT BIOMOLECULES 15

Carbohydrates (mono, di, oligo & polysaccharides) mutarotation, glycosidic bond, reactions of monosaccharides and reducing sugars Starch, glycogen, cellulose and chitin. Proteoglycans, glycosaminoglycans. hyaluronic acid, chondroitin sulfate.

Lipids**:** Fatty acids, glycerol, triacylglycerol, saponification, iodination, hydrogenation, phospholipids, glycolipids, sphingolipids. Inherited metabolic disorders of Lipid-metabolism-Tay-Saach's disease, Niemann-Pick's disease and Gaucher's disease. Cholesterol, steroids, Bile acids and salts, Gluco-and Mineralo-corticosteroids. Aldosterone, cortisone and synthetic derivative-prednisolone. Androgens-testosterone, Estrogens- estrone, estradiol and progesterone. Prostaglandins and their functions. LDL, HDL and VLDL. Cardiovascular disease and correlation with circulating lipid and lipoprotein concentration

Amino Acids, Peptides, and Proteins.Classification based on side-chain properties. Structures, hierarchy of organization primary, secondary, tertiary and quaternary structures, glycoproteins, lipoproteins. Determination of primary structure.

Nucleic acids: Purines, pyrimidines, nucleosides, nucleotides, Chargaff's Rules. Base pairing, A-T and G-C, mRNA, rRNA and tRNA., Watson-Crick structure of DNA. reactions, properties, Tm and hypochromicity, Measurement of DNA and RNA. Nucleoprotein complexes

UNIT III METABOLISM CONCEPTS 5

Functions of Proteins, Enzymes, introduction to biocatalysts, metabolic pathways, primary and secondary metabolites. Interconnection of pathways and metabolic regulation.

UNIT IV INTERMEDIARY METABOLISM AND REGULATION 15

Glycolysis, TCA cycle, gluconeogenesis, pentose phosphate shunt, glyoxalate shunt, fatty acid synthesis and oxidation, reactions of amino acids, deamination, transamination and decarboxylation, urea cycle, Bioenergetics - High energy compounds, electronegative potential of compounds, respiratory chain, ATP cycle, calculation of ATP yield during oxidation of glucose and fatty acids.

UNIT V CASE STUDIES 5

Case study on overproduction of primary and secondary metabolites - glutamic acid, threonine , lysine, methionine, isoleucine, propionic acid and ethanol.

TOTAL: 45 PERIODS

OUTCOMES

- To ensure students have a strong foundation in the structure and reactions of Biomolecules.
- To introduce them to metabolic pathways of the major biomolecules and relevance to clinical conditions.
- To correlate Biochemical processes with Biotechnology applications.

TEXT BOOKS

1. Lehninger Principles of Biochemistry 6th Edition by David L. Nelson, Michael M. Cox
2. Satyanarayana, U. and U. Chakerapani, "Biochemistry" 3rd Rev. Edition, Books & Allied (P) Ltd., 2006.
3. Rastogi, S.C. "Biochemistry" 2nd Edition, Tata McGraw-Hill, 2003.
4. Conn, E.E., etal., "Outlines of Biochemistry" 5th Edition, John Wiley & Sons, 1987.
5. Outlines of biochemistry, 5th Edition: By E E Conn, P K Stumpf, G Bruening and R Y Doi. pp 693. John Wiley and Sons, New York. 1987.

REFERENCES

1. Berg, Jeremy M. et al. "Biochemsitry", 6th Edition, W.H. Freeman & Co., 2006.
2. Voet, D. and Voet, J.G., "Biochemistry", 3rd Edition, John Wiley & Sons Inc.,2004.
3. Murray, R.K., etal "Harper's Illustrated Biochemistry", 27th Edition, McGraw-Hill, 2006.

IB7262 MICROBIOLOGY LABORATORY L T P C
0 0 4 2

Experiments

1. Introduction, Laboratory Safety, Use of Equipment; Sterilization Techniques
2. Culture Media-Types and Use; Preparation of Nutrient broth and agar
3. Culture Techniques, Isolation and Preservation of Cultures- Broth: flask, test tubes; Solid:Pour plates, streak plates, slants, stabs
4. Microscopy – Working and care of Microscope
5. Microscopic Methods in the Study of Microorganisms., Microscopic identification of yeast/mould
6. Staining Techniques Simple, Differential- Gram's Staining, spore /capsule staining
7. Quantification of Microbes: Sampling and Serial Dilution; Bacterial count in Soil – TVC
8. Effect of Disinfectants- Phenol Coefficient
9. Antibiotic Sensitivity Assay
10. Growth Curve in Bacteria and Yeast
11. Effect of pH, Temperature, UV radiation on Growth Bacteria

TOTAL : 60 PERIODS

Equipment Needed for 20 Students

Autoclave 1
Hot Air Oven 1
Incubators 2
Light Microscopes 4
Glassware, Chemicals, Media as required

Incubator Shaker 1
Colorimeter 2
Lamina Flow Chamber 2

TEXT BOOKS

1. Cappuccino, J.G. and N. Sherman "Microbiology : A Laboratory Manual", 4th Edition, Addison-Wesley, 1999.
2. Collee, J.G. etal., "Mackie & McCartney Practical Medical Microbiology" 4th Edition, Churchill Livingstone, 1996.

IB7261 **BIOCHEMISTRY LABORATORY** **L T P C**
0 0 4 2

AIM

To learn and understand the principles behind the qualitative and quantitative estimation of biomolecules (proteins, carbohydrates, lipids, metabolites etc.,) and laboratory analysis of the same in the body fluids.

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 and keto 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.

Equipment Needed for 20 Students

Autocalve	1
Hot Air Oven	1
Incubators	2
Light Microscopes	4
Incubator Shaker	1
Colorimeter	2
Laminar Flow Chamber	2
Glassware, Chemicals, Media as required	

TOTAL: 60 PERIODS

TEXT BOOKS

1. Practical Biochemistry by R.C. Gupta and S. Bhargavan.
2. Introduction of Practical Biochemistry by David T. Phummer. (II Edition)

REFERENCES

1. Harpers Biochemistry Ed. R.K. Murray , D.K. Granner, P.A. Mayes and V.W.Rodwell, Appleton and Lange ,Stanford ,Conneticut.
2. Textbook of Biochemistry with clinical correlations. Ed. Thomas M. Devlin. Wiley Liss Publishers

MA7301 **MATHEMATICS FOR BIOTECHNOLOGISTS** **L T P C**
4 0 0 4

AIM

To facilitate the understanding of the principles and to cultivate the art of formulating physical problems in the language of mathematics.

OBJECTIVES

- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations in which the functions used are not periodic.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model physical processes.
- To develop Z- transform techniques which will perform the same task for discrete time systems as Laplace Transform, a valuable aid in analysis of continuous time systems.

UNIT I FOURIER SERIES 12

Dirichlet's conditions – General Fourier series – Odd and even functions – Half-range Sine and Cosine series – Complex form of Fourier series – Parseval's identity – Harmonic Analysis.

UNIT II FOURIER TRANSFORM 12

Fourier integral theorem – Fourier transform pair - Sine and Cosine transforms – Properties – Transform of elementary functions – Convolution theorem – Parseval's identity.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS 12

Formation – Solutions of first order equations – Standard types and Equations reducible to standard types – Singular solutions – Lagrange's Linear equation – Integral surface passing through a given curve – Solution of linear equations of higher order with constant coefficients.

UNIT IV APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 12

Method of separation of variables – Solutions of one dimensional wave equation and one-dimensional heat equation – Steady state solution of two-dimensional heat equation – Fourier series solutions in Cartesian coordinates.

UNIT V Z – TRANSFORM AND DIFFERENCE EQUATIONS 12

Z-transform – Elementary properties – Inverse Z-transform – Convolution theorem – Initial and final value theorems – Formation of difference equation – Solution of difference equation using Z-transform.

TOTAL: 60 PERIODS

TEXTBOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 43rd Edition, 2014.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 9th Edition, New Delhi, 2014.

REFERENCES:

1. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 2007.
2. Ramana, B.V., "Higher Engineering Mathematics", Tata McGraw Hill, 2007.
3. Bali, N.P. and Manish Goyal, "A Text Book of Engineering", 7th Edition, Lakshmi Publications (P) Limited, New Delhi, 2007.

IB7301 APPLIED THERMODYNAMICS FOR BIOTECHNOLOGISTS L T P C
3 0 0 3

UNIT I THERMODYNAMIC LAW AND PROPERTIES OF FLUIDS 9

First Law of thermodynamics, a generalized balance equation and conserved quantities,

Volumetric properties of fluids exhibiting non ideal behavior; residual properties; estimation of thermodynamic properties using equations of state; calculations involving actual property exchanges; Maxwell's relations and applications.

UNIT II SOLUTION THERMODYNAMICS 9

Partial molar properties; concepts of chemical potential and fugacity; ideal and non-ideal solutions; concepts and applications of excess properties of mixtures; activity coefficient; composition models; Gibbs Duhem equation.

UNIT III PHASE EQUILIBRIA 9

Criteria for phase equilibria; VLE calculations for binary and multi component systems; liquid-liquid equilibria and solid-solid equilibria.

UNIT IV CHEMICAL REACTION EQUILIBRIA 9

Equilibrium criteria for homogeneous chemical reactions; evaluation of equilibrium constant; effect of temperature and pressure on equilibrium constant; calculation of equilibrium conversion and yields for single and multiple reactions.

UNIT V THERMODYNAMIC DESCRIPTION OF MICROBIAL GROWTH AND PRODUCT FORMATION 9

Thermodynamics of microbial growth stoichiometry thermodynamics of maintenance, Calculation of the Operational Stoichiometry of a growth process at Different growth rates, Including Heat using the Herbert –Pirt Relation for Electron Donor, thermodynamics and stoichiometry of Product Formation

TOTAL: 45 PERIODS

TEXT BOOKS

1. Smith J.M., Van Ness H.C., and Abbot M.M. "Introduction to Chemical Engineering Thermodynamics", VIth Edition. Tata McGraw-Hill, 2003.
2. Narayanan K.V. "A Text Book of Chemical Engineering Thermodynamics", PHI, 2003.
3. Christiana D. Smolke, " The Metabolic Pathway Engineering Handbook Fundamentals", CRC Press Taylor & Francis Group, 2010.

REFERENCE

1. Sandler S.I. "Chemical and Engineering Thermodynamics", John Wiley,1989.

IB7302 BASIC INDUSTRIAL BIOTECHNOLOGY L T P C
3 0 0 3

UNIT I INTRODUCTION TO INDUSTRIAL BIOPROCESS 10

Fermentation- Bacterial, Fungal and Yeast, Biochemistry of fermentation. Traditional and Modern Biotechnology- A brief survey of organisms, processes, products. Basic concepts of Upstream and Downstream processing in Bioprocess, Process flow sheeting – block diagrams, pictorial representation.

UNIT II PRODUCTION OF PRIMARY METABOLITES 8

Primary Metabolites- Production of commercially important primary metabolites like organic acids, amino acids and alcohols.

UNIT III PRODUCTION OF SECONDARY METABOLITES 8

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

UNIT IV PRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS 11

Production of Industrial Enzymes, Biopesticides, Biofertilizers, Biopreservatives, Biopolymers Biodiesel. Cheese, Beer, SCP & Mushroom culture, Bioremediation.

UNIT V PRODUCTION MODERN BIOTECHNOLOGY PRODUCTS 8

Production of recombinant proteins having therapeutic and diagnostic applications, vaccines. Bioprocess strategies in Plant Cell and Animal Cell culture.

TOTAL: 45 PERIODS

TEXT BOOKS

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

REFERENCES

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", IInd Edition, Panima Publishing, 2000.
4. Moo-Young, Murrey, "Comprehensive Biotechnology", 4 Vols. Pergamon Press, (An Imprint of Elsevier) 2004.
5. Stanbury, P.F., A. Whitaker and S.J. Hall "Principles of Fermentation Technology", IInd Edition, Butterworth – Heinemann (an imprint of Elsevier), 1995.
6. C.F.A Bryce and EL.Mansi, Fermentation microbiology & Biotechnology, 1999.
7. K.G.Ramawat & Shaily Goyal, Comprehensive Biotechnology, 2009, S.Chand publications.

IB7303 BIOORGANIC CHEMISTRY L T P C

3 0 0 3

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. Stereochem activity around the tetrahedral carbon – optical activity - Conformation of the peptide bond.

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. Ester enolates - claisen .condensation – Michael condensation.

UNIT III KINETICS 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: 45 PERIODS

TEXT BOOKS

1. Carey, Francis A." Organic Chemistry". VIIth Edition, Tata MCGraw Hill, 2009.
2. Page, M.I. and Andrew Williams "Organic and Bio-organic Mechanisms". Pearson, 2010.

REFERENCE

1. Dugas, Hermann " Bioorganic Chemistry : A Chemical Approach to Enzyme Action" 3rd Edition, Springer, 2003.

IB7304 CELL BIOLOGY L T P C
3 0 0 3

UNIT I CELL STRUCTURE AND FUNCTION OF THE ORGANELLES 9

Prokaryotic, Eukaryotic cells, Sub-cellular organelles and functions. Principles of membrane organization membrane proteins, cytoskeletal proteins. Extra cellular matrix, cell-cell junctions, various types of transport across cell membrane.

UNIT II TECHNIQUES USED TO STUDY CELLS 9

Cell fractionation and flow cytometry, Morphology and identification of cells using microscopic studies like SEM, TEM and Confocal Microscopy. Localization of proteins in cells – Immunostaining.

UNIT III CELL DIVISION, CANCER, APOPTOSIS AND IMMORTALIZATION OF CELLS 9

Cell cycle – Mitosis, Meiosis, Molecules controlling cell cycle, cancer, role of Ras and Raf in oncogenesis and apoptosis. Stem cells, Cell culture and immortalization of cells and its applications.

UNIT IV SIGNAL TRANSDUCTION 9

Hormones as signals, Chemical classification of hormones. Peptide hormones- vasopressin, protein hormones like insulin and growth hormone. Lipid and phospholipid derived hormones- glucocorticoids, cortisol, androgens, estrogens, monoamines and thyroxine. Mechanism of action of different class of hormones.

UNIT V VITAMINS AND CO-ENZYMES 9

Fat soluble vitamins, pro vitamins, vitamins A, D, E and K- structure, physiological significance and deficiency symptoms. Water soluble vitamins and co-enzymes. Structure, functions, recommended dietary intake and deficiency symptoms of Thiamine, Riboflavin, Niacin, Folate, Vitamin B12 and biotin. Co-enzymes role in metabolic pathways: NAD, FAD, TPP, PLP and carboxy biotin.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Lodish, Harvey etal., "Molecular Cell Biology", Vth Edition, W.H.Freeman, 2005.
2. Cooper, G.M. and R.E. Hansman "The Cell : A Molecular Approach", IVth Edition, ASM Press, 2007.
3. Alberts, Bruce etal., "Molecular Biology of the Cell", IVth Edition, Garland Science (Taylors Francis), 2002.
4. Sadava, D.E. "Cell Biology : Organelle Structure and Function", Panima Publishing, 2004.
5. Rastogi, S.C. "Cell Biology" IInd Edition, New Age International, 2002.

REFERENCES

1. Becker, W.M. etal., "The World of the Cell", Vth Edition, Pearson Education, 2003.
2. Campbell, N.A., J.B. Recee and E.J. Simon "Essential Biology", IIIrd Edition,Pearson International, 2007.
3. Alberts, Bruce etal., "Essential Cell Biology", II nd Edition, Garland Press (Taylor & Francis), 2004.

IB7305 STOICHIOMETRY L T P C

3 2 0 4

UNIT I BASIC CHEMICAL CALCULATIONS 15

Dimension – Systems of units esp. engineering FPS, Engineering MKS & SI systems – Conversion from one system to the other – composition of mixtures and solutions – mass fraction, mass %, mole fraction, mole %, mass ratios, molarity, molality, normality, ppm, composition by density.

UNIT II IDEAL AND ACTUAL GAS EQUATIONS 15

Ideal and actual gas equations, Vander Walls, compressibility factor equations, Application to pure gas & gas mixtures – partial pressures, partial volumes – Air-water vapour systems, Humidity, Molar Humidity, Relative Humidity, % Saturation, humid Volume – Humidity chart – wet, Dry bulb, Dew point temperatures, pH of solutions, Vapour pressure.

UNIT III MATERIAL BALANCE 15

Material balance concept – overall & component – material balance applications for evaporator, gas absorber without reaction, Distillation (Binary system), Liquid extraction, solid-liquid extraction, crystallization, drying, Humidification, Reverse Osmosis separation and Mixing Recycle and Bypass illustration

UNIT IV CHEMICAL REACTION 15

Chemical Reaction-Limiting, excess component, Fractional conversion, Percent conversion, Fractional yield in multiple reactions. Simple problems, Combustion Reactions.

UNIT V ENERGY BALANCE 15

General energy balance equation for open systems, closed system sensible heat calculation, Heat required for phase change thermo chemistry, application of steam tables, Saturated and superheated steam application in bioprocess

TOTAL : 75 PERIODS

TEXT BOOKS:

1. Bhatt B.I & SB Thakore, Stoichiometry - Fifth edition Tata McGraw Hill 2012
2. Geankoplis C.J. “Transport process & Separation process Principles 4th edition-PHI 2006.

REFERENCE:

1. McCabe W.L & J.C.Sonith & P.Harriot “Unit operations of chemical Engineering” 6th Edn McGraw Hill 2001
2. Robert W.Fox, Alan T.McDonald & Philip J.Pritchard “Introduction to Fluid Mechanics” 6th edn John Wiley & Sons 2003.
3. Himmelblau D.M “Basic principles & Calculations in Chemical Engineering” 6th edn PHI 2006.

IB7311 BIOORGANIC CHEMISTRY LABORATORY L T P C
0 0 4 2

1. Synthesis of aspirin
2. Hydrolysis of sucrose
3. Preparation of pyruvic acid from tartaric acid
4. Preparation of oleic acid from tartaric 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 hydroxyl butonate from ethyl aceto acetate using yeast
11. Resolution of S-ethyl hydroxyl butonate using 3,5 dinitro benzoate.
12. Preparation of 5, 10, 15, 20-tetrakisphenyl porphyrin.

TOTAL: 60 PERIODS

Equipment Needed for 20 Students
Colorimeter 2
Glassware, Chemicals, Media as required

REFERENCES

1. Organic Chemistry, Francis A.Carey, VII Edition, Tata MCGraw Hill, Fourth reprint 2009.
2. Organic and Bio-organic Mechanisms, M.I. Page and Andrew Williams. Pearson, First Impression, 2010.

IB7312 CELL BIOLOGY LABORATORY L T P C
0 0 4 2

1. Introduction to principles of sterile techniques and cell propagation
2. Principles of microscopy, phase contrast and fluorescent microscopy
3. Identification of given plant, animal and bacterial cells & their components by microscopy
4. Gram's Staining
5. Leishman Staining
6. Giemsa Staining
7. Thin Layer Chromatography
8. Separation of Peripheral Blood Mononuclear Cells from blood
9. Osmosis and Tonicity
10. Tryphan Blue Assay
11. Staining for different stages of mitosis in AlliumCepa (Onion)

TOTAL : 60 PERIODS

REFERENCES

1. Rickwood, D. and J.R. Harris "Cell Biology : Essential Techniques", Johnwiley, 1996.
2. Davis, J.M. "Basic Cell Culture : A Practical Approach", IRL, 1994.

Equipment Needed for 20 Students

Autoclave	1	Incubator Shaker	1
Hot Air Oven	1	Colorimeter	2
Incubators	2	Lamina Flow Chamber	2
Light Microscopes	4		

Glassware, Chemicals, Media as required

MA7357 PROBABILITY AND STATISTICS L T P C
4 0 0 4

OBJECTIVES:

To make the students acquire a sound knowledge in statistical techniques that model engineering problems.
The Students will have a fundamental knowledge of the concepts of probability.

UNIT I RANDOM VARIABLES 12

Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma, Weibull and Normal distributions - Functions of a random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 12

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

UNIT III TESTS OF SIGNIFICANCE 12

Sampling distributions - Tests for single mean, proportion, Difference of means (large and small samples) – Tests for single variance and equality of variances – $\chi 2$- test for goodness of fit – Independence of attributes – Non-parametric tests: Test for Randomness and Rank - sum test (Wilcoxon test).

UNIT IV DESIGN OF EXPERIMENTS 12

Completely randomized design – Randomized block design – Latin square design - 2^2 - factorial design - Taguchi's robust parameter design.

UNIT V STATISTICAL QUALITY CONTROL 12

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

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Milton, J. S. and Arnold, J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, New Delhi, 4th Edition, 3rd Reprint, 2008.
2. Johnson, R.A. and Gupta, C.B., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2011.

REFERENCES:

1. Devore, J.L., "Probability and Statistics for Engineering and the Sciences", Thomson Brooks/Cole, International Student Edition, New Delhi, 7th Edition, 2008.
2. Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", Elsevier, New Delhi, 3rd Edition, 2004.
4. Spiegel, M.R., Schiller, J. and Srinivasan, R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill, New Delhi, 2004.

GE7251 ENVIRONMENTAL SCIENCE AND ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

To the study of nature and the facts about environment.

To find and implement scientific, technological, economic and political solutions to environmental problems.

To study the interrelationship between living organism and environment.

To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.

To study the dynamic processes and understand the features of the earth's interior and surface.

To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 14

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, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – 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 ex-situ conservation of biodiversity.
Field study of common plants, insects, birds
Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 8

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 – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.
Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – 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.
Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act– Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
Public awareness of environment at infant stage.
Ignorance and incomplete knowledge has lead to misconceptions.
Development and improvement in standard of living has lead to serious environmental disasters.

TEXT BOOKS:

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

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

REFERENCES:

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia',Jaico
3. Publ., House, Mumbai, 2001.
4. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD, New Delhi, 2007.
5. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press 2005.

IB7404 MASS TRANSFER OPERATIONS L T P C
3 0 0 3

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 III VAPOUR 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 IV EXTRACTION 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.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Treybal R.E. Mass Transfer Operations.IIIrd edition. Mcgraw Hill, 1981.
2. Geankoplis C.J. Transport Processes and Unit Operations. IIIrd edition, Prentice Hall of India, 2002.

REFERENCE

1. Coulson and Richardson's Chemical Engineering. Vol I & II, Asian Books Pvt Ltd, 1998.

IB7402 ENZYME TECHNOLOGY AND BIOTRANSFORMATIONS L T P C
3 0 0 3

UNIT I INTRODUCTION TO ENZYMES 9

Classification of enzymes. Mechanisms of enzyme action; concept of active site and energetics of enzyme substrate complex formation; specificity of enzyme action; principles of catalysis – collision theory, transition state theory; role of entropy in catalysis.

UNIT II KINETICS OF ENZYME ACTION 9

Kinetics of single substrate reactions; estimation of Michelis – Menten parameters, multisubstrate reactions- mechanisms and kinetics; turnover number; types of inhibition &

models –substrate, product. Allosteric regulation of enzymes, Monod Changeux Wyman model, pH and temperature effect on enzymes & deactivation kinetics.

UNIT III ENZYME IMMOBILIZATION AND BIOSENSORS 9

Physical and chemical techniques for enzyme immobilization – adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding etc., - examples, advantages and disadvantages, design of enzyme electrodes and their application as biosensors in industry, healthcare and environment.

UNIT IV PURIFICATION AND CHARACTERIZATION OF ENZYMES FROM NATURAL SOURCES 9

Production and purification of crude enzyme extracts from plant, animal and microbial sources; methods of characterization of enzymes; development of enzymatic assays

UNIT V BIOTRANSFORMATION APPLICATIONS OF ENZYMES 9

Hydrolytic- Ester bond, Amide, Epoxides, Nitriles, Reduction reactions –aldehydes, Ketones, C=C, Oxidation reactions – Alkanes, Aromatic, Baeyer-Villiger, Enzymes in organic synthesis – esters, amide, peptide , Modified and Artificial Enzymes , Catalytic antibodies

TOTAL: 45 PERIODS

REFERENCES

1. Harvey W. Blanch, Douglas S. Clark, Biochemical Engineering, Marcel Dekker, Inc.
2. James M. Lee, Biochemical Engineering, PHI, USA.
3. James. E. Bailey & David F. Ollis, Biochemical Engineering Fundamentals, McGraw Hill.
4. Wiseman, Enzyme Biotechnology, Ellis Horwood Pub.

TEXT BOOKS

1. Trevor Palmer , Enzymes IInd Horwood Publishing Ltd
2. Faber K , Biotransformations in Organic Chemistry, IV edition , Springer

IB7403 FLUID MECHANICS AND HEAT TRANSFER OPERATIONS L T P C 4 0 0 4

UNIT I FLUID PROPERTIES & FLUID MECHANICS 11

Fluid definition- compressible, in compressible fluids – coefficient of isothermal compressibility, Density, specific gravity, specific weight, surface tension, vapour pressure, viscosity. Newtonian and Non-newtonian fluids. Fluid statics – Barometric equation – application for incompressible and compressible fluids. Pressure changes in atmospheric air – Gauge and absolute pressure – pressure measurement with Bourdon gauge & manometers. Centre of pressure concept. Fluid Dynamics – equation of continuity – Bernoulli's equation – press loss in straight pipes – in fittings – expansion and contraction losses (applied to Newtonian Fluids only) Fluid flow measurement, Orifice, venture & Rotameter for Newtonian fluids.

UNIT II FLOW OF FLUID THROUGH PACKINGS 12

Fluidization, Fluid transport Industrial application of fluid flow through packing-characterics of packed bed-Bed surface area-void fraction-Laminar flow through packed bed and turbulent flow-pressure drop experienced by the fluid-equations and application problems. Fluidization phenomena-Industrial application-minimum fluidization velocities. Industrial pipes and fittings-Fluid moving machinery-pumps centrifugal, Reciprocating-gear, lobe, Peristaltic pumps, gas moving machinery-Fans, blowers, compressors. Principle of ejectors. MIXING & AGITATION - Application, Dimensional analysis, Power requirement in agitation, Liquid agitation, Gas-liquid & solid-liquid systems-agitation scale up.

UNIT III CONDUCTION HEAT TRANSFER 12

Heat transfer phenomena-thermodynamics & heat transfer. Heat conduction – Fourier's

equation –steady state conduction in plexor and radial systems – Resistance concept – series and resistance in conduction –and parallel resistance in conduction – unsteady state conduction – lumped capacity model – extended surfaces (Feris) –combined conduction & convection – 2 dimensional conduction.

UNIT IV CONVECTION HEAT TRANSFER 14

Forced and natural convection – Dimensional analysis, Dimensional numbers, Convection heat transfer coefficient, Correlations for flow over plate, through tubes, over spheres and cylinders, Agitated systems, Packed columns, condensation phenomena, Film and drop wise condensation over tubes. Billing phenomena, heat transfer coefficient.

UNIT V RADIATION HEAT TRANSFER AND HEAT TRANSFER EQUIPMENTS 11

Electromagnetic waves, energy of radiation, Planck's equation-Blackbody, Radiation exchange. Kirchhoff's law, Stefen Boltemann equation of radiant energy – Wien's law, Radiation exchange between surfaces – black, gray bodies, view factors-sample problems. Concept of overall heat transfer coefficient, Heat exchangers, types, boilers, Kettles, Heat exchanger Design concept. NTU concept-Industrial evaporators, Evaporator components. Boiling of solutions-elevation in boiling point-Disforcing rule-Factors affecting performance of evaporators, Material and energy balance in single effect evaporator – multiple effect evaporators, types of operation, simple application problems.

TOTAL : 60 PERIODS

TEXT BOOKS:

1. Geamkoplis. C.J "Transport Process & separation Process Principles" IVth Edition Prentice Hall of India 2005.
2. Heat & Mass Transfer by P. K. Nag, Tata McGraw Hill – IIIrd Edition 2003

REFERENCE:

1. Principles of Heat Transfer Frank Kreith, Raj M. Manglik VIIth edition Cenage Learning Inc Mark S. Bohn

IB7401 ANALYTICAL METHODS AND INSTRUMENTATION L T P C
3 0 0 3

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

TOTAL: 45 PERIODS

TEXT BOOKS

1. Skoog, D.A. F. James Holler, and Stanky, R.Crouch "Instrumental Methods of Analysis".. Cengage Learning , 2007.
2. Willard, Hobart, etal., "Instrumental Methods of Analysis". VIIth Edition, CBS, 1986.
3. Braun, Robert D. " Introduction to Instrumental Analysis". Pharma Book Syndicate, 1987.
4. Ewing,G.W. "Instrumental Methods of Chemical Analysis", Vth Edition, McGraw-Hill, 1985

REFERENCE

1. Sharma, B.K. "Instrumental Methods of Chemical Analysis : Analytical Chemistry" Goel Publishing House, 1972.
2. Haven, Mary C., etal., "Laboratory Instrumentation ". IVth Edition, John Wiley, 1995.

IB7412 INSTRUMENTATION METHOD OF ANALYSIS LAB L T P C
0 0 4 2

1. Precision and validity in an experiment using absorption spectroscopy .
2. Validating Lambert-Beer's law using $KMnO_4$
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 SO_4-- by nephelometry.
8. Estimation of Al^{3+} by Flourimetry.
9. Limits of detection using aluminium alizarin complex.
10. Chromatography analysis using TLC.
11. Chromatography analysis using column chromatography.

TOTAL : 60 PERIODS

REFERENCES

1. Skoog, D.A. etal. "Principles of Instrumental Analysis", Vth Edition, Thomson / Brooks – Cole,1998.
2. Braun, R.D. "Introduction to Instrumental Analysis", Pharma Book Syndicate, 1987.
3. Willard, H.H. etal. "Instrumental Methods of Analysis", VIth Edition, CBS, 1986.
4. Ewing,G.W. "Instrumental Methods of Chemical Analysis", Vth Edition, McGraw-Hill, 1985.

Equipment Needed for 20 Students

Colorimeter 2
Glassware, Chemicals, Media as required

IB7411 CHEMICAL ENGINEERING LAB L T P C
0 0 4 2

1. Flow measurement a) Orifice meter b) Venturimeter, c) Rotameter
2. Pressure drop flow in pipes
3. Pressure drop in flow through packed column
4. Pressure drop in flow through fluidized beds
5. Characteristics of centrifuge pump
6. Flate and frame filter press
7. Filteration in leaf filter
8. Heat transfer characteristics in heat exchanger
9. Simple and steam distillation
10. HETP in packed distillation
11. Ternary equilibrium in liquid-liquid extraction
12. Adsorption isotherm
13. Drying characteristics in a pan dryer

Equipment Needed for 20 Students

Colorimeter	2	Venturimeter	1
Filter leaf	1	Rotameter	1
Orifice meter	1		

Glassware, Chemicals, Media as required

TOTAL : 60 PERIODS

IB7551 BIOPROCESS ENGINEERING L T P C
3 0 0 3

UNIT I OVERVIEW OF FERMENTATION PROCESSES 6

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 10

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 6

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 12

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 11

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. Biomass estimation – Direct and Indirect methods.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Shuler, Michael L. and Fikret Kargi, " Bioprocess Engineering ", Prentice Hall, 1992.
2. Doran, Pauline "of Bioprocess Engineering Principles ". Elsevier, 1995

REFERENCES

1. Lydersen, Bjorn K. "Bioprocess Engineering Systems, Equipment and Facilities" John Wiley, 1994.
2. Bailey, James E. and David F. Ollis, " Biochemical Engineering Fundamentals", IInd Edition. McGraw Hill , 1986.
3. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, Principles of Fermentation Technology, Science & Technology Books.
4. Harvey W. Blanch, Douglas S. Clark, Biochemical Engineering, Marcel Dekker, Inc.

IB7552 CHEMICAL REACTION ENGINEERING L T P C
3 0 0 3

OBJECTIVES:

- To provide the basic concepts of types of reactions, variable affecting the rate of reaction, predicting the rate equations for different types of reactions.
- To provide the information about different reactor systems, deriving the performance equations and predicting the rate equations in chemical reaction engineering system.

UNIT I SCOPE OF CHEMICAL KINETICS & CHEMICAL REACTION ENGINEERING 8

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 10

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

UNIT III IDEAL FLOW AND NON IDEAL FLOW 10

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

UNIT IV GAS-SOLID, GAS-LIQUID REACTIONS 9

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

UNIT V FIXED BED AND FLUID BED REACTORS 8

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

TOTAL: 45 PERIODS

OUTCOMES:

The student will be able to

- Write the rate equation for any type of reaction.
- Design reactors for heterogeneous reactions and optimize operating conditions.
- Relate and calculate the conversions, concentrations and rates in a reaction and identify, formulate and solve chemical engineering problems.

TEXT BOOKS:

1. Levenspiel O. Chemical Reaction Engineering. IIIrd Edition. John Wiley.1999.
2. Fogler H.S. Elements Of Chemical Reaction Engineering. Prentice Hall India.2002

REFERENCES:

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", Ist Edition, Central Techno Publications, 2001.

3. Richardson, J.F. and Peacock, D.G., "Coulson Richardson - Chemical Engineering", Vol.III, III[rd] Edition, Butterworth- Heinemann- Elsevier, 2006.

IB7501 MOLECULAR BIOLOGY L T P C
3 0 0 3

UNIT I CHEMISTRY OF NUCLEIC ACIDS 10

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 10

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 III TRANSCRIPTION 8

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 IV TRANSLATION 10

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. Post-translational modifications and its importance.

UNIT V REGULATION OF GENE EXPRESSION 7

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: 45 PERIODS

TEXT BOOKS

1. Friefelder, David. " Molecular Biology." Narosa Publications, 1999
2. Weaver, Robert F. " Molecular Biology" IInd Edition, Tata McGraw-Hill, 2003.
1. Karp, Gerald " Cell and Molecular Biology : Concepts and Experiments" IVth Edition, John Wiley, 2005.
2. Friefelder, David and George M. Malacinski "Essentials of Molecular Biology" IInd Edition, Panima Publishing, 1993.

REFERENCES

1. Tropp, Burton E. " Molecular Biology : Genes to Proteins". IIIrd Edition. Jones and Bartlett,

2008.
2. Glick , B.R. and J.J. Pasternak. “Molecular Biotechnology : Principles and Applications of Recombinant DNA” 4th Edition. ASM, 2010.

IB7502 PROTEIN STRUCTURE - FUNCTION RELATIONSHIP L T P C
3 0 0 3

UNIT I BONDS, ENERGIES, BUILDING BLOCKS OF PROTEINS 10

Covalent, Ionic, Hydrogen, Coordinate, hydrophobic and Vander walls interactions in protein structure. Interaction with electromagnetic radiation (radio, micro, infrared, visible, ultraviolet, X-ray) and elucidation of protein structure. Amino acids (the students should be thorough with three and single letter codes) and their molecular properties (size, solubility, charge, pKa), Chemical reactivity in relation to post-translational modification (involving amino, carboxyl, hydroxyl, thiol, imidazole groups).

UNIT II PROTEIN ARCHITECTURE 10

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-turn-beta (hairpin), beta-sheets, alpha-beta-alpha, topology diagrams, up and down & TIM barrel structures nucleotide binding folds, prediction of substrate binding sites.

UNIT III TERTIARY STRUCTURE 5

Tertiary structure: Domains, folding, denaturation and renaturation, overview of methods to determine 3D structures. Quaternary structure: Modular nature, formation of complexes. Computer exercise on the above aspects

UNIT IV STRUCTURE-FUNCTION RELATIONSHIP 10

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, Trans-membrane segments, prediction, bacteriorhodopsin and Photosynthetic reaction center, Immunoglobulins: IgG Light chain and heavy chain architecture, abzymes and Enzymes: Serine proteases, understanding catalytic design by engineering trypsin, chymotrypsin and elastase, substrate-assisted catalysis other commercial applications.
Computer exercise on the above aspects

UNIT V PROTEOMICS 10

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

Computer exercise on the above aspects

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Branden C. and Tooze J., “Introduction to Protein Structured” 2nd Edition, Garland Publishing, 1999.
2. Creighton T.E. “Proteins” 2nd Edition. W.H. Freeman, 1993.
3. Pennington, S.R and M.J. Dunn, “Proteomics : Protein Sequence to Function”. Viva Books, 2002
4. Liebler, “Introduction to Proteomics” Humana Press, 2002.

REFERENCES

1. Voet D. and Voet G., "Biochemistry". 3rd Edition. John Wiley and Sons, 2008.
2. Haggerty, Lauren M."Protein Structure : Protein Science and Engineering".Nova Science Publications, 2011.
3. Williamson, Mike "How Proteins Work". Garland Science, 2012.

IB7511 BIOPROCESS LABORATORY – I L T P C
0 0 4 2

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/ Cross linking
6. Enzymatic conversion in Packed bed Column/Fluidized bed Column
7. Growth of Bacteria – Estimation of Biomass, Calculation of Specific Growth Rate, Yield Coefficient
8. Growth of Algae – Estimation of Biomass, Calculation of Specific Growth Rate, Yield Coefficient
9. Medium optimization – Plackett Burman Design
10. Medium optimization – Response Surface Methodology

TOTAL: 60 PERIODS

Equipment Needed for 20 Students

Autocalve	1	Incubator Shaker	1
Hot Air Oven	1	Colorimeter	2
Incubators	2	Laminar Flow Chamber	2
Light Microscopes	4		

Glassware, Chemicals, Media as required

REFERENCES

1. Bailey and Ollis, " Biochemical Engineering Fundamentals", McGraw Hill (2nd Ed.), 1986.
2. Shuler and Kargi, " Bioprocess Engineering ", Prentice Hall, 1992.
3. Pauline Doran, Bioprocess Engineering Calculation, Blackwell Scientific Publications.
4. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, Principles of Fermentation Technology, Science & Technology Books.

IB7512 MOLECULAR BIOLOGY LABORATORY L T P C
0 0 4 2

1. Isolation of bacterial DNA
2. Isolation of plant cell and animal cell genomic DNA
3. Agarose gel electrophoresis
4. Restriction enzyme digestion
5. Competent cells preparation
6. Transformation
7. Blue and white selection for recombinants
8. Plating of λ phage
9. Lamda phage lysis of liquid cultures

TOTAL: 60 PERIODS

Equipment Needed for 20 Students

Electrphoresis Kit	1	Incubator Shaker	1
PCR	1	Spectrophotometer	2
Incubators	2	Laminar Flow Chamber	2
Light Microscopes	4		

Glassware, Chemicals, Media as required

REFERENCE

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

GE7652 TOTAL QUALITY MANAGEMENT L T P C
3 0 0 3

AIM

To provide comprehensive knowledge about the principles, practices, tools and techniques of Total quality management.

OBJECTIVES

To understand the need for quality, its evolution, basic concepts, contribution of quality gurus, TQM framework, Barriers and Benefits of TQM.
To understand the TQM Principles.
To learn and apply the various tools and techniques of TQM.
To understand and apply QMS and EMS in any organization.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts of TQM –-Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES 9

Leadership--The Deming Philosophy, Quality council, Quality statements and Strategic planning-- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal--Continuous process improvement –Juran Trilogy, PDSA cycle, 5s and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma Process Capability– Bench marking – Reasons to bench mark, Bench marking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Bench Marking – FMEA – Intent of FMEA, FMEA Documentation, Stages, Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures-- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM 9

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration--**ENVIRONMENTAL MANAGEMENT SYSTEM:** Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

TOTAL: 45 PERIODS

OUTCOMES:

Ability to apply TQM concepts in a selected enterprise.
Ability to apply TQM principles in a selected enterprise.
Ability to apply the various tools and techniques of TQM.

Ability to apply QMS and EMS in any organization.

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", (6th Edition), South-Western (Thomson Learning), 2005.
2. Oakland, J.S. "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, Third Edition, 2003.
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006 .
4. Janakiraman,B and Gopal, R.K, "Total Quality Management – Text and Cases",Prentice Hall (India) Pvt. Ltd., 2006.

IB7601 BIOPROCESS TECHNOLOGY L T P C
3 0 0 3

UNIT I OPERATIONAL MODES OF BIOREACTORS 10

Fed batch cultivation, Cell recycle cultivation, Cell recycle cultivation in waste water treatment, two stage cultivation Packed bed reactor, airlift reactor, fluidized bed reactor bubble column reactors

UNIT II BIOREACTOR SCALE – UP 8

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 8

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 12

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 7

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: 45 PERIODS

REFERENCES

1. Anton Moser, "Bioprocess Technology, Kinetics and Reactors", , Springer Verlag.
2. James E. Bailey & David F. Ollis, Biochemical Engineering Fundamentals, McGraw Hill.
3. James M. Lee, Biochemical Engineering, PHI, USA.
4. Atkinson, Handbook of Bioreactors,Harvey W. Blanch, Douglas S. Clark, Biochemical Engineering, Marcel Decker Inc.
5. Shuler and Kargi, " Bioprocess Engineering ", Prentice Hall, 1992.

Attested

DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025.

6. Pauline Doran, Bioprocess Engineering Calculation, Blackwell Scientific Publications. Harvey W. Blanch, Douglas S. Clark, Biochemical Engineering, Marcel Dekker, Inc

IB7602 GENETIC ENGINEERING L T P C
4 0 0 4

UNIT I BASICS OF RECOMBINANT DNA TECHNOLOGY 12

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 12

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

UNIT III SEQUENCING AND AMPLIFICATION OF DNA 12

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 12

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 12

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 : 60 PERIODS

TEXT BOOKS

1. Old RW, Primrose SB, "Principles Of Gene Manipulation, An Introduction To Genetic Engineering ", Blackwell Science Publications, 1993.
2. Principles of Genome Analysis and Genomics by S.B.Primrose and R.M.Twyman, Third Edition (Blackwell Publishing)

REFERENCES

1. Ansubel FM, Brent R, Kingston RE, Moore DD, "Current Protocols In Molecular Biology "Greene Publishing Associates, NY, 1988.
2. Berger Sl, Kimmer AR, "Methods In Enzymology", Vol 152, Academic Press, 1987.
3. Genomes 3 by T.A.Brown, Third Edition (Garland Science Publishing)

IB7611 BIOPROCESS LABORATORY II L T P C
0 0 4 2

1. Batch Sterilization kinetics
2. Batch cultivation with exhaust gas analysis.
3. Estimation of KLa – Dynamic Gassing-out method,
4. Estimation of KLa – Sulphite Oxidation Method
5. Estimation of KLa – Power Correlation Method
6. Fed batch cultivation and Total cell retention cultivation
7. Algal cultivation-Photobioreactor
8. Residence time distribution

9. Estimation of Overall Heat Transfer Coefficient
10. Estimation of Mixing Time in reactor

TOTAL : 60 PERIODS

Equipment Needed for 20 Students

Electrphoresis Kit	1		
Reactors	6	Incubator Shaker	1
Incubators	2	Spectrophotometer	2
Light Microscopes	1	Laminar Flow Chamber	1
Glassware, Chemicals, Media	as required		

REFERENCES

1. Anton Moser, "Bioprocess Technology, Kinetics and Reactors", , Springer Verlag.
2. James E. Bailey & David F. Ollis, Biochemical Engineering Fundamentals, McGraw Hill.
3. James M. Lee, Biochemical Engineering, PHI, USA.
4. Atkinson, Handbook of Bioreactors,Harvey W. Blanch, Douglas S. Clark, Biochemical Engineering, Marcel Decker Inc.

IB7612 GENETIC ENGINEERING LABORATORY L T P C
0 0 4 2

1. Preparation of plasmid DNA
2. Elution of DNA from agarose gels
3. Ligation of DNA into expression vectors
4. Transformation
5. Optimisation of inducer concentration for recombinant protein expression
6. Optimisation of time of inducer for recombinant protein expression
7. SDS-PAGE
8. Western blotting
9. Hybridisation with anti-sera
10. PCR.

TOTAL : 60 PERIODS

Equipment Needed for 20 Students

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

REFERENCES

1. Old RW, Primrose SB, "Principles Of Gene Manipulation, An Introduction To Genetic Engineering ", Blackwell Science Publications, 1993.
2. Ansubel FM, Brent R, Kingston RE, Moore DD, "Current Protocols In Molecular Biology ", Greene Publishing Associates, NY, 1988.
3. Berger Sl, Kimmer AR, "Methods In Enzymology", Vol 152, Academic Press, 1987

IB7752 DOWNSTREAM PROCESSING L T P C
3 0 0 3

OBJECTIVES:

To enable the students to

- Understand the methods to obtain pure proteins, enzymes and in general about product development R & D
- Have depth knowledge and hands on experience with on Downstream processes required in multi-factorial manufacturing environment in a structured and logical fashion

UNIT I DOWNSTREAM PROCESSING 10

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 6

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

UNIT III ISOLATION OF PRODUCTS 12

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

UNIT IV PRODUCT PURIFICATION 12

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

UNIT V FINAL PRODUCT FORMULATION AND FINISHING OPERATIONS 5

Crystallization, drying and lyophilization in final product formulation.

TOTAL : 45 PERIODS

OUTCOMES:

Upon success completion of this course, the students will be able to:

- Define the fundamentals of downstream processing for product recovery
- Understand the requirements for successful operations of downstream processing
- Describe the components of downstream equipment and explain the purpose of each
- Apply principles of various unit operations used in downstream processing and enhance problem solving techniques

TEXT BOOKS:

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.
3. Asenjo, Juan A. “Separation Processes in Biotechnology”. CRC / Taylor & Francis, 1990.

REFERENCES

1. Ghosh, Raja “Principles of Bioseparations Engineering”. World Scientific, 2006
2. “Product Recovery in Bioprocess Technology”. (BIOTOL – Biotechnology by Open Learning Series). Butterworth – Heinmann / Elsevier, 2004.

IB7753 IMMUNOLOGY LT P C
3 0 0 3

OBJECTIVES:

- To discuss the structure, functions and integration of immune system.
- To explain the antigen-antibody interactions and how the immune system is protecting the body from foreign pathogens/germs.
- To explain various techniques of monoclonal and engineered antibodies (important therapeutic molecules) production, for treating most of the human diseases.

UNIT I INTRODUCTION TO IMMUNE SYSTEM 10

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

UNIT II HUMORAL AND CELLULAR IMMUNITY 10

Development, maturation, activation, regulation, differentiation and classification of T-cells and B-cells, 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 10

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 8

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 7

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

TOTAL: 45 PERIODS

OUTCOMES:

- The students after completing the course would be aware of immune system structure and functions.
- The students would be aware of immunity to various pathogens
- The students would be aware of the principles behind the production of therapeutic/diagnostic molecules.
- The students would be aware of the concepts and mechanism behind tumour development, allergy and hypersensivity reactions.

TEXT BOOKS:

1. Roitt I, Male, Brostoff. Immunology, Mosby Publ., XIIth edition 2011. 52
2. Kuby J, Immunology, WH Freeman & Co., 7th Edition 2012.
3. Ashim K. Chakravarthy, Immunology, Tata McGraw-Hill, 2006.

REFERENCES:

1. Coico, Richard “Immunology: A Short Course” VIth Edition. John Wiley, 2008.
2. Khan, Fahim Halim “Elements of Immunology” Pearson Education, 2009.

IB7751 BIOINFORMATICS L T P C
3 2 0 4

UNIT I 15

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

UNIT II 15

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

UNIT III 15

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

UNIT IV **15**

Machine learning techniques: Artificial Neural Networks in protein secondary structure prediction, Hidden Markov Models for gene finding, Decision trees, Support Vector Machines. Introduction to Systems Biology and Synthetic Biology, Microarray analysis, DNA computing, Bioinformatics approaches for drug discovery, Applications of informatics techniques in genomics and proteomics: Assembling the genome, STS content mapping for clone contigs, Functional annotation, Peptide mass fingerprinting.

UNIT V **15**

Basics of PERL programming for Bioinformatics: Data types: scalars and collections, operators,
Program control flow constructs, Library Functions: String specific functions, User defined functions, File handling.

TOTAL : 75 PERIODS

TEXT BOOKS

1. Introduction to Bioinformatics by Arthur K. Lesk , Oxford University Press.
2. Algorithms on Strings, Trees and Sequences by Dan Gusfield, Cambridge University Press.
3. Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids by R.Durbin, S.Eddy, A.Krogh, G.Mitchison.
4. Bioinformatics Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press.
5. Beginning Perl for Bioinformatics: An introduction to Perl for Biologists by James Tindall, O'Reilley Media

REFERENCE

1. Bioinformatics The Machine Learning Approach by Pierre Baldi and Soren Brunak.

IB7711 DOWNSTREAM PROCESSING LABORATORY **L T P C**
0 0 4 2

1. Solid liquid separation – centrifugation, microfiltration
2. Cell disruption techniques – ultrasonication, French pressure cell
3. Cell disruption techniques – dynomill – batch and continuous
4. Precipitation – ammonium sulphite precipitation
5. Ultra filtration separation
6. Aqueous two phase extraction of biologicals
7. High resolution purification – affinity chromatography
8. High resolution purification – ion exchange chromatography
9. Product polishing – spray drying, freeze drying

TOTAL: 60 PERIODS

List of equipments for 30 students

Centrifuge	1	Sonicator	1
Cross flow filtration set up	2	French press	1
FPLC	1		

REFERENCES

1. P.A. Belter, E.L. Cussler And Wei-Houhu – Bioseparations – Downstream Processing For Biotechnology, Wiley Interscience Pun. (1988).

2. R.O. Jenkins, (Ed.) – Product Recovery In Bioprocess Technology – Biotechnology By Open Learning Series, Butterworth-Heinemann (1992).
3. J.C. Janson And L. Ryden, (Ed.) – Protein Purification – Principles, High Resolution Methods And Applications, VCH Pub. 1989.

IB7712 IMMUNOLOGY LABORATORY L T P C
0 0 4 2

1. Handling of animals, immunization and raising antisera
2. Identification of cells in a blood smear
3. Identification of blood group
4. Immunodiffusion & immunoelectrophoresis
5. Testing for typhoid antigens by Widal test
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 : 60 PERIODS

List of equipments for 30 students

Elisa reader	1	Vortex mixer	4
Microscopes	8	Table top refrigerated Centrifuge	1
Microwave owen	1	Fluorescent microsope	1
Hot plate	4		

REFERENCES

1. Roitt I, Male, Brostoff. Immunology, Mosby Publ., 2002.
2. Kuby J, Immunology, WH Freeman & Co., 2000.
3. Ashim K. Chakravarthy, Immunology, TataMcGraw-Hill, 1998.

IB7001 ADVANCED BIOCHEMISTRY L T P C
3 0 0 3

UNIT I METABOLISM OF AMINO ACIDS 10

Biosynthesis of Gly, Ser and Cys; Biosynthesis of six essential amino acids (Met, Thr, Lys, Ile, Val, Leu) and regulation of branched chain amino acids (concerted inhibition, allosteric regulation and enzyme multiplicity, sequential feedback) from oxaloacetate and pyruvate;Biosynthesis of aromatic amino acids. Metabolic disorders associated with branched chain and aromatic amino acid degradation. Important molecules derived from amino acids (auxins, DOPA, Serotonin, porphyrins, T3, T4, Adrenaline, Noradrenaline, histamine, GABA, polyamines etc)

UNIT II PROTEIN TRANSPORT AND DEGRADATION 5

Protein targeting, signal sequence, secretion; Folding, Chaperons and targeting of organelle proteins, Protein degradation, receptor-mediated endocytosis, turnover.

UNIT III METABOLISM OF NUCLEIC ACIDS, POLYSACCHARIDES AND LIPIDS 12

Biosynthesis of nucleotides, denovo and salvage pathways for purines and pyrimidines, regulatory mechanisms: Degradation of nucleic acid by exo and endo nucleases. Biosynthesis and degradation of starch and glycogen. Triacylglycerol and phospholipid biosynthesis and degradation; Cholesterol biosynthesis and regulation and targets and action of cholesterol

lowering drugs.

UNIT IV VITAMINS AND COENZYMES 9

Fat Soluble Vitamins, provitamins (A, D, E and K). Structure,physiological significance and deficiency symptoms. Water soluble vitamins, structure, coenzyme role and deficiency symptoms. Thiamine,riboflavin, pyridoxine, niacin, folic acid, biotin and Vitamin B12.
Recommended dietary intake. Coenzymes: Their role in metabolic pathways.NAD, FAD,TPP, PLP, carboxy biotin

UNIT V HORMONES 9

Introduction. Effects of Hormones. Chemical classification of hormones.Peptide hormone-vasopressin, protein hormone- insulin. Lipid and phospholipid derived hormones-prostaglandin and phospholipids. Steroid hormones-testosterone, estrogen, cortisol. Monoamines: thyroxine, adrenaline. Mechanism of action of the different classes of hormones.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Nelson, D.L et al., “Lehninger’s Principles of Biochemistry” Stryer, Lubert. “Biochemistry”. IVth Edition, W.H Freeman & Co., 2000.
2. Voet, D.J and J.G. Voet and C.W. Pratt “Principles of Biochemistry” IIIrd Edition, John Wiley & Sons Inc., 2008.
3. Murray, R.K., et al., “Harper’s Illustrated Biochemistry”. XXVIIth Edition. McGraw-Hill, 2006.

REFERENCES

1. Creighton. T.E., “Proteins: Structure and Molecular Properties” IInd Edition, W.H. Freeman and Co.,1993.
2. Salway, J.G., “Metabolism at a Glance”. IInd Edition, Blackwell Science Ltd., 2000.

IB7002 ANIMAL BIOTECHNOLOGY L T P C
3 0 0 3

UNIT I ANIMAL CELL CULTURE 12

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 AND THEIR DIAGNOSIS 10

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 III THERAPY OF ANIMAL DISEASES 12

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 IV MICROMANIPULATION OF EMBRYO’S 6

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 5

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: 45 PERIODS

TEXT BOOKS

1. Ranga M.M. Animal Biotechnology. Agrobios India Limited, 2002
2. Ramadass P, Meera Rani S. Text Book Of Animal Biotechnology. Akshara Printers, 1997.

REFERENCE

1. Masters J.R.W. Animal Cell Culture: Practical Approach. Oxford University Press.2000

IB7003 BIO- INDUSTRIAL ENTREPRENEURSHIP AND IPR L T P C
3 0 0 3

UNIT-I: 9

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

UNIT-II: 9

- Develop a Business Plan

UNIT-III: 9

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

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 : 45 PERIODS**

TEXT BOOK

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

IB7005 BIOPHARMACEUTICAL TECHNOLOGY L T P C
3 0 0 3

UNIT I INTRODUCTION 7

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 III MANUFACTURE OF DRUGS, PROCESS AND APPLICATIONS 7

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

UNIT IV PRINCIPLES OF DRUG MANUFACTURE 15

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 7

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

TOTAL: 45 PERIODS

TEXTBOOK

1. Finkel, Richard, etal., "Lippincott's Illustrated Reviews Pharmacology" IVth Edition. Wolters Kluwer / Lippincott Williams & Wilkins, 2009.

REFERENCES

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

IB7006 BIOPHYSICS L T P C
3 0 0 3

UNIT I MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEMS 9

Intramolecular 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 nucleic acids.

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 OF BIOLOGICAL SYSTEMS 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 : 45 PERIODS

TEXTBOOKS

1. Biophysics ; R. Glaser, Springer Verlag , 2000.
2. Biophysics: Molecules In Motion ; R. Duane. Academic Press , 1999

REFERENCE

1. Cantror, Charles R. and Paul R. Schimmel "Biophysical Chemistry" . 1-3 Vols. W.H.Freeman & Co.,1980.

IB7008 CANCER BIOLOGY L T P C
3 0 0 3

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 12

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

UNIT III PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER 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 IV PRINCIPLES 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 6

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 : 45 PERIODS

TEXTBOOKS

1. Weinberg, R.A. “The Biology of Cancer” Garland Science, 2007
2. McDonald, F etal., “ Molecular Biology of Cancer” IInd Edition. Taylor & Francis, 2004.

REFERENCES

1. King, Roger J.B. “Cancer Biology” Addison Wesley Longman, 1996.
2. Ruddon, Raymond W. “ Cancer Biology” IIIrd Edition . Oxford University Press, 1995.

IB7007 BIOSAFETY AND HAZARD MANAGEMENT L T P C
3 0 0 3

AIM

- To introduce awareness on the importance of plant safety and risk analysis

OBJECTIVES

- Students learn about implementation of safety procedures, risk analysis and assessment, hazard identification

UNIT I 9

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

UNIT II 9

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

UNIT III 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 IV 9

Hazard identification safety audits, checklist, what if analysis, vulnerability models event tree analysis fault tree analysis, Hazan past accident analysis Fixborough-Mexico-Madras-VizagBopal analysis.

UNIT V **9**

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

TOTAL : 45 PERIODS

TEXT BOOKS

1. Fawatt, H.H. and Wood, W.S., "Safety and Accident Prevention in Chemical Operation", Wiley Interscience, 1965.
2. Marcel, V.C., Major Chemical Hazard- Ellis Harwood Ltd., Chi Chester, UK, 1987.
3. Skeleton, B., Process Safety Analysis : An introduction, Institution of chemical Engineers, U.K., 1997.
3. Hyatt, N., Guidelines for process hazards analysis, hazards identification & risk analysis, Dyadem Press, 2004.

REFERENCES

1. Handley, W., "Industrial Safety Hand Book ", 2nd Edn., McGraw-Hill Book Company,1969.
2. Heinrich, H.W. Dan Peterson, P.E. and Rood, N., "Industrial Accident Prevention", McGraw-Hill Book Co., 1980.
3. Chemical Process Safety: Fundamentals with Applications, Daniel A. Crowl, J.F. Louvar, Prentice Hall, NJ, 1990.
4. Taylor, J.R., Risk analysis for process plant, pipelines and transport, Chapman and Hall, London, 1994

IB7019 SYMBOLIC MATHEMATICS **L T P C**
3 0 0 3

UNIT I INTRODUCTION TO MATLAB **9**

Introduction - Operations with variables – Arrays - Multidimensional Arrays - Element by Element operations - Polynomial operations using arrays - Cell Arrays - Structure arrays - Writing script files - Logical variables and operators- Flow control- Loop operators- Writing functions- Input/ output arguments- Function visibility, path.- Simple graphics- 2D plots- Figures and subplots

UNIT II DATA AND DATA FLOW IN MATLAB **9**

Data types- Matrix, string -cell and structure- Creating, accessing elements and manipulating of data of different types - File Input-Output- Matlab files- Text files- Binary files - Mixed text-binary files- Communication with external devices- Serial port- Parallel port- Sound card-Video input

UNIT III FUNCTIONS & FILES **9**

Elementary Mathematical Functions - User Defined Functions - Advanced Function Programming - Working with Data Files, Introduction to Numerical Methods -Linear algebra-numerical integration and differentiation- solving systems of ODE's and interpolation of data.

UNIT IV PROGRAMMING TECHNIQUES & DATA VISUALIZATION AND STATISTICS **9**

Program Design and Development - Relational Operators and Logical Variables Logical Operators and Functions - Conditional Statements -Loops - Basic statistical tools in Matlab,XY-plotting functions - Subplots and Overlay plots - Special Plot types - Interactive plotting - Designing GUI interfaces using Matlab's GUIDE interface.

UNIT V FUNDAMENTALS OF VIRTUAL INSTRUMENTATION & DATA ACQUISITION **9**

Concept of virtual instrumentation (VI)– LabVIEW software- basics- Creating, Editing and debugging a VI in LabVIEW- Creating a sub VI- Loops and charts- data acquisition with LabVIEW-plug-in DAQ boards- Organization of the DAQ VI System- Performing analog input and analog output- Scanning multiple analog channels- Driving the digital I/Os- Buffered data acquisition

Attested

DIRECTOR
Centre For Academic Courses
Anna University, Chennai-600 025.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Essential Matlab for Engineers and Scientists (Fourth Edition). Copyright © 2010 Elsevier Ltd. Author(s): Brian H. Hahn and Daniel T. Valentine ISBN: 978-0-12-374883-6
2. Rahman, and Herbert Pichlik,, 'LabVIEW – Applications and Solutions', National Instruments Release, ISBN 01309642392. National Instruments LabVIEW Manual

ONLINE MATLAB TUTORIALS AND REFERENCES:

1. Tutorials offered by The Mathworks .The creators of Matlab.
2. Introductory Matlab material from Indiana University
3. A practical introduction to Matlab from Michigan Tec
4. Links to Matlab tutorials, references, books, packages, etc. - The Math Department at UIC

MATLAB guides Provided with the Matlab installation

1. Getting Started with Matlab
2. Using Matlab
3. Using Graphs in Matlab
4. Using GUIs in Matlab

For links to these documents visit Dr. Randy Jost's web page (USU ECE Department). For other links related to Matlab,

IB7004 BIOETHICS L T P C
3 0 0 3

UNIT I 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 – Professions and Professionalism – Professional Ideals and Virtues – Uses of Ethical Theories

UNIT II ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Research Ethics - Codes of Ethics – Industrial Standards - A Balanced Outlook on Law – The Challenger Case Study

UNIT III ENGINEER'S RESPONSIBILITY FOR SAFETY 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis – Reducing Risk – The Government Regulator's Approach to Risk - Chernobyl and Bhopal Case Studies.

UNIT IV RESPONSIBILITIES AND RIGHTS 9

Collegiality and Loyalty – 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 – Business Ethics - Environmental Ethics – Computer Ethics - Role in Technological Development – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Honesty – Moral Leadership – Sample Code of Conduct.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York (2005).
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics – Concepts and Cases", Thompson Learning, (2000).

REFERENCES

1. Charles D Fleddermann, “Engineering Ethics”, Prentice Hall, New Mexico, (1999).
2. John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, (2003)
3. Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, (2001)
4. Prof. (Col) P S Bajaj and Dr. Raj Agrawal, “Business Ethics – An Indian Perspective”, Biztantra, New Delhi, (2004)
5. David Ermann and Michele S Shauf, “Computers, Ethics and Society”, Oxford University Press, (2003)

IB7013 MOLECULAR MODELING L T P C
3 0 0 3

UNIT I INTRODUCTION TO CLASSICAL MECHANICS 9

Newtons laws of motion – time intervals- algorithms

UNIT II INTRODUCTION TO STATISTICAL MECHANICS 9

Boltzman’s Equation – Ensembles – Distribution law for non interacting molecules – Statistical mechanics of fluids.

UNIT III QUANTUM MECHANICS 9

Photoelectric effect – De Broglies hypothesis – Uncertainity principle – Schrodingers time independent equation – particle in a one -dimensional box.

UNIT IV GROMOS , GROMACS , AMBER & DOCK 9

Various forcefields for proteins and nucleic acids – Molecular mechanics – Molecular dynamics
– Molecular dynamics simulations in water and organic solvents.

UNIT V GAUSSIAN 03 9

Preparing input files – job types – model chemistries – basis sets – molecule specifications running Gaussian – examples.

TOTAL : 45 PERIODS

TEXTBOOKS

1. Leach, Andrew R. “ Molecular Modelling : Principles and Applications” IInd Edition, Pearson, 2010.
2. Cohen, N.C. “ Guide Book on Molecular Modeling in Drug Design” Academic Press/ Elsevier, 1996.

REFERENCES

1. Statistical Mechanics ; D. McQuarrie, Narosa, 1999.
2. Quantum Mechanics; D. McQuarrie, Narosa, 1999.
3. GROMOS Handbook.

IB7014 MOLECULAR PATHOGENESIS OF INFECTIOUS DISEASES L T P C
3 0 0 3

UNIT I OVERVIEW 5

Historical perspective - discovery of microscope, Louis Pasteur’s contributions, Robert Koch’s postulates, early discoveries of microbial toxins, toxic assays, vaccines, antibiotics and birth of molecular genetics and modern molecular pathogenesis studies, Various pathogen types and modes of entry.

UNIT II HOST-DEFENSE AGAINST PATHOGENS AND PATHOGENIC STRATEGIES 8

Attributes & components of microbial pathogenesis, Host defense: skin, mucosa, cilia, secretions, physical movements, limitation of free iron, antimicrobial compounds, mechanism

of killing by humoral and cellular defense mechanisms, complements, inflammation process, general disease symptoms, Pathogenic adaptations to overcome the above defenses.

UNIT III MOLECULAR PATHOGENESIS (WITH SPECIFIC EXAMPLES) 16

Virulence, virulence factors, virulence- associated factors and virulence lifestyle factors, molecular genetics and gene regulation in virulence of pathogens, Vibrio Cholerae: Cholera toxin, co-regulated pili, filamentous phage, survival E.coli pathogens: Enterotoxigenic E.coli (ETEC), labile & stable toxins, Entero- pathogenic E.coli (EPEC), type III secretion, cytoskeletal changes, intimate attachment; Enterohaemerrohogic E.coli (EHEC), mechanism of bloody diarrhoea and Hemolytic Uremic Syndrome, Enteroaggregative E.coli

(EAEC). Shigella: Entry, macrophage apoptosis, induction of macropinocytosis, uptake by epithelial cells, intracellular spread, inflammatory response, tissue damage Plasmodium: Life cycle, erythrocyte stages, transport mechanism and processes to support the rapidly growing schizont, parasitiparous vacuoles, and knob protein transport, Antimalarials based on transport processes. Influenza virus: Intracellular stages, Neuraminidase & Haemagglutinin in entry, M1 & M2 proteins in assembly and disassembly, action of amantidine.

UNIT IV EXPERIMENTAL STUDIES ON HOST-PATHOGEN INTERACTIONS 8

Virulence assays: adherence, invasion, cytopathic, cytotoxic effects. Criteria & tests in identifying virulence factors, attenuated mutants, molecular characterization of virulence factors, signal transduction & host responses

UNIT V MODERN APPROACHES TO CONTROL PATHOGENS 8

Classical approaches based on serotyping. Modern diagnosis based on highly conserved virulence factors, immuno & DNA-based techniques. New therapeutic strategies based on recent findings on molecular pathogenesis of a variety of pathogens, Vaccines - DNA, subunit and cocktail vaccines.

TOTAL : 45 PERIODS

REFERENCES

1. Iglewski B.H and Clark V.L " Molecular basis of Bacterial Pathogenesis ", Academic Press, 1990.
2. Peter Williams, Julian Ketley & George Salmond, "Methods in Microbiology : Bacterial Pathogenesis, Vol. 27", Academic Press, 1998.
3. Recent reviews in Infect. Immun., Mol. Microbiol., Biochem. J., EMBO etc
4. Nester, Anderson, Roberts, Pearsall, Nester, "Microbiology: A Human Perspective", Mc Graw Hill, 3rd Edition, 2001.
5. Eduardo A. Groisman, Principles of Bacterial Pathogenesis, Academic Press, 2001.

IB7015 NEUROBIOLOGY AND COGNITIVE SCIENCES L T P C
3 0 0 3

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 III NEUROPHARMACOLOGY 9

Synaptic transmission, neurotransmitters and their release; fast and slow neurotransmission; 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 : 45 PERIODS

REFERENCE

1. Mathews G.G. Neurobiology, 2nd edition, Blackwell Science, UK, 2000.

IB7016 PLANT BIOTECHNOLOGY **L T P C**
3 0 0 3

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 III NITROGEN 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 , theraputic products.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Gamburg OL, Philips GC, Plant Tissue & Organ Culture fundamental Methods, Narosa Publications. 1995.
2. Singh BD. Text Book of Biotechnology, Kalyani Publishers. 1998

REFERENCES

1. Heldt HW. Plant Biochemistry & Molecular Biology, Oxford University Press. 1997.
2. Ignacimuthu .S, Applied Plant Biotechnology , Tata McGraw Hill. 1996.

IB7017 PRINCIPLES OF FOOD PROCESSING **L T P C**
3 0 0 3

UNIT I FOOD AND ENERGY **9**

Constituents of food – carbohydrates, lipids, proteins, water, vitamins and minerals, dietary sources, role and functional properties in food, contribution to organoleptic and textural characteristics.

UNIT II FOOD ADDITIVES **9**

Classification, intentional and non-intentional additives, functional role in food processing and preservation; food colourants – natural and artificial; food flavours; enzymes as food processing aids.

UNIT III MICROORGANISMS ASSOCIATED WITH FOOD 9

Bacteria, yeasts and molds – sources, types and species of importance in food processing and preservation; fermented foods and food chemicals, single cell protein.

UNIT IV FOOD BORNE DISEASES 9

Classification – food infections – bacterial and other types; food intoxications and poisonings – bacterial and non-bacterial; food spoilage – factors responsible for spoilage, spoilage of vegetable, fruit, meat, poultry, beverage and other food products.

UNIT V FOOD PRESERVATION 9

Principles involved in the use of sterilization, pasteurization and blanching, thermal death curves of microorganisms, canning; frozen storage-freezing characteristics of foods, microbial activity at low temperatures, factors affecting quality of foods in frozen storage; irradiation preservation of foods.

TOTAL : 45 PERIODS

REFERENCES

1. T.P. Coultate – Food – The Chemistry Of Its Components, 2nd Edn. Royal Society, London, 1992.
2. B. Sivasanker – Food Processing And Preservation, Prentice-Hall Of India Pvt. Ltd. New Delhi 2002.
3. W.C. Frazier And D.C. Westhoff – Food Microbiology, 4th Ed., Mcgraw-Hill Book Co., New York 1988.
4. J.M. Jay – Modern Food Microbiology, Cbs Pub. New Delhi, 1987.

IB7018 PROCESS EQUIPMENTS AND PLANT DESIGN L T P C

3 0 0 3

UNIT I HEAT EXCHANGERS, CONDENSERS, EVAPORATORS 12

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 6

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 10

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 8

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 : 45 PERIODS

REFERENCES

1. Brownbell I.E., Young E.H.. “Chemical Plant Design” 1985.
2. Kern D.Q. “Heat Transfer”. McGraw Hill, 1985.
3. McCabe, W.L., J.C. Smith and P. Harriott “Unit Operations of Chemical Engineering”, VIth Edition, McGraw-Hill, 2001

IB7020 **SYSTEMS BIOLOGY** **L T P C**
3 0 0 3

UNIT I **9**

Introduction to Systems Biology, Systems level understanding of biological systems. Basic concepts in Systems modeling : Model Scope, Model Statements, System state, Variables, parameters and constants, Model behavior, classification and steady state. Merits of computational modeling.

UNIT II **9**

Kinetic modeling of biochemical reactions, describing dynamics with ODEs, rate equations, deriving a rate equation, incorporating regulation of enzyme activity by effectors, E-cell platform and erythrocyte modeling.

UNIT III **9**

Introduction to Flux balance analysis, Construction of stoichiometric matrices, Constraint based models. Network basics, examples of mathematical reconstruction of transcriptional networks and signal transduction networks.

UNIT IV **9**

Network motifs, Feed forward loop network motif. Gene circuits, robustness of models, Chemotaxis model, Integration of data from multiple sources: Building genome scale models.

UNIT V **9**

Tools and databases for modeling: Pathway databases KEGG, EMP, Metacyc, Enzyme kinetics database BRENDA, Gene expression databases, Biomodels database, Basics of Systems Biology Markup Language (SBML), SBML editors.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Edda Klipp, Wolfram Liebermeister, Christoph Wierling ,Systems Biology a Textbook by Wiley-BlackWell Publications (2009 Edition).
2. Uri Alon , An introduction to Systems Biology: Design Principles of Biological Circuits, (Chapman and Hall / CRC 2007 Edition)
3. Edda Klipp, Ralf Herwig, Axel kowald, Christoph Wierling, Hans Lehrach ,Systems Biology in practice : concepts, implementation and application. (Wiley – VCH 2005)

REFERENCE BOOKS

1. Foundations of Systems Biology Edited by Hiroaki Kitano (MIT Press)
2. Systems Biology: Definitions and perspectives by Lilia Albhergina (Springer Publications 2008)

IB7021 **TISSUE ENGINEERING** **L T P C**
3 0 0 3

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 III BIOMATERIALS 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 IV BASIC 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

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 : 45 PERIODS

TEXT BOOKS

1. Bernhard O.Palsson,Sangeeta N.Bhatia,"Tissue Engineering" Pearson Publishers 2009.
2. Meyer, U.; Meyer, Th.; Handschel, J.; Wiesmann, H.P. .Fundamentals of Tissue Engineering and Regenerative Medicine.2009.

REFERENCES

1. Bernard N. Kennedy (editor). Stem cell transplantation, tissue engineering, and cancer applications, Nova Science Publishers, 2008.
2. Raphael Gorodetsky, Richard Schäfer..Stem cell-based tissue repair. RSC Publishing, 2011.
3. R. Lanza, I. Weissman, J. Thomson, and R. Pedersen, Handbook of Stem Cells, Two-Volume, Volume 1-2: Volume 1-Embryonic Stem Cells; Volume 2-Adult & Fetal Stem Cells, Academic Press, 2004.
4. R. Lanza, J. Gearhart etal (Eds), Essential of Stem Cell Biology, Elsevier Academic press,2006.
5. J. J. Mao, G. Vunjak-Novakovic et al (Eds), Translational Approaches In Tissue Engineering & Regenrative Medicine" Artech House, INC Publications, 2008.
6. Naggy N. Habib, M.Y. Levicar, , L. G. Jiao,.and N. Fisk, Stem Cell Repair and Regeneration, volume-2, Imperial College Press,2007.

IB7071 BIOCONJUGATE TECHNOLOGY AND APPLICATIONS L T P C
3 0 0 3

UNIT I FUNCTIONAL TARGETS 9

Modification of Amino Acids, Peptides and Proteins – Modification of sugars, polysaccharides and glycoconjugates – modification of nucleic acids and oligonucleotides.

UNIT II CHEMISTRY OF ACTIVE GROUPS 9

Amine reactive chemical reactions – Thiol reactive chemical reactions – carboxylate reactive chemical reactions – hydroxyl reactive chemical reactions – aldehyde and ketone reactive chemical reactions – Photoreactive chemical reactions.

UNIT III BIOCONJUGATE REAGENTS 9

Zero length cross linkers – Homobifunctional cross linkers – Heterobifunctional cross linkers – Trifunctional cross linkers – Cleavable reagent systems – tags and probes.

UNIT IV ENZYME AND NUCLEIC ACID MODIFICATION AND CONJUGATION 9

Properties of common enzymes – Activated enzymes for conjugation – biotinylated enzymes – chemical modification of nucleic acids – biotin labeling of DNA- enzyme conjugation to DNA – Fluorescent of DNA.

UNIT V BIOCONJUGATE APPLICATIONS 9

Preparation of Hapten-carrier Immunogen conjugates - antibody modification and conjugation – immunotoxin conjugation techniques – liposome conjugated and derivatives- Colloidal – gold-labeled proteins – modification with synthetic polymers.

TOTAL : 45 PERIODS

REFERENCE:

1. Bioconjugate Techniques, G.T. Hermanson, Academic Press, 1999.

IB7072 BIOLOGICAL SPECTROSCOPY L T P C
3 0 0 3

OBJECTIVES:

- To deliver the knowledge of spectroscopic techniques and its functions
- To provide the technical information of spectroscopy for biological applications

UNIT I OPTICAL ROTATORY DISPERSION 5

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

UNIT II NUCLEAR MAGNETIC RESONANCE 10

Chemical shifts – spin – spin coupling – relaxation mechanisms – nuclear overhauser effect – multidimensional nmr spectroscopy – determination of macromolecular structure by NMR – magnetic resonance imaging.

UNIT III MASS SPECTROMETRY 10

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

UNIT IV X-RAY DIFFRACTION 10

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 10

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

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the student would be able understand Basics of optical rotary dispersion methods and nuclear magnetic resonance
- Principles and applications of mass spectrometry and X-ray diffraction
- About the microscopic techniques and applications
- And apply the spectroscopic techniques for various biological applications

TEXT BOOK

1. Banwell, Colin N. and E.M. McCash. "Fundamentals of Molecular Spectroscopy" IVth Edition, Tata McGraw-Hill, 1994.
2. Aruldas, G. "Molecular Structure and Spectroscopy". IInd Edition, Prentice Hall of India, 2007.

3. Pavia, D.L., G.M. Lampman and G.S. Kriz. " Introduction to Spectroscopy:" III[rd] Edition, Thomson, Brooks/ Cole, 2001.
4. Williams, Dudley H. and Ian Fleming. "Spectroscopic Methods in Organic Chemistry". V[th] Edition, Tata McGraw-Hill, 1995.

REFERENCES

1. Siuzdak, Gary. "Mass Spectrometry for Biotechnology ". Academic Press / Elsevier,1996.
2. Hammes, Gordon G. "Spectroscopy for the Biological Sciences". John Wiley, 2005.
3. Campbell I.D and Dwek R.A., " Biological Spectroscopy ", Benjamin Cummins and Company, 1986.
4. Atkins P.W., "Physical Chemistry ", Oxford IV Edition, 1990.

GE7073 FUNDAMENTALS OF NANOSCIENCE L T P C
3 0 0 3

OBJECTIVES:

To learn about basis of nanomaterial science, preparation method, types and application

UNIT I INTRODUCTION 8

Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nano particles- quantum dots, nanowires-ultra-thinfilms-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 12

Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, 92 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, TiO_2,MgO, ZrO_2, NiO, nanoalumina, CaO, $AgTiO_2$, Ferrites, Nanoclays-functionalization and applications-Quantum wires, Quantum dotspreparation, 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 7

NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nano biotechology: 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 : 45 PERIODS

OUTCOMES:

Upon completing this course, the students

- Will familiarize about the science of nanomaterials
- Will demonstrate the preparation of nanomaterials
- Will develop knowledge in characteristic nanomaterial

TEXT BOOKS

1. A.S. Edelstein and R.C. Cammearata, eds., “Nanomaterials: Synthesis, Properties and Applications”, Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, “Nanoscale characterization of surfaces & Interfaces”, 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES

1. G Timp (Editor), “Nanotechnology”, AIP press/Springer, 1999.
2. Akhlesh Lakhtakia (Editor),“The Hand Book of Nano Technology,Nanometer Structure, Theory, Modeling and Simulations”. Prentice-Hall of India (P) Ltd, New Delhi, 2007.

CH7072 INSTRUMENTATION AND PROCESS CONTROL L T P C
3 0 0 3

AIM

To familiarize the students with concepts of process dynamics and control leading to control system design.

OBJECTIVE

To introduce dynamic response of open and closed loop systems, control loop components and stability of control systems along with instrumentation.

UNIT I INSTRUMENTATION 6

Principles of measurements and classification of process instruments, measurement of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity, pH, concentration, electrical and thermal conductivity, humidity of gases.

UNIT II OPEN LOOP SYSTEMS 11

Laplace transformation, application to solve ODEs. Open-loop systems, first order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics; transportation lag.

UNIT III CLOSED LOOP SYSTEMS 10

Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatory problems, transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transient response of closed-loop control systems and their stability

UNIT IV FREQUENCY RESPONSE 9

Introduction to frequency response of closed-loop systems, control system design by frequency response techniques, Bode diagram, stability criterion, tuning of controller settings

UNIT V ADVANCED CONTROL SYSTEMS 9

Introduction to advanced control systems, cascade control, feed forward control, Smith predictor controller, control of distillation towers and heat exchangers, introduction to computer control of chemical processes

TOTAL : 45 PERIODS

TEXT BOOKS

1. Stephanopoulos, G., “Chemical Process Control“, Prentice Hall of India, 2003.
2. Coughnowr, D., “ Process Systems Analysis and Control “, IInd Edn., McGraw Hill, New York, 1991.

REFERENCES

1. Marlin, T. E., “ Process Control “, IInd Edn, McGraw Hill, New York, 2000.
2. Smith, C. A. and Corripio, A. B., “Principles and Practice of Automatic Process Control”, IInd Edn., John Wiley, New York, 1997.

CH7751 TRANSPORT PHENOMENA L T P C
3 0 0 3

AIM

To give an overview of mass, momentum and energy transport, present the fundamental equations and illustrate how to use them to solve problems.

OBJECTIVES

To describe mass, momentum and energy transport at molecular, microscopic and macroscopic level, to determine velocity, temperature and concentration profiles

UNIT I MOMENTUM TRANSPORT 7

Viscosity, temperature effect on viscosity of gases and liquids, Newton's law, mechanism of momentum transport, shell balance method, pressure and velocity distributions in falling film, circular tube, annulus, slit.

UNIT II EQUATIONS OF CHANGE AND TURBULENT FLOW 8

Equation of continuity, motion, mechanical energy, use of equations of change to solve flow problems, dimensional analysis of equations of change, comparison of laminar and turbulent flows, time-smoothed equation of change, empirical expressions.

UNIT III ENERGY TRANSPORT 10

Thermal conductivity, temperature and pressure effect on thermal conductivity of gases and liquids, Fourier's law, mechanism of energy transport, shell energy balance, temperature distribution in solids and laminar flow, with electrical, nuclear, viscous, chemical heat source, heat conduction through composite walls, cylinders, spheres, fins, slits.

UNIT IV EQUATIONS OF CHANGE FOR NON ISOTHERMAL SYSTEM AND TEMPERATURE DISTRIBUTION IN TURBULENT FLOWS 10

Energy equations, special forms, use of equations of change, dimensional analysis of equations of change, time-smoothed equations of change, empirical expressions, temperature distribution for turbulent flow in tubes, jets.

UNIT V MASS TRANSPORT, EQUATIONS OF CHANGE FOR MULTICOMPONENT SYSTEMS AND CONCENTRATION DISTRIBUTION IN TURBULENT FLOWS 10

Diffusivity, temperature and pressure effect, Fick's law, mechanism of mass transport, theory of diffusion in gases and liquids, shell mass balances, concentration distribution in solids and in laminar flow : stagnant gas film, heterogeneous and homogeneous chemical reaction systems, falling film, porous catalyst.The equation of continuity, summary of equations of change and fluxes, use of equations of change, dimensional analysis, time smoothed equations of change, empirical expressions for turbulent mass flux.

TOTAL : 45 PERIODS

TEXT BOOKS

1. Bird, R. B., Stewart, W. E. and Lighfoot, E. W., "Transport Phenomena", 2nd Edn., John Wiley, 2002
2. Brodkey, R. S., and Hershey, H. C., "Transport Phenomena", McGraw-Hill, 1988.

REFERENCES

1. Welty, J. R., Wilson, R. W., and Wicks, C. W., "Fundamentals of Momentum Heat and Mass Transfer ", 3rd Edn. John Wiley, New York, 1984.
2. Slattery, J. S., "Advanced Transport Phenomena", Cambridge University Press, London, 1992.

IB7012 MARINE BIOTECHNOLOGY L T P C
3 0 0 3

UNIT I INTRODUCTION TO MARINE ENVIRONMENT 9

World oceans ans seas – ocean currents – physical and chemical properties of sea water – abiotic and biotic factors of the sea – ecological divisons of the sea – history of marine bilogy – bioecochemical 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 : 45 PERIODS

TEXT BOOKS

1. Recent advances in marine biotechnology volume 3 – M.Fingerman , R . Nagabhushanam Mary – Frances Thomson.
2. Recent advances marine biotechnology volume 2 – M.Fingerman , R .Nagabhushanam Mary – Frances Thomson

IB7073 METABOLIC ENGINEERING L T P C
3 0 0 3

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, Xenobioticdegradation.

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, overdetermined 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,

consistencytests and experimental validation.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Gregory N. Stephanopoulos ,Aristos A. Aristidou, Jens Nielsen, Metabolic Engineering: Principles and Methodologies ,Academic Press 1998.
2. Sang Yup Lee E. Terry Papoutsakis Marcel Dekker, Metabolic Engineering.inc 1998
3. Nielsen J and Villadsen J. (1994) Bioreaction Engineering Principles. New york:PlenumPress

REFERENCES

1. Computational Analysis of Biochemical Systems: A Practical Guide for Biochemists and Molecular Biologists by Eberhard O. Voit Cambridge University Press 2000
2. Applications of Plant Metabolic Engineering. R. Verpoorte, A. W. Alfermann and T. S. Johnson (eds). Springer, P.O. Box 17, 3300 AA Dordrecht, The Netherlands. 2007.
3. Systems Modeling in Cellular Biology: From Concepts to Nuts and Bolts Edited by Zoltan Szallasi, JorgStelling and VipulPeriwal MIT Press Cambridge 2006

IB7010 GENETICS L T P C
3 0 0 3

AIM

To give an understanding on the fundamentals of conventional genetics and its relevance in disease and therapy

OBJECTIVES

To describe various genetic laws, learn the chromosome structure function and understand methodologies for cytogenetic applications

UNIT I BACTERIAL GENETICS 7

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

UNIT II CLASSICAL GENETICS 8

Mendel's principles and experiments, segregation, multiple alleles – Independent Assortments, Genotypic interactions, epistasis and Sex chromosomes, Sex determination, Dosage compensation, sex linkage and pedigree analysis

UNIT III APPLIED GENETICS 9

Chromosome organization, structure and variation in prokaryotes and eukaryotes, Giant chromosomes – polytene and lampbrush, deletion, inversion, translocation, duplication. variation in chromosomal numbers – aneuploidy, euploidy, polyploidy, Ames test, karyotyping, Linkage, Crossing over – cytological basis of crossing over, chromosome mapping – two and three factor cross – interference, somatic cell hybridization

UNIT IV POPULATION GENETICS 9

Hardy-Weinberg equilibrium, Extensions of Hardy- Weinberg equilibrium, non random mating, population analysis, Models for population genetics. Mutation and Migration size, Genetic variation and Sociobiology

UNIT V GENETIC DISEASES 12

Inborn errors of metabolism, Sickle cell, hemochromatosis, cystic fibrosis, hypogonadotropic hypogonadism, Gaucher's disease, achondroplasia, phenylketonuria, Huntington's Disease, Cystic fibrosis, hemoglobinopathies, Age-related macular degeneration, Obesity, Type 2 diabetes, Psychiatric disease, including missing heritability, autism

TOTAL : 45 PERIODS

TEXT BOOKS

1. Tamarin, R.H., “Principles of Genetics”, Tata McGraw Hill, New Delhi, 2002
2. De Robertis, E. D. P. and De Robertis, E. M. F., “Cell and Molecular Biology”, 8th Edition, Lippincott Williams & Wilkins, New York, USA, 2001.

REFERENCES

1. Gardner, E.J, Simmons, M.J, and Snustad, D.P., “Principles of Genetics”,8th Edition, John Wiley & Sons, Singapore, 2003.
2. Strickberger, M.W., “Genetics”, 3rd Edition, Prentice Hall of India, New Delhi, 2008.
3. Klug, W.S. and Cummings, M.R., “Concepts of Genetics”, Pearson Education, New Delhi, 2003.

IB7011 GENOMICS AND PROTEOMICS L T P C
3 0 0 3

OBJECTIVES:

To provide the students a broader knowledge on the structure and function of genomes, the technologies developed for genomics, functional genomics and proteomics.

UNIT I INTRODUCTION 8

Introduction to genome, transcriptome, and proteome; Overview of genomes of bacteria, archae, and eukaryote; Genomes of organelles.

UNIT II GENOME MAPPING AND SEQUENCING 10

Genetic and physical mapping, Linkage analysis, RFLP, SNP, SSLP, Restriction mapping, STS mapping, FISH, Top-down and bottom-up sequencing strategies, Whole genome sequencing, Gap closure, Pooling strategies.

UNIT III FUNCTIONAL GENOMICS 9

Genome annotation, ORF and functional prediction,Gene finding,Substractive DNA library screening, Differential display and Representational difference analysis, SAGE,TOGA, Introduction to DNA microarray.

UNIT IV TECHNIQUES IN PROTEOMICS 9

In-vitro and in vivo-labeling of proteins, One and two-dimensional gel electrophoresis, Detection of proteins on SDS gels,Protein cleavage,Edman protein microsequencing, Massspectrometry- principles of MALDI-TOF, Peptide mass fingerprinting.

UNIT V PROTEIN PROFILING 9

Large-scale protein profiling using proteomics, Post-translational modifications, Phosphoprotein and glycoprotein analyses; Analysis of protein-protein interactions, Protein microarrays.

TOTAL: 45 PERIODS

OUTCOMES:

The students would have gained a better understanding of the organization of genomes in multiple levels of taxa, and the methodologies and approaches used for the study of structural and functional genomics. The students would have also acquired knowledge on various genome mapping and sequencing methods, genomic markers, microarray technology and methods for proteomics.

TEXTBOOKS

1. Suhai, Sandor “Genomics and Proteomics: Functional and Computational Aspects”. Springer, 2000
2. Pennington, S.R. and M.J. Dunn “Proteomics: From Protein Sequence to Function”. VivaBooks Pvt. Ltd., 2002.
3. O’Connor, C.D. and B.D.Hames. “ Proteomics”. Scion Publishing, 2008.
4. Primrose, S.B. and Twyman. “Principles of Genome Analysis and Genomics”. 7th Edition,Blakwell Publishing, 2006

REFERENCES

1. Cantor, Charles R. and Cassandra L. Smith. “Genomics : The Science and Technology Behind the Human Genome Project”. John Wiley & Sons, 1999.
2. Liebler, R.C. “Introduction to Proteomics”. Humana Press, 2002.
3. Hunt, Stephen P. and Frederick J. Livesey. “Functional Genomics”. Oxford University Press,2000.
4. Conard, Edward. “Genomics”. Apple Academics, 2010

GE7071 DISASTER MANAGEMENT L T P C
3 0 0 3

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

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 Processes and Framework at State and Central Level- State Disaster Management Authority(SDMA) – Early Warning System – Advisories from Appropriate Agencies.

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT 9

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario and Scenarios in the context of India - Relevance of indigenous knowledge, appropriate technology and local resources.

UNIT IV DISASTER RISK MANAGEMENT IN INDIA 9

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: 45 PERIODS

OUTCOMES:

On Completion of the course, the students should be able to:

- Differentiate the types of disasters, causes and their impact on environment and society
- Assess vulnerability and various methods of risk reduction measures as well as mitigation.
- Draw the hazard and vulnerability profile of India, Scenarios in the Indian context, Disaster damage assessment and management

TEXTBOOKS:

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES:

1. Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2. Government of India, National Disaster Management Policy,2009.

GE7074 HUMAN RIGHTS L T P C
3 0 0 3

OBJECTIVE:

To sensitize the Engineering students to various aspects of Human Rights.

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 : 45 PERIODS

OUTCOME:

- Engineering students will acquire the basic knowledge of human rights.

REFERENCES:

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.

3. Upendra Baxi, The Future of Human Rights, Oxford University Press, New Delhi.

GE7072 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT **L T P C 3 0 0 3**

OBJECTIVES:

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
- To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT 9

Global Trends Analysis and Product decision - Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends **- Introduction to Product Development Methodologies and Management -** Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies **-** Product Life Cycle – Product Development Planning and Management.

UNIT II REQUIREMENTS AND SYSTEM DESIGN 9

Requirement Engineering - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - **System Design & Modeling -** Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

UNIT III DESIGN AND TESTING 9

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – **Challenges in Integration of Engineering Disciplines** - Concept Screening & Evaluation - **Detailed Design -** Component Design and Verification – **Mechanical, Electronics and Software Subsystems** - High Level Design/Low Level Design of S/W Program **-** Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – **Prototyping -** Introduction to Rapid Prototyping and Rapid Manufacturing - **System Integration, Testing, Certification and Documentation**

UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT 9

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - **Sustenance -**Maintenance and Repair – Enhancements - **Product EoL -** Obsolescence Management – Configuration Management - EoL Disposal

UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY 9

The Industry - Engineering Services Industry - Product Development in Industry versus Academia –**The IPD Essentials -** Introduction to Vertical Specific Product Development processes -Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

- Define, formulate and analyze a problem
- Solve specific problems independently or as part of a team
- Gain knowledge of the Innovation & Product Development process in the Business Context
- Work independently as well as in teams
- Manage a project from start to finish

TEXTBOOKS:

1. Book specially prepared by NASSCOM as per the MoU.
2. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
3. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.

REFERENCES:

1. Hiriyappa B, “Corporate Strategy – Managing the Business”, Author House, 2013.
2. Peter F Drucker, “People and Performance”, Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, “Enterprise Resource Planning – Concepts”, Second Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013