AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY, PAIYANOOR, CHENNAI

&

VINAYAKA MISSION'S KIRUPANANDA VARIYAR ENGINEERING COLLEGE, SALEM

(Constituent Colleges of Vinayaka Mission's Research Foundation, Deemed to be University, Salem, Tamil Nadu, India)

(AICTE APPROVED AND NAAC ACCREDITED)

Faculty of Engineering and Technology

REGULATIONS 2017

DEPARTMENT OF BIOTECHNOLOGY

Programme:

B.Tech. BIOTECHNOLOGY

Full Time (4 Years)

STRUCTURED CHOICE BASED CREDIT SYSTEM (SCBCS)

CURRICULUM AND SYLLABUS

(Semester I to VIII)

PROGRAM OUTCOMES (POs) OR GRADUATE ATTRIBUTES

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of problems in the area of Biotechnology.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex biotechnology- oriented problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex bio-based problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations in the area of biotechnology.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional practice.
7. **Environment and sustainability**: Understand the impact of the professional biotechnological solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the technology practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the technology audience and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

(B) PROGRAM SPECIFIC OUTCOMES (PSOs)

Upon successful completion of the course the students are expected to:

PSO1: To identify, formulate, design, analyse and develop processes and technologies for biotechnological products for societal usage and economically sustainable for the present and future.
PSO2: To assess the human health and environmental issues and provide relevant professional mitigation measures and implementation of biotechnological tools.
PSO3: To function in a multi-disciplinary team and understand the professional ethics and responsibilities and equip themselves for higher learning for addressing technological challenges.

(C) PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To provide the biotechnology graduates to have expertise in biotechnological aspects which will enable them to have a career and professional achievements in public and private sector
PEO2: Address the nuances of biotechnology in real life on application of microorganisms in industrial production of enzymes and products, downstream processing, genetic engineering, tissue culture and applications.
PEO3: Identify, design and develop biotechnological process and technologies to meet the industrial challenges and produce tools which a sound and economically viable and sustainable.

Credit Structure of Course Category

Sl. No.	Category of Courses	Credits
01	**A. Foundation Courses (FC)**	**54 - 63**
	i. Humanities and Sciences (English and Management Subjects)	12 – 21
	ii. Basic Sciences (Maths, Physics and Chemistry Subjects)	24 – 33
	iii. Engineering Sciences (Basic Engineering Courses)	18 - 27
02	**B. Core courses (CC) relevant to the chosen programme of study.**	**81**
03	**C. Elective Courses (EC)**	**18 - 27**
	i. Programme Specific (Class Room or Online)	12 – 15
	ii. Open (Class Room or Online)	6 - 9
04	**D. Project + Internship + Industry Electives (P + I + I)**	**18**
	i. Project	9
	ii. Internship / Industry Supported Courses	9
05	**E. Employability Enhancement Courses + Co - Curricular Courses + Extra Curricular Courses (EEC)****	**9 - 18**
	Minimum Credits to be earned	**180**

**** - Mandatory, Credits would be mentioned in Mark sheets but not included for CGPA Calculations. Overall CGPA Calculations will be out of minimum 171 credits earned in categories A to D.**

CURRICULUM B.TECH.– BIOTECHNOLOGY - SEMESTER I TO VIII

B.TECH. – BIOTECHNOLOGY - SEMESTER I TO VIII

CATEGORY A – FOUNDATION COURSES - HSS, BS AND ES COURSES - CREDITS (54-63)

(i) HUMANITIES AND SCIENCES (ENGLISH AND MANAGEMENT SUBJECTS) - CREDITS (12 - 21)

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1.	17EGHS01	TECHNICAL ENGLISH	ENGLISH	FC (HS)	3	0	0	3	NIL
2.	17EGHS02	BUSINESS ENGLISH	ENGLISH	FC (HS)	3	0	0	3	NIL
3.	17MBHS04	TOTAL QUALITY MANAGEMENT	MANAGEMENT	FC (HS)	3	0	0	3	NIL
4.	17EGHS81	ENGLISH LANGUAGE LAB	ENGLISH	FC (HS)	0	0	4	2	NIL
5.	17YMHS82	YOGA & MEDITATION	PHYSICAL EDUCATION	FC (HS)	0	0	4	2	NIL
6.	17EGHS82	PROFESSIONAL COMMUNICATION AND PERSONALITY DEVELOPMENT	ENGLISH	FC (HS)	0	0	2	1	NIL

(ii) BASIC SCIENCES (MATHS, PHYSICS AND CHEMISTRY SUBJECTS) - CREDITS (24 - 33)

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1.	17MABS03	MATHEMATICS FOR BIO-ENGINEERING	MATHS	FC (BS)	2	2	0	3	NIL
2.	17PCBS02	PHYSICAL SCIENCES	PHYSICS & CHEMISTRY	FC (BS)	4	0	0	4	NIL
3.	17MABS07	BIOSTATISTICS	MATHS	FC (BS)	2	2	0	3	MATHEMATICS FOR BIO-ENGINEERING
4.	17PHBS05	SMART MATERIALS	PHYSICS	FC (BS)	3	0	0	3	NIL
5.	17CHBS03	BIOORGANIC CHEMISTRY	CHEMISTRY	FC (BS)	3	0	0	3	NIL
6.	17CHBS01	ENVIRONMENTAL SCIENCE AND ENGINEEIRNG	CHEMISTRY	FC (BS)	3	0	0	3	NIL
7.	17PHBS02	NANOTECHNOLOGY	PHYSICS	FC (BS)	3	0	0	3	NIL
8.	17PCBS81	PHYSICAL SCIENCES LAB	PHYSICS & CHEMISTRY	FC (BS)	0	0	4	2	NIL
9.	17CHBS81	BIOORGANIC CHEMISTRY LAB	CHEMISTRY	FC (BS)	0	0	4	2	NIL

(iii) ENGINEERING SCIENCES (BASIC ENGINEERING COURSES) - CREDITS (18 - 27)

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1.	17BTES04	FUNDAMENTALS OF BIOTECHNOLOGY	BTE	FC (ES)	3	0	0	3	NIL
2.	17CSES01	ESSENTIALS OF COMPUTING	CSE	FC (ES)	3	0	0	3	NIL
3.	17CSES06	PROGRAMMING IN C	CSE	FC (ES)	3	0	0	3	NIL
4.	17BMES01	BIOSENSORS & MEASUREMENT DEVICES	BME	FC (ES)	3	0	0	3	NIL
5.	17BMES02	MEDICAL INSTRUMENTATION	BME	FC (ES)	3	0	0	3	NIL
6.	17CSES85	PROGRAMMING IN C LAB	CSE	FC (ES)	0	0	4	2	NIL
7.	17BMES81	BIOSENSORS & MEASUREMENT DEVICES LAB	BME	FC (ES)	0	0	4	2	NIL
8.	17BMES82	MEDICAL INSTRUMENTATION LAB	BME	FC (ES)	0	0	4	2	NIL

CATEGORY B – CORE COURSES RELEVANT TO THE PROGRAMME - CREDITS (81)

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1.	17BTCC01	ESSENTIALS OF BIOCHEMISTRY	BTE	CC	3	0	0	3	NIL
2.	17BTCC02	CELL BIOLOGY	BTE	CC	3	0	0	3	NIL
3.	17BTCC03	MICROBIOLOGY	BTE	CC	3	0	0	3	NIL
4.	17BTCC04	CLASSICAL AND MOLECULAR GENETICS	BTE	CC	3	0	0	3	NIL
5.	17BTCC05	UNIT OPERATIONS IN PROCESS INDUSTRIES	BTE	CC	3	0	0	3	NIL
6.	17BTCC06	ADVANCED BIOCHEMISTRY	BTE	CC	3	0	0	3	ESSENTIALS OF BIOCHEMISTRY
7.	17BTCC07	ENZYME ENGINEERING AND TECHNOLOGY	BTE	CC	3	0	0	3	NIL
8.	17BTCC08	BIOINSTRUMENTATION	BTE	CC	3	0	0	3	NIL
9.	17BTCC09	MOLECULAR BIOLOGY	BTE	CC	3	0	0	3	CLASSICAL AND MOLECULAR GENETICS
10.	17BTCC10	PRINCIPLES OF CHEMICAL ENGINEERING	BTE	CC	3	0	0	3	UNIT OPERATIONS IN PROCESS INDUSTRIES
11.	17BTCC11	PLANT AND ANIMAL BIOTECHNOLOGY	BTE	CC	3	0	0	3	NIL
12.	17BTCC12	GENETIC ENGINEERING	BTE	CC	3	0	0	3	MOLECULAR BIOLOGY
13.	17BTCC13	THERMODYNAMICS FOR BIOTECHNOLOGY	BTE	CC	4	0	0	4	PRINCIPLES OF CHEMICAL ENGINEERING
14.	17BTCC14	IMMUNOLOGY	BTE	CC	3	0	0	3	NIL
15.	17BTCC15	FOOD PROCESSING TECHNOLOGY	BTE	CC	3	0	0	3	NIL
16.	17BTCC16	BIOPROCESS ENGINEERING	BTE	CC	3	0	0	3	ENZYME ENGINEERING AND TECHNOLOGY
17.	17BTCC17	DOWNSTREAM PROCESSING IN BIOTECHNOLOGY	BTE	CC	4	0	0	4	BIOPROCESS ENGINEERING
18.	17BTCC18	MASS TRANSFER OPERATIONS	BTE	CC	4	0	0	4	THERMODYNAMICS FOR BIOTECHNOLOGY
19.	17BTCC81	BIOCHEMISTRY LAB	BTE	CC	0	0	4	2	NIL
20.	17BTCC82	CELL BIOLOGY LAB	BTE	CC	0	0	4	2	NIL
21.	17BTCC83	MICROBIOLOGY LAB	BTE	CC	0	0	4	2	NIL
22.	17BTCC84	ADVANCED BIOCHEMISTRY LAB	BTE	CC	0	0	4	2	NIL
23.	17BTCC85	MOLECULAR BIOLOGY LAB	BTE	CC	0	0	4	2	NIL
24.	17BTCC86	CHEMICAL ENGINEERING LAB	BTE	CC	0	0	4	2	NIL
25.	17BTCC87	BIOINSTRUMENTATION LAB	BTE	CC	0	0	4	2	NIL
26.	17BTCC88	GENETIC ENGINEERING LAB	BTE	CC	0	0	4	2	NIL
27.	17BTCC89	IMMUNOLOGY LAB	BTE	CC	0	0	4	2	NIL
28.	17BTCC90	FOOD PROCESSING TECHNOLOGY LAB	BTE	CC	0	0	4	2	NIL
29.	17BTCC91	BIOPROCESS ENGINEERING LAB	BTE	CC	0	0	4	2	NIL
30.	17BTCC92	DOWNSTREAM PROCESSING ENGINEERING LAB	BTE	CC	0	0	4	2	NIL
31.	17BTCC93	BIOINFORMATICS LAB	BTE	CC	0	0	4	2	NIL

CATEGORY C – ELECTIVE COURSES - CREDITS (18 - 27)

(i) PROGRAMME SPECIFIC (CLASS ROOM OR ONLINE) - CREDITS (12 - 15)									
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.	17BTEC01	PLANT AND ANIMAL DISEASES AND THEIR CONTROL	BTE	EC (PS)	3	0	0	3	MICROBIOLOGY
2.	17BTEC02	OCEAN SCIENCE	BTE	EC (PS)	3	0	0	3	NIL
3.	17BTEC03	PRINCIPLES OF BIOINFORMATICS	BTE	EC (PS)	3	0	0	3	NIL
4.	17BTEC04	DIAGNOSTICS AND THERAPEUTICS	BTE	EC (PS)	3	0	0	3	MICROBIOLOGY
5.	17BTEC05	CYTOGENETICS	BTE	EC (PS)	3	0	0	3	NIL
6.	17BTEC06	STEM CELL BIOLOGY AND TISSUE ENGINEERING	BTE	EC (PS)	3	0	0	3	NIL
7.	17BTEC07	GENETICALLY MODIFIED ORGANISMS AND ETHICAL ISSUES	BTE	EC (PS)	3	0	0	3	GENETIC ENGINEERING
8.	17BTEC08	MOLECULAR EVOLUTION	BTE	EC (PS)	3	0	0	3	MOLECULAR BIOLOGY
9.	17BTEC09	MICROBIAL BIOTECHNOLOGY	BTE	EC (PS)	3	0	0	3	MICROBIOLOGY
10.	17BTEC10	CRYOPRESERVATION THEORY AND APPLICATIONS	BTE	EC (PS)	3	0	0	3	NIL
11.	17BTEC11	PROTEIN ENGINEERING	BTE	EC (PS)	3	0	0	3	NIL
12.	17BTEC12	NEUROBIOLOGY AND COGNITIVE SCIENCES	BTE	EC (PS)	3	0	0	3	NIL
13.	17BTEC13	FOOD MICROBIOLOGY	BTE	EC (PS)	3	0	0	3	NIL
14.	17BTEC14	ENDOCRINOLOGY	BTE	EC (PS)	3	0	0	3	NIL
15.	17BTEC15	BIOREMEDIATION TECHNOLOGY	BTE	EC (PS)	3	0	0	3	NIL
16.	17BTEC16	CANCER BIOLOGY	BTE	EC (PS)	3	0	0	3	MOLECULAR BIOLOGY
17.	17BTEC17	APPLIED BIOTECHNOLOGY	BTE	EC (PS)	3	0	0	3	PLANT AND ANIMAL BIOTECHNOLOGY
18.	17BTEC18	METABOLIC ENGINEERING	BTE	EC (PS)	3	0	0	3	ADVANCED BIOCHEMISTRY
19.	17BTEC19	CLINICAL TRIALS	BTE	EC (PS)	3	0	0	3	NIL
20.	17BTEC20	AGRICULTURAL BIOTECHNOLOGY	BTE	EC (PS)	3	0	0	3	NIL
21.	17BTEC21	GENOMICS AND PROTEOMICS	BTE	EC (PS)	3	0	0	3	GENETIC ENGINEERING
22.	17BTEC22	MOLECULAR MODELLING AND DRUG DESIGNING	BTE	EC (PS)	3	0	0	3	PRINCIPLES OF BIOINFORMATICS
23.	17BTEC23	NANOBIOTECHNOLOGY	BTE	EC (PS)	3	0	0	3	NIL
24.	17BTEC24	BIOFERTILIZER TECHNOLOGY	BTE	EC (PS)	3	0	0	3	NOT FOR BTE STUDENTS
25.	17BTEC25	BIOLOGY FOR NON BIOLOGISTS	BTE	EC (PS)	3	0	0	3	NOT FOR BTE STUDENTS
26.	17BTEC26	ECO-FRIENDLY MULTI-STOREY BUILDING	BTE	EC (PS)	3	0	0	3	NOT FOR BTE STUDENTS
27.	17BTEC27	RENEWABLE ENERGY AND CONSTRUCTION METHODS	BTE	EC (PS)	3	0	0	3	NOT FOR BTE STUDENTS
28.	17BTEC28	ENVIRONMENT FRIENDLY PRACTICES IN CIVIL ENGINEERING	BTE	EC (PS)	3	0	0	3	NOT FOR BTE STUDENTS
29.	17BTEC29	GREEN BUILDING AND SUSTAINABLE ENVIRONMENT	BTE	EC (PS)	3	0	0	3	NOT FOR BTE STUDENTS
30.	17BTEC30	NATURAL RESOURCES	BTE	EC (PS)	3	0	0	3	NOT FOR BTE STUDENTS

		MANAGEMENT							
31.	17BTEC31	APPLICATIONS OF ENZYME IN WASTE MANAGEMENT	BTE	EC (PS)	3	0	0	3	NOT FOR BTE STUDENTS
32.	17BTEC32	BIOLOGICAL DATABASE	BTE	EC (PS)	3	0	0	3	NOT FOR BTE STUDENTS

(ii) OPEN ELECTIVE (CLASS ROOM OR ONLINE) - CREDITS (6 - 9)									
1.	17CSCC02	OBJECT ORIENTED PROGRAMMING	CSE	EC (OE)	3	0	0	3	NIL
2.	17CSCC07	OPERATING SYSTEM	CSE	EC (OE)	3	0	0	3	NIL
3.	17CSCC09	JAVA PROGRAMMING	CSE	EC (OE)	3	0	0	3	NIL
4.	17CSCC16	CLOUD COMPUTING	CSE	EC (OE)	3	0	0	3	NIL
5.	17CSCC17	CYBERSECURITY	CSE	EC (OE)	3	0	0	3	NIL
6.	17CSEC30	UNIX INTERNALS	CSE	EC (OE)	3	0	0	3	NIL
7.	17CSEC34	WEB DESIGN AND MANAGEMENT	CSE	EC (OE)	3	0	0	3	NIL
8.	17CSPI07	LEARNING IT ESSENTIALS BY DOING	CSE	EC (OE)	3	0	0	3	NIL
9.	17CSPI10	MOBILE APPLICATION DEVELOPMENT	CSE	EC (OE)	3	0	0	3	NIL
10.	17BMCC03	BIOSENSORS AND TRANSDUCERS	BME	EC (OE)	3	0	0	3	NIL
11.	17BMCC05	PATHOLOGY AND MICROBIOLOGY	BME	EC (OE)	3	0	0	3	NIL
12.	17BMEC01	MEDICAL OPTICS	BME	EC (OE)	3	0	0	3	NIL
13.	17BMEC02	BIOTELEMETRY	BME	EC (OE)	3	0	0	3	NIL
14.	17BMEC04	MEMS AND ITS BIOMEDICAL APPLICATIONS	BME	EC (OE)	3	0	0	3	NIL
15.	17BMEC09	DESIGN OF MEDICAL DEVICES	BME	EC (OE)	3	0	0	3	NIL
16.	17BMEC13	PRINCIPLES OF TISSUE ENGINEERING	BME	EC (OE)	3	0	0	3	NIL
17.	17BMEC22	MEDICAL ETHICS AND STANDARDS	BME	EC (OE)	3	0	0	3	NIL
18.	17BMSE23	MEDICAL WASTE MANAGEMENT	BME	EC (OE)	3	0	0	3	NIL
19.	17BMSE24	MEDICAL TECHNOLOGY AND ENTREPRENEURSHIP	BME	EC (OE)	3	0	0	3	NIL
20.	17BMSE28	NANO TECHNOLOGY IN MEDICINE	BME	EC (OE)	3	0	0	3	NIL
21.	17CVEC35	MUNICIPAL SOLID AND WASTE MANAGEMENT	CIVIL	EC (OE)	3	0	0	3	NIL
22.	17CVEC14	AIR POLLUTION MANAGEMENT	CIVIL	EC (OE)	3	0	0	3	NIL
23.	17CVEC06	HYDROLOGY	CIVIL	EC (OE)	3	0	0	3	NIL
24.	17CVEC07	DISASTER MITIGATION AND MANAGEMENT	CIVIL	EC (OE)	3	0	0	3	NIL
25.	17CVEC08	REMOTE SENSING TECHNIQUES AND APPLICATIONS	CIVIL	EC (OE)	3	0	0	3	NIL
26.	17EEEC18	RENEWABLE ENERGY TECHNOLOGY	EEE	EC (OE)	3	0	0	3	NIL
27.	17EEEC20	MATHEMATICAL MODELLING AND SIMULATION	EEE	EC (OE)	3	0	0	3	NIL
28.	17EEEC21	NON-CONVENTIONAL ENERGY SOURCES	EEE	EC (OE)	3	0	0	3	NIL
29.	17ATEC08	TRACTOR AND FARM EQUIPMENTS	AUTO	EC (OE)	3	0	0	3	NIL
30.	17ATEC18	ALTERNATIVE FUELS	AUTO	EC (OE)	3	0	0	3	NIL
31.	17MECC16	INDUSTRIAL AUTOMATION	MECH	EC (OE)	3	0	0	3	NIL

32.	17ECEC06	MEMS AND SENSORS	ECE	EC (OE)	3	0	0	3	NIL
33.	17ECEC23	INTRODUCTION TO MACHINE VISION	ECE	EC (OE)	3	0	0	3	NIL
34.	17MESE03	HYDROGEN AND FUEL CELL TECHNOLOGY	MECH	EC (OE)	3	0	0	3	NIL
35.	17MESE05	WASTE ENERGY CONVERSION TECHNOLOGIES	MECH	EC (OE)	3	0	0	3	NIL
36.	17MESE06	BIO ENERGY TECHNOLOGY	MECH	EC (OE)	3	0	0	3	NIL

CATEGORY D
PROJECT + INTERNSHIP + INDUSTRY ELECTIVES (P + I + I) CREDITS (18)

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1	17BTPI01	PROJECT	BTE	PI	0	0	18	9	NIL
(ii) INTERNSHIP + INDUSTRY ELECTIVES - CREDITS (9)									
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.	17BTPI02	MINI PROJECT	BTE	PI	0	0	6	3	NIL
2.	17BTPI03	INDUSTRIAL ENZYMOLOGY	BTE	PI	3	0	0	3	NIL
3.	17BTPI04	BIOPHARMACEUTICALS	BTE	PI	3	0	0	3	NIL
4.	17BTPI05	INDUSTRIAL BIOSAFETY	BTE	PI	3	0	0	3	NIL
5.	17BTPI06	WASTE MANAGEMENT	BTE	PI	3	0	0	3	NIL
6.	17BTPI07	PROCESS ECONOMICS AND INDUSTRIAL MANAGEMENT	BTE	PI	3	0	0	3	NIL
7.	17BTPI08	FERMENTATION AND BREWING TECHNOLOGY	BTE	PI	3	0	0	3	NIL

CATEGORY E

EMPLOYABILITY ENHANCEMENT COURSES, CO - CURRICULAR COURSES AND EXTRA CURRICULAR COURSES (EEC)** - CREDITS (9 - 18)
(** - MANDATORY, CREDITS WOULD BE MENTIONED IN MARK SHEETS BUT NOT INCLUDED FOR CGPA CALCULATIONS.)

(i) EMPLOYABILITY ENHANCEMENT COURSES (EEC)									
SL. NO	**CODE**	**COURSE**	**OFFERING DEPT.**	**CATEGORY**	**L**	**T**	**P**	**C**	**PREREQUISITE**
1.	17APEE01	PERSONALITY SKILLS DEVELOPMENT - I	MATHS	EE	2 WEEKS OF TRAINING			1	NIL
2.	17APEE02	PERSONALITY SKILLS DEVELOPMENT - II	ENGLISH & MANAGEMENT	EE	2 WEEKS OF TRAINING			1	NIL
3.	17BTEE01	TECHNICAL SKILLS -I	BTE	EE	0	0	2	1	NIL
4.	17BTEE02	TECHNICAL SKILLS –II	BTE	EE	0	0	2	1	NIL
5.	17BTEE03	TECHNICAL SKILLS –III	BTE	EE	0	0	2	1	NIL
6.	17BTEE04	TECHNICAL SKILLS–IV	BTE	EE	0	0	2	1	NIL
7.	17BTEE05	TECHNICAL SKILLS -V	BTE	EE	0	0	2	1	NIL
(ii) CO - CURRICULAR COURSES (CCC)									
1.	17APEE03	NCC	NCC	EE	2 WEEKS OF TRAINING IN NCC CAMP			1	NIL

2.	17APEE04	NSS	NSS	EE	2 WEEKS OF SOCIAL SERVICE IN NSS CAMP	1	NIL
3.	17APEE05	SPORTS AND GAMES (INTER –UNIVERSITY LEVEL)	PHYSICAL EDUCATION	EE		1	NIL
4.	17APEE06	SPORTS AND GAMES (INTRA-UNIVERSITY LEVEL)	PHYSICAL EDUCATION	EE		2	NIL
5.	17APEE07	SPORTS AND GAMES (STATE AND NATIONAL LEVELS)	PHYSICAL EDUCATION	EE		2	NIL
(iii) EXTRA CURRICULAR COURSES (ECC)							
1.	17BTEE06	EXTRA CURRICULAR COURSE - I	BTE	EE	15 HOURS	1	NIL
2.	17BTEE07	EXTRA CURRICULAR COURSE - II	BTE	EE	15 HOURS	1	NIL
3.	17BTEE08	EXTRA CURRICULAR COURSE - III	BTE	EE	15 HOURS	1	NIL
4.	17BTEE09	EXTRA CURRICULAR COURSE - IV	BTE	EE	15 HOURS	1	NIL
5.	17BTEE10	EXTRA CURRICULAR COURSE - V	BTE	EE	15 HOURS	1	NIL

FOR DEGREE WITH

SPECIALISATION

CATEGORY C –

PROGRAMME SPECIFIC

ELECTIVE COURSES -

CREDITS (12 - 15)

SPECIALISATION - INDUSTRIAL BIOTECHNOLOGY

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1.	17BTSE01	INDUSTRIAL BIOTECHNOLOGY	BTE	EC (SE)	3	0	0	3	NIL
2.	17BTSE02	CHEMICAL REACTION ENGINEERING	BTE	EC (SE)	3	0	0	3	NIL
3.	17BTSE03	FERMENTER DESIGN AND ANALYSIS	BTE	EC (SE)	3	0	0	3	NIL
4.	17BTSE04	BIOSEPARATION TECHNOLOGY	BTE	EC (SE)	3	0	0	3	NIL
5.	17BTSE05	INDUSTRIAL WASTE MANAGEMENT	BTE	EC (SE)	3	0	0	3	NIL
6.	17BTSE06	FUNDAMENTALS OF FLUID MECHANICS	BTE	EC (SE)	3	0	0	3	NIL
7.	17BTSE07	BIOPROCESS ECONOMICS AND REACTOR DESIGN	BTE	EC (SE)	3	0	0	3	NIL
8.	17BTSE08	BIOREACTOR THEORY	BTE	EC (SE)	3	0	0	3	NIL
9.	17BTSE09	INDUSTRIAL BIOTECHNOLOGY LAB	BTE	EC (SE)	0	0	4	2	NIL
10.	17BTSE10	FERMENTATION LAB	BTE	EC (SE)	0	0	4	2	NIL
11.	17BTSE11	FLUID MECHANICS FOR BIOTECHNOLOGY LAB	BTE	EC (SE)	0	0	4	2	NIL

SPECIALISATION - MEDICAL AND PHARMACEUTICAL BIOTECHNOLOGY

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1.	17BTSE12	INDUSTRIAL MANAGEMENT AND PHARMACEUTICAL MARKETING	BTE	EC (SE)	3	0	0	3	NIL
2.	17BTSE13	PHARMACEUTICAL PHYTO CHEMISTRY	BTE	EC (SE)	3	0	0	3	NIL
3.	17BTSE14	MEDICAL PHARMACOLOGY AND DRUG DELIVERY	BTE	EC (SE)	3	0	0	3	NIL
4.	17BTSE15	PHARMACEUTICAL ASPECTS OF MICROBIOLOGY	BTE	EC (SE)	3	0	0	3	NIL
5.	17BTSE16	PHARMACEUTICAL PROCESS CHEMISTRY	BTE	EC (SE)	3	0	0	3	NIL
6.	17BTSE17	PHARMACOGENOMICS	BTE	EC (SE)	3	0	0	3	NIL
7.	17BTSE18	HERBS AND DRUG ACTION	BTE	EC (SE)	3	0	0	3	NIL
8.	17BTSE19	SKILL BASED ETHANO MEDICINE	BTE	EC (SE)	3	0	0	3	NIL
9.	17BTSE20	PHARMACEUTICAL CHEMISTRY LABORATORY	BTE	EC (SE)	0	0	4	2	NIL
10.	17BTSE21	PHYTO CHEMISTRY LAB	BTE	EC (SE)	0	0	4	2	NIL
11.	17BTSE22	PHARMACEUTICAL MICROBIOLOGY LAB	BTE	EC (SE)	0	0	4	2	NIL
12.	17BTSE23	ANALYTICAL METHODS OF PHARMACEUTICAL LABORATORY	BTE	EC (SE)	0	0	4	2	NIL

VINAYAKA MISSION'S RESEARCH FOUNDATION
(DEEMED TO BE UNIVERSITY, SALEM)
AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY, CHENNAI
&
VINAYAKA MISSION'S KIRUPANANDA VARIYAR ENGINEERING COLLEGE, SALEM
FACULTY OF ENGINEERING AND TECHNOLOGY

BOARD : BIOTECHNOLOGY

REGULATION : 2017

PROGRAM : B.Tech., – BIOTECHNOLOGY (FULL TIME - REGULAR)

CURRICULUM AND SYLLABUS

SEMESTER – I								
S.NO	**COURSE CODE**	**COURSE TITLE**	**OFFERING DEPARTMENT**	**CATEGORY**	**L**	**T**	**P**	**C**
THEORY								
1	17EGHS01	TECHNICAL ENGLISH	ENGLISH	FC(HSS)	3	0	0	**3**
2	17MABS03	MATHEMATICS FOR BIO-ENGINEERING	MATHEMATICS	FC(BS)	2	2	0	**3**
3	17PCBS02	PHYSICAL SCIENCES	PHYSICS & CHEMISTRY	FC(BS)	4	0	0	**4**
4	17CSES01	ESSENTIALS OF COMPUTING	CSE	FC(ES)	3	0	0	**3**
5	17BTES01	FUNDAMENTALS OF BIOTECHNOLOGY	BTE	FC(ES)	3	0	0	**3**
PRACTICAL								
6	17EGHS81	ENGLISH LANGUAGE LAB	ENGLISH	FC(HSS)	0	0	4	**2**
7	17PCBS81	PHYSICAL SCIENCES LAB	PHYSICS & CHEMISTRY	FC(BS)	0	0	4	**2**
8	17YMHS82	YOGA & MEDITATION	PHYSICAL EDUCATION	FC (HSS)	0	0	4	2
TOTAL					**14**	**2**	**14**	**22**
L – LECTURE HOUR T – TUTORIAL HOUR P – PRACTICAL HOUR C – CREDIT								

HSS	HUMANITIES AND SOCIAL SCIENCES	CC	CORE COURSES
BS	BASIC SCIENCES	EC	ELECTIVE COURSES
ES	ENGINEERING SCIENCES	EEC	EMPLOYABILITY ENHANCEMENT COURSES + EXTRA CURRICULAR COURSES + CO - CURRICULAR COURSES
PII	PROJECT + INTERNSHIP + INDUSTRY ELECTIVES		

SYLLABUS – SEMESTER I

17EGHS01	TECHNICAL ENGLISH	Category	L	T	P	Credit
		HSS	3	0	0	3

PREAMBLE

Technical English is a life skill course necessary for all students of Engineering and Technology. It aims at developing communication skills in English, essential for understanding and expressing the ideas of different professional context. The outcome of the course is to help the students acquire the language skills of Listening, Speaking, Reading and Writing competency in English language and thereby making the students competent and employable in the globalised scenario.

PREREQUISITE- Nil

COURSE OBJECTIVES

1	To enable students to develop LSRW skills in English. (Listening, Speaking, Reading, and Writing.)
2	To make them to become effective communicators
3	To ensure that learners use Electronic media materials for developing language
4	To aid the students with employability skills.
5	To motivate students continuously to use English language
6	To develop the students communication skills in formal and informal situations

COURSE OUTCOMES

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

CO1. Listen, understand and respond to others in different scenario	Understand
CO2. Speak fluently and correctly with correct pronunciation in different situation.	Apply
CO3. To make the students experts in professional writing	Apply
CO4. To make the students recognize the role of technical writing in their careers in business, technical and scientific field	Apply
CO5. To make the students good communicators at the work place and to be theoretically strong.	Apply
CO6. To make the students in proficient technical communicator	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	-	-	M	M	M	L	S	S	S	M	-	-	-
CO2	S	-	L	M	S	S	M	L	M	S	M	S	-	-	-
CO3	L	L	-	L	S	M	-	L	M	S	-	L	-	-	-
CO4	L	M	-	-	M	M	S	M	M	M	S	S	-	-	-
CO5	S	M	L	-	L	-	S	M	S	S	L	M	-	-	-
CO6	M	-	-	-	M	-	-	-	M	S	-	S	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT – I: Self introduction - Simulations using E Materials - Whatsapp, Face book, Hiker, Twitter- Effective Communication with Minimum Words - Interpretation of Images and Films - Identify the different Parts of Speech- Word formation with Prefixes and suffixes -Common Errors in English - Scientific Vocabulary (definition and meaning) - Listening Skills- Passive and Active listening, Listening to Native Speakers - Characteristics of a good listener.

UNIT – II: Articles - Phonetics (Vowels, Consonants and Diphthongs) - Pronunciation Guidelines -Listening to Indian speakers from different regions, intrusion of mother tongue - Homophones – Homonyms - Note taking and Note making - Difference between Spoken and Written English- Use of appropriate language - Listening and Responding to Video Lectures (Green India, environment, social talks) - Extempore.

UNIT – III Tense forms- Verbal and Non verbal Communication - Describing objects - Process Description- Speaking Practice - Paragraph Writing on any given topic (My favourite place, games / Hobbies / School life, etc.) -Types of paragraphs - Telephone Etiquettes - Telephonic conversation with dialogue.

UNIT – IV Impersonal Passive Voice - Conditional Sentences - Technical and Non technical Report Writing (Attend a technical seminar and submit a report) - News Letters and Editing - Skimming- Scanning - How to Improve Reading Speed - Designing Invitations and Poster Preparation.

UNIT – V Sentence Pattern (SVOCA) - Statement of Comparison - Transcoding (Flow Chart, Bar Chart and Pie Chart) - Informal letters - Resume Writing- Difference between Bio data, Resume and Curriculum Vitae.

TEXTBOOK

1. English for Engineers- Faculty of English – VMKV Engineering College, Salem and AVIT, Chennai

REFERENCES

1. English for Effective Communication, Department of English, VMKV & AVIT, SCM Publishers, 2009.
2. Practical English Usage- Michael Swan (III edition), Oxford University Press
3. Grammar Builder- I, II, III, and Cambridge University Press.

4 Pickett and Laster. Technical English: Writing, Reading and Speaking, New York: Harper and Row Publications, 2002.

17MABS03	MATHEMATICS FOR BIO-ENGINEERING	Category	L	T	P	Credit
		FC (BS)	2	2	0	3

PREAMBLE

This course offers the knowledge of solving problems involving rates of change of variables subject to a functional relationship, to solve optimization problems, to find the area under curves and the area between curves, to develop skills and knowledge of standard concepts in ordinary differential equations, to design data collection plans, analyze data appropriately and interpret and draw conclusions from those analyses.

PREREQUISITE

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COURSE OBJECTIVES

1	To improve their ability in solving geometrical applications of differential calculus problems.
2	To develop the knowledge in integral calculus.
3	To enable the students to solve ordinary differential equations.
4	To get the single value that describes the characteristic of the entire group and to analyze variation of items from the central value.
5	To correlate two or more variables, one needs simple, multiple and partial correlations and suitable interpretation.

COURSE OUTCOMES

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

CO1. Apply the concept of differentiation in functions of single and several variables.	Apply
CO2. Apply tools to find area and volume.	Apply
CO3. Apply knowledge of Ordinary differential equations in biological processes.	Apply
CO4. Apply statistics in conducting the experiments about the plants and animals.	Apply
CO5. Apply the concept of correlation and regression in computational biology.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	--	--	--	--	M	--	--	--	L	--	--	--
CO2	S	M	L	--	--	--	--	M	--	--	--	L	--	--	--
CO3	S	M	M	L	--	--	--	M	--	--	--	M	--	--	--
CO4	S	S	M	L	--	--	--	M	--	--	--	M	--	--	--
CO5	S	M	M	L	--	--	--	M	--	--	--	M	--	--	--

S- Strong; M-Medium; L-Low

SYLLABUS

DIFFERENTIAL CALCULUS:

Ordinary Differentiation – Basic Concepts – Slope – Maxima, Minima of a function of a single variable – Second order derivates – Partial Differentiation– maxima and minima of a function of two variables.

INTEGRATION:

Concept of integration-Integration of Rational and Trigonometric functions – Using Partial Fractions – Substitutions – Integration by parts.

ORDINARY DIFFERENTIAL EQUATIONS:

Formation of differential equations – Solution of first order equation – Variable separable and solution of Linear differential equation of the form $\frac{dy}{dx} + Py = Q$ – Linear Second Order ordinary differential equation with constant coefficients (exp(ax) , cosax, sinax).

STATISTICS:

Measure of central value – Average – Type of average – Arithmetic; Mean, Median, Mode –Measures of Dispersion – Measure of Skewness and Kurtosis – measure of Skewness based on Moments.

CORRELATION AND REGRESSION ANALYSIS: Correlation analysis – methods of correlation. Regression analysis – Regression equation – Multiple and partial correlation – Notations – Equation of regression plane (Three variables) – Multiple correlation coefficients – Partial Correlation coefficients

TEXT BOOKS:

1. Grewal, B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi (2012).
2. S.P. Gupta, "Statistical Methods", 34th Edition, Sultan Chand & Sons Publishers (2006).

REFERENCES:

1. Kreyszig, E., "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons (Asia) Pvt Ltd., Singapore (2012).
2. Ewans & G.Grant, "Statistical Methods in Bio informatics – An Introduction", (2005).

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Name of the College	Mail ID
1	Dr.P.Sasikala	Prof	VMKVEC	sasikalap@vmkvec.edu.in
2	Mrs.V.T.Lakshmi	Asso.Prof	VMKVEC	lakshmi@vmkvec.edu.in

17PCBS02	PHYSICAL SCIENCES PART A - ENGINEERING PHYSICS	Category	L	T	P	Credit
		FC (BS)	2	0	0	2

PREAMBLE

Engineering Physics is the application of the concepts of physics to various technological applications. Understanding the concepts of laser, types of lasers, the propagation of light through fibers, applications of optical fibers in communication and different types of non-destructive techniques will help an engineer to analyze and design various equipments.

PREREQUISITE

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COURSE OBJECTIVES

1	To recall the properties of laser and to explain principles of laser
2	To examine the applications of laser
3	To outline the principles of fibre optics
4	To examine the applications of fibre optics
5	To explain various techniques used in Non-destructive testing

COURSE OUTCOMES

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

CO1. Define the principles of laser	Understand
CO2. Use laser in designing equipments	Apply
CO3. Explain the principles of fiber optics & the propagation of light in optical fibers	Understand
CO4. Utilize fibre optics in communication systems and sensors	Apply
CO5. Inspect materials using non-destructive testing techniques	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M	L	L											
CO2	S	S	M	M	S	M			L			M			
CO3	L	M	L	L											
CO4	S	S	M	M	S	M			L			M			
CO5	S	S	M	M	S	M			M			M			

S- Strong; M-Medium; L-Low

SYLLABUS

LASERS: Laser characteristics - Stimulated Emission – Population Inversion - Einstein coefficients – Lasing action – Types of Laser – Nd:YAG laser, CO2 laser, GaAs laser – Applications of Laser – Holography – construction and reconstruction of a hologram

FIBRE OPTICS: Principle and propagation of light in optical fibres – numerical aperture and acceptance angle – types of optical fibres (material, refractive index, mode) – Applications: Fibre optic communication system – fibre optic displacement sensor and pressure sensor.

NON-DESTRUCTIVE TESTING: Introduction – Types of NDT - Liquid penetrant method – characteristics of penetrant and developer - ultrasonic flaw detector – X-ray Radiography: displacement method – X-ray Fluoroscopy.

TEXT BOOK

Engineering Physics, compiled by Department of Physics, Vinayaka Missions University, Salem.

REFERENCE BOOKS

1. Beiser, Arthur, Concepts of Modern Physics, 5th Ed., McGraw-Hill, 2009.

2. Halliday. D, Resnick. R, Walker. J, Fundamentals of Physics, Wiley & sons, 2013.

3.Gaur R. K. and Gupta S. L., Engineering Physics, Dhanpat Rai publishers, New Delhi, 2001.

4. Avanadhanulu. M. N., Arun Murthy. T. V. S, Engineering Physics Vol. I, S. Chand, 2014.

5. Rajendran. V, Engineering Physics, Tata Mc Graw Hill Publication and Co., New Delhi, 2009.

6. Baldev Raj et al. Practical Non-Destructive Testing, Narosa Publications, 2017.

COURSE DESIGNERS

S.No.	Name of the Faculty	Mail ID
1	Dr. C. SENTHIL KUMAR	senthilbdu@gmail.com
2	Dr. R. SETHUPATHI	sethupathivmkv@gmail.com

17PCBS02	**PHYSICAL SCIENCES (PART B - ENGINEERING CHEMISTRY)**	Category	L	T	P	Credit
		FC (BS)	2	0	0	2

PREAMBLE

Engineering Chemistry explains the fundamentals of Engineering Chemistry and helps the learners to understand the applications of Engineering Chemistry. The electrodes, Cell and batteries study gives a clear idea about electrochemistry. Water technology study gives the initiative about softening of water, desalination and corrosion. Conventional and Non-conventional energy field is essential for the current scenario and the advanced engineering materials are needed for our fast growing life style.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To impart fundamental knowledge in Chemistry so that the student will understand the engineering concept and can face the forthcoming years as well as the industry effectively.
2	To have a clear knowledge of electrochemistry, cells and electrodes.
3	To familiarizes the type of batteries and fuel cell.
4	To lay foundation for practical applications of water softening and desalination in engineering aspects.
5	To inculcate the knowledge of fuel, this is essential for current scenario.

COURSE OUTCOMES

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

CO1. Understand the vital knowledge in Engineering Chemistry helps the learners in future studies	Understand
CO2. Employ the basic knowledge of cells and electrodes	Apply
CO3. Demonstrate the applications of water softening	Apply
Apply desalination process with engineering aspects	Apply
CO5. Discuss about conventional and non-conventional fuel for the current scenario.	Understand
CO6 Generalize polymers and smart materials	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	M	-	-	M	M	-	-	-	-	M			
CO2	M	M	M	-	-	M	M	-	-	-	-	S			
CO3	M	S	M	-	-	S	M	-	-	-	-	S			
CO4	M	M	M	-	-	M	M	-	-	-	-	S			
CO5	M	M	L	-	-	M	S	-	-	-	-	S			
CO6	M	M	M	-	-	M	M	-	-	-	-	S			

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT – I: ELECTROCHEMISTRY, BATTERIES AND FUEL CELLS

Electrode potential - Nernst equation – Electrodes (SHE, Calomel and Glass) - cells - EMF measurement. Primary battery (Daniel and dry cell) – secondary battery (lead Acid storage battery and Nickel-Cadmium battery) – Fuel cell (H_2-O_2 fuel cell)

UNIT – II: WATER TECHNOLOGY AND CORROSION

Sources of water – impurities – Hardness and its determination (problems to be avoided) – boiler troubles – water softening (Zeolite & Demineralisation) – Domestic water treatment – Desalination (Electrodialysis&ReverseOsmosis).

UNIT – III FUELS AND CHEMISTRY OF ADVANCED MATERIALS

Classification of Fuels (Solid, Liquid, Gaseous, Nuclear and Bio fuels) – Calorific Value of a fuel –Non Petroleum Fuels –Non conventional sources of Energy – combustion.

Basics and Applications:-Organic electronic material, shape memory alloys, polymers (PVC, Teflon, Bakelite)

TEXTBOOK

1.Engineering Chemistry by VMU.

REFERENCES

1. A text book of Engineering Chemistry by S.S. Dara, S.Chand & company Ltd., New Delhi
2. Engineering Chemistry by Jain & Jain, 15th edition Dhanpatrai Publishing Company (P) Ltd., New Delhi
3. A text book of Engineering Chemistry by Shashi Chawla, Edition 2012 Dhanpatrai & Co., New Delhi.
4. Engineering Chemistry by Dr. A. Ravikrishnan, Sri Krishna Publications, Chennai.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.T.Shanthi	Professor & Head	Chemistry	shanthi@vmkvec.edu.in
2	Mr.A Gilbert sunderraj	Assistant Professor	Chemistry	gilbertsunderraj@vmkvec.edu.in

17CSES01	ESSENTIALS OF COMPUTING	Category	L	T	P	Credit
		ES	3	0	0	3

PREAMBLE

This course aims to provide the fundamental concepts of Computer operations like hardware and software installation, and emphasizing principles application packages. Studying the fundamentals concepts of Algorithms, to resolve the real world application.

PRERQUISITE – Nil

COURSE OBJECTIVES

1	To provide basic knowledge of hardware and software components of computers.
2	To introduce and demonstrate various software application packages.
3	To study Problem solving Techniques and program development cycle.
4	To learn about various algorithm and identifying the algorithm efficiency.
5	To learn different algorithm for various application.

COURSE OUTCOMES

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

CO1. Basic knowledge on hardware and software terminologies.	Remember and Understand
CO2. Demonstration about various Application Packages like MS-word, MS- Excel etc.	Apply
CO3. Understand Program Devolvement Cycle and apply various Problem Solving Techniques.	Understand, Apply.
CO4. Identifying and analyzing the efficiency of Algorithms.	Understand.
CO5. Implementation of Algorithms for various concepts.	Understand and Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	--	--	--	--	--	--	--	--	--	--	--	S	M	--
CO2	S	M	--	--	--	--	--	--	--	--	--	--	S	M	L
CO3	S	S	S	--	M	--	--	--	--	--	--	--	S	L	--
CO4	S	S	S	--	S	--	--	--	--	--	--	--	S	M	--
CO5	S	M	M	--	M	--	--	--	--	--	--	--	S	M	--

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF COMPUTER AND INFORMATION TECHNOLOGY: Computer – Generations, Types of Computers, Block diagram of a computer – Components of a computer system –Hardware and software definitions – Categories of software – Booting – Installing and Uninstalling a Software –Software piracy – Software terminologies – Applications of Computer – Role of Information Technology – History of Internet – Internet Services.

SOFTWARE APPLICATIONS: Office Automation: Application Packages – Word processing (MS Word) – Spread sheet (MS Excel) – Presentation (MS PowerPoint).

PROBLEM SOLVING METHODOLOGIES: Problems Solving Techniques - Program Development Cycle – Algorithm Development – Flow chart generation –Programming Constructs (Sequential, Decision-Making, Iteration) – Types and generation of programming Languages.

INTRODUCTION TO ALGORITHMS: Implementation of Algorithms – program verification – The efficiency of algorithms – The analysis of algorithms.

IMPLEMENTATION OF ALGORITHMS: Fundamental Algorithms: Introduction – Exchanging the values of two variables – Counting – Summation of a set of Numbers – factorial computation – Generation of the Fibonacci sequence – Reversing the digits of an integer.

TEXT BOOKS:

1. "Essentials of Computer Science and Engineering", Department of Computer Sciences, VMKVEC, Salem, Anuradha Publishers, 2017.
2. Dromey.R.G, "How to Solve it by Computer", Prentice-Hall of India, 1996.

REFERENCES:

1. Aho.A.V., Hopcroft.J.E and Ullman.J.D, "The Design and Analysis of Computer Algorithms", Pearson Education, 2004.
2. Knuth D.E., "The Art of computer programming Vol 1: Fundamental Algorithms", 3rd Edition, Addison Wesley, 1997.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.V.Amirthalingam	Associate Professor	Computer Science and Engineering	amirthalingam@vmkvec.edu.in
2	Mrs.T.Geetha	Assistant Professor	Computer Science and Engineering	geetha@vmkvec.edu.in

17BTES04	FUNDAMENTALS OF BIOTECHNOLOGY	Category	L	T	P	Credit
		FC (ES)	3	0	0	3

PREAMBLE

Biotechnology is the Combination of biological sciences and engineering in order to understand and improve the lifestyle of living organisms. Bioprocesses and pathways, living microorganisms, plant and animal cells and/or cellular materials are exploited to develop new expertise. Advanced tools and technologies developed by biotechnologists are used in research and development, healthcare, agriculture, and the industry to further enhance organisms and bioprocesses. Fundamental principles of genetic engineering, rDNA technology helps to produce commercial manufacture of new recombinant DNA derived products.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To acquire knowledge on principles of biotechnology.
2	To study in detail about mechanism and applications of genetic engineering in the food and agricultural industry.
3	To understand importance of biotechnology to develop genetically modified animals its applications.
4	To analyze in details about performance of drugs developed using rDNA technology.
5	To apply the knowledge of biotechnology to enhance the environment.

COURSE OUTCOMES

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

CO1. Knowledge about fundamental principles about biotechnology.	Understand
CO2. Acquired good knowledge on genetically modified products in food and agricultural field.	Understand
CO3. Understand in detail about the applications of genetically modified animals in research and development	Understand
CO4. Apply the knowledge of biotechnology to improve global environment.	Apply
CO5. Analyzing in detail about the performance of drugs produced by novel methods	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	M	L	M	L	S	L	M	L	S	S	S	M
CO2	S	M	S	S	M	M	S	M	S	M	M	S	S	M	M
CO3	S	S	S	S	M	M	M	M	S	M	M	S	S	M	M
CO4	S	S	S	S	S	M	M	S	S	M	M	M	S	S	S
CO5	S	M	M	S	M	M	S	S	M	M	M	M	S	S	S

S- Strong; M-Medium; L-Low

SYLLABUS

FOOD BIOTECHNOLOGY

Scope and importance of Food Biotechnology, Arctic Apples, Golden Rice, Flavr – Savr Tomato, Bt-potatoes, Virus resistant Squash, Fermented Food, Single Cell Protein – Spirulina.

AGRICULTURAL BIOTECHNOLOGY

Basics of plant tissue culture – callus induction, organogenesis, embryogenesis – embryo rescue, somatic embryogenesis, somaclonal variation, artificial seeds, secondary metabolites and their uses, Protoplast technology – hybrids and Cybrids, Biofertilizer, Biological Pest Control.

ANIMAL BIOTECHNOLOGY

Transgenic animals – Knock out mice, chimeric mice, Baculoviruses and transgenic silkworm, Hybridoma Technique for Monoclonal antibodies, Pharmaceuticals from animal systems, Animal bioreactors to produce therapeutic proteins, Karyotyping, FISH – Fluorescent in situ hybridization.

MEDICINAL BIOTECHNOLOGY

Industrial Enzyme production: α-amylase, cellulase, protease and lipase, Recombinant protein production: Insulin and interferon, Antibiotic production: Penicillin- Synthetic and Semisynthetic and Bacitracin (Novartis and Genetech), Gene Therapy, Clinical Diagnosis using electronic devices (PCR, ELISA, Glucometer, RIA, Biosensor).

ENVIRONMENTAL BIOTECHNOLOGY

Molecular approaches towards bioremediation, Biosensors for detection of environmental pollutants, Ecofriendly & sustainable Environmental Technologies, Renewable energy technologies.

TEXT BOOKS

1. Gupta, P.K., “Elements of Biotechnology”, Rastogi Publications, 2nd Edition, 2010.
2. Satyanarayana.U., “Biotechnology”, Books and Allied Pvt Ltd., 2005.

REFERENCE BOOKS

1. John E. Smith., “Biotechnology”, Cambridge Press. 3rd Edition, 2005.
2. Glazer A and Nikaido H., “Microbial Biotechnology - Fundamentals of Applied Microbiology”, Cambridge University Press, 2nd Edition, 2007.
3. Jogdand S.N., “Environmental Biotechnology”, Himalaya Publishing House, 2003.
4. Kumar H.D., “Modern Concepts and Biotechnology”, Vikas Publishing House Pvt. Ltd, 1998.
5. R.C. Dubey., “Textbook of Biotechnology”, S. Chand Publishing., 2001.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr.N.Jawahar	Assistant Professor	Biotechnology	jawahar@vmkvec.edu.in
2	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@ vmkvec.edu.in

17EGHS81	ENGLISH LANGUAGE LAB	Category	L	T	P	Credit
		HSS	0	0	4	2

PREAMBLE

English Language Laboratory provides technological support to students. It acts as a platform for learning, practicing and producing language skills through interactive lessons and communicative mode of teaching.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To understand communication nuisances in the corporate sector.
2	To understand the role of mother tongue in second language learning and to avoid interference of mother tongue.
3	To communicate effectively through different activities
4	To understand and apply the telephone etiquette
5	Case study to understand the practical aspects of communication
6	To improve the oral skills of the students

COURSE OUTCOMES

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

CO1. Give best performance in group discussion and interview	Understand
CO2. Best performance in the art of conversation and public speaking.	Apply
CO3. Give better job opportunities in corporate companies	Apply
CO4. Better understanding of nuances of English language through audio-visual experience and group activities	Apply
CO5. Speaking skills with clarity and confidence which in turn enhances their employability skills	Understand
CO6. Acquire strategic competence to use both spoken and written language in a wide range of communication strategies	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**-**	**S**	**M**	**S**	**-**	**L**	**-**	**-**	**S**	**S**	**M**	**-**	**-**	**-**	**-**
CO2	**M**	**L**	**-**	**-**	**-**	**-**	**L**	**-**	**M**	**S**	**-**	**M**	**-**	**-**	**-**
CO3	**M**	**-**	**-**	**L**	**-**	**L**	**-**	**-**	**L**	**S**	**-**	**M**	**-**	**-**	
CO4	**M**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**M**	**-**	**-**	**-**
CO5	**M**	**-**	**-**	**S**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**M**	**-**	**-**	**-**
CO6	**-**	**M**	**M**	**-**	**-**	**-**	**-**	**-**	**-**	**M**	**-**	**M**	**-**	**-**	**-**

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT – I: Ice Breaker, Grouping, Listening- (Hearing and listening)- Active Listening- Passive Listening

– Listening to a song and understanding- (fill in the blanks) Telephone Conversation **UNIT – II:** Influence of mother tongue, videos, understanding nuances of English language (video) puzzle to solve, Activity. **UNIT – III:**Why is English important, Communication skills, TED (video) Communication in different scenario – a case study, ingredients of success, Activity – chart, speak the design, feedback on progress, Group wise, Individual. **UNIT IV**. Telephone Etiquette, Dining Etiquette, Meeting Etiquette. **UNIT V.** Case study of Etiquette in different scenario. TEXTBOOK REFERENCES

S.No.	Name of the Faculty	Mail ID
1.	Dr. P.Saradha/ Associate Professor - English	saradhap@vmkvec.edu.in

17PCBS81	PHYSICAL SCIENCES LAB: PART A – REAL AND VIRTUAL LAB IN PHYSICS	Category	L	T	P	Credit
		FC (BS)	0	0	2	1

PREAMBLE

Real and Virtual Lab in Physics trains the students to take readings with precision. The experiments involve the calculation of physical parameters. In addition to the above, the students have the hands-on experience in performing the experiments through virtual laboratory.

PREREQUISITE

-

COURSE OBJECTIVES

1	To impart basic skills in taking reading with precision of physics experiments
2	To inculcate the habit of handling equipments appropriately
3	To gain the knowledge of practicing experiments through virtual laboratory.
4	To know the importance of units
5	To obtain results with accuracy

COURSE OUTCOMES

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

CO1. Operate the equipments with precision	Apply
CO2. Practice to handle the equipments in a systematic manner	Apply
CO3. Demonstrate the experiments through virtual laboratory	Apply
CO4.Recognize the importance of units while performing experiments, during calculating the physical parameters and in obtaining results	Understand
CO5. Calculate the result with accuracy	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	M	S				M			M			
CO2	S														
CO3	S	S	M	M	S							S			
CO4	S	S													
CO5	S	S													

S- Strong; M-Medium; L-Low

SYLLABUS

1. Young's modulus of a bar - Non-uniform bending
2. Rigidity modulus of a wire - Torsional Pendulum
3. Viscosity of a liquid - Poiseuille's method
4. Velocity of ultrasonic waves in liquids - Ultrasonic Interferometer
5. Particle size determination using Laser

6. Wavelength of spectral lines – grating – Spectrometer
7. Thickness of a wire - Air wedge Method
8. Thermal conductivity of a bad conductor - Lee's disc
9. Band gap determination of a thermistor - Post Office Box
10. Specific resistance of a wire – Potentiometer

LAB MANUAL

Physical Sciences Lab: Part A – Real And Virtual Lab In Physics Manual, prepared by the faculty of Department of Physics, Vinayaka Mission's Kirupananda Variyar Engineering College, Salem (2017).

COURSE DESIGNERS

S.No.	Name of the Faculty	Mail ID
1	Dr. C. SENTHIL KUMAR	senthilbdu@gmail.com
2	Dr. R. SETHUPATHI	sethupathivmkv@gmail.com

17PCBS81	PHYSICAL SCIENCES PART B - ENGINEERING CHEMISTRY LAB	Category	L	T	P	Credit
		FC (BS)	0	0	2	1

PREAMBLE

Engineering Chemistry Lab experiments explains the basics and essentials of Engineering Chemistry. It also helps the students to understand the applications of Engineering Chemistry. The electrodes, Cell and batteries study gives clear basic application oriented knowledge about electrochemistry. Water technology study gives the idea about hardness and its disadvantages.. Now-a-days the practical and handling of equipments are needed for our fast growing life style.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To impart basic skills in Chemistry so that the student will understand the engineering concept.
2	To inculcate the knowledge of water and electrochemistry.
3	To lay foundation for practical applications of chemistry in engineering aspects.

COURSE OUTCOMES

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

CO1. Understand the basic skills for his/her future studies.	Understand
CO2 Analyze the water comprehensively.	Apply
CO3. Apply the practical knowledge in engineering aspects	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	-	L	M	M	S	-	-	-	M	-	-	-
CO2	S	M	M	-	L	M	M	L	-	-	-	M	-	-	-
CO3	S	S	M	-	L	M	M	M	-	-	-	M			

S- Strong; M-Medium; L-Low

SYLLABUS

1. Determination of Hardness by EDTA method
2. Estimation of Hydrochloric acid by conductometric method
3. Acid Base titration by pH method
4. Estimation of Ferrous ion by Potentiometric method
5. Determination of Dissolved oxygen by Winkler's method
6. Estimation of Sodium by Flame photometer
7. Estimation of Copper from Copper Ore Solution
8. 8.Estimation of Iron by Spectrophotometer

Text Book:

1. Engineering Chemistry Lab Manual by VMU.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Dr.T.Shanthi	Professor & Head	Chemistry	shanthi@vmkvec.edu.in
2	Mr.A.Gilbertraj	Assistant Professor	Chemistry	gilbertsunderraj@vmkvec.edu.in

VINAYAKA MISSION'S RESEARCH FOUNDATION
(DEEMED TO BE UNIVERSITY, SALEM)
AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY, CHENNAI
&
VINAYAKA MISSION'S KIRUPANANDA VARIYAR ENGINEERING COLLEGE, SALEM
FACULTY OF ENGINEERING AND TECHNOLOGY
STRUCTURED CHOICE BASED CREDIT SYSTEM

BOARD : BIOTECHNOLOGY
REGULATION : 2017
PROGRAM :B.Tech., – BIOTECHNOLOGY (FULL TIME - REGULAR)

CURRICULUM AND SYLLABUS

SEMESTER – II								
S.NO	**COURSE CODE**	**COURSE TITLE**	**OFFERING DEPARTMENT**	**CATEGORY**	**L**	**T**	**P**	**C**
THEORY								
1	17MABS07	BIOSTATISTICS	MATHEMATICS	FC(BS)	2	2	0	**3**
2	17CSES06	PROGRAMMING IN C	CSE	FC(ES)	3	0	0	**3**
3	17BTCC02	CELL BIOLOGY	BTE	CC	3	0	0	**3**
4	17PHBS05	SMART MATERIALS	PHYSICS	FC(BS)	3	0	0	**3**
5	17BTCC01	ESSENTIALS OF BIOCHEMISTRY	BTE	CC	3	0	0	**3**
PRACTICAL								
6	17CSES85	PROGRAMMING IN C LAB	CSE	FC(ES)	0	0	4	**2**
7	17BTCC81	BIOCHEMISTRY LAB	BTE	CC	0	0	4	**2**
8	17BTCC82	CELL BIOLOGYLAB	BTE	CC	0	0	4	**2**
TOTAL					**14**	**2**	**12**	**21**
L – LECTURE HOUR		T – TUTORIAL HOUR	P – PRACTICAL HOUR		C – CREDIT			

HSS	HUMANITIES AND SOCIAL SCIENCES	CC	CORE COURSES
BS	BASIC SCIENCES	EC	ELECTIVE COURSES
ES	ENGINEERING SCIENCES	EEC	EMPLOYABILITY ENHANCEMENT COURSES + EXTRA CURRICULAR COURSES + CO - CURRICULAR COURSES
PII	PROJECT + INTERNSHIP + INDUSTRY ELECTIVES		

SYLLABUS – SEMESTER II

17MABS07	**BIOSTATISTICS** (Statistical table permitted for Examination)	Category	L	T	P	Credit
		FC (BS)	2	2	0	3

PREAMBLE

Biostatistics is the application of statistical methods in studies in biology by collection of data, analysis and interpretation of data. The data come from a wide range of sources, including genomic studies, experiments with cells and organisms, and clinical trials. Testing of hypothesis is a Statistical procedure to draw inferences from samples about population. Statistical Quality control is a method of quality control which employs statistical methods to monitor and control a process. This helps ensure the process operates efficiently, producing more specification-conforming product. Acceptance sampling allows measuring the quality of a batch of products by selecting a specified number of products for testing.

PREREQUISITE

Mathematics for Bio-Engineering

COURSE OBJECTIVES

1	Develop skills in presenting quantitative data using appropriate diagrams, tabulations and summaries
2	Gain fundamental knowledge of the probability concepts with respect to how they are applied to the fundamental interpretation of statistical data.
3	To acquire knowledge of Testing of Hypothesis useful in making decision and test them by means of the measurements made on the sample.
4	To be get exposed to the statistical methods designed to contribute to the process of making scientific judgments in the face of uncertainty and variation.
5	To understand the concept of Quality control and the use of operating characteristic (OC) curves in Acceptance sampling.

COURSE OUTCOMES

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

CO1. Plan a statistical data investigation in the biosciences and related fields, and propose a method for data collection and analysis.	Apply
CO2. Apply probability rules and probability models to solve problems and translate real-world problems into probability models. Identify and recognize the appropriate sample survey design for related problems.	Apply
CO3. Identify and perform statistical significance tests for small, large samples and interpret the test results appropriately.	Apply
CO4. Interpret results from Analysis of Variance (ANOVA), a technique used to compare means amongst more than two independent populations.	Analyze
CO5. Prepare Control charts and decide on the in-control status of the process. Estimate whether a lot is acceptable or unacceptable based on acceptance sampling plans.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	--	--	--	--	L	--	--	--	M	--	--	--
CO2	S	M	M	L	--	--	--	M	--	--	--	M	--	--	--
CO3	S	S	M	L	--	--	--	M	--	--	--	M	--	--	--
CO4	S	S	M	L	--	--	--	M	--	--	--	M	--	--	--

CO5	S	M	M	L	--	--	--	M	--	--	--	M	--	--	--

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO BIOSTATISTICS : Statistics – Definition, Scope, Limitation – Collection of data – Primary & Secondary Data; Classification & Tabulation of data – Type of Classification & Tabulation – Diagrammatic and Graphical representation of data – Types and significance.

PROBABILITY AND SAMPLING: Probability – Definition – Measurement & Law of Probability – Conditional Probability – Baye's Theorem – Probability Distributions – Application of Probability. Sampling: Method of Sampling – Random and Non-Random Sampling – Merits and Demerits, Limitation of sampling.

TESTING OF HYPOTHESIS: Sampling distributions – Statistical hypothesis – Testing of hypothesis for mean, variance, proportions using Normal, t and F distributions. Chi-square Tests for independence of attributes and Goodness of fit.

DESIGN OF EXPERIMENTS: Analysis of variance – One way and Two way classifications – Completely randomized design – Randomized block design.

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

TEXT BOOKS:

1. S.P. Gupta, "Statistical Methods", 34^{th} Edition, Sultan Chand & Sons Publishers (2006).
2. P.N.Arora, P.K.Malhan, "Biostatistics", Himalaya Publishing House (2010).

REFERENCES:

1. Milton.J.S, "Statistical Methods in Biological & Health Science", McGraw Hill, New York (1992).
2. S.S.Sundar Rao, J.Richard, "Introduction to Biostatistics and Research Methods", 5^{th} Edition, Prentice-Hall of India Pvt. Ltd (2016).

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr.P.Sasikala	Professor	Mathematics	sasikalap@vmkvec.edu.in
2	Ms.M.Usha	Assistant Professor	Mathematics	usha@vmkvec.edu.in

17CSES06	PROGRAMMING IN C	CATEGORY	L	T	P	CREDIT
		FC	3	0	0	3

PREAMBLE

This is a course offered in first semester for the students of Bio-Tech Engineering. This course has three credits dedicated to provide the students a strong foundation on programming concepts and its application. It also enables the students to solve problems using programmable logic.

PRERQUISITE

NIL

COURSE OBJECTIVES

1	To introduce Basics of C.
2	To understand Control Structures & Arrays.
3	To learn about String concept, Structure and Union in C.
4	To introduce the concepts of Functions and Pointers.
5	To introduce Memory and File management concepts in C.

COURSE OUTCOMES

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

CO1. To understand the basics of C Data types, scope of variables, different types of Operators	Understand
CO2. Demonstrate the difference between iteration and recursion in terms of C programming	Understand
CO3. Develop C programs for arrays and structure	Apply
CO4. Develop C programs for functions	Apply
CO5. Develop C programs for File Management concept	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L												S	L	
CO2	S	S	S	M	S	M	S			M			S	M	L
CO3	S	S	S	M	S				M				S	L	L
CO4	S	S	S	M	S		M						S	M	
CO5	S	S	S	M	S								S	M	

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF C

Identifiers, variables, expression, keywords, data types, constants, scope of variables. Operators: arithmetic, logical, relational, conditional and bitwise operators – Special operators: size of ( ) & comma (,) operator – Precedence and associatively of operators – Type conversion in expressions.

CONTROL STRUCTURES

Basic input/output and library functions: Single character input/output i.e. getch( ), getchar( ), getche( ), putchar( ) – Formatted input/output: printf( ) and scanf( ) – Library functions (mathematical and character functions). Decision Making and Branching – Looping statements.

ARRAYS, STRING, STRUCTURE & UNION

Arrays – Initialization – Declaration – One dimensional and two dimensional arrays. Strings: Declaration – Initialization and string handling functions. Structure and Union: structure declaration and definition – Accessing a Structure variable – Structure within a structure – Union.

FUNCTIONS AND POINTERS

Function – Function Declaration – function definition – Pass by value – Pass by reference – Recursive function – Pointers – Definition – Initialization

MEMORY AND FILE MANAGEMENT

Static and dynamic memory allocation – Storage class specifier – Preprocessor directives. File handling concepts – File read – write – Functions for file manipulation: fopen, fclose, gets, puts, fprintf, fscan, getw, putw, fputs, fgets, fread, fwrite.

TEXT BOOKS:

1.Balaguruswami. E, "Programming in C", TMH Publications, 1997

REFERENCES:

1. Behrouz A. Forouzan& Richard F. Gilberg, "Computer Science A Structured Programming using C", Cengage Learning, 3rd Edition, 2007.
2. Gottfried, "Programming with C", schaums outline series, TMH publications, 1997.
3. Mahapatra , "Thinking in C", PHI publications, 2nd Edition, 1998.
4. Subbura.R , "Programming in C", Vikas publishing, 1st Edition, 2000.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr. B. Sundharamurthy	Assistant Professor	Computer science and engineering	sundharamurthy@vmkvec..edu.in
2	Mr. S. Senthilkumar	Assistant Professor	Computer science and engineering	senthilkumars@vmkvec.edu.in

17BTCC02	CELL BIOLOGY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Cell biology deals with the structures, organization and functions of the cells and organelles, their physiological properties, life cycle, metabolic processes, signalling pathways and their interactions with their environment at microscopic and molecular level. The subject helps to gain knowledge in fundamentals of cells to all biological sciences, for research in bio-medical fields such as cancer, and other diseases and also in research related to genetics, biochemistry, molecular biology, immunology, and developmental biology.

PRERQUISITE - NIL

COURSE OBJECTIVES

1	To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
2	Students will understand how these cellular components are used to generate and utilize energy in cells and the concepts behind cell division.
3	To give an overview of cell signaling molecules and their receptors.
4	To understand the pathways and intracellular signal transduction
5	To make students to apply their knowledge of cell biology to selected examples of changes or losses in cell function

COURSE OUTCOMES

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

CO1. List the fundamental features of prokaryotic and eukaryotic cells, their structure, composition and role of cell membranes and the major stages of the cell cycle	Understand
CO2. To understand the specific processes and proteins involved in membrane transport	Understand
CO3. To understand about intercellular chemical messengers, receptor subclasses and their possible uses in cell signalling.	Understand
CO4. To analyze the mechanisms by which different messenger-receptor interactions bring about long or short-term changes in cell state.	Apply
CO5. To Integrate the different levels of biological organization, from molecules to cells to organisms.	Apply
CO6. To apply critical thinking and logical analysis in the assessment and evaluation of issues in cell biology and genetics.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L	M	S	L	L	-	-	-	-	-	-	-	-	-
CO2	L	M	M	L	L	L	-	-	-	-	-	-	-	-	-
CO3	L	M	M	L	M	L	M	-	-	-	-	-	-	-	-
CO4	M	M	S	S	M	L	-	-	-	-	-	-	S	M	M

CO5	M	M	S	S	M	M	M	-	-	-	-	L	-	M	-
CO6	M	M	S	S	S	S	-	-	-	-	-	-	-	S	M

S- Strong; M-Medium; L-Low

SYLLABUS

CELL AND FUNCTIONS OF THE ORGANELLES

General structure – Prokaryotic and eukaryotic cell, Molecular organization of the cell membrane, Cell membrane – Proteins, Lipids and Carbohydrates, Cell organelles, Cytoskeletal proteins, Types of cell functions, Cell cycle - Mitosis and meiosis, apoptosis.

CELL MEMBRANE AND PERMEABILITY

Passive and active transport, Permeases, Sodium potassium pump, Ca2+, AT Pase pumps, Lysosomal and vacuolar membrane, Co-transport, Uniport, Symport, Antiport, Protein localization & Membrane trafficking, Endocytosis and exocytosis, Entry of viruses and toxins into cells.

CELL SIGNALING MOLECULES AND THEIR RECEPTORS

Cytosolic, Nuclear and membrane bound receptors, Examples of receptors, Modes of cell – cell signaling: Autocrine, Paracrine and Endocrine models of action, Secondary messenger's molecules, Quantitation and characterization of receptors.

PATHWAYS AND INTRACELLULAR SIGNAL TRANSDUCTION

Signal amplification – Different models of signal amplifications, Cyclic AMP, Role of inositol phosphates as messengers, Biosynthesis of inositol triphosphates, Cyclic GMP and G proteins role in signal transduction, Calcium ion flux and its role in cell Signaling, Current models of signal amplification, Phosphorylation of protein kinases.

CELL CULTURE

Techniques for the propagation of prokaryotic and eukaryotic cells, Cell line, Generation of cell lines, Maintenance of stock cells, Characterization of cell, Morphological analysis techniques in cell culture, Explant cultures, Primary cultures, Contamination, Differentiation.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mrs.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in
2	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi @ vmkvec.edu.in

17PHBS05	SMART MATERIALS	Category	L	T	P	Credit
		Basic Sciences	3	0	0	3

PREAMBLE

Smart Materials gives an outlook about various types of materials having potential application in Engineering and Technology. In particular, Students learn about Smart Materials and their applications, Properties of Crystalline Materials & Nanomaterials, Characteristics of Magnetic materials. They also get a clear picture about superconducting materials.

PRERQUISITE

NIL

COURSE OBJECTIVES

1	To explain the properties of smart materials
2	To demonstrate the structure of crystalline materials
3	To examine the synthesis of Nano materials
4	To explain the properties and classification of magnetic materials
5	To outline the concept of superconducting materials and their properties

COURSE OUTCOMES

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

CO1. Utilize the smart materials for designing equipments	Apply
CO2. Interpret the structure of crystalline materials	Apply
CO3. Develop equipments using nanomaterials	Analyze
CO4. Use the properties of magnetic materials in designing equipments	Apply
CO5. Develop the efficiency of superconducting materials	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	M	S				M			M			
CO2	S	M	S	M	S				M			M			
CO3	S	S	S	S	S				S			M			
CO4	S	M	S	M	S				M			M			
CO5	S	S	S	S	S				S			M			

S- Strong; M-Medium; L-Low

SYLLABUS

SMART MATERIALS:

Shape Memory Alloys (SMA) – Characteristics and properties of SMA, Application, advantages and disadvantages of SMA. Metallic glasses – Preparation, properties and applications.

CRYSTALLINE MATERIALS:
Unit cell – Bravais lattice – Miller indices – Calculation of number of atoms per unit cell – atomic radius – coordination number – packing factor for SC, BCC, FCC, HCP structures.

NANO MATERIALS:
Nanophase materials – Top-down approach - Mechanical Grinding - Lithography - Bottom-up approach – Sol-gel method – Carbon nanotubes – Fabrication – applications.

MAGNETIC MATERIALS:
Basic concepts – Classification of magnetic materials – Domain theory – Hysteresis – Soft and Hard magnetic materials.

SUPERCONDUCTING MATERIALS:
Superconducting phenomena – properties of superconductors – Meissner effect – isotope effect – Type I and Type II superconductors – High Tc Superconductors – Applications of superconductors.

TEXT BOOK:
Mani P, Engineering Physics II, Dhanam Publications, 2011.

REFERENCES:
1. Pillai S.O., Solid State Physics, New Age International (P) Ltd., publishers, 2009.

2. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. C. Senthil Kumar	Professor & Head	Physics	senthilbdu@gmail.com
2	Dr. R. Sethupathi	Associate Professor	Physics	sethupathivmkv@gmail.com

17BTCC01	ESSENTIALS OF BIOCHEMISTRY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Essentials of biochemistry deals with the study of biomolecules found in living organism. The course exposes the students to classification, properties, basic structure and functions of biomolecules like carbohydrate, amino acid, lipids, nucleic acid and vitamins. Knowledge of this course will enable students to understand the importance of biomolecules and give awareness to the various diseases associated with the deficiency of biomolecules

PRERQUISITE - NIL

COURSE OBJECTIVES

1	To understand the basic structure, properties and functions of Biomolecules
2	To emphasize the role of biomolecules by providing basic information on specific metabolic diseases.

COURSE OUTCOMES

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

CO1. Explain the classification properties and biological importance of carbohydrates	Understand
CO2. Discuss the classification, nomenclature, structure and properties of fatty acids	Understand
CO3. Knowledge about amino acids and proteins	Understand
CO4. Know about the importance of nucleic acid	Apply
CO5. Distinguish the vitamins and its deficiency	Understand
CO6. Know about the importance of minerals	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO02	PSO3
CO1	S	-	L	-	-	-	-	-	-	-	-	-	L	L	-
CO2	S	-	L	-	-	-	-	-	-	-	-	-	L	L	-
CO3	S	-	L	-	-	-	-	-	-	-	-	-	L	L	-
CO4	S	-	L	-	-	-	-	-	-	-	-	-	L	L	-
CO5	S	-	L	-	-	M	-	-	-	-	-	-	L	L	-
CO6	S	-	L	-	-	M	-	-	-	-	-	-	L	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

CARBOHYDRATE

Biological importance, Classification and Properties of Monosaccharides, Disaccharides and Polysaccharides (Starch, Glycogen, Cellulose and their derivatives, Chitin, Peptidoglycans, Glycoaminoglycans, Glycoconjugates).

LIPIDS

Biological importance, Classification. Fattyacids: classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids, Triacylglycerols: nomenclature, physical properties, chemical properties. Glycerophospholipids (lecithins, cephalins, phosphatidyl serine, phosphatidyl inositol, sphingomyelins).

AMINO ACIDS AND PROTEINS

Amino acids – Classification, Structure, Properties and Biological importance. Proteins – Classification, Structural organization of Proteins – Primary, Secondary (α-helix, β-pleated structure, triple helix), Tertiary and Quaternary (Myoglobin and Hemoglobin), Factors stabilizing, Properties and Biological importance, Denaturation and Renaturation.

NUCLEIC ACIDS

Nucleosides and nucleotides, configuration and conformation, Composition of RNA and DNA, Physico-chemical properties of nucleic acids – effect of alkali, acid and heat (denaturation and renaturation), features of phosphodiester bond, endonucleases. Complementary base pairing, secondary structure of RNA, features of DNA double helix (Watson-Crick model), Nucleoproteins – histone and nonhistone

VITAMINS

Nutritional importance of vitamin, classification, source, daily requirements and functions, Deficiency symptoms – hypervitaminosis of fat soluble vitamins. Nutritional importance of Minerals – classification, source, daily requirement and deficiency symptoms.

TEXT BOOKS

1. "Fundamentals of Biochemistry", Jain J.L., Sunjay Jain and Nitin Jain., S.Chand & Company Ltd., 6th Edition, 2005.

REFERENCES:

1. "Text Book of Biochemistry for Medical Students", Ambika Shanmugham, Lippin cott Williams & Wilkins, 7th Edition, 2012.
2. "Biochemistry", Rastogi S.C. Mc. Graw-Hill Publishing Company Ltd, 6th Edition, 2007.
3. "Principles of Biochemistry", David L. Nelson and Michael M. Cox, W. H. Freeman and Company, 4th Edition, 2005.
4. "Text book of Biochemistry", Sathyanarayana U and Chakrapani U., Uppala Author Publishers Interlinks, 3rd Edition, 2006.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@ vmkvec.edu.in
2	Mrs.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in

17CSES85	PROGRAMMING IN C LAB	Category	L	T	P	Credit
		ES	0	0	4	2

PREAMBLE

This Laboratory course will enable students to identify, formulate and solve real world engineering problems that require usage of algorithms in C. The course serves as a foundation laboratory for improving the problem solving skills of students.

PREREQUISITE

NIL

COURSE OBJECTIVES

1.	Gain knowledge about basic' C' language syntax and semantics to write 'C' programs and use concepts such as variables, conditional and iterative execution methods etc.
2.	Understand the fundamentals of String handling functions, structures and pointers.
3.	Understand the concepts of file handling.

COURSE OUTCOMES

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

CO1.Design algorithms for the given problem specifications	Analyze
CO2. To write simple programs and understand the basics of C.	Apply
CO3. Develop C programs for array sorting, searching and structure	Apply
CO4. To write C programs for matrix multiplication using functions	Apply
CO5. To write C programs for read, write and manipulate data using file concept.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L	-	-	-	-	-	-	-	-	-	-	S	M	-
CO2	S	M	M	-	-	-	-	-	-	-	-	-	S	M	L
CO3	S	S	S	-	-	-	-	-	-	-	-	-	S	L	-
CO4	S	S	S	-	-	-	-	-	-	-	-	-	S	M	-
CO5	S	M	M	-	-	-	-	-	-	-	-	-	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

Lab Experiments

Develop C programs for.

1. Write a C Program to Implementation of Sine and cosine series.
2. Write a C Program to generate Fibonacci Series using for loop.
3. Write a C program to calculate factorial using while loop.
4. Write a C Program to

a) Find the greatest of three numbers using if condition.

b) Find the greatest of three numbers using conditional operator.

5. Write a C program for finding the roots of a given quadratic equation using conditional control statements.
6. Write a C program to

a) Compute matrix multiplication using the concept of arrays.
b) Illustrate the concept of string handling functions.

7. Write a C program to find the largest element in an array using pointers.
8. Write a C program to read and write data using file concepts.
9. Write a C program to store employee details using the concept of structures.

REFERENCES

1. Laboratory Reference Manual.
2. Balaguruswami. E, “Programming in C”, TMH Publications, 1997
3. Gottfried, “Programming with C”, schaums outline series, TMH publications, 1997.
4. Mahapatra , “Thinking in C”, PHI publications, 2nd Edition, 1998.
5. Subbura.R , “Programming in C”, Vikas publishing, 1st Edition, 2000.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1.	Mr.B.Sundaramurthy	Associate Professor	Associate Professor	Computer Science and Engineering
2.	Mrs.T.Narmadha	Assistant Professor	Computer Science and Engineering	narmadhat@vmkvec.edu.in

17BTCC81	BIOCHEMISTRY LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

The course is a laboratory course that focuses on developing the skills of the students by providing hands on training in various techniques in Biochemistry

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To Understand laboratory safety and standard operating procedures of common laboratory equipment's.
2	To impart skills in preparation of solutions and biological buffers.
3	To extend knowledge in analysis & estimation of biomolecules

COURSE OUTCOMES

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

CO1. Demonstrate safe laboratory practices and handle the equipment safely	Apply
CO2. Prepare solutions and biological buffers	Apply
CO3. Isolate biomolecules from various source	Analyze
CO4. Determine the quality and quantity of biomolecules	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	-	-	M	S	M	-	-	-	-	-	-	M	-
CO2	S	S	M	-	-	-	-	-	-	-	-	-	-	S	-
CO3	S	S	S	M	S	-	-	-	-	-	-	-	M	S	-
CO4	S	S	S	-	S	-	-	-	-	-	-	-	-	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. pH measurements and Buffer preparations.

TITRIMETRIC EXPERIMENTS

2. Estimation of Ascorbic acid by Titrimetric method using 2, 6 Dichloro phenol indophenols.
3. Determination of Saponification value of Edible oil
4. Determination of Acid number of Edible oils.
5. Determination of Iodine value of Oil.

BIOCHEMICAL PREPARATIONS

6. Isolation of Chloroplast from Spinach leaves.
7. Cheese Production from Milk.
8. Casein from Milk.
9. Starch from Potato.

REFERENCES:

1. Laboratory Manual.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@vmkvec.edu.in
2	Mrs.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in

17BTCC82	CELL BIOLOGY LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

To offer hands on training in the areas of cell culture, cell identification and to demonstrate various techniques to learn the morphology, identification and propagation of cells.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	Demonstrate working principles of microscopy
2	Perform the basic techniques to work with cells.
3	Differentiate the cells by staining techniques.
4	Categorize the various stages of mitosis.
5	Differentiate the types of blood cells.

COURSE OUTCOMES

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

CO1. Demonstrate the basic concepts of sterilization techniques	Understand
CO2. Interpret the behaviour of cells in their microenvironment	Understand
CO3. Analyze scientific work and experimental results in of cell biology	Analyse
CO4. Categorize the cell organelles	Analyse
CO5. Examine physiological processes of cell e.g. cell divisions	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	-	-	-	-	-	-	-	-	-	-		-	-
CO2	S	M	-	-	-	-	-	-	-	-	-	-	-	M	-
CO3	M	S	-	L	-	-	-	-	-	-	-	-	L	L	-
CO4	S	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	M	L	-	-	-	-	-	-	-	-	-	-	-		-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Introduction to principles of sterilization techniques and cell propagation.
2. Principles of Microscopy.
3. Isolation of Cell organelle – Mitochondria, Microtubules, Actin and Myosin filaments.
4. Cell Fractionation – Separation of peripheral blood mononuclear cells from blood.
5. Cell staining - Gram’s staining, Leishman staining
6. Cell counting - Tryphan blue assay, Alamar blue assay.
7. Osmosis and Tonicity.
8. Staining for different stages of mitosis in *Allium cepa* (Onion).

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

COURSE DESIGNERS

S. No	Name of the Faculty	Designation	Department	Mail ID
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2	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@vmkvec.edu.in

SYLLABUS

SEMESTERS III TO VIII

CATEGORY 'A' –
FOUNDATION COURSES –
HS, BS AND ES COURSES
(i) HUMANITIES AND SCIENCES (ENGLISH AND MANAGEMENT COURSES)

17EGHS02	BUSINESS ENGLISH	Category	L	T	P	Credit
		HSS	3	0	0	3

PREAMPLE

Language is one of the most valued possessions of men. It acts as a repository of wisdom. Among all other languages English, the international language plays a vital role as a propeller for the advancement of knowledge in different fields and as a telescope to view the dream of the future

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To impart and enhance corporate communication.
2	To enable learners to develop presentation skills.
3	To build confidence in learners to use English in Business context.
4	To make them experts in professional writing
5	To assist students understand the role of thinking in all forms of communication
6	To equip students with employability and job searching skills

COURSE OUTCOMES

After Successful completion of this course, the students will be able to:

CO1. Communicate with a range of formal and informal context	Understand
CO2. Students will undergo in activities, demonstrating interaction skills and consider how own communication is adjusted in different scenario.	Apply
CO3. Strengthening of oral and written skills in the business context	Apply
CO4. Create interest among the students about a topic by exploring thoughts and ideas	Understand
CO5. Make the students to start with pleasing note and make them to give different ideas	Apply
CO6. Make them in better performance in the art of communication	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M	M	-	M	L	M	M	M	S	-	M	-	-	-
CO2	L	-	-	L	-	M	-	-	-	S	M	L	-	-	-
CO3	-	L	M	-	-	-	L	-	M	S	-	-	-	-	-
CO4	M	M	-	-	L	S	-	M	S	S	-	L	-	-	-
CO5	M	-	-	-	-	M	-	M	M	S	-	-	-	-	-
CO6	S	M	M	-	-	S	M	-	-	S	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

SUBJECT -VERB AGREEMENT

Subject and Verb Agreement (concord) - Preposition and Relative Pronoun - Cause and effect - Phrasal Verbs-Idioms and phrases-Listening Comprehension -Listening to Audio Files and Answering Questions-Framing Questions-Negotiation Skills-Presentation Skills and Debating Skills

STRESS

Stress (Word Stress and Sentence Stress) Intonation- Difference between British and American English Vocabulary-Indianism-Compound Words (including Technical Terminology).

READING SKILLS

Reading Skills-Understanding Ideas and making Inferences-Group Discussion-Types of Interviews – FAQs – E - Mail Netiquette - Sample E – mails - Watching Documentary Films and Responding to Questions.

CORPORATE COMMUNICATION

Corporate Communication -Recommendation-Instruction-Check List- Circulars-Inter Office Memo- Minutes of Meeting and Writing Agenda - Discourse Markers - Rearranging Jumbled Sentences - Technical Articles - Project Proposals-Making Presentations on given Topics -Preparing Power Point Presentations

CRITICAL READING

Critical Reading-Book Review-Finding Key Information and Shifting Facts from Opinions-Business Letters (Calling for Quotation, Placing Orders and Complaint Letters) - Expansion of an Idea-Creative Writing

TEXTBOOK

1. English for Effective Communication - Faculty of English – VMKV Engineering College, Salem and AVIT, Chennai

REFERENCES

1. Grammar Builder – I, II, III – Cambridge University Press.
2. Technical English – Writing, Reading and Speaking – Pickett and Lester, Harper and Row

Course Designers:

S.No.	Name of the Faculty	Mail ID
1.	Dr.P.Saradha / Associate Professor - English	saradhap@vmkvec.edu.in

17MBHS04	TOTAL QUALITY MANAGEMENT	Category	L	T	P	Credit
		HSS	3	0	0	3

PREAMBLE:

Total Quality Management (**TQM**) is a management approach describes to long–term success through customer satisfaction and, is an integrative philosophy of management for continuously improving the quality of products and processes.

PREREQUISITE: Not Required

COURSE OBJECTIVES:

1. To understand the introduction about Quality and Total Quality Management.
2. To understand the TQM principles.
3. To understand the statistical process control
4. To impart the various TQM tools
5. To understand the quality systems.

COURSE OUTCOMES:

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

CO1: Understand the importance of quality and TQM at managerial level.	Understand
CO2: Explain the required tools to implement TQM.	Apply
CO3: Analyse various TQM parameters with help of statistical tools.	Analysing
CO4: Evaluating various TQM Techniques	Evaluate
CO5: Propose the Quality Management Systems in a different organization environment	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	M	L	L	L	L	L	L	L	L	M	L	L		
CO2	S	S	M	L	M	L	L	M	M	L	L	L		
CO3	S	S	S	M	S	M	L	M	M	L	L	M		
CO4	M	S	S	L	M	L	L	M	M	L	L	M		
CO5	S	S	S	L	M	M	S	M	M	S	M	S		

S- Strong; M-Medium; L-Low

SYLLABUS:

INTRODUCTION

Quality: Definition - Dimensions - Planning- costs – Analysis Techniques for Quality Costs- Basic concepts of Total Quality Management- Historical Review- Principles - Leadership – Concepts- Role of Top Management- Quality Council – Quality Statements- Strategic Planning- Deming Philosophy- TQM Implementation – Barriers.

TQM PRINCIPLES

Customer satisfaction – Perception of Quality- Complaints- Service Quality- Customer Retention- Employee Involvement – Motivation- Empowerment - Teams- Recognition and Reward- Performance Appraisal- Benefits- Continuous Process Improvement – Juran's Trilogy- PDSA Cycle- 5S – Kaizen - Basic Concepts.

STATISTICAL PROCESS CONTROL (SPC)

The Seven tools of Quality- Statistical Fundamentals – Measures of central Tendency & Dispersion- Population and Sample- Normal Curve- Control Charts for variables and attributes- Process capability- Concept of six sigma- New seven Management tools.

TQM TOOLS

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

QUALITY SYSTEMS

Need for ISO 9000 and Other Quality Systems- ISO 9000:2000 Quality System – Elements- Implementation of Quality System- Documentation- Quality Auditing- QS 9000- ISO 14000 – Concept- Requirements and Benefits.

TEXT BOOKS:

1. Dale H.Besterfiled- et at. - Total Quality Management- PHI-1999. (Indian reprint 2002).
2. Feigenbaum.A.V. "Total Quality Management- McGraw-Hill- 1991.

REFERENCES:

1. James R.Evans & William M.Lidsay - The Management and Control of Quality- (5th Edition) - South-Western (Thomson Learning) - 2002 (ISBN 0-324-06680-5).
2. Oakland.J.S. "Total Quality Management Butterworth – Hcinemann Ltd - Oxford. 1989.
3. Narayana V and Sreenivasan - N.S. Quality Management – Concepts and Tasks- New Age International 1996.

COURSE DESIGNERS:

S.No	Name of the Faculty	Designation	Department	Mail ID
1	A. Mani	Associate Professor	Management Studies	asmanimba@gmail.com
2	B. Rajnarayanan	Assistant Professor	Management Studies	Rajsachin.narayanan@gmail.com

17EGHS82	PROFESSIONAL COMMUNICATION AND PERSONALITY DEVELOPMENT	Category	L	T	P	Credit
		HSS	0	0	2	1

To develop students with good presentation and writing skills (Professionally & technically). Articulate and enunciate words and sentences clearly and effectively. Develop proper listening skills. Understand different writing techniques and styles based on the communication being used.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To develop communication and personality skills.
2	To improve Aptitude skills, train to improve self-learning / researching abilities, presentation skills & technical writing.
3	To improve students employability skills.
4	To develop communication and problem solving skills.
5	To develop professional with idealistic, practical and moral values.
6	To produce cover letters, resumes and job application strategies.

COURSE OUTCOMES

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

CO1. Improve communication and personality skills.	Apply
CO2. Demonstrate effective use of team work skills to complete given tasks.	Apply
CO3. Speaking with clarity and confidence thereby enhancing employability skills of the students.	Apply
CO4. Train the students in organized and professional writing	Apply
CO5. Develop students reading skills that could be adopted while reading text	Apply
CO6. Improve students their vocabulary and use them in appropriate situation	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	**M**	**M**	**-**	**L**	**M**	**M**	**M**	**-**	**M**	**S**	**-**	**M**			
CO2	**M**	**M**	**L**	**-**	**-**	**-**	**-**	**L**	**S**	**M**	**L**	**-**			
CO3	**-**	**-**	**-**	**-**	**L**	**L**	**M**	**-**	**S**	**S**	**M**	**-**			
CO4	**S**	**L**	**L**	**L**	**-**	**L**	**-**	**M**	**-**	**-**	**-**	**M**			
CO5	**-**	**-**	**-**	**-**	**L**	**-**	**-**	**-**	**-**	**-**	**L**	**-**			
CO6	**S**	**-**	**L**	**L**	**L**	**-**	**L**	**-**	**M**	**S**	**-**	**M**			

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT – I: COMMUNICATION AND SELF DEVELOPMENT: Basic Concepts of Communication; Barriers in Communication; How to Overcome Barriers to Communication.

UNIT – II: GRAMMAR & SYNTAX: Subject verb concord, tenses, Homophones, Homonyms, Spotting errors.

UNIT – III. READING AND WRITING SKILLS: Reading Comprehension; and suggesting title for given passage Back office job for organizing a conference / seminar (member of organizing committee and submit a report); Jumbled sentences, respond to real time advertisement and prepare a covering letter with CV.

UNIT IV. SPEAKING SKILLS: Hard and soft Skills; Feedback Skills; Skills of Effective Speaking; Component of an effective Talk; how to make an effective oral presentation

UNIT V TECHNICAL REPORT, RESEARCH CASE STUDY & REPORTING: Types and Structure of Reports; Collecting Data; Technical Proposals; Visual Aids; General Tips for Writing Reports. Research Case Study and reporting, how to make an effective power point presentation

TEXTBOOK

1. The Functional Aspects of Communication Skills, Prajapati Prasad and Rajendra K.Sharma, S. K Kataria & Sons, New Delhi, Rep''nt 2007

REFERENCES

1. Business Communication, Sinha K. K. S. Chand, New Delhi.
2. Business Communication, Asha Kaul, Prentice Hall of India
3. Business Correspondence and Report Writing A Practical Approach to Business and Technical Communication, Sharma, R.C.and Krishna Mohan, Tata Mc Graw – Hill.

Course Designers:

COURSE DESIGNERS		
S.No.	Name of the Faculty	Mail ID
1.	Dr. P.Saradha/Associate Professor - English	saradhap@vmkvec.edu.in

CATEGORY 'A' – FOUNDATION COURSES – HS, BS AND ES COURSES

(ii) BASIC SCIENCES (MATHS, PHYSICS AND CHEMISTRY COURSES)

17CHBS03	BIOORGANIC CHEMISTRY	Category	L	T	P	Credit
		FC (BS)	3	0	0	3

PREAMBLE

Bioorganic Chemistry explains the study of living cell chemistry in an organism. The Bioorganic study gives the knowledge of proximity effects in organic chemistry, molecular recognition and the supramolecular systems. It also deals analogy between organic reaction, energy transfer and biochemical transformations. It gives the basic knowledge of enzymes, peptides, proteins amides and metals and their roles. Acquiring the knowledge of concepts and principles will facilitate students to understand how they work in the research fields and show the way to the higher levels of various fields.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To acquire the knowledge of living cells chemistry.
2	To study the proximity effects in organic chemistry, molecular recognition and the supramolecular systems - concepts
3	To know the importance of enzyme catalysis in the living cells.
4	To understand the various reactions of metal ions in proteins and biological molecules. .
5	To apply the knowledge of enzymes designing in molecular theft and steroid templates.
6	To understand the biomodels of photosynthesis and energy transfer.

COURSE OUTCOMES

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

CO1. Discuss about the chemistry of living cells	Understand
CO2. Describe the Proximity effects in organic chemistry, molecular recognition and the supramolecular systems - concepts	Understand
CO3. Generalize the importance of enzyme catalysis in the living cells.	Apply
CO4. Employ the various reactions of metal ions in proteins and biological molecules	Apply
CO5. Use the knowledge of designing in molecular theft and enzymes	Apply
CO6. Recognise the biomodels of photosynthesis and energy transfer.	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	-	-	M	-	-	-	-	-	S	-	-	-
CO2	M	S	M	L	M	M	-	-	-	-	-	M	-	-	-
CO3	S	L	M	L	L	S	M	-	-	-	-	M	-	-	-
CO4	M	-	L	-	M	M	L	-	-	-	-	-	-	-	-
CO5	M	L	S	M	M	-	-	-	-	-	-	S	-	-	-
CO6	S	-	S	L	S	-	-	-	-	-	-	M	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO BIO-ORGANIC CHEMISTRY

Basic Considerations - Proximity effects in Organic chemistry -Molecular recognition and the supramolecular systems

BIO - ORGANIC CHEMISTRY OF AMINO ACIDS AND PEPTIDES

Chemistry of living cells, Analogy between organic reactions and Biochemical Transformations, Chemistry of the peptide bond, Asymmetric synthesis of amino acids - Retrosynthetic analysis, Transition state analogues.

ENZYME CHEMISTRY

Introduction to catalysis - Mutifunctional, Acid - base and Covalent catalysis, Introduction to enzymes - Chymotrypsin, Pyruvate dehydrogenase, Ribonuclease, Lysozyme, Enzymes in synthetic organic chemistry, Design of molecular clefts.

ENZYME MODELS

Host guest Complexation chemistry - Cyclodextrin, Development in Crown ether chemistry - Azo Crown ethers and Lariat Crown ethers, Enzyme design using steroid templates -, Co - enzyme chemistry- NAD, NADP, FAD and pyridoxal phosphate.

METAL IONS IN BIOLOGICAL SYSTEMS

Metal ions in proteins and biological molecules - Carboxy peptidase and role of zinc, Hydrolysis of amino acid esters, amides and peptides, Iron and oxygen transport, Biomodels for photosynthesis and energy transfer.

TEXT BOOKS:

1. Zubay, G., 1987. Biochemistry. 2nd Edn., Maxwell Macmillan International Editions.

2. Dugas, H., 1989. Bio-organic Chemistry - A Chemical Ap-proach to Enzyme Action. Springer Verlag.

3. David Van Vranken, Gregory A. Weiss., 2012. Introduction to Bioorganic Chemistry and Chemical Biology. (1st Edition) New York: Garland Science.

REFERENCE BOOKS:

1. Mathew, Van Holde and Athern, 2000. Biochemistry. Pearson Publishers Ltd.

2. Page, M. I. and Williams, A., 1997. Organic and bio-organic mechanisms. Pearson India Edition.

3. Ariya, K. and Kumtake T., 2006. Supramolecular chemistry : Fundamentals and applications. Springer India Edition.

4. Palmer, Trevor, 2004. Enzymes : Biochemistry, biotechnology, clinical chemistry. East - West Press Pvt. Ltd.

5. Fersht, Alan, 1998. Structure and Mechanism in Protein Science: A Guide to Enzyme Catalysis and Protein Folding. W. H. Freeman.

COURSE DESIGNERS

S.No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Dr.T.Shanthi	Professor & Head	Chemistry	shanthi@vmkvec.edu.in
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17CHBS01	**Environmental Science & Engineering (Common to All Branches)**	Category	L	T	P	Credit
		FC (BS)	3	0	0	3

Environmental science is an interdisciplinary field that integrates physical, chemical, biological, information, telemedicine and atmospheric sciences. Environmental studies also incorporate the social sciences for understanding human relationships, a solution to the environmental and social related problems and conserving the environment for the future. Environmental engineering focuses on sustainable development for improving environmental quality in every aspect.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To create the awareness of environment studies and its scope
2	To inculcate the knowledge of significance and conserving the natural resources.
3	To help the learners to know the value of ecosystem and food chain.
4	To assess the importance of biodiversity
5	To familiarizes the different pollution sources, consequences and its control measures.
6	To educate the ways and means to manage natural calamities.
7	To help the learners to know the urban energy related problems and social issues.

COURSE OUTCOMES

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

CO1Discuss and appreciate the unity of life in all its forms, the implications of life style on the environment.	Understand
CO2.Initiate the awareness and recognize the social responsibility in environmental issues.	Apply
CO3Illustrate the importance of ecosystem and biodiversity	Apply
CO4. Interpret the society on the various pollutions and their impact.	Apply
CO5.Demonstrate the Solid waste and disaster management.	Apply
CO6Recognize the issues of environment and sustainable development	Understand
CO7.Schedule the urban problems and social issues.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	-	-	S	S	S	-	-	-	S			
CO2	S	M	M	-	-	S	S	S	-	-	-	S			
CO3	S	L	M	-	-	S	S	S	-	-	-	S			
CO4	S	S	S	L	-	S	S	S	-	-	-	S			
CO5	S	S	S	M	-	S	S	S	-	-	-	S			
CO6	S	S	S	M	-	S	S	S	-	-	-	S			
CO7	S	S	S	M	-	S	S	S	-	-	-	S			
CO8	S	M	S	M	-	S	S	S	-	-	-	S			

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT-I ENVIRONMENT AND NATURAL RESOURCES

Environment - Definition, scope & importance - Public awareness- Forest resources, mineral resources , water resources, food resources , energy resources (uses, over -exploitation & adverse effects in each case) - Scope & role of environmental engineers in conservation of natural resources - Sustainability development

UNIT-II ECOSYSTEMS AND BIO – DIVERSITY

Ecosystem - Definition, structure and function - Energy flow -Ecological succession - food chain, food web, ecological pyramids- Introduction, types, characteristics, structure and function of forest, grassland, desert and Aquatic ecosystems - Bio - Diversity :values and uses, hotspots, threats and conservation.

UNIT-III ENVIRONMENTAL POLLUTION

Pollution - Definition , man made impacts and control measures of air, water and land pollution - Water quality standards & characterization - Importance of sanitation -Nuclear hazards – Hazardous waste management : Solid waste, waste water and biomedical waste - Prevention of pollution and role of individual – Disasters management : Floods, earthquake, cyclone and land slides - Clean technology options

UNIT-IV SOCIAL ISSUES AND ENVIRONMENT

Urban problems related to energy - Water conservation – Resettlement and rehabilitation of people - Environmental ethics - Climate change - Global warming - Acid rain - Ozone depletion-Waste land reclamation, Environment Protection Act for air, water, wild life and forests - Pollution Control Board

UNIT-V HUMAN POPULATION AND ENVIRONMENT

Population growth - Population explosion - Family welfare programme - Environment & human health - Human rights – Value education - Women and child welfare, Role of information technology in environment and human health.

Text Book

1. Environmental Science and Engineering by Dr.A. Ravikrishnan, Sri Krishna Publications, Chennai.

REFERENCES:

1.Wager K.D. "Environmental Management", W.B. Saunders Co. Philadelphia, USA, 1998.
2.Bharucha Erach "The Biodiversity of India" Mapin Publishing Pvt Ltd, Ahmedabad, India.
3. Trivedi R.K. “Handbook of Environmental Laws", Rules, Guidelines,Compliances and Standards Vol I & II, Enviro media.
4. Environmental Science and Engineering by Dr. J. Meenambal ,MJP Publication , Chennai Gilbert M. Masters : Introduction to Environmental Engineering and Science , Pearson EducationPvtLtd., II Edition, ISBN 81-297-0277-0,2004.
5. Miller T.G. Jr Environmental Science Wadsworth Publishing Co.
6. Townsend C. Harper J. and Michael Begon, Essentials of Ecology,Blackwell Science.

Course Designers:

COURSE DESIGNERS

S.No.	Name of the Faculty	Mail ID
1.	Dr.T.Shanthi, Professor and Head	Shantht@vmkvec.edu.in

Subject Code	Subject Title	Category	L	T	P	Credit
17PHBS02	**NANOTECHNOLOGY**	CC	3	0	0	3

PREAMBLE

Nanotechnology is the study and application of extremely small things and can be used across all the other science fields, such as chemistry, biology, physics, materials science, and engineering. Nanomaterials exhibit enhanced properties such as higher strength, lighter weight, and greater chemical reactivity than their larger-scale counterparts. The study about nanomaterials is extremely important for an engineer to understand its properties and design equipments.

PREREQUISITE

-

COURSE OBJECTIVES

1	To learn the properties and types of nanomaterials
2	To know about the preparation methods of nanomaterials
3	To learn about lithography techniques
4	To know about carbon nano tubes
5	To learn about various characterization techniques

COURSE OUTCOMES

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

CO1. Describe the properties of nanomaterials	Understand
CO2. Compare the preparation methods of nanomaterials	Analyze
CO3. Utilize the lithographic techniques	Apply
CO4. Interpret the properties of carbon nanotubes	Apply
CO5. Categorize various characterization techniques	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	L	M	L	M			M			M			
CO2	S	M	M	M	M	M			M			M			
CO3	S	S	S	S	S	M			M			M			
CO4	S	S	S	S	S	M			M			M			
CO5	S	S	S	S	S	M			M			M			

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION: Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering-Classifications of nanostructured materials- nanoparticlesquantum 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).

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

LITHOGRAPHY FOR NANOSCALE DEVICES: Introduction to optical/UV electron beam and X-ray Lithography systems and processes, Wet etching, dry (Plasma /reactive ion) etching, Etch resists-dip pen lithography

CARBON NANO TUBE: Introduction to Carbon Nano Tube (CNT) - Types of carbon nano tube - Characteristics of carbon nano tube - synthesis of CNT- Properties of CNT- Application of CNT.

CHARECTERISATION TECHNIQUES: 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 Nano-indentation

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, “Nanoscalecharecterisation of surfaces & Interfaces”, 2nd Edition, Weinheim Cambridge, Wiley-VCH, 2000

REFERENCES:

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

COURSE DESIGNERS

S.No.	Name of the Faculty	Mail ID
1	Dr. C. SENTHIL KUMAR	senthilbdu@gmail.com
2	Dr. R. SETHUPATHI	sethupathivmkv@gmail.com

17CHBS81	BIOORGANIC CHEMISTRY LAB	Category	L	T	P	Credit
		FC (BS)	0	0	4	2

PREAMBLE

The purpose of teaching Bioorganic Chemistry is a fundamental science and has contributed immensely to the improvement of the life of human beings by providing many of human requirements and essentialities. The developments in Bioorganic Chemistry during last few decades are phenomenal. It is also seen that these developments are crossing the traditional vertical boundaries of scientific disciplines; the more inclination is seen towards biological sciences. The practice of Bioorganic Chemistry at industrial scale also is undergoing radical changes and is more or more based on deep understanding the phenomena.

PRERQUISITE - NIL

COURSE OBJECTIVES

1	To Recognize the basics of stoichiometry
2	To Express the knowledge about measurements and units
3	To Demonstrate the students in preparation of bioorganic solutions and their material balance equations
4	To Organise the Students should be able to develop their skills in the inter-conversions of one bioorganic compound to desired products.

COURSE OUTCOMES

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

CO1. Describe about the basic bioorganic chemistry	Understand & Apply
CO2. Illustrate the importance of measurements and units in bioorganic reaction procedures	Apply
CO3. Estimate the basics steps involved in the synthesis of various bioorganic substances	Analyse
CO4. Evaluate their understanding skills in the inter-conversions	Evaluate Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	-	M	L	-	-	-	-	-	-	M	S	L	L
CO2	M	L	-	M	L	-	-	-	-	-	-		S	L	L
CO3	M	M	-	M	L	M	L	M	-	-	-	M	S	L	L
CO4	M	L	-	-	-	L	-	-	-	-	-	L	S	L	L

S- Strong; M-Medium; L-Low

SYLLABUS

1. Synthesis of Aspirin
2. Hydrolysis of Sucrose
3. Preparation of Pyruvic acid from Tartaric acid.
4. Preparation of Oleic acid
5. Preparation of alpha D- glucopyranose pentaacetate
6. Preparation of Lycopene from Tomato paste
7. Preparation of L-Proline.
8. Preparation of 1,2,5,6 di- O-Cyclohexylidine-alpha-D-glucofuranose.
9. Preparation of s-ethyl hydroxybutonate from ethyl acetoacetate using Yeast.
10. Preparation of s-ethyl hydroxybutonate using 3,5 dinitrobenzoate.

REFERENCE BOOKS:

1. Laboratory Manual.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.T.Shanthi	Professor & Head	Chemistry	shanthi@vmkvec.edu.in
2	Mr.A.Gilbertraj	Assistant Professor	Chemistry	gilbertsunderraj@vmkvec.edu.in

CATEGORY ‘A’ – FOUNDATION COURSES – HS, BS AND ES COURSES

(iii) ENGINEERING SCIENCES (BASIC ENGINEERING COURSES)

17BMES01	BIOSENSORS & MEASUREMENT DEVICES	Category	L	T	P	Credit
		FC-ES	3	0	0	3

PREAMBLE

This course is designed to acquire knowledge about the different components of biosensors, bio-amplifier, transducers and display units in biomedical equipment and its working principle and to measure various physiological parameters.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To understand the concepts of transducers and its classification.
2	To study the various types of transducers and classification of bio-sensors.
3	To know about bioelectric signals, electrodes and its types.
4	To know the various Bio potential amplifiers.
5	To study about various Physiological measurements.

COURSE OUTCOMES

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

CO1. Know the acquisition of various bio signals using various types of Electrodes.	Understand
CO2. Describe about the biosensors and transducers for measuring biosignal.	Understand
CO3. Utilize the electrode and amplifier for measuring biosignal.	Apply
CO4. Record and analyze various physiological signals.	Analyze
CO5. Design bio amplifiers and their applications.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	L	S	--	--	--	S	L	--	M	L	--	--
CO2	S	M	M	M	S	M	--	--	S	L	--	M	L	--	L
CO3	S	M	M	M	S	M	--	--	S	L	--	M	--	S	--
CO4	S	M	M	M	S	M	--	--	S	L	--	M	--	S	L
CO5	S	M	M	M	S	M	--	S	S	L	--	M	--	S	--

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

General measurement system – purpose, structure and elements – Transducers – Definition, Classification. Resistance transducers, strain gauges, resistance thermometers, potentiometers. Capacitive transducer, Inductive transducer, LVDT, Biomedical Applications.

TRANSDUCERS AND BIOSENSORS
Temperature transducers, flow transducer, optical transducer, photoelectric transducers, pressure transducer, Biomedical applications. Introduction, biological elements – Enzymes, antibodies, nucleic acids, receptors. Immobilization of biological components.

ELECTRODES AND BIO AMPLIFIERS
Basic medical instrumentation system, Origin of Bioelectric Potential, Recording electrodes – Electrodes: Tissue interface, Electrolyte – skin interface, Polarization, Skin contact impedance, motion artefacts. Electrodes – Silver – silver chloride electrodes, electrodes for ECG, EMG, EEG, Electrical conductivity of electrode jellies and creams, Types of electrodes. Bio amplifier, Need for Bio amplifier, Basic operational amplifier circuits, differential amplifier, Instrumentation amplifier, Chopper amplifier, Isolation Amplifier.

BIO SIGNALS RECORDING
ECG – Anatomy and Electrical conducting system of heart, Genesis of ECG, Einthoven triangle, Lead system, Segments and intervals of ECG, Normal and abnormal ECG wave forms, ECG Machine, Recording set up of EMG and EEG. Heart sounds and PCG, ERG, EOG.

CARDIAC FUNCTION MEASUREMENTS
Blood pressure measurement – direct and indirect method, Respiration rate measurement, Measurement of heart rate and pulse rate, Plethysmography technique. Blood flow measurement – electromagnetic, ultrasonic. Cardiac output measurement – Indication dilution method and dye dilution method

TEXT BOOKS:

1. Khandpur R.S, **"Hand-book of Biomedical Instrumentation"**, Tata McGraw Hill, 2nd Edition, 2003.
2. Arumugam, M, **"Biomedical instrumentation"**, Anuradha Publications, 2008.
3. H.S. Kalsi, **"Electronic Instrumentation & Measurement"**, Tata McGraw Hill, 1995.
4. Brain R Eggins, **"Biosensors: An Introduction"**, John Wiley Publication, 1997.

REFERENCES:

1. Leslie Cromwell, Fred Weibell J, Erich Pfeiffer. A, **"Biomedical Instrumentation and Measurements"**, Prentice-Hall India, 2nd Edition, 1997.
2. K.Sawhney, **"A course in Electronic Measurements and Instruments"**, Dhapat Rai & Sons, 1991.
3. John P Bentley, **"Principles of Measurement Systems"**, 3rd Edition, Pearson Education Asia, (2000 Indian reprint).

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mrs. S.Vaishnodevi	Assistant Professor	BME	vaishnodevi@vmkvec.edu.in
2	Mrs. R.Indumathi	Assistant Professor (Gr-II)	BME	indhumr@avit.ac.in
3	Mr. R. Ezhilan	Assistant Professor	BME	ezhilan@vmkvec.edu.in

17BMES02	MEDICAL INSTRUMENTATION	Category	L	T	P	Credit
		FC-ES	3	0	0	3

PREAMBLE
To enable the students to develop knowledge of principles, design and applications of the Biomedical Instruments.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To know about bioelectric signals, electrodes and its types.
2	To know the various Biopotential recording methods.
3	To study about patient monitoring concept and various Physiological measurements methods.
4	To study the principle of operation blood flow meter, blood cells counter.
5	To study about bio chemical measurements and details the concept of biotelemetry and patient safety,

COURSE OUTCOMES

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

CO6.	Explain the different Bio signal or biopotential.	Understand
CO7.	Identify the working principles of diagnostic and therapeutic equipments.	Understand
CO8.	Operate various instruments like as ECG, EMG, EEG, X-ray machine.	Apply
CO9.	Differentiate the medical instruments based on principles and application used in hospital.	Analyze
CO10.	Evaluate and calibrate fundamental biomedical instrumentation used in hospital.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	S	S	--	--	--	S	L	L	L	L	--	--
CO2	S	M	M	S	S	M	--	--	S	L	L	L	L	--	L
CO3	S	M	M	M	S	M	--	--	S	L	L	M	--	S	--
CO4	S	M	M	M	S	M	--	S	S	M	M	M	--	S	L
CO5	S	M	M	M	S	M	--	S	S	M	M	M	--	S	--

S- Strong; M-Medium; L-Low

SYLLABUS

BIOELECTRIC SIGNALS AND ELECTRODES
Basic medical instrumentation system, Origin of Bioelectric Potential, Recording electrodes – Electrode Tissue interface, Electrolyte – skin interface, Polarization, Skin contact impedance, motion artifacts. Electrodes – Silver – silver chloride electrodes, electrodes for ECG, electrodes for EEG, electrodes for EMG, Electrical conductivity of electrode jellies and creams, Microelectrodes.

BIO AMPLIFIER AND BIOMEDICAL RECORDERS
Bioamplifier, Need for Bioamplifier, Differential amplifier, Instrumentation amplifier, Chopper amplifier, Isolation Amplifier, ECG, EEG, EMG, PCG, EOG, ERG lead system and recording methods, typical waveform.

PATIENT MONITORING SYSTEM AND NON ELECTRICAL PARAMETERS MEASUREMENTS
System concepts of patient monitoring system, Bedside patient monitoring system, central monitors, Blood pressure measurement, Measurement of temperature, Respiration rate measurement, cardiac output measurement, Measurement of pulse rate, Plethysmography technique.

BLOOD FLOW METERS, BLOOD CELL COUNTERS
Electromagnetic blood flow meter, ultrasonic blood flow meter, Laser Doppler blood flow meter, Types of blood cells, Methods of cell counting, coulter counters, automatic recognition and differential counting.

BIO- CHEMICAL MEASUREMENTS AND BIOTELEMETRY AND PATIENT SAFETY
Ph, Pc02, p02, Phco3 and electrophoresis, colorimeter, spectrophotometer, flame photometer, auto-analyser. Biotelemetry-wireless telemetry, single channel telemetry, multichannel telemetry, multi patient telemetry.

TEXT BOOKS:
1. Khandpur R.S, **"Hand-book of Biomedical Instrumentation"**, Tata McGraw Hill, 2nd Edition, 2003.
2. Leslie Cromwell, Fred Weibell J, Erich Pfeiffer. A, **"Biomedical Instrumentation and Measurements"**, Prentice-Hall India, 2nd Edition, 1997.

REFERENCES:
1. John G. Webster, **"Medical Instrumentation application and design"**, John Wiley, 3rd Edition, 1997.
2. Carr, Joseph J, Brown, John.M, **"Introduction to Biomedical equipment technology"**, John Wiley and sons, New York, 4th Edition, 1997.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mrs. S.Vaishnodevi	Assistant Professor	BME	vaishnodevi@vmkvec.edu.in
2	Dr. N.Babu	Professor	BME	babu@vmkvec.edu.in
3	Mrs. R.Indumathi	Assistant Professor (Gr-II)	BME	indhumr@avit.ac.in

17BMES81	BIOSENSORS & MEASUREMENT DEVICES LAB	Category	L	T	P	Credit
		FC-ES	0	0	4	2

PREAMBLE

The curriculum of biosensors and measuring devices lab is concerned to enable the students to know and operate the various biomedical instruments for measuring and diagnosing biological signals using basic components such as sensors, amplifiers, signal processing and display unit.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To design of amplifiers for biological signals.
2	To recording and analysis of bio signals.
3	To measurement of Ph, blood pressure.
4	To study and measurement of various transducers like temperature, pressure, optical and piezoelectric.
5	To measurement of galvanic skin resistance.

COURSE OUTCOMES

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

CO11. Design operational amplifier for inverting and non-inverting mode.	Apply
CO12. Record and analyze EEG, ECG, EMG signals.	Analyze
CO13. Measure of PH value of a given solution.	Evaluate
CO14. Measure temperature, pressure, optical and piezoelectric using different sensors.	Evaluate
CO15. Design Filters for bio signals.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	L	S	--	--	--	S	L	--	M	L	--	--
CO2	S	M	M	M	S	M	--	--	S	L	--	M	L	--	L
CO3	S	M	M	M	S	M	--	--	S	L	--	M	--	S	--
CO4	S	M	M	M	S	M	--	--	S	L	--	M	--	S	L
CO5	S	M	M	M	S	M	--	S	S	L	--	M	--	S	--

S- Strong; M-Medium; L-Low

SYLLABUS

<u>List of Experiments</u>

1. Characteristics of temperature transducers.

2. Characteristics of pressure and optical transducers.
3. Characteristics of strain gauge.
4. Blood pressure measurement using sphygmomanometer.
5. Design of instrumentation amplifier.
6. Measurement PH using PH meter.
7. Galvanic Skin resistance measurement.
8. Recording of ECG using ECG simulator.
9. Recording of EEG using EEG simulator.
10. Recording of EMG using EMG simulator.

TEXT BOOKS:
Department Lab Manual

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mrs. S.Vaishnodevi	Assistant Professor	BME	vaishnodevi@vmkvec.edu.in
2	Mrs. R.Indumathi	Assistant Professor (Gr-II)	BME	indhumr@avit.ac.in
3	Mr. R. Ezhilan	Assistant Professor	BME	ezhilan@vmkvec.edu.in

17BMES82	MEDICAL INSTRUMENTATION LAB	Category	L	T	P	Credit
		FC-ES	0	0	4	2

PREAMBLE

To provide hands on training on measurement of physiological parameters, biochemical parameters measurement and biosignal analysis.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To study the application of optical isolation amplifier.
2	To recording and diagnosis using bio signals.
3	To understanding working principle of biotelemetry.
4	To study of galvanic skin resistance.
5	To study the human auditory response using audiometer.

COURSE OUTCOMES

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

CO1. Explain about the pH and conductivity.	Understand
CO2. Record and analyze EOG, ECG, EMG signals	Analyze
CO3. Measure the bio signals using biotelemetry	Analyze
CO4. Operate diathermy for cutting and coagulation	Apply
CO5. Calculate the human auditory response using audiometer	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	S	S	--	--	--	S	L	L	L	L	--	--
CO2	S	M	M	S	M	M	--	--	S	L	L	L	L	--	L
CO3	S	M	M	M	M	M	--	--	M	L	L	M	--	S	--
CO4	S	M	M	M	M	M	--	S	M	M	M	M	--	S	L
CO5	S	M	M	M	L	M	--	S	M	M	M	M	--	S	--

S- Strong; M-Medium; L-Low

SYLLABUS

List of Experiments

1. Design and analysis of biological pre amplifiers.
2. Plotting of human auditory response using audiometer.
3. Recording of ECG signal and analysis
4. Recording of EMG-Signal

5. Recording of EEG-Signal
6. Recording of various physiological parameters using patient monitoring system and telemetry units.
7. Measurement of pH and conductivity.
8. Study of ESU – cutting and coagulation modes
9. Study of characteristics of optical Isolation amplifier
10. Galvanic skin resistance (GSR) measurement

TEXT BOOKS:
Department Lab Manual

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Mrs. S.Vaishnodevi	Assistant Professor	BME	vaishnodevi@vmkvec.edu.in
2	Dr. N.Babu	Professor	BME	babu@vmkvec.edu.in
3	Mrs. R.Indumathi	Assistant Professor (Gr-II)	BME	indhumr@avit.ac.in

CATEGORY ‘B’ – CORE COURSES RELEVANT TO THE PROGRAMME – 81 CREDITS

17BTCC01	ESSENTIALS OF BIOCHEMISTRY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Essentials of biochemistry deals with the study of biomolecules found in living organism. The course exposes the students to classification, properties, basic structure and functions of biomolecules like carbohydrate, amino acid, lipids, nucleic acid and vitamins. Knowledge of this course will enable students to understand the importance of biomolecules and give awareness to the various diseases associated with the deficiency of biomolecules

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To understand the basic structure, properties and functions of Biomolecules
2	To emphasize the role of biomolecules by providing basic information on specific metabolic diseases.

COURSE OUTCOMES

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

CO1. Explain the classification properties and biological importance of carbohydrates	Understand
CO2. Discuss the classification, nomenclature, structure and properties of fatty acids	Understand
CO3. Knowledge about amino acids and proteins	Understand
CO4. Know about the importance of nucleic acid	Apply
CO5. Distinguish the vitamins and its deficiency	Understand
CO6. Know about the importance of minerals	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	L	-	-	-	-	-	-	-	-	-	L	L	-
CO2	S	-	L	-	-	-	-	-	-	-	-	-	L	L	-
CO3	S	-	L	-	-	-	-	-	-	-	-	-	L	L	-
CO4	S	-	L	-	-	-	-	-	-	-	-	-	L	L	-
CO5	S	-	L	-	-	M	-	-	-	-	-	-	L	L	-
CO6	S	-	L	-	-	M	-	-	-	-	-	-	L	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

CARBOHYDRATE

Biological importance, Classification and Properties of Monosaccharides, Disaccharides and Polysaccharides (Starch, Glycogen, Cellulose and their derivatives, Chitin, Peptidoglycans, Glycoaminoglycans, Glycoconjugates).

LIPIDS

Biological importance, Classification. Fattyacids: classification, nomenclature, structure and properties of saturated and unsaturated fatty acids. Essential fatty acids, Triacylglycerols: nomenclature, physical properties, chemical properties. Glycerophospholipids (lecithins, cephalins, phosphatidyl serine, phosphatidyl inositol, sphingomyelins).

AMINO ACIDS AND PROTEINS
Amino acids – Classification, Structure, Properties and Biological importance. Proteins – Classification, Structural organization of Proteins – Primary, Secondary (α-helix, β-pleated structure, triple helix), Tertiary and Quaternary (Myoglobin and Hemoglobin), Factors stabilizing, Properties and Biological importance, Denaturation and Renaturation.

NUCLEIC ACIDS
Nucleosides and nucleotides, configuration and conformation, Composition of RNA and DNA, Physico-chemical properties of nucleic acids – effect of alkali, acid and heat (denaturation and renaturation), features of phosphodiester bond, endonucleases. Complementary base pairing, secondary structure of RNA, features of DNA double helix (Watson-Crick model), Nucleoproteins – histone and nonhistone

VITAMINS
Nutritional importance of vitamin, classification, source, daily requirements and functions, Deficiency symptoms – hypervitaminosis of fat-soluble vitamins. Nutritional importance of Minerals – classification, source, daily requirement and deficiency symptoms.

TEXT BOOKS

1. "Fundamentals of Biochemistry", Jain J.L., Sunjay Jain and Nitin Jain., S.Chand & Company Ltd., 6th Edition, 2005.

REFERENCES:

1. "Text Book of Biochemistry for Medical Students", Ambika Shanmugham, Lippin cott Williams & Wilkins, 7th Edition, 2012.
2. "Biochemistry", Rastogi S.C. Mc. Graw-Hill Publishing Company Ltd, 6th Edition, 2007.
3. "Principles of Biochemistry", David L. Nelson and Michael M. Cox, W. H. Freeman and Company, 4th Edition, 2005.
4. "Text book of Biochemistry", Sathyanarayana U and Chakrapani U., Uppala Author Publishers Interlinks, 3rd Edition, 2006.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@vmkvec.edu.in
2	Mrs.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in

17BTCC02	CELL BIOLOGY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Cell biology deals with the structures, organization and functions of the cells and organelles, their physiological properties, life cycle, metabolic processes, signaling pathways and their interactions with their environment at microscopic and molecular level. The subject helps to gain knowledge in fundamentals of cells to all biological sciences, for research in bio-medical fields such as cancer, and other diseases and also in research related to genetics, biochemistry, molecular biology, immunology, and developmental biology.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
2	Students will understand how these cellular components are used to generate and utilize energy in cells and the concepts behind cell division.
3	To give an overview of cell signaling molecules and their receptors.
4	To understand the pathways and intracellular signal transduction
5	To make students to apply their knowledge of cell biology to selected examples of changes or losses in cell function

COURSE OUTCOMES

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

CO1. List the fundamental features of prokaryotic and eukaryotic cells, their structure, composition and role of cell membranes and the major stages of the cell cycle	Understand
CO2. To understand the specific processes and proteins involved in membrane transport	Understand
CO3. To understand about intercellular chemical messengers, receptor subclasses and their possible uses in cell signaling.	Understand
CO4. To analyze the mechanisms by which different messenger-receptor interactions bring about long or short-term changes in cell state.	Apply
CO5. To Integrate the different levels of biological organization, from molecules to cells to organisms.	Apply
CO6. To apply critical thinking and logical analysis in the assessment and evaluation of issues in cell biology and genetics.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L	M	S	L	L	-	-	-	-	-	-	-	-	-
CO2	L	M	M	L	L	L	-	-	-	-	-	-	-	-	-
CO3	L	M	M	L	M	L	M	-	-	-	-	-	-	-	-
CO4	M	M	S	S	M	L	-	-	-	-	-	-	S	M	M
CO5	M	M	S	S	M	M	M	-	-	-	-	L	-	M	-
CO6	M	M	S	S	S	S	-	-	-	-	-	-	-	S	M

S- Strong; M-Medium; L-Low

SYLLABUS

CELL AND FUNCTIONS OF THE ORGANELLES

General structure – Prokaryotic and eukaryotic cell, Molecular organization of the cell membrane, Cell membrane – Proteins, Lipids and Carbohydrates, Cell organelles, Cytoskeletal proteins, Types of cell functions, Cell cycle - Mitosis and meiosis, apoptosis.

CELL MEMBRANE AND PERMEABILITY

Passive and active transport, Permeases, Sodium potassium pump, Ca2+, AT Pase pumps, Lysosomal and vacuolar membrane, Co-transport, Uniport, Symport, Antiport, Protein localization & Membrane trafficking, Endocytosis and exocytosis, Entry of viruses and toxins into cells.

CELL SIGNALING MOLECULES AND THEIR RECEPTORS

Cytosolic, Nuclear and membrane bound receptors, Examples of receptors, Modes of cell – cell signaling: Autocrine, Paracrine and Endocrine models of action, Secondary messenger's molecules, Quantitation and characterization of receptors.

PATHWAYS AND INTRACELLULAR SIGNAL TRANSDUCTION

Signal amplification – Different models of signal amplifications, Cyclic AMP, Role of inositol phosphates as messengers, Biosynthesis of inositol triphosphates, Cyclic GMP and G proteins role in signal transduction, Calcium ion flux and its role in cell Signaling, Current models of signal amplification, Phosphorylation of protein kinases.

CELL CULTURE

Techniques for the propagation of prokaryotic and eukaryotic cells, Cell line, Generation of cell lines, Maintenance of stock cells, Characterization of cell, Morphological analysis techniques in cell culture, Explant cultures, Primary cultures, Contamination, Differentiation

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TEXT BOOKS:

1. De Robertis E.D.P and De Robertis E.M.F, "Cell and Molecular Biology", 8th Edition, Lippincott Williams & Wilkins, New York, USA, 2001.
2. Harvey Lodish, Arnold Berk, Chirs A. Kaiser, Monty Krieger, Matthew P. Scott, Anthony Bretscher, Hidde Ploegh and Paul Matsudaira, "Molecular Cell Biology", 6th Edition, W. H. Freeman and Company, New York, 2008.

REFERENCES:

1. B Alberts, A Johnson, J Lewis, M Raff, K Roberts and P Walter, "Molecular Biology of the Cell", (4th Edition) New York: Garland Science, 2002.
2. Kimball, T.W., "Cell Biology', Addision Wesley Publishers, 1989.
3. Geoffrey M. Cooper and Robert E. Hansman, "The Cell: A Molecular Approach", ASM Press and Sinauer Associates Inc., USA, 4th Edition, 2007.
4. Ian Freshney, R, "Culture of Animal Cells", Alan R. Liss Inc., New York, 4th Edition, 2005

COURSE DESIGNERS

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1	Mrs.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in
2	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@vmkvec.edu.in

17BTCC03	MICROBIOLOGY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Microbiology deals with the study of microbes. It will cover wide spectrum of classification, cellular organization and characteristics of microscopic organisms, diseases caused and beneficial effects, environmental damage or stress. Microbiologists often use cutting-edge techniques and sophisticated machinery along with other applied fields of research like biotechnology, genetics to study microbes and their complex mechanisms. Knowledge of these principles will enable students to understand how they react under different conditions and how they cause different diseases and their control.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To describe about the evolution of microorganisms and microscopy.
2	To Explain the Structure and replication in microorganisms – concepts.
3	To interpret the effects of Microbes in food and the clinical importance of microorganisms.
4	To explain about the various Control measures and assessing the environmental impacts.
5	To outline the requirements of Microbial nutrition for growth of microorganisms and the impact of environment on its growth.

COURSE OUTCOMES

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

CO1. Recall about historical perspective of microbiology and its developments	Remember
CO2.Describe the fundamental structure and functions of a cell	Understand
CO3. Explain the control of microbes using physical and chemical methods	Understand
CO4. Demonstrate the microbial nutritional requirements for growth	Apply
CO5. Demonstrate the microorganism have an indispensable role in the environment	Apply
CO6. Categorize the role of microorganisms in environmental applications	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	M	S	-	-	-	-	-	-	-	-	-	-	-
CO2	L	M	L	M	-	-	-	-	-	-	-	-	-	-	-
CO3	L	L	M	M	-	-	-	-	-	-	-	-	L	L	-
CO4	L	S	M	S	-	-	-	-	-	-	-	-	-	-	-
CO5	S	S	S	S	-	-	M	-	-	-	-	-	-	L	-
CO6	L	M	S	M	-	-	M	-	-	-	-	-	M	L	L

S- Strong; M-Medium; L-Low

SYLLABUS

WORLD OF MICRORGANISMS AND MICROSCOPY

Historical review of the foundation of microbiology, Characteristics of microorganisms, Taxonomy methods of studying microorganisms, Microscopy - Light, Electron, Micrometry.

STRUCTURAL ORGANISATION OF MICROORGANISMS

General structural and cellular organization of Bacteria, virus, fungi, algae and protozoa.

MICROBIAL GROWTH AND NUTRITION

Nutritional requirements, Growth of microorganisms, Aerobic and anaerobic growth, Different methods of microbial enumeration, Methods of preservation of microbes. Effects of physical, chemical and environmental factors on microbial growth.

FOOD AND CLINICAL MICROBIOLOGY

Food spoilage and poisoning, Clinically important microorganisms and their effects on infections, Formation of toxic materials by microorganisms and their role in clinical microbiology.

CONTROL OF MICROORGANISMS AND ITS ENVIRONMENTAL APPLICATIONS

Pollution control through use of microorganisms, Recycling of biomaterials, Production of biogas, Leaching of ores by microorganisms, Microbial indicators, Biofouling.

TEXT BOOKS:

1. Pelzar, M.J., Chan, E.C. S and Krieg, N.R. 1993.Microbiology. Tata McGraw Hill Edition. New Delhi. India.
2. Ananthanarayan and Jayaram Paniker, 1999. Text Book of Microbiology. Orient Longman Publishers.

REFERENCES:

1. Talaro, K., Talaro A. Cassida Pelza and Reid, 1993. Foundation in Microbiology. W.C. Brown Publishers.
2. Prescott, Harley and Klen, 2003. Microbiology. McGraw Hill Publications. 5th Edn.
3. Frazier, W.S. and Weshoff, D.C., 1988. Food Microbiology, 4th Edn., McGraw Hill Book Co., New York.
4. George, J.B., 1987. Basic Food Microbiology. CBS Publishers and Distributors.
5. James, M.J., 1987. Modern Food Microbiology. CBS Publishers and Distributors.

COURSE DESIGNERS

S. No	Name of the Faculty	Designation	Department	Mail ID
1	Mrs.G.Arthi	Assistant Professor	Biotechnology	arthi@vmkvec.edu.in
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17BTCC04	CLASSICAL AND MOLECULAR GENETICS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Genetics is a field of biology that deals with the study of genes, genetic variation, and heredity in living organisms that intersects with many other life sciences and information systems. Genetics is concerned with the problem of how the hereditary information in DNA controls, what an organism looks like and how it works. Classically this involved the use of genetic variants to upset the biological function of the cells or organisms and from the effect of these mutations, to make deductions about the way cells and organisms worked.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To define the basic principles of inheritance at the molecular, cellular and organismal levels.
2	To explain on how genes, work together in biological processes.
3	To discuss about the causal relationships between molecule/cell level phenomena (“modern” genetics) and organism-level patterns of heredity (“classical” genetics).
4	To correlate the concepts of linkage and crossing over and Genetic mapping of chromosomes.
5	To make the students to test and deepen their mastery of genetics by applying this knowledge in a variety of problem-solving situations.

COURSE OUTCOMES

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

CO1. Recall about the historical background and development of genetic concepts	Remember
CO2. Describe the differences between transmission genetics, molecular genetics and classical genetics	Understand
CO3. Use of genetic data to determine the modes of inheritance, linkage and predict outcomes in future generations	Understand
CO4. Illustrate the various theories of how new species form and the molecular role of inheritance.	Apply
CO5. Generalize the factors that play a role in the process of evolution and understand the genetic basis of evolutionary change.	Apply
CO6. Illustrate about various genetic transfer methods	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L	M	L	-	-	-	-	-	-	-	-	-	-	-
CO2	L	M	M	L	-	-	-	-	-	-	-	-	-	-	-
CO3	M	S	M	S	M	M	-	-	-	-	-	-	M	-	-
CO4	M	M	S	M	M	-	L	-	-	-	-	-	-	M	-

CO5	M	M	M	L	L	-	-	-	-	-	-	L	-	-	-
CO6	M	-	M	M	-	-	-	-	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF GENETICS & GENES

Classical genetics, Mendelian laws, Mendel's experiment monohybrid and dihybrid inheritance, Fine structure of genes, Gene as the unit of expression, Control sequences - promoter, operator, terminator and attenuator.

KARYOLOGY

Chromosome structure and organization in prokaryotes and eukaryotes, Extra chromosomes and their inheritance, Biology of plasmids, Giant chromosomes – Polytene and Lamp brush chromosome.

ALLELES

Classical concept of allelomorphs, Multiple alleles, Sex linkage in Drosophila, Sex determination in Human beings, Sex linkage in Human beings, Colour blindness, Haemophilia, Blood group antigens.

LINKAGE AND CROSSING OVER

Coupling and repulsion – Hypothesis, Test cross in maize and Crossing over, Sex chromosomes, Sex linked inherited disorders, Linkage, Crossing over and Genetic mapping of chromosomes.

MICROBIAL GENETIC TRANSFER

Identification of the genetic material – Classical experiments, Hershey Chase, Avery McLeod etc., Conjugation, Transduction and Transformation, Transposons- mechanism.

TEXT BOOKS:

1. Gardner, Simmons and Snustad, Principles of genetics, John wiley and Sons, inc. New York. 8th Edition, 2005
2. Verma, P.S. and Agarwal, V.K., Genetics. S. Chand Publication, 2005.
3. Robert H. Tamarin, Principles of Genetics, 7th Edition, Tata McGraw Hill, New Delhi, 2002.

REFERENCES:

1. David Freifelder., Microbial Genetics, Narosa Publishing House, New York, New Delhi, 2nd Edition, 2001.
2. Stanly R. Maloy, John E. Cronan and David Freifelder, Jr., 2006. Microbial Genetics. Narosa Publishing House.
3. Brown, T. A. Genetics – A Molecular Approach.2011.
4. Snustad, D. P., 2008. Principles of Genetics. 6th Edition., John Wiley & Sons

COURSE DESIGNERS

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1	Mrs.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in
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17BTCC05	UNIT OPERATIONS IN PROCESS INDUSTRIES	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

In the Engineering related fields, a unit operation is a basic step in a process. Unit operations involve a physical change (or) a chemical transformation such as separation, crystallization, evaporation, filtration, polymerization, isomerization, and other reactions. For example, in milk processing, homogenization, pasteurization, and packaging are each unit operations which are connected to create the overall process. A process may require many unit operations to obtain the desired product from the starting materials, or feedstocks. Knowledge of various unit operation principles will enable students to understand to work in any biotechnology industries.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To describe the knowledge about the various modes of heat transfer.
2	To explain about the radiation, black bodies and its application
3	To outline about the heat exchanger and its operation
4	To discuss about the fluids, types and its measurement.
5	To evaluate the drying and other mechanical separation processes and its role in industries

COURSE OUTCOMES

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

CO1. Describe about basic concepts of various models of heat transfer	Understand
CO2. Discuss the concepts of radiation, convection and black bodies and its application.	Understand
CO3. Practice the usage of heat exchanger, evaporators and its application	Apply
CO4. Demonstrate the fluid flow and its measurement.	Apply
CO5. Categorize about drying, mechanical separation techniques and its applications	Analyze
CO6. Test and operate various unit operations and heat transfer equipment in chemical and biochemical industries.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	M	L	L	L	-	-	-	-	-	M	-	-	-
CO2	S	-	L	M	M	-	-	-	-	-	-	-	-	-	-
CO3	S	M	M	L	L	-	-	-	-	-	S	M	M	-	-
CO4	S	M	S	L	M	-	-	-	-	-	-	L	M	-	-
CO5	S	L	S	M	M	-	-	-	-	-	-	L	L	-	-
CO6	S	M	M	L	-	-	-	-	-	-	S	M	S	-	L

S- Strong; M-Medium; L-Low

SYLLABUS

CONDUCTION

Modes of Heat Transfer – Heat conduction – Steady state conduction – Heat Conduction through composite wall, Hollow Sphere, Hollow cylinder, Combined Conduction-convection – Extended Surfaces, Critical Thickness of Insulation, individual and Overall Heat transfer Coefficient.

CONVECTION AND RADIATION

Convection – Dimensional Analysis – Forced Convection and Natural convection – Boiling and condensation, Concept of Radiation, Laws of Radiation, Grey & Black Bodies

HEAT EXCHANGER

Heat Exchanger – Types of Heat Exchangers – Types of Flows, LMTD, Fouling Factor, NTU concept, Types of Evaporators – Calculation for Single and Multiple Effects.

FLUID MECHANICS

Introduction – Nature of Fluids, Properties of Fluids, Types of Fluids, Fluid Statics, Pressure measurement, Measurement of Fluid flow – Venturimeter, orifice meter, rotameter, Fluidization – Mechanism, types and its applications

DRYING AND MECHANICAL SEPARATION

Drying – Air properties – Drying Equipment – Drying Rates and Drying time.

Classification of Mechanical Separation processes, Solid Liquid Separation – Filtration – Constant Pressure, Constant Volume, Batch and Continuous Filtration – Industrial Filter, Centrifugal Separation, Settling and Sedimentation.

TEXT BOOKS:

1. Warren McCabe, Julian Smith, Peter Harriott, 2005.Unit Operations of Chemical Engineering 7th Ed., McGraw Hill Inc., New York.
2. C.J. Geankoplis, 2003.Transport Processes and separation Principles: Includes Unit Operations, 4th Ed., Prentice-Hall Inc., New Jersey

REFERENCES:

1. R.E. Traybal, Mass Transfer Operations, 3rd Ed, McGraw-Hill, New York, 1981.
2. Frank P. Incropera, David T. Dewitt, Theoder l. Bergman. 2013. Fundamentals of Heat and Mass Transfer and Interactive Heat Transfer. *John Wiley & Sons.*
3. Gavahane.K. A. 2011 Heat and Mass Transfer. Vol. II. Nirali Prakashan

COURSE DESIGNERS

S. No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Mrs.G.Arthi	Assistant Professor	Biotechnology	arthi@vmkvec.edu.in
2	Mr.N.Jawahar	Assistant Professor	Biotechnology	jawahar@vmkvec.edu.in

17BTCC06	ADVANCED BIOCHEMISTRY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Advanced Biochemistry uses the knowledge and understanding gained in the prerequisite course and provides understanding of metabolism of macromolecules like carbohydrate, amino acid, lipids and nucleic acid. This course also highlights the process of Biological oxidation involved in the energy production by burning the food materials and give awareness to the various diseases associated with the errors of metabolism of the biomolecules.

PREREQUISITE

17BTCC01- Essentials of Biochemistry

COURSE OBJECTIVES

1	To Discuss the metabolic pathways of major bio-molecules
2	To Describe the starting, intermediate and ending molecule, enzymes and cofactors in the pathways
3	To Differentiate biochemical basis of various disease processes
4	To Outline the process of Biological oxidation involved in the energy production by burning the food materials

COURSE OUTCOMES

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

CO1. Explain the metabolic pathways of carbohydrates & amino acids and metabolic disorders associated them	Understand
CO2. Exemplify the importance of molecules derived from amino acids	Understand
CO3. Discuss the fatty acid metabolic pathways and its metabolic disorders	Understand
CO4. Explain about the synthetic and degradative pathways of nucleic acid and its metabolic disorders	Understand
CO5. Illustrate the Integration of energy metabolism of macromolecules	Apply
CO6. Generalize the bioenergetics and oxidative phosphorylation concepts	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	-	L	-	-	-	-	-	-	-	M	-	-	-
CO2	M	-	-		-	-	-	-	-	-	-	-	-	-	-
CO3	S	L	-	L	-	-	-	-	-	-	-	M	-	-	-
CO4	S	M	-		-	-	-	-	-	-	-	M	-	M	-
CO5	S	-	-	L	-	-	-	-	-	-	-	-	-	-	-
CO6	S	M	-		-	-	-	-	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

CARBOHYDRATE METABOLISM

Introduction to Metabolism- Glycolysis- Citric acid cycle-Gluconeogenesis- Glycogen Metabolism-

Glycogenesis-Glycogenolysis- HMP Shunt. Carbohydrate disorder - Glycogen storage diseases, Diabetes mellitus.

AMINO ACID METABOLISM

Introduction-Metabolism of amino acids-Transamination-Deamination-Metabolism of ammonia-Urea Cycle-Biosynthesis and degradation of amino acids- Gly, Ser and Cys; Met, Thr, Lys, Ile, Val, Leu, aromatic amino acids. Important molecules derived from amino acids (auxins, DOPA, Serotonin, porphyrins, T3, T4, Adrenaline, Noradrenaline, histamine, GABA, polyamines etc). Amino acid disorder - Alkaptonuria, Albinism, Phenylketonuria, Gout, Cystinuria.

FATTY ACID METABOLISM

Introduction-Fatty acid oxidation-Ketone bodies & Ketogenesis-Biosynthesis of Fatty acids-Cholesterol Biosynthesis-Lipoproteins- Metabolism of glycolipids- Lipid disorder - Niemann Pick disease, Gaucher's disease, Fabrys disease, Tay-sach's disease.

NUCLEIC ACID METABOLISM

Nucleic acids: Biosynthesis of nucleotides, denovo and salvage pathways for purines and its regulation, Biosynthesis of pyrimidines & its regulatory mechanisms. Degradation of nucleic acid by exo and endo nucleases. Nucleic acid disorder - Xanthinuria, Orotic acidiuria, Leasch-Nyhan syndrome, Nucleoside Phosphorylase deficiency.

INTEGRATION OF METABOLISM & OXIDATIVE PHOSPHORYLATION

Integration of major Metabolic pathways of energy metabolism, Organ specialization and metabolic integration, metabolism in starvation.

Introduction-Bioenergetics, High energy compounds, Biological Oxidation-Electron transport chain, Oxidative phospholyration, Chemiosmotic theory-inhibitors of ETC & Oxidative phospholyration, Shuttle pathway – Glycerol phosphate Shuttle, Malate aspartate Shuttle.

TEXT BOOKS:

1. Principles of Biochemistry by Lehninger, D.L., Cox, M.M., McMillan Publishers (2008) 4th edition
2. Biochemistry by Stryer, Lubert. W.H Freeman & Co., (2000) 4th edition.
3. Fundamentals of Biochemistry by Donald Voet, Judith G. Voet and Charlotte W., John Wiley & Sons (2008), 3rd edition Pratt.

REFERENCES:

1. Fundamentals of Biochemistry by Jain, J L, Jain, Nitin, Sunjay Jain, S. Chand Group, ISBN: 8121924537
2. Text book of Biochemistry by Sathyanarayana, U. and Chakrapani, U., 2006, 3rd Edition, Uppala Author Publishers Interlinks.

COURSE DESIGNERS

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1	Dr.M.Sridevi	Professor and Head	Biotechnology	sridevim@vmkvec.edu.in
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17BTCC07	ENZYME ENGINEERING AND TECHNOLOGY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Enzyme Engineering is the process of designing and modifying enzymes structures by altering amino acid sequences using recombinant DNA technology. Knowledge of structure and functions of proteins gained from advanced biochemistry can be applied here to design and modify structure of enzymes to perform different useful roles including enhanced catalytic activity, drug discovery and diagnostic applications.

PREREQUISITE -NIL

COURSE OBJECTIVES

1	To Describe about the different classes of enzymes and their characteristics.
2	To Illustrate in detail about mechanism and kinetics of enzyme activity.
3	To Generalize about enzyme inhibition and enzyme immobilization and its applications.
4	To correlate in details about performance of immobilized enzymes in different types of bioreactors and their own design restrictions.
5	To examine the knowledge of enzymes to enhance bioreactions and to design sensors for diagnostic applications.

COURSE OUTCOMES

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

CO1. Classify about classification of enzymes and their characteristics.	Understand
CO2. Exemplify fundamental knowledge about enzyme kinetics and mechanism of enzyme activity.	Understand
CO3. Demonstrate the effect of enzyme inhibition and enzyme immobilization.	Understand
CO4. Illustrate about the enzyme kinetics to design biosensors.	Apply
CO5. Categorize in detail about consequences of immobilized enzymes and its effect in bioreactors.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-
CO3	S	S	M	-	-	-	-	-	-	-	-	-	-	-	-
CO4	S	-	-	-	M	-	-	-	-	-	-	L	S	M	-
CO5	S	S	-	-	L	-	-	-	-	-	-	-	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

CLASSIFICATION, PURIFICATION AND CHARACTERIZATION OF ENZYMES FROM NATURAL SOURCES

Classification of enzymes, Production and purification of crude enzyme extracts from plants, Animals and microbial sources – Case studies (Isolation and purification of lipase and protease from microbial sources), Methods of characterization of enzymes, Overview of enzymatic assays.

MECHANISMS AND KINETICS OF ENZYME ACTION

Mechanisms of enzyme action, Concept of active site and energetics of enzyme substrate complex formation, Specificity of enzyme action, Kinetics of single substrate reactions –Michaelis – Menton kinetics, Determination of Km, Lineweaver – Burk plot, Eadie – Hofstee plot, Hanes – Woolf plot, Multi substrate reaction mechanisms (Ping – Pong, Bi – Bi and Random Bi – Bi), Monod Changeux Wyman model.

INHIBITION OF ENZYME ACTIVITY AND ENZYME IMMOBILIZATION

Types of enzyme inhibition – Competitive inhibition, Uncompetitive inhibition, Non- competitive inhibition, Mixed inhibition, Substrate inhibition, Allosteric inhibition, Irreversible inhibition, Physical and chemical techniques for enzyme immobilization – Adsorption, Matrix entrapment, Encapsulation, Cross - linking, Covalent binding etc., Advantages and disadvantages of different immobilization techniques, Application of immobilized enzyme systems.

IMMOBILIZED ENZYME REACTORS AND DIFFUSIONAL LIMITATIONS

Immobilized enzyme reactors – Packed bed, Fluidized bed, Membrane reactors, Air - lift bioreactors and CSTRs suited for immobilized enzymes. Diffusion effects in surface – bound enzymes on non-porous support materials, Diffusion effects in enzyme immobilized in a porous material.

APPLICATIONS OF ENZYMES

Applications of enzyme in disease diagnosis, Food industry, Pharmaceutical industry and Paper industry. Enzyme electrodes as biosensors – Calorimetric, Optical and Potentiometric biosensors, Applications of biosensors.

TEXT BOOKS:

1. Bhatt S.M, 2014.Enzymology and Enzyme Technology. S Chand & Company, Bengaluru, Karnataka.
2. T. Devasena, 2010. Enzymology, Oxford University Press, Oxford, United Kingdom.
3. Trevor Palmer, 2008. Enzymes: Biochemistry, biotechnology and clinical chemistry. East West Press, Horwood.
4. Zubay, G. L., 1998. Biochemistry, McGraw-Hill Companies, Dubuque, 4th Edn.
5. Bailey and Ollis, D.F..2017. Biochemical Engineering Fundamentals. McGraw Hill. New York. 2nd Edn.

REFERENCES:

1. M. Y. Khan & Farha Khan, 2015.Principles of Enzyme Technology. PHI Learning.
2. Butterworth, 1995. Technological Applications of Biocatalysts. BIOTOL Series.
3. Cornish-Bowden, A., 1996. Analysis of Enzyme Kinetic Data. Oxford University Press.
4. Wiseman, A., Blakeborough, N. and Dunnill, P., 1981. Enzymatic and Nonenzymatic catalysis. Vol. 5, Ellis and Harwood, UK.
5. Wiseman, A. Topics in Enzyme and Fermentation Biotechnology. Vol.5 Ellis and Harwood, UK.

6. Kolot, F.B. 1998 Immobilized Microbial Systems, Principles, Techniques and Industrial applications. R.R Krieger Publications.

COURSE DESIGNERS

S. No	Name of the Faculty	Designation	Department	Mail ID
1	Mr.N.Jawahar	Assistant professor	Biotechnology	jawahar@vmkvec.edu.in
2	Mrs.G.Arthi	Assistant Professor	Biotechnology	arthi@vmkvec.edu.in

17BTCC08	BIOINSTRUMENTATION	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The Bioinstrumentation course acts as to link between academics and industry. Knowledge gained in this course applied on varies fields in biotechnology industry. The techniques studied in this course include principle, instrumentation and applications of the instrument.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To Discuss about varies instruments used in biotechnology.
2	To Describe in detail about the Molecular spectroscopy
3	To Summarize about different separation and purification techniques used in DNA and protein purification.
4	To distinguish the protein structure using thermal an X- ray based methods.
5	To Perform various immunological techniques to identify biomolecules and to analyze different bioprocess techniques

COURSE OUTCOMES

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

CO1. Knowledge about basic principles and instruments in biotechnology.	Understand
CO2. Explain about spectroscopy and its principles along with instrumentation.	Apply
CO3. Demonstrate separation and purification techniques in biotechnology.	Apply
CO4. Distinguish the biomolecular structure by thermal and X- ray based analysis.	Analyze
CO5. Evaluate biomolecules by immunological techniques	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	M	L	L	-	-	-	-	-	-	-	-	L	-	-
CO3	-	L	M	S	-	-	-	-	-	-	-	-	M	M	-
CO4	-	L	S	S	L	-	-	-	-	-	-	-	S	-	-
CO5	-	L	M	S	L	-	-	-	-	-	-	S	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF BIOINSTRUMENTION

Classification and calibration of instrumental methods, Principles and Instrumentation of pH meter & Electronic balance, Gel documentation system, Turbidimetric and Nephelometric titrations.

SPECTROSCOPY

General design and components of spectroscopy, Principles, Instrumentation and applications of colorimetry, UV – Visible – IR- Raman spectroscopy –NMR spectroscopy, Auger electron and

Atomic absorption spectroscopy (AAS)

SEPARATION AND PURIFICATION TECHNIQUES

Principles and Instrumentation of centrifugation, Paper and column chromatography, Ion exchange, Size exclusion, Thin Layer Chromatography (TLC), High Performance Liquid Chromatography (HPLC), Gas chromatography, Electrophoresis of Nucleic acid and protein.

THERMAL AND X-RAY

Thermo-gravimetric methods, Differential thermal analysis, Differential scanning calorimetry. X-ray sources, absorption of X-rays, X-ray diffraction, X-ray detectors.

IMMUNOTECHNIQUES AND ANALYSIS OF BIOPROCESS

Radio Immuno Assay (RIA), Enzyme Linked Immunosorbent Assay (ELISA), Immunoblotting, Measurement of BOD and COD in waste waters, Gas analysis for O2 and CO2, Flow injection analysis.

TEXT BOOKS:

1. Chatwal and Anand, 2016. Instrumental Methods of Chemical Analysis, Himalaya Publishing House,5th Edition

2. Upadhyay, Upadhyay and Nath.,2017. Himalaya Publishing House. Biophysical Chemistry (Principles & Technology,4th Edition.

3. Skoog, D., 2014. Instrumental Methods of Analysis, David Hariss, 6th Edition.

4. Willard, H.H., Merrit, J.A., Dean, L.L. and Setlle, F.A., 1986. Instrumental Methods of Analysis. CBS Publishers and Distributors.

REFERENCES:

1. Dinesh Kumar Chatanta and Prahlad Singh Mehra, 2012. Instrumental Methods of Analysis in Biotechnology. I K International Publishing House.
2. P.Asokan. 2003. Analytical Biochemistry. 2nd Edition. China publications.
3. Hobart H. Willard, Lynne L. Merrit, John, A. and Frank A. Settle, 1981. Instrumental Methods of Analysis. Van Nostrand.
4. Campbell, I.D. and Dwek, R.A., 1986. Biological Spectroscopy, Benjamin Cummins and Company.
5. Sewell, P.A. and Clarke, B., 1991. Chromatographic Separations. John Wiley and Sons.
6. Ewing, G.W., 1989. Instrumental Methods of Chemical Analysis. McGraw Hill Book Company.

COURSE DESIGNERS

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1	Mr.N.Jawahar	Assistant professor	Biotechnology	jawahar@vmkvec.edu.in
2	Mrs.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in

17BTCC09	MOLECULAR BIOLOGY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Molecular Biology gives in-depth knowledge of basic principles and Structure of DNA, RNA, DNA Replication, Transcription, Translation, Gene regulation and Mutation and repair mechanism. Students will gain an understanding of chemical and molecular processes that occur in cell and between cells and also capable to explain mechanism which occur in the living organisms. The paper starts with the basic organization of the genome in prokaryotes and eukaryotes along with their discerning features. This is followed by chapters on prokaryotic and eukaryotic replication, transcription, translation processes, gene regulation and mutation.

PREREQUISITE

17BTCC04 - CLASSICAL AND MOLECULAR GENETICS

COURSE OBJECTIVES

1	To describe on Nucleic acids, structure, their characteristics and organization, biological importance, replication process etc.,
2	To discuss about the process of Transcription, mechanism, types of RNA and inhibitors involved in this process.
3	To interpret the relation of genetic code and translation mechanism, post translation modification, translation inhibitors.
4	To outline the mechanism of Gene regulation in prokaryotes and eukaryotes
5	To categorize the mutations, its types and repair mechanism.

COURSE OUTCOMES

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

CO1. Describe the basic concepts and principles of nucleic acids in prokaryotic and eukaryotic organisms. Discuss and distinguish the replication of prokaryotic and eukaryotic DNA	Understand
CO2. Explain the synthesis of RNA and post-transcriptional modifications	Understand
CO3. Describe the genetic code and protein synthesis mechanism	Understand
CO4. Develop understanding about the molecular mechanisms behind different modes of gene regulation in bacteria and eukaryotes	Analyse
CO5. Examine about Mutations, DNA damage and repair mechanisms	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	M	-	-	-	-	-	-	-	-	L	-	-
CO2	S	L	-	L	-	-	-	-	-	-	-	-	-	-	-
CO3	S	M	-	-	-	-	-	-	-	-	-	-	-	L	-
CO4	M	M	-	S	-	-	-	-	-	-	-	-	-	-	-
CO5	S	M	-	S	-	-	M	-	-	-	-	L	M	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

NUCLEIC ACIDS AND DNA REPLICATION

Introduction to Nucleic acids – Primary, Secondary and Tertiary structures, Structure and physicochemical properties of elements in DNA and RNA, Chemical and structural qualities of 3’,5’-Phosphodiester bond, Replication in prokaryotes and eukaryotes – Different modes of replication, Inhibitors of replication.

TRANSCRIPTION

Structure and function of mRNA, rRNA and t RNA, Exon, Intron, Transcription in prokaryotes and eukaryotes, Inhibitors, Post transcriptional modifications, Reverse transcription.

TRANSLATION

Genetic code and its features, Wobble hypothesis and its importance, Colinearity of gene and polypeptide, Translation mechanism, Post translational modifications, Protein folding.

REGULATION OF GENE EXPRESSION

Organization of genes in prokaryotic and eukaryotic chromosomes, Regulation of gene expression with reference to λ phage life cycle. Gene regulation – Operons: Lac, trp, ara and gal.

MUTAGENESIS AND REPAIR

Mutagens, DNA Mutations and their mechanism, various types of DNA repair mechanism.

TEXT BOOKS:

1. Freifelder, D., “Molecular Biology”, 2nd Edition, Narosa Publishing House, 1999.
2. Benjamin L., “Genes IX” Jones and Bartlett, 2008.
3. Jeremy M. Berg, John L. Tymoczko and Lubert Stryer, 2002 “Biochemistry”. 5th Edition. W.H. Freeman and Company.

REFERENCES:

1. James Watson et al., 1987. Molecular Biology of Gene. The Benjamin / Cummings Publication Co. Inc., California.

COURSE DESIGNERS

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1	Mrs.G.Arthi	Assistant professor	Biotechnology	arthi@vmkvec.edu.in
2	Mrs.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in

17BTCC10	PRINCIPLES OF CHEMICAL ENGINEERING	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The course introduces the basic principles and calculation techniques in the field of chemical engineering. It provides a concrete understanding of fundamentals and applications of material balances and energy balances which help students to understand the concepts of thermodynamics and fluid mechanics. It also provides a basis for non-chemical engineers to realize the chemical engineering aspects of subsequent modules.

PREREQUISITE

17BTCC05- Unit Operations in Process Industries

COURSE OBJECTIVES

1	To express words into diagrams and mathematical expressions.
2	To describe problem-solving skills, specifically the ability to think quantitatively by including numbers and units.
3	To interpret vague and ambiguous language in problem statements.
4	To implement judicious use of approximations and reasonable assumptions to simplify problems.
5	To compare principles of operation and design for a range of items of plant.

COURSE OUTCOMES

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

CO1. Explain about correlation of mathematics, science and engineering principles for problem solving in process industries.	Understand
CO2. Demonstrate the fundamental concepts of dimensions, units, psychometry, steam properties and law of conservation of mass and energy.	Understand
CO3. Interpreting the problems in material and energy balances related to chemical and bioreactors	Understand
CO4. An ability to employ knowledge to spot and create simple engineering troubles linked to material balance, energy balance, thermodynamics and energy transformation	Apply
CO5. Practice material balances on unit operations and processes in various industries and to evaluate humidity with/without the use of psychrometric chart.	Apply
CO6. Formulating and optimizing various parameters with respect to the industrial processes.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	L	-	-	-	-	-	-	-	-	M	-	-
CO2	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	S	S	-	M	L	L	-	-	-	-	-	-	-	-	-
CO4	S	S	S	L		-	-	-	-	-	-	-	-	-	-
CO5	S	M	-	M	L	-	-	-	-	-	-	L	-	-	-
CO6	S	M	M	L	L	L	-	-	-	-	-	S	-	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

OVERVIEW OF STOICHIOMETRY

Introduction, Units and dimensions, conversion factors, Stoichiometric principles, Composition relation - Atomic, Molecular, Equivalent weights, Molar concepts - Moles, Mole fraction, Mass fraction, Mixtures and solutions - Molarity, Molality and Normality, Density and specific gravity, Conversion factors, Ideal Gas law, Gaseous mixtures- Dalton's law of additive volumes, Dimensional analysis.

MATERIAL BALANCES

Material balances without chemical reactions - Overall and component balances; Material balances with chemical reactions - Limiting reactant, Excess reactant; Unit operations- Distillation, Evaporation, Drying, crystallization; Recycling and bypass; Material balance of unsteady state operations; Problems in industrial applications.

VAPOUR PRESSURE, HUMIDITY AND SOLUBILITY

Vapour pressure - Effect of temperature; Vapourization; Humidity and saturation; Condensation, Solubility, Dissolution

ENERGY BALANCE

Thermochemistry - Calculation of heat of reaction at other temperatures - Hess's law of summation, heat capacity, heat capacities of gases at constant pressure, heat capacities of gas mixture, heat capacities of liquid mixture, Latent heat - Heat of formation, Reaction, Mixing, Theoretical flame temperature.

FLUID MECHANICS

Fluids; fluid statics and applications in chemical engineering; fluid flow; laminar; turbulent pressure drops; compressible fluid flow concepts.

TEXT BOOKS:

1. Principles of Biochemistry by Lehninger, D.L., Cox, M.M., McMillan Publishers (2008) 4th edition
2. Biochemistry by Stryer, Lubert. W.H Freeman & Co., (2000) 4th edition.
3. Fundamentals of Biochemistry by Donald Voet, Judith G. Voet and Charlotte W., John Wiley & Sons (2008), 3rd edition Pratt

REFERENCES:

1. George T. Austine, Shreeves chemical process industries, 1984, McGraw Hill International Edition, 5th Edition.
2. Finlayson, B. A., Introduction to Chemical Engineering Computing, 2006, John Wiley & Sons, New Jersey.
3. Geankoplis, C.J., Transport Processes and Unit Operations, 2002. Prentice Hall India.
4. Nicholas Chopey, Handbook of Chemical Engineering Calculations Process Principles", Mc Graw Hill, 2004.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Mrs.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in
2.	Mrs.G.Arthi	Assistant Professor	Biotechnology	arthi@vmkvec.edu.in

17BTCC11	**PLANT AND ANIMAL BIOTECHNOLOGY**	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The course is customized to provide a perceptive of the basic concepts, techniques and methods underlying plant and animal biotechnology. The learners will gain understanding of theoretical principles enabling them to employ the knowledge to solve problems related to plant protection and disease diagnosis through biotechnological approaches.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	Summarize about different types of cell culture methods
2	To develop an understanding on patenting genetically engineered animals and ethical issues
3	Describe about the genetic transformation in plants by the aid of different vector systems.
4	Outline cell culture technique, significance of its cultivation and its application in the disease diagnosis and protection

COURSE OUTCOMES

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

CO1. Explain the basics of tissue culture	Understand
CO2. Demonstrate the techniques for development of Hybrids, screening and selection procedure. Apply the techniques in production of Cybrids.	Apply
CO3. Appraise the plant tissue culture and genetic manipulation of plants	Analyse
CO4. Categorize about the different animal tissue culture and Molecular biological technique for rapid diagnosis of genetic disease.	Analyse
CO5. Inspect the animal gene transfer techniques and their ethical issues	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PS	PSO3
CO1	S	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	S	M	M	-	-	-	-	-	-	-	-	-	-	-	-
CO3	S	S	S	M	S	-	M	L	-	-	-	-	M	-	-
CO4	M	S	S	M	L	-	-	L	-	-	-	-	S	S	-
CO5	L	S	S	M	L	-	-	L	-	-	-	-	S	S	-
CO6	S	L	-	-	-	-	-	-	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF TISSUE CULTURE

Tissue culture media – Composition and preparation, aseptic techniques, Organogenesis, Somatic embryogenesis, Shoot-tip culture, Embryo culture and embryo rescue, totipotency.

SOMATIC HYBRIDIZATION AND TRANSFORMATION TECHNIQUES

Protoplast isolation, Culture and fusion, hybrids and Cybrids, Plant vectors, basic features of vectors, Direct gene transfer methods, Agrobacterium mediated gene transfer, applications.

TRANSGENIC PLANTS AND MOLECULAR MARKERS

Herbicide resistance-use of herbicide in modern agriculture, pest resistance-nature, insect resistant crops-Bt approach to insect resistance and food safety. Molecular markers.

TRANSGENIC ANIMALS AND DISEASE DIAGNOSIS

Basic techniques of animal cell culture and their application, Gene cloning techniques for mammalian cells, Transgenic animals, *In-vitro* fertilization and embryo transfer, Molecular biological technique for rapid diagnosis of genetic disease and gene therapy.

TRANSFECTION METHODS, PATENT AND ETHICAL ISSUES

Gene transfer methods in animals, Xenotransplantation, Manipulation of Growth hormone, thyroid hormone, patenting genetically engineered animals- Ethical issues

TEXT BOOKS:

1. Gupta, P.K., 1996. Elements of Biotechnology. *Rastogi* and Co., Meerut.
2. Ranga, M.M., 2002. Animal Biotechnology. *Agrobios India Limited.*
3. Ignacimuthu, S., 1996. Applied Plant Biotechnology. *Tata McGraw Hill*.
4. Gamburg, O.L. and Philips, G.C., 1995. Plant Tissue and Organ Culture Fundamental Methods. *Narosa Publications.*
5. Singh, B.D., 1998. Text Book of Biotechnology. *Kalyani Publishers.*
6. Ramadas, P. and Meera Rani, S., 1997. Text Book of Animal Biotechnology. *Akshara Printers.*

REFERENCES:

1. Hamond, J., McGarvey, P. and Yusibov, V., 2000. Plant Biotechnology. *Springer Verlag.*
2. Mantal, S.H., Mathews, J.A. and Mickee, R.A., 1985. Principles of Plant Biotechnology. An Introduction of Genetic Engineering in Plants. *Blackwell Scientific Publication*

COURSE DESIGNERS

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1	Dr.M.Sridevi	Professor and Head	Biotechnology	sridevim@vmkvec.edu.in
2	Mrs.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in

17BTCC12	GENETIC ENGINEERING	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Genetic engineering has developed genetic recombination techniques to manipulate gene sequences in plants, animals and other organisms to express specific traits. Applications for genetic engineering are increasing as engineers and scientists work together to identify the locations and functions of specific genes in the DNA sequence of various organisms. Once each gene is classified, engineers develop ways to alter them to create organisms that provide benefits such as cows that produce larger volumes of meat, fuel- and plastics-generating bacteria, and pest-resistant crops.

PRERQUISITE

17BTCC09-MOLECULAR BIOLOGY

COURSE OBJECTIVES

1	To understand the principle of nucleic acid isolation, PCR and their uses in genetic engineering, nucleic acid hybridization
2	The students after completing this course would be aware of how to clone commercially important genes
3	The students would be aware Analysis of Gene expression
4	To discuss the gene cloning methods and the tools and techniques involved in gene cloning
5	To explain the heterologous expression of cloned genes in different hosts, production of recombinant proteins and its applications

COURSE OUTCOMES

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

CO1. Gain knowledge on various recombinant DNA techniques and their applications.	Understand
CO2.Familiar with the problems they could encounter and how to trouble shoot them learn various types of host-vector systems and steps in creating a recombinant DNA molecule	Understand
CO3.Monitor both in-vitro and in-vivo activity.	Analyse
CO4.Give insight into the functioning of Recombinant DNA molecules, their constructions, analysis and fine tuning.	Apply
CO5. Know about the production of commercially important recombinant proteins.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	S	S	L	-	-	-	-	-	-	-	-	M	-	-
CO2	S	M	S	M	-	-	-	-	-	-	-	-	S	-	-
CO3	M	L	M	S	-	-	-	-	-	-	-	-	L	-	-
CO4	S	M	L	S	-	-	-	-	-	-	-	-	-	-	-
CO5	M	M	S	L	-	-	-	-	-	-	-		-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

BASIC TOOLS IN GENETIC ENGINEERING

Role of genes and core techniques in gene manipulations; Restriction enzymes -Cutting and joining of DNA; Gene specific and degenerate primer design- DNA amplification using PCR, Types of PCR - RAPD, RT-PCR and applications of PCR; DNA sequencing - Maxam and Gilbert method and Sanger and Coulson enzymatic chain termination method; DNA labelling Methods; Nucleic acid hybridization techniques – Southern, Northern and Western.

CLONING AND EXPRESSION VECTORS

Vectors; Plasmid biology, Plasmids as vectors – pBR 322, Derivatives of pBR 322, pUC vectors, Lambda vectors, *In vitro* packaging, M13 vectors, Cosmids, Phasmids, Retroviral vectors, Baculovirus vectors, Cloning vectors in Gram positive bacteria (p1J101), Cloning vectors in Gram negative bacterium (Col E1, R1, pT181, pSC 101), Expression vectors – Prokaryotic expression vectors *(E. coli*, *Streptomyces*) and Eukaryotic expression vectors.

GENE LIBRARIES AND GENE MAPPING

Construction and screening of Genomic DNA and cDNA Library; Analysis of gene expression; Chromosome walking, Chromosome jumping; DNA probes; Molecular markers - Variable Nucleotide Tandem Repeats (VNTR's), Short Tandem Repeats (STR); Mini and Microsatellite sequences; Restriction mapping; Transcript mapping; Gene targeting.

CLONING STRATEGIES

Safety lines for recombinant DNA techniques; Construction of recombinant DNA; Preparation of competent cells- Transformation and Transfection; Selection and screening of recombinants; Gene transfer - Shotgun method, Nuclear injection method; Cloning in plants-Ti Plasmids of *Agrobacterium*, Structure and function of T-DNA

GENE MODIFICATIONS AND APPLICATIONS OF RECOMBINANT DNA TECHNOLOGY

Mutagenesis – Deletion mutagenesis, Oligonucleotide derived mutagenesis, Site directed mutagenesis and their applications; DNA Fingerprinting - RFLP analysis; Applications of recombinant DNA technology for the production of recombinant proteins – Insulin, Interferon and Growth hormones; Guidelines for the disposal of recombinant product wastes.

TEXT BOOKS:

1. Primrose SB and R. Twyman "Principles of Gene Manipulation & Geneomics Blackwell Science Publications, 2006.
2. Principles of Genome Analysis and Genomics by S.B.Primrose and R.M.Twyman, Third Edition (Blackwell Publishing), 2003.

REFERENCES:

1. Winnacker, Ernst – L. "From Genes to Clones: Introduction to Gene Technology", Panima, 2003.
2. Glover, D. M., 1984. Gene cloning: The mechanism of DNA manipulation. IRC Press, Oxford University.
3. Jose Cibelli, Robert P. Lanza, Keith H.S. Campbell, Michael D. West, 2002. Principles of cloning. Academic Press.
4. Glick, B.R. and J.J. Pasternak "Molecular Biotechnology: Principles and Applications of Recombinant DNA", 3rd Edition, ASM, 2003.

5. Ansubel FM, Brent R, Kingston RE, Moore DD, “Current Protocols in Molecular Biology “Greene Publishing Associates, NY, 1988.
6. Berger Sl, Kimmer AR, “Methods in Enzymology”, Vol 152, Academic Press, 1987.
7. Genomes 3 by T.A.Brown, Third Edition (Garland Science Publishing), 2007
8. Sambrook and Elliot. Molecular Cloning. Vol. III.

COURSE DESIGNERS

S.No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Mrs.G. Arthi	Assistant professor	Biotechnology	arthi@vmkvec.edu.in
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17BTCC13	THERMODYNAMICS FOR BIOTECHNOLOGY	Category	L	T	P	Credit
		CC	4	0	0	4

PREAMBLE

Thermodynamics for Biotechnology deals with the basic laws and its application. This course deals with various law, volumetric application, Phase equilibria and Chemical Reaction Equilibria, Knowledge of this course will enable students to understand the importance of thermodynamics and its applications in the field of biotechnology.

PRERQUISITE

17BTCC10-PRINCIPLES OF CHEMICAL ENGINEERING.

COURSE OBJECTIVES

1	To list fundamental laws of thermodynamics.
2	To interpret its application to simple biological systems.
3	To discuss properties of pure fluids and property changes in fluid mixtures.
4	To implement the concepts to phase and reaction equilibria.
5	To formulate the equilibrium criteria for the chemical reactions

COURSE OUTCOMES

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

CO1. Summarize the fundamentals of thermodynamics and laws of thermodynamics.	Understand
CO2. Explain the laws of thermodynamics to different systems and processes	Understand
CO3. Describe the thermodynamics concepts to explain the properties of pure fluids and their mixtures.	Understand
CO4. Deduce the concepts of thermodynamic to phase equilibrium.	Analyse
CO5. Appraise and adapt biochemical reaction equilibrium to biological systems.	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L	-	-	-	-	-	-		-	-	-	-	-	L
CO2	-	M	L	-	-	-	-	-	L	-	-	-	-	L	M
CO3	-	M	L	-	-	-	-	-	L	-	-	-	-	-	M
CO4	-	M	L	-	-	-	-	-		L	-	-	-	-	M
CO5	-	M	L	-	-	-	-	-	L	L	-	-	-	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

LAWS OF THERMODYNAMICS AND ITS APPLICATIONS

Introduction - Work, Energy, Heat, Internal energy, Extensive and intensive properties, State and path functions, First law of thermodynamics, Energy balance for closed systems, Equilibrium, The reversible process, Constant - v and Constant - p processes, Enthalpy, Heat capacity, Application of First law to Steady state flow processes, Entropy and Second law of thermodynamics – Limitations of First law, Third law of Thermodynamics. Heat engines, Thermodynamic temperature scale, Power cycles, Calculation of Ideal work.

VOLUMETRIC AND THERMODYNAMIC PROPERTIES OF FLUIDS
Ideal gas law, Isobaric, Isochoric, Isothermal, Adiabatic and Polytropic process. P-V-T relations of fluid, Equation of state for gases, Compressibility factors, Compressibility charts, The principles of corresponding states, Acentric factor. Thermodynamic properties of fluids – Reference properties, Energy properties, Derived properties, Maxwell's relations. Heat capacity relations, Effect of pressure and volume on heat capacities.

SOLUTION THERMODYNAMICS
Partial molar properties, Concepts of chemical potential and fugacity; Activity and activity co-efficient, Gibbs Duhem equation, Margules activity model, Ideal and non-ideal solut ions, Excess properties of mixtures, Composition models.

PHASE EQUILIBRIA
Phase equilibrium – Criteria for phase equlilbria, Phase equilibria in single and multi-component systems, Vapour Liquid Equilibria (VLE), Liquid – Liquid Equilibria (LLE), Solid – Liquid Equilibrium.

CHEMICAL REACTION EQUILIBRIA
Equilibrium criteria for homogeneous chemical reactions, Evaluation of equilibrium constant, Effect of temperature and pressure on equilibrium constant, Calculation of equilibrium conversion for single and multiple reactions, Heterogeneous reaction equilibria.

TEXT BOOK:

1. Narayanan, K.V., 2001. A Text Book of Chemical Engineering Thermodynamics. Prentice Hall India.
2. Smith, J.M., Van Ness, H.C. and Abbot, M.M., 2001. Chemical Engineering Thermodynamics. 6th Edn., McGraw- Hill.

REFERENCES:

1. Rao, Y.V.C. Chemical Engineering Thermodynamics.
2. Sandler, S.I., 1989. Chemical and Engineering Thermodynamics. John Wiley and Sons.
3. Roels, J.A., 1983. Kinetics and Energetics in Biotechnology. Elsevier.
4. Donald T. Haynie. Biological Thermodynamics. Cambridge.
5. Volker Hessel, 2005. Chemical Microprocess Engineering. John Wiley and Sons.
6. Irving J. Dunn and Eth Zurich, 2003. Biological Reaction Engineering. John Wiley.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Mr.N.Jawahar	Assistant Professor	Biotechnology	jawahar@vmkvec.edu.in
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17BTCC14	IMMUNOLOGY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The course aims in imparting the fundamental knowledge in the science of immunology and a detailed study of various types of immune systems and their classification, structure, and mechanism of immune activation. It discusses about the principles of microbial pathogenesis, production of new drugs and diagnostic methods.

PRERQUISITE - NIL

COURSE OBJECTIVES

1	To gain knowledge about the general concepts of immune system, immune organ and cells
2	To learn the mechanisms related to cell mediated immunity, complement system, hypersensitivity and transplantation immunology
3	To acquire knowledge on the principles of microbial pathogenesis the concepts and principle of immunoassay techniques in routine diagnosis, research
4	To demonstrate a capacity for problem-solving about immune responsiveness and be able to provide an overview of the interaction between the immune system and pathogens
5	Explore strategies to improve existing Immuno technology and how to approach these.

COURSE OUTCOMES

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

CO1. Explain the general concepts of immune system, describe the cells and organs of the immune system, and describe the properties of antigens and antibodies	Understand
CO2. Explain the concept of cell mediated immunity and hypersensitivity	Understand
CO3. Illustrate the mechanisms behind transplantation immunology and autoimmunity	Apply
CO4. Students understand principles and molecular mechanisms involved in microbial pathogenesis and learn the principle and production of vaccines	Apply
CO5. Demonstrate various antigen-antibody interactions and techniques and explore the diagnostic methods	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	L	M	S	M	L	-	-	-	-	-	-	-	M	L	-
CO4	M	S	S	M	L	-	-	-	-	-	-	-	S	S	-
CO5	-	S	S	M	M	-	-	-	-	-	-	M	L	S	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO IMMUNE SYSTEM

Phylogeny of immune system, Innate and acquired immunity, Clonal nature of immune response, Organization and structure of lymphoid organs, antigens: chemical and molecular nature, haptens, adjuvants, Cells of immune system – Haematopoiesis and differentiation – B-Lymphocytes, T-Lymphocytes, Macrophages, Dendrite cells

ASSESSMENT OF CELL MEDIATED IMMUNITY

Identification of lymphocytes and their subsets in blood, T cell activation, Estimation of cytokines, Macrophages activation, Macrophage-microbicidal assays, Hypersensitivity.

TRANSPLANTATION AND AUTOIMMUNITY

HLA System, Transplantation – Organ transplantation, Grafting – graft rejection and prevention, Immunosuppressive drugs, Autoimmunity – Auto antibodies in human, Pathogenic mechanism, Experimental models of Autoimmune disease, Treatment of Autoimmune disorders.

MOLECULAR IMMUNOLOGY

Immunity to virus, Bacteria, Parasites, Genetic control of immune response, MHC associated predisposition to disease, Principles and strategy for developing vaccines, Newer methods of vaccine production. Immunodeficiency diseases.

IMMUNOTECHNOLOGY

Antigen-antibody interaction, Agglutination and precipitation, complement fixation test, Immunodiffusion, Immunoelectrophoretic, Purification and synthesis of antigen, Fluorescence immunoassay – Immuno Fluorescence (IF), SLFIA, DELFIA, Fluorescence Activated Cell Sorter, Immunomics.

TEXT BOOKS:

1. Lydyard, P.M., Whelan, A. and Fanger, M.W., 2003. Instant Notes in Immunology. 2nd Edn., Viva Books Private Limited.
2. Dulsy Fatima and Arumugam N., 2014.

REFERENCES:

1. Talwar, G.P. and Gupta, S.K., 1992.A Handbook of Practical and Clinical Immunology. Volume 12., CBS Publications.
2. Richard A., Goldsby, Thomas J.Kindt and Barbara A, Osborne, Kuby, Immunology. IV Edition, W.H. Freeman and Company, New York.
3. Goding, J.W., 1983. Monoclonal Antibodies: Principles and Practice. Academic Press.
4. Benjamin, E. and Leskowitz, S., 1991. Immunology – A Short Course. Wiley Liss., New York.
5. Kuby J, Immunology, WH Freeman & Co., 7th Edition 2012.

COURSE DESIGNERS

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17BTCC15	FOOD PROCESSING TECHNOLOGY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Food Processing Technology deals with the study of food production, processing, packaging, preservation and the use of technology and Engineering techniques in aiding the above-mentioned stages. It also deals with artificial food, artificial edible items, nutrition science and its Chemistry. It allows students to learn about food and nutrients, role of functional foods and the strategies to produce specific food ingredients.

PRERQUISITE - NIL

COURSE OBJECTIVES

1	To explain different types of foods, factors affecting food & food products and the micro-organisms which cause food borne diseases
2	To explain the concepts of food spoilage and different food preservation methods, and their impact on the shelf life, quality, and other physical and sensory characteristics of foods
3	To discuss the different food processing methods and its applicability in food product preparations
4	To choose appropriate modern methods of food preservation for industrialization
5	To Choose the materials and types of packaging for foods and its quality testing

COURSE OUTCOMES

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

CO1. Identify different microbes associated with foods, and food borne diseases.	Understand
CO2. Describe the role of microbes in food spoilage and food preservation	Understand
CO3. Summarize all food processing methods and demonstrate its application in food product preparation	Understand
CO4. Illustrate the modern methods to modify foods using biotechnology.	Apply
CO5. Demonstrate packing methods, materials and factors affecting food packing.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M	L	M	L	M	L	-	-	-	-	-	-	-	-
CO2	L	S	L	M	L	L	L	-	-	-	-	-	-	-	-
CO3	S	M	M	L	M	M	M	-	-	-	-	-	M	-	-
CO4	M	S	S	S	S	M	L	-	-	-	-	-	-	M	M
CO5	S	M	M	M	M	L	M	-	-	-	-	-	-	--	-

S- Strong; M-Medium; L-Low

SYLLABUS

FUNDAMENTALS OF FOOD MICROBIOLOGY

Microbiology of different types of foods-Vegetables, fruits, milk and milk products, meat and meat products. Factors affecting the food products. Food borne diseases and causative organisms.

FOOD SPOILAGE AND PRESERVATION

Spoilage of foods and Shelf –life-Milk and milk products, meat and meat products. Factors influencing food spoilage. Methods of food preservation-Pickling, salting, drying, freezing, refrigeration, use of food additives and irradiation.

PROCESSING OF FOODS

Heating, boiling, oxidation, toxic inhibition, dehydration, drying-Yeast based products, Milk products, Jams and jellies, Pickles, Meat and meat products. Labelling Instructions.

INDUSTRIALIZATION/ MODERN FOOD PRESEVERVATION

Pasteurization, Vacuum packing, food additives, irradiation, bio preservation, Modified atmosphere packing, cryopreservation.

PACKAGING AND QUALITY TESTING

Methods of packaging of foods-Solid, liquid, semi solids, Modified atmosphere packing. Factors affecting packaging. Packaging materials.

TEXT BOOKS

1. Frazier. Food Microbiology. McGraw Hill Publication.4th Edition.2001
2. Sivashankar.B.Food processing Preservation, Prenlice Hall of India.Pvt.Ltd.2002

REFERENCE BOOKS

1. James M Jay, Martin J, Loessner and David A Golden. Food Microbiology, Springer Publication, 7th Edition. 2005
2. Shetty K, Paliyath, Food Microbiology, 2nd Edition, Taylor and Francis, 2006

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17BTCC16	BIOPROCESS ENGINEERING	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

This course aims to develop the skills of students in the area of Bioprocess engineering. This will also help the students to undertake project in Bioprocess technology

PRERQUISITE

17BTCC07- ENZYME ENGINEERING AND TECHNOLOGY.

COURSE OBJECTIVES

1	To Explain about the historical development of Bioprocess technology, Design and construction of fermenter.
2	To Interpret the kinetics of Microbial growth and product formation
3	To Summarize the knowledge on Design and operation of Bioreactors
4	To Perform the Mass transfer principles in bioreactor and scale-up criteria.
5	To Execute the Methods of Online and Offline monitoring of bioprocess.

COURSE OUTCOMES

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

CO1. Identify the appropriate bioreactor configurations and operation modes based upon the nature of Bio products and cell lines and other process criteria.	Understand
CO2. Illustrate about modelling and simulation of bioprocesses so as to reduce costs and to enhance the quality of products and systems.	Understand
CO3. Review a research career or to work in the biotechnology industry with strong foundation about bioreactor design and scale-up.	Understand
CO4. Demonstrate theory, principle, design, application and possible integrations of unit operations in bioprocessing.	Apply
CO5. Initiate the research lab and Industry; identify problems and seek practical solutions for large scale implementation of Biotechnology.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	S	-	-	-	-	-	-	-	-	M	-	-
CO2	S	M	L	M	-	-	-	-	-	-	-	-	S	-	-
CO3	S	M	M	S	-	-	-	-	-	-	-	-	L	-	-
CO4	S	M	L	S	-	-	-	-	-	-	-	-	-	M	-
CO5	M	M	S	L	-	-	-	-	-	-	-		S	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO BIOPROCESS AND FERMENTATION

Historical development of the fermentation industry, General requirements of fermentation process, Basic configuration of fermenter and ancillaries, Main parameters to be monitored and controlled in fermentation processes**.**

KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION

Kinetics of Batch, Fed batch and Continuous culture processes, Comparison of batch and continuous culture in industrial process, Introduction to structured and unstructured models – Using unstructured non-segregated models to predict specific growth rate – Substrate limited growth (Monod equation and alternatives to Monod equation), Models with growth inhibitors (Substrate, Product inhibition and Inhibition by toxic compounds).

DESIGN OF BIOREACTORS

Classification of bioreactors – Immobilized enzyme bioreactors, Packed bed bioreactors, Membrane bioreactors, Airlift loop reactor, Fluidized bed and Trickle bed bioreactors, Design of bioreactors – Aseptic operation and containment, Body construction, Aeration and agitation Types of agitators and spargers, Sterilization of Media, Fermentor, Air supply and Exhaust and Sterilization kinetics.

BIOREACTOR SCALE-UP AND MASS TRANSFER

Scale up of fermentation process – Factors involved in scale-up, Scale-up of aeration / agitation, Oxygen mass transfer in bioreactors, Determination of K_La values – Sulphite oxidation technique, Gassing out technique, Oxygen balance technique, Mass transfer correlations.

MONITORING OF BIOPROCESSES

Methods of measuring process variables – Online and offline analysis for measurement of important biochemical parameters, Biomass estimation, Control systems – Manual and automatic control.

TEXT BOOKS

1. Shuler and Kargi, 1992. Bioprocess Engineering. *Prentice Hall*.
2. James E. Bailey and David F. Ollis, 1986. Biochemical Engineering Fundamental. 2nd Edn. *Mc Graw Hill*.

REFERENCES:

1. Trevan, Boffey, Goulding and Stanbury. Biotechnology. *Tata Mc Graw Hill Publishing Co*. Anton Moser. Bioprocess Technology, Kinetics and Reactors. *Springer Verlag*.
2. James M. Lee. Biochemical Engineering. *PHI, USA*.
3. Atkinson. Handbook of Bioreactors.
4. Harvey W. Blanch, Douglas S. Clark. Biochemical Engineering. *Marcel Decker Inc*.

Pauline M. Doran, 2002. Bioprocess Engineering Principles. *Academic Press*

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17BTCC17	DOWNSTREAM PROCESSING IN BIOTECHNOLOGY	Category	L	T	P	Credit
		CC	4	0	0	4

PREAMBLE

Downstream processing is defined as various stages of cascade or non-cascade process that occurs after the completion of the fermentation or biotransformation to recover and purify synthetic bio products includes drugs, antibiotics, enzymes, hormones, etc., from fermentation broth. Downstream processing includes separation, purification, and packaging of the fermented products

PRERQUISITE

17BTCC16- BIOPROCESS ENGINEERING

COURSE OBJECTIVES

1	To interpret role of downstream processing in biotechnology.
2	To explain in detail about the physical methods of separation.
3	To summarize the knowledge on isolation of products.
4	To execute product fractionation and purification.
5	To implement the knowledge of formulation of the final product and finishing.

COURSE OUTCOMES

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

CO1. Explain the knowledge about Role and importance of Downstream processing in biotechnology	Understand
CO2.Summarize the fundamental knowledge about the physical methods of separation.	Understand
CO3. Express in detail knowledge on isolation of products.	Understand
CO4.Implement know-how to product fractionation and purification by chromatography and Hybrid separation Technology.	Apply
CO5. Implement the knowledge to formulate the final product using crystallization, drying.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	-	-	-	-	-	-	-	-	-	L	L	-	-
CO2	S	L	-	-	-	-	-	-	-	-	-	L	M	-	-
CO3	S	L	-	-	-	-	-	-	-	-	-	L	M	-	-
CO4	S	L	-	-	-	-	-	-	-	-	-	-	L	-	-
CO5	S	L	-	-	-	-	-	-	-	-	-	-	M	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

DOWNSTREAM PROCESSING IN BIOTECHNOLOGY

Role and importance of Downstream processing in biotechnological processes, Characteristic of Biomolecules and Bioprocesses, Cell disruption for product release - Mechanical, Enzymatic and Chemical methods. Pre-treatment and stabilization of bioproducts.

PHYSICAL METHODS OF SEPARATION

Unit operation for solid liquid separation - Removal of Insoluble, Biomass, Flocculation, sedimentation, Centrifugation and Filtration methods.

ISOLATION OF PRODUCTS

Adsorption, Liquid - Liquid extraction, Aqueous two-phase extraction, Membrane separation - Ultra filtration and Reverse osmosis, Dialysis, Precipitation of proteins by Various methods – Salting out, Isoelectric point, Organic solvents, Polyelectrolytes, Polyvalent metallic ions and Non – ionic hydrophilic polymers.

PRODUCT FRACTIONATION / PURIFICATION

Partition Chromatography – single dimensional and Two-dimensional Chromatography –Thin layer chromatography, Gas liquid chromatography, Adsorption Chromatography – Column chromatography and, Ion Exchange Chromatography, High performance liquid Chromatography (HPLC) and Hybrid separation Technology.

PRODUCT FORMULATION AND FINISHING OPERATION

Crystallization - Basic concepts, Crystal size distribution, Batch crystallisation, Continuous crystallization of pharmaceuticals and Solution crystallization, Drying - Drying equipment - Conduction dryers, Adiabatic dryers, Drying rate and Drying time, Zone refining, Lyophilization in final product formulation.

TEXT BOOKS:

1. H. Sivasankaran. Bioseparation
2. Asenjo, J.M., 1993. Separation Processes in Biotechnology. Marcel Dekker Inc.
3. Belter, P.A., Cussler, E.L. and Wei - Houhu, 1988. Bioseparations - Downstream
4. Processing for Biotechnology. Wiley Interscience Publications.

REFERENCE BOOKS:

1. Wankat, P.C., 1990. Rate Controlled Separation. Elsevier.
2. Satinder Ahuja., 2000 Volume 2 Handbook of Bioseparations, Academic Press.
3. Janson, J.C. and Ryden, L., 1989. Protein Purification - Principles, High Resolution Methods and Applications. VCH Publication.
4. Scopes, R.K., 1994.Protein Purification - Principles and Practice. Narosa Publication.
5. Jenkins, R.O., 1992. Product Recovery in Bioprocess Technology - Biotechnology by Open Learning Series. Butterworth -Heinemann.

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17BTCC18	MASS TRANSFER OPERATIONS	Category	L	T	P	Credit
		CC	4	0	0	4

PREAMBLE

Mass transfer is the net movement of mass from one location, usually meaning stream, phase, fraction or component, to another. Mass transfer occurs in many processes, such as absorption, evaporation, drying, precipitation, membrane filtration, and distillation. Mass transfer is used by different scientific disciplines for different processes and mechanisms. The phrase is commonly used in engineering for physical processes that involve diffusive and convective transport of chemical species within physical systems. Mass transfer operations include separation of chemical components in distillation columns, absorbers such as scrubbers or stripping, absorbers such as activated carbon beds, and liquid-liquid extraction.

PRERQUISITE

17BTCC13-THERMODYNAMICS FOR BIOTECHNOLOGY.

COURSE OBJECTIVES

1	To Explain the Mass transfer principles
2	To Demonstrate the principles of adsorption, absorption, leaching and drying extraction
3	To Perform the distillation, crystallization operations
4	To Express the concept of Liquid – Liquid Extraction
5	To Study the concept of Solid – Fluid operation

COURSE OUTCOMES

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

CO1. Describe the principles of diffusion and apply the concepts of inter phase mass transfer	Understand
CO2. Operate the concept of absorption in bioprocess industries and multi component system	Apply
CO3.Describe the concept of distillation and multi stage tray tower application	Understand & Apply
CO4.Explain liquid-liquid equilibrium and Differential extractor	Understand
CO5.Explain the extraction and its application in bioprocess industries	Understand & Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	-	-	-	-	-	-	-	-	-	-	-	-	S	-
CO2	S	S	S	-	-	-	-	-	M	-	-	M	-	W	-
CO3	S	M	S	-	-	-	-	-	M	-	-	M	-	-	-
CO4	-	M	-	-	-	-	-	-	M	-	-	-	-	M	-
CO5	-	-	-	-	M	-	W	-	-	-	-	-	-	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

DIFFUSION

Molecular diffusion in fluids, Mass transfer coefficients, Diffusion in solids, Inter phase mass transfer.

GAS – LIQUID OPERATION

Equipment for gas liquid operation, Principles of gas absorption, Equilibrium solubility of gases in liquid, One component transfer material balance, Counter current multistage operation, Continuous contact equipment, Multi component system, Absorption with chemical reaction.

DISTILLATION

Vapour – Liquid Equilibria, Single stage- Flash vaporization, Differential or simple distillation, Continuous rectification – Binary system, Multistage tray towers – Mc Cabe- Thiele and Ponchon Savarit principles.

LIQUID – LIQUID EXTRACTION

Liquid – Liquid Equilibria, Stage wise contact, Stage type extractor, Differential extractor

SOLID – FLUID OPERATION

Adsorption equilibria – Liquids, Single gases and vapours, Leaching – Unsteady state operation, Steady state continuous operation.

TEXT BOOKS

1. Treybal, R.E., 1981. Mass Transfer Operations. 3rd Edn., *Mc Graw Hill*.
2. Geankoplis, C.J., 2002. Transport Processes and Unit Operations. 3rd Edn., *Prentice Hall of India*.

REFERENCES:

1. Coulson and Richardson's, 1998. Chemical Engineering. Vol. I & II, *Asian Books Pvt. Ltd*.
2. Badger and Banchero. Introduction to Chemical Engineering. *Tata Mc Graw Hill*, New Delhi.
3. Mc Cabe, W.L., Smith, J.C., Harriot, P., 1993. Unit Operations in Chemical Engineering. 5th Edn., *McGraw Hill Book Co.*, New York.
4. Pauline M. Doran, 2002. Bioprocess Engineering Principles. *Academic Press*.
5. Butterworth - Heinemann, 1992. Bioprocess Technology: Modelling and Transport Phenomena.

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17BTCC81	BIOCHEMISTRY LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

The course is a laboratory course that focuses on developing the skills of the students by providing hands on training in various techniques in Biochemistry

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To Understand laboratory safety and standard operating procedures of common laboratory equipment's.
2	To impart skills in preparation of solutions and biological buffers.
3	To extend knowledge in analysis & estimation of biomolecules

COURSE OUTCOMES

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

CO1. Demonstrate safe laboratory practices and handle the equipment safely	Apply
CO2. Prepare solutions and biological buffers	Apply
CO3. Isolate biomolecules from various source	Analyze
CO4. Determine the quality and quantity of biomolecules	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	-	-	M	S	M	-	-	-	-	-	-	M	-
CO2	S	S	M	-	-	-	-	-	-	-	-	-	-	S	-
CO3	S	S	S	M	S	-	-	-	-	-	-	-	M	S	-
CO4	S	S	S	-	S	-	-	-	-	-	-	-	-	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. pH measurements and Buffer preparations.

TITRIMETRIC EXPERIMENTS

2. Estimation of Ascorbic acid by Titrimetric method using 2, 6 Dichloro phenol indophenols.
3. Determination of Saponification value of Edible oil
4. Determination of Acid number of Edible oils.
5. Determination of Iodine value of Oil.

BIOCHEMICAL PREPARATIONS

6. Isolation of Chloroplast from Spinach leaves.
7. Cheese Production from Milk.
8. Casein from Milk.
9. Starch from Potato.

REFERENCES:

1. Laboratory Manual.

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17BTCC82	CELL BIOLOGY LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

To offer hands on training in the areas of cell culture, cell identification and to demonstrate various techniques to learn the morphology, identification and propagation of cells.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	Demonstrate working principles of microscopy
2	Perform the basic techniques to work with cells.
3	Differentiate the cells by staining techniques.
4	Categorize the various stages of mitosis.
5	Differentiate the types of blood cells.

COURSE OUTCOMES

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

CO1. Demonstrate the basic concepts of sterilization techniques	Understand
CO2. Interpret the behaviour of cells in their microenvironment	Understand
CO3. Analyze scientific work and experimental results in of cell biology	Analyse
CO4. Categorize the cell organelles	Analyse
CO5. Examine physiological processes of cell e.g. cell divisions	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	-	-	-	-	-	-	-	-	-	-		-	-
CO2	S	M	-	-	-	-	-	-	-	-	-	-	-	M	-
CO3	M	S	-	L	-	-	-	-	-	-	-	-	L	L	-
CO4	S	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO5	M	L	-	-	-	-	-	-	-	-	-	-	-		-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Introduction to principles of sterilization techniques and cell propagation.
2. Principles of Microscopy.
3. Isolation of Cell organelle – Mitochondria, Microtubules, Actin and Myosin filaments.
4. Cell Fractionation – Separation of peripheral blood mononuclear cells from blood.
5. Cell staining - Gram’s staining, Leishman staining
6. Cell counting - Tryphan blue assay, Alamar blue assay.
7. Osmosis and Tonicity.
8. Staining for different stages of mitosis in *Allium cepa* (Onion).

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

COURSE DESIGNERS

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1	Mrs.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in
2	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@vmkvec.edu.in

17BTCC83	MICROBIOLOGY LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

This course includes preparing stained smears, culturing microorganisms, conducting immunology experiments, performing tests to identify bacteria and fungi, and studying microbial growth control.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	Describe the safe practices in a microbiology laboratory.
2	Perform various cells staining techniques.
3	Demonstrate proper usage, identify the parts/functions of the following microscopes
4	Perform transfer of living microbes using aseptic technique.
5	Differentiate the microbes enumerated from various environments.

COURSE OUTCOMES

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

CO1. Discuss how microscopy has revealed the structure and function of microorganisms	Understand
CO2. Demonstrate the methods for isolation, subculture, and maintenance of bacterial and fungal specimens	Understand
CO3 Employ the uses of various media and testing protocols with focus on clinical applications.	Apply
CO4. Examine the causes and consequences of microbial evolution and the generation of diversity as well as human impacts on adaptation.	Analyze
CO5.Inspect the evidence of bacterial and fungal metabolism as it relates to identification and control of pathogenic organisms	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	-	-	-	-	-	S	-	-	-	-	M	-
CO2	S	L	-	-	-	-	-	-	-	-	-	-	S	-	-
CO3	M	L	-	-	-	-	-	-	-	-	-	-	-	S	-
CO4	S	L	-	-	-	-	-	-	-	-	-	-	L	-	-
CO5	M	L	-	-	-	-	-	-	M	-	-	M	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Sterilization Techniques.
2. Culture Media Preparations
    a. Broth media

b. Agar

3. Culturing of Micro organisms

a. Pure Culture techniques -Streak plate

-Pour plate

4. Isolation, Enumeration and Purification of Microbes from a given sample.

5. Preservation of Bacterial Culture.

6. Identification of Microorganisms

a. Staining techniques-Simple-Gram-Spore-Hanging drop

b. Biochemical identification

7. Quantification of Microorganisms

Microscopy

a. Serial dilution and plating

8. Environmental Sample Analysis-. MPN Test

9. Food Microbiology

-Milk

-Fermented food

10. Clinical Microbiology

- Blood and Urine Culture
- Antibiotic Disc test Assay.

REFERENCES:

1. Cappuccino, J. G. and Sherman, N., 1999. Microbiology: A laboratory Manual. 4th Edn, Addison -Wesley.

2.Collee, J. G., et al., 1996. Mackie and McCartney Practical Medical Microbiology. 4th Edn, Churchill Livingstone.

3. Sundararaj, T., 2007. Microbiology laboratory manual. Aswathy Sunndararaj.

4.Laboratory Manual

COURSE DESIGNERS

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2	Dr.M.Sridevi	Professor & Head	Biotechnology	sridevi@ vmkvec.edu.in

17BTCC84	ADVANCED BIOCHEMISTRY LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

The course focuses on the general biochemical reactions for the identification of biomolecules. The students also learn about qualitative and quantitative analysis of macromolecules.

PREREQUISITE- NIL

COURSE OBJECTIVES

1	Discuss about basic reactions of Biomolecules
2	Calculate the different concentration of macro-molecules
3	To distinguish the importance of blood sampling site and estimation of hemoglobin
4	To perform various techniques for separation of pigments

COURSE OUTCOMES

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

CO1. Examine the reactions of proteins, carbohydrates and amino acids	Analyze
CO2. Estimate Hemoglobin concentration in the blood	Analyze
CO3. Separate plant pigments using chromatography	Apply
CO4. Estimate the various biomolecules	Analyze
CO5. Differentiate the Normal and abnormal constituents of Urine	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	-	-	M	-	-	-	-	-	-	-	S	-
CO2	S	S	L	L	-	-	-	-	-	-	-	-	-	-	-
CO3	S	S	M	S	S	-	-	-	-	-	-	-	L	M	-
CO4	S	S	M	-	-	M	M	-	-	-	-	-	-	M	-
CO5	S	S	M	S	-	S	-	-	-	-	-	-	-	S	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Qualitative Analysis of Carbohydrates.
2. Qualitative Analysis of Amino acids.
3. Qualitative Analysis of Lipids.
4. Qualitatively analysis of Normal and abnormal constituents of Urine
5. Estimation of Glucose by O-toludine method.
6. Protein estimation by Biuret,
7. Estimation of Cholesterol by Zak's method.
8. Estimation of urea DAM method.
9. Estimation of Hemoglobin.
10. Separation of plant pigments by column chromatography (Demo).

REFERENCES: 1. Laboratory Manual.				
COURSE DESIGNERS				
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17BTCC85	MOLECULAR BIOLOGY LAB	Category	L	T	P	C
		CC	0	0	4	2

PREAMBLE

The Molecular Biology laboratory has become a prominent and essential fixture in the training of undergraduate students for careers related to the molecular techniques.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To discuss about sample preparation
2	To perform the principle of isolation of DNA from bacterial, plant, human and mitochondria.
3	Estimate the nucleic acids- RNA / DNA.
4	Acquire laboratory skills in techniques such as micro pipetting, spectrophotometry and electrophoresis.

COURSE OUTCOMES

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

CO1. Explain the concepts and principles of sample preparation	Understand
CO2. Practice laboratory techniques used for the isolation of nucleic acids from bacterial, plant, human & mitochondria.	Apply
CO3. Illustrate the enzymatic action on nucleic acids & proteins	Apply
CO4. Quantify the nucleic acids	Analyze
CO5. Examine the Purification of biomolecules by electrophoresis	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	-	-	-	-	-	-	-	-	-	-	L	-	-
CO2	S	-	-	-	L	-	-	-	L	-	-	-	-	L	-
CO3	M	-	-	-	-	-	-	-		-	-	-	-	-U	-
CO4	S	L	-	-	-	-	-	-		-	-	-	L	-	-
CO5	M	M	-	-	S	-	-	-	M	-	-	M	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Isolation of Bacterial Genomic DNA
2. Isolation of DNA – Isolation of plant Genomic DNA
3. Isolation of Human genomic DNA
4. Isolation of Mitochondrial DNA.
5. Quantification of RNA / DNA.
6. Agarose gel electrophoresis
7. Extraction of DNA from agarose gel.

REFERENCES:

1. Sambrook, Joseph and David W. Russell "The Condensed Protocols: From Molecular Cloning: A Laboratory Manual", Cold spring harbor Laboratory Press, New York, USA.
2. Ausubel, F.M. "Short Protocols in Molecular Biology", 4th Edition, John Wiley, 1999.

COURSE DESIGNERS

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17BTCC86	CHEMICAL ENGINEERING LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

Chemical engineering laboratory includes pilot and lab scale experimental set-up on Fluid mechanics, Unit Operations, Mass Transfer and Heat Transfer. It helps students for the development of their skills in understanding and operating basic and more complex industrial systems.

PRERQUISITE- NIL

COURSE OBJECTIVES

1	To interpret chemical engineering principles and their practical applications in the areas of mass transfer, reaction engineering and particle mechanics.
2	To differentiate and categorize chemical processes that span molecular to macroscopic scales.
3	To assess different coefficients and factors involved in fluid flow
4	To construct the governing equations for designing and analyzing heat transfer equipment

COURSE OUTCOMES

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

CO1. Exemplify the terminology and knowledge of contemporary issues associated with chemical engineering.	Understand
CO2. Perform, co-ordinate, implement and validate laboratory procedures to conduct quantitative and qualitative analyses.	Apply
CO3. Apply process principles learnt in chemical engineering courses to practical situations.	Apply
CO4. Identify and analyse the fundamental theoretical concepts of an experimental system	Analyze
CO5. Ability to analyze industrial problems along with appropriate approximations and boundary condition.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	-	M	S	-	-	-	-	-	-	-	S	L	L
CO2	-	M	-	L	S	-	-	-	-	-	-	-	M	L	L
CO3	M	-	L	M	S	-	-	-	-	-	-	-	M	L	L
CO4	M	M	S	S	S	-	-	-	-	-	-	-	S	L	L
CO5	M	M	S	S	M	-	-	-	-	-	-	-	S	L	L

S- Strong; M-Medium; L-Low

SYLLABUS

1. Flow measurement a) Orifice meter b) Venturimeter, c) Rotameter
2. Filtration.
3. Heat exchangers.
4. Simple and Steam distillation.

5. Fluidization.
6. Pressure drop in pipes and packed columns.
7. Distillation in packed column.
8. Liquid – liquid equilibria in extraction.
9. Solid liquid extraction
10. Adsorption equilibrium.
11. Jaw crusher.
12. Determination of Screen effectiveness.
13. Sedimentation.

REFERENCE BOOKS:

1. Laboratory Manual

COURSE DESIGNERS

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17BTCC87	BIOINSTRUMENTATION LAB	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

Bioinstrumentation is used to provide the understanding and knowledge of various instrumentation through handling and working. This course also highlights thevarious instrumentation used in the biotechnology industries for various analytical purpose.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To understand the concepts of instrumentation used to measure factors that characterize biological systems and physical or chemical factors that have a profound effect on biological entities.
2	To demonstrate the proper operation, maintenance and applications of common analytical laboratory instruments, including equipment for electrophoresis, spectrophotometry, and chromatography.
3	To properly apply scientific mathematical skills to calculations relevant to the laboratory.
4	To demonstrate qualitative and quantitative analytical skills with various common instruments using common biotechnology laboratory protocols.
5	To develop critical thinking skills relevant to biotechnology rough data analysis, troubleshooting experiments and equipment, suggesting continuous improvements.

COURSE OUTCOMES

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

CO1. Understand the purpose of measurement, the methods of measurements, errors associated with measurements.	Understand
CO2. Employ the principle of various instrumentation	Apply
CO3. Compare the various spectrometers for analysis purpose	Analyse
CO4. Estimate the various parameters by using the like Conductivity meter and Potentiometer.	Analyse
CO5. Measure the dissolved oxygen in the given solution	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	-	-	-	-	-	M	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	M	-	-	-	-	-	-	-
CO3	-	S	-	-	-	-	-	-	-	-	-	-	-	-	-
CO4	M	S	-	S	-	-	-	-	-	-	-	-	-	-	-
CO5	M	-	-	-	-	-	S	-	-	-	-	-	-	-	S

S- Strong; M-Medium; L-Low

SYLLABUS

1. Validating Lambert – Beer’s law using $KMnO_4$.
2. Determination of complementary color and complementary wavelength
3. Precision and Validity in an experiment using Absorption spectroscopy.

4. Finding the Stoichiometry of the Fe (1,10 Phenanthroline Complex) using Absorption spectroscopy.
5. UV spectra of Nucleic Acid.
6. Estimation of Alizarin Aluminium complex
7. Estimation of Al^{3+} concentration using Alizarin in the spectrometer.
8. Estimation of Sulphate by Nephelometry.
9. Experiments on
    a. Conductivity meter
    b. Turbidity meter.
10. Estimation of Dissolved oxygen.
11. Determination of Fe^{2+} content in fruit juices

TEXT BOOKS:

1. Laboratory Manual.

COURSE DESIGNERS

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3	AVIT staff			

17BTCC88	GENETIC ENGINEERING LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

To understand and develop the skills involved in rDNA Technology.

PRERQUISITE - NIL

COURSE OBJECTIVES

1	To explain the preparation of recombinant DNA molecule
2	To construct a method for amplifying a gene
3	To perform DNA fingerprinting using RAPD
4	To demonstrate gene cloning and screening of recombinants
5	To differentiate proteins through SDS-PAGE

COURSE OUTCOMES

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

CO1. Describe core Nucleic acid techniques such as extraction, nucleic acid separations and elution.	Understand
CO2. Illustrate DNA amplification using Polymerase Chain Reaction	Apply
CO3. Classify the methods of Nucleic acids characterization, through the application of gene probes	Apply
CO4. Employ Gene cloning and screening of recombinants.	Apply
CO5. Compare the proteins through SDS-PAGE.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	S	M	-	-	-	-	-	-	-	-	S	-	-
CO2	S	M	L	L	-	-	-	-	S	-	-	-	-	M	-
CO3	M	L	M	M	-	-	-	-	-	-	-	-	-	S	-
CO4	S	L	M	S	-	-	-	-	-	-	-	-	L	-	-
CO5	M	L	S	M	-	-	-	-	M	-	-	M	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Isolation of Plasmid DNA.
2. Isolation of Bacteriophage Genomic DNA
3. Polymerase Chain Reaction.
4. Electroelution of DNA from Agarose gel.
5. Restriction digestion of λ DNA.
6. Restriction Digestion of Plasmid DNA.
7. Ligation of DNA.
8. Preparation of Competent Cells – Calcium chloride Method.
9. Transformation in *E. coli* by Heat Shock Induction Method.
10. DNA Fingerprinting using Restriction fragment length polymorphism (RFLP)

11. DNA Fingerprinting using Random Amplified Polymorphic DNA(RAPD)
12. Blue White Screening of Recombinants.
13. SDS Poly Acrylamide Gel Electrophoresis.
14. Blotting techniques – Southern, Western.

REFERENCES:

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

COURSE DESIGNERS

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3	AVIT staff			

17BTCC89	**IMMUNOLOGY LAB**	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

The Immunology Laboratory provides hands on training on laboratory testing and simple experiments in evaluation of autoimmune disease, immune deficiencies etc., as well as having responsibility for some aspects of infectious disease serology. To develop skills of students in Immunological techniques by performing simple experiments in the laboratory.

PRERQUISITE – NIL

COURSE OBJECTIVES

1	To define about immune system, their structure, classification and genetic control of antibody production
2	To summarize the techniques like blood grouping, ELISA and identification of T-cell, Immunofluorescence etc.
3	to execute skills in Isolation and purification of antibodies
4	To compare the various Immunological techniques and its applications
5	To evaluate and correlate test results with associated diseases or conditions.

COURSE OUTCOMES

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

CO1. Underline a comprehensive and practical understanding of basic immunological principles involved in research and clinical science	Remember
CO2. Interpret the knowledge for identification of immunological cells, their structure, function and Characteristics.	Understand
CO3. Apply principles of safety, quality assurance and quality control in Immunology.	Apply
CO4. Correlate the immunological disorders and the factors involved in it by various immunological assays.	Analyze
CO5. Assess the Immuno assay to understand complement fixation system and other diseased conditions.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	L		-	-	-	-	-	-	-	-	-	L	-	-
CO2	-	M		-	-	-	-	-	-	-	-	-		M	-
CO3	-		M	-	-	-	-	-	-	-	-	-	-	L	-
CO4	-	S		S	-	-	-	-	-	-	-	-	L	-	-
CO5	-	-	-	S	-	-	-	-	-	-	-	-	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Handling of animals, immunization and raising antisera.
2. Identification of cells in a blood smear.
3. Identification of blood groups.
4. Immunodiffusion
5. Immunoelectrophoresis.
6. Testing for Typhoid antigens by Widal test.
7. Enzyme Linked Immuno Sorbent Assay (ELISA).
8. Isolation of pheripheral blood mononuclear cells.
9. Isolation of monocytes from blood.
10. Immunofluorescence

REFERENCE BOOKS:

1. Laboratory Manual

COURSE DESIGNERS

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17BTCC90	FOOD PROCESSING TECHNOLOGY LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

The Course aims to promote the chances of entrepreneurial success and to create trained and skilled human resources well versed in engineering aspects of food processing to cater the needs of the rapidly growing food processing sector.

PRERQUISITE - NIL

COURSE OBJECTIVES

1	Recognise the basic knowledge about the preparation of instant and Convenience food.
2	Students can interpret the techniques to improve the nutritive value and minimize loss of essential nutrients during processing and preservation.
3	Implementation of appropriate processing, preservation and packaging method.
4	To differentiate and compare methods of fruits and vegetable processing.
5	Formulate the principals involved in preparation of different Food stuffs

COURSE OUTCOMES

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

CO1. Define the properties of food materials and their processing methods	Remember
CO2. Interpret the ability to process the different categories of food and mechanisms of preservation.	Understand
CO3. Schedule the process flow diagrams, combination and sequence within a process of food materials	Apply
CO4. Develop and analyze the processes, various unit operations and the scientific principles behind processing the food materials.	Analyze
CO5. Validate the changes occurring during various food processing techniques and during storage and preservation.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO	PSO3
CO1	-	L	-	-	-	-	-	-	-	-	-	-	M	-	-
CO2	-	L	-	-	-	-	-	-	-	-	-	-	L	-	-
CO3	-	M	-	S	-	-	-	-	-	-	-	-	M	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	M	-	-
CO5	-	M	-	S	-	-	-	-	-	-	-	-	S	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Preparation of orange squash.
2. Preparation of mango jam and guava jelly.
3. Preparation of tomato ketchup
4. Preparation of canned peas/ pine apple.

5. Preparation of mango pickle /garlic pickle
6. Experiment on preparation of fruit bar.
7. Preparation of frozen prawn.
8. Experiment on preparation of sauce
9. Preparation of bread
10. Identification of Adulterants

REFERENCE BOOKS:

1. Ramaswamy H and Marcott M, Food Processing Principles and Applications CRC Press, 2006.
2. Laboratory Manual

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3	AVIT Staff			

17BTCC91	BIOPROCESS ENGINEERING LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

This bioprocess engineering lab course will provide practical training on upstream and downstream process operations, designing of fermentation medium, effect of varies parameters on fermentation and bioproduct production including recombinant protein synthesis.

PRERQUISITE - Nil

COURSE OBJECTIVES

1	To Interpret the Growth factors.
2	To Summarize the medium optimization.
3	To Describe Enzyme activity.
4	To Execute Enzyme Immobilized Reaction.
5	To Perform large scale production of bioproducts.

COURSE OUTCOMES

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

CO1. Discuss information on behavior and growth of microorganisms in growth medium.	Understand
CO2. Summarize knowledge about optimization on growth medium.	Understand
CO3. Review information on activity of enzyme and parameters affects enzyme activity.	Understand
CO4. Utilize the knowledge of Enzyme Immobilized to use in bioreactors.	Apply
CO5. Employ the know-how to produce bioproducts in reactors.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	S	-	-	-	-	-	-	-	L	-	L
CO2	-	-	-	-	S	-	-	-	-	-	-	-	M	-	L
CO3	-	-	-	-	S	-	-	-	-	-	-	-	M	-	L
CO4	-	-	-	-	S	-	-	-	-	-	-	-	L	-	M
CO5	-	-	-	-	S	-	-	-	-	-	-	-	M	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

1. Growth of microorganism – Estimation of Monod parameters.
2. Medium optimization – PlackettBurman design.
3. Enzyme activity – Effect of pH.
4. Enzyme activity – Effect of temperature.
5. Enzyme Immobilization – Gel Entrapment.
6. Enzyme Immobilisation – Cross linking.
7. Production of Wine by Yeast.
8. Production of Amino acid.
9. Production of Yogurt.

TEXT BOOKS:

1. Pauline M. Doran, 2002. Bioprocess Engineering Principles. Academic Press.
2. James E. Bailey and David F. Ollis, 1986. Biochemical Engineering Fundamental. 2nd Edn. McGraw Hill.
3. Shuler, M.L. and Kargi, F. Bioprocess Engineering : Basic concepts, 2nd ed., Prentice-Hall, 2002.
4. Doran Pauline M, Bioprocess Engineering Principles, Academic Press, 1995.

REFERENCE BOOKS:

1. Jenkins, R.O., 1992. Product Recovery in Bioprocess Technology - Biotechnology by Open Learning Series. Butterworth -Heinemann.
2. Harvey W. Blanch, Douglas S. Clark. Biochemical Engineering. Marcel Decker Inc.

COURSE DESIGNERS

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17BTCC92	DOWNSTREAM PROCESSING ENGINEERING LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

Downstream processing laboratory is used to provide the understanding and knowledgetechniques like Solid-liquid separation, Cell disruption, High resolution purification, Product polishing of bio-products from fermenter. This courseprovides deeper understanding about the techniques in downstream processing.

PRERQUISITE -Nil

COURSE OBJECTIVES

1	To explain the importance of downstream processing in biotechnology.
2	To describe in detail about the Solid-Liquid Separation methods such as Centrifugation, Microfiltration.
3	To describe the knowledge on cell disruption techniques to extract valuable biomolecules.
4	To demonstrate in detail aboutChromatography techniques for product purification.
5	To demonstrate the knowledge of extraction techniques to separate biomolecules.

COURSE OUTCOMES

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

CO1. Describe the role and importance of downstream processing in biotechnology.	Understand
CO2. Identify the fundamental knowledge about the solid-liquid separation.	Understand
CO3. Demonstrate the information on cell disruption techniques for separation of biomolecules.	Understand
CO4. Employ the knowledge about product fractionation and purification by chromatography Technique.	Apply
CO5. Employ the knowledge of flocculation and aqueous two phase extraction to extract living or non-living cells / intracellular materials such as enzymes, proteins, etc.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	M	-	-	-	-	-	-	-	-	L	L	-	L
CO2	S	L	M	-	-	-	-	-	-	-	-	L	M	-	L
CO3	S	L	M	-	-	-	-	-	-	-	-	L	M	-	L
CO4	S	L	S	-	-	-	-	-	-	-	-	-	S	-	M
CO5	S	L	S	-	-	-	-	-	-	-	-	-	M	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

1. Solid-Liquid Separation – Centrifugation, Microfiltration.

2. Mechanical cell disruption – homogeneizer
3. Cell Disruption Techniques – Ultra sonication.
4. Separation of Pigments by Thin Layer Chromatography.
5. Precipitation – Ammonium Sulphite Precipitation.
6. Ultra Filtration Separation.
7. Aqueous Two Phase Extraction of Biologicals.
8. Flocculation

TEXT BOOKS

1. Wankat, P.C., 1990. Rate Controlled Separation. Elsevier.
2. Satinder Ahuja., 2000 Volume 2 Handbook of Bioseparations, Academic Press.
3. Asenjo, J.M., 1993. Separation Processes in Biotechnology. Marcel Dekker Inc.
4. Belter, P.A., Cussler, E.L. and Wei - Houhu, 1988. Bioseparations - Downstream
5. Processing for Biotechnology. Wiley Interscience Publications.

REFERENCE BOOKS

1. Janson, J.C. and Ryden, L., 1989. Protein Purification - Principles, High Resolution Methods and Applications. VCH Publication.
2. Scopes, R.K., 1994.Protein Purification - Principles and Practice. Narosa Publication.
3. Jenkins, R.O., 1992. Product Recovery in Bioprocess Technology - Biotechnology by Open Learning Series. Butterworth -Heinemann.

COURSE DESIGNERS

S.No	Name of the Faculty	Designation	Department	Mail ID
1	Mr.N.Jawahar	Assistant Professor	Biotechnology	jawahar@vmkvec.edu.in
2	Mrs.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in

17BTCC93	BIOINFORMATICS LAB	Category	L	T	P	Credit
		CC	0	0	4	2

PREAMBLE

Bioinformatics is the field emerging from biology which is the combination of biology and computer science. There are number of computer programs developed to maintain, analyse biological data to support research and development. This field of science is used to simulate various biological process in virtual environment to investigate the already available along with newly produced data to predict new structures and functions of biomolecules.

PRERQUISITE- NIL

COURSE OBJECTIVES

1	To Summarize the significance of biological databases.
2	To Perform sequence alignment using various sequence alignment tools.
3	To Distinguish the structure and functions of protein molecule using 3D structure of the protein.
4	To Construct phylogenetic tree to analysis the evolution.
5	To Generate, compare and analyse 3D structure of ligand and receptor complex.

COURSE OUTCOMES

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

CO1. Discuss in detail about impotence of biological databases.	Understand
CO2. Demonstrate sequence alignment by different opensource software programs	Apply
CO3. Compare the structure of protein molecule to predict its functions.	Analyse
CO4. Evaluate the phylogenetic tree Construction.	Evaluate
CO5. Assemble ligand and receptor complex using Docking programs.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	S	L	-	-	-	-	-	-	L	L	-	-
CO2	M	L	M	M	L	-	-	-	-	-	-	L	M	-	-
CO3	L	L	L	L	S	-	-	-	-	-	-	M	L	-	-
CO4	S	M	L	L	M	-	-	-	-	-	-	S	S	-	-
CO5	S	S	L	M	L	-	-	-	-	-	-	M	M	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Biological Database (DNA) - NCBI-Genbank, EMBL
2. Biological Database (Protein) – Uniprot, Protein Data Bank
3. Sequence Alignment Programs – BLAST, FASTA, Clustal W
4. Protein 3D Structure Prediction Programs – Swissmodel, Rasmol
5. Phylogenetic Analysis Program – Phylip

6. Docking Studies – PatchDock

TEXT BOOKS

1. Algorithms on Strings, Trees and Sequences by Dan Gusfield, Cambridge University Press.
2. Biological Sequence Analysis Probabilistic Models of proteins and nucleic acids by R.Durbin, S.Eddy, A.Krogh, G.Mitchison.
3. Bioinformatics Sequence and Genome Analysis by David W. Mount, Cold Spring Harbor Laboratory Press.

REFERENCES

1. Introduction to Bioinformatics by Arthur K. Lesk , Oxford University Press.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Mr.N.Jawahar	Assistant Professor	Biotechnology	jawahar@vmkvec.edu.in
2.	Dr. R. Deepapriya	Assistant professor	Biotechnology	deepapriya.biotech@avit.ac.in

CATEGORY ‘C’ – ELECTIVE COURSES - PROGRAMME SPECIFIC – 12-15 CREDITS GENERAL

17BTEC01	PLANT AND ANIMAL DISEASES AND THEIR CONTROL	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Plant and animal diseases and their control deals with the study of different types of pests and their impact on agriculture and live stocks. Students will learn about the fungus, bacteria, virus or nematodes that can cause damages to the plant parts above or below the ground. The farmers challenges will be solved by identifying the proper ecofriendly control measures will pave the new path in the area of plant breeding. To familiarize the students with principles of insect pest management, including concept and philosophy of Integrated Pest Management. Knowledge of these principles will enable students to understand the different factor that threatens the agricultural productivity and humans.

PREREQUISITE

17BTCC03 - MICROBIOLOGY

COURSE OBJECTIVES

1	To recognize the pest morphology and its corresponding pesticides
2	To describe the pest in agriculture and their control measures.
3	To choose the appropriate pest control method
4	To outline the vector plant pathogen interaction and management of vectors for controlling diseases.
5	To formulate the different sampling methods and monitoring protocol

COURSE OUTCOMES

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

CO1. To recall the epidemiology of diseases caused by pests in plant and	Remember
CO2. Discuss about the common plant pathogens in agriculture.	Understand
CO3. Classify about the plant and animal disease & integrated control	Apply
CO4. Examine the diseases in plants and animal & its control	Analyze
CO5. Validate the different samplings methods	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	-	L	-	-	L	L	-	-	L	L	L	-	-	-
CO2	M	M	M	M	L	M	L	-	-	-	L	L	-	-	-
CO3	S	S	S		-	-	S	-	M	-	-	L	-	L	-
CO4	M	-	M	-	M	M	S	-	-	-	-	L	-	L	-
CO5	L	L	-		S	-	-	-	L	-	M	M	-	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

CLASSIFICATION OF PESTS AND PESTICIDES

Pests – Definition, Morphology and Life cycle, classification of pests – Vertebrate pests, Invertebrate pests and plant pests, Classification of pesticides on chemical nature and according to target species, mode of action.

AGRICULTURAL PESTS AND THEIR CONTROL

Concept of Pest and Types of pests in agricultural products - stored grains- veterinary- forestry and nursery. Major insect pests of agricultural- importance -Marks of identification- life cycle- nature of damage, chestnut blight, potato late blight, downy mildew, Damage economic threshold level and control measures.

PEST CONTROL PRACTICES

Issues, Challenges and Opportunities in the Control of Insects in Vegetable Crops, Control measures-Cultural, Physical, Mechanical, Chemical, Herbal and Biological control. Pheromonal and autocidal control.

EMERGING CONCEPTS AND PRACTICES IN INTEGRATED CONTROL MEASURES

The integrated control/IPM concept, Damage thresholds, Forecasting, Increasing agro-ecosystem resistance, Pesticide selectivity, Eradication versus control, Pests and humans – direct pests and vectors of plant and animal diseases, potential human practices and the occurrence of pests, Prevention of communicable diseases after the disaster.

SAMPLING AND MONITORING ARTHROPODS

Methods of sampling and monitoring, Components of a sampling plan, Types of sampling plans, Allocation of Sampling units.

TEXT BOOKS:

1. Principles and procedures of plant protection, 1993. S.B.Chattopadhyay, Oxford-IBH.
2. Agricultural pests of India and south East Asia - A. S. Atwal, 1986. Kalyani Publishers.
3. Francisco Prieto Garcia, Sandra Y. Cortés Ascencio, John C. Gaytan Oyarzun, Alejandra Ceruelo Hernandez and 3Patricia Vazquez Alavarado (2012) Pesticides: classification, uses and toxicity. Measures of exposure and genotoxic risks. Journal of Research in Environmental Science and Toxicology (Vol. 1(11) pp. 279-293.

REFERENCES:

1. Agricultural insect pests of the crops and their control-D.S.Hill, Cambridge Univ. Press Insect pest of crops - S.Pradhan, National Book trust.
2. Healthy Roses: Environmentally friendly ways to manage pests and disorders in your garden and landscape, 2nd Edition , John Karlik, Mary Louise Flint, and Deborah Golino.
3. Hayes' Handbook of Pesticide Toxicology, Editor-in-Chief: Robert Krieger, University of California, Riverside, U.S.A. Published by January 2010, imprint: Academic Press, ISBN: 978-0-12-374367-1.

COURSE DESIGNERS				
S.No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Dr.S.Vinoth	Assistant Professor	Biotechnology	vinoth@avit.ac.in
2	Ms.G.Arthi	Assistant Professor	Biotehnology	arthi@vmkvec.edu.in

17BTEC02	OCEAN SCIENCE	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Ocean science deals with the various aspects of marine ecosystem. It gives the basic knowledge about availability of the bio resources and its applications. It also deals with exploration of various culturing techniques of few marine organisms in the laboratory conditions. This study further facilitates the student to understand the economic importance of marine derived products.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To sate the art of marine ecosystem and their properties
2	To describe the about biodiversity in marine environment and their resources
3	To perform various culture techniques of marine organisms
4	To develop drug from marine compounds and their economic Values
5	To assess the human impact on marine environment

COURSE OUTCOMES

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

CO1. Recall the Marine ecosystem sources and their properties	Remember
CO2. Describe the biodiversity in marine environment	Understand
CO3. Demonstrate the different culture techniques of marine organisms	Apply
CO4 Assess the developed drug	Analyse
CO5. Criticize the human impact on marine environment	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	-	-	-	-	L	L	-	-	-	-	L	-	-	-
CO2	S	M	-	S	L	M	-	-	L	-	-	L	-	-	-
CO3	M	-	M	M	L	-	M	-	M	-	-	L	-	-	-
CO4	L	L	L	L	S	-	S	-	S	-	M	M	-	-	-
CO5	S	M	L	L	M	M	M	-	M	-	-	S	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO MARINE ENVIRONMENT

Stratification of coastal environment- Bathymetric map, Thermo cline; components of marine ecosystem; Biotic and Abiotic and their interrelationships-Role in food chain, food web ;Tropic systems; Taxonomy of marine flora and fauna; Physico chemical properties of marine water.

BIODIVERSITY AND BIORESOURCES

Biodiversity of marine ecosystem – Phytoplankton; Algal bloom; Indicator organisms. Biogeocycles; Bioresources and their economic importance; Adaptations of flora and fauna in marine & estuarine environment.

CULTURE TECHNIQUES

Culture Techniques of microalgae; seaweeds; tiger shrimp; lobsters; Common marine pathogens and symptoms; Transgenesis and cryopreservation.

ECONOMIC VALUE

Economic importance of marine products; Economic value - corals, sponges, pearls, oysters, molluscs; Drug development from natural marine derived compounds.

IMPACTS ON MARINE ENVIRONMENT

Human Impact on Marine Environment – Oil spill, Nuclear reactors, Thermal impact, Bio fouling; Heavy metal pollution.

TEXT BOOKS:

1. Milton Fingerman and Rachakonda Nagabhushanam, Recent Advances in Marine Biotechnology (Series) Biomaterials and Bioprocessing, Science Publishers 2009.
2. Proksch and Werner E.G.Muller, Frontiers in Marine Biotechnology. Horizon Bioscience, 2006

REFERENCES:

1. Le Gal, Y.Ulber, marine Biotechnology 1: Advances in Biochemical Engineering/Biotechnology (Series editor: T. Scheper) Springer – Verlag Berlin Heideberg. Vol. 96,97, 2007
2. Mun and Munn, Marine Microbiology Ecology & Applications. BIOS, Scientific Publisher. 1996

COURSE DESIGNERS

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1	Dr. G. Karthiga Devi	Assistant Professor	Biotechnology	vinoth@avit.ac.in
2	Dr. R. Subbaiya	Associate Professor	Biotechnology	subbaiya@avit.ac.in
3	Mr.N.Jawahar	Assistant Professor	Biotechnology	jawahar@vmkvec.edu.in

17BTEC03	PRINCIPLES OF BIOINFORMATICS	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Principles of Bioinformatics is an interdisciplinary field that combines Computer Science, Molecular Biology, Genetics ,Mathematics, Statistics and Engineering etc. to analyze and interpret biological data. Bioinformatics has been used for *in silico* analyses of biological queries using mathematical and statistical techniques. This course includes the use computer programming as part of their methodology, in the field of genomics, the identification of candidate genes, genetic basis of disease etc. leading to specific drug discovery by molecular modelling.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	Define the basis of Bioinformatics in the biological field
2	Explains the *in-silico* analysis of biological queries using mathematical and statistical techniques.
3	Implement the Bioinformatics software and tools based on its applications
4	Construct the phylogenetic tree based on the biological information and queries using bioinformatics tools.
5	Develop bioinformatics tools in various field like medicine, agriculture etc.,

COURSE OUTCOMES

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

CO1. Relate the basics of computer science and interdisciplinary subjects related to Bioinformatics	Remember
CO2. Demonstrate the importance of biological databases and their significance in Biotechnology	Understand
CO3. Operate the various tools and software which can be adopted in different fields of Biotechnology	Apply
CO4. Measure the significance of evolutionary traits using Bioinformatics tools and software	Evaluate
CO5. Validate the various bioinformatics tools in different fields	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	-	L	L	-	-	-	L	-	-	L	-	-	-
CO2	S	-	-	S	L	-	-	-	-	-	-	L	L	-	-
CO3	M	L	-	M	L	S	-	-	-	-	-	L	M	-	-
CO4	S	M	L	L	M	-	-	-	-	-	-	S	-	-	-

CO5	-	L	L	L	M	-	-	-	-	-	L	S	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO BIOINFORMATICS

Introduction, Scope of bioinformatics – Introduction to UNIX- Files and processes, Basic UNIX commands for listing files and directories, Making directories, Changing to a different directory, Copying and moving files, Removing files in directories, Clear, CAT and Less commands, Word count, Help, Redirection, Access rights, Running background process and killing processes, ftp, telnet, Internet, http, Search engines.

DATABASES

Introduction to databases – Flat files, Relational databases, Object oriented databases and hypertext databases, Biological databases and their uses, Introduction to EMB net and NCBI, Classification of biological databases; Primary nucleic acid sequence databases – Gen Bank, EMBL, DDBJ; Primary protein sequence databases – PIR, SWISS-PROT; Composite databases – NRDB, OWL, SWISS-PROT+TrEMBL; Secondary databases – PROSITE, PRINTS; Structural databases – PDB, MMDB.

SEQUENCE ALIGNMENT

Introduction to sequence alignment and its significance, Types – Global, Local, Pairwise and Multiple alignment. DOT PLOTS, Scoring matrices – PAM, BLOSSUM. Dynamic programming algorithms, BLAST, FASTA. Multiple sequence alignment by PSI- BLAST.

PHYLOGENETIC ANALYSIS

Terminology and basics of Phylogenetics – Clades, Taxons, Baranches, Nodes; Orthologs and Paralogs. Steps to construct a Phylogenetic tree – Constructing a Multiple Sequence Alignment, Determining the substitution model, Tree building and tree evaluation.

APPLICATION OF BIOINFORMATICS

Application of bioinformatics in various fields – Medicine, Agriculture and Industries.

TEXT BOOKS:

1. Rastogi, S.C., Namita Mendiratta, Parag Rastogi. 2006. Bioinformatics – Concepts, Skills, Application. CBS Publications.
2. Westhead, D.R., Parish, J.H., Twyman, R.M., 2000. Instant Notes in Bioinformatics. *BIOS Scientific Publishers*.
3. Teresa, K., Attwood and David J. Parry-Smith, 2007. Introduction to Bioinformatics. *Pearson Education Ltd*.

REFERENCES:

1. Bergeran, B., 2002. Bioinformatics Computing. *PHI*.
2. Richard Durbin, Sean Eddy, Anders Krogh and Graeme Mitchison, 1998. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids. *Cambridge University Press*.

3. Bishop, M.J., Rawlings, C.J., 1997. DNA and Protein Sequence Analysis. A Practical Approach. *IRL Press*, Oxford.
4. Gibas, C. and Jambeck, P., 1999. Developing Bioinformatics Skills. *O'Reilly*.
5. Dan Gusfield, 2007. Algorithms on Strings Tree and Sequence. *Cambridge University Press*.
6. Baldi, P. and Brunak, S., 1998. Bioinformatics: A Machine Learning Approach. *MIT Press*
7. Essential Bioinformatics. Jin Xiong. Cambridge University Press. 2006.
8. An Introduction ti Bioinformatics Algorithms. Neil C Jones, Pavel A Pevzner. MIT Press.2004.
9. The New Avenue in Bioinformatics. Joseph Seckbeck Eitan Rubin. Springer.2010.

COURSE DESIGNERS

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1	Dr.R.Devika	Professor	Biotechnology	devika@avit.com
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17BTEC04	DIAGNOSTICS AND THERAPEUTICS	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

The Diagnostics and Therapeutics is to explore the fundamental mechanisms of disease and use the knowledge to design, test and evaluate new drugs and develop innovative drug delivery and release strategies. It creates technologies and tools to combat disease, promote health, and safeguard the environment. The Knowledge gained will help in realization of physical systems at scales and dimensions similar to biological entities such as bacterial and mammalian cells, viruses, spores, etc.

PREREQUISITE

17BTCC03- MICROBIOLOGY

COURSE OBJECTIVES

1	List the nature of infection, procedural skills to collect and interpret data.
2	Classify the cause of infection and the pathogens.
3	Demonstrate the genetic nature of Human diseases.
4	Organize current Molecular diagnostics of infectious diseases.
5	Assess the biosafety aspects involved in molecular diagnosis.

COURSE OUTCOMES

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

CO1. Recall about infection, sample collection, transport and the data.	Remember
CO2. Explain about the most appropriate infectious agent.	Understand
CO3. Demonstrate the microorganism have an indispensable role in disease diagnosis	Apply
CO4. Appraise the genomic knowledge.	Analyze
CO5. Choose the tool for disease diagnosis.	Evaluate
CO6. Plan diagnostics based on the bio-safety aspects	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	-	L	-	-	-	-	-	-	-	-	-	-	-
CO2	S	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	M	L	-	M	-	-	M	-	-	-	-	L	-	-	-
CO4	L	L	L	-	-	-	-	-	S	-	-	M	-	-	-
CO5	S	M	L	L	M	-	-	-	-	-	-	S	-	-	-
CO6	S	S	L	M	L	L	L	M	-	-	-	M	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO DIAGNOSTICS AND THERAPEUTICS

Mode of transmissions of infection, Pre-disposing factors of microbial pathogenicity, Normal microbial flora of the human body, Types of infectious diseases, Host - Parasite relationships, Clinical specimens – Collection, Transport and Processing of samples, Interpretation of results.

MICROBIAL INFECTIONS AND DIAGNOSIS

Pathogenicity and diagnosis of major bacterial infections: Streptococcus, Coliforms, Salmonella, and Mycobacterium, Pathogenicity and diagnosis of major fungal infections: Dermetophytosis, Candidiosis and Aspergillosis, Pathogenicity and diagnosis of major Protozoan infections: Amoebiosis, Malaria, Leishmaniasis, DNA and RNA Viruses: Pox viruses, Hepatitis viruses, Adeno viruses and Retro viruses.

MEDICAL GENETICS

Organization of Human genome, Identifying human disease genes, Genetic disorders - Sickle cell anemia, Duchenne muscular Dystrophy, Retinoblastoma, Cystic Fibrosis, Neonatal and Pre-natal disease diagnostics, Gender identification, Analysis of mitochondrial DNA for maternal inheritance, Genetic counselling.

METHODS IN MOLECULAR DIAGNOSTICS

Isolation and purification of nucleic acids, Nucleic acid labelling, Hybridization, PCR and types, PCR based molecular typing, Molecular diagnosis of pathogens based on 18S and 16S rRNA sequences, Automated DNA sequencing, Microarrays - types and applications.

BIOSAFETY FOR MOLECULAR DIAGNOSTICS

Good Laboratory Practices, Different levels of biosafety containments for rDNA experiments, Biosafety aspects of tissue / Cell transplantation.

TEXT BOOKS:

1. Lele Buckingham and Maribeth L. Flaws, 2007. Molecular Diagnostics: Fundamentals, Methods & Clinical Applications.
2. David E. Bruns, Edward R. Ashwood and Carl A. Burtis, 2007. Fundamentals of MolecularDiagnostics.
3. Griffiths, A. J. F., Miller, J. H. and Suzuki, D. T., 2000. An Introduction to Genetic Analysis.
4. Jeremy M. Berg, John L. Tymoczko and LubertStryer, 2002. Biochemistry. W.H. Freeman andCompany.5thEdn.
5. Parasitology, Chatterjee K.D, Chatterjee Medical Publishers

REFERENCES:

1. Lodish, Berk, Zipursky, Matsudaira, Baltimore Darnell, 2000. Molecular Cell Biology. W.H. Freeman and Company. 4thEdn.
2. Benjamin L., 2008. Genes IX. Jones and Bartlett.
3. Turner, P. C., McLennan, A. G., Bates, A. D. and White, M. R. H., 2003. Instant Notes in Molecular Biology. *Viva Books Private Limited*

COURSE DESIGNERS				
S.No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	Dr.B.Prabasheela	Associate Professor	Biotechnology	prabasheela@avit.ac.in
2	Mr.N.Jawahar	Assistant Professor	Biotechnology	jawahar@vmkvec.edu.in

17BTEC05	CYTOGENETICS	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Cytogenetics is the branch of genetics that studies the structure and behaviour of chromosomes and their relation to human disease and disease processes. It also deals with chromosomes and their inheritance, particularly as applied to medical genetics. The application of cytogenetic is to monitor mutagenic and clastogenic exposures, and evaluates the importance of these tests for preventive health measures. Cytogenetics often use cutting-edge tool for the diagnosis of various genetic disorders, paving the way for possible treatment and management.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	State the basic concept of genetic material and their structural organization
2	Compare the structure of the gene and their genetic mapping
3	Differentiate the sex in plants and animals
4	Assess the effects of Structural changes in chromosomes and their translocations
5	Check the genetic material in population and their frequency of occurrence

COURSE OUTCOMES

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

CO1. Recall the Knowledge about concept of genotype and phenotype characters	Remember
CO2. Compare the structure of gene and their mapping system	Understand
CO3. Predict the Sex determination in plants and animals.	Analyze
CO4. Validate the Structural changes in chromosomes.	Evaluate
CO5. Assess the genetic material, mutation and their frequency of occurrence in	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	S	M	-	-	-	-	-	-	L	-	-	-	-	-	-
CO3	L	L	L	L	-	-	-	-	-	-	-	-	-	-	-
CO4	S	M	L	L	-	-	-	S	-	S	-	-	-	-	-
CO5	S	M	L	L	M	-	-	-	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

GENETICS AND HEREDITY

Introduction to genetics. Genotype and phenotype, Mendelian laws of Inheritance, Test cross, back cross; Structural organization of eukaryotic chromosomes: Nucleosome structure, Euchromatin, heterochromatin, telomeres, Satellite DNA, centromeres, Types of chromosome on the basis of centromeres; Lampbrush chromosomes; polytene chromosomes; Extrachromosomal inheritance; maternal effects and cytoplasmic inheritance, Chi square analysis.

LINKAGE AND CROSSING OVER

Fine structure of the gene: cistron, recon, mutan; Linkage; crossing over: molecular mechanism - double strand break model, Holiday model, Genetic mapping of chromosomes: Diploid mapping - two point cross, three point cross, Haploid mapping; Lod score analysis.

SEX DETERMINATION

Sex determination in plants and animals: Concepts of autosomes and allosomes, XX - XY, XX - XO, ZW - ZZ, ZO – ZZ Types; Sex differentiation; Dosage compensation; Sex linked inheritance, Sex influenced inheritance Multiple Alleles; Lethality and Interaction of genes. Karyotyping - amniocentesis; banding techniques

CHROMOSOMAL ABERRATIONS & MUTATIONS

Structural changes: duplications, translocations, inversions; Numerical changes: aneuploidy; Euploidy; polyploidy; Types of mutations; Spontaneous & Induced mutation, lethal mutations, silent mutations, adaptive mutations, biochemical mutations & chemical mutagens, ionizing and non- ionizing radiations; Ames Test.

GENETIC MATERIAL IN POPULATIONS

Population genetics: gene pool, gene frequencies, Hardy - Weinberg law and its applications, factors affecting allele frequencies - selection, mutation, migration and genetic drift; Inbreeding depression; Heterosis; speciation; pedigree analysis.

TEXT BOOKS:

1. Tamarin, R.H. 2008. “Principles of Genetics”, Tata McGraw Hill, New Delhi.
2. Verma, P.S. and Agarwal, V.K. 2006. “Cell Biology, Genetics & Evolution & Ecology”, S. Chand & Co., New Delhi.

REFERENCES:

1. Simmons, M.J, and Snustad, D.P. 2008. “Principles of Genetics”, John Wiley & Sons, New Delhi.
2. Strickberger, M.W. “Genetics”, Pearson Education India, New Delhi. 2015

COURSE DESIGNERS

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17BTEC06	STEM CELL BIOLOGY AND TISSUE ENGINEERING	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Stem cells in regenerative medicine holds promise for improving human health by restoring the function of cells and organs damaged due to degeneration or injury. Stem cell biology has potential application in several areas of biomedical research that includes drug development, toxicity testing, developmental biology, disease modeling, tissue engineering etc.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To define topics related to stem cells and regenerative biology
2	To describe Stem cell basics and their applications for the benefit of mankind.
3	To execute technologies in engineering stem cells
4	To organize scaffold for tissue engineering
5	To Assess the ethical issues in stem cell research

COURSE OUTCOMES

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

CO1. To recall the basics of stem cell	Remember
CO2. To identify the basic applications of stem cell in regenerative medicine	Understand
CO3. To Illustrate the latest tissue engineering concepts	Apply
CO4. To develop the scaffold tissue using stem cell	Analyse
CO5. To validate the research in tissue engineering.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	-	L	L	-	-	-	-	L	-	L	L	-	-	-
CO2	S	M	S	S	-	M	-	-	-	-	L	L	-	-	-
CO3	M	-	M	M	L	S	-	M	M	-	M	L	-	-	-
CO4	L	L	L	-	S	L	-	-	-	-	L	M	-	-	-
CO5	S	M	L	L	M	M	M	S	M	-	S	L	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO STEM CELL BIOLOGY

Definition and concepts of stem cell terminology. Classification of stem cells. Basic biology of stem cells - Types & sources of stem cell with characteristics. Stem cells in embryonic and adult tissues. Overview of basic and translational research of stem cells modeling disease states, gene/cell therapies,

EMBRYONIC STEM CELLS AND INDUCED PLURIPOTENT STEM CELLS

Early steps in human reproduction (Zygote to blastocyst stage), Totipotent vs Pluripotent stem cells, Embryonic stem cells: Sources, characterization and experimental manipulations, Discovery of Induced pluripotent stem cells (iPSC) and its experimental differentiation into specific tissue types, Generation and characterization of pluripotent stem cells. Experimental breakthroughs and limitations.

ADULT STEM CELLS

Multipotent stem cells from adult tissues and organ systems, stem cell niches. Advantages and disadvantages for use, characterization, experimental manipulations, Immune markers and tissue/organ rejection, Hematopoietic stem cells - characteristics and differentiation pathways, Lymphoid vs myeloid cell pathways and stem cells ,Cord blood transplantation, Mesenchymal stem cells – Isolation, characterization and functional assessment.

TISSUE REGENERATION AND BIOENGINEERING OF TISSUE AND ORGANS

Overview of regeneration and bioengineering of tissues. Role of stem cells in controlling tissue regeneration. Experimental strategies to bioengineer tissues and organs from cultured stem cells. 3-D organoid cultures and tissue scaffolds. Characterization of functional bioengineered organs.

ETHICAL, POLITICAL AND SOCIETAL IMPLICATIONS

Future innovations, trends and misconceptions of using human stem cells. Practicalities and feasibilities of using stem cells to treat human disease and injuries. Commercialization of stem cell-based therapies.

TEXT BOOKS:

1. Robert Lanza, John Gearhart, Brigid Hogan,Douglas Melton, Roger Pedersen, James ThomsonE and Donnall Thomas. Essentials of Stem cell Biology. Elsevier Academic press.
2. Robert Lanza, Robert Langer and Joseph Vacanti, “Principles of Tissue Engineering”, Academic Press, 2007

REFERENCES:

1. Scudellari, Megan “A decade of iPS cells” *Nature*, 534: 310-312.
2. Bredenoord, AL, Clevers, H, Knoblich J (2017) “Human tissues in a dish: The research and ethical implications of organoid technology” Science 355.
3. ThomsonE and Donnall Thomas.Essentials of Stem Cell Biology. Elsevier Academic press.
4. Stewart Sell. Stem Cell Handbook, 2004. *Humana Press*.
5. Freshney, R. and Ian. Alan, R. Culture of Animal Cells : A Manual of Basic Techniques. Liss Inc.
6. Modlinske, J.A., Reed, M., A., Wagner, T.E. and Karasiewicz, J., 1996. Embryonic Stem Cells: Developmental Capabilities and their Possible Use in Mammalian Embryo Cloning. *Animal Reproduction Science* 42: 437 – 446.

COURSE DESIGNERS				
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17BTEC07	GENETICALLY MODIFIED ORGANISMS AND ETHICAL ISSUES	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Genetically modified organisms and ethical issues course deals with the study of modified genes found in and around us. Genetically modified organisms classifies the genetic modification and characteristics of modified genes and beneficial effects. Genetically modified organisms use pioneering techniques in science along with other applied fields of research like biotechnology, genetics to study microbes and their complex mechanisms. Knowledge of these principles will enable students to understand how they react under different conditions and how they cause different diseases and their control.

PREREQUISITE

17BTCC12- GENETIC ENGINEERING

COURSE OBJECTIVES

1	To state the knowledge on concept of Genetically modified organisms
2	To explain the principles of risk benefit analysis of genetically modified organisms
3	To classify the legislation, regulations and ethical values relevant to genetic modification
4	To categorise the importance of crop protection and improvement.
5	To design various laws for the selection of genetic changes.

COURSE OUTCOMES

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

CO1. List out the basic knowledge about genetically modified microbes and	Remember
CO2. Classify the modified gene copy number and chromosomal changes	Understand
CO3. Compare the genetically engineered organisms and methods of bio confinement	Understand
CO4. Categorise the economic and political aspects of genetic modification	Analyze
CO5. Appraise the advantages of structural changes and numerical changes	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	L	-	-	-	-	-	L	-	-	-	L	-	-	-
CO2	-	M	-	-	L	M	-	L	L	-	L	L	-	L	L
CO3	-	-	-	S	-	-	M	L	-	L	-	L	-	-	L
CO4	-	-	L	-	-	-	-	M	-	-	-	M	L	-	M
CO5	-	-	L	M	-	-	-	S	-	S	-	S	-	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

GENETIC MODIFICATION

Generation of Genetic Modification- Genetically Modified Microbes (bacteria and yeast) and Genetically Modified Organism (plants and animals) - Recombinant DNA technology for GMOs with examples of applications in plants - applications of GMM and GMO within basic science- Biological and medical research.

DETECTION AND ANALYSIS OF GMOS AND GMO PRODUCTS

Modified gene copy number determination, detection of chromosomal changes, toxicological studies, residual DNA analysis, product analysis – microbial, biochemical and molecular, toxicological evaluation.

SEX DETERMINATION

Sex determination in plants and animals: Concepts of autosomes and allosomes, XX - XY, XX - XO, ZW - ZZ, ZO – ZZ Types; Sex differentiation; Dosage compensation; Sex linked inheritance, Sex influenced inheritance Multiple Alleles; Lethality and Interaction of genes. Karyotyping - amniocentesis; banding techniques.

CHROMOSOMAL ABERRATIONS & MUTATIONS

Structural changes: duplications, translocations, inversions; Numerical changes: aneuploidy; Euploidy; polyploidy; Types of mutations; Spontaneous & Induced mutation, lethal mutations, silent mutations, adaptive mutations, biochemical mutations & chemical mutagens, ionizing and non- ionizing radiations; Ames Test.

GENETIC MATERIAL IN POPULATIONS

Population genetics: gene pool, gene frequencies, Hardy - Weinberg law and its applications, factors affecting allele frequencies - selection, mutation, migration and genetic drift; Inbreeding depression; Heterosis; speciation; pedigree analysis.

TEXT BOOKS:

1. David E Newton. 2014. Genetically Modified Organisms food, Santa Barbara, California: ABC-CLIO
2. Debra A Miller, 2012, Genetically Engineered Food, Detroit Green haven press.
3. Tamara Thompson, 2015. Genetically modified food. Farmington Hills Mich, Greenhaven press, a part of Gale, Cengage learning.

REFERENCES:

1. Noel Merino, 2014. Genetically modified food. Farmington Hills, MI, Greenhaven press
2. Ronald Ross Watson and Victor Preedy, 2015, Genetically modified Organisms in Food, 1st edition Academic press
3. R. R. Vittal and R. Bhat, Biotechnology, Concepts and Applications (2009)
4. S. C. Rastogi, Biotechnology, Principles and Applications (2007)

COURSE DESIGNERS				
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17BTEC08	MOLECULAR EVOLUTION	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

This course provides a review of current knowledge in molecular evolution, with attention to evolutionary theory, the patterns and mechanisms of molecular change, the reconstruction of evolutionary trees from gene sequences, the evolution of gene families and their functions, and the evolution of development.

PREREQUISITE

17BTCC09- MOLECULAR BIOLOGY

COURSE OBJECTIVES

1	To state the students about genes and its structure, and effect of mutation of genes
2	To describe the students about the classical models used to find out the changes in the nucleotide sequence during evolution
3	To demonstrate the students about the conventional method of sequence alignment and building the phylogenetic tree
4	To outline the gene duplication and dating of gene duplication
5	To develop and interpret phylogenetic trees

COURSE OUTCOMES

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

CO1. Students will recall the concept and processes of protein and genes in the molecular evolution	Remember
CO2. Explain how the evolutionary changes act at the molecular level	Understand
CO3. Utilize the diversity of molecular evolution computational methods to analyze and interpret molecular evolutionary patterns	Apply
CO4. Correlate the bioinformatics tools to find out the evolutionary relationship.	Analyse
CO5. Appraise the domains of gene duplication and exon shuffling	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L	-	-	-	-	-	-	-	-	M	-	-	-
CO2	S	M	S	-	-	-	-	-	-	-	-	-	-	-	-
CO3	M	-	M	M	L	-	-	-	M	-	-	-	-	-	-
CO4	L	-	L	-	S	-	-	-	-	-	-	-	-	-	-
CO5	S	-	L	-	M	-	-	-	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

GENES, GENETIC CODES, AND MUTATION

Genes and gene structure- Protein-coding genes, RNA-specifying genes, Un transcribed genes

Mutation- Substitution mutations, Recombination, Deletions and insertions, Inversions, Mutation rates, Spatial distribution of mutations.

EVOLUTIONARY CHANGE IN NUCLEOTIDE SEQUENCES

Nucleotide substitution in a DNA sequence- Jukes and Cantor's one-parameter model, Kimura's two-parameter model, Number of substitutions between two noncoding sequences, Substitution schemes with more than two parameters

ALIGNMENT OF NUCLEOTIDE AND AMINO ACID SEQUENCES

Manual alignment by visual inspection, The dot matrix method, Distance and similarity methods, Alignment algorithms, Multiple alignments

MOLECULAR PHYLOGENETICS

Impacts of molecular data on phylogenetic studies, Advantages of molecular data in phylogenetic studies, Rooted and unrooted trees, Scaled and unscaled trees, The Newick format, Number of possible phylogenetic trees, True and inferred trees, Gene trees and species trees, Taxa and clades. Methods of tree construction

GENE DUPLICATION, EXON SHUFFLING, AND CONCERTED EVOLUTION

Types of gene duplication, Domain duplication and Gene elongation- The ovomucoid gene, Enhancement of function in the allele of haptoglobin, Origin of an antifreeze glycoprotein gene, Dating of gene duplication.

TEXT BOOKS:

1. D. Graur and W-H Li. Fundamentals of Molecular Evolution. Sinauer, 1999.
2. D.B. Futuyma. Evolutionary Biology, Third Edition. Sinauer, 1997. This is an excellent general evolution textbook. While it is expensive, it is a great reference and learning tool for anyone interested in evolution in general.

REFERENCES:

1. RDM Page and LC Holmes. Molecular Evolution: A Phylogenetic Approach. Blackwell Science, 1998. A very good introduction with an emphasis on techniques and concepts in molecular systematics, one of the major weak points in Graur and Li.
2. D.B. Futuyma. Evolutionary Biology, Third Edition. Sinauer, 1997. This is an excellent general evolution textbook. While it is expensive, it is a great reference and learning tool for anyone interested in evolution in general.

COURSE DESIGNERS

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1	Dr. S. Vinoth	Assistant Professor	Biotechnology	vinoth@avit.ac.in
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17BTEC09	MICROBIAL BIOTECHNOLOGY	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Microbial Biotechnology deals with the study of Microbial products, organization and function of prokaryotes. As the pioneering field in the area of microbial it clearly shows that the industrially important microbes and metabolites. Industrially important microbial metabolites were identified and they were taken to the different steps for the production of antibiotics. Genetically modified organisms are concerned with the application of microbial metabolites in pharma industry and also the types of drugs, how the biofertilizers and biopesticides are useful to the agriculture for the enormous amount of production. Classically recovery and purification of microbial products were analysed for the application in agriculture.

PREREQUISITE

17BTCC03- MICROBIOLOGY

COURSE OBJECTIVES

1	To learn the basic principles of isolation and purification of microbial products
2	To understand the kinetics of microbial metabolites and their actions
3	To understand the recovery and product identification from the microbes
4	To know the importance and application of microbial metabolites in the Parma industry
5	To make the students to test and deepen their mastery of microbial products by applying this knowledge in a variety of problem-solving situations.

COURSE OUTCOMES

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

CO1: To describe the historical background and cultural characteristics of microbes	Remember
CO2: To describe the differences between culturing techniques, product purification and recovery process	Understand
CO3: To analyze the production of microbial metabolites	Analyse
CO4: To compare and contrast the production of primary and secondary metabolites	Analyse
CO5: Identify the factors that play a role in the production of antibiotics.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	-	L	L	L	-	L	-	-	-	-	-	L	-	-
CO2	-	M	S	S	L	-	S	-	-	-	L	-	-	-	-
CO3	-	-	L	L	S	-	-	M	-	-	L	M	-	M	-
CO4	-	-	-	-	-	-	S	-	-	-	L	M	-	M	-

CO5	-	-	L	-	M	-	-	-	-	-	-	S	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

MICROBES AND APPLICATION

Introduction, aims and scope: Organization and function of prokaryotes, Isolation of industrially important microorganisms from different sources. Extremophiles and their applications: Characteristics of selected groups of microbes. Control of micro organisms- physical and chemical agents. Culture concept and cultural characteristics

ISOLATION OF INDUSTRIALLY IMPORTANT MICROBES

Methods in microbiology- Pure culture techniques, Microbial nutrition and growth principles. Growth measurement techniques: Isolation of microorganisms from various sources, long term preservation and improvement of cultures. Design and Preparation of Media- fermentation processes. Study of various methods of biomass measurement- Growth curve studies of microbes in Batch culture and continuous culture. Determination of yield coefficient and Monod's constant

INDUSTRIALLY IMPORTANT MICROBIAL METABOLITES

Industrially important microbial metabolites- Process technology for the production of primary metabolites e.g. enzymes (Amylases, Proteases, Lactases, Pectinase and Lipases), baker's yeast, ethanol, citric acid, polysaccharides, nucleosides and bioplastics. Production of secondary metabolites- penicillin, Tetracycline, streptomycin, vitamins etc

APPLICATIONS OF GREEN CONCEPTS

Applications of microbial metabolites: Pharmaceutical industry, Therapeutics, and Clinical analysis- glucose isomerase, aminopeptidase; amylase, cellulase, penicillin acylase, lipase, oxido-reductase; protease etc. for the production of different types of drugs and drugs intermediates. Biogenic synthesis of nanoparticles from microbes-mechanism, characterization, and applications. Microbes in environmental management, Biocontrol, Biofertilizers, and biopesticides

RECOVERY AND PURIFICATION OF MICROBIAL PRODUCTS

Removal of microbial cells- Precipitation, filtration, centrifugation. Cell disruption- extraction and chromatography, Drying and crystallization

TEXT BOOKS:

1. Michael T. Madigan, John M. Martinko, Paul V. Dunlap, and David P. Clark "Brock Biology of microorganisms", Prentice Hall, 12th Edition, 2008
2. Michael J. Pelczar, S. Chan, and Noel R. Krieg "Microbiology", McGraw Hill, 7th Edition, 2011 3.
3. Richard Harvery, Cynthia Nau Cornelissen, Bruce D Fisher, 2011, Microbiology, Lippincott illustrated Reviews: Microbiology.
4. Stanier Y. Roger, Adelberg A. Edward, and Ingraham John "General Microbiology", Prentice Hall, 5th Edition, 1986.

REFERENCES:

1. Geo Brooks, Karen C. Carroll, Janet Butel, and Stephen Morse "Medical Microbiology", McGraw-Hill Medical, 26^{th} Edition, 2012 6.
2. Lansing M. Prescott, Donald A. Klein, and John P. Harley, "Microbiology", McGraw Hill, 5^{th} Edition, 2002 7.
3. G. Reed, Prescott and Dunn's, "Industrial Microbiology", 4th Edition, CBS Publishers, 2009.
4. P. E. Stanbury, A. Whitaker, and S. J. Hall, "Principles of Fermentation Technology", Indian Edition, Hall Books, 2007

COURSE DESIGNERS

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1	Dr. R. Subbaiya	Associate Professor	Biotechnology	rsubbaiya80@gmail.com
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17BTEC10	CRYOPRESERVATION THEORY AND APPLICATIONS	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Cryopreservation Theory and Applications subject deals with the basic knowledge in the preservation techniques. The course often use cutting-edge techniques and sophisticated machinery along with other applied fields of research to study how the eggs and sperm are preserved for later uses. Knowledge of these principles will enable students to understand the various free drying preservation techniques and its usefulness.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To recognise the basics of cryopreservation and effects caused by it.
2	Summarize about different types cryopreservation
3	To implement cryopreservation in fertilization process.
4	To outline the knowledge of cryopreservation in therapeutics and other fertilization process
5	To assess the role of cryopreservation in therapeutics.

COURSE OUTCOMES

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

CO1. Recall the basic principle cryopreservation.	Remember
CO2. Discuss about different types of cryopreservation.	Understand
CO3. Practice the cryopreservation techniques in fertilization process	Apply
CO4. Distinguish the cryopreservation techniques for storage system	Analyze
CO5. Appraise the importance of cryopreservation process.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L	L	-	-	L	-	-	-	-	L	L	-	-
CO2	S	M	-	-	L	-	-	-	-	-	L	L	-	-	-
CO3	M	L	M	-	-	-	-	-	-	-	L	L	-	L	-
CO4	L	L	L	-	-	-	-	-	-	-	M	-	-	-	M
CO5	S	M	L	-	-	-	-	-	-	-	L	-	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Cryopreservation – History and Definition, temperature factor – normal biochemical reaction leading to death, Damages caused by general freezing of cell and tissues, Natural cryopreservation, Gaia theory (James Love Lock), freezing and refrigeration.

VARIATION IN CRYOPRESERVATION

Cryobiology, Cryogenics, Frozen zoo, *ex situ* conservation, Long time preservation.

TECHNOLOGY OF CRYOPRESERVATION

General Biotechnology in cryopreservation, Cellular cryobiology and hydrobiology, Deep freezing damages, *in vitro* storage and cryopreservation.

CRYOPRESERVATION AND FERTILITY

Fertility failures, Embryo cryofreezing, techniques in embryo freezing, Storage thawing, retrieval, Cryoprotectant solution.

CRYOPRESERVATION MAN'S HOPE

Cryopreservation of egg, Sperm of *Homosapiens*, Techniques employed in aquaculture (Fish Plankton), Cawthron collection, Design and use of thermal transport containers for cryopreservation, Role of cryopreservation in therapeutics.

TEXT BOOKS:

1. Annamaria Pardo, John M. Baust and Todd Upton, 2005. Improving Quality in Cryopreserved Cells.
2. Gardner, Weissman, Howles and Shoham, 2009. Textbook of Assisted Reproductive Technology. Informa Health Care. 3rd Edn.

REFERENCES:

1. Walvekar, V. R., Jassawalla, M. J., Anjaria, P. H. And Wani, R. J., 2001. Reproductive Endocrinology. Federation of OGS of India. Jaypee Publications. 2nd Edn.
2. Benson, E., Paul T. Lynch and Glyn N. Stacey, 1998. Advance in Plant Cryopreservation Technology Current Application. Erica.
3. Peter R. Brinsden, 2005. Textbook of in vitro Fertilization and Assisted Reproduction – Guide to Clinical Lab Practice. Taylor & Francis. 3rd Edn.
4. Steven R. Bayer, Michael M. Alperand Alan S. Perzias, 2007. Handbook of Infertility. Informa Health Care. 2nd Edn.
5. Igor I. Katkov, 2012. Current Frontiers in Cryopreservation. Intech Publisher.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.R. Devika	Professor and Head	Biotechnology	devika@avit.ac.in
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17BTEC11	PROTEIN ENGINEERING	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

The aim of the course is to explain the molecular mechanisms at the basis of the structure-function relationships of proteins and the experimental approaches to modulate the protein functionality and to evolve a desired function or structure. The course is also aimed to provide the most updated knowledge/skills related to the production of recombinant proteins. This course is a blend of modern discoveries and applications in protein sciences.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To recall the translation and post translational modification processes.
2	To discuss the structure, functional correlation and the prediction of properties of protein based on its sequence.
3	To illustrate therole of analytical methods to determine protein structure and protein – protein interactions
4	To observe the similarities in structure at basal level in a group of having similar function, thereby predicting the strategies to modify and design novel proteins.
5	To provide updated knowledge about recombinant proteins and its application in therapeutics

COURSE OUTCOMES

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

CO1. Recognize the structure and classification of proteins	Remember
CO2.Describe the amino acid sequence and structure of proteins, and relate this information to the function of proteins strategies.	Understand
CO3. Outline the characteristics of individual amino acids and their effect on the solubility, structure and function of proteins	Understand
CO4. Develop biotechnical methods to construct plasmids for the expression of natural and modified genes	Analyze
CO5. Validate a simple research plan for a protein engineering and design	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	M	M	-		L	-	-	-	-	-	-	L	L	-	-
CO4	M	M	-	-	S	-	L	-	-	-	-	-	-	M	-
CO5	M	M	L	L	S	S	-	L	-	-	-	-	-	L	L

S- Strong; M-Medium; L-Low

SYLLABUS

BONDS AND ENERGIES IN PROTEIN MAKEUP

Covalent and Non-covalent interactions in Protein structure, Translation and Post Translational Modifications

PROTEIN ARCHITECTURE

Primary structure, Secondary structures, Super secondary structures, Topology diagrams, Nucleotide binding folds, Tertiary structures, Modular nature and Formation of complexes in Quaternary structures.

PROTEIN FOLDING AND STRUCTURE DETERMINATION

Protein Denaturation and Renaturation, Protein folding pathways, Stability of folded conformation of proteins, Methods to determine primary, tertiary and quaternary structure - Peptide mapping, Peptide sequencing, Circular Dichroism, Mass spectroscopy and X-ray diffraction.

PROTEIN STRUCTURE - FUNCTION RELATIONSHIP

Helix-turn-Helix motifs, Cro, Lamda and Trp repressor, Zn fingers, Tata Box binding proteins, Homeodomain, Leucine zippers, Enzyme - Understanding the catalytic design by engineering trypsin, chymotrypsin and elastase.

PROTEIN ENGINEERING AND PROTEIN DESIGN

Site directed mutagenesis, Engineering of T4 Lysozyme and Recombinant Insulin, Protein design - Principles and examples.

TEXT BOOKS:

1. Branden, C. and Tooze,J., 1999.Introduction to Protein structure. 2nd Garland Publishing, NY, USA. Edn.,

2. Daniel C. Liebler, "Introduction to Proteomics – Tools for the New Biology," Humana Press, 2001

REFERENCES:

1. Moody P.C.E. and Wilkinson A.J., 1990. Protein Engineer-ing. IRL Press,Oxford, UK.

2. DoanaldVoet and Judith Voet, G., 2001. Biochemistry. 3rd Edn., John Wiley and Sons, 2001.

3. Stefan Lutz and Uwe T. Bornscheuer, 2009. Protein Engineer-ing Handbook. Vol 1 & 2, 1st Edn., Wiley Publishers.

4. Berg, J. M., Tymoczko, J. L. and Stryer, L., 2002. Biochemis-try. 5th Edn., W.H. Freeman and Company.

COURSE DESIGNERS

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17BTEC12	NEUROBIOLOGY AND COGNITIVE SCIENCES	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Neurobiology is the scientific study of the nervous system. It is a multidisciplinary branch of biology, that deals with the anatomy, biochemistry, molecular biology and physiology of neurons and neural circuits. It also drawn upon other fields, with the most obvious being pharmacology, psychology and medicine. The scope of neuroscience has broadened over time to include different approaches used to study the molecular, cellular, developmental, structural, functional, evolutionary, computational, psychological and medical aspects of the nervous system.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To learn the basic principles of nervous system and function of neurons
2	To develop knowledge on neurophysiology and synaptic transmission
3	To understand the basic concept of neuropharmacology and neuronal function
4	To understand the concepts of applied neurobiology and its mechanism
5	To make the students to test and deepen their mastery of neurobiology and the importance of behavioural science.

COURSE OUTCOMES

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

CO1: To understand the anatomy and organization of nervous systems	Remember
CO2: To describe the function of nervous systems	Understand
CO3: To analyze how drugs affect cellular function in the nervous system	Analyse
CO4: To analyze the basic mechanisms associated with behavioural science	Analyse
CO5: Identify the neurological responses associated with nervous system.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	M	L	-	-	-	-	-	-	-	L	-	-
CO2	S	L	L	L	L	-	-	-	-	-	-	-	-	-	-
CO3	S	M	L	L	l	-	-	-	-	-	-	-	-	L	-
CO4	M	M	-	S	S	-	-	-	-	-	-	-	-	L	-
CO5	S	M	L	S	S	-	-	-	-	-	-	L	M	L	L

S- Strong; M-Medium; L-Low

SYLLABUS

NEUROANATOMY

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.

NEUROPHYSIOLOGY

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.

NEUROPHARMACOLOGY

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

APPLIED NEUROBIOLOGY

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

BEHAVIOUR SCIENCE

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

TEXT BOOKS:

1. Mathews G.G. Neurobiology, 2nd edition, Blackwell Science, UK, 2000.
2. Gordon M. Shepherd G.M, and Shepherd Neurobiology, 3rd Edition Oxford University Press, USA, 1994

REFERENCES:

1. Mason P., Medical Neurobiology, Oxford University Press, 2011.

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17BTEC13	FOOD MICROBIOLOGY	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Food microbiology is the study of the microorganisms that inhibit, create, or contaminatefood, including the study of microorganisms causing food spoilage, pathogens that may cause disease especially if food is improperly cooked or stored, those used to produce fermented foods such as cheese, yogurt, bread, beer, and wine, and those with other useful roles such as producing probiotics. Knowledge of these principles will enable practice well in handling food substances carefully.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To recognize the basic knowledge on food safety levels.
2	To discuss various factors affecting the growth of microorganisms.
3	To classify the role of food preservation techniques
4	To categorise the fermented dairy products
5	To check and prevent the ways of food spoilage substances

COURSE OUTCOMES

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

CO1: Recall the various food safety levels.	Remember
CO2: Explain the various factors affecting growth of microorganisms	Understand
CO3: Identify the role of food preservation techniques	Understand
CO4: Analyze the risk involved in fermented dairy products	Analyse
CO5: Differentiate the various food spoilage substances	Analyse
CO6: Practice the safety procedure in lab and others research institutions.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L	L	L	-	-	-	-	-	M	-	L	S	M	-
CO2	M	L	-	M	-	-	-	-	-	-	M	L	-	-	M
CO3	S	-	M	L	L	-	-	M	-	-	-	-	-	-	-
CO4	M	S	L	M	L	-	-	S	-	-	-	-	-	M	-
CO5	S	M	L	-	L	-	-	-	-	-	-	-	-	-	-
CO6	M	S	L	L	-	-	-	S	-	-	-	L	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

SCOPE OF FOOD MICROBIOLOGY

The Scope of Food Microbiology. Microorganisms and Food, Food Spoilage/Preservation, Food Safety, Microbiological Quality Assurance**.** Micro-organisms and Food Materials- Diversity of Habitat, Micro-organisms in the Atmosphere - Airborne Bacteria, Airborne Fungi, Micro-organisms of Soil, Micro-organisms of Water, Micro-organisms of Plants, Micro-organisms of Animal Origin.

FACTORS AFFECTING THE GROWTH OF MICROORGANISMS

Factors Affecting the Growth and Survival of Micro-organisms in Foods. -Microbial Growth, Intrinsic Factors-Nutrient Content, pH and Buffering Capacity, Redox Potential, Antimicrobial Barriers and Constituents, Water Activity and Extrinsic Factors - Relative Humidity, Temperature and GaseousAtmosphere

FOOD PRESERVATION

The Microbiology of Food Preservation **-** Heat Processing, Irradiation, High-pressure Processing – Pasteurization, Low-temperature Storage and Chemical Preservatives.

FERMENTED DIARY PRODUCTS

Production of fermented dairy products: Cheese, yoghurt, butter milk, sour cream Fermented vegetables; Sauerkraut, pickles, olives and soy sauce. Fermented meat, Fermented Indian foods - leavening of bread.

FOOD SPOILAGE

Food spoilage**:** Spoilage of fruit and vegetables. Spoilage of cereal and cereal products – cereal grains, and bread. Spoilage of meat and meat products – Bacon and Ham. Spoilage of milk and milk products – butter and frozen desserts. Food borne diseases – indicators of pathogens & food poisoning

TEXT BOOKS:

a. Adams, M.R. and Moss, M.O. 2008. Food Microbiology, RSC Publishing, Cambridge, UK.
b. Benwart, G.J. 1987. Basic Food Microbiology, CBS Publishers & Distributors, New Delhi.
c. Blackburn C. de W. 2006, Food spoilage microorganisms, Woodhead Publishing, Cambridge,UK
d. Frazier, W.C., and Westhoff, D.C. 1988. Food Microbiology (Reprint 1995), Tata McGraw Hill Publishing Ltd., NewDelhi

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REFERENCES:

1. Garbutt, J. 1997. Essentials of Food Microbiology, Arnold – International Students edition,London.
2. Jay J.M. 2000. Modern Food Microbiology. 6^{th} Edition. 2000. Chapman & Hall, New York.
3. Prescott, L.M., Harley, J.P. and Helin, D.A. 2008. Microbiology, Fifth Edition, McGraw Hill, New York.

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17BTEC14	ENDOCRINOLOGY	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Endocrinology is a branch of biology and medicine dealing with the endocrine system, its diseases and its specific secretions known as hormones. It is also concerned with the integration of developmental events proliferation, growth and differentiation and the psychological or behavioural activities of metabolism, growth and developmental events proliferation, growth and differentiation, tissue function, sleep, digestion, respiration, excretion, mood, stress, lactation, movement, reproduction and sensory perception caused by hormones. Specializations include behavioural endocrinology and comparative endocrinology.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To define the basic principles of endocrine system which consists of several glands
2	To explain about hormones and behavioural endocrinology
3	To Outline the basic concept of female reproductive tract and endocrine regulation of ovarian functions
4	To compare the concepts of fertilization and conception of sexual reproduction
5	To develop diagnostic method for detection of diseases related to endocrine system.

COURSE OUTCOMES

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

CO1:Define the historical background and development of endocrine system	Remember
CO2:Describe the importance of sexual differentiation and the role of biochemical and hormonal aspects	Understand
CO3: Examine the sources of ovarian hormones and regulation of ovarian functions	Analyse
CO4 Compare and contrast the internal and external fertilization and genetic recombination.	Analyse
CO5: Evaluate the role of hormones in developmental stages and the basis of evolutionary change.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L	L	L	-	-	-	-	-	-	-	L	-	-
CO2	S	L	L	L	L	L	-	-	-	-	-	-	-	-	-
CO3	L	L	L	L	M	-	L	M	L	-	-	L	-	L	-
CO4	M	M	-	S	S	-	-	-	-	L	M	L	-	L	-
CO5	S	M	L	L	M	-	-	-	-	-	-	L	M	L	L

S- Strong; M-Medium; L-Low

SYLLABUS

GENERAL ENDOCRINOLOGY

Endocrine glands and hormones, Classification of hormone, Brief account of structural features of endocrine glands. Hormonal effects and regulation – basic concepts and methods. Biosynthesis and secretion of pancreas, adrenal, ovary, testis and thyroid hormones. Factors influencing secretion. Endocrine disorders- brief description.

GONADAL DIFFERENTIATION

Sexual differentiation: Genetic sex- gonadal sex- somatic sex. Differentiation of testis and Ovary: Morphological, biochemical and hormonal aspects. Development abnormalities of male and female sex organs: genetic and endocrine aspects. Hypothalamo- hypophyseal- gonadal axis.

FEMALE REPRODUCTIVE TRACT-I

Study of ovary Ovary: Structure, folliculogenesis, Ovulation. Sources of ovarian hormones, Ovarian androgen, inhibin, Endocrine regulation of ovarine functions

CONCEPTION

Fertilization, Conception, Parturition, Maternal- foetal placental hormones.

APPLIED ENDOCRINOLOGY

Hormones, growth and development, Hormones and human health. Production of hormones as Pharmaceuticals.

TEXT BOOKS:

1. Endocrinology: Adult and Pediatric 7th Edition) *J. Larry Jameson and Leslie J. De Groot* ISBN: 978-0-323-18907-1. 2011.
2. Endocrinology Adult and Pediatric: Reproductive Endocrinology 6th Edition. J. Larry Jameson David de Kretser John Marshall Leslie De Groot. 2013.

REFERENCES:

2. General Endocrinology 6th Edition, C. Donnell Turner and Joseph T. Bagnara. 2009
3. Endocrinology 6th Edition, Mac E Hadley and Jon E Levine, Pearson Publishers. 2010

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17BTEC15	BIOREMEDIATION TECHNOLOGY	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Bioremediation technology is one of the emerging technologies in the branch of biotechnology which deals with controlling the pollution with the help of microorganism. Bioremediation technology often use leading-edge techniques and sophisticated machinery along with other applied fields of research like biotechnology, genetics to study microbes and their complex mechanisms in degrading the waste materials. With the Knowledge of these principles students will enable to understand the different approaches to reduce the waste and turning them into valuable bio products.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To discuss the basics about the bioremediation and biodegradation.
2	To describe about the various techniques involved in bioremediation.
3	To outline the role of microorganism in decomposition process.
4	To categorise the different transformation process during bioremediation.
5	To develop a high value bioproducts from renewable sources.

COURSE OUTCOMES

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

CO1. Explain about the concepts of bioremediation and biodegradation.	Understand
CO2. Explain about the usage of different techniques involved in bioremediation	Understand
CO3. Compare the aerobic and anaerobic mode of decomposition	Analyse
CO4. Compare the energy transformation process	Analyse
CO5. Appraise the product produced from the renewable sources	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	-	L	-	-	L	-	-	-	L	L	L	-	-
CO2	S	M	S	-	-	-	S	-	-	-	L	L	-	-	-
CO3	M	-	M	M	-	-	M	-	-	-	L	-	-	L	-
CO4	L	-	-	L	-	-	S	-	-	-	-	-	-	-	-
CO5	S	M	L	L	-	-	-	-	-	-	L	S	M	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

BASIC STUDIES ON BIOREMEDIATION

History, stages to set up study on bioremediation (Preliminary investigation, site evaluation, laboratory studies, start up, operational support), limitation of bioremediation, relative biodegradability, Process design of aerobic and anaerobic system – Activated sludge process – Trickling filter – Rotating biological contactors – Fluidized bed reactor – Up flow anaerobic sludge blanket reactor (UASB).

BIOREMEDIATION TECHNIQUES

Bioremediation types - In situ and ex situ bioremediation, biophiles, bioventing, land forming, bio stimulation, bioaugmentation, biosparging,biofilters, bio scrubbers and phytoremediation – bioleaching, bio precipitation, bioaccumulation and biosorption. Merits and demerits.

MICROBIAL METABOLISM IN BIODEGRADATION AND BIOREMEDIATION PROCESS

Aerobic and Anaerobic degradation of aliphatic and aromatic compounds – Biodegradation of herbicides and pesticides. Decomposition of organic compounds in natural ecosystems – Co-metabolic degradation of organo-pollutants - Hydrolysis of biopolymers by aerobic and anaerobic microorganisms – Anaerobic degradation of carbohydrates, proteins, lipids – Nitrogen removal – Ammonification, nitrification, denitrification.

BIOREMEDIATION PROCESS

Bioremediation process, metabolic process, energy transformation process, growth requirement, microbial and enzymatic biodegradable mechanism on heavy metals like cadmium and mercury nuclear waste, Bioremediation of greenhouse gas, hydrocarbons. Environmental variation in field.

BIOPRODUCTS FROM RENEWABLE SOURCES

Overview of renewable sources, Production of bio compost and vermicomposting, Production of biofertilizers and biopesticides, Production of biomethane, bioethanol, biohydrogen, biodiesel, Production of bioplastics and biopolymers, Bioelectricity generation and value-added products from renewable sources.

TEXT BOOKS:

1. Mohapatra P.K., 2016. Text Book of Environmental Biotechnology 5th edition, I.K. International Publishing House Pvt. Ltd., New Delhi.
2. Chatterji. A.K., 2011. Introduction to Environmental Technology, 3rd edition Prentice Hall of India Pvt. Ltd., New Delhi,
3. Evans, G.G. and Furlong, J., Environmental Biotechnology: Theory and Application, 2nd Edition, John Wiley & Sons, 2011.
4. Henze, M., Harremoes, P., Jansen, J.C. and Arvin, E., "Wastewater Treatment: Biological and Chemical Processes", 2 nd Edition, Springer, 2013.

REFERENCES:

1. Popular Biotechnology Lecture Series Focus: Bioremediation by Division of Biotechnology, PSCST, 2013.
2. R.C. Dubey., 2014. A Text Book of Biotechnology by Fifth Revised *Edition* S. Chand Publications.
3. Wong J.W-C., Tyagi R.D., and Pandey. A., 2016. Current Developments in Biotechnology and Bioengineering Solid waste, Elsevier.

COURSE DESIGNERS				
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17BTEC16	CANCER BIOLOGY	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Cancer Biology is to learn the foundation principles in cancer mechanisms. It creates a broad base of knowledge to differentiate normal and cancerous cell and also about different types of agents leading to carcinogenesis. It aims to provide the strength to acquire an advanced knowledge and understanding of the molecular mechanism, diagnosis, prevention and therapeutic management

PRERQUISITE

17BTCC09-MOLECULAR BIOLOGY

COURSE OBJECTIVES

1	To define the basic principles in cancer biology.
2	To discuss about the carcinogens.
3	To demonstrate students on various genetic and molecular changes normal cells undergo during transformation into malignant cancer
4	To outline mechanism of cancer development and progression
5	To have an understanding in a multidisciplinary approach to *cancer treatment*

COURSE OUTCOMES

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

CO1. Relate the hallmarks of cancer.	Remember
CO2. Differentiate the types of gene mutations and cancer formation.	Understand
CO3. Demonstrate the molecular mechanisms underlying the development of cancer	Apply
CO4. Correlate the genomic knowledge.	Analyse
CO5. Infer the cancer progression, metastasis and new therapies.	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L	-	L	L	L	-	L	S	-	-	-	-	-	-
CO2	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	S	S	-	M	-	-	S	-	-	-	-	-	-	-	-
CO4	M	M	L	-	-	-	-	-	M	-	-	-	-	-	-
CO5	M	M	M	L	-	-	-	-	-	-	-	L	-	-	L

S- Strong; M-Medium; L-Low

SYLLABUS

FUNDAMENTALS OF CANCER BIOLOGY

Cell cycle and check points, Cancer mechanism, Receptors, Signal molecules, Signal transduction – Modulation study, Tumour suppressor gene, Different forms of cancers, Diet and cancer. Detection using biochemical assays, Tumor markers, Molecular tools for early diagnosis of cancer.

PRINCIPLES OF CARCINOGENESIS

Theory of carcinogenesis, Chemical carcinogenesis, Metabolism of carcinogenesis, Principles of physical carcinogenesis – X – ray radiation, Mechanism of radiation carcinogenesis.

PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER

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.

PRINCIPLES OF CANCER METASTASIS

Clinical significances of invasion, Heterogeneity of metastatic phenotype, Metastatic cascade, Basement membrane disruption, Three step theory of invasion, Proteinases and tumour cell invasion, Angiogenesis.

NEW MOLECULES FOR CANCER THERAPY

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

TEXTBOOKS

1. Maly, B.W.J., 1987. Virology A Practical Approach. IRLI Press, Oxford.
2. Dunmock, N.J. and Primrose, S.B., 1988. Introduction to Modern Virology. Blackwell Scientific Publications, Oxford.

REFERENCES:

1. An Introduction Top Cellular and Molecular Biology of Cancer, Oxford Medical Publications, 1991.

2. Primrose, S.B. and Twyman, R.M., 2006. Principles of Gene Manipulation and Genomics. Blackwell Publishing.3. Lewis J. Klein Smith, 2005. Principles of Cancer Biology. Benjamin Cummings.

4. MomnaHejmadi, 2000. Introduction to Cancer Biology. Asian Publishing Exchange Pvt. Ltd.

5. Leonard Maurice Franks L., Natalie N., 2007. Cellular and Molecular Biology of Cancer. Oxford University Press.

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17BTEC17	APPLIED BIOTECHNOLOGY	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

This is a multidisciplinary course deals with various aspects like plant and animal biotechnology, medical biotechnology, Biopharmaceutical technology, Bioprocess and Environmental biotechnology to educate students within the field of Biotechnology. Students will gain theoretical and practical competence within the broad field of Biotechnology, both in the molecular level as well as with its applications.

PREREQUISITE

17BTCC11-PLANT AND ANIMAL BIOTECHNOLOGY

COURSE OBJECTIVES

1	To list the basic techniques of plant tissue culture for crop improvement.
2	ToDescribethe novel techniques used in medical biotechnology
3	To outline the recombinant therapeutics in pharmaceutical industry
4	To distinguish the uses of different microbes in various industry
5	To execute theuse of genetically engineered organisms in environment

COURSE OUTCOMES

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

CO1. Recall the basic information about plant tissue culture techniques	Remember
CO2. Demonstrate the various novel techniques used in medical field	Understand
CO3. Validate the different methods for the production of therapeutics agents in pharmaceutical industry	Evaluate
CO4.Examine the uses of genetically engineered microbes in Industrial application	Analyze
CO5. Employ the uses of genetically engineered organism in Environmental issues	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	S	-	S	-	M	S	-	-	-	M	-	-	-
CO2	S	M	M	-	S	-	M	-	-	-	-	L	-	-	-
CO3	S	M	-	S	M	S	-	S	-	-	-	M	-	-	-
CO4	M	L	M	-	S	M	M	S	-	-	-	L	-	-	-
CO5	M	-	-	-	M	L	S	S	-	-	-	L	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

PLANT AND ANIMAL BIOTECHNOLOGY

Plant tissue culture and application of transgenic for crop improvement in agriculture, horticulture and forestry, Plantibodies, plastic from plant, genetically modified soybean, transgenic animals and its uses.

MEDICAL BIOTECHNOLOGY

Gene therapy – gene delivery methods, New approaches, Applications of stem cell in the treatment for major diseases in reparative medicine, Hematopoietic Stem Cell transplantation, Applications of tissue engineering – reconstruction of connective tissues, epithelial and endothelial surfaces, DNA fingerprinting, DNA based diagnosis of Genetic disease.

BIOPHARMACEUTICAL TECHNOLOGY

Production of recombinant pharmaceutical products – Biotechnology derived products (Therapeutic proteins): Study of hematopoietic growth factor, Interferon's and Interleukins, Insulin, Growth hormones, Vaccines and Monoclonal antibody-based pharmaceuticals, Recombinant coagulation factors and thrombolytic agents, Somatostatin, Somatotropin.

BIOPROCESS TECHNOLOGY

Application of microbes in industry – Industrial Processing, recovery, extraction and purification, Production of antibiotics, solvents, organic acids, amino acids, enzymes, vitamins, single cell protein, food substances from brewing and dairy industry.

ENVIRONMENTAL BIOTECHNOLOGY

Use of genetically engineered organisms, bioleaching and its applications in environmental science, Fuel technology – Ethanol and Biogas. Biotechnological applications in waste management, Novel methods for pollution control, Biosensors, Biodegradable plastics, Biotechnology in Pesticide, Tannery and Paper industry.

TEXT BOOKS

1.Gupta, P.K. , 2015. Elements of Biotechnology. *Rastogi Publications*.

2.Vaidyanath Pratap Reddy and Sathya Prasad, 2004. Introduction to Applied Biology and Biotechnology. 1st Edn., *B. S. Publications.* Hyderabad.

3. Gary Walsh. Biopharmaceutical: Biochemistry and Biotechnology. 2nd Edn., *John Wiley & sons Ltd.*

4. Samuel E. Lynch and Be Roberts J. Geng. Tissue Engineering.

REFERENCE BOOKS

1. Maulik and Patel, 1996. Molecular Biotechnology Therapeutic Applications and Strategies. *Wiley & Sons*.

2. Cruger, W. and Cruger, A., 2004. Biotechnology : A Text Book of Industrial Microbiology. 2nd Edn., *Panima Publishers*.

3. Kumar, H.D. Modern Concepts and Biotechnology. *Vikas Publication House Pvt. Ltd*.

4. Casida, L.E., 2000. Industrial Microbiology. *New Age International*, Delhi.

5. Bernhard Palsson, Jeffery A. Hubble, Robert P. Lonsey, Joseph D. Bronzino, 2005. Tissue Engineering, Principles and Applications in Engineering, *CRC Press*.

6. Sharma, B.K. Environmental Chemistry.

COURSE DESIGNERS				
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17BTEC18	METABOLIC ENGINEERING	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Metabolic engineering involves the redesign of metabolism to enable cells to produce new products such as valuable chemicals and biofuels, and/or remediate toxins. This field is growing rapidly in both academia and industry. The biotechnology industry requires skilled engineers with knowledge of how to apply engineering principles to metabolic pathways in order to analyse, design, and alter cell functions. The introduction of basic concepts, current technologies, and challenges within the field will provide students with a valuable toolset to address metabolic engineering problems that are relevant to the emerging biotechnology industry.

PREREQUISITE –

17BTCC06-ADVANCED BIOCHEMISTRY

COURSE OBJECTIVES

1	To define the appropriate host and/or metabolic pathways to produce a desired product or remediate a toxin
2	To describe and compare the potential metabolic engineering strategies using quantitative metabolic modeling - concepts
3	To analyze metabolic flux and to determine metabolic pathway utilization using 13C-labeling strategies
4	To assess and derive effective combinatorial metabolic engineering strategies
5	To produce those strategies to implement genetic manipulations

COURSE OUTCOMES

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

CO1. Recall about energetics of cellular metabolism	Remember
CO2.Describe the structure and regulation of metabolic networks	Understand
CO3. Explain the optimal strategy for introducing directed genetic changes in the microorganisms with the aim of obtaining better production strains	Understand
CO4. Demonstrate the modern biology with engineering principles.	Apply
CO5. Design Case studies on metabolically engineered products and processes in various expression systems	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	M	-	-	-	-	-	-	-	-	-	-	-	L
CO2	S	M	M	L	M	-	-	-	-	-	-	-	-	-	-
CO3	S	L	-	L	L	M	-	-	-	-	-	-	-	-	L
CO4	S	M	L	-	-	-	-	-	-	-	-	-	-	-	-
CO5	M	S	M	L	-	-	-	-	L	-	-		-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Overview of metabolism, Basic concept of metabolic engineering, Cellular metabolism, Transport Processes-Active and passive transports, Biosynthetic and degradation pathways of amino acids, nucleotides, fats and nucleotides

METABOLIC FLUX ANALYSIS

Introduction to metabolic engineering, comprehensive models of cellular reactions with stoichiometry and reaction rates; metabolic flux analysis of exactly/over/under determined systems. Shadow price, sensitivity analysis.

CONSTRAINT BASED GENOMIC SCALE METABOLIC MODEL

Underdetermined systems- linear programming, sensitivity analysis, Development of Genomic scale metabolic model, Flux balance analysis, Regulatory on-off Minimization and Minimization of metabolic adjustments and Opt knock tool development, Elementary mode analysis, Extreme pathways.

METABOLIC FLUX ANALYSIS BY ISOTOPIC LABELLING

Methods for the experimental determination of metabolic fluxes by isotope labeling metabolic fluxes using various separation-analytical techniques. Validation of flux estimates by 13C labeling studies in mammalian cell culture

CASE STUDIES IN METABOLIC ENGINEERING

Metabolic engineering examples for bio-fuel, bio-plastic and green chemical synthesis. Study of genome scale model in various systems for the production of green chemicals using software tools. Validation of the model with experimental parameters

TEXTBOOKS

1. Smolke, C. (2009). “The Metabolic Pathway Engineering Handbook”, 1st Edn., CRC press.
2. Kholodenko, B. (2004). “Metabolic Engineering in the Post Genomic Era”, New edition Edn., Taylor & Francis.
3. Torres N. V. and Voit, E. O.(2002).“Pathway Analysis and Optimization in Metabolic Engineering”, 1st Edn., Cambridge University Press.
4. Cortassa, S, Aon, M.A. Iglesias, A.A. and Lloyd, D (2002). “An Introduction to Metabolic and Cellular Engineering”, 1st Edn., World Scientific Pub. Co.

REFERENCES

1. NéstorV.Torres and Eberhard O. Voit (2011) Pathway Analysis and Optimization in Metabolic Engineering Ist edition, Cambridge University Press.
2. Gregory N. Stephanopoulos, Aristos A. Aristidou, and Jens Nielsen (1998) Pathway Analysis and Optimization in Metabolic Engineering by Metabolic Engineering: Principles and Methodologies,Academic Press
3. Routledge Chapman &Hall and E. Goldberg (1997), Handbook of Downstream Processing , Inc

Staff				
COURSE DESIGNERS				
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17BTEC19	**CLINICALTRIALS**	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Clinical Trial is to expose the students to literature survey and to understand research objectives, learn the advanced instrumental techniques to be used in research, and computational application in Pharmaceutical and Medicinal Chemistry research. The students should also be made aware of the research ethics, principles and conduct of clinical trials for medical research and Intellectual Property Right.

PRERQUISITE - NIL

COURSE OBJECTIVES

1	To recognize the research objectives
2	To discuss with the essential components necessary to conduct clinical trial research
3	To Demonstrate the basic principles for design of clinical trials
4	To Execute toxicological studies
5	To Check the interventions

COURSE OUTCOMES

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

CO1 Relate the research work.	Remember
CO2 Identify the research component	Understand
CO3 Illustrate the procedures for clinical trial	Apply
CO4 Demonstrate the role of toxicology in drug development	Apply
CO5 Assess a Clinical trial	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2	PSO3
CO1	M	-	-	L	-	L	-	L	L	-	-	-	-	-	-
CO2	S	M	-	-	L	-	-	L	-	-	-	L	-	L	-
CO3	M	L	M	M	-	-	M	-	-	-	-	-	-	-	-
CO4	L	L	L	L	-	-	-	-	M	-	-	-	-	-	M
CO5	S	-	S	M	-	L	-	S	-	-	L	S	-	-	L

S- Strong; M-Medium; L-Low

SYLLABUS

PURPOSEOF RESEARCH

Research –Meaning, Purpose,Types, (Educational, Clinical, Experimental, Historical Descriptive, Basic applied and Patent oriented research), Objectives of research, Literature survey –Use of Library, Books and Journals–Medlines–Internet, Patent Search and Reprints of articles as a source for Literature survey, Selecting a problem and preparing research proposals.

BASIC TERMINOLOGY USED IN CLINICAL RESEARCH

Research –Meaning, Purpose, Types,(Educational, Clinical, Experimental, Historical Descriptive, Basic applied and Patent oriented research), Objectives of research, Literature survey –Use of Library, Books and Journals–Medlines–Internet, Patent Search and Reprints of articles as a source for Literature survey, Selecting aproblem and preparing research proposals.

CLINICAL TRIALS

New drug discovery process – Purpose, Main steps involved in new drug discovery process, Timelines of each steps, Advantages and purposes of each steps, Ethics in clinical research, Unethical trials, Thalidomide tragedy, Phase – I, II, III, IV trials (Introduction and designing, Various phases of clinical trials, Post marketing surveillance, Methods, Principles of sampling, Inclusion and exclusion criteria, Methods of allocation and randomization, Informed consent process in brief, Monitoring treatment outcome, Termination of trial, Safety monitoring in clinical trials).

PRECLINICAL TOXICOLOGY

General principles, Systemic toxicology (Single dose and repeat dose toxicity studies), Carcinogenicity, Mutagenicity, Teratogenicity, Reproductive toxicity, Local toxicity, Genotoxicity, Animal toxicity requirements.

APPLICATIONS

Study of various clinical trials (completed or ongoing), Clinical trial applications in India Import and export of drug in India, Investigational New Drug application (IND), Abbreviated New Drug Application (ANDA), New Drug Application (NDA).

TEXTBOOKS

1. Katzung, B. G. Basic and Clinical Pharmacology. *Prentice Hall International*.
2. Laurence, D. R. and Bennet, P. N. Clinical Pharmacology. *Scientific Book Agency*.
3. Krishna, D. R. and Klotz, V. Clinical Pharmacokinetics. *Springer Verlab*.
4. Lippincott, Williams and Wilkins. Remington Pharmaceutical Sciences.
5. Kven Stockley and Hamsten. Drug interaction.

REFERENCES:

1. Ethical Guidelines for Biomedical Research on Human Subjects. *Indian Council of Medical Research*, New Delhi, 2000.
2. Rick, N.G., 2004. Drug from Discovery to Approval. *John Wiley & Sons Inc.*.
3. Mehra, J. K. Drug interaction. *Basic Bussiness Publication.*
4. Grahame smith and Aronson. Clinical Pharmacology and Drug Therapy.
5. Richard A. Helms. Text Book of Therapeutics Drug and Disease Management. Hardbound.
6. Herfindal, E. T., Hirschman, J. L., Williams and Wilkins. Clinical Pharmacy and Therapeut

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17BTEC20	AGRICULTURAL BIOTECHNOLOGY	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

This course deals about the biology of plants, plant microbe's interaction, genetic manipulation of crops, different vectors and their applications and how plant act as factories for the production of various compounds. This course will prepare the students for a variety of careers, including modern plant biotechnology processes, breeding of healthy plants, plants with improved characteristics and p`lants for biomolecule production.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To state the basic of cell structure and function
2	Todescribe the interaction of microbes and plants
3	To perform the novel techniques used in genetic manipulation in crops
4	To categorise the uses of different vectors in biotechnology
5	To produce the different organic compounds using Plants as Factories

COURSE OUTCOMES

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

CO1. Recall the basic information about cell structure and functions	Remember
CO2. Interpret about plant and microbes interactions	Understand
CO3. Demonstrate the novel techniques used in genetic engineering and genetic manipulation in crop improvement	Apply
CO4. Examine the uses of different vectors and their application in biotechnology field	Analyze
CO5. Prepare the different organic compounds like vitamins, amino acids and proteins etc, using plant as a major source.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	-	-	-	-	L	L	-	L	-	-	L	L	-	L
CO2	-	M	-	S	-	M	S	L	-	-	L	L	L	L	-
CO3	M	-	M	-	L	S	M	M	M	M	-	L	L	-	-
CO4	L	-	L	-	S	L	S	M	-	-	-	-	M	-	-
CO5	S	-	L	-	L	L	L	M	-	-	-	M	M	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

BIOLOGY OF PLANTS

Plant cell structure and functions. Plant nutrition, Water and mineral availability and uptake. Growth regulators-Phytohormones, auxins, cytokines, Gibberellins, Abscisic acid, ethylene.

PLANT –MICROBES INTERACTIONS

Biotic and Abiotic stress. Plant response to pathogens. Toxins of fungi, algae and bacteria. Systemic and induced resistance, pathogen derived resistance. Genetic engineering for biotic stress resistance.

GENETIC MANIPULATION IN CROPS

Genetic engineering- scope and methods. Gene guns, electroporation, transformation, microinjections, CRISPR, TALEN. Types of modifications- Transgenic, cisgenic, subgenic. Stress resistance, pest resistance, herbicide tolerance and other modified traits.

PLASMIDS AND PROMOTERS

Ti and Ri plasmids, Antisense and RNAi in crop improvement. Disarming Ti plasmid, opines and their significance. Co integrate and binary vectors. Screenable and selectable markers. Promoters and poly A signals.

PLANTS AS BIO –FACTORIES

Seed storage proteins, essential amino acids, vitamins and minerals, heterologous protein production in transgenic plants for agriculture, industry and pharmaceuticals uses, biodegradable plastics.

TEXT BOOKS

1. Ahindra Nag. Textbook of Agricultural Biotechnology. PHI Publisher. 2008.

REFERENCE BOOKS

1. Adrian Slater, Nigel Scott and Mark Fowler. 2003. Plant Biotechnology: The genetic manipulation of plants. I edition, Oxford University Press.
2. Vidhyasekaran P. 2005. Bacterial disease resistance in plants. Molecular Biology and Biotechnological applications. Haworth food and agricultural products press. New York.
3. Pessarakti M. 1999. Handbook of planrt and crop stress, 2nd edition. Marcel Dekkar Inc. New York.
4. Melvin J oliver. Agricultural Biotechnology. Wiley Blackwell. 2009

COURSE DESIGNERS

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1	A.Nirmala	Assistant professor	Biotechnology	nimmi_aruna@yahoo.com
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17BTEC21	GENOMICS AND PROTEOMICS	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Genomics and Proteomics deals with a rapidly evolving scientific area that introduces students into genomes, proteomes and databases that store various data about genes, proteins, genomes and proteomes. Students would learn about genomics, proteomics and bioinformatics and offer basic knowledge of genome sequencing, major differences between prokaryotic and eukaryotic genomes, basic proteomics and its applications. Students would gain skills in applied bioinformatics, comparative, evolutionary, human genomics and functional genomics. The acquired knowledge during the course would be helpful to those students who want to work in core facilities and commercial biological and medical laboratories as well as in their postgraduate studies.

PREREQUISITE

17BTCC12- GENETIC ENGINEERING

COURSE OBJECTIVES

1	To explain advanced theoretical knowledge on the organization and function of genomes
2	To execute different mapping techniques.
3	To Perform gene identification and gene expression studies
4	To outline the identification, separation and sequencing of proteins
5	To evaluate the principles of bioinformatics and databases

COURSE OUTCOMES

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

CO1. To describe the organisations genes in prokaryotes and eukaryotes	Understand
CO2. To illustrate various genome mapping techniques and its strategies.	Apply
CO3. To relate the flow of genetic information from DNA to RNA to protein	Apply
CO4. To compare the advantages and the drawbacks of various proteomics technologies with the emerging technologies	Analyse
CO5. To evaluate the role of proteomics in drug discovery	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	M	L	L	L	L	-	L	-	-	-	-	L	L	L	L
CO3	M	L	-	L	L	L	-	-	-	-	-	-	-	L	-
CO4	L	L	L	-	L	-	L	-	L	-	-	-	L	-	-
CO5	S	M	L	L	-	-	-	-	L	-	-	-	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

OVERVIEW OF GENOMES OF PROKARYOTES, EUKARYOTES AND HUMAN

Organisation of genes, Coding and non-coding chromosomes and high order structures, Genome relatedness, Introduction of genomics.

MAPPING TECHNIQUES

Mapping strategies, Maps – Physical and Genetic maps, Comparative map, Integrated map, Top down and bottom up approach, linking and jumping of clones, STS maps, Human Genome Project

FUNCTIONAL GENOMICS

Gene identification and prediction, Annotation, Functional prediction, Gene expression and micro arrays, Substractive DNA library screening, differential display and representational difference analysis, SAGE.

PROTEOMIC TOOLS

Edman protein microsequencing, Proteome analysis, 2D gel electrophoresis, Metabolic labeling, Detection of protein on SDS gels. Mass spectrometry – MALDI - TOF, Tandem MS - MS, Peptide mass finger printing.

PROTEIN PROFILING AND APPLICATION OF PROTEOMICS

Protein – protein interaction, Post translational modification, Proteomics in drug discovery.

TEXT BOOKS:

1. Rastogi, S.C., Mendiratta, N. and Rastogi, P, 2008. Bioinformatics Methods and Applications. Prentice-Hall of India (Private), Limited.
2. Andreas D. Baxevanis and Francis Oueliette, B.F, 2004. Bioinformatics A Practical Guide to the Analysis of Genes and Proteins, 3rd Edition. *John Wiley and Sons Inc*.

REFERENCES:

1. David W. Mount, 2001. Bioinformatics, Sequence and Genome Analysis. *Cold Spring Harbor Laboratory Press*.
2. Pennington and Dunn, 2001. Proteomics. *BIOS Scientific Publishers*.
3. Liebler, 2002. Introduction to Proteomics. *Humana Prem*.
4. Primrose and Twyman, 2003. Principles of Genome Analysis and Genomics. *Blackwell Publishing Co*.
5. Westhead, D.R., Parish, J.H. and Twyman, R.M., 2003. Instant Notes Bioinformatics. 1st Edn.,*Viva Books Private Limited*.
6. Ignacimuthu, S., 2005. Basic Bioinformatics. *Narosa Publishing House*.

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17BTEC22	MOLECULAR MODELLING AND DRUG DESIGNING	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

This course enables the students to broaden their interests to use structure-based and non-linear classification methods in drug design.

PREREQUISITE

17BTEC03-PRINCIPLES OF BIOINFORMATICS

COURSE OBJECTIVES

1	To list concepts involved in molecular modeling
2	To summarize molecular mechanisms involved in energy minimization
3	To execute the molecular dynamics using different models
4	To develop basic steps involved in modeling of proteins
5	To justify the molecular dynamics in drug designing and discovery

COURSE OUTCOMES

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

CO1. Recognize about molecular modeling concepts	Remember
CO2. Classify molecular mechanisms behind energy minimization problems	Understand
CO3. Illustrate the models to study the molecular dynamics	Understand
CO4. Compare molecular dynamics with drug designing concepts	Apply
CO5. Design new techniques for the discovery of drugs	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	M	L	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	M	M	-	L	-	-	-	-	-	-	-	-	-	-	-
CO4	S	M	L	M	M	-	-	-	-	-	-	L	-	-	-
CO5	S	M	S	L	M	L	-	-	-	-	-	L	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

QUANTUM MECHANICS & CONCEPTS IN MOLECULAR MODELING

Introduction – coordinate systems – potential energy surfaces – introduction to quantum mechanics – postulates – Schrodinger wave equation – hydrogen molecule – Born-Oppenheimer approximation, introduction to computer hardware and software

MOLECULAR MECHANICS AND ENERGY MINIMIZATION

Empirical force field models – Bond stretching – angle bending – torsional term – nonbonding interactions – thermodynamics properties using a forcefield – derived and non-derived energy minimization method – simplex – sequential univariate method – steepest descent method – conjugate gradient method- Newton-Rapson method.

MOLECULAR DYNAMICS AND MONTE CARLO SIMULATION

Introduction – Using single Model – time steps – Multiple steps – Setting up MD – energy conservation in MD Simulation Examples – Monte Carlo – Random number generation – Difference in MD & MC

HOMOLOGY MODELING

Comparative modeling of proteins – comparison of 3D structure – Homology – steps in homology modeling – tools – databases – side chain modeling – loop modeling.

DRUG DESIGN

General approach to discovery of new drugs - lead discovery – lead modification – physiochemical principles of drug action – drug stereo chemistry –drug action - 3D database search – computer aided drug design – docking - molecular modeling in drug design – structure based drug design – pharmacophores - QSAR

TEXTBOOKS:

1. Leach R. (1996), "Molecular Modeling Principles and Application", 2nd edition, Longman Publications.
2. Baxivanis D. and Foulette - Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd Edition edition, Wiely-Blackwell Publishers
3. Kothekar V. (2001), "Essentials of Drug Designing", Indian Edition, Dhruv Publications
4. Gerhard Edwin Seibold, Alexander Hillisch, Rolf, (2002) "Modern Methods of Drug Discovery", Hilgenfeld Publisher.

REFERENCES:

1. Attwood, T K , parry-Smith, D J (2005), " Introduction to Bioinformatics", Pearson Education, 1st Edition, 11th Reprint
2. Alan Hinchliffe, (2003), " Molecular Modelling for Beginners", John-Wiley
3. "Drug Design: Cutting Edge Approaches". AngewandteChemie, International Edition,Vol.42 "Advanced Drug Design and Development" Kourounakis Taylor and Francis

COURSE DESIGNERS

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17BTEC23	NANOBIOTECHNOLOGY	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

One of major applications of nanoscience is in biotechnology field. In various disciplines, a single course which starts by sensitizing students from a varied background about the biological/biotechnological basics and culminates into modern day applications of nanoscience in biotechnology field will be highly useful. This course will act as a bridge between students from non-biology course at all levels

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To define about the basic concepts of Nanotechnology.
2	To explain about the Fabrication and Characterization of nanomaterials
3	To classify the nanoscale elements delivery in Biosystems
4	To outline the interaction of Microorganism in Nanobiotechnology.
5	To design the novel drug delivery system for *in vivo* studies

COURSE OUTCOMES

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

CO1. Recall the terms and properties of nanoparticles	Remember
CO2. Interpret and characterise the nanoparticles using biotechniques	Understand
CO3. Illustrate the properties of nanoparticle in signalling pathway	Apply
CO4. Examine the role of microorganisms in Nanobiotechnology	Analyse
CO5. Assess the role of Nan particles in treatment of disease	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO	PSO2	PSO3
CO1	-	-	-	-	-	-	L	-	-	-	-	L	-	-	-
CO2	S	-	S	-	L	-	-	-	L	-	L	L	S	L	L
CO3	-	-	M	-	-	-	-	-	-	-	-	L	L	-	-
CO4	L	-	-	-	S	-	S	-	S	-	M	M	L	M	-
CO5	L	L	M	-	M	M	-	S	M	S	L	S	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO NANOBIOTECHNOLOGY

Introduction to types and properties of nanoparticles, Overview of nanodevices and techniques, Inorganic nano scale systems for biosystems–Nanostructured materials–Fullerenes: Properties and characterization – Carbon nanotubes: Characterisation and application–Quantum dots and wires–Gold Nanoparticles –Nanopores

FABRICATION AND CHARACTERISATION

Synthesis –Top-down and Bottom-up Methods, Epitaxial growth, Characterization: X-Ray Diffraction

(XRD), Transmission Electron Microscopy(TEM), Scanning Electron Microscopy (SEM), Scanning Tunneling Microscopy (STM), Atomic Force Microscopy (AFM), Energy Dispersive of X ray spectrum (EDS)

NANOMOLECULES IN BIOSYSTEMS

DNA, RNA, Proteins and Lipids–Nanoscale elements for delivery of materials into cells, Nanotechnology in cell –Cell motility: Nanomotors and cellular navigation– Chemotaxis – Transmembrane signalling and related proteins.

MICROORGANISMS AND NANOBIOTECHNOLOGY

Nanobiotechnology and microorganisms – Polyhydroxy alkanotes (PHA) Cyanophycin inclusions– Magnetosomes– Alginates s-layer proteins –Bacteriorhodopsin.

APPLICATIONS OF NANOBIOTECHNOLOGY

Nanomedicine, Nanobiosensor–Electrochemical DNA sensors, Nanobiochips, Nanocrystals in Biological Detection, Small scale systems for *in vivo* drug delivery, Nanotechnology for diagnosis and treatment (Cancer and Leprosy), Commercializing Nanobiotechnology. Nanotechnology for disaster relief – Decontamination Emergency equipment, Lab on a chip and sustainability.

TEXT BOOKS:

1. BhushanBharat (Ed.). Hand book of Nanotechnology. *Springer* 3rd Edition (2010)
2. Ajayan P.A. and Schadler L, Braun P. V., Nanocomposite Science and Technology. *Wiley– VCH* (2003).
3. Nlemeyer, C.M. (Ed.) and Mirkin, C.A. (Ed.) Nanobiotechnology–Concepts, Applications and Perspectives. *Wiley–VCH* (2004)
4. GeoffOzin and Arsenault, A., Nanochemistry: A Chemical Approach to Nanomaterials. 1st Edn., *Royal Society of Chemistry* (2005)
5. Charles P. Poole and Junior Frank J. Owens, Introduction to Nanotechnology. *John Wiley and Sons* (2003).

REFERENCES:

1. Rosenthal, S.J. and Wright, D.W. Nanobiotechnology Protocols in methods in Molecular Biology Series. *Humana Press* (2005).
2. Michael Crichton. Understanding Nanotechnology. *Scientific American Publisher* (2002).
3. RalphS.Greco,FritzB.Prinz and LaneSmithm,R., Nanoscale Technology in Biological systems. *CRC Press* (2005).

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17BTEC24	**BIOFERTILIZER TECHNOLOGY**	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

This course will provide knowledge of comprehensive understanding of the biofertilizer technology and its current trends. It develops the entrepreneurship to catch with the current trends as well as creating the industry ready professionals.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To state the basic knowledge on biofertilizer in agriculture.
2	To discuss about the role of biofertilizer in crop production
3	To implement the production and application of biofertilizer technology
4	To outline the marketing strategies of biofertilizer.

COURSE OUTCOMES

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

CO1. Recall the types and importance of biofertilizer.	Remember
CO2. Describe in detail about the different chemical fertilizer, green manuring and its role in crop production	Understand
CO3. Illustrate the functions of microorganism from various sources and their mass production	Apply
CO4. Appraise in detail about the application and limitation of biofertilizer in crop field	Analyze
CO5. Estimate the promotion and strategies improvement in distribution system.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	-	L	-	-	L	-	-	-	L	L	-	L	-
CO2	S	M	S	-	-	-	S	-	-	-	L	L	L	L	-
CO3	M	-	M	M	-	-	M	-	-	-	L	-	-	-	-
CO4	L	-	-	L	-	-	S	-	-	-	-	-	-	-	-
CO5	S	M	L	L	-	-	-	-	-	-	L	S	-	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

BIOFERTILIZER

Definition and types, importance of biofertlizers in agriculture, Characteristics of biofertilizers- *Rhizobium*, *Azotobactor*, *Azospirillum*, Phosphate solubilizing microorganisms, cyanobacteria, *Azolla*, Mycorrhizae. Symbiosis- Physiology, biochemistry and molecular genetics of symbiosis, Enzymes and their regulation: Nitrogenase, hydrogenase

BIOFERTILIZER AND ITS ROLE IN CROP PRODUCTION SYSTEM

Different chemical fertilizer, its function and effect on agriculture. Role of organic matter on crop production and soil health. Various type of bio-inocula and techniques application and keep soil environment free from pollution. Green manuring, its sources, use and role in cropping system.

FUNCTION AND MASS SCALE PRODUCTION

Total and differential count of microorganisms from soil, water and carrier material. Nitrogen cycle andnitrogen fixation technology. Isolation, purification, screening, selection, mass scale production and preservation of *Rhizobia/Bradyrhizobia, Azotobacter, Azospirillum*, PSB and KSB. General biology, function, use and important of green manuring, particularly Sesbania and Azolla.

APPLICATION TECHNOLOGY

Strain selection, sterilization, growth and fermentation, mass production of various biofertilizers. Application technology: Standards and quality control, application for field and tree crops, nursery plants and seedlings. Limitation of bio-fertilizer and bio-pesticide application in agriculture.

EXTENSION, PROMOTION AND MARKETING

Extension strategies, diagnosis for the effectiveness of inoculation, improvement in distribution system.

TEXT BOOKS:

1. Dr. HLS Tomdon, Fertilizers, organic manures, recyclable water and biofertilizer, Fertilizer development and consultation organization 204-204 A New Delhi.
2. S.L. Tisdale, J.D. Beaton, W.L. Nelson, J.L. Havling, Soil fertility and fertilizers, fifth edition, Mc millan publishing company 866 third avenue new yark.
3. R. Serraj, Symbiotic nitrogen fixation prospects for enhanced application in tropical agriculture, Oxford & IBH publishing Co Pvt. Ltd New Delhi.

REFERENCES:

1. HLS. Tandan, Biofertilizer technology marketing and uses, Fertilizer development.
2. N.S. Subba Rao, Biofertilizer in Agriculture, Oxford & IBH Publishing co.pot ltd.

COURSE DESIGNERS

S.No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1	R. Deepa Priya	Assistant professor	Biotechnology	deepapriya.biotech@avit.ac.in
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17BTEC25	BIOLOGY FOR NON BIOLOGISTS	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

The purpose of this course is to provide a basic understanding of biological mechanisms of living organisms from the perspective of engineers. In addition, the course is expected to encourage engineering students to think about solving biological problems with engineering tools.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To list out the students with the basic organization of organisms and subsequent building to a living being
2	To summarize about the machinery of the cell functions that is ultimately responsible for various daily activities.
3	To implement the knowledge about biological problems that requires engineering expertise to solve them.

COURSE OUTCOMES

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

CO1: Recall the structure and cell theory of living organism.	Remember
CO2: Discuss about the biological diversity of life.	Understand
CO3: Classify the application of enzymes in industrial level.	Apply
CO4: Detect the uses of Bioremediation and Biosensors using molecular machines.	Analyse
CO5: Appraise in detail about the principles of cell signalling in nervous system and immune system.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	-	-	-	-	-	-	-	-	-	-	L	L	L	-
CO2	S	M	S	-	-	M	S	-	L	L	-	L	L	L	-
CO3	-	L	M	-	L	S	M	-	M	M	L	L	M	L	L
CO4	L	L	L	L	-	L	S	M	S	L	-	M	L	M	M
CO5	S	M	L	L	-	-	-	-	-	S	L	S	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO BIOLOGY – CELL AND CELL STRUCTURE AND FUNCTION

Introduction, Scope, Disciplines of biology –An over View of plants, animal, Microorganism.

INTRODUTION TO BIOLOGY – BIO CHEMISTRY, ENZYME, INDUSTRIAL USE

Prokaryotes – Eukaryotes, Cell, Cell structure, Organelles and their functions, Yeast, Bacteria –Friends and Foe.

FOOD DIET NUTRITION

Major constituents of food – carbohydrate, protein, lipids, vitamins and minerals. Balanced diet-BI-Junk food, Fermented food, nutritional values.

ENVIRONMENT

Clean environment-Reduce, Recycle and Reuse-Renewable energy-Waste management –water-waste water management – personal hygiene, Global Climatic Changes -Tsunami, global warming, storms, vardha, Okhi. Recycled products -Paper, No to plastic, go green.

HEALTH, IMMUNE SYSTEM AND MEDICINE

Immunology- Blood Grouping – Antigen- Antibody. Antibiotics, Vaccines their significance. Diagnosis –Parameters in Urine and Blood. Instruments – ECG, ECHO, MRI, X-ray. Prophylaxis, Chemotherapy and Allergy.

TEXT BOOKS:

1. J.M.Berg, J.L.Tymosczko and L.Sryer. Biochemistry, W.H Freeman publication.
2. Student Companion to accompany Biochemistry, Fifth Edition-Richard I. Gum port.
3. Frank H.Deis, Nancy Count Gerber, Roger E.Koeppe, 2 Molecular motors

REFERENCE BOOKS:

1. Albert’s, 2003, Molecular Biology of the cell
2. Lodish, 2004, Molecular cell Biology

COURSE DESIGNERS

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1	Dr. R. Deepapriya	Assistant Professor	Biotechnology	deepapriya21@gmail.com
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17BTEC26	ECO FRIENDLY MULTI STOREY BUILDING	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

The built environment is a major source of society's environmental impact, and is a major opportunity to find solutions. Recent attention to "green construction" emerges in many domains including energy systems, water use, construction processes, architectural design, site planning and brownfield development, At present, environmental issues can be considered in seemingly unlimited areas of the design and construction process.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To state about the infrastructure providing clean drinking water, clean air to breath and safe building to live in.
2	To explain the students about the threats due to pollution leading to sustainable infrastructure
3	To demonstrate the impact and aspects of green building and Architecture

COURSE OUTCOMES

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

CO1. Underline the concepts related to pollution problem during construction.	Remember
CO2. Classify the design of system for comfortable living	Understand
CO3. Employ geochemical transport model to maintain the thermodynamics equilibrium and kinetic control.	Apply
CO4. Appraise the Construction of buildings for economically, environmentally and socially sustainable to future.	Analyse
CO5. Evaluate the resources and sustainability of construction and green buildings	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L	L	L	L	L	-	L	L	L	L	L	-	-
CO2	S	M	S	S	-	-	-	-	-	-	L	-	-	L	-
CO3	M	L	M	M	-	-	-	-	M	M	L	L	M	-	-
CO4	L	L	L	L	-	-	-	-	S	L	-	M	L	M	M
CO5	S	M	L	L	-	-	-	-	-	-	-	S	S	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

CONCEPTS OF CONSTRUCTING MULTI STOREY BUILDING

Study of water, soil, air and their related pollution problems in construction. Identification and development of technical solution to solve / control problems- legislative, economic and social concern.

CONCEPT OF HUMAN HABITAT

Design of systems – Living area, ventilation, electrical circuits (less consumption) technologies and structures to suit the growing population for comfortable living.

GEOCHEMICAL ASPECTS OF GREEN BUILDING

Geochemical transport model maintaining thermodynamics equilibrium and kinetic control-Hydrology transfer resources and impact of bioremediation, treatment plant design, problem solving techniques, civil and environmental application of engineering science and creative problems solving methods

ENGINEERING ARCHITECTURE

Impact of architecture, engineering and construction on individuals, communities and nation. Construction of buildings which are economically, environmentally and socially sustainable to future - knowledge, tools and materials that enhance the safety and cost effective

RESOURCES AND SUSTAINABILITY

Environmental chemistry, advanced air and water treatment technologies durability of construction, green building (sustainable buildings). Resource efficient building from planning to design, construction, maintenance, renovation and demolition.

REFERENCE BOOKS:

1. Adaptation and mitigation of climate change - Scientific Technical Analysis. Cambridge University Press, Cambridge, 2006
2. Arvind Krishnan et al. – Climate Responsive Architecture, Tata Mcgraw –Hill New Delhi 2001.
3. Sandra Mendler, William Odell, The Guide Book Of Sustainable Design, John Wiley & Sons, 2000.
4. 4. Lawson.B , Bulding Materials, Energy And The Environment; Towards Ecologically Sustainable Development Raia, Act, 1996

COURSE DESIGNERS

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1	Dr.S.Vinoth	Assistant Professor	Biotechnology	vinogenes@gmail.com
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17BTEC27	RENEWABLE ENERGY AND CONSTRUCTION METHODS	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Course provides an introduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternate energy sources and their technology and application.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To list out the explore society’s present needs and future energy demands.
2	To explain conventional energy sources and systems, including fossil fuels and nuclear energy.
3	To perform on alternate, renewable energy sources such as solar, biomass (conversions), wind power, geothermal, and hydro.
4	To outline the energy conservation methods will be emphasized.

COURSE OUTCOMES

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

CO1. To state the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the environment.	Remember
CO2. Discuss remedies/potential solutions to the supply and environmental issues associated with fossil fuels and other energy resources.	Understand
CO3. Illustrate and describe the primary renewable energy resources and technologies.	Apply
CO4. Demonstrate the basic electrical concepts and system components.	Apply
CO5. Estimate the quantify energy demands and make comparisons among energy uses, resources, and technologies.	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L	L	L	L	L	-	-	-	-	-	-	-	-
CO2	S	M	S	S	-	M	S	-	L	-	-	L	L	-	-
CO3	M	L	M	M	-	S	M	-	-	-	-	L	M	-	-
CO4	L	L	L	L	-	L	S	-	-	-	-	M	L	-	-
CO5	S	M	L	L	-	M	M	-	-	-	-	S	S	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

PRINCIPLES OF SOLAR RADIATION

Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

SOLAR ENERGY COLLECTION STORAGE AND APPLICATIONS
Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors. Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating/cooling technique, solar distillation and drying, photovoltaic energy conversion.
WIND ENERGY
Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria
BIO-MASS
Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, I.C. Engine operation and economic aspects.
OCEAN ENERGY AND DIRECT ENERGY CONVERSION
OTEC, Principles utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.
Need for DEC, Carnot cycle, limitations, principles of DEC.

TEXT BOOKS:

1. GD Rai- Non-Conventional Energy Sources, Khanna Publishers, 2004
2. Twidell & Wier Renewable Energy Resources – 3rd Edition –, CRC Pres, Taylor & Francis, 2015

REFERENCES:

1. D.O.hall and R.P. Overeed - Biomass Renegerable Energy – John Wiley and Sons, New york, 1987.

COURSE DESIGNERS

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1	Dr.S.Vinoth	Assistant Professor	Biotechnology	vinogenes@gmail.com
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17BTEC28	ENVIRONMENT FRIENDLY PRACTICES IN CIVIL ENGINEERING	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

This course will make the student aware of the various construction techniques, practices and the equipment needed for different types of construction activities. At the end of this course the student shall have a reasonable knowledge about the various construction procedures for sub to super structure and also the equipment needed for construction of various types of structures from foundation to super structure.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To list out thestudents, who can work in a multi-disciplinary environment to anticipate and address evolving challenges of the 21st century.
2	To summarize the synthesize data with sound engineering principles, methodologies, and the latest technology into creative, sustainable, safe and economical engineering solutions to environmental engineering problems.
3	To classify the Characterize and mitigate natural and man-made hazards
4	To outline the fundamental knowledge of the inter-relationships between the built environment and natural systems.
5	To design the technological innovations needed to safeguard, improve, and economize infrastructure and society
6	To generate and apply high performance eco-friendly structural materials and systems.

COURSE OUTCOMES

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

CO1. Recall the function on multidisciplinary teams.	Remember
CO2. Exemplify to identify, formulate, and solve engineering problems.	Understand
CO3. Illustrate the professional and ethical responsibility. An ability to communicate effectively.	Apply
CO4. Categorize the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.	Analyse
CO5. Measure the convert units of energy—to quantify energy demands and make comparisons among energy uses, resources, and technologies.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	L	S	M	S	-	M	L	-	-	-	-	-
CO2	S	M	L	M	-	L	S	-	-	-	-	S	S	-	-
CO3	S	M	M	M	-	M	S	S	-	-	-	M	M	-	-
CO4	S	M	M	M	-	-	S	-	-	L	-	L	S	-	-
CO5	S	M	L	L	-	-	S	-	-	-	-	S	M	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

CIVIL ENGINEERING IN TWENTY FIRST CENTURIES

Essential skills and strategies- critical thinking, finance and economics, design skill, communication, law and ethics, heritage and future.

ENVIRONMENTAL IMPACT DESIGN (EID)

Definition, scope and strategies of EID, categorical types- Direct, indirect and cumulative and its impact. Focus on construction process, materialization and building efficiencies and its life cycle.

GEOCHEMICAL ASPECTS OF GREEN BUILDING

Geochemical transport model maintaining thermodynamics equilibrium and kinetic control-Hydrology transfer resources and impact of bioremediation, treatment plant design, problem solving techniques, civil and environmental application of engineering science and creative problems solving methods

ENVIRONMENTAL GEOLOGY

Introduction, definition, scope, geological factors- location, design, construction, operation and maintenance (residential, commercial and industrial development) stormwater drainage system, sewage treatment plant, geohazards.

ENVIRONMENTAL PUBLIC HEALTH PROTECTION

Definition, discipline - epidemiology, toxicology, exposure science, environmental engineering, law. Environmental health profession.

TEXT BOOKS

1.Prof. D. Venkat Reddy, NIT-Karnataka, Engineering Geology, Vikas Publishers, 2010 ISBN 978-81259-19032

2. Novice, Robert (editor) (1999-03-29). "Overview of the environment and health in Europe in the 1990s" *(PDF). World Health Organization.*

3. Neil S. Grigg, P.E.D.WRE, Marvin E. Crisus, P.E.Darrell, G. Fontune, J.Siller. 2001. Civil Engineering practice in twenty first century. ASCE Press.

REFERENCE BOOKS

1.Legget, Robert F., and Karrow, Paul F., 1983, Handbook of geology in civil engineering: McGraw-Hill Book Company, 1,340 pages, 50 chapters, five appendices, 771 illustrations. ISBN 0-07-037061-3

2.Price, David George, Engineering Geology: Principles and Practice, Springer, 2008 ISBN 3-540-29249-7

COURSE DESIGNERS

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17BTEC29	GREEN BUILDING AND SUSTAINABLE ENVIRONMENT	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Before starting with this course, one must get a clear knowledge on the basics of green building, learning the plan details of HVAC for a building, energy efficient modelling.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To define, develop and & Plan the details of Implementation.
2	To summarize the fundamentals of electric power systems and building electric wiring.
3	To demonstrate about the Bioclimatic design and concepts.
4	To construct the water conservation & water management systems.
5	To assess the key components of remodelling project.

COURSE OUTCOMES

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

CO1. Define the basics of green building	Remember
CO2. Discuss the advantages and benefitsof green building practices	Understand
CO3. Illustrate low energy architecture features in residential and commercial buildings	Apply
CO4. Develop proper water conservation systems to make up a healthy building	Apply
CO5. Validate the green sustainable materials and practices	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	M	M	-		L	-	-	-	-	-	-	L	L	-	-
CO4	M	M	-	-	S	-	L	-	-	-	-	-	-	M	-
CO5	M	M	L	L	S	S	-	L	-	-	-	-	-	L	L

S- Strong; M-Medium; L-Low

SYLLABUS

GREEN BUILDING BASICS AND PRACTICES:

Site Design / Development & Plan Implementation, Resource Efficiency, Energy Efficiency, Water Efficiency, Indoor Environmental Quality and Homeowner Education, Operation, Maintenance & Practices. Assessment of building design and construction, emission of CO_2, SO_2, and NO_2 of building materials, elements, and construction process.

ENERGY MANAGEMENT SYSTEM OF BUILDINGS

The objective of the course is to provide students the necessary tools to control, monitor and optimize the building's facilities, mechanical and electrical equipment for comfort, safety, and efficiency. It starts with the fundamentals of electric power systems and building electric wiring and then works through building automation systems (BAS) principles. The course allows students to acquaint applying BAS to commercial HVAC equipment, lighting systems, fire systems and security/observation systems.

LOW ENERGY ARCHITECTURE, PASSIVE BUILDING DESIGN

Solar geometry, climate/regional limitations, natural lighting, passive design and sustainability initiatives, insulating and energy storing material. Bioclimatic design and concepts. Case studies will be used extensively as a vehicle to discuss the success/failure of ideas and their physical applications.

WATER MANAGEMENT, BUILDING METHODS & MATERIALS

Water conservation, water management systems, water efficient landscaping, green roofing, rainwater harvesting, sanitary fixtures and plumbing systems, wastewater treatment and reuse, and process water strategies. AAC (Aerated Autoclave Concrete), ICF (Insulated Concrete Forms), new Advanced Framing & Insulation Techniques, SIPs (Structural Insulated Panels), Straw Bale and Pumice-crete Rammed Earth, Timber Frame, Straw Clay, and Earth ship buildings.

ENERGY EFFICIENT REMODELLING

Key components of remodelling projects-windows, walls, roofs, heating and ventilation, insulation, tighten up the building envelope, Advances in building technology and materials, incorporate active and passive solar into the home or commercial building, Mistakes to avoid, various improvements cost

TEXT BOOKS:

1.Kibert, C. J. "Sustainable Construction: Green Building Design and Delivery," Second Edition, New York:

1. John Wiley & Sons, Inc., 2008.
2. Thermal analysis and design of passive solar buildings by A. K. Athienitis and Mat Santamouris.
3. Passive building desing by N.K. Bansal, G. Hauser, and G. Minke.

REFERENCES:

1. McDonough, W. and Braungart, M. "Cradle to Cradle: Remaking the Way We Make Things," New York: Farrar, Straus and Giroux, 2002

COURSE DESIGNERS

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17BTEC30	NATURAL RESOURCES MANAGEMENT	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

Bioresource management showers the knowledge on importance of various resource available in the world and its economic importance. Students will gain the knowledge in wide spectrum of bioresource availability and its culturing method. This paper also deals with the conservation of wild resource and cultivation of valuable products for the sophistication of human life.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To state about the kinds and importance of bioresource management.
2	To describe about the various types of aquaculture and its breeding types.
3	To construct the characteristics of vermiculture and its scope and importance.
4	To categorise and preserve the afforestation process with certain conservation policies.
5	To develop the economic importance of value-added products.

COURSE OUTCOMES

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

CO1. Recognize the basic concepts and importance of Bioresource management	Remember
CO2. Explain the culturing process and various types of aquaculture.	Understand
CO3. Demonstrate the scope and economic importance of vermiculture and sericulture.	Understand
CO4. Develop the strategies on conservation and management of forest resource.	Analyze
CO5. Measure the crop improvement technologies in the production of bioresource products.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	-	L	L	-	-	L	-	-	-	-	M	L	L	-
CO2	L	-	M	L	L	-	M	-	S	-	L	M	S	M	M
CO3	S	S	-	-	-	-	M	L	-	-	L	-	-	L	-
CO4	L	-	L	L	-	L	S	L	-	-	-	-	-	-	L
CO5	L	L	-	L	-	-	L	-	-	-	-	S	M	L	M

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF BIORESOURCE MANAGEMENT

Basics of Bioresources - Concept, kinds, importance. Human Resource: Management, scope and importance of human resource management (HRM) and personnel management; human development index (HDI). Animal Resources Conservation and Management: Concept on livestock and livestock production management; role in livelihood and nutritional securities; sustainable livestock production, problems and opportunities

AQUACULTURE

Introduction to aquaculture; Prawn culture, Methods of prawn fishing, Preservation and processing of prawn; Pearl culture and status of pearl culture in India; Economically important of fishes. Setting up of a fish farm, Monoculture and composite fish culture, Bundh breeding, Induced breeding, methods of fishing, Fish preservation and processing; Identification of fish diseases and their control.

VERIMICULTURE AND SERICULTURE

Introduction and scope, Species of earthworm, Characteristics features of earthworm. Overview of methods of vermicomposting, Role of earthworm in solid waste management. Vermiwash- its importance, Vermicompost as bio-fertilizer. Overview of scope, economic importance and the product of Sericulture.

FOREST MANAGEMENT AND PLANTS CULTIVATION

Classification and distribution of forests, current strategies of conservation and management of forest resource; agro-forestry, social forestry; Joint Forest Management; National Forest Policy; Forest (conservation) Act, 1980. A brief account of Harlan and Hawkes theories; practices of floriculture, agroforestry, BT crops (brief account).

VALUE ADDED BIORESOURCE PRODUCTS

Economic uses of important cereals, legumes (pulses and fodders), fruits and vegetables, spices and condiments, beverages, oils and fats, essential oils, medicinal plants, hallucinogens (psychotropic drugs), timber plants, fibre plants, natural rubber, resins, raw materials for paper. A brief account of crop improvement technologies, biosafety considerations, natural products.

TEXT BOOKS:

1. Manju Yadav. 2010. "Economic Zoology" Discovery publishing housePvt.Ltd., New Delhi
2. Trivedi, T, R. (2011) "Forest Management"Discovery Publishing Pvt.Ltd. New Delhi
3. Milton Fingerman, RachakondaNagabhushanam 2000. "Recent Advances in Marine Biotechnology" IstEdition Science Pub Inc.

REFERENCES:

1. Peter Bettinger Kevin Boston Jacek Siry Donald Grebner 2017. Forest Management and Planning 2nd Edition. Academic press.

COURSE DESIGNERS

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17BTEC31	APPLICATIONS OF ENZYME IN WASTE MANAGEMENT	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

This course explains about different waste generation in environment, management of waste, general characters of enzymes, their immobilization process, makes an attempt to bring students in direct contact with nature, to find the environmental problems and possible solutions. To empower the students to enrich their knowledge on waste treatment using biocatalyst to solve the environmental pollution.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To state the basic knowledge on different wastes
2	To discuss about the waste management methods
3	To perform the waste treatment using enzymes
4	To implement the basics of enzyme immobilization process
5	Tooutline the students to basic knowledge concerning biodegradation with the usage of enzymes

COURSE OUTCOMES

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

CO1. List and classify the different wastes in environment	Remember
CO2. Describe about the general waste management methods	Understand
CO3. Illustrate the waste treatment using enzymes	Apply
CO4. Demonstrate the basics of enzyme immobilization process	Apply
CO5.Appraise different method of biodegradation of waste using enzymes	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P	PO11	PO12	PS	PSO	PSO3
CO1	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	M	M	-		L	-	-	-	-	-	-	L	L	-	-
CO4	M	M	-	-	S	-	L	-	-	-	-	-	-	M	-
CO5	M	M	L	L	S	S	-	L	-	-	-	-	-	L	L

S- Strong; M-Medium; L-Low

SYLLABUS

CLASSIFICATION AND TECHNOLOGIES IN REDUCING WASTE

Definition of waste, and its classification, Waste treatment technologies including waste incineration and energy from waste, advanced conversion technologies of pyrolysis and gasification, anaerobic digestion, composting and biological treatment of wastes.

WASTE AND RESOURCE MANAGEMENT

3 RS, Advances in waste recycling and recovery technologies to deliver added value products; Landfill engineering, Sustainability and resource efficiency with consideration for materials flow through the economy, steps towards designing out waste and maximizing the value of outputs from waste treatment processes.

ENZYME IN WASTE TREATMENT

Enzymes in enhanced oil recovery; treatment of wastewater of brewery, pharmaceutical, textile dyeing, metal processing, petrochemical, pulp and paper industry; role of natural/stimulated, dead/spent microbial cultures, GMOs, phytoremediation. Biological indicators of waste by enzyme.

ENZYME ACTION AND IMMOBILIZATION

Action of enzyme on xenobiotic compound, phenolic compounds, pesticides (organo chlorinated, organo phosphorous and carbonated) immobilization techniques.

BIOSENSOR AND OPTICAL INSTRUMENTS

Birth of biosensors, advantages and disadvantages, construction of biosensors- enzyme and microbial biosensor. Transducers- piezoelectric, potentiometric, amperometric and fiber optics.

TEXTBOOKS:

1. Instant Notes in Ecology by A. Mackenzie, A.S. Ball and S.R. Virdee, Bios Scientific Publishers Ltd., UK, 1999.
2. Biotechnology-Applications to Environmental Protection by M.M. Pandey, Himalaya Publishing House, 1993.
3. Pesticide Properties in the Environment by A.G. Hornsky, R.D. Wauchope and A.E. Herner, Springer-Verlag, New York Inc., 1996.
4. Basic Environmental Science by G.S.P. Iyer, Educational Publishers and Distributers, New Delhi, 1997.

REFERENCES:

1. Popular Biotechnology Lecture Series Focus: Bioremediation by Division of Biotechnology, PSCST, 2013.
2. Pesticide Properties in the Environment by A.G. Hornsky, R.D. Wauchope and A.E. Herner, Springer-Verlag, New York Inc., 1996.
3. Introduction to Environmental Technology by A.K. Chatterji, Prentice Hall of India Pvt. Ltd., New Delhi, 2002.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
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17BTEC32	BIOLOGICAL DATABASE	Category	L	T	P	Credit
		EC (PS)	3	0	0	3

PREAMBLE

This course is designed to impart the knowledge on *Biological database* and they deals with libraries of life sciences information, collected from scientific experiments, published literature, high-throughput experiment technology, and computational analysis.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To state the knowledge on Bioinformatics and Database management
2	To explain the basics of Genome databases
3	To demonstrate the different methods of sequence databases
4	To outline the basics of homology modelling
5	To assess the regulatory of structural similarities

COURSE OUTCOMES

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

CO1: Recall the design and Database management	Remember
CO2: Discuss the genome browsers and databases	Understand
CO3: Classify different methods of sequence databases	Apply
CO4: Infer the Molecular modelling and enzyme databases	Analyse
CO5: Assess the sequence and motif -based search engines	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	M	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	M	M	-		L	-	-	-	-	-	-	L	L	-	-
CO4	M	M	-	-	S	-	L	-	-	-	-	-	-	M	-
CO5	M	M	L	L	S	S	-	L	-	-	-	-	-	L	L

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO BIOINFORMATICS DATA AND DATABASES

Types of Biological data:- Genomic DNA, Complementary DNA (cDNA), Recombinant DNA (rDNA), Expressed sequence tags (ESTs), Genomic survey sequences (GSSs). Primary Databases: - GenBank, EMBL, DDBJ, Composite Databases:-NRDB, UniProt, Literature Databases:- Open access and open sources, PubMed, PLoS, Biomed Central

GENOME DATABASES

Viral genome database (ICTVdb, VirGen), Bacterial Genomes database (Genomes OnLine Database –GOLD, Microbial Genome Database-MBGD), Organism specific Genome database (OMIM / OMIA, SGD, WormBase, PlasmoDB, FlyBase, TAIR), and Genome Browsers (Ensembl, VEGA genome browser, NCBI-NCBI map viewer, KEGG, MIPS, UCSC Genome Browser).

SEQUENCE DATABASES

Nucleotide sequence Databases (GenBank, EMBL, DDBJ).). Protein sequences Databases (Swiss-Prot, TrEMBL, UniProt Knowledgebase – UniProtKB, UniProt Archive –UniParc, UniProt Reference Clusters – UniRef, UniProt Metagenomic and Environmental Sequences –UniMES. Sequence motifs Databases:-Prosite, ProDom, Pfam, InterPro. Sequence file formats:- GenBank, FASTA, PIR, ALN/ClustalW2, GCG/MSF.

STRUCTURE AND DERIVED DATABASES

The primary structure databases (Protein Data Bank –PDB, Cambridge Structural Database –CSD, Molecular Modeling Database -MMDB). The secondary structure databases (Structural Classification of Proteins –SCOP, Class Architecture Topology Homology –CATH, Families of Structurally Similar Proteins –FSSP, Catalytic Site Atlas –CSA. Molecular functions/Enzymatic catalysis databases (KEGG ENZYME database, BRENDA).

BIOINFORMATICS DATABASE SEARCH ENGINES

Text-based search engines (Entrez, SRS, DBGET / LinkDB). Sequence similarity based search engines (BLAST and FASTA). Motif-based search engines (ScanProsite and eMOTIF). Structure similarity based search engines (VAST and DALI). Proteomics tools at the ExPASy server, GCG utilities and EMBOSS

TEXT BOOKS

1. Bioinformatics: Sequence and Genome Analysis by Mount D., Cold Spring Harbor Laboratory Press, New York. 2004

2. Bioinformatics- a Practical Guide to the Analysis of Genes and Proteins by Baxevanis, A.D. and Francis Ouellellette, B.F., Wiley India Pvt Ltd. 2009

REFERENCES BOOK

1. Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith. Pearson Education. 1999.

COURSE DESIGNERS

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1	Dr. R. Subbaiya	Associate Professor	Biotechnology	rsubbaiya80@gmail.com
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CATEGORY ‘C’ – ELECTIVE COURSES - PROGRAMME SPECIFIC – 12-15 CREDITS SPECIALISATION

SPECIALISATION – INDUSTRIAL BIOTECHNOLOGY

17BTSE01	INDUSTRIAL BIOTECHNOLOGY	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

PREAMBLE

Industrial Biotechnology deals with the chronological development of fermentation process. This subjects aims to deliver a detailed method of production product recovery process of all primary, secondary metabolites and biological products. Industrial Biotechnology syllabus students are able to understand the use of more advances and sophisticated instruments for the production and purification of biological products. Knowledge of these production process will enable students to carry out their project effectively and individually.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To list the overall industrial fermentation process and the process flow sheet.
2	To summarize the knowledge on production of commercially important primary metabolites.
3	To perform the knowledge on production of commercially important secondary metabolites.
4	To develop production process for different biological products.
5	To formulate the production of therapeutic products.

COURSE OUTCOMES

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

CO1. Recall the overall view of industrial fermentation and the process flow sheet	Remember
CO2. Discuss the methods for the production of primary metabolites	Understand
CO3. Practice the knowledge on commercial production of primary metabolites	Understand
CO4. Illustrate about the production of enzyme from different sources	Apply
CO5. Select the methods for the commercial production of modern biological products.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L	-	L	L	-	-	L	-	-	L	L	-	-
CO2	S	M	S	S	L	M	-	-	L	-	-	L	L	-	-
CO3	S	M	S	S	L	M	-	-	L	-	-	L	L	-	-
CO4	M	L	M	-	L	-	-	-	M	-	-	-	M	L	-
CO5	L	L	L	L	-	L	-	-	-	-	-	-	L	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO INDUSTRIAL BIOPROCESS

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.

PRODUCTION OF PRIMARY METABOLITES

Primary Metabolites- Production of commercially important primary metabolites like organic acids (citric acid, acetic acid, lactic acid) amino acids (L- cysteine, L- Tryptophan and L-phenylalanine), alcohols (ethanol, butanol, propanol) and vitamins Vitamin B12 and Vitamin C).

PRODUCTION OF SECONDARY METABOLITES

Secondary Metabolites- Production processes for various classes of secondary metabolites: Antibiotics natural and semisynthetic penicillin, chloramphenicol Erythromycin, macrolides and Steroids – transformation process and its biological significance

PRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS

Production of Industrial Enzymes (protease and lipase), Biopesticides, Biofertilizers, Bio preservatives (Nisin), Biopolymers (PHA and PHB Xanthaan Gum) Biodiesel – production process, characteristics, merits and demerits, Production process of Cheese, Beer, SCP & Mushroom culture.

PRODUCTION OF MODERN BIOTECHNOLOGY PRODUCTS

Production of recombinant proteins having therapeutic and diagnostic applications (Insulin, Interferon, Interleukins and Growth stimulating Hormone), Vaccines – Subunit vaccine, recombinant vaccine advantages and disadvantages. Bioprocess strategies in Plant Cell and Animal Cell culture.

TEXT BOOKS:

1. Satyanarayana, U. (2013) “Biotechnology” Books and Allied (p) Limited.
2. Dubey, R.C. (2014)“A Textbook of Biotechnology” 5th revised Edition S. Chand Publishing. Ltd.,
3. Kumar, H.D. (1998) “A Textbook on Biotechnology” 2 nd Edition. Affiliated East West Press Pvt.Ltd.,
   Ratledge, Colin and Bjorn Kristiansen (2001)“Basic Biotechnology” 2 nd Edition Cambridge University Press

REFERENCES:

1. .F.A Bryce and EL.Mansi (2011) Fermentation microbiology & Biotechnology, 3rd Edition CRC Press.
2. Presscott, S.C. and Cecil G. Dunn, (2005). “Industrial Microbiology”, Agrobios (India).
3. Cruger,Wulf and Anneliese Crueger (2000) “Biotechnology: A Textbook of Industrial Microbiology”, 2nd Edition, Panima Publishing,
4. Moo-Young, Murrey, “Comprehensive Biotechnology”, 4 Vols. Pergamon Press, (An Imprint of Elsevier) 2004.
5. K.G.Ramawat & Shaily Goyal, Comprehensive Biotechnology, 2009, S.Chand publications.

COURSE DESIGNERS

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17BTSE02	CHEMICAL REACTION ENGINEERING	Category	L	T	P	Credit
		EC (SE)	3	0	0	3

PREAMBLE

Principles of Chemical Engineering deals with the material and elemental balance in a reaction. A chemical engineers have a broad knowledge on ideal and non- reactor flow models. This paper also impart the knowledge on reaction rate of the reaction and its kinetics gas liquid reactions. Knowledge of these principles will enable students to understand vital role of engineer in a process industry.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To define the basic knowledge on the material balance equations.
2	To discuss the performance of ideal reactors
3	To demonstrate the difference between ideal flow and non- ideal flow.
4	To outline the heterogeneous reaction of gas- liquid and solid.
5	To develop the knowledge on various chemical reactors

COURSE OUTCOMES

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

CO1. Recall the basics of material balance in chemical reaction	Remember
CO2. Explain the effectiveness of an ideal reactor	Understand
CO3. Classify the various flow pattern of fluids	Apply
CO4. Differentiate the various ideal and non – ideal fluid model	Analyze
CO5. Test the heterogeneous reactions.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L	L	L	-	-	-	-	-	-	L	L	L	-
CO2	S	M	S	S	L	-	-	-	-	-	-	-	L	L	-
CO3	M	L	M	M	L	S	-	-	-	-	-	-	M	L	-
CO4	L	L	L	L	L	S	-	-	-	-	M	M	-	-	-
CO5	S	M	-	L	M	M	-	-	-	-	-	S	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

MATERIAL BALANCE

Overall and component balances; material balances without and with chemical reactions; degrees of freedom; steady and unsteady state; unit operations; recycle and by pass; humidity calculations.

IDEAL REACTORS

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

IDEAL FLOW AND NON IDEAL FLOW

Conditions for a non-ideal reactors, RTD in non-ideal flow; E- Curve, F- curve. Non-ideal flow model- – laminar flow; turbulent flow, pressure drops; compressible fluid flow concepts. Reactor performance with non-ideal flow.

GAS-SOLID, GAS-LIQUID REACTIONS

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

FIXED BED AND FLUID BED REACTORS

Broad outline of chemical reactors; Industrial scale reactors. Gas liquid reactions on solid catalysis; trickle bed, slurry reactors; three phase-fluidized beds; reactors for fluid-fluid reactions; tank reactors

TEXT BOOKS:

1. Levenspiel O. 2006. Chemical Reaction Engineering. 3rd Edition. John Wiley.
2. Fogler H.S. 2016 Elements of Chemical Reaction Engineering.5th Edition Prentice Hall India.
3. Hill, Jr., C.G.; Root, T.W. 2014. Introduction to chemical engineering kinetics and reactor design. 2nd Edition. Wiley.

REFERENCES:

1. Missen R.W., Mims C.A., Saville B.A. 1999. Introduction to Chemical Reaction Engineering and Kinetics. John Wiley.
2. Froment, G.F.; Bischoff, K.B.; De Wilde, J. 2011. Chemical reactor analysis and design. 3rd Edition. John Wiley & Sons

COURSE DESIGNERS

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17BTSE03	FERMENTER DESIGN AND ANALYSIS	Category	L	T	P	Credit
		EC (SE)	3	0	0	3

PREAMBLE

Fermentation design and analysis deals with the basic design of fermenter and its concepts. This paper also deals with the aeration and agitation equipments which were used for proper mixing substrate with the microorganisms. Fermentor design often use cutting-edge techniques and sophisticated machinery for the scale up and scale down issues for their complex mechanisms. Knowledge of these principles will enable students to understand the flow mechanisms, biomass growth and inlet and outlet gas analysis

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To label the body construction and types of fermenter.
2	To describe the power requirement for aerated and non-aerated fermenter.
3	To construct the various designs for studying the heat and mass transfer in the fermenter.
4	To outline the various problems related to scale up and scale down process.
5	To assess the various instrumentation involved in the monitoring and control of fermentation process.

COURSE OUTCOMES

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

CO1. Recall how to construct the fermenter and the materials used for it.	Remember
CO2. Interpret the power requirement for aerated and non-aerated fermenter	Understand
CO3. Classify the various design of heat transfer mechanism in fermentor design	Apply
CO4. Categorize the issues involved in scale up and scale down process	Analyze
CO5. Validate the parameters involved in the instrumentation and control	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO	PO12	PSO	PSO2	PSO3
CO1	M	L	L	L	L	-	-	-	-	-	L	L	L	L	L
CO2	S	M	L	M	L	-	-	-	-	-	L	L	L	L	-
CO3	M	L	L	M	L	-	-	-	-	-	M	L	L	L	L
CO4	L	L	L	L	M	-	-	-	-	L	L	M	M	L	-
CO5	S	M	M	L	M	-	-	-	-	-	M	M	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

BASIC FERMENTER CONCEPTS

Define Fermenter, body construction of fermenter, Bioreactor Operation, Batch operation, fed-batch operation and Continuous Operation, Chemostat, turbidostat, Microbiological reactors, Enzyme reactors, Tank-type, Column-type biological reactors.

AERATION AND AGITATION IN BIOPROCESS SYSTEMS

Mass transfer in agitated tanks, Effect of agitation on dissolved oxygen, Correlations with kLa in Newtonian and non - Newtonian liquid, Power number, Power requirement for mixing in aerated and non - aerated tanks for Newtonian and non-newtonian liquid-Agitation rate studies, Mixing time in agitated reactor, residence time distribution, Shear damage, bubble damage, Methods of minimizing cell damage, Laminar and Turbulent flow in stirred tank bioreactors

SELECTION AND DESIGN OF BIOPROCESS EQUIPMENT

Materials of construction for bioprocess plants, Design considerations for maintaining sterility of process streams processing equipments, selection, specification, Design of heat and mass transfer equipment used in bioprocess industries, Requirements, design and operation of bioreactor for microbial, plant cell and animal cell

SCALE UP AND SCALE DOWN ISSUES

Effect of scale on oxygenation, mixing, sterilization, pH, temperature, inoculum development, nutrient availability and supply, Bioreactor scale-up based on constant power consumption per volume, mixing time, impeller tip speed (shear), mass transfer co-efficients, Scale up of downstream processes, Adsorption (LUB method), Chromatography (constant resolution etc.), Filtration (constant resistance etc.), Centrifugation (equivalent times etc.), Extractors (geometry based rules), Scale–down related aspects.

FERMENTER INSTRUMENTATION AND CONTROL

Bioreactor controlling probes, Characteristics of bioreactor sensors, Methods of measuring process variables, Temperature, Flow measurement and control, Pressure measurement and control, Agitation, shaft power, rate of stirring. Detection and prevention of foam, Measurement of Microbial biomass, Measurement and control of Dissolved oxygen, Inlet and outlet gas analysis, pH measurement and control - Biosensors.

TEXT BOOKS:

1. Impre, J.F.M.V., Vanrolleghem, P.A. and Iserentant, D.M., "Advanced Instrumentation, Data Interpre and Control of Biotechnological Processes", Kluwer Academic Publi 2010.
2. Panda, T. 2011. Bioreactors analysis and design, Tata McGraw Hill, New Delhi, New York.
3. Mann, U., "Principles of Chemical Reactors Analysis & Design: New tools for Industrial Chemical Reactor Operations", Willey–VCH, 2009.

REFERENCES:

1. Mansi, E.M.T.EL., Bryce, C.F.A., Demain, A.L. and Allman, A.R., "Fermentation Microbiolog Biotechnology", 3rd edition Taylor and Francis, 2012.
2. Towler, G. and Sinnott, R., "Chemical Engineering Design: Principles, Practice, Econ of Plant and Process Design", 2nd edition, Butterworth – Heinemann ltd., Elsevier, 2012.

COURSE DESIGNERS

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17BTSE04	BIOSEPARATION TECHNOLOGY	Category	L	T	P	Credit
		EC (SE)	3	0	0	3

PREAMBLE

Bioseparation technology deals with the economics and importance of bioproducts purification process. In this subjects the purification process comprises various unit operation in levels of purification process. Bioseparation technology often use pioneering techniques and sophisticated machinery along with other applied field's chemical engineering and instrumentation for purification of biological products. Knowledge of these principles will enable students to understand various steps involved in purification process of biological products.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To list the downstream processes employed in the biotechnology industry.
2	To classify the physical and chemical separation processes in DSP.
3	To demonstrate separation processes by means of membrane separation techniques in DSP.
4	To perform the various types of chromatography for the separation process.
5	To develop the concepts for separation and purification.

COURSE OUTCOMES

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

CO1. Define the need of downstream processing in biotechnology industry	Remember
CO2. Identify the importance of separation process involved in the downstream processes	Understand
CO3. Illustrate the various types of membrane separation process employed in the DSP	Apply
CO4. Categorize the various parameters that governs chromatography techniques	Apply
CO5. Assess the various finishing operations involved in the DSP	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L	L	L	-	-	-	-	-	-	L	L	L	L
CO2	S	M	M	S	L	-	-	-	-	-	-	L	L	L	L
CO3	M	L	M	L	L	-	-	-	-	-	-	L	M	L	L
CO4	M	L	L	M	L	-	-	-	-	-	-	L	M	L	L
CO5	S	M	L	L	M	-	-	-	-	-	-	S	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

DOWNSTREAM PROCESSING IN BIOTECHNOLOGY

Role and importance of downstream processing in biotechnological processes – Problems and requirements of bio product purification – Economics of downstream processing in Biotechnology, cost-cutting strategies – Separation characteristics of proteins and enzymes – size, stability, properties – Flocculation and conditioning of broth – Process design criteria for various classes of bio products (high volume, low value products and low volume, high value products) – Upstream production methods affect downstream purification strategies.

PHYSICO-CHEMICAL BASIS OF BIO-SEPARATION PROCESSES

Cell disruption methods for intracellular products – Physical, chemical, mechanical – Removal of insoluble, biomass and particulate debris separation techniques – Filtration at constant pressure and at constant rate – Empirical equations for batch and continuous filtration – Types of filtration - Centrifugal and cross – flow filtration – Types of filtration equipments – Centrifugation – Basic principles, design characteristics – Types of centrifuge and applications – Sedimentation

MEMBRANE SEPARATIONS AND ENRICHMENT OPERATIONS

Theory, Design consideration and configuration of membrane separation processes – Reverse osmosis, microfiltration, ultra filtration and dialysis – Structure and characteristics of membranes – Membrane modules – Enrichment Operations – Extraction–equipment for extraction – Aqueous two-phase extraction process – Evaporators – Types of evaporators – Adsorption isotherms and techniques – Protein precipitation – Methods of precipitational

MECHANISM AND MODES OF CHROMATOGRAPHIC SEPARATION

Chromatography – Classification of chromatographic techniques – General description of column chromatography – Chromatographic terms and parameters – Practice of chromatography – Partition, normal-phase, displacement, reversed-phase, size exclusion, ion exchange, hydrophobic, affinity chromatography – Scale-up of chromatography – Process considerations in Preparative liquid chromatography and HPLC

FINISHING OPERATIONS AND FORMULATIONS

.Drying – Mechanism, methods and applications, Types of dryers – Tray, spray, rotary, belt, disc – Crystallization – Nucleation , growth – Types of crystallizers – Tank, scrapped surface, Oslo, Circulating-magma evaporator – Freeze drying – Principle, process, applications

TEXT BOOKS:

1. Belter, P.A., Gussler, E.L. and Hu, W.S., “Bioseparation: Downstream Processing for Biotechnology”, John Wiley and Sons, 2011.
2. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, 2013. Principles of Fermentation Technology, Science & Technology Books 2nd edition. Pergamon Press.
3. Sivasankar, B., 2009. Bioseparations: Principles and Techniques. PHI Learning Private Limited, New Delhi.

REFERENCES

1. Ghosh, R., “Principles of Bioseparation Engineering”, World Scientific Publishers, 2006.
2. Ladisch, M.R., “Bioseparation Engineering: Principles, Practice, and Economics”, John Wiley & Sons, 2001.
3. Roger, H., 2015. “Bioseparation Science and Engineering”, 2nd Edition Oxford University Press

COURSE DESIGNERS

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17BTSE05	INDUSTRIAL WASTE MANAGEMENT	Category	L	T	P	Credit
		EC (SE)	3	0	0	3

PREAMBLE

This course will provide an overview of management techniques for industrial wastes, as well as State and Central Pollution Board regulations for waste management. The course will also highlight the business profitability, legal framework, and the economic feasibility of the environmentally sustainable technologies for waste management.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To state the present scenario of industrial waste management in India
2	To explain the knowledge on sources and characteristics of various industrial wastes and strategies for its prevention and control
3	To execute about the onsite pollution from major industries
4	To outline the various effects and disposal options for the industrial waste.
5	To check the maintenance of hazardous waste

COURSE OUTCOMES

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

CO1: Recall an insight into the pollution from major industries including the sources and characteristics of pollutants	Remember
CO2: Identify the plan minimization of industrial wastes	Understand
CO3: Illustrate the facilities for the processing and reclamation of industrial waste	Apply
CO4: Correlate the various treatments for disposals of industrial waste.	Analyse
CO5: Asses the physio chemical treatment for hazardous waste.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	-	-	L	L	L	-	-	-	L	-	L	L	L	-
CO2	S	-	-	M	L	M	-	-	-	L	L	L	-	-	-
CO3	M	L	-	-	L	-	-	-	-	-	L	L	L	L	L
CO4	L	L	S	L	S	L	-	-	M	L	M	M	-	-	-
CO5	S	M	M	-	M	M	-	L	-	S	L	S	L	L	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO INDUSTRIAL POLLUTION

Types of Industries And Industrial Pollution, Characteristics Of Industrial Wastes, Population Equivalent, Bioassay Studies, Effects Of Industrial Effluents On Streams, Sewer, Land, Sewage Treatment Plants And Human Health Environmental Legislations Related to Prevention And Control Of Industrial Effluents And Hazardous Wastes

CLEANER PRODUCTION

Waste Management Approach, Waste Audit, Volume And Strength Reduction, Material And Process Modifications, Recycle, Reuse And Byproduct Recovery – Applications.

POLLUTION FROM MAJOR INDUSTRIES

Sources, Characteristics, Waste Treatment Flow Sheets For Selected Industries Such As Textiles, Tanneries, Pharmaceuticals, Electroplating Industries, Dairy, Sugar, Paper, Distilleries, Steel Plants, Refineries, Fertilizer, Thermal Power Plants, Wastewater Reclamation Concepts

TREATMENT TECHNOLOGIES

Equalisation, Neutralisation, Removal of Suspended and Dissolved Organic Solids, Chemical Oxidation, Adsorption, Removal of Dissolved Inorganics, Combined Treatment Of Industrial And Municipal Wastes, Residue Management, Dewatering, Disposal.

HAZARDOUS WASTE MANAGEMENT

Hazardous Wastes, Physico Chemical Treatment, Solidification, Incineration, Secure Land Fills.

TEXT BOOKS

1. Rao M. N. & Dutta A. K. “Wastewater Treatment”, Oxford - IBH Publication, 1995.
2. Eckenfelder W.W. Jr., “Industrial Water Pollution Control”, McGraw Hill Book Company, New Delhi, 2000.
3. Patwardhan. A.D., Industrial Wastewater Treatment", Prentice Hall of India, New Delhi 2010.

REFERENCES

1. Shen T.T., “Industrial Pollution Prevention”, Springer, 1999.
2. Stephenson R.L. and Blackburn J.B., Jr., “Industrial Wastewater Systems Hand book”, Lewis Publisher, New York, 1998
3. Freeman H.M., “Industrial Pollution Prevention Hand Book”, McGraw Hill Inc., New Delhi, 1995.
4. Bishop, P.L., “Pollution Prevention: Fundamental & Practice”, McGraw Hill, 2000.
5. Pandey, "Environmental Management" Vikas Publications, 2010.
6. Industrial Wastewater Management, Treatment and Disposal",(WEF - MOP - FD3) McGraw Hill, 2008

COURSE DESIGNERS

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17BTSE06	FUNDAMENTALS OF FLUID MECHANICS	Category	L	T	P	Credit
		EC (SE)	3	0	0	3

PREAMBLE

Fundamentals of fluid mechanics deals with fundamental concepts of fluid flow with Newtonian laws and application of fluid static equation. This papers also deals with the need of dimensional analysis and dimensionless parameter. Helps to regain the knowledge in type of flow and flow measurement in pipes. Fundamentals of fluid mechanics often use cutting-edge techniques and sophisticated machinery along with other applied fields of research like biotechnology, mechanical engineering and chemical engineering. Knowledge of these principles will enable students to understand various types of fluid flow and their importance in the industry.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To acquire knowledge about the fundamentals concepts of fluid flow.
2	To apply the knowledge on fluid static equation.
3	To analyze the need for dimension analysis and dimensionless parameter.
4	To understand the various type of flow through pipes.
5	To analyze the various types of pumps with its working principle.

COURSE OUTCOMES

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

CO1: Recall the concepts of fluid flow	Remember
CO2: Report the fluid static equation based on fluid flow	Understand
CO3: Compare the dimension and dimensional analysis water	Apply
CO4: Calculate the types flow measurement in pipes.	Analyse
CO5: Illustrate the boundary layer concepts	Evaluate

COS	PO	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	-	L	L	L	L	L	-	-	L	L	L	L	L	-
CO2	S	M	S	-	L	-	S	-	-	L	L	L	-	L	L
CO3	M	L	-	M	-	S	-	-	-	M	-	L	M	L	L
CO4	L	L	L	L	S	L	S	-	S	S	M	M	-	M	M
CO5	S	M	L	L	-	M	M	S	-	S	L	S	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

FUNDAMENTAL CONCEPTS

Definition of Fluid, Continuum concept of fluid, Terminologies of fluid flow, velocity – local, average, maximum, flow rate – mass, volumetric, velocity field; dimensionality of flow; flow visualization – streamline, pathline, streak line, stress field; viscosity; Newtonian fluid; Non-Newtonian fluid; Reynold’s number—its significance, laminar, transition and turbulent flows: Prandtl boundary layer, compressible and incompressible flows

FLUID STATICS

Fluid statics – basic equation – equilibrium of fluid element – pressure variation in a static fluid – application to manometry – Differential analysis of fluid motion – continuity, equation of motions, Euler's equation, Bernoulli equation, and Navier- Stokes equation.

DIMENSIONAL ANALYSIS

Formal procedure for *dimensional analysis* – Dimensional homogeneity – Buckingham's Pi theorem – Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude – Dimensionless parameters- application of dimensionless parameters – Model analysis

FLOW MEASUREMENT

Reynolds number regimes, internal flow – flow through pipes – pressure drop under laminar and turbulent flow conditions – major and minor losses; Line sizing; External flows – boundary layer concepts, boundary layer thickness under laminar and turbulent flow conditions- Flow over a sphere – friction and pressure drag – flow through fixed and fluidized beds.

PUMPS

Impact of jets – Euler's equation – Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles – Centrifugal pumps– working principle – work done by the impeller – performance curves – Reciprocating pump- working principle – Rotary pumps –classification

TEXT BOOKS:

1. Bansal R. K. 2016. "A Text book of Fluid Mechanics" Laxmi Publications
2. Modi P.N. and Seth, S.M. 2004."Hydraulics and Fluid Mechanics", Standard Book House, New Delhi.
3. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011.

REFERENCES:

1. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi, 2004
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011

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17BTSE07	BIOPROCESS ECONOMICS AND REACTOR DESIGN	Category	L	T	P	Credit
		EC (SE)	3	0	0	3

PREAMBLE

The aim of this course is to develop in students the ability to synthesise design solutions for the biochemical engineering sector that take into account consideration of good design practice, that are inherently safe and that are most economically viable.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To define economic evaluation of Bioprocess technology
2	To discuss cost estimation analysis of process design and development
3	To describe and synthesise a design in terms of safety and provide measures for its safe operation
4	To demonstrate a design using best practice economic principle
5	To perform experimental design for screening & optimizing the process parameters.

COURSE OUTCOMES

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

CO1. Recall the economic evaluation concepts involved in bioprocess techniques	Remember
CO2.Describe the different costs involved in the total product for a typical Chemical Process	Understand
CO3. Explain the optimal strategy for design and analysis of various Bioreactors	Understand
CO4. Demonstrate the instrumentation and control of bioprocess using engineering principles.	Apply
CO5. Illustrate case studies on screening designs and optimization of various bioprocess	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C	M	L	L	-	-	-	-	-	-	-	-	-	-	-	L
C	S	M	S	S	L	-	-	-	-	-	-	-	L	-	-
C	M	L	-	M	L	S	M	M	-	M	-	-	-	L	L
C	L	L	L	-	-	-	-	-	-	-	M	-	-	-	-
C	S	M	L	L	-	-	-	-	M	-	-		-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

ECONOMIC EVALUATION

Capital cost of a project; Interest calculations, nominal and effective interest rates; basic concepts in tax and depreciation; Measures of economic performance, rate of return, playout time; Cash flow diagrams; Cost accounting-balance sheet and profit loss account; Break even and minimum cost analysis.

BIOPROCESS ECONOMICS

Cost Estimation: Capital investments (Fixed and working capital), Types of capital cost estimates, Cost

Indexes, Estimating equipment costs by scaling 6/10 Factor Rule, Purchase Equipment Installation, Insulation costs, Instrumentation & Control, Piping , Electrical Installation , Service facilities, Land, Engineering . & Supervision, Start –up expenses. Methods of Estimating Capital Investment, Estimation of total product cost, Different costs involved in the total product for a typical Chemical Process plant. Interest & Investment Costs: Types of interest (simple & compound interest), Nominal & Effective Rates of interest, Continuous interest, Present worth & discounts, perpetuities, capitalized costs, Interest & Investment costs.

DESIGN AND ANALYSIS OF BIOREACTORS

Chemostat model with cell growth kinetics, Plug flow reactor for microbial processes; optimization of reactor systems; Multiphase bioreactors, packed bed with immobilized enzymes or microbial cells; three phase fluidized bed trickling bed reactor; Component of Fermenter and their design, a sceptic operations, RTD studies in bioreactors, Design and analysis of the above reactor systems; Gas liquid reactors; Reactor with non-ideal mixing; dispersion model; Tanks in series Model; Bubble column reactors, airlift fermenters etc. Air and medium sterilization Mechanical fittings in a bioreactor: vessel, agitation system materials, welds, finish, valves, piping and valves for biotechnology, cleaning

INSTRUMENTATION AND CONTROL OF BIOPROCESSES

Physical and chemical sensors for the medium and gases. Online sensors for cell properties, off-line analytical methods; Biosensors.

DESIGN OF EXPERIMENTS – SCREENING DESIGNS, OPTIMIZATION

Screening designs: Fractional factorial design – General 2k-p design, Placket-Burman design, confounding and aliasing, resolution of design, main effects, interaction effects, screening criteria, Numerical. Optimization: Response surface methodology, Linear model (method of steepest ascent), Second order models (CCD, CCRD, Taguchi design); generation of experimental design; response variables; model terms: linear, quadratic & interaction terms; ANOVA table, data diagnostics & outlier analysis, contour & surface plots, optimization criteria, D-optimal design, Numerical.

TEXTBOOKS

1. Stanbury P F and Whitaker A, "Principles of Fermentation Technology," Pergamon Press (1995)
2. Bailey J E and Ollis D F, "Biochemical Engineering Fundamentals", McGraw Hill (1986)
3. Peters, M S & Timmerhaus K D,"Plant Design and Economics for Chemical Engineers", McGraw Hill, New York , 4th Edition (2003)
4. Ulrich, G D,"A Guide to Chemical Engineering Process Design and Economics", John Wiley (1984)

REFERENCES:

1. Aiba S, Humphrey A E and Millis N F,"Biochemical Engineering" , Academic Press (1973
2. Peters, M S & Timmerhaus K D,"Plant Design and Economics for Chemical Engineers", McGraw Hill, New York , 4th Edition (2003
3. Biochemical Engineering–Atkinson

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17BTSE08	BIOREACTOR THEORY	Category	L	T	P	Credit
		EC (SE)	3	0	0	3

PREAMBLE

Bioreactor theory subject deals with the basic knowledge in the construction of bioreactor and its working principles. This subject also provides a wide knowledge on various types of bioreactor and with its merits and demerits. Bioreactor theory often use cutting-edge techniques and sophisticated machinery along with other applied fields of research to study how the nutrients are up taken by microbes and converted into products with the elemental balances. Knowledge of these principles will enable students to understand the different kinetic models of microbes to fit into a microbial growth and product formation kinetics.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To recognize knowledge on the basic principle and components of bioreactors
2	To classify the different types of bioreactors and its working principle
3	To implement the design for fermentation process for biomass growth and product formation.
4	To outline the stoichiometric elemental balance.
5	To assess kinetics model on the microbial growth

COURSE OUTCOMES

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

CO1. Recall the basic principle and components of bioreactors.	Remembrance
CO2. Discuss about different types of bioreactors with its working principle.	Understand
CO3. Demonstrate for fermentation process for biomass growth and product formation	Apply
CO4. Estimate the microbial growth and product formation.	Analyze
CO5. Validate the stoichiometric elemental balance with microbial growth.	Evaluate
CO6. Create a kinetic model for microbial growth.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L	L	-	-	M	-	-	-	-	L	L	-	-
CO2	S	M	S	-	L	-	-	-	-	-	L	L	-	-	-
CO3	M	L	M	L	-	-	-	-	-	-	L	L	-	L	-
CO4	L	L	L	-	-	-	-	-	-	-	M	-	-	-	-
CO5	S	M	L	-	-	-	-	-	-	-	-	-	M	L	-
CO6	S	-	L	M	L	-	-	-	-	-	S	M			

S- Strong; M-Medium; L-Low

SYLLABUS

OVER VIEW OF BIOREACTOR

Definition of Bioreactor, Chronological development of bioreactor design, Basic principles of Bioreactor, Classification of bioreactors, body construction of basic bioreactor, configuration of bioreactors and ancillaries parts, Removal of Heat in bioreactor main parameters to be monitored and controlled in fermentation process.

BIOREACTOR TYPES

Unconventional bioreactors, Packed bed reactor, slurry bioreactor, Hollow fibre reactor. , Multiphase Bioreactor - Air lift Bioreactors, bubble column bioreactor, fluidised bioreactor, Hydrodynamic three phase flow, Perfusion reactor for animal and plant cell culture. Merits and demerits.

DESIGN OF FERMENTATION PROCESSES

Kinetics of substrate utilization, biomass growth and product formation, inhibition on cell growth and product formation. Design and operation of continuous cultures, chemostat in series, batch and fed batch cultures, total cell retention cultivation.

METABOLIC STOICHIOMETRY AND ENERGETICS

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.

KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION

Batch cultivation and continuous cultivation. Morphologically structured model, genetically structured models, cybernetic model, modelling of recombinant systems. 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.

TEXT BOOKS

1. Doran M Pauline, 2012. "Bioprocess Engineering Principles". 2 nd Edition, Elsevier.
2. Bailey, James E. and David F. Ollis, 2010. "Biochemical Engineering Fundamentals", 2 nd Edition. Mc Graw Hill India.
3. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, 2013. Principles of Fermentation Technology, Science & Technology Books 2nd edition. Pergamon Press.
4. Ghasem D.Najafpour, 2009. "Biochemical Engineering and Biotechnology", Elsevier.

REFERENCES

1. Tapobrate Panda, 2011. "Bioreactors: Analysis and Design", Tata McGraw Hill,
2. Villadsen, John, Nielsen, Jens, Lidén, Gunnar, Bioreaction Engineering Principles, Springer 3rd edition 2011.

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17BTSE09	INDUSTRIAL BIOTECHNOLOGY LAB	Category	L	T	P	Credit
		EC (SE)	0	0	4	2

PREAMBLE

The curriculum of Industrial Biotechnology Lab involves in the steps of production of Citric acid, ethanol from yeast and the production of wine from black grapes. As the application part it may deals with the production of beer form cereals and the antibiotics using *streptomyces* species.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To acquires and recognize the morphology of different microbes.
2	To Interpret and analyse the different types of media
3	To differentiate, the biochemical characters of microorganisms
4	To assess the quality of biotechnology products
5	To Check preservation procedure for microorganisms

COURSE OUTCOMES

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

CO1. Determine the production of citric acid	Remember
CO2. Outline the steps involved in the production of ethanol from yeast	Understand
CO3. Illustrate the mechanism of wine produced from black grapes	Analyse
CO4.Understand the process of production of antibiotics from *Streptomyces* species.	Evaluate
CO5. Outline the process involved in the production of protease from different sources	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L	-	-	L	L	-	L	-	L	-	-	-	-
CO2	S	-	S	-	L	M	-	-	L	-	-	L	-	-	-
CO3	M	L	M	-	L	S	-	-	M	-	L	-	-	-	-
CO4	-	L	L	L	S	-	S	-	-	-	-	-	-	-	-
CO5	S	-	L	L	M	-	M	-	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Production of Citric acid
2. Production of ethanol from black grapes
3. Production of Beer from cereals
4. Production of Protease
5. Production of Antibiotics using *Streptomyces* species

6. Production of Vitamins
7. Production of growth regulators
8. Production of Biofertilizers (N – Fixers & P - Solubilizers)
9. Production of Biocontrol Agents
10. Production of Single cell Protein (Spirulina)
11. Production of Vermicompost

REFERENCE BOOKS

1. Cruger, W., Cruger, A., "Biotechnology: A textbook of Industrial Microbiology", Panima Publishing Corporation, New Delhi, 2000

COURSE DESIGNERS

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17BTSE10	FERMENTATION LAB	Category	L	T	P	Credit
		EC (SE)	0	0	4	2

PREAMBLE

The curriculum of Fermentation Lab involved in the steps of production of primary and secondary metabolites for various industrial applications. It determine the growth kinetics of microorganisms in fermentation process. These study may understand the important aspects in fermentation engineering

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To acquires and recognize the morphology of different microbes.
2	To Interpret and analyse the different types of media
3	To differentiate, the biochemical characters of microorganisms
4	To assess the quality of biotechnology products
5	To Check preservation procedure for microorganisms

COURSE OUTCOMES

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

CO1. Determine and record growth of bacterial yeast and to estimate biomass specific growth rate and yield coefficient	Remember
CO2. Describe the steps involved in the production process of ethanol and wine	Understand
CO3. Develop the mechanism of Solid state fermentation for the production of metabolites	Analyse
CO4. Evaluate process for production of antibiotics using *Streptomyces* species	Evaluate
CO5. Assess the process involved in the production of protease from different sources	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	S	L	-	-	L	L	-	L	-	M	-		-	-
CO2	L	-	M	-	L	L	-	-	L	-	-	L		-	-
CO3	M	L	S	-	L	L	-	-	M	-	S	-		-	-
CO4	-	M	L	L	M	-	M	-	-	-	-	-		-	-
CO5	L	-	M	L	M	-	M	-	-	-				-	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. Growth of Bacterial yeast-Estimation of Biomass, Calculation of μ and Yp/s
2. Production of ethanol from yeast
3. Production of wine from black grapes
4. Growth Kinetics in Fermentation
5. Solid State Fermentation (Production of Metabolite Primary & Secondary)
6. Production of Antibiotics using Streptomycin species
7. Residence Time Distribution
8. Production of Protease
9. Production of Biofertilizers(N – Fixers & P - Solubilizers)
10. Production of Microbial Biomass

11. Production of Single cell Protein (Spirulina)
12. Production of Vermicompost

REFERENCE BOOKS

1. Irwin H.Segel, "Biochemical Calculations", John Wiley & Sons, 2nd Edition, Wiley Publishers, New Delhi. 2011.
2. Pierre-Yves Bouthyette, "Fermentation Technologies", 2nd edition, Rai University, Ahmedabad, 2005.

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17BTSE11	FLUID MECHANICS FOR BIOTECHNOLOGY LAB	Category	L	T	P	Credit
		EC (SE)	0	0	4	2

PREAMBLE

This lab course is designed to impart good knowledge in fluid mechanics concepts

PRERQUISITE - Nil

COURSE OBJECTIVES

1	To learn calibration of flow meters
2	To describe in detail about the pressure loss for fluid flows
3	To describe about pump characteristics
4	To demonstrate in detail about hydrodynamic concepts.

COURSE OUTCOMES

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

CO1. Students will be familiar with various variable area flow meters and variable head flow meters	Understand
CO2. Identify the fundamental knowledge about the open channels	Understand
CO3. Demonstrate the techniques for analysing the flow of fluids through closed conduits	Apply
CO4. Employ the knowledge of pumps for the transportation of fluids based on process conditions/requirements and fluid properties	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	M	-	-	-	-	-	-	-	-	L	L	-	L
CO2	S	L	M	-	-	-	-	-	-	-	-	L	M	-	L
CO3	S	L	M	-	-	-	-	-	-	-	-	L	M	-	L
CO4	S	L	S	-	-	-	-	-	-	-	M	-	S	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

1. Viscosity measurement of non- Newtonian fluids
2. Calibration of constant and variable head meters
3. Calibration of weirs and notches
4. Open drum orifice and draining time
5. Flow through straight pipe
6. Flow through annular pipe
7. Flow through helical coil and spiral coil
8. Losses in pipe fittings and valves
9. Characteristic curves of pumps
10. Pressure drop studies in packed column

11.	Hydrodynamics of fluidized bed
12.	Drag coefficient of solid particle

TEXT BOOKS

1. Frank M. White, Fluid Mechanics (Sixth Edition), Tata McGraw-Hill, New Delhi (2008).
2. J. O. Wilkes, Fluid Mechanics for Chemical Engineers, Prentice Hall (1999).
3. W. L. McCabe, W. L. Smith, and P. Harriot, Unit Operations of Chemical Engineering, McGraw-Hill International Edition (Sixth edition) (2001).

REFERENCE BOOKS

1. R. B. Bird, W. L. Stewart and E. L. Lightfoot, Transport Phenomena (Secondedition), Wiley Singapore (2002).
2. M. M. Denn, Process Fluid Mechanics, Prentice Hall (1980).
3. Ron Darby, Chemical Engineering fluid Mechanics, Marcel Dekker Inc, NY (1996).

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SPECIALISATION - MEDICAL AND PHARMACEUTICAL BIOTECHNOLOGY

17BTSE12	INDUSTRIAL MANAGEMENT AND PHARMACEUTICAL MARKETING	Category	L	T	P	Credit
		SE (PS)	3	0	0	3

PREAMBLE

This course is designed to impart advanced knowledge and skills required such as Industry plant location, lay out, to learn the concept of pharmaceutical industry, drug manufacture and marketing, various regulatory affairs.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To state the knowledge about industry layout and Design
2	To explain the basics of industry production, storages, quality control and Personnel management
3	To demonstrate the different methods of Product planning, method of marketing Distribution polices
4	To outline the basics of industrial accountancy and Principles of Costing, Estimating Balance sheet and Profit and Loss Account etc.,
5	To assess the regulatory affairs which involved in pharmaceutical industry

COURSE OUTCOMES

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

CO1: Underline the industry layout and Design	Remember
CO2: Discuss the industry production and observe the quality control and Personnel management	Understand
CO3: Classify different methods in marketing and distribution	Apply
CO4: Infer industry accountancy, costing, profit and loss	Analyse
CO5: Assess the regulatory affairs which involved in pharmaceutical industry	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L	L	-	-	-	-	-	-	-	-	-	-	-
CO2	S	L	L	L	L	-	L	-	-	-	-	L	L	L	L
CO3	M	L	-	L	L	L	-	-	-	-	-	-	-	L	-
CO4	S	L	L	-	L	-	L	-	L	-	-	-	L	-	-
CO5	S	M	L	L	-	-	-	-	L	-	-	-	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

PLANT LOCATION AND LAY-OUT OF AN INDUSTRY

Various factors affecting locational aspect, layout of building and equipment product lay-out v/s process layout, drug store location and selection of premises, drug store management.

PRODUCTION PLANNING AND CONTROL

Scientific purchasing, quality control, problems of productivity, stores organization, location of stores, receiving, inspection of materials, issue from the store, control of stores and stocks, Store Accounting and Records. Personnel management: Selection, Appointment, training, transfer, Promotion, demotion policies, remuneration, job evaluation, human relations.

SALES ORGANISATION

Market, definition–Determent approaches to the study of marketing, institutional approach, Market planning – Product planning, method of marketing, wholesale retailers, functional approach, cost and efficiency in marketing commodity approach. Distribution polices: pharmaceutical product marketing, sales promotion policies-Detailing to physician, professional persons, sampling, window and interior display, product advertising, sales promotion, publicity.

ELEMENTARY INDUSTRIAL ACCOUNTANCY

Elements of Double entry book Keeping, Books of Accounts-Journal and ledger, cash book. Balance sheet, Profit and Loss Account, Principles of Costing and Estimating.

REGULATORY AFFAIRS

Schedule M of Drugs and Cosmetics act, Drug Development Stages - NDA and NADA filing, ICH guidelines - Introduction.

TEXT BOOKS

1. New Drug Approval Process: Accelerating Global Registrations by Richard A Guarino, MD,5th edition, Drugs and the Pharmaceutical Sciences, Vol.190.

2. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons.Inc

REFERENCES BOOK

1. FDA regulatory affairs: a guide for prescription drugs, medical devices, and biologics/edited By Douglas J. Pisano, David Mantus.

2. Guidebook for drug regulatory submissions / Sandy Weinberg. By John Wiley & Sons.Inc.

3. FDA regulatory affairs: a guide for prescription drugs, medical devices, and biologics/edited By Douglas J. Pisano, David Mantus.

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17BTSE13	PHARMACEUTICAL PHYTO CHEMISTRY	Category	L	T	P	Credit
		SE (PS)	3	0	0	3

PREAMBLE

The subject is designed to impart knowledge about recent advances in the field of medicinal chemistry at the molecular level including different techniques involved in rational drug design, pro drug and analog design, pharmaceuticals derived from medicinal plants and their applications.

PREREQUISITE- NIL

COURSE OBJECTIVES

1	To list the Medicinal plants, constituents, isolation, Characterization and purification of phyto constituents.
2	To interpret the basic concepts involved in drug discovery
3	To execute the different mechanism of action involved in pro drug design and analog design
4	To categorise the phyto constituents derived from the medicinal plants
5	To generate the monographs of herbal drugs

COURSE OUTCOMES

Recall the basic information of different medicinal plants ,estimation of phyto constituents, isolation procedure and characterization of phytoconstituents	Remember
Demonstrate the concepts involved in drug discovery	Understand
Practice the prodrug design and analog design	Apply
Estimate the different phytoconstituents derived from the medicinal plants	Analyse
Design the monographs of herbal drugs	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	S	-	M	-	-	-	-	-	-	L	-	M	-
CO2	M	L	M	L	S	-	-	-	-	-	-	M	-	M	-
CO3	M	M	M	L	M	-	-	-	-	-	-	M	-	M	-
CO4	S	M	L	M	M	-	-	L	-	-	-	L	-	S	-
CO5	S	M	S	L	M	L	S	L	-	-	-	L	-	S	L

S- Strong; M-Medium; L-Low

SYLLABUS

MEDICINAL PLANTS

Medicinal plants constituents & their Biosynthesis, Isolation, Characterization and purification with a special reference to their importance in herbal industries of following phyto-pharmaceuticals containing drugs- Alkaloids, Glycosides, Steroids and Terpenoids:

DRUG DISCOVERY

Stages of drug discovery, lead discovery; identification, validation and diversity of drug targets. Biological drug targets: Receptors, types, binding and activation, theories of drug receptor interaction, drug receptor interactions, agonists vs antagonists, artificial enzymes

PRO DRUG DESIGN AND ANALOG DESIGN

Prodrug design: Basic concept, Carrier linked pro drugs / Bio precursors, Pro drugs of functional group, Pro drugs to improve patient acceptability, Drug solubility, Drug absorption and distribution, site specific drug delivery and sustained drug action.

Analog Design: Introduction, Classical & Non classical, Bio isosteric replacement strategies, rigid analogs, alteration of chain branching, changes in ring size, ring position isomers, design of stereo isomers and geometric isomers, fragments of a lead molecule, variation in inter atomic distance

PHARMACEUTICALS FROM MEDICINAL PLANTS

New pharmaceuticals for the following class of drugs- Drugs Affecting the Central Nervous System: Morphine Alkaloids, Anticancer Drugs: Paclitaxel and Docetaxel, Etoposide Cardiovascular Drugs: Lovastatin, Teprotide and Dicoumarol.

MONOGRAPHS OF HERBAL DRUGS

General parameters of monographs of herbal drugs and comparative study in IP, USP, Ayurvedic Pharmacopoeia, Siddha and Unani Pharmacopoeia. WHO guidelines in quality assessment of herbal drugs.

TEXT BOOKS

1. Herbal drug industry by R.D. Choudhary (1996), Eastern Publisher, NewDelhi.
2. GMP for Botanicals - Regulatory and Quality issues on Phytomedicine by
Pulok K Mukharjee (2003), Ist Edition, Business horizons Robert Verpoorte, New Delhi.
3. Text book of Pharmacognosy and Phytochemistry by Vinod D. RangarI (2002), Part I & II, Career Publication, Nasik, India.

REFERENCE BOOKS

1. Drug Formulation Manual by D.P.S.Kohli and D.H.Shah (1998), Eastern Publisher, New Delhi.
2. Quality control of herbal drugs by Pulok K Mukarjee (2002), Business Horizons Pharmaceutical Publisher, New Delhi.

COURSE DESIGNERS

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17BTSE14	MEDICAL PHARMACOLOGY AND DRUG DELIVERY	Category	L	T	P	Credit
		SE (PS)	3	0	0	3

PREAMBLE

This course is designed to impart knowledge on the area of pharmacology and advances in novel drug delivery systems, contraindications and clinical use of drugs in treatment of disease, formulation, evaluation of novel drug delivery systems, merits, demerits and its applications.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To recognize the knowledge on Molecular and Cellular mechanism of action of hormones
2	To summarize the basic concepts of chemotherapy agents
3	To demonstrate the different mechanism of action of immune response and hypersensitivity reactions
4	To construct the Rate Controlled Drug Delivery Systems and their feedback regulation
5	To implement the Novel Drug Delivery Systems and their merits and demerits

COURSE OUTCOMES

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

CO.1 Underline the molecular and cellular mechanism of action of hormones and their regulation.	Remember
CO2. Discuss the basics of chemotherapy, Antifungal and antiviral drugs	Understand
CO3. Illustrate the different mechanism of action of immune response and hypersensitivity reactions	Apply
CO4. Employ the rate controlled drug delivery system and their feedback regulated Drug Delivery Systems	Apply
CO5. Demonstrate the different kind of novel drug delivery system	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	-	L	-	-	-	-	-	L	S	-	-	-
CO2	S	-	-	L	M	L	-	-	-	-	L	M	-	-	-
CO3	M	L	-	S	S	L	-	-	-	-	M	L	-	-	-
CO4	S	M	L	S	S	-	-	-	-	-	M	-	-	-	-
CO5	S	M	-	M	S	-	M	-	-	L	-	M	M		

S- Strong; M-Medium; L-Low

SYLLABUS

ENDOCRINE PHARMACOLOGY

Molecular and cellular mechanism of action of hormones such as growth hormone, prolactin, thyroid, insulin and sex hormones. Anti-thyroid drugs, Oral hypoglycaemic agents, Oral Contraceptives, Corticosteroids. Drugs affecting calcium regulation.

CHEMOTHERAPY

Cellular and molecular mechanism of actions and resistance of antimicrobial agents such as ß-lactams, aminoglycosides, quinolones, Macrolide antibiotics. Antifungal, antiviral, and anti-TB drugs

IMMUNOPHARMACOLOGY

Cellular and biochemical mediators of inflammation and immune response. Allergic or hypersensitivity reactions. Pharmacotherapy of asthma and COPD. Immuno suppressants and Immuno stimulants

RATE CONTROLLED DRUG DELIVERY SYSTEMS

Principles & Fundamentals, Types, Activation; Modulated Drug Delivery Systems; Mechanically activated, pH activated, Enzyme activated, and Osmotic activated Drug Delivery Systems Feedback regulated Drug Delivery Systems; Principles & Fundamentals.

NOVEL DRUG DELIVERY SYSTEMS

Introduction, formulation, merits, demerits, Application and evaluation of following— Mucosal drug delivery system, Transdermal drug delivery system (TDDS), Parenteral implants, ophthalmic inserts, Intrauterine drug delivery system (IUDs), Liposomes, Probiotics and Prebiotics. Gastro retentive drug delivery system, Colon targeted drug delivery system, externally modulated devices and delivery

TEXT BOOKS:

1. Y W. Chien, Novel Drug Delivery Systems, 2nd edition, revised and expanded, Marcel Dekker, Inc., New York, 1992.
2. Robinson, J. R., Lee V. H. L, Controlled Drug Delivery Systems, Marcel Dekker,Inc., New York, 1992.
3. Encyclopedia of controlled delivery, Editor- Edith Mathiowitz, Published by WileyInterscience Publication, John Wiley and Sons, Inc, New York, Chichester/Weinheim

REFERENCES:

1. N.K. Jain, Controlled and Novel Drug Delivery, CBS Publishers & Distributors, New Delhi, First edition 1997.
2. Laurence Brunton, Bruce A. Chabner, Bjorn Knollman, "Goodman and Gillman's The Pharmacological basis of therapeutics", 12th Edition, 2011, Publisher: McGraw Hill Education.
3. David E Golan, Armen H. Tashjian Jr., Ehrin J. Armstrong, April W. Armstrong, "Principles of Pharmacology. The Pathophysiologic basis of drug therapy", 3rd Edition, 2011, Publisher: LWW.
4. Katzung , Bertram, "Basic and Clinical Pharmacology", 14th Edition, 2018, Publisher: McGraw-Hill.

COURSE DESIGNERS

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17BTSE15	PHARMACEUTICAL ASPECTS OF MICROBIOLOGY	Category	L	T	P	Credit
		SE (PS)	3	0	0	3

PREAMBLE

This subject is designed to provide the advanced knowledge to the students in invaluable areas of advanced microbiology which plays a crucial role in determining its future use and applications in medicine, drug discovery, mechanism of action of antibiotics, and uses in pharmaceutical industry.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To discuss the knowledge about industrially important microorganism and their application
2	To summarize the basic concepts of Antibiotics and Synthetic antimicrobial agents action
3	To outline the Mechanism and action of antibiotics
4	To outline the Mechanisms and action of Bacterial Virulence
5	To check the disease causing microorganisms and the corresponding diseases

COURSE OUTCOMES

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

CO1: Recall the basic information of industrially important microorganism and their application	Understand
CO2: Describe the difference between the Antibiotics and Synthetic antimicrobial agents action	Understand
CO3: Predict the Mechanism of action of antibiotics	Analyze
CO4: Detect Bacterial Virulence	Analyze
CO5: Validate the disease causing microorganism and their related disease	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	-	L	-	-	-	-	-	L	S	-	-	-
CO2	S	-	-	L	M	L	-	-	-	-	L	M	-	-	-
CO3	M	L	-	S	S	L	-	-	-	-	M	L	-	-	-
CO4	S	M	L	S	S	-	-	-	-	-	M	-	-	-	-
CO5	L	L	L	L	M	S	M	S	-	-	L	-	S	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

MICROBIOLOGY

Introduction –Bacteria, fungi, actionmycetes and virus - structure, chemistry and morphology, cultural, physiological and reproductive features. Methods of isolation, cultivation and maintenance of pure cultures. Industrially important microorganisms - examples and applications

ANTIBIOTICS AND SYNTHETIC ANTIMICROBIAL AGENTS

Mechanism of action; microbial resistance; therapeutic, prophylactic usage and adverse reactions; Antibiotic and Synthetic antimicrobial agents: β- lactam, aminoglycosides, tetracyclines. Antifungal antibiotics: Griseofulvin; Antiviral drugs: Amantidines; Nucleoside analogues, Interferons, Peptide antibiotics.

MECHANISM OF ACTION OF ANTIBIOTICS

Inhibition of cell wall synthesis; nucleic acid and protein synthesis. Bacterial resistance to antibiotics; Penetration of antimicrobial agents (cellular permeability barrier, cellular transport system and drug diffusion). Mode of action of non–antibiotic antimicrobial agents; Mode of action of bacterial killing by quinolinones; Bacterial resistance to quionolinones.

MECHANISMS OF BACTERIAL VIRULENCE

A step wise process of infection – Crossing physical, chemical and biological barriers, Colonization, Association, Adhesion and Invasion of host tissue and toxigenesis with details account of virulence factors.

MICROBIAL PATHOLOGY

Identifying the features of pathogenic bacteria, fungi and viruses. Mechanism of microbial pathogenicity, etiology and pathology of common microbial diseases and currently recommended therapies for common bacterial, fungal & viral infections.

TEXT BOOKS

1. Agarwal S. S. and Paridhavi M., (2007), Herbal Drug Technology, Universities Press (India) Pvt. Ltd
2. Altreuter D., and D S. Clark, (1999), Combinatorial Biocatalysis: Taking the Lead From Nature, Curr. Opin. Biotechnol. 10, 130.
3. Burn J. H. (1957) Principles of Therapeutics, Blackwell Scientific Pub. O. Ltd. Oxford.

REFERENCES:

1. Bentley's Textbook of Pharmaceutics, Editior E. A. Rawlins, 8th Ed. (2002), Publisher: Bailliere Tindall, London
2. Burn J. H. (1957) Principles of Therapeutics, Publisher: Blackwell Scientific Pub. O. Ltd. Oxford.

COURSE DESIGNERS

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17BTSE16	PHARMACEUTICAL PROCESS CHEMISTRY	Category	L	T	P	Credit
		SE (PS)	3	0	0	3

PREAMBLE

This subject is designed to impart knowledge on the development and optimization of a synthetic drugs, various stages of process in pharmaceutical industry, Different methods involved in Unit operations and Industrial safety measures.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To acquire knowledge on basics of Process chemistry in industry
2	To know the techniques of Extraction, Filtration, Distillation and Evaporation process
3	To discriminate the Aerobic and anaerobic fermentation
4	To predict the Impurities in **Active Pharmaceutical Ingredient**
5	To understand the basics of Industrial Safety measures and Occupational Health

COURSE OUTCOMES

CO1: After the successful completion of the course, learner will be able to

CO2: Know the basic knowledge on Process chemistry	Understand
CO3: Operate the techniques of Extraction, Filtration, Distillation and Evaporation process in industry	Understand
CO4: Compare and differentiate the Aerobic and anaerobic fermentation process	Analyze
CO5: Validate the Impurities in **Active Pharmaceutical Ingredient**	Evaluate
CO6: Perform the Industrial Safety measures and Occupational Health in work place	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	-	L	-	-	-	-	-	L	S	-	-	-
CO2	S	-	-	L	M	L	-	-	-	-	L	M	-	-	-
CO3	M	L	-	S	S	L	-	-	-	-	M	L	-	-	-
CO4	S	M	L	S	S	-	-	-	-	-	M	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

PROCESS CHEMISTRY

Introduction, Synthetic strategy Stages of scale up process: Bench, pilot and large scale process. In-process control and validation of large scale process. Case studies of some scale up process.

UNIT OPERATIONS

a) Extraction: Liquid equilibria, extraction with reflux, extraction with agitation, counter current extraction.

b) Filtration: Theory of filtration, pressure and vacuum filtration, centrifugal filtration,

c) Distillation: steam distillation.
d)Evaporation: Types of evaporators, factors affecting evaporation.

UNIT PROCESSES
Fermentation: Aerobic and anaerobic fermentation. Production of Antibiotics- Penicillin and Streptomycin .Vitamins: B2 and B12

IMPURITIES IN API (ACTIVE PHARMACEUTICAL INGREDIENT)
Impurities in API and their types including genotoxic impurities. Isolation, characterization and profiling of impurities in APIs with at least one example

INDUSTRIAL SAFETY
MSDS (Material Safety Data Sheet), hazard labels of chemicals and Personal Protection Equipment, Fire hazards, Occupational Health, Effluents and its management.

TEXT BOOKS:

1. Burger A., A Guide to the Chemical Basis of Drug Design, Volume 1-8, Wiley Interscience Publication (John Wiley & Sons), New York.
2. Sharma A.M., Safety and Health in Industry A Handbook, BS Publications Hyderabaad.

REFERENCES:

1. Pharmaceutical Manufacturing Encyclopedia, Volume 2.

Gadamasetti K., Process Chemistry in the Pharmaceutical Industry: Challenges in an Ever-Changing Climate-An Overview, Vol-2, CRC Press, London

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.S.Vinoth	Assistant Professor	Biotechnology	vinoth@avit.ac.in
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17BTSE17	PHARMACOGENOMICS	Category	L	T	P	Credit
		SE (PS)	3	0	0	3

PREAMBLE

The course provides fundamental knowledge in pharmacogenomics and implementation of pharmacogenomic studies. The detailed study on human drug response, drug metabolizing enzymes, methods and applications will be focused.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To study about impact of polymorphism in human genome and applications.
2	To know about functional analysis of gene variation
3	To understand the drug dose response relationships with pharmacogenetics.
4	To understand the genomics of biotech products
5	To study about the pharmacogenomics application in diseases

COURSE OUTCOMES

CO1: Know about the different method of analysing the gene variation	Understand
CO2: Discuss the response of gene towards drug	Understand
CO3: Analyse the techniques in biotech products	Analyze
CO4: Analyse the techniques in medicine	Evaluate
CO5: Exemplify the genomics of disease	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	-	L	-	-	-	-	-	L	S	S	-	-
CO2	S	-	-	L	M	L	-	-	-	-	L	M	-	-	-
CO3	M	L	-	S	S	L	-	-	-	-	M	L	-	-	-
CO4	S	M	L	S	S	-	-	-	-	-	M	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO PHARMACOGENOMICS

Historical perspectives and current status, Human Genome and Genomic Applications, Genetic Polymorphism of Metabolic Reactions, SNPs, Association Studies in Pharmacogenomics, Study on industries developing pharmacogenomic research

FUNCTIONAL ANALYSIS OF GENE VARIATION

Transfection Assays With Allele-Specific Constructs: Functional Analysis of UDP-Glucuronosyltransferase Variants, CYP 2D6, CYP2C19 in drug metabolism, Snapshot of the Allele-Specific Variation in Human Gene Expression, Genome-Wide Analysis of Allele-Specific Gene

Expression Using Oligo Microarrays, Roche Ampli Chip, HaploChIP: An In Vivo Assay.

HUMAN DRUG RESPONSE

Pharmacological profile of Human drug response, pharmacokinetics in pharmacogenetics, Drug-dose response relationships in pharmacogenetics, the genetic profile of Human drug response, Twin studies in pharmacogenomics

BIO-TECH PRODUCTS

Biotechnology and Related Techniques: Protein engineering, peptide chemistry and peptidomimetics, nucleic acid technology, catalytic antibodies and glycobiology ; Present products in medicine: Insulin, GH, Vaccines, Monoclonal antibodies, FSH, Tissue plasminogen activator (t-PA) ; Pharmacokinetics and dynamics of the peptide and protein drugs.

PHARMACOGENOMICS IN MEDICINE

Pharmacogenomics of Cardiovascular Diseases, Pharmacogenomics of Cancer treatment(Herceptin as model), Pharmacogenomics of Neurodegenerative Diseases, Inflammatory bowel syndrome, Pharmacogenomics in Depression, Pharmacogenomics and Respiratory diseases, Pharmacogenomics in AIDS, Pharmacogenomics in Antibiotics.

TEXT BOOKS:

1. Pharmacogenomics: Methods and Protocols (Methods in Molecular Biology) First Edition (2005) Federico Innocenti, Humana Press Inc, New Jersey, USA.
2. Pharmacogenomics and Personalized Medicine (Methods in Pharmacology and Toxicology) First Edition (2005) Nadine Cohen, Humana Press Inc, New Jersey, USA

REFERENCES:

1. An A-Z Guide to Pharmacogenomics, First Edition (2006) M.C. Catania, Published by American Association for Clinical Chemistry
2. Pharmacogenomics: Social, Ethical, and Clinical Dimensions, First Edition (2003) Mark A. Rothstein, Wiley-Liss Publications.

COURSE DESIGNERS

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1	Dr.S.Vinoth	Assistant Professor	Biotechnology	vinoth@avit.ac.in
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17BTSE18	HERBS AND DRUG ACTION	Category	L	T	P	Credit
		SE (PS)	3	0	0	3

PREAMBLE

This course is one of the most advanced introductions in Herbs and drug action that is offered. Students will learn about classification of Medicinal Plants, drugs and allergic reactions, their Science and mechanism of action of drugs, different medicinal plants used for various diseases etc. How herbs influence our physiology and can be helpful against several disorders.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To acquire knowledge about the medicinal plants and classification.
2	To study the basic concepts of allergens involved in allergic reaction
3	To analyze, different mechanism of action of drugs in living system
4	To understand the effects of various medicinal plants used for treatment of common disease
5	To elucidate the uses of medicinal plants for various illness

COURSE OUTCOMES

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

CO1. To Know the basic information of different medicinal plants their uses	Remember
CO2. To Gain information about allergens involved in allergic reactions	Understand
CO3. To Evaluate the mechanism action of drugs in living system	Analyse
CO4. To Analyse the various medicinal plants used for treatment of common disease	Analyse
CO5. To Forecast the disease manifestation and treatment with medicinal plants	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	L	M	L	-	S	S	L	L	M	S	M	M	S
CO2	-	M	-	L	L	-	M	L	L	M	M	S	M	S	-
CO3	S	M	-	L	M	L	M	M	M	L	M	M	S	S	-
CO4	S	M	-	S	S	L	M	L	M	M	L	M	S	L	L
CO5	-	M	-	S	S	L	L	L	-	-	-	M	L	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO MEDICINAL PLANTS

Terminologies – Definitions – Classification of medicinal plants based on their effects – Ecological status with special reference to India.

ALLERGENS

Allergens – types – sources – active principles – Chemical nature – Cell modifiers – Lectins – mutagens, teratogens – Allergic reactions with known examples

MECHANISM OF DRUG ACTION

Drugs acting on brain and nervous system – Rheumatic arthritis – Psychoactive drugs – Depressants, Stimulants, hallucinogens – sources, effects, basic mechanism of action

DRUGS FROM MEDICINAL PLANTS

Cardiovascular diseases – blood pressure – cardiac drugs of plant origins – alkaloids, anticoagulants – basic mechanism of action. Pulmonary / respiratory disorders – asthma – bronchitis – common cold – allergy – Remedy from plants.

DISEASE MANIFESTATION AND COMMONLY USED MEDICINAL PLANTS

Drugs for urinogenital disorders – roots of *Withania somnifera* – Memory stimulants – *Centella asiatica* – Drugs for dissolving kidney stones – *Musa paradisica* (pseudo stem) – Anti-inflammatory drugs – Cardiospermum – Anticancer drugs – *Catharanthus roseus*

TEXT BOOKS:

1. R. Cassileth, K. Simon Yeung, Jyothirmai Gubili , 2010. Herb-Drug Interactions in Oncology, 2nd edition 2nd Edition, People\'s Medical Publishing House

REFERENCES:

1. 1. Kumar, N.C. (1993). An Introduction to Medical botany and Pharmacognosy. Emkay

Publications, New Delhi.

2. Rao, A.P. (1999). Herbs that heal. Diamond Pocket Books (P) Ltd., New Delh

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17BTSE19	SKILL BASED ETHNO MEDICINE	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

PREAMBLE

Ethno medicine course deals with the interaction of people and plants with a broad survey on diversity of plants described both scientifically and culturally. Students learn about the social impact of plants on culture and also gain knowledge on identification, characterization and the uses of different medicinal plants in treating various diseases.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To state the scope and history of people and plant interaction from the past
2	To explain the functions and uses of plants
3	To demonstrate the different tribal medicine used for disease diagnosis and treatment.
4	To develop an understanding of the importance of plants in our daily lives
5	To produce cosmetics using medicinal plants

COURSE OUTCOMES

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

CO1. Recall the basic information and ethnic knowledge about plants	Remember
CO2. Demonstrate the knowledge about the uses of medicinal plants	Understand
CO3. Illustrate the uses of different tribal medicine for disease diagnosis and treatment	Apply
CO4. Appraise the traditional knowledge and utility of some commonly used medicinal plants	Analyze
CO5. Develop the cosmetics using medicinal plants	create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	--	---	S	--	-	M	--	-	-	-	-	-	-	-
CO2	S	M	--	--	--	M	-	-	-	-	-	-	-	-	-
CO3	S	---	M	--	-	-	-	-	-	-	-	S	-	-	-
CO4	S	--	---	S	M	S	M		-	-	-	-	-	-	-
CO5	M	--	--	S	M	S	M	E	-	--	--	S	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INRODUCTION TO ETHNOMEDICINE

Ethno medicine – definition, history and its scope – Inter disciplinary approaches in ethno botany – Collection of ethnic information.

MEDICINAL PLANTS AND HEALTH CARE

Importance of medicinal plants – role in human health care – health and balanced diet (Role of proteins, carbohydrates, lipids and vitamins).

TRIBAL MEDICINE

Tribal medicine – Plants in folk religion – *Aegle marmelos, Ficus benghalensis, Curcuma domestica, Cyanodon dactylon and Sesamum indicum*- methods of disease diagnosis and treatment.

MEDICINAL PLANTS IN DAY TO DAY LIFE

Traditional knowledge and utility of some medicinal plants in Tamilnadu – *Solanum trilobatum, Cardiospermum halicacabum, Vitex negundo, Adathoda vasica, Azadirachta indica, Gloriosa superba, Eclipta alba, Aristolochia indica, Phyllanthus fraternus and Boerhaavia diffusa. Ocimum sanctum, Centella asiatica, Solanum trilobatum, Cassia auriculata, Aloe vera.*

HERBAL PLANTS USED IN COSMETICS

Plants used as a cosmetics-Almond (*Prunus dulcis*), Aloe (*Aloe vera*), Argan Tree (*Argania spinosa*), Buriti Palm (*Mauritia flexuosa*), Cinnamon (*Cinnamomum verum*), Grape (*Vitis vinifera*), Lemonbalm (*Melissa officinalis*), Malabar Tamarind (*Garcinia cambogia)*

TEXT BOOKS:

1. Ethnobiology – R.K.Sinha & Shweta Sinha – 2001. Surabhe Publications – Jaipur.
2. Swapan Kumar Kolay, Ethno-medicine for Traditional Health Care, 2016,

   Publisher B.R. Publishing Corporation

REFERENCES:

1. Tribal medicine – D.C. Pal & S.K. Jain 1998, Naya Prakash, 206, Bidhan Sarani, Calcutta – 700 006.
2. Contribution to Indian ethnobotany – S.K. Jain 1995, 3rd edition, Scientific publishers, P.B.No. 91, Jodhpur, India.
3. A Manual of Ethnobotany – S.K.Jain, 1995, 2nd edition.

COURSE DESIGNERS

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17BTSE20	PHARMACEUTICAL CHEMISTRY LABORATORY	Category	L	T	P	Credit
		SE (PS)	0	0	4	2

PREAMBLE

The course is focused on analysis of properties of raw material used for drug preparation and development of pharmaceutical products like Syrups, powders, suppositories, gargles and mouth washes

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To know certain properties of raw materials used in drug preparations
2	To classify compound based on the reactions
3	To formulate syrup, powders, suppositories, gargles and mouth washes

COURSE OUTCOMES

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

CO1. Understand the different types of reaction during drug preparation	Understand
CO2. Demonstrate about the reaction in drug preparations	Apply
CO3. Test the melting and boiling point of the given sample	Analyze
CO4. Distinguish the reactions in drug preparations	Analyze
CO5. Prepare the drug based on type of reaction	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	-	-	M	S	M	-	-	-	-	-	-	M	-
CO2	S	S	M	-	-	-	-	-	-	-	-	-	-	S	-
CO3	S	S	S	M	S	-	-	-	-	-	-	-	M	S	-
CO4	S	S	S	-	S	-	-	-	-	-	-	-	-	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

1. To analyze the presence of acid radicals (anions) in the given mixture.
2. To perform detection of group I and group II radicals
3. To perform determination of melting point and boiling points.
4. Preparation of simple organic compounds based on different types of reactions

a) N-Acetylation : Preparation of Acetanilide from Aniline
b) O-Acetylation : Preparation of Aspirin from Salicylic acid
c) Bromination : Preparation of p-Bromoacetanilide from Acetanilide
d) Hydrolysis : Preparation of p-Bromoaniline from p-Bromoacetanilide
e) Nitration : Preparation of m-dinitrobenzene from Nitrobenzene/picric acid from phenol
f) Reduction : Preparation of m-nitro aniline from m-dinitro benzene.
g) Oxidation : Preparation of Benzoic acid from benzyl chloride / benzyl alcohol.
h) Esterification : Preparation of Benzyl benzoate from benzoyl chloride.

REFERENCES:

1. Laboratory Manual.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.B.Prabasheela	Associate Professor	Biotechnology	prabasheela@avit.ac.in
2	Mr.N.Jawahar	Assistant Professor	Biotechnology	jawahar@vmkvec.edu.in

17BTSE21	PHYTOCHEMISTRY LAB	Category	L	T	P	Credit
		SE (PS)	0	0	4	2

PREAMBLE

The course aims to provide students with the necessary skills for separation of the active constituents obtained from natural sources (alkaloids – glycosides – Coumarins- Tannins) in addition to the different methods of separation (chromatography) and then identify these active ingredients either in pure form of a mixture- as well as the different methods to evaluate these components.

PREREQUISITE – Biochemistry

COURSE OBJECTIVES

1	To acquires and recognize the basics of sample collection,identify plant powder.
2	To Interpret and analyse the routine phytochemical analysis test
3	To differentiate, the compounds like Alkaloids, Steroids, Triterpenoids and their glylosides using different methods
4	To assess the phyto chemical constituents of plants
5	To Check and formulate different phyto constituents from plants

COURSE OUTCOMES

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

CO1.Recall the basic information of sample collection, process and storage methods	Remember
CO2. Demonstrate the routine phytochemical constitutes of plants	Understand
CO3. Distinguish the compounds like Alkaloids, Steroids, Triterpenoids and their glylosides using different methods	Analyse
CO4.Test, Extract, isolates and identifies the active substances of the medicinal plants.	Evaluate
CO5. Validate the different phyto constituents from plants	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PS O3
CO1	L	S	L	-	-	M	M	-	L	-	M	-		-	-
CO2	L	-	M	-	S	M	-	-	L	-	-	M		-	-
CO3	M	L	S	-	S	L	-	-	M	-	S	-		-	-
CO4	-	M	L	L	S	-	L	-	-	-	-	-		-	-
CO5	L	-	M	L	S	-	M	-	-	-				-	-

S- Strong; M-Medium S; L-Low

SYLLABUS

I. Preparation of extracts of Organized crude drugs/Herbs by successive solvent extraction method to record the percentage yield and physical status of the respective extracts and for subjecting them to phytochemical screening.

II. Detection of Phytoconstituents such as i) Alkaloids, ii) Steroids, Triterpenoids and their glylosides and Saponins iii) Flavonoids and their glycosides iv) Anthracene Glycosides v) Coumarins vi) Tannins by Test

Tube and TLC methods.
III. a) Identification of alkaloids in a mixture by TLC b) Colour reactions of different groups of Alkaloids.
IV) Detection, extraction and estimation of volatile oils by Clevenger's method (Hydro distillation method) TLC of Volatile oils and their pure constituents.
V) Identification of mono saccharides by paper chromatography
VI) Analysis of recorded spectra of some simple phytochemicals.

TEXT BOOKS

1. Principles and Practice of Phototherapy: Modern Herbal Medicine" (2000) by Mills S., Bone K., Corrigan D., Duke J.A. and Wright J.V. Churchill Living Stone, Edinburgh; New York.

REFERENCE BOOKS

1**.** Medicinal Plant Constituents" (1981), 3rd ed. by Balbaa S., Hilal S.H. and Zaki A.Y., Egyptian Dar El-kotob, Cairo.

2. The Systemic Identification of Flavonoids" (1970) by Mabry T.J., Markham K.R. & Thomas M.B., Springer-Verlag, Berlin–Heidelberg– New York.

COURSE DESIGNERS

S.No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1.	Dr.B.Prabasheela	Associate Professor	Biotechnology	prabasheela@avit.ac.in
2.	Mr.N.Jawahar	Assistant Professor	Biotechnology	jawahar@vmkvec.edu.in

17BTSE22	PHARMACEUTICAL MICROBIOLOGY LAB	Category	L	T	P	Credit
		SE (PS)	0	0	4	2

PREAMBLE

The course aims to provide students with the necessary skills for the research and development of anti-infective agents, the use of microorganisms to detect mutagenic and carcinogenic activity in prospective drugs, and the use of microorganisms in the manufacture of pharmaceutical products like insulin and human growth hormone.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To acquire and recognize the morphology of different microbes.
2	To Interpret and analyse the different types of media
3	To distinguish the biochemical characters of microorganisms
4	To check the pure cultures by different streaking methods
5	To assess preservation procedure for microorganisms

COURSE OUTCOMES

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

CO1.Recall the basic information of morphology and preparation of various culture media	Remember
CO2. Describe the motility of bacteria and biochemical methods	Understand
CO3. Estimate the pour plate and microscopic count methods	Analyse
CO4. To compare, Extract, isolates and identifies the microbes.	Evaluate
CO5. Estimate the disinfectant and oligodynamic action	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	S	L	-	-	M	M	-	L	-	M	-		-	-
CO2	L	-	M	-	S	M	-	-	L	-	-	M		-	-
CO3	M	L	S	-	S	L	-	-	M	-	S	-		-	-
CO4	-	M	L	L	S	-	L	-	-	-	-	-		-	-
CO5	L	-	M	L	S	-	M	-	-	-				-	-

S- Strong; M-Medium S; L-Low

SYLLABUS

1. Introduction to equipment and glassware used in microbiology laboratory.
2. Study of morphology of different microbes
3. Preparation of various culture media, cultivation of microbes and observation of colony characteristics.

4. Sterilization techniques (moist and dry heat) and their validations.
5. Aseptic transfer of culture into different types of media.
6. Characterisation of microbes by staining techniques (simple, gram's, acid fast and negative staining).
7. Study of motility of bacteria by hanging drop method.
8. Characterization of microbes through Bio chemical reactions:
   a. Indole test.
   b. Methyl red test.
   c. Voges proskauer test.
   d. Starch hydrolysis test.
   e. Fermentation of carbohydrates.
9. Isolation of pure cultures by streak plate, spread plate & pour plate techniques.
10. Enumeration of bacteria by pour plate/spread plate technique
11. Enumeration of bacteria by direct microscopic count.
12. Evaluation of any disinfectant by phenol coefficient test
13. Study of Oligodynamic action (of metals on bacteria)
14. Preservation of microrganisms (slant and stab cultures)
15. Microbiological Analysis of Water.

REFERENCE BOOKS

1. Garg,F C Experimental Microbiology
2. Gaud.R.S, Gupta G.D, Practical Microbiology
3. Vanitha Kale and kishore Bhusari, Pratical microbiology principles and Techniques

COURSE DESIGNERS:

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1.	Dr. S. Vinoth	Assistant Professor	Biotechnology	vinogenes@gmail.com
2.	Mrs.C.Nirmala	Assistant Professor	Biotechnology	nirmala@vmkvec.edu.in

17BTSE23	ANALYTICAL METHODS IN PHARMACEUTICAL LABORATORY	Category	L	T	P	Credit
		SE (PS)	0	0	4	2

PREAMBLE

This lab course is designed to impart good knowledge in various analytical techniques in pharmaceutical industry

PRERQUISITE

Nil

COURSE OBJECTIVES

1	To interpret the importance of calibration in apparatus
2	To express the different types of Titration processes
3	To summarize the knowledge on gravimetric methods
4	To demonstrate the Chromatographic techniques for product purification.
5	To outline the extraction techniques to separate biomolecules.

COURSE OUTCOMES

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

CO1. Express the various titration techniques used in pharmaceutical Industry.	Understand
CO2. Identify the fundamental knowledge about the gravimetric analysis	Understand
CO3. Demonstrate the techniques for the separation of aminoacids	Understand
CO4. Employ the separation using chromatographic techniques	Apply
CO5. Practice the spectroscopic techniques	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L	-	-	-	-	-	-	-	-	L	L	-	L
CO2	S	M	S	-	-	-	-	-	-	-	-	L	L	-	L
CO3	M	L	M	-	-	-	-	-	-	-	-	L	M	-	L
CO4	L	L	L	-	-	-	-	-	-	-	M	-	S	-	M
CO5	S	M	L	-	-	-	-	-	-	-	L	-	S	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

1. Standardization of analytical weights and calibration of volumetric apparatus.
2. Acid Base Titrations ; Preparation and standardization of acids and bases, some exercise related with determination of acids and bases separately in mixture form, some official assay procedure e.g. boric acid should also be covered.
3. Oxidation reduction titrations ; Preparation and standardization of some redox titrants e.g. potassium permanganate, potassium dichromate, iodine, sodium thiosulphate, etc., some exercises related to determination of oxidizing and reducing agents in the sample shall be covered. Exercises involving potassium iodate, potassium bromate, iodine solution, titanous chloride, sodium 2,6,-di chlorophenol indophenol, ceric ammonium sulphate be designed.

4. Precipitation Titrations ; Preparation and standardization of titrants like silver nitrate and ammonium thiocyanate, titrations according to Mohrs Volhards and Fajans methods.
5. Gravimetric Analysis : Preparation of Gooch crucible for filtration and use of sintered glass crucible, determination of water of hydration, some exercises related to gravimetric analysis should be covered.
6. Non-aqueous Titrations ; Preparation and standardization of perchloric acid and sodium/ potassium/lithium methoxides solutions, Estimations of some pharmacopoeial products.
7. Complexometric titrations ; Preparations and standardization of EDTA solution, some exercises related to pharmacopoeial assays by complexometric titrations.
8. Separation & identification of amino acids by paper chromatography
9. Separation & identification of alkaloids by TLC
10. UV spectrometric determination of Ibuprofen

TEXT BOOKS

1. Atherden, L.M. “Bentley and Driver’s Textbook of Pharmaceutical Chemistry”. 8th Edition, Oxford University Press, 1977.
2. Siddiqui, Anees A. “Pharmaceutical Analysis”. Vol.I & II, CBS, 2006.
3. Parimoo, P. “Pharmaceutical Analysis”. CBS, 1998.
4. Higuchi, Tekeru and Brochmann, Einar “Pharmaceutical Analysis”. CBS Publishers, 1997.

REFERENCE BOOKS

1. Gennaro, Alfonso R. “Remington : The Science and Practice of Pharmacy” Vol. I & II, 20th Edition, Lippincott Williams & Wilkins / B.I. Publication, 2000.
2. Connors, Kenneth A. “A Textbook of Pharmaceutical Analysis”. 3rd Edition, Johnwiley & Sons, 1982.
3. Ohannesian, Lena and Streeter, A.J. “Handbook of Pharmaceutical Analysis”. Marcek Dekker, 2002.
4. Stahl, Egon “Thin – Layer Chromatography : A Laboratory Handbook”. 2nd Edition, Springer, 2005

COURSE DESIGNERS

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CATEGORY ‘C’ – OPEN ELECTIVE COURSES - 6 - 9 CREDITS

17CSCC02	OBJECT ORIENTED PROGRAMMING	Category	L	T	P	Credit
		FC(ES)	3	0	0	3

PREAMBLE

This syllabus is intended for the Computer science students and enables them to learn Object Oriented Programming and the design of computer solutions in a precise manner. The syllabus emphasizes on OOP concepts, Functions, Polymorphism, Inheritance and I/O. The intention is to provide sufficient depth in these topics to enable candidates to apply Object Oriented Programming approach to programming. The modules in the syllabus reflect solving general problems via programming solution. Thus, modules collectively focus on programming concepts, strategies and techniques; and the application of these toward the development of programming solutions.

PREREQUISITE

Nil

COURSE OBJECTIVES

1	To implement the concepts of object oriented programming.
2	To learn the syntax and semantics of C++ programming language
3	To design C++ classes for code reuse, Constructors and member functions
4	To learn how inheritance and virtual function implement dynamic binding with polymorphism
5	To learn and implement the concepts of Templates and Exception handling

COURSE OUTCOMES

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

CO1. Construct object-oriented programs for a given scenario using the concepts of abstraction, encapsulation, message-passing and modularity.	Apply
CO2. Develop object-oriented programs for a given application using the concepts of compile-time and run-time polymorphism.	Apply
CO3. Construct object-oriented programs for a given application by using constructors	Apply
CO4. Develop object-oriented applications that can handle exceptions.	Apply
CO5. Construct object-oriented applications for a given scenario to persist data using files and object-serialization.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	L	-	-	-	-	M	M	L	L	L	S	M	-
CO2	S	S	M	-	-	-	-	M	M	L	L	L	S	S	L
CO3	S	S	M	-	-	-	-	M	M	L	L	L	S	L	L
CO4	S	S	L	-	-	-	-	M	M	L	L	L	S	S	-
CO5	S	S	M	-	-	-	-	M	M	L	L	L	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO FUNDAMENTAL CONCEPTS OF OOP

Object Oriented Paradigm: Elements of Object Oriented Programming – Working with classes, Classes and Objects-Class specification- accessing class members- defining member functions - Passing and returning objects – Array of objects - inline functions - accessing member functions within class - Static members.

OBJECT INITIALIZATION AND FRIEND FUNCTION

Constructors - Parameterized constructors - Constructor overloading. Copy constructor, Destructors, Default arguments - new, delete operators - "this" pointer, friend classes and friend functions.

OVERLOADING AND GENERIC PROGRAMMING

Function overloading – Operator overloading- Non-over loadable operators- unary operator overloading-operator keyword- limitations of increment/decrement operators- binary operator overloading- Generic programming with templates-Function templates- class templates.

INHERITANCE AND VIRTUAL FUNCTION

Inheritance-Base class and derived class relationship-derived class declaration-Forms of inheritance- inheritance and member accessibility, abstract class, virtual functions, pure virtual function **.**

EXCEPTION HANDLING AND STREAMS

Exception handling - Try Catch Throw Paradigm - Uncaught Exception- Files and Streams-Opening and Closing a file- file modes- file pointers and their manipulation, sequential access to a file-random access to a file-Reading and Writing – Exception handling. String Objects.

TEXT BOOKS:

1. B. Trivedi, "Programming with ANSI C++", Oxford University Press, 2007.
2. K. R. Venugopal, Rajkumar, T. Ra vishankar, Mastering C++, 4th Edition, Tata McGraw 2. Hill, 2008.
3. Budd T., An Introduction to Object-oriented Programming, Addison-Wesley 3rd 4. edition, 2008.
4. Bjarne stroustrup, The C++ programming Language, Addison Wesley, 3rd edition2008.
5. Harvey M. Deitel and Paul J. Deitel, C++ How to Program, 7th edition, Prentice Hall, 2010.
6. Tony Gaddis, Starting Out with Java: From Control Structures through Objects, 4/E, Addison-Wesley, 2009.

REFERENCES:

1. H.M. Deitel and P.J. Deitel, C How to program Introducing C++ and Java, Fourth Edition, Pearson Prentice Hall, 2005.
2. B. Stroustrup, "The C++ Programming language", Third edition, Pearson Education, 2004.

COURSE DESIGNERS

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1	Dr. K. Sasikala	Associate Professor	CSE	sasikalak@vmkvec.edu.in
2	Mr.B.Sundaramurthy	Associate Professor	CSE	sundaramurthy@vmkvec.edu.in

17CSCC07	OPERATING SYSTEM	Category	L	T	P	Credit
		FC	3	0	0	3

PREAMBLE

The student will be able to understand the concepts of operating system to distributed environment like cloud computing, mobile computing etc. This course also includes set of case studies that provides insight into some existing distributed operating systems.

PREREQUISITE

Operating Systems Concepts

COURSE OBJECTIVES

1	To be aware of the evolution of operating systems.
2	To learn what processes are, how processes communicate, how process synchronization is done and how to manage processes.
3	To have an understanding of the main memory and secondary memory management techniques.
4	To understand the I/O Subsystem.
5	To have an exposure to the role of operating system in cloud and mobile environment operating systems.

COURSE OUTCOMES

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

CO1.Apply the concepts of operating system to anevolution of operating systems and identify the features specific to operating systems.	Apply
CO2.Apply the process synchronization concepts for the given scenario in operating systems environment.	Apply
CO3.Illustrate the different techniques of management of memory (the main memory and secondary memory management techniques).	Apply
CO4.Apply the I/O Subsystem concepts for a given scenario.	Apply
CO5. Identify the role of operating system in cloud and mobile environment.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	L	-	-	-	-	-	-	-	-	-	L	M	S
CO2	S	M	L	-	-	-	-	-	-	-	-	-	L	M	S
CO3	S	M	M	-	M	-	-	-	-	-	-	-	L	M	S
CO4	S	M	M	-	M	-	-	-	-	-	-	-	L	M	S
CO5	S	M	M	-	M	-	-	-M	M	--	-	M	L	M	S

S- Strong; M-Medium; L-Low

SYLLABUS

OPERATING SYSTEM

Introduction & Structure: Basics, OS Architecture, OS Operations, System calls.

PROCESSES &SYNCHRONIZATION

Process concept – Process scheduling – Operations on processes – Cooperating processes – Inter process communication – Communication in client-server Systems. Case study: IPC in Linux. Threads: Multi-threading models – Threading issues. Case Study: Threads library– Clock Synchronization – Event Ordering – Mutual Exclusion – Deadlock Modelling – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection and Recovery - Election Algorithms.

STORAGE MANAGEMENT

Background – Swapping – Contiguous memory allocation – Paging – Segmentation – Segmentation with paging. Virtual Memory: Background –Demand paging – Process creation – Page replacement – Allocation of frames – Thrashing. Case Study: Memory management in Linux.

I/O SYSTEMS

I/O Systems – I/O Hardware – Application I/O interface – kernel I/O subsystem – streams – performance. Mass-Storage Structure: Disk scheduling – Disk management – Swap-space management – RAID – disk attachment – stable storage – tertiary storage. Case study: I/O in Linux.

CLOUD OS & MOBILE OS

Introduction to Cloud Computing, Features of Cloud OS, Case Studies. - Introduction to Mobile Computing Features of Mobile OS, Case Studies.

TEXT BOOKS:

1.Silberschatz, Galvin, and Gagne, "Operating System Concepts", Sixth Edition, Wiley India Pvt Ltd, 2003.

REFERENCES:

1. Andrew S. Tanenbaum, "Modern Operating Systems", Second Edition, Pearson Education, 2004.
2. Gary Nutt, "Operating Systems", Third Edition, Pearson Education, 2004.
3. Harvey M. Deital, "Operating Systems", Third Edition, Pearson Education, 2004.
4. Fundamentals Of Mobile Computing, Patnaik, Prasant, Kumar , Mall, Rajib, PHI, 2012.
5. Mobile Computing - Technology, Applications, and Service Creation – 1st edition, Asoke K Talukder,Roopa Yavagal, McGraw-Hill, 2006.
6. The Practice of Cloud System Administration: Designing and Operating Large Distributed Systems, Thomas A. Limoncelli Strata R. Chalup , Christina J. Hogan , Addison-Wesley Professional; 1st Edition ,2014.
7. Cloud Computing: Concepts, Technology & Architecture, Thomas Erl, Ricardo Puttini , Zaigham Mahmood ,
   Prentice Hall; 1st Edition, 2013.

COURSE DESIGNERS

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17CSCC09	JAVA PROGRAMMING	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

This course of study builds on the skills gained by students in Java Fundamentals and helps to advance Java programming skills. Students will design object-oriented applications with Java and will create Java programs using hands-on, engaging activities.

PREREQUISITE

Basic programming Knowledge

COURSE OBJECTIVES

1	Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
2	Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
3	Be aware of the important topics and principles of software development.
4	Understand Event Handling and Swing Components.
5	Understand Generic Programming.

COURSE OUTCOMES

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

CO1.Knowledge of the structure and model of the Java programming language	Knowledge
CO2.Use the Java programming language for various programming technologies	Understand
CO3. Develop software in the Java programming language	Apply
CO4.Evaluate user requirements for software functionality required to decide whether the Java programming language can meet user requirements	Analyse
CO5.Choose an engineering approach to solving problems, Starting from the acquired knowledge of programming and knowledge of operating systems.	Evaluation

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S			S	S	M	S				S	S			
CO2	S		S		S			S	L	L		L			
CO3	S		M	L	S	M					L	L			
CO4	S		S	M	S		S				S	M			
CO5	S		S	M	S		M				S	M			

S- Strong; M-Medium; L-Low

SYLLABUS

BASICS OF JAVA

Object oriented programming concepts – objects – classes – methods and messages – abstraction and encapsulation – inheritance – abstract classes – polymorphism.- Objects and classes in Java – defining classes – methods - access specifiers – static members – constructors – finalize method.

ARRAYS, STRINGS &OBJECTS

Arrays – Strings - Packages – Java-Doc comments –- Inheritance – class hierarchy – polymorphism – dynamic binding – final keyword – abstract classes - The Object class – Reflection – interfaces – object cloning – inner classes – proxies.

EVENTS & GRAPHICS PROGRAMMING

I/O Streams - Filter and pipe streams – Byte Code interpretation - Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy – Graphics programming – Frame – Components – working with 2D shapes.

SWING & GENERIC PROGRAMMING

Introduction to Swing – Model-View-Controller design pattern – buttons – layout management – Swing Components – exception handling – exception hierarchy – throwing and catching exceptions - Motivation for generic programming – generic classes – generic methods – generic code and virtual machine – inheritance and generics – reflection and generics.

THREADS & SOCKET PROGRAMMING

Multi-threaded programming – interrupting threads – thread states – thread properties – thread synchronization – Executors – synchronizers – Socket Programming – UDP Datagram – Introduction to Java Beans.

TEXT BOOKS:

1. Cay S. Horstmann and Gary Cornell, "Core Java: Volume I – Fundamentals", Eighth Edition, Sun Microsystems Press, 2008.
2. Elliotte Rusty Harold, " Java Network Programming", O‟Reilly publishers, 2000 (UNIT II).
3. Ed Roman, "Mastering Enterprise Java Beans", John Wiley & Sons Inc., 1999 (UNIT III and UNIT V).

REFERENCES:

1. K. Arnold and J. Gosling, "The JAVA programming language", Third edition, Pearson Education, 2000.
2. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition,Pearson Education, 2000.
3. C. Thomas Wu, "An introduction to Object-oriented programming with Java", Fourth Edition,Tata McGraw-Hill Publishing company Ltd., 2006.

COURSE DESIGNERS

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1	T.Vijila			vijila@avit.ac.in
2	Dr.K.Sasikala	Associate Professor	CSE	sasikalak@vmkvec.edu.in

17CSCC16	CLOUD COMPUTING	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

To study and understand the concepts in cloud computing and apply them practically.

PREREQUISITE

NIL

COURSE OBJECTIVES

1.	To understand cloud computing concepts.
2.	To study various cloud services.
3.	To apply cloud computing in collaboration with other services.
4.	To understand the cloud computing services.
5.	To apply cloud computing online.

COURSE OUTCOMES

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

CO1: Able to Understand basics in Cloud Computing	Understand
CO2: Able to apply cloud computing concepts in real time	Apply
CO3: Able to develop cloud computing projects	Apply
CO4: Able to apply cloud services	Apply
CO5: *Able to collaborate cloud services with other applications*	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12			
CO1	M	M									L	L			
CO2	M	M		L								L			
CO3	M	M	L	L		M									
CO4	M	S	L			L				L		M			
CO5	M	L				M					M	L			

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT - I	**INTRODUCTION**

Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage –Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in

the Cloud Today – Cloud Services.	
UNIT - II	**DEVELOPING CLOUD SERVICES**
Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon Ec2 – Google App Engine – IBM Clouds.	
UNIT - III	**CLOUD COMPUTING FOR EVERYONE**
Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation.	
UNIT - IV	**USING CLOUD SERVICES**
Collaborating on Calendars, Schedules and Task Management – Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases – Storing and Sharing Files.	
UNIT - V	**COLLABORATING ONLINE**
Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services –Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware –Collaborating via Blogs and Wikis.	
TEXT BOOKS	
1. Rajkumar Buyya, James Broberg, Andzej M.Goscinski, "Cloud Computing –Principles and Paradigms",John Wiley & Sons, 2010. 2. Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", Que Publishing, August 2008.	
REFERENCES	
1. Haley Beard, "Cloud Computing Best Practices for Managing and Measuring. Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs", Emereo Pty Limited, July 2008.	

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr.R.Jaichandran	PROFESSOR	CSE	rjaichandran@avit.ac.in
2				

17CSCC17	CYBER SECURITY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

To understand the need for Cyber Security in real time and to study techniques involved in it.

PREREQUISITE

NIL

COURSE OBJECTIVES

1.	To understand the fundamentals of Cyber Security
2.	To study various attacking techniques
3.	To apply exploitation in cyber space
4.	To study about Malicious codes
5.	Defending against cyber attacks

COURSE OUTCOMES

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

CO1: Able to Understand basics in cyber security	Understand
CO2: Able to apply attackers techniques in real time	Apply
CO3: Able to apply exploitation in web applications	Apply
CO4: Able to understand and apply malicious in networks.	Understand and Apply
CO5: Able to apply defense and analysis techniques in real time	Apply
CO1: Able to Understand basics in cyber security	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12			
CO1	M	M									L	L			
CO2	M	M		L								L			
CO3	M	M	L	L		M									
CO4	M	S	L			L				L		M			
CO5	M	L				M					M	L			

S- Strong; M-Medium; L-Low

SYLLABUS:

UNIT - I	INTRODUCTION
Network and security concepts – basic cryptography – Symmetric encryption – Public key Encryption – DNS – Firewalls – Virtualization – Radio Frequency Identification – Microsoft Windows security	

Principles.	
UNIT - II	**ATTACKER TECHNIQUES**
Antiforensics – Tunneling techniques – Fraud Techniques - Threat Infrastructure.	
UNIT - III	**EXPLOITATION**
Techniques to gain a foot hold – Misdirection, Reconnaissance, and disruption methods.	
UNIT - IV	**MALICIOUS CODE**
Self Replication Malicious code – Evading Detection and Elevating privileges – Stealing Information and Exploitation.	
UNIT - V	**DEFENSE AND ANALYSIS TECHNIQUES**
Memory Forensics – Honeypots – Malicious code naming – Automated malicious code analysis systems – Intrusion detection systems – Defense special file investigation tools.	
TEXT BOOKS	
1. James Graham, Richard Howard and Ryan Olson, "Cyber Security Essentials", CRC Press, Taylor & Francis Group, 2011. 2. By Dan Shoemaker, Ph.D., William Arthur Conklin, Wm Arthur Conklin, "Cyber security: The Essential Body of Knowledge", Cengage Learning, 2012.	
REFERENCES	
1.. Ali Jahangiri, "Live Hacking: The Ultimate Guide to hacking Techniques & Counter measures for Ethical Hackers & IT Security Experts", 2009.	

COURSE DESIGNERS				
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1	Dr.R.Jaichandran	PROFESSOR	CSE	rjaichandran@avit.ac.in

17CSEC30	UNIX INTERNALS	Category	L	T	P	Credit
		PC	3	0	0	3

PREAMBLE

This talk is a brief guide to UNIX programming languages, tools and concepts.It is aimed at programming novices or programmers migrating from a Windows system. The aim is to introduce you to the concepts, the possibilities and the tools used in Unix programming.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To understand the design of the UNIX operating system
2	To become familiar with the various data structures used

COURSE OUTCOMES

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

CO1: To learn The basic Unix operating systems and its basic commands	Understand
CO2: To analyze the buffers and kernel representation	Analysis
CO3: To understand the UNIX system structure, system calls	Remember
CO4: To understand UNIX segmentation, scheduling, paging	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12			
CO1	S			L					L			S			
CO2		S					M			S	M				
CO3			M		S							S			
CO4	L						L		S		M				

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION 9 - hours

General Review of the System-History-System structure-User Perspective-OperatingSystem Services-Assumptions About Hardware. Introduction to the Kernel-ArchitectureSystem Concepts-Data Structures-System Administration

DISK BLOCKS 9 – hours

The Buffer Cache-Headers-Buffer Pool-Buffer Retrieval-Reading and Writing Disk Blocks - Advantages and Disadvantages. Internal Representation of Files-Inodes- Structure-Directories-Path Name to Inode- Super Block-Inode Assignment-Allocation of Disk Blocks -Other File Types

FILE SYSTEM 9 - hours

System Calls for the File System-Open-Read-Write-Lseek-Close-Create-Special files Creation -Change Directory and Change Root-Change Owner and Change Mode-Stat- Fstat-Pipes-Dup-Mount-Unmount-Link-Unlink-File System Abstraction-Maintenance.

PROCESS MANAGEMENT 9 - hours

The System Representation of Processes-States-Transitions-System Memory-Context of a Process-Saving the Context-Manipulation of a Process Address Space-Sleep Process Control-signals-Process Termination-Awaiting-Invoking other Programs-The Shell-System Boot and the INIT Process.

MEMORY MANAGEMENT 9 - hours

Memory Management Policies-Swapping-Demand Paging-a Hybrid System-I/O Subsystem-Driver Interfaces-Disk Drivers-Terminal Drivers.

TEXT BOOKS

1. Maurice J. Bach, "The Design of the Unix Operating System", Pearson Education 2002.

REFERENCES

1. UreshVahalia, "UNIX Internals: The New Frontiers", Prentice Hall, 2000.
2. John Lion, "Lion's Commentary on UNIX", 6th edition, Peer-to-Peer Communications, 2004.
3. Daniel P. Bovet & Marco Cesati, “Understanding the Linux Kernel”, O’REILLY, Shroff Publishers &Distributors Pvt. Ltd, 2000.
4. M. Beck et al, “Linux Kernel Programming

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
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17CSEC34	WEB DESIGN AND MANAGEMENT	Category	L	T	P	Credit
		PC	3	0	0	3

PREAMBLE

To understand and learn the scripting languages with design of web applications. and maintenance and evaluation of web design management.

PREREQUISITE

Web Technology

COURSE OBJECTIVES

1	To learn the concepts of Web design patterns and page design
2	To understand and learn the scripting languages with design of web applications
3	To learn the maintenance and evaluation of web design management

COURSE OUTCOMES

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

CO1: To familiarize decision support systems and their characteristics	Understand
CO2: To study about Intelligent DSS and applications of DSS	Apply
CO3: To learn the technologies related to decision support systems	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12			
CO1	S		S		M				L		L				
CO2		M		M				S							
CO3	S					L	M				L				

S- Strong; M-Medium; L-Low

SYLLABUS

SITE ORGANIZATION AND NAVIGATION 9 - hours

User Centered Design–Web Medium–Web Design Process–Basics of Web Design –Introduction to Software used for Web Design – ADOBE IMAGE READY, DREAM WEAVER, FLASH – Evaluating Process – Site Types and Architectures – Navigation Theory – Basic Navigation Practices – Search – Sitemaps.

ELEMENTS OF PAGEDESIGN 9 – hours

Browser Compatible Design Issues-Pages and Layout – Templates – Text – Color – Images – Graphics and Multimedia – GUI Widgets and Forms – Web Design Patterns – STATIC pages: Slice– URL in ADOBE IMAGE READY. Creation and Editing of site map – Layer, Tables, Frame set, - CSS style – Forms –Tools like Insert, Rollover etc., in DREAM WEAVER

SCRIPTING LANGUAGES AND ANIMATION USING FLASH 9 - hours

Client side scripting :XHTML – DHTML – JavaScript – XML Server Side Scripting: Perl–PHP– ASP/JSP Designing a Simple Web Application - Introduction to MACROMEDIA FLASH, Importing Other File Formats to Flash – Saving and Exporting Flash Files, Frame by Frame Animation–Motion Tweening – Shape Tweening.

PRE-PRODUCTION MANAGEMENT 9 - hours

Principles of Project Management – Web Project Method – Project Road Map – Project Clarification – Solution Definition – Project Specification – Content – Writing and Managing Content.

PRODUCTION, MAINTENANCE AND EVALUATION 9 - hours

Design and Construction – Testing, Launch and Handover – Maintenance – Review and Evaluation – **Case Study:** Using the Skills and Concepts Learn with the ADOBE IMAGE READY, DREAM WEAVER, FLASH, and Scripts, Develop Portfolios in the Form of Web Pages which have to be uploaded in Free Public Domain.

TEXT BOOKS

1.Themas A. Powell, ―The Complete Reference–Web Design‖, Tata McGraw Hill, Third Edition, 2003.

2.Ashley Friedlein, ―Web Project Management‖, Morgan Kaufmann Publishers, 2001.

3.H.M. Deitel, P.J. Deitel, A.B. Goldberg, ―Internet and World Wide Web – How to Program‖, Third Edition, Pearson Education, 2004.

REFERENCES

1.Joel Sklar, ―Principles of Web Design‖, Thomson Learning, 2001.

2.Van Duyne, Landay and Hong, ―The Design of Sites: Patterns for Creating Winning Websites‖, Second Edition, Prentice Hall, 2006.

3.Lynch, Horton and Rosenfeld, ―Web Style Guide: Basic Design Principles for Creating Websites‖, Second Edition, Yale University Press, 2002.

COURSE DESIGNERS

S. No.	Name of the Faculty	Designation	Department	Mail ID
1	K.Karthik	Assistant Professor	CSE	karthik@avit.ac.in
2	Dr.M.Nithya	Professor	CSE	Nithya@vmkvec.edu.in

17CSPI07	LEARNING IT ESSENTIALS BY DOING	Category	L	T	P	Credit
		PI	3	0	0	3

PREAMBLE

The proposed elective course exposes the non-CS/IT students to IT Essentials. The core modules of this Elective includes programming ,Database and web Technology amongst other related topics.This course refers to the basic tools and technologies for the right type of website development and enable student to create simple web applications

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To learn about the essentials of Information Technology
2	To get an idea about the scripting languages.
3	To get an idea about the internet protocols

COURSE OUTCOMES

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

CO1 understand the fundamentals of web applications and its modeling	Understand
CO2. To understand and learn the scripting languages with design of web applications.	Understand
CO3. To understand n the networking concept internet protocols, network routing	Understand
CO4. Analyze the process of mobile communication and network technologies	Analyze
CO5. Build simple interactive applications ,database applications and multimedia applications.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	--	--	--	M	M	M	L	S	S	S	M	--	--	--
CO2	S	--	L	M	S	S	M	L	M	S	M	S	--	--	--
CO3	L	L	--	L	S	M	--	L	M	S	--	L	--	--	--
CO4	L	M	--	--	M	M	S	M	M	M	S	S	--	--	--
CO5	S	M	L	--	L	--	S	M	S	S	L	M	--	--	--

S- Strong; M-Medium; L-Low

SYLLABUS

Fundamentals of Computer architecture-introduction-organization of a small computer
Central Processing Unit - Execution cycle – Instruction categories – measure of CPU performance
Memory – Input/output devices - BUS-addressing modes. System Software – Assemblers – Loaders and linkers – Compilers and interpreters

Operating system – introduction – memory management schemes Process management Scheduling – threads.

Problem solving with algorithms- Programming styles – Coding Standards and Best practices - Introduction to C -Programming Testing and Debugging. Code reviews -System Development Methodologies – Software development Models -User interface Design – introduction – The process – Elements of UI design & reports.

RDBMS- data processing – the database technology – data models-ER modeling concept –notations – Extended ER features -Logical database design - normalization -SQL – DDL statements – DML statements – DCL statements

Writing Simple queries – SQL Tuning techniques – Embedded SQL - OLTP

Objected oriented concepts – object oriented programming -UML Class Diagrams– relationship – Inheritance – Abstract classes – polymorphism-Object Oriented Design methodology - Common Base class -Alice Tool – Application of OOC using Alice tool.

Client server computing - Internetworking – Computer Networks – Working with TCP/IP – IP address – Sub netting – DNS – VPN – proxy servers World Wide Web – Components of web application - browsers and Web Servers

URL – HTML – HTTP protocol – Web Applications - Application servers – Web Security.

TOTAL HOURS: 45

REFERENCES

1. Andrew S. Tanenbaum, Structured Computer Organization, PHI, 3rd ed., 1991
2. Silberschatz and Galvin, Operating System Concepts, 4th ed., Addision-Wesley, 1995
3. Dromey R.G., How to solve it by Computers, PHI, 1994
4. Kernighan, Ritchie, ANSI C language PHI,1992
5. Wilbert O. Galitz, Essential Guide to User Interface Design, John Wiley, 1997
6. Alex Berson, Client server Architecture, Mc Grew Hill International, 1994
7. Rojer Pressman, Software Engineering-A Practitioners approach, McGraw Hill, 5th ed., 2001
8. Alfred V Aho, John E Hopcroft, Jeffrey D Ullman, Design and Analysis of Computer Algorithms, Addison Wesley Publishing Co., 1998
9. Henry F Korth, Abraham Silberschatz, Database System Concept, 2nd ed. McGraw-Hill International editions, 1991
10. Brad J Cox, Andrew J.Novobilski, Object – Oriented Programming – An evolutionary approach, Addison – Wesley, 1991

Course Designers:

S.No.	**Name of the Faculty**	**Designation**	**Department**	**Mail ID**
1.	Dr.K.Sasikala	Associate Professor	CSE	sasikalak@vmkvec.edu.in
2	Mr. R. Bharanidharan	Assistant Professor	CSE	bharanidharan@vmkvec.edu.in

17CSPI10	MOBILE APPLICATION DEVELOPMENT	Category	L	T	P	Credit
		PI	3	0	0	3

PREAMBLE

In this modern era almost every hands has a handheld devices. Each handheld device have the computing capability to meet the half the needs of user such as banking, browsing, education and emergency etc. It is a must for a computer engineer to have some basic knowledge about the handheld devices platform and its supporting software development. This course will give adequate knowledge in developing a mobile applications for different such as Android, iOS, Windows.

PREREQUISITE – NIL

COURSE OBJECTIVES

1.	Understand system requirements for mobile applications
2.	Generate suitable design using specific mobile development frameworks
3.	Generate mobile application design
4.	Implement the design using specific mobile development frameworks
5.	Deploy the mobile applications in marketplace for distribution

COURSE OUTCOMES

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

CO1. Be exposed to technology and business trends impacting mobile applications	Understand
CO2.Understanding enterprise scale requirements of mobile applications	Understand
CO3. Be competent with the characterization and architecture of mobile applications	Apply
CO4. Familiarize in the Graphics used for Android application development	Apply
CO5. Be competent with designing and developing mobile applications using one application development framework.	Apply
CO6. Test the developed app and publish in	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	M	M	S	S	M	S	S	S	S	M	M	M	S
CO2	S	S	M	L	S	S	S	M	M	S	M	M	M	M	S
CO3	S	M	M	L	S	M	M	M	S	S	M	M	M	M	S
CO4	S	S	M	M	S	M	M	M	S	S	S	M	M	M	S
CO5	S	S	M	M	S	M	M	M	S	S	S	M	M	M	S
CO6	S	S	M	L	S	M	M	L	S	S	S	M	M	M	S

S- Strong; M-Medium; L-Low

SYLLABUS

UNIT I INTRODUCTION

Introduction to mobile applications –Embedded systems -Market and business drivers for mobile applications –Publishing and delivery of mobile applications –Requirements gathering and validation for mobile applications

UNIT II BASIC DESIGN

Introduction –Basics of embedded systems design –Embedded OS -Design constraints for mobile applications, both hardware and software related –Architecting mobile applications –User interfaces for mobile applications –touch events and gestures –Achieving quality constraints –performance, usability, security, availability and modifiability.

UNIT III ADVANCED DESIGN

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV TECHNOLOGY I – ANDROID

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI –Persisting data using SQLite–Packaging and deployment –Interaction with server side applications –Using Google Maps, GPS and Wifi –Integration with social media applications.

UNIT V TECHNOLOGY II –IOS

Introduction to Objective C –iOS features –UI implementation –Touch frameworks –Data persistence using Core Data and SQLite –Location aware applications using Core Location and Map Kit –Integrating calendar and address book with social media application –Using Wifi -iPhone marketplace.

TEXT BOOKS

1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012.

REFERENCES

1. Charlie Collins, Michael Galpin and Matthias Kappler, “Android in Practice”, DreamTech, 2012.
2. James Dovey and Ash Furrow, “Beginning Objective C”, Apress, 2012.
3. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, “Beginning iOS 6 Development: Exploring the iOS SDK”, Apress, 2013

Course Designers:

S.No.	Name of the Faculty	Designation	Department	Mail ID
1.	Mr. M. Annamalai	Assistant Professor	CSE	annamalaim@vmkvec.edu.in
2.	Mr. R. Bharanidharan	Assistant Professor	CSE	

17BMCC03	BIOSENSORS AND TRANSDUCERS	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The course is designed to make the student acquire conceptual knowledge of the transducers and biological components used for the detection of an analyte. The relation between sensor concepts and biological concepts is highlighted. The principles of biosensors that are currently deployed in the clinical side are introduced.

PREREQUISITE – Nil

COURSE OBJECTIVES

1	To use the basic concepts of transducers, electrodes and its classification.
2	To determine the recording of biological components.
3	To employ the knowledge in electrochemical and optical biosensors.
4	To outline the various biological components using biosensors.

COURSE OUTCOMES

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

CO1. Respond the working principles of transducers.	Understand
CO2. Explain the various types of electrodes.	Understand
CO3. Utilize various FET sensors for recording of biological components.	Apply
CO4. Distinguish various biosensors like electrochemical and optical biosensors.	Analyze
CO5. Analyze the biological components using biosensors in various applications.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	L	L	--	--	--	--	--	--	--	L	--	--	L
CO2	S	M	M	M	--	--	--	--	--	--	--	L	L	--	L
CO3	S	M	M	M	--	L	L	L	L	L	--	L	M	--	L
CO4	S	S	S	M	--	L	L	L	L	L	--	L	S	L	L
CO5	S	S	S	S	--	L	L	L	L	L	--	L	S	M	L

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION: General measurement system, Transducers and its classification, Resistance transducers, capacitive transducer, Inductive transducer.

TRANSDUCERS: Temperature transducers, piezoelectric transducers, Piezo resistive transducers, photoelectric transducers.

BIO POTENTIAL ELECTRODES: Half cell potential, Types of Electrodes –Micro electrodes, Depth and needle electrodes, Surface electrodes, Chemical electrodes, Catheter type electrodes, stimulation electrodes, electrode paste, electrode material.

BIOSENSORS: Biological elements, Immobilization of biological components, Chemical Biosensor-ISFET, IMFET, electrochemical sensor, chemical fibro sensors.

APPLICATIONS OF BIOSENSORS: Bananatrode, blood glucose sensors, non invasive blood gas monitoring, UREASE biosensor, Fermentation process control, Environmental monitoring, Medical applications.

TEXT BOOKS:

1. H.S. Kalsi, **"Electronic Instrumentation & Measurement"**, Tata McGraw HILL, 1995.
2. Brain R Eggins, **"Biosensors: An Introduction",** John Wiley Publication, 1997.
3. Shakthi chatterjee, **"Biomedical Instrumentation"**, Cengage Learning, 2013.
4. John G Webster, **"Medical Instrumentation: Application and design"**, John Wiley Publications, 2001.

REFERENCES:

1. K.Sawhney, **"A course in Electronic Measurements and Instruments"**, Dhapat Rai & sons, 1991.
2. John P Bentley, **"Principles of Measurement Systems"**, 3rd Edition, Pearson Education Asia, (2000 Indian reprint).
3. Geddes and Baker, **"Principles of Applied Biomedical Instrumentation"**, 3rd Edition, John Wiley Publications, 2008.

COURSE DESIGNERS

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1	Mrs.S.Vaishnodevi	Assistant Professor	BME	vaishnodevi@vmkvec.edu.in
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17BMCC05	PATHOLOGY AND MICROBIOLOGY	Category	L	T	P	Credit
		CC	3	0	0	3

PREAMBLE

The curriculum of pathology aims at preparing the students in basic understanding of diseases and their pathogenesis. The topics build the concepts of how human system work in altered and diseased stage under the influence of various internal and external stimuli. Thus the syllabi of pathology compliments and supplements the necessary knowledge students have gained in Physiology.

The Microbiology course has been formulated to impart basic and medically relevant information on the microbes. The microbial structure, growth and development, methods and role of sterilization in the context of study of microbes are included.

PRERQUISITE : NIL

COURSE OBJECTIVES

1	To explain the cellular responses to stress, cell degeneration, regeneration and neoplasia.
2	To classify and explain the different fluid and haemodynamic disorders.
3	To illustrate the working principle of various microscopes and demonstrate the specimen preparation.
4	To examine the pathogenesis of viral and bacterial diseases and their control.
5	To categorize the various immunological and sterilization techniques.

COURSE OUTCOMES

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

CO1. Describe the cellular responses to stress, cell degeneration, cellular repair and concepts of tumour.	Understand
CO2. Describe the causes and pathophysiology of different fluid and Haemodynamic disorders.	Understand
CO3. Apply the knowledge to operate the different types of microscopes and prepare the specimens for observation.	Apply
CO4. Apply the knowledge to identify causes and prevention method to control various infectious diseases due to bacteria, and viruses.	Apply
CO5. Diagnose the infectious diseases using immunological techniques like Immunofluorescence, ELISA, RIA and compare the sterilization techniques.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	--	--	--	--	--	L	--	M	--	--	M	--	L	L
CO2	L	--	--	--	--	--	L	--	M	--	--	M	--	L	L
CO3	S	M	--	--	S	S	M	M	S	--	--	S	M	S	S
CO4	S	M	--	--	S	S	M	M	S	--	--	S	M	S	S
CO5	S	S	--	--	S	S	S	S	S	--	M	S	S	S	S

S- Strong; M-Medium; L-Low

SYLLABUS

CELL DEGENERATION, REPAIR AND NEOPLASIA: Introduction to pathology, Cellular responses to stress, Cellular adaptations, Cell injury and Necrosis – causes, mechanism and morphology, Apoptosis, Inflammation, Tissue repair, Neoplasia - Classification, Benign and Malignant tumours, Carcinogenesis, Etiology and Spread of tumours.

FLUID AND HEMODYNAMIC DERRANGEMENTS: Edema, Normal haemostasis and Thrombosis, Disseminated intravascular coagulation, Embolism, Infarction, Shock. Haematological disorders – Red cell Disorders, White cell disorders, Bleeding disorders.

STRUCTURE OF BACTERIA, VIRUSES AND MICROSCOPY: Morphological features and structural organization of bacteria, Bacterial growth and Nutrition, Growth curve, Culture media and its types, Culture techniques and observation of culture. Viruses – Structure, Classification and Replication. Light microscope, Bright field, Dark field, Phase contrast, Fluorescence and Electron microscope (TEM& SEM), Preparation of samples for electron microscope, Staining methods – Simple, Gram's staining and AFB staining.

IMMUNITY, INFECTION AND DISORDERS: Antigen, Antibodies and its types, Immunity – Innate and Adaptive immunity, Immunodeficiency diseases, Genetic disorders, Hypersensitivity diseases, Bacterial, Viral, Fungal, Protozoan and Helminthic diseases.

IMMUNOLOGICAL TECHNIQUES AND CONTROL OF MICROORGANISMS: Agglutination and Precipitation reactions, Immunofluorescence, ELISA, RIA. Diagnosis of Infectious Diseases. Methods of Sterilization and disinfection: Physical Methods - Dry heat, Moist heat, Filtration, Radiation, Chemical Methods – Alcohol, Aldehyde, Dyes, Halogens, Phenols, Ethylene oxide.

TEXT BOOKS:

1. Robbins &Cotran, "Pathologic Basis of Disease" 9th Edition, Saunders Co. 2014.
2. Anatha Narayanan R &JayaramPanickerC.K, "Text Book of Microbiology", 10th Edition, Orient Longman, 2017.

REFERENCES:

1. Prescott, Harley, Klein, "Microbiology" 7th Edition, Mc Graw Hill, 2008.
2. Janis Kuby, "Immunology", 5thEdition, W.H. Freeman and Company, New York, 2003.

COURSE DESIGNERS

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3	Mrs. G. Arthi	Assistant Professor	BTE	arthig@vmkvec.edu.in

17BMEC01	MEDICAL OPTICS	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

Medical optics is a branch of science uses light as an electromagnetic wave, similar to X-rays, microwaves, and radio waves, which is used as an investigational technique for medical applications. Examples include optical microscopy, spectroscopy, endoscopy, scanning laser ophthalmoscopy, and optical coherence tomography.

PREREQUISITE: 17BMCC08 - DIAGNOSTIC AND THERAPEUTIC EQUIPMENT – I

COURSE OBJECTIVES

1	To learn about properties of light and its application
2	To study various instruments in photonics
3	To understand the applications of LASER
4	To understand optical Holography
5	To study Optical tomography

COURSE OUTCOMES

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

CO1. Gain adequate knowledge inproperties of light	Understand
CO2. Getting idea about various instruments used in photonics	Understand
CO3. Apply LASER in medical field for diagnosis and therapeutic	Apply
CO4. Construct hologram	Knowledge
CO5. Image optical tomogram.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	--	L	--	--	--	--	--	--	--	--	--	S	S	--
CO2	S	--	L	--	--	--	--	--	--	--	--	--	M	M	--
CO3	S	--	L	--	--	--	--	--	--	--	--	--	M	L	--
CO4	S	--	L	--	--	--	--	--	--	--	--	--	M	S	--
CO5	S	--	M	--	M	L	--	--	--	--	--	--	M	M	--

S- Strong; M-Medium; L-Low

SYLLABUS

OPTICAL PROPERTIES OF THE TISSUES

Refraction, Scattering, absorption, light transport inside the tissue, tissue properties, Light interaction with tissues, optothermal interaction, fluorescence, speckles.

INSTRUMENTATION IN PHOTONICS

Instrumentation for absorption, scattering and emission measurements, excitation light sources – high pressure arc lamp, solid state LEDs, LASERs, optical filters, polarisers, solid state detectors, time resolved and phase resolved detectors.

APPLICATIONS OF LASERS

Laser in tissue welding, lasers in dermatology, lasers in ophthalmology, otolaryngology, urology.

OPTICAL HOLOGRAPHY

Wavefronts, Interference patterns, principle of hologram, optical hologram, applications.

OPTICAL TOMOGRAPHY

Optical coherence tomography, Elastography, Doppler optical coherence tomography, Application towards clinical imaging.

TEXT BOOK

1. Leon Goldman, M.D., & R. James Rockwell, Jr., **"Lasers in Medicine"**, Gordon and Breach, Science Publishers Inc., New York, 1971.

REFERENCE

1. Mark E. Brezinski., **"Optical Coherence Tomography: Principles and Applications"**, Academic Press, 2006.

COURSE DESIGNERS

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17BMEC02	BIOTELEMETRY	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE
To study the overall concept of a Biotelemetry system and the concept of signal transmission.

PREREQUISITE: Nil

COURSE OBJECTIVES

1	To study the basic concepts and the principles used in a Telemetry system.
2	To study the building blocks used to make a electrical telemetry system.
3	To study the basic components of transmitting and receiving techniques.
4	To know about how optical fibers are used in signal transmission.
5	To understand the real time application in biotelemetry.

COURSE OUTCOMES

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

CO1. Discuss about the basic information about Telemetry system.	Understand
CO2. Describe the knowledge about design of Electrical Telemetry Systems.	Understand
CO3. Demonstrate the different types of modulation techniques.	Apply
CO4. Explain about the implementation of optical fibers in telemetry system.	Understand
CO5. Validate the healthcare system using Telemetry system.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	--	S	M	S	S	M	S	--	--	--	M	S	--	M
CO2	S	--	M	L	S	M	M	--	--	--	--	L	M	S	M
CO3	S	L	M	--	L	S	L	--	--	--	--	M	M	M	M
CO4	M	--	--	--	L	M	L	S	--	--	--	L	S	L	S
CO5	M	--	--	--	M	L	S	S	--	--	--	L	L	--	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION
Fundamental concepts – Significance, Principle, functional blocks of Telemetry and Telecontrol system-Methods of telemetry – Electrical, Pneumatic, Hydraulic and Optical Telemetry – State of the art-Telemetry standards.

ELECTRICAL TELEMETRY
Electrical Telemetry – Current Systems – Voltage Systems – Synchro Systems – Frequency systems – Position and Pulse systems – Example of a landline telemetry system.

RADIO TELEMETRY SYSTEM
Block diagram of a Radio Telemetry system – Transmitting and receiving techniques – AM, FM, PM, Multiplexing and demultiplexing – Transmitting and receiving techniques – Digital coding methods – Advantages of PCM, PWM, PM, FSK – Delta modulation – coding and decoding equipment – Example of a radiotelemetry system.

OPTICAL TELEMETRY SYSTEM
Optical fibers for signal transmission – Sources for fiber optic transmission – Optical detectors – trends in fiber– optic device development – Example of an optical telemetry System.

APPLICATION OF BIOTELEMETRY
Use of computers in distance mode of healthcare delivery, Web technology, Satellite communication systems; hypertext, voice & image transfer protocols, Medical image scanning, Data compression and Transfer, Capturing of medical signals, Analog to digital conversion, Video conferencing, Remote sensing, Rural primary setups, Referral and Super specialty centers, Societal medico legal aspects, Networking (local, national & global).

TEXT BOOKS
1. D.Patranabis, **"Telemetry principles"**, Tata Mcgraw Hill Publishers.
2. Marilyn J. Field, **"Telemedicine: A Guide to Assessing Telecommunications for Health Care"**, National Academic Press, 1996.

REFERENCE
1. Charles J. Amlaner, David W. Macdonald, **"A Handbook on Biotelemetry and Radio Tracking"**, Pergamon Press; 1st Edition (January 1, 1980).

COURSE DESIGNERS

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17BMEC04	MEMS AND ITS BIOMEDICAL APPLICATIONS	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To enable the students to acquire knowledge about the principles and applications of MEMS & Nanotechnology in Biomedical Industry.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To understand the working principle of MEMS & Microsystems.
2	To understand the working of MOEMS Technology.
3	To give an insight to the microfluidic systems.
4	To give an insight to the Bio-MEMS & its application in healthcare.
5	To study about the biomedical Nanotechnology & its application in research domain.

COURSE OUTCOMES

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

CO1. Introduces the concepts of microfluidic systems.	Understand
CO2. Introduce about the Basics of working of MOEMS Technology.	Understand
CO3. Explain the working principle of MEMS & Microsystems.	Understand
CO4. Analyze the nanomaterial in various biomedical applications.	Analyze
CO5. Evaluate about the biomedical Nanotechnology & its application in research domain.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	--	M	--	S	M	M	--	--	--	--	M	--	--	--
CO2	S	--	M	L	S	M	M	--	--	--	--	S	--	--	--
CO3	S	--	M	--	M	S	S	M	--	--	--	M	--	L	--
CO4	M	--	M	L	L	S	S	S	--	--	--	M	L	--	L
CO5	S	--	M	--	M	S	S	S	--	--	--	M	M	L	--

S- Strong; M-Medium; L-Low

SYLLABUS

MEMS & MICROSYSTEM

MEMS and Microsystems-Introduction-Typical MEMS and Microsystem Products-Application of Micro-system in Healthcare Industry – Working Principles of Microsystems Micro-sensors – Micro-actuation –

MEMS with Microactuation – Micro-accelerators.

MICRO-OPTO ELECTROMECHANICAL SYSTEMS (MOEMS)
Fundamental principle of MOEMS Technology, Advantages - Light Modulators, Beam splitter – Micro-lens, Micro-mirrors - Digital Micro-mirror Device, Grating Light Valve, Optical Switch, Waveguide and Tuning

MICROFLUIDIC SYSTEMS
Microfluidics - Introduction and Fluid Properties, Applications of MFS-Fluid Actuation Methods - Electrophoresis, Dielectrophoresis, Electrowetting, Optoelectrowetting, Electro osmosis Flow, ElectrothermalFlow, Thermocapillary Effect – Microfluidic Channel – Microdispenser – Microneedle - Microfilter

BIOMEMS
Introduction to BioMEMS, BioMEMS for Clinical Monitoring, Lab on a chip, DNA Sensors, E-Nose, E-Tongue, Microsystem approaches to PCR, MEMS based Implantable Drug Delivery System, Emerging, BioMEMS Technology.

BIOMEDICAL NANOTECHNOLOGY
Introduction to nanoscale phenomena, Nanoparticles - Nanomaterial characterization – XRD,SAXS,TEM,SEM, Scanning Tunneling microscopy, AFM, SPM technique, Biomolecular sensing for cancer diagnostics using carbon nanotubes, Carbon nanotube biosensors, Magnetic nanoparticles for MRImaging, Nano-devicesin biomedical applications.

TEXT BOOKS:

1. Tai-Ran Hsu, **"MEMS & Microsystems- Design, Manufacture and Nanoscale Engineering"**, John Wiley & Sons, 2nd Edition, 2008.
2. Nitaigour Premch and Mahalik, **"MEMS"**, Tata McGraw Hill, 2nd Reprint 2008.
3. Wanjun Wang & Steven A. Soper, **"BioMEMS – Technologies and applications"**, CRC Press, First Edition 2007.

REFERENCES:

1. Steven S. Saliterman, **"Fundamentals of BioMEMS & Medical Microdevices"**, International Society for Optical Engineering, 1st Edition 2006.
2. Gerald A Urban, **"BioMEMS"**, Springer, 1st Edition 2006.
3. Abraham P. Lee and James L. Lee, **"BioMEMS and Biomedical Nanotechnology"**, Volume-I, Springer, 1st Edition, 2006.

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3	Mr.S.Kannan	Assistant Professor	BME	kannan@vmkvec.edu.in

17BME09	DESIGN OF MEDICAL DEVICES	Category	L	T	P	Credit
		EC-PC	3	0	0	3

PREAMBLE

This course will offer students exposure to the core concepts of the global medical device regulatory framework and provide a foundation for the practical application. It includes all elements of the device product lifecycle from idea to initial market entry, sustaining activities and post-market activities.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To understand the post-marketing requirements associated with medical devices.
2	To understand the necessary steps to take an idea to a prototype.
3	To follow a deterministic engineering design process to create new products.
4	To apply engineering theory to practice.
5	To perform risk assessment and countermeasure development.

COURSE OUTCOMES

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

CO6.	Understand the necessary steps to take an idea to a prototype.	Understand
CO7.	Utilize fundamental design principles, machine elements, manufacturing and assembly techniques.	Apply
CO8.	Identify and incorporate basic risk management concepts into the Quality Management System.	Analyze
CO9.	Identify the Medical Device Regulatory Framework for any given country based upon device type.	Analyze
CO10.	Create potential regulatory pathway.	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	S	--	S	--	--	M	--	--	L	--	--	--
CO2	S	S	M	M	--	S	--	--	M	--	--	---	S	--	--
CO3	S	M	M	S	--	M	--	--	M	M	--	L	S	--	--
CO4	S	M	L	S	--	M	--	--	L	M	--	--	M	M	--
CO5	M	L	L	M	--	M	--	--	L	L	--	L	L	M	--

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO MEDICAL DEVICES AND MEDICAL DEVICE REGULATIONS

Medical Device Classification, Bioethics and Privacy, Biocompatibility and Sterilization Techniques, Design of Clinical Trials, Design Control & Regulatory Requirements.

INTRODUCTION TO SPECIFIC MEDICAL TECHNOLOGIES
Biopotential measurement (EMG, EOG, ECG, EEG), Medical Diagnostics (In-vitro diagnostics), Medical Diagnostics (Imaging), Minimally Invasive Devices, Surgical Tools and Implants.

MEDICAL DEVICES STANDARD AND INTELLECTUAL PROPERTY
Standard-ISO, IES, Intellectual Property - Patents, Copy rights, Trademarks, Trade secrets.

HARDWARE AND SOFTWARE DESIGN
Hardware design, Hardware risk analysis, Design and project merits, Design for six sigma, software design, software coding, software risk analysis, software metrics.

DESIGN TRANSFER AND MANUFACTURING
Transfer to manufacturing, hardware manufacturing, software manufacturing, configuration management, documents and deliverables.

TEXT BOOKS:

1. Richard Fries, **"Reliable Design of Medical Devices"**, CRC Press, 2nd Edition, 2006.
2. Paul H. King, Richard C. Fries, Arthur T. Johnson, **"Design of Biomedical Devices and Systems"**, Third Edition, ISBN 9781466569133.

REFERENCES:

1. John G. Webster (ed), **"Medical Instrumentation: Application and Design"**, 2007.
2. Peter J. Ogrodnik, **"Medical Device Design: Innovation from Concept to Market"**, Academic Press Inc; 1st Edition (2012), ISBN-10: 0123919428

COURSE DESIGNERS

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17BMEC13	PRINCIPLES OF TISSUE ENGINEERING	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

The goal of tissue engineering is to replace or even improve biological tissues and their functions by the use of engineering methods and life sciences.The fast-moving fields oftissue engineering are considered to have transformative implications for futurebiomedical applications and the future health care. This course gives an overview on the current state intissue engineering, for example cell culture, molecular aspects, and engineering biomaterialswith additional focus on case study.

PRERQUISITE: NIL

COURSE OBJECTIVES

1	To understand about the different types of tissues.
2	To illustrate the aspects of cell culture.
3	To illustrate the molecular aspects in tissue engineering.
4	To outline thebiomaterials for tissue engineering.
5	To analyse the case study and regulatory issues in tissue engineering

COURSE OUTCOMES

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

CO6. Describe the structureand organization of tissues.	Understand
CO7. Describe the different cell types andaspects of cell culture.	Understand
CO8. Analyze the molecular aspects in tissue engineering.	Analyze
CO9. Apply the knowledge to engineering tissues for replacing bone, cartilage, tendons, ligaments, skin and liver.	Apply
CO10. Apply the knowledge to conduct case study in tissue engineering.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	--	--	--	--	--	--	--	--	--	--	--	--	L	L
CO2	L	--	--	--	--	--	--	--	--	--	--	--	--	L	L
CO3	S	S	--	--	--	M	--	--	M	--	--	M	--	M	M
CO4	S	M	M	--	--	M	--	--	M	--	--	M	S	M	M
CO5	S	M	--	S	--	M	--	--	M	--	--	M	--	M	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Basic definition, Structural and organization of tissues: Epithelial, connective; vascularity and angiogenesis, basic wound healing, cell migration, current scope of development and use in therapeutic and in-vitro testing.

CELL CULTURE

Different cell types, progenitor cells and cell differentiations, different kind of matrix, cell-cell interaction. Aspects of cell Culture: cell expansion, cell transfer, cell storage and cell characterization, Bioreactors.

MOLECULAR BIOLOGY ASPECTS

Cell signaling molecules, growth factors, hormone and growth factor signaling, growth factor delivery in tissue engineering, cell attachment: differential cell adhesion, receptor-ligand binding, and Cell surface markers.

SCAFFOLD AND TRANSPLANT

Engineering biomaterials for tissue engineering, Degradable materials (collagen, silk and polylactic acid), porosity, mechanical strength, 3-D architecture and cell incorporation. Engineering tissues for replacing bone, cartilage, tendons, ligaments, skin and liver. Basic transplant immunology stems cells: introduction, hepatopoiesis.

CASE STUDY AND REGULATORY ISSUES

Case study of multiple approaches: cell transplantation for liver, musculoskeletal, cardiovascular, neural, visceral tissue engineering. Ethical, FDA and regulatory issues of tissue engineering.

TEXT BOOK:

3. Robat Lanza and Robert Langer, **"Principles of Tissue Engineering"**, Elsevier, 2007.

REFERENCES:

3. Bernhard O. Palsson, Sangeeta N. Bhatia, **"Tissue Engineering"**, Pearson Publishers 2009.
4. Ed. Joseph D. Bronzino, **"The Biomedical Engineering Hand Book"**, Second Edition, CRC Press LLC, 2000.

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17BMEC22	MEDICAL ETHICS AND STANDARDS	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To enable the students to acquire knowledge about the medical standards, ethics medicine and drugs acts, Drugs and cosmetics standards and various Medical Acts.

PREREQUISITE:NIL

COURSE OBJECTIVES

1	To Enable the students to understand the medical ethics.
2	To Analyze medical standards.
3	To study the Medicine and Drug Acts.
4	To learn about drugs and cosmetics standards.
5	To learn about various medical Laws.

COURSE OUTCOMES

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

CO1. To get Educated on the students to understand the medical ethics.	Understand
CO2. To Introduce about the Basics of Medical Standards.	Understand
CO3.To introduce the concepts of Medicine and drug related acts.	Understand
CO4. To get familiarize about drugs and cosmetics standards.	Analyze
CO5. To Evaluate about the various medical Laws.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	--	M	--	S	M	M	--	--	--	--	M	--	L	L
CO2	S	--	M	L	S	M	M	--	--	--	--	S	--	L	--
CO3	S	--	M	--	M	S	S	M	--	--	--	S	L	L	--
CO4	M	--	M	M	L	S	S	S	--	--	--	S	L	M	M
CO5	S	--	M	--	M	S	S	S	--	--	--	M	M	L	--

S- Strong; M-Medium; L-Low

SYLLABUS

Medicine and Medical Ethics

Infections diseases, Diseases of CVS, Respiratory system, Kidney & Urinary tract, Liver and biliary tract disease, Endocrinology and metabolism. medical ethics, Code of conduct, Basic principles of medical ethics, Autonomy and informed consent, Organ transplantation, Medico legal aspects of medical.

MEDICAL STANDARDS

Evolution of Medical Standards – IEEE 11073 - HL7 – DICOM – IRMA - LOINC – HIPPA – Electronics Patient Records –Healthcare Standard Organizations – JCAHO (Join Commission on Accreditation of Healthcare Organization) - JCIA (Joint Commission International Accreditation) - Evidence Based Medicine - Bioethics.

MEDICINE AND DRUGS ACTS

Narcotics and Psychotropic substances Act, Drugs and Magic remedies (Objectionable advertisement) Act 1954, Poisons act 1919 – Patent Act – Intellectual Property Rights.

DRUGS AND COSMETICS STANDARDS

Medicinal and Toilet preparations (Excise duties) Act and rules, Drugs Price control order, Shops & Establishments Act, Sales promotion employees (conditions of service) Act.

MEDICAL ACT

Medical Termination of Pregnancy Act, Prevention of cruelty to Animals act, Insecticides Act. Consumer protection Act 1986 - The Factories Act 1948 and the Amendment (salient features).

TEXT BOOKS

1. R.D.Lele, **"Computers in Medicine Progress in Medical Informatics"**, Tata McGraw Hill Publishing computers Ltd, 2005, New Delhi.
2. Mohan Bansal, **"Medical informatics**", Tata McGraw Hill Publishing computers Ltd, 2003 New Delhi.
3. N. K. Jain,**"Forensic Pharmacy"**, 6th Edition CBS Publishers. Delhi
4. 4K. Ram Kumar,**"Forensic Pharmacy and Pharmaceutical Business Management"**, 1st Edition, 2006

REFERENCES

1. G. Vidyasagar & T. V. Narayana,**"Forensic Pharmacy"**, Kalyani Publishers, New Delhi.
2. Vijay Malik,**"Drugs and Cosmetics Act, 1940"**, Eastern Book Company, Lucknow.

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17BMSE23	MEDICAL WASTE MANAGEMENT	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE
To learn more about managing medical waste, Health Care and its necessary.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To understand the process of managing medical waste.
2	To educate awareness among the various Medical Establishments producing Bio-Medical Waste regarding the hazardous effects of Bio-Medical Waste and necessity of compliance of Bio-Medical Waste
3	To create awareness among people associated with different local bodies and healthcare units about the necessities and requirements for scientific segregation, storage, treatment and disposal of Bio-Medical Waste
4	To Make available treatment & disposal of Bio-Medical Waste in Most scientific manner at a reasonable cost & to comply all the rules of the Bio-Medical Waste Management.
5	To understand modern technologies for managing medical waste.

COURSE OUTCOMES

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

CO1: Summarize the history of waste management including impacts from early huma civilization to current day.	Understand
CO2: Describe the major categories of waste.	Understand
CO3: Characterize the components and chemical and physical properties of medical	Analyse
CO4: Summarize requirements for hazardous waste generation, transportation, treatment, storage, and disposal.	Understand
CO5: Describe waste collection, recycling, and materials recovery techniques for MSW	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	M	--	S	--	--	--	S	L	--	M	L	--	--
CO2	S	L	M	--	S	M	--	--	S	L	--	M	L	S	--
CO3	S	L	M	--	S	M	--	--	S	L	--	M	--	S	--
CO4	S	L	M	--	S	M	--	S	S	L	--	M	--	S	--

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

General Introduction, Definition of Biomedical Waste, General and Hazardous health care waste – Colour Coding and types of containers for disposal of medical waste, Segregation, Collection & Disposal.

BIOMEDICAL WASTES

Infectious waste, Genotoxic waste, Waste Sharps – Categories, Categorization and composition of Biomedical waste. Liquid Biomedical Waste - Radioactive wastes, Metals, Chemicals & drugs.

BLOOD PRODUCTS

Human Blood and Blood Products, pathological wastes, Contaminated sharps, Contaminated animal carcasses, body parts, and bedding Basic information about infection, Infectious agents on organizations spread of infection, Basic information about Hospital acquired infection.

STERILISATION

Disinfections unit container for Autoclaving, Sharp waste containers for storage & transportation, autoclaving, Incineration, Plasma Pyrolysis / Gasification systems, Composting.

MODERN TECHNOLOGY FOR MEDICAL WASTES

Modern Technology for handling Biomedical Wastes – Monitoring & Controlling of Cross Infections, Protective Devices – Bioethics and Handling of Waste Management.

TEXT BOOK:

1. V. J. Landrum, **"Medical Waste Management and disposal"**, Elsevier, 1991.

REFERENCES:

1. Malhotra A., **"Hospital Management: An Evaluation"**, Global India Publications, 2009.
2. S L Goel, **“Hospital Management”**, Deep and Deep Publications, 2010.
3. J Glyn Hendry & Gary W Heinke, **“Environmental Science and Engineering”**, Prentice Hall India, 2004.
4. Shyam Divan, **“Environmental law and policy in India”**, Oxford India Press, 2004.

5. Charles A Wentz, **“Hazardous Waste Management”**, McGraw Hill Inc, Newyork, 1995.

COURSE DESIGNERS

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17BMSE24	MEDICAL TECHNOLOGY AND ENTREPRENEURSHIP	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE

The purpose of learning this course on medical technology and entrepreneurship for biomedical engineering students is to acquire knowledge and understand the advanced in medical equipments in therapeutic, diagnostic and entrepreneurship.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To impart the knowledge about the Home Medicare in various clinical application.
2	To make the students understand the active control trials in the evaluation of new treatments.
3	To impart the knowledge about Legal issues and Health policies related to Biosciences.
4	To study the minimally invasive device and technique used in medical devices.
5	To get knowledge about the advances in healthcare technologies and wireless technology related to healthcare system.

COURSE OUTCOMES

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

CO11.	Explain the system description of different therapeutic equipments.	Understand
CO12.	Describe the system description of different diagnostic equipments.	Understand
CO13.	Outline the ethical and regulatory guidance.	Apply
CO14.	Investigate healthcare technologies and wireless technology related to healthcare system.	Analyze
CO15.	Summarize the organization and the need for home medicare system.	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	S	M	--	--	--	S	M	--	--	--	S	--	--
CO2	S	S	M	M	--	--	--	S	M	--	--	--	M	--	--
CO3	S	M	M	L	--	--	--	S	M	--	--	--	M	--	--
CO4	S	M	M	L	--	--	--	S	M	--	--	--	L	--	--
CO5	S	M	L	L	--	--	--	S	L	--	--	--	L	--	--

S- Strong; M-Medium; L-Low

SYLLABUS

SYSTEM DESCRIPTION OF THERAPEUTIC EQUIPMENT

Pacemaker, External cardiovector defibrillator, Implantable cardiovector defibrillator, Deep brain stimulation, Functional electrical stimulator (FES), Hemodialysis delivery system, Mechanical ventilator.

SYSTEM DESCRIPTION OF DIAGNOSTIC EQUIPMENT

Patient monitoring system, ECG, EEG, Blood pressure monitor, Digital stethoscope, Thermometer, System description and diagram of pulse oximeter, optical fiber optics for circulatory and respiratory system measurement.

ETHICAL AND REGULATORY GUIDANCE

Immobilization, The Nurenberg code, Declaration of Helsinki: Ethical principles of medical research involving human subjects, The Belmont report: Ethical principles and guidelines for the protection of human subjects, The common rule, Code of federal regulations

WIRELESS TECHNOLOGY

Wireless communication basics – Types of wireless network, Body area network – Emergency rescue – Remote recovery – General health assessments Technology in medical information processing – Future trends in healthcare technology.

ADVANCEMENT IN MEDICAL TECHNOLOGIES

Advances and trends in health care technologies – Driver impacting the growth of medical Technologies – Impact of Moore's law of medical imaging – E-health and personal healthcare – Defining the future of health Technology – Inventing the future – tools for self health – Future of nano fabrication molecular scale devices – Future of telemedicine – Future of medical computing.

TEXT BOOKS:

1. Ezekiel J, Emanuel, Robert A Crouch, John D Arras, Jonathan D Moreno, Christine Grady, **"Ethical and Regulatory Aspects of Clinical Research"**, Johns Hopkins University Press, First Edition, 2003.
2. Kenneth J. Turner, **"Advances in Home Care Technologies: Results of the match Project"**, Springer, 2011.

REFERENCES:

1. Anthony Y. K, Chan, **"Biomedical Device Technology: Principles and Design"**, Charles Thomas, 2008.
2. Theodore R, Kucklick, **"The Medical Device Ramp-D Handbook"**, Taylor & Francis Group LLC, 3rd Edition 2013.

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17BMSE28	NANO TECHNOLOGY IN MEDICINE	Category	L	T	P	Credit
		EC-SE	3	0	0	3

PREAMBLE
To study about Nano materials, fundamentals of nano technology & applications of Nanotechnology.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To know about the concept of Nanotechnology.
2	To study about the fundamentals of Nanoscience.
3	To study about materials and properties used for MEMS & NEMS.
4	To know about the medical use of nanomaterials.
5	To study about the medical applications.

COURSE OUTCOMES

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

CO16. Describe the basic science behind the properties of materials.	Understand
CO17. Explain the basics properties of NEMS	Understand
CO18. Apply their knowledge of nanotechnology to identify how they can be exploited for new applications.	Apply
CO19. Outline the applications of nanomedicine.	Apply
CO20. Analyze the biomolecular components like nanotubes with nanotechnology	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	S	--	S	--	M	L	S	S	--	--	--	S	M	L
CO2	S	S	--	S	--	M	L	S	S	--	--	--	S	M	L
CO3	S	M	--	S	--	M	L	S	S	--	--	--	M	L	L
CO4	S	M	--	S	--	L	L	S	S	--	--	--	M	L	L
CO5	S	M	--	S	--	L	L	S	S	--	--	--	M	L	L

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION
Introduction to Nanotechnology: Nanomaterials, Fullerenes and carbon forms. Nanoparticles and Colloids, structure and bonding in nanoparticles, Nanomaterials fabrication by Bottom-up and Top down approaches, Classification of nanodevices based on the characteristics, Quantum dots and their properties.

FUNDAMENTALS OF NANOSCIENCE

Size dependence of properties – Particle size determination – Bulk to nanotransition – Semiconducting nanoparticles – Carbon nanostructures – Mechanical properties (hardness, ductility, elasticity) – Optical properties of nanotubes – Electrical properties of nanotubes.

MEMS & NEMS

Definition of MEMS, materials for MEMS (Silicon, Polymers and metals) and their properties, Deposition processes, Photolithography, and etching processes, Limitations of MEMS, NEMS, difference between MEMS and NEMS, properties of NMES, fabrication processes, applications.

NANOMEDICINE

Nanomedicine: Medical use of Nanomaterials, Drug delivery systems. Cancer treatment, Surgery. Drug tracking systems. Targeted drug delivery systems.Applications of Nanomaterials in Medical imaging. Neuro-electronic interfaces.

BIO MOLECULAR NANOTECHNOLOGY

Nanorobots and their application, nanosensors based on biomolecules such as DNA and proteins, nanoparticles for gene delivery systems, Computational genes, Biosensors for Glucose and measurement, Optical biosensors and their application ,Preparation of Nanosystems: Introduction to nanolithography – Carbon nanotubes: preparation – Synthesis and preparation of nanomaterials (crystalline and thinfilm) - Physical and chemical methods - Control and stability (size, shape, composition).

TEXT BOOKS:

1. Lynn E. Foster, Foreword by George Allen, Foreword by Joe Lieberman, **“Nanotechnology’**.
2. Di Ventra, Massimiliano; Evoy, Stephane; Heflin, James R., **“Introduction to Nanoscale Science and Technology”**, Springer publications, 2004.

REFERENCES:

1. Chattopadhyay, **“Introduction to Nanoscience and Nanotechnology"**, PHI, 2009.
2. B.k. Parthasarathy, **“Nanoscience and Nanotechnology”**, Gyan Books, 2007.

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17CVEC35	MUNICIPAL SOLID AND WASTE MANAGEMENT	Category	L	T	P	Credit
		EC	3	0	0	3

PREAMBLE

Structure is an arrangement and organization of interrelated elements in a material object or system, or the object or system so organized. Material structures include man-made objects such as buildings and machines and natural objects such as biological organisms, minerals and chemicals.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	The on-site/off-site processing of the same and the disposal methods.
2	The student is expected to know about the various effects and disposal options for the municipal solid waste.
3	The collection and supply of water
4	The offsite processing involved in site

COURSE OUTCOMES

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

Co1. To know about the types of waste & Sources	Analyse
Co2 . To Study the on site Storage & Processing	Apply
Co3. To study about the collection & transfer the waste	Apply
Co4. To Study the process of off site processing	Apply
CO5. To know about the solid waste disposal	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO3
CO1.	S	M	L	-	-	-	-	-	-	L	-	-	-	-	M
CO2.	S	M	L	S	S	S	-	-	-	-	-	-	L	-	-
CO3.	S	M	M	S	-	-	L	M	M	-	-	-	-	S	M
CO4.	S	M	M	M	-	-	-	-	-	L	M	-	-	-	-
CO5.	S	M	M	-	-	-	-	-	-	-	-	L	S	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

SOURCES AND TYPES OF MUNICIPAL SOLID WASTES: Sources and types of solid wastes - Quantity – factors affecting generation of solid wastes; characteristics – methods of sampling and characterization; Effects of improper disposal of solid wastes – public health effects. Principle of solid waste management – social & economic aspects; Public awareness; Role of NGOs; Legislation.

ON-SITE STORAGE & PROCESSING: On-site storage methods – materials used for containers – on-site segregation of solid wastes – public health & economic aspects of storage – options under Indian conditions – Critical Evaluation of Options.

COLLECTION AND TRANSFER: Methods of Collection – types of vehicles – Manpower requirement – collection routes; transfer stations – selection of location, operation & maintenance; options under Indian conditions.

OFF-SITE PROCESSING: Processing techniques and Equipment; Resource recovery from solid wastes – composting, incineration, Pyrolysis - options under Indian conditions.
DISPOSAL: Dumping of solid waste; sanitary landfills – site selection, design and operation of sanitary landfills – Leachate collection & treatment.

TEXT BOOKS:
1. George Tchobanoglous et.al., "Integrated Solid Waste Management", McGraw-HillPublishers, 2002.
2. B.Bilitewski, G.HardHe, K.Marek, A.Weissbach, and H.Boeddicker, "Waste Management",Springer, 1994.

REFERENCES:
1. R.E.Landreth and P.A.Rebers, "Municipal Solid Wastes – problems and Solutions", Lewis Publishers, 1997.
2. Bhide A.D. and Sundaresan, B.B., "Solid Waste Management in Developing Countries", INSDOC, 1993.

COURSE DESIGNERS

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17CVEC14	AIR POLLUTION MANAGEMENT	Category	L	T	P	Credit
		EC	3	0	0	3

PREAMBLE

The course work offers the basic knowledge on various sources of air pollutants and their possible effects on local, regional and global environment. It provides various techniques for sampling and analyzing he pollutants. Also, it deals with the principles and design of control of particulate/gaseous air pollutants and its emerging trends to fulfil the legal aspects of air pollution to have a sustainable environment for future generation. In addition.

PREREQUISITE

Environmental engineering

COURSE OBJECTIVES

1	About noise pollution and the methods of controlling the same.
2	The student is expected to know about source inventory and control mechanism.
3	To impart knowledge on the sources, effects
4	The control techniques of air pollutants and noise pollution
5	The sources, characteristics and effects of air

COURSE OUTCOMES

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

CO1. Identify the sources of air pollution, impacts of air pollutants and their measurements	Apply
Co2. identify the significance of meteorological factors in pollutants dispersion and to predict the pollutant concentration	Understand
Co3. Suggest preventive and control measures for air pollution.	Apply
Co4. Suggest locations for industries and appropriate city planning tips for the effective air pollution management of a city	Apply
CO5. The course work offers the basic knowledge on various sources of air pollutants and their possible effects on local, regional and global environment.	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**S**	**M**	**L**	**L**	**---**	**L**	**---**	**L**	**---**	**---**	**---**	**---**	-	-	-
CO2	**S**	**M**	**L**	**L**	**L**	**M**	**---**	**L**	**---**	**L**	**L**	**---**	-	-	-
CO3	**S**	**M**	**L**	**L**	**L**	**M**	**---**	**L**	**---**	**L**	**---**	**---**	-	-	-
CO4	**S**	**M**	**M**	**S**	**L**	**---**	**---**	**L**	**---**	**L**	**---**	**L**	-	-	-
CO5	**S**	**M**	**M**	**S**	**---**	**---**	**---**	**M**	**---**	**M**	**L**	**---**	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

SOURCES AND EFFECTS OF AIR POLLUTANTS : Classification of air pollutants – Particulates and gaseous pollutants – Sources of air pollution – Source inventory – Effects of air pollution on human beings, materials, vegetation, animals – global warming-ozone layer depletion, Sampling and Analysis – Basic Principles of Sampling – Source and ambient sampling – Analysis of pollutants – Principles.

DISPERSION OF POLLUTANTS : Elements of atmosphere – Meteorological factors – Wind roses – Lapse rate - Atmospheric stability and turbulence – Plume rise – Dispersion of pollutants – Dispersion models – Applications.

AIR POLLUTION CONTROL : Concepts of control – Principles and design of control measures – Particulates control by gravitational, centrifugal, filtration, scrubbing, electrostatic precipitation – Selection criteria for equipment - gaseous pollutant control by adsorption, absorption, condensation, combustion – Pollution control for specific major industries.

AIR QUALITY MANAGEMENT : Air quality standards – Air quality monitoring – Preventive measures - Air pollution control efforts – Zoning – Town planning regulation of new industries – Legislation and enforcement – Environmental Impact Assessment and Air quality

NOISE POLLUTION: Sources of noise pollution – Effects – Assessment - Standards – Control methods - Prevention

TEXT BOOKS:

1. Anjaneyulu, D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai, 2002.
2. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi, 1996

REFERENCE BOOKS:

1. W.L.Heumann, Industrial Air Pollution Control Systems, McGraw-Hill, New Yark, 1997
2. Mahajan S.P., Pollution Control in Process Industries, Tata McGraw-Hill Publishing Company,New Delhi, 1991.

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17CVEC06	HYDROLOGY	Category	L	T	P	Credit
		EC	3	0	0	3

PREAMBLE

It is the science that deals with the waters of the earth, their occurrence, circulation, distribution and their reaction with environment including their relation to living things.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	The mechanics of rainfall, its spatial and temporal measurement and their applications will be understood.
2	The mechanics of rainfall, its distribution and measurement of rainfall using Hydrograph.
3	Analysis of Simple statistical and application of probability
4	Student will also learn simple methods of flood routing and ground water hydrology.
5	Distribution of rainfall and run off shall also be understood.

COURSE OUTCOMES

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

CO1. Explain the importance of Hydrological cycle and the measurement and analysis of rainfall data	Understand
CO2. Compute the quantity of runoff generated from a catchment	Apply
CO3.Develop hydrographs to measure the stream flow	Apply
CO4. Estimate floods and propose suitable control measures	Apply
CO5. Suggest methods of conserving surface and groundwater storage	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M	-	-	-	L	S	L	-	-	-	M	L	L	-
CO2	S	M	L	L	-	-	S	-	-	-	-	M	L	L	-
CO3	S	M	L	L	-	-	M	-	-	-	-	L	L	L	-
CO4	S	M	-	L	-	-	S	-	-	-	-	L	L	L	-
CO5	L	-	L	-	-	L	M	L	L	L	-	L	L	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

PRECIPITATION: Hydrologic cycle – Types of precipitation – Forms of precipitation – Measurement of Rainfall – Spatial measurement methods – Temporal measurement methods – Frequency analysis of point rainfall – Intensity, duration, frequency relationship – Probable maximum precipitation.

ABSTRACTION FROM PRECIPITATION: Losses from precipitation – Evaporation process – Reservoir evaporation – Infiltration process – Infiltration capacity – Measurement of infiltration – Infiltration indices – Effective rainfall.

HYDROGRAPHS: Factors affecting Hydrograph – Baseflow separation – Unit hydrograph – Derivation of unit hydrograph – S curve hydrograph – Unit hydrograph of different deviations - Synthetic Unit Hydrograph

FLOODS AND FLOOD ROUTING: Flood frequency studies – Recurrence interval – Gumbel's method – Flood routing – Reservoir flood routing – Muskingum's Channel Routing – Flood control

GROUND WATER HYDROLOGY: Types of aquifers – Darcy's law – Dupuit's assumptions – Confined Aquifer – Unconfined Aquifer – Recuperation test – Transmissibility – Specific capacity – Pumping test – Steady flow analysis only.

TEXT BOOKS:

1. Subramanya, K., “Engineering Hydrology”, Tata McGraw-Hill Publishing Co., Ltd., 2000
2. Raghunath, H.M., “Hydrology”, Wiley Eastern Ltd., 2000

REFERENCES:

1. Chow, V.T. and Maidment, “Hydrology for Engineers”, McGraw-Hill Inc., Ltd., 2000
2. Singh, V.P., “Hydrology”, McGraw-Hill Inc., Ltd.,
3. Raghunath,H.M,Ground Water,New Age International(P) Limited,Publishers.
4. Raghunath,H.M, Hydrology:Principles,Analysis & Design, New Age International(P) Limited,Publishers.

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17CVEC07	DISASTER MITIGATION AND MANAGEMENT	Category	L	T	P	Credit
		EC	3	0	0	3

PREAMBLE

This course deals with the various disasters and to expose the students about the measures, its effect against built structures, and Hazard Assessment procedure in India. This course also deals with the methods of mitigating various hazards such that their impact on communities is reduced.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To Understand basic concepts in Disaster Management
2	To Understand Definitions and Terminologies used in Disaster Management
3	To Understand the Challenges posed by Disasters
4	To understand Impacts of Disasters

COURSE OUTCOMES

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

CO1. Understand the various types of disaster viz Hydrological, Coastal and Marine Disasters, Atmospheric Disasters, Geological, Mass Movement and Land Disasters, Wind and Water Driven Disasters.	Understand
CO2. Identify the potential deficiencies of existing buildings for Earthquake disaster and suggest suitable remedial measures.	Understand
CO3.Derive the guide lines for the precautionary measures and rehabilitation measures for Earthquake disaster.	Apply
CO4. Derive the protection measures against floods, cyclone, land slides	Apply
CO5. Understand the effects of disasters on built structures in India	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	-	-	L	-	-	-	-	-	-	-	-	L	-	-
CO2	M	M	L	L	-	M	-	-	-	-	-	-	L	-	-
CO3	S	M	S	M	-	L	-	M	-	-	-	-	M	L	-
CO4	S	M	S	-	L	-	-	-	-	-	-	-	M	L	-
CO5	L	L	-	L	-	-	-	-	-	-	-	-	L	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION: Concept of disaster; Different approaches; Concept of Risk; Levels of disasters; Disaster phenomena and events (Global, national and regional); Natural and man-made hazards

RISK ASSESSMENT AND VULNERABILITY ANALYSIS: Response time, frequency and forewarning levels of different hazards; Characteristics and damage potential of natural hazards; hazard assessment ;Dimensions of vulnerability factors; vulnerability assessment; Vulnerability and disaster risk; Vulnerabilities to flood and earthquake hazards

DISASTER MANAGEMENT MECHANISM: Concepts of risk management and crisis management ; Disaster management cycle ;Response and Recovery ; Development, Prevention, Mitigation and Preparedness; Planning for relief

DISASTER RESPONSE: Mass media and disaster management; Disaster Response Plan; Communication, Participation, and Activation of Emergency Preparedness Plan; Logistics Management; Psychological Response; Trauma and Stress Management; Rumour and Panic Management ;Minimum Standards of Relief; Managing Relief; Funding.

DISASTER MANAGEMENT IN INDIA: Strategies for disaster management planning; Steps for formulating a disaster risk reduction plan; Disaster management Act and Policy in India; Organisational structure for disaster management in India; Preparation of state and district disaster management plans.

TEXT BOOKS:

1. Alexander, D. Natural Disasters, ULC press Ltd, London, 1993.
2. Carter, W. N. Disaster Management: A Disaster Management Handbook, Asian Development Bank, Bangkok, 1991.
3. Chakrabarty, U. K. Industrial Disaster Management and Emergency Response, Asian Books Pvt. Ltd., New Delhi 2007.

REFERENCES:

1. Abarquez I. & Murshed Z. Community Based Disaster Risk Management: Field Practitioner’s Handbook, ADPC, Bangkok, 2004.
2. Goudie, A. Geomorphological Techniques, Unwin Hyman, London 1990.
3. Goswami, S. C. Remote Sensing Application in North East India, Purbanchal Prakesh, Guwahati, 1997.
4. Manual on Natural Disaster Management in India, NCDM, New Delhi, 2001.
5. Disaster Management in India, Ministry of Home Affairs, Government of India, New Delhi, 2011.
6. National Policy on Disaster Management, NDMA, New Delhi, 2009.
7. Disaster Management Act. (2005), Ministry of Home Affairs, Government of India, New Delhi, 2005.

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17CVEC08	**REMOTE SENSING TECHNIQUES AND APPLICATIONS**	Category	L	T	P	Credit
		EC	3	0	0	3

PREAMBLE

Remote sensing is the science and art of obtaining information about an object, area or phenomenon, by the use of either recording or real time sensing devices that are not in physical contact with the object. The Global Positioning System (GPS) is a satellite-based navigation system made up of a network of 24 satellites placed into orbit by the U.S. Department of Defense. These GPS satellites circle the earth twice a day in a very precise orbit and transmit signal information to earth. Remote sensing and GPS data are further used in numerous applications, including GIS data collection, surveying, and mapping.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	Students will learn about the land use mapping techniques,site suitability techniques
2	Students will learn about the use of zone mapping for water bodies
3	Students will learn about the use of mapping techniques for Agriculture and Earth sciences
4	Students will also learn about the recent techniques used for GPS system

COURSE OUTCOMES

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

CO1. Recollect the fundamentals of physics of Remote sensing and concepts.	Remember
CO2. Outline the various data acquisition systems and collection methods for remote sensing data information and storage	Understand
CO3.Apply knowledge of satellites on various Civil Engineering applications.	Apply
CO4. Utilize the various data input methods for mapping	Apply
CO5. Creation of data models using remote sensing techniques and GPS	Apply

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	S	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO3	S	-	-	-	-	-	-	-	-	-	-	-	L	-	-
CO4	S	L	-	-	L	-	-	-	L	L	L	-	L	L	-
CO5	S	L	-	-	L	-	-	-	L	L	L	-	L	L	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION: Definition – Physics of remote sensing – electromagnetic radiation (EMR) – remote sensing windows – interaction of EMR with atmosphere, earth surface, soils, water and vegetation – platform and sensors – image interpretations.

LAND USE STUDIES: Definition of land use – land use / land cover classification – schemes and levels of classification systems with RS data – land use mapping – change detection – urban land use planning, site suitability analysis, transportation planning.

WATER RESOURCES: Areal assessment of surface water bodies – Capacity survey of water bodies – mapping of snow-covered areas – flood risk zone mapping – identification of groundwater potential zones, recharge areas – droughts, definition, drought assessment and management.

AGRICULTURE, SOIL AND FORESTRY: Crop inventory mapping – production estimation – command area monitoring – soil mapping – crop stress detection - estimation of soil erosion – forest types and density mapping – forest fire risk zone mapping.

EARTH SCIENCE: Lithology – lithological mapping – structural mapping – Geomorphology – nature and type of landforms – identification – use of remote sensing data for landslides – targeting mineral resources – Engineering geology and Environmental geology.

TEXT BOOKS:

1. Lillesand, T.M., Kiefer, R.W. and J.W.Chipman., Remote Sensing and Image Interpretation. V Edn. John Willey and Sons (Asia) Pvt. Ltd., New Delhi, 2004
2. Lo. C.P.and A.K.W.Yeung, Concepts and Techniques of Geographic Information Systems. Prentice-Hall of India Pvt. Ltd., New Delhi, 2002

REFERENCES:

1. Chandra,A.M,Geo Informatics,New Age International(P) Limited,Publishers.
2. Fazal,Shahab,GIS Basics,New Age International(P) Limited,Publishers.
3. Space Applications Centre. Manual for Forest mapping and Damage detection using satellite data, Report No.IRS-UP/SAC/FMDD/TN/16/90,1990, pp-253.
4. Sabins, F.F.Jr. Remote sensing principles and interpretation, W.H.Freeman & Co., 1978.
5. Manual of Remote Sensing Vol. II. American Society of Photogrammetry

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	A.Fizoor Rahman	Asst. Professor	CIVIL	fizoorr@gmail.com
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17EEEC18	**RENEWABLE ENERGY TECHNOLOGY**	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To introduce the fundamentals of PV & WIND technologies and Converters used in renewable energy technologies and its lead to understand a modern control techniques to monitor wind turbine systems.

PREREQUISITE-NIL

COURSE OBJECTIVES

1	To learn about PV technology principles.
2	To learn economical and environmental merits of solar energy for variety applications.
3	To learn modern wind turbine control & monitoring.
4	To learn various power converters in the field of renewable energy technologies.
5	To study and analyse different types of Power converters for Renewable energy conversion

COURSE OUTCOMES

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

CO1	Understand the PV technologies	Understand
CO2	Applications of PV technology.	Apply
CO3	Design the solar power plant.	Apply
CO4	Understand modern wind turbines and its control.	Understand
CO5	Analyze various power converters to select for particular application.	Analyze

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	M	S				M			L		M	S	M	S
CO2	M	L	L				M			M		M	S	L	M
CO3	S	S	S	S	M				L				S	M	S
CO4	L	L	L		S		M		L				L	L	S
CO5	S	S	S	M	M									M	
CO6													S	M	S

S- Strong; M-Medium; L-Low

SYLLABUS

SOLAR THERMAL TECHNOLOGIES

Principle of working, types, design and operation of - Solar heating and cooling systems - Thermal Energy storage systems – Solar Desalination – Solar cooker : domestic, community – Solar pond – Solar drying.

Principle of working, types, design and operation of - Solar heating and cooling systems - Thermal Energy storage systems – Solar Desalination – Solar cooker : domestic, community – Solar pond – Solar drying.

SPV SYSTEM DESIGN AND APPLICATIONS

Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cellarray design concepts - PV system design - design process and optimization - detailed array design - storage autonomy - voltage regulation - maximum tracking - centralized and decentralized SPVsystems - stand alone - hybrid and grid connected system - System installation - operation andmaintenances - field experience - PV market analysis and economics of SPV systems.

DIRECT ROTOR COUPLED GENERATOR (MULTIPOLE) [VARIABLE SPEED VARIABLE FREQ.]

Excited Rotor Synch. Generator / PMG Generator, Control Rectifier, Capacitor Banks, Step Up / Boost Converter (DC-DC Step Up), Grid Tied Inverter, Power Management, Grid Monitoring Unit (Voltage and Current), Transformer, Safety Chain Circuits

MODERN WIND TURBINE CONTROL & MONITORING SYSTEM

Details of Pitch System & Control Algorithms, Protections used & Safety Consideration in Wind turbines, Wind Turbine Monitoring with Error codes, SCADA & Databases: Remote Monitoring and Generation Reports, Operation & Maintenance for Product Life Cycle, Balancing technique (Rotor &Blade), FACTS control & LVRT & New trends for new Grid Codes.

POWER CONVERTERS

Solar: Block diagram of solar photo voltaic system: line commutated converters (inversion-mode) - Boost and buck-boost converters- selection Of inverter, battery sizing, array sizing. Wind: three phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid Interactive Inverters-matrix converters.

TEXT BOOK

1.Goswami, D.Y., Kreider, J. F. and & Francis., Principles of Solar Engineering, Taylor and Francis,2000
2.Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, 1996

REFERENCES

1. Sukhatme S P, J K Nayak, Solar Energy – Principle of Thermal Storage and collection, Tata McGraw Hill, 2008.
2. Solar Energy International, Photovoltaic – Design and Installation Manual – New Society Publishers, 2006
3.Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd., 1983
4. John D Sorensen and Jens N Sorensen, Wind Energy Systems, Woodhead Publishing Ltd, 2011
5. Rashid .M. H "power electronics Hand book", Academic press, 2001.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	e-Mail ID
1	P. LOGANATHAN	Assistant Professor	EEE	loganathan@vmkvec.edu.in
2	R. SATHISH	Assistant Professor	EEE	sathish@vmkvec.edu.in

17EEEC20	MATHEMATICAL MODELLING AND SIMULATION	Category	L	T	P	Credit
		EC-PS	3	0	0	3

PREAMBLE

To introduce the students to study the fundamentals of computing and modeling software environments for electrical engineering. This Course contains Programming in numerical computing and modeling software environments for electrical engineering. No prior programming experience or knowledge of SCILAB is assumed, and the course is structured to allow thorough assimilation of ideas through hands-on examples and exercises.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To study basic concepts of scientific programming using SCILAB.
2	To learn about the Basics of Program of SCILAB and related Mathematical Applications.
3	Analyze the concepts of Program of SCILAB.
4	To understand the different tools in SCILAB and ODE, DAE
5	To apply a software program to Electrical circuits and solve the simulation based solutions.

COURSE OUTCOMES

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

CO1	Understand the main features of the SCILAB program development environment to enable their usage in the higher learning.	Understand
CO2	Understand the need for simulation/implementation for the verification of mathematical functions.	Understand and Analyze
CO3	Implement simple mathematical functions/equations in numerical computing environment such as SCILAB.	Create
CO4	Interpret and visualize simple mathematical functions and operations thereon using plots/display.	Analyze and Apply
CO5	Analyze the program for correctness and determine/estimate/predict the output and verify it under simulation environment using SCILAB tools	Analyze and Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S		M			L	L					L	S	M	S
CO2	S	M										M	S	L	S
CO3	S	M											S	M	S
CO4	S	M				M							S	M	S
CO5	S		L			L							S	M	

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Introduction to SCILAB – Constants – Data types – SCILAB Syntax – Data type related functions – Over loading.

GRAPHICAL ANALYSIS USING SCILAB

The media – global plot parameters – 2D and 3D plotting – examples – printing graphics and exporting to Latex.

SCILAB PROGRAMMING

Linear algebra – Polynomial and rational function manipulation – Sparse matrices – random numbers – cumulative distribution functions and their inverse – building interface programs – inter SCI – dynamic linking – static linking.

SCILAB TOOLS

Systems and control toolbox – improper systems – system operation – control tools classical control – state space control – model reduction – identification – linear matrix inequalities – integrating ODEs – integrating DAEs.

APPLICATIONS

Resistive circuits – inductive and capacitive circuits – transients – steady state analysis – logics circuits – electronic devices - DC machines

TEXT BOOK

1. Claude Gomez Engineering and Scientific Computing with SCILAB, Birkhauser publications

REFERENCES

1. **Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB: Scientific and Engineering Applications**A. Vande Wouwer, P. Saucez, C. V. Fernández 2014ISBN: 978-3319067896

2. SCILAB(a Free Software to Matlab),Er. HemaRamachandran and Dr. Achutsankar Nair, S. Chand

Publishers, ISBN-10: 8121939704,2011

3. http://in.mathworks.com/

4.https://www.scilab.org/resources/documentation/tutorials

5. **http://www.scilab.org/**

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	e-Mail ID
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2	R. SATHISH	Assistant Professor	EEE	sathish@vmkvec.edu.in

<table>
<tr><td rowspan="2">17EEEC21</td><td rowspan="2">NON CONVENTIONAL ENERGY SOURCES</td><td>Category</td><td>L</td><td>T</td><td>P</td><td>Credit</td></tr>
<tr><td>EC-PS</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
</table>

PREAMBLE

Non Conventional resources include solar energy, wind, falling water, the heat of the earth (geothermal), plant materials (biomass), waves, ocean currents, temperature differences in the oceans and the energy of the tides. Non Conventional energy technologies produce power, heat or mechanical energy by converting those resources either to electricity or to motive power. It concerned with development of the national grid system will focus on those resources that have established themselves commercially and are cost effective for on grid applications. Such commercial technologies include hydroelectric power, solar energy, fuels derived from biomass, wind energy and geothermal energy. Wave, ocean current, ocean thermal and other technologies that are in the research or early commercial stage, as well as non-electric Non Conventional energy technologies, such as solar water heaters and geothermal heat pumps, are also based on Non Conventional resources, but outside the scope of this Manual.

PREREQUISITE-NIL

COURSE OBJECTIVES

1	To learn about PV technology principles.
2	To learn economical and environmental merits of solar energy for variety applications.
3	To learn modern wind turbine control & monitoring.
4	To learn various power converters in the field of renewable energy technologies.
5	To study and analyse different types of Power converters for Renewable energy conversion

COURSE OUTCOMES

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

CO1	Understand to Renewable Energy Sources, Principles of Solar Radiation, Different Methods of Solar Energy Storage and its Applications, Concepts of Solar Ponds, Solar Distillation and Photo Voltaic Energy Conversion	Understand and Analyse
CO2	Learn the Flat Plate and Concentrating Collectors, Classification of Concentrating Collectors	Analyse
CO3	Learn the Wind Energy, Horizontal and Vertical Access Wind Mills, Bio Conversion	Analyse

CO4	Types of Bio-Gas Digesters and Utilization for Cooking Geothermal Energy Resources	Understand and Apply
CO5	Types of Wells and Methods of Harnessing the Energy, Ocean Energy and Setting of OTEC Plants	Understand
CO6	Tidal and Wave Energy and Mini Hydel Power Plant, Need and Principles of Direct Energy Conversion, Concepts of Thermo-Electric Generators and MHD Generators	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	S				M			L		M	S	M	S
CO2	M	L	L				M			M			S	L	M
CO3	S	M	S	S	M									M	S
CO4	L	L	L		S		M						L	L	S
CO5	S	S	S	M	M									M	
CO6												M	S	M	

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Statistics on conventional energy sources, Classification of Energy Resources, Definition Concepts of NCES, Limitations of RES, Criteria for assessing the potential of NCES. - Solar, Wind, Geothermal, Bio-mass, Ocean Energy Sources, comparison of these energy sources

SOLAR ENERGY CONCEPT

Solar Energy-Energy available form Sun, Solar radiation data, Solar energy conversion into heat, Flat plate and Concentrating collectors, Mathematical analysis of Flat plate collectors and collector efficiency, Principle of Natural and Forced convection, Solar engines-Stirling, Brayton engines, Photovoltaic, p-n junction, solar cells, PV systems, Stand-alone, Grid connected solar power satellite.

WIND ENERGY CONCEPT

Wind energy conversion, General formula -Lift and Drag- Basis of wind energy conversion – Effect of density, frequency variances, angle of attack, and wind speed. Windmill rotors Horizontal axis and vertical axis rotors. Determination of torque coefficient, Induction type generators- working principle.

GEOTHERMAL AND BIOMASS ENERGY

Nature of Geothermal sources, Definition and classification of resources, Utilization for electric generation and direct heating, Well Head power generating units, Basic features Atmospheric exhaust and condensing, exhaust types of conventional steam turbines. Pyrolysis of Biomass to produce solid, liquid and gaseous fuels, Biomass gasification, Constructional details of gasifier, usage of biogas for chulhas, various types of chulhas for rural energy needs.

TODAL AND WAVE ENERGY

Wave, Tidal and OTEC energy- Difference between tidal and wave power generation, Principles of tidal and wave power generation, OTEC power plants, Operational of small cycle experimental facility, Design of 5 Mw OTEC pro-commercial plant, Economics of OTEC, Environmental impacts of OTEC. Status of multiple product OTEC systems.

TEXT BOOK

1. Ashok V Desai, Non-Conventional Energy, Wiley Eastern Ltd, New Delhi, 2003
2. K M, Non-Conventional Energy Systems, Wheeler Publishing Co. Ltd, New Delhi, 2003.

REFERENCES

1. Ramesh R & Kumar K U, Renewable Energy Technologies, Narosa Publishing House, New Delhi, 2004
2. Wakil MM, Power Plant Technology, Mc Graw Hill Book Co, New Delhi, 2004.
3. Non – Conventional Energy Sources. Rai.

COURSE DESIGNERS

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17ATEC08	TRACTOR AND FARM EQUIPMENTS	Category	L	T	P	C
		EC(PS)	3	0	0	3

Preamble

This course reviews the study of fundamentals and design of tractors and farm equipments

Prerequisite

Nil

Course Objectives

1	To study the components and safety rules of tractors
2	To learn the engine cycles and performance of tractors
3	To study the various engine components
4	To study the engine cooling, lubrication and fuel supply system
5	To study the various farm equipments

Course Outcomes:

After Successful completion of this course, the students will be able to:

CO1.	Understand the safety rules of tractors and their components	Understand
CO2.	Understand the operation of engine cycles and performance of tractors	Understand
CO3.	Know the various engine components of tractors	Understand
CO4.	Understand the engine cooling, lubrication and fuel supply systems of tractors	Understand
CO5.	Know the various Farm equipments	Understand

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	--	--	--	--	--	--	--	--	--	--	--	L	--	--
CO2	S	--	--	--	--	--	--	--	--	--	--	--	L	--	--
CO3	S	--	--	--	L	--	L	--	--	--	--	--	L	--	--
CO4	S	--	L	--	--	--	--	--	--	--	--	--	L	--	--
CO5	S	M	L	L	M	M	M	--	--	--	--	--	L	--	--

S- Strong; M-Medium; L-Low

Syllabus

GENERAL DESIGN OF TRACTORS

Classification of tractors –Main components of tractor – safety rules, Control of the Tractor and Fundamentals of Engine Operation

CONTROL DESIGN OF THE TRACTOR AND FUNDAMENTALS

Tractor controls and the starting of the tractor engines – basic notions and definition – Engine cycles – operation of multi cylinder engines - General engine design – Basic engine performance characteristics.

ENGINE FRAME WORK AND VALVE MECHANISM OF TRACTORS

Cylinder and pistons –Connecting rods and crankshafts – Engine balancing – Construction and operations of the valve mechanism – Valve mechanism troubles

COOLING SYSTEM, LUBRICATION SYSTEM AND FUEL SYSTEMS OF TRACTOR

Cooling system – Classification – Liquid cooling systems – Components, Lubricating system servicing and troubles – Air cleaner and turbo charger – Fuel tanks and filters – Fuel pumps

FARM EQUIPMENTS

Working attachment of tractors –Farm equipments – Classification – Auxiliary equipment – Trailers and body tipping mechanism.

TEXT BOOK:

1. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987

REFERENCES:

1. Kolchin A., an dV.Demidov, Design of Automotive Engines for Tractor.

Course Designers:

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1	T.Raja	Associate Professor	Auto / VMKVEC	rajat@vmkvec.edu.in
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4				

17ATEC18	**ALTERNATIVE FUELS**	Category	L	T	P	C
		EC(PS)	3	0	0	3

Preamble

To study and understand the Composition and Development in Alternate Fuels

Prerequisite

Nil

Course Objectives

1	Understand the importance of Biochemistry
2	Select suitable production technology for Cellulases
3	Identify the standards and quality control measures to be followed for bioethanol production
4	Understand the various Composition of Bio Diesel
5	Understand the various Development in Alternate Fuels

Course Outcomes:

After Successful completion of this course, the students will be able to:

CO1.	Identify potential biomass sources for renewable energy generation.	Understand
CO2.	Understand the production process for lipid based biofuels.	Understand
CO3.	Understand the production process of biomethane and biohydrogen	Understand
CO4.	Differentiate first and second generation biofuels	Understand
CO5.	Understand the bio production of gases	Understand

Mapping with Programme Outcomes and Programme Specific Outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	M	M	--	--	S	M	--	--		--	--	L	--	--
CO2	--	M	L	S	--	M	--	--	--	M	--	--	L	--	--
CO3	--	M	M	--	S	--	--	--	--	--	--	M	L	--	--
CO4	M	L	--	M	M	M	M	--	--	--	--		L	--	--
CO5	S	--	S	S	--	--	M	--	--	M	--	M	L	--	--

S- Strong; M-Medium; L-Low

Syllabus

INTRODUCTION

Chemistry, Biochemistry, and Microbiology of Lignocellulosic Biomass, Biomass as an Energy Source: Traditional and Modern Views, Structural and Industrial Chemistry of Lignocellulosic Biomass, Lignocellulose as a chemical resource, Physical and chemical pretreatment of lignocellulosic biomass, Biological pretreatments, Acid hydrolysis to saccharify pretreated lignocellulosic biomass,

BIOCHEMISTRY

Cellulases: Biochemistry, Molecular Biology, and Biotechnology, Enzymology of cellulose degradation by cellulases, Cellulases in lignocellulosic feedstock processing, Molecular biology and biotechnology of cellulase production, Hemicellulases: New Horizons in Energy Biotechnology, A multiplicity of hemicellulases, Hemicellulases in the processing of lignocellulosic biomass, Lignin-Degrading Enzymes as Aids in Saccharification, Commercial Choices of Lignocellulosic Feedstocks for Bioethanol Production, Biotechnology and Platform Technologies for Lignocellulosic Ethanols

BIOCHEMICAL ENGINEERING

Biochemical Engineering and Bioprocess Management for Fuel Ethanol, Biomass Substrate Provision and Pretreatment, Wheat straw — new approaches to complete saccharification, Switchgrass, Corn stover,

Softwoods, Sugarcane bagasse, Other large-scale agricultural and forestry, biomass feedstocks, Fermentation Media and the “Very High Gravity” Concept, Fermentation media for bioethanol production, Highly concentrated media developed for alcohol fermentations,
COMPOSITION OF BIO DIESEL
Vegetable oils and chemically processed biofuels, Biodiesel composition and production processes, Biodiesel economics, Energetics of biodiesel production and effects on greenhouse gas emissions, Issues of ecotoxicity and sustainability with expanding biodiesel production, Fischer-Tropsch Diesel: Chemical Biomass–to–Liquid Fuel Transformations
DEVELOPMENT OF ALTERNATE FUELS
Radical Options for the Development of Biofuels, Biodiesel from Microalgae and Microbes, Biohydrogen, The hydrogen economy and fuel cell technologies, Bioproduction of gases, Production of H2 by photosynthetic organisms, Emergence of the hydrogen economy, Microbial Fuel Cells: Eliminating the Middlemen of Energy Carriers Biofuels as Products of Integrated Bioprocesses

TEXT BOOK:

1. David M. Mousdale, Biofuel-Biotechnology, Chemistry, and sustainable Development, 1st Ed., CRC Press Taylor & Francis Group, 2008
2. Joseph M Norbeck, Hydrogen fuel for surface transportation, Society of Automotive Engineers, 1996.

REFERENCES:

1. Ayhan Demirbas, Green Energy and Technology, Biofuels, Securing the Planet’s Future Energy Needs, 1st edition, Springer, 2009.
2. James D. Halderman, James Linder. Automotive Fuel and Emission Control system, Prentice Hall, 2005.

Course Designers:

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4				

17MECC16	INDUSTRIAL AUTOMATION	Category	L	T	P	Credit
		CC	3	0	0	3

Preamble

To introduce the need, evolution, and motivation for Industrial Automation. Familiarization with basic concepts and different automation strategies being used in practice worldwide.

Prerequisite NIL

Course Objective

1	To understand the factory automation and integration
2	To learn about hydraulics/pneumatics circuits
3	To understand the various design of pneumatic and electro-pneumatic circuits
4	To learn about PLC and its applications
5	To understand the automation in transfer machines & assembly.

Course Outcomes: On the successful completion of the course, students will be able to

CO1.	Understand need and scope of industrial automation	Remember
CO2.	Understand the basics and need for implementation hydraulic and pneumatic systems.	Understand
CO3.	Design of pneumatic and electro-pneumatic circuits	Apply
CO4.	Know about PLC and its applications	Understand
CO5.	Understand the basics of automatic transfer machines & assembly automation	Understand

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M											L	L		
CO2	M											L	L		
CO3	M	M	S	S	M							L	L		
CO4	M		M	S	M							L	L		
CO5	M		M	S	M							L	L		

S- Strong; M-Medium; L-Low

SYLLABUS
INTRODUCTION TO FACTORY AUTOMATION AND INTEGRATION
Basic concepts and scope of industrial automation, socio-economic considerations, modern developments in automation in manufacturing and its effect on global competitiveness.-Need and implications of automation in manufacturing- Different types of production systems and automation-Hard/fixed automation
INTRODUCTION TO HYRDAULICS/PNEUMATICS
Basic elements of hydraulics/pneumatics, electro-pneumatic controls and devices, electro-pneumatic systems, fluid power control elements and standard graphical symbols for them, construction and performance of fluid power generators, hydraulic and pneumatic actuators, their design and control devices-Sequence operation of hydraulic /pneumatic actuators-Applications in manufacturing- Hydraulic & pneumatic valves for pressure, flow & direction control, servo valves and simple servo systems with mechanical feedback, solenoid-Different sensors for hydraulic, pneumatic & electro-pneumatic systems.
DESIGN OF PNEUMATIC AND ELECTRO-PNEUMATIC LOGIC CIRCUITS
Logic circuits to be designed for a given time displacement diagram or sequence of operation-Pneumatic safety and control circuits and their applications to clamping, traversing and releasing operations.
PROGRAMMABLE LOGIC CONTROLLERS (PLC)
PLC for design demonstration, programming and interface the hardware with software for modern manufacturing applications.
AUTOMATIC TRANSFER MACHINES & ASSEMBLY AUTOMATION
Classifications, analysis of automated transfer lines, without and with buffer storage, group technology and flexible manufacturing system- Types of assembly systems, assembly line balancing, performance and economics of assembly system.

Text Books	
1	Esposito, A., Fluid Power with Applications, Prentice Hal of India, New Delhi .,
2	Majumdar, S. R., Pneumatic Systems, Tata McGraw Hill, New Delhi
Reference Books	
1	Auslander, D. M. and Kempf, C. J., Mechatronics: Mechanical System Interfacing, Prentice Hall Inc., New Jersey .
2	Deppert, W. and Stoll, K., Pneumatic Control, Vogel Verlag, Wurzburg, Germany,
3	Herbert, E.M., Hydraulic Control System, John Wiley & Sons, New York

Course Designers

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1	M.SARAVANAN	ASST. PROF	MECH./ AVIT	saravanan@avit.ac.in

17ECEC06	MEMS & SENSORS	Category	L	T	P	Credit
		EC	3	0	0	3

PREAMBLE

In recent years, MEMS have revolutionized the semiconductor industry, with sensors being a particularly buoyant sector. Smart MEMS and Sensor Systems presents readers with the means to understand, evaluate, appreciate and participate in the development of the field, from a unique systems perspective.The combination of MEMS and integrated intelligence has been put forward as a disruptive technology. The full potential of this technology is only evident when it is used to construct very large pervasive sensing systems.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	Understand the fundamental concept of MEMS and their relevance to current industry/scientific needs
2	Gain the physical knowledge underlying the operation principles and design of microsystems;
3	Build an understanding of microscale physics for use in designing MEMS applications
4	Understand the basic principles of MEMS sensors and actuators (mechanical, electrical, piezoresistive, piezoelectric, thermal, microfluidic)
5	Design the process flow of a basic MEMS device, such as an inertia sensor (accelerometer), given a fabrication process description.

COURSE OUTCOMES

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

CO1. Knowledge on the basics of MEMS and mechanics for MEMS Design	Understand
CO2. Ability to apply the basic knowledge of MEMS in different fields	Apply
CO3. Apply the MEMS for different applications.	Apply
CO4. Use concepts in common methods for converting a physical parameter into an electrical quantity	Apply
CO5. Locate different type of sensors used in real life applications and paraphrase their importance	Create

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	L	L	-	L	-	-	-	-	-	-	M	L	-	-
CO2	S	S	M	M	M	-	-	-	-	-	-	M	M	-	-
CO3	S	S	M	M	L	M	-	-	-	-	-	M	M	-	-
CO4	S	S	S	-	L	S	-	-	-	-	-	M	L	M	-
CO5	S	M	S	S	S	S	M	-	-	-	-	M	M	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

OVERVIEW AND INTRODUCTION Introduction to Design of MEMS, Overview of Micro electromechanical Systems, Materials for MEMS: Silicon, silicon compounds, polymers, metals ,Micro fabrication, Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, **S**election of packaging materials

MECHANICS FOR MEMS DESIGN Elasticity, Stress, strain and material properties, Bending of thin plates, Spring configurations, torsional deflection, Mechanical vibration, Resonance, Thermo mechanics – actuators, force and response time, Fracture and thin film mechanics.

MEMS APPLICATION Case studies – Capacitive accelerometer, Peizo electric pressure sensor, Microfluidics application, Modeling of MEMS systems, CAD for MEMS.

INTRODUCTION AND DISPLACEMENT MEASUREMENT Sensors - Basic requirements of a sensors- Classification of sensors- Static and Dynamic characteristics of sensors- Displacement Sensors- Linear and Rotary displacement sensors-Potentiometer, Capacitive and Inductive type displacement sensor- position sensors- Optical encoder, Photoelectric sensor, Hall Effect Sensor.

MICRO SENSORS AND ACTUATORS Micro Sensors: Principles and examples, Force and pressure micro sensors,position and speed micro sensors, acceleration micro sensors, chemical sensors,biosensors, temperature micro sensors and flow micro sensors. Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect, other principles.

Text Books

1.N. P. Mahalik, “MEMS”,Tata McGraw hill, Sixth reprint, 2012.
2.Stephen Santeria,” Microsystems Design”, Kluwer publishers, 2000.
3.Sensor & transducers, D.Patranabis, 2nd edition, PHI

Reference Books

1. 1 Nadim Maluf,” An introduction to Micro electro mechanical system design”, ArtechHouse, 2000.
2. Mohamed Gad-el-Hak, editor,” The MEMS Handbook”, CRC press Baco Raton,2000.
3.. Tai Ran Hsu,” MEMS & Micro systems Design and Manufacture” Tata McGraw Hill, New Delhi, 2002. Liu,”MEMS”, Pearson education, 2007..
4. Instrument transducers, H.K.P. Neubert, Oxford University press.

COURSE DESIGNERS

1	**Mrs.A.Malarvizhi**	malar.ece06@gmail.com
2		
3		

17ECEC23	Introduction to Machine Vision

Category	L	T	P	Credit
EC	3	0	0	3

Preamble

To introduce the students the concepts behind machine vision and object recognition techniques.

Prerequisite

NIL

Course Objectives

1	To understand the fundamental of digital image processing
2	To understand the concepts of edge detection, segmentation and texture analysis
3	To understand the concepts of image analysis
4	To understand the concepts of 3D vision and motion
5	To get introduced to the concepts behind pattern recognition schemes

Course Outcomes

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

CO 1	Understand the basic operation of imaging techniques in the computers	Remember and Understand
CO 2	Analyze the basic processing techniques of image processing	Analyze
CO 3	Study and analyze the pattern of computer understandings of structures.	Evaluate
CO 4	Understand and study the 3D create new standards for securing the data	Create
CO 5	Evaluate the various real time computer vision systems.	Evaluate

Mapping with Programme Outcomes and Programme Specific Outcomes

CoS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	S	M	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	M	L	S	-	-	-	-	-	-	-	-	L	-	-	-
CO3	S	S	M	-	L	-	-	-	-	-	-	L	-	-	-
CO4	S	M	M	-	S	-	-	-	-	-	-	S	-	-	-
CO5	S	M	L	-	M	-	-	-	-	-	-	S	-	-	-

S – Strong; M – Medium; L – Low

Syllabus

UNIT – I - LOW LEVEL VISION – INTRODUCTION TO IMAGE PROCESSING 9

Fundamental steps in digital image processing – Components of an image processing system –Image sampling and quantization – Basic relationships between pixels – Basic intensity transformation functions – Fundamentals of spatial filtering – Basics of filtering in frequency domain – Filtering in spatial and freuency domains.

UNIT – II: LOW LEVEL VISION - EDGE DETECTION, SEGMENTATION & TEXTURE 9

Thresholding Techniques, Edge Detection, Corner and Interest Point Detection, Mathematical Morphology, Texture.

UNIT – III: INTERMEDIATE LEVEL VISION 9

Binary Shape Analysis, Boundary Pattern Analysis, Line Detection, Circle and Ellipse Detection, the Hough Transform and Its Nature, Pattern Matching Techniques.

UNIT – IV: 3D VISION AND MOTION 9

The Three-Dimensional World, Tackling the Perspective n-point Problem, Invariants and Perspective, Image Transformations and Camera Calibration, Motion.

UNIT – V: REAL TIME PATTERN RECOGNITION SYSTEMS 9

Automated Visual Inspection, Inspection of Cereal Grains, Surveillance, In-Vehicle Vision Systems, Statistical Pattern Recognition.
Image Acquisition, Real-Time Hardware and Systems Design Considerations.

Text Books

1. "Digital Image Processing", Rafael C Gonzalez & Richard E Woods, Pearson Education International, Third Edition, 2008, ISBN 0-13-168728-x, 978-0-13-168728-8.
2. "Computer and Machine Vision: Theory, Algorithms, Practicalities", E R Davies, Fourth Edition, 2012, Academic Press, Elsevier.

Reference Books

1. Digital Image Processing, Bernd Jahne, Springer -Verlag, Fifth Edition, 2002, ISBN 3-540 - 67754 - 2.
2. The Essential Guide to Image Processing", Al Bowik,2009, Elsevier Inc, ISBN 978-0-12-374457-9.
3. Machine Vision Algorithms and Applications, C Steger, M Ulrich, & C Wiedemann, First Edition, Wiley VCH, 2006, ISBN 3527407340.

Course Designers:

S.No	Name of the Faculty	Mail ID
1	P. Subramanian	subramanian@avit.ac.in

17MESE03	HYDROGEN AND FUEL CELL TECHNOLOGY	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

PREAMBLE

To enlighten on various technological advancements, benefits and prospects of utilizing hydrogen/fuel cell for meeting the future energy requirements.

PREREQUISITE

NIL

COURSE OBJECTIVES

1	To detail on the hydrogen production methodologies, possible applications and various storage options.
2	To discuss on the working of a typical fuel cell, its types and to elaborate on its thermodynamics and kinetics.
3	To analyze the cost effectiveness and eco-friendliness of Fuel Cells.
4	To make students understand the different fuel cells and their applications.
5	To enable students to understand the economics of fuel cells.

COURSE OUTCOMES

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

CO1. Know the hydrogen production methodologies and various storage options	Understand
CO2. Know the working of fuel cell and its types with thermodynamic performance.	Understand
CO3. Understand the cost effectiveness and eco-friendliness of fuel cells.	Understand
CO4. Know the different types of fuel cells and their applications.	Understand
CO5.Understand the economics of fuel cells.	Understand

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	S	S	S	S	S	S						L		
CO2	S	S	S	M	M	M	L						L		
CO3	M	L	--	--	M	M	S						L		
CO4	S	M	M	--	M	M	M						L		
CO5	M	L	--	--	L	L	L						L		

S- Strong; M-Medium; L-Low

SYLLABUS

HYDROGEN – BASICS AND PRODUCTION TECHNIQUES: Hydrogen – physical and chemical properties, salient characteristics. Production of hydrogen – steam reforming – water electrolysis – gasification and woody biomass conversion – biological hydrogen production – photo dissociation – direct thermal or catalytic splitting of water.

HYDROGEN STORAGE AND APPLICATIONS: Hydrogen storage options – compressed gas – liquid hydrogen – Hydride – chemical Storage – comparisons. Safety and management of hydrogen. Applications of Hydrogen.

FUEL CELLS: History – principle - working - thermodynamics and kinetics of fuel cell process – performance evaluation of fuel cell – comparison on battery Vs fuel cell.

FUEL CELL – TYPES: Types of fuel cells – AFC, PAFC, SOFC, MCFC, DMFC, PEMFC – relative merits and demerits.

APPLICATION OF FUEL CELL AND ECONOMICS: Fuel cell usage for domestic power systems, large scale power generation, Automobile, Space. Economic and environmental analysis on usage of Hydrogen and Fuel cell. Future trends in fuel cells**.**

TEXT BOOKS:

1. Viswanathan, B and M Aulice Scibioh, Fuel Cells – Principles and Applications, Universities Press (2006)
2. Rebecca L. and Busby, Hydrogen and Fuel Cells: A Comprehensive Guide, Penn Well Corporation, Oklahoma (2005
3. Bent Sorensen (Sørensen), Hydrogen and Fuel Cells: Emerging Technologies and Applications, Elsevier, UK (2005)

REFERENCES:

1. Kordesch, K and G.Simader, Fuel Cell and Their Applications, Wiley-Vch, Germany (1996)
2. Hart, A.B and G.J.Womack, Fuel Cells: Theory and Application, Prentice Hall, New York Ltd., London (1989)
3. Jeremy Rifkin, The Hydrogen Economy, Penguin Group, USA (2002).

1.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department / Name of the College	Mail ID
1	SHIVAKUMAR N	Asst. Prof. - II	Mechanical, AVIT	shiva.thermal@gmail.com

17MESE05	WASTE ENERGY CONVERSION TECHNOLOGIES	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

This subject deals with various techniques involved in waste treatment, waste disposal and how to convert energy from that waste. Detailed study extends to the method of thermo chemical and bio chemical conversion techniques. Also deals a case study of environmental and health impact due energy conversion to waste.

Prerequisite - NIL

Course Objective

1	To understand the waste and waste processes.
2	To understand waste treatment and disposal.
3	To apply how to convert waste to energy from thermo chemical conversion.
4	To apply how to convert waste to energy from bio chemical conversion.
5	To analysis the environmental impact due to waste with case study.

Course Outcomes: On the successful completion of the course, students will be able to

CO1.	Explained types of waste and source of waste	understand
CO2.	Understand various waste treatment and disposal	understand
CO3.	Apply the various techniques to convert waste to energy by thermo chemical conversion.	apply
CO4.	Apply various methods to convert waste to energy from bio chemical conversion.	apply
CO5.	Analysis the environmental and health impacts due to waste with case study.	analysis

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO 1	PSO 2	PSO 3
CO1	M	L											L		
CO2	S	M	L										L		
CO3	S	M	L										L		
CO4	S	S	M	L									L		
CO5	S	S	S	M									L		

S- Strong; M-Medium; L-Low

SYLLABUS
INTRODUCTION TO WASTE & WASTE PROCESSING
Definitions, sources, types and composition of various types of wastes; Characterisation of Municipal SolidWaste (MSW) , Industrial waste and Biomedical Waste (BMW), waste collection and transportation; waste processing-size reduction, separation; waste management hierarchy, waste minimization and recycling of MSW; Life Cycle Analysis (LCA), Material Recovery Facilities (MRF), recycling processes of solid waste.
WASTE TREATMENT AND DISPOSAL
Aerobic composting, incineration, different type of incineration; medical and pharmaceutical waste incinerations- land fill classification, types, methods and sitting consideration, layout and preliminary design of landfills: composition, characteristics, generation, movement and control of landfill leachate and gases, environmental monitoring system for land fill gases.
ENERGY FROM WASTE-THERMO CHEMICAL CONVERSION
Sources of energy generation, incineration, pyrolysis, gasification of waste using gasifiers, briquetting, utilization and advantages of briquetting,-environmental and health impacts of incineration; strategies for reducing environmental impacts.
ENERGY FROM WASTE- BIO-CHEMICAL CONVERSION
Anaerobic digestion of sewage and municipal wastes, direct combustion of MSW-refuse derived solid fuel, industrial waste, agro residues, anaerobic digestion- biogas production, land fill gas generation and utilization, present status of technologies for conversion of waste into energy, design of waste to energy plants for cities, small townships and villages.
ENVIRONMENTAL AND HEALTH IMPACTS-CASE STUDIES
Environmental and healthimpacts of waste to energy conversion, case studies of commercial waste to energy plants,waste to energy- potentials and constraints in India, eco-technological alternatives for waste to energy conversions - Rules related to the handling, treatment and disposal of MSW and BMW in India.

Text Books	
1	Parker, Colin, & Roberts, “Energy from Waste An Evaluation of Conversion Technologies”, Elsevier Applied Science, London, 1985.
2	Shah, Kanti L., “Basics of Solid & Hazardous Waste Management Technology”, Prentice Hall, 2000.
Reference Books	
1	Robert Green, From Waste to Energy, Cherry Lake Publication, 2009.
2	Velma I Grover and Vaneeta Grover, “Recovering Energy from Waste Various Aspects”, Science Pub Inc, 2002.

Course Designers

S.No	**Faculty Name**	**Designation**	**Department/Name of the College**	**Email id**
1	R.CHANDRASEKAR	Assistant Professor	MECH / VMKVEC	chandrasekar@vmkvec.edu.in

17MESE06	BIO ENERGY TECHNOLOGY	Category	L	T	P	Credit
		EC(SE)	3	0	0	3

Preamble

To disseminate the technologies for utilizing bio-energy and its manifold benefits compared to conventional fossil fuels.

Prerequisite - NIL

Course Objective

1	To provide the students the sources of biomass.
2	To make understand the students on different processes of biomethanation.
3	To study the combustion of bio fuels,
4	To study the gasification methods of biomass.
5	To provide the students on liquefied biofuels.

Course Outcomes: On the successful completion of the course, students will be able to

CO1.	To gain the knowledge of the basic concepts of Biomass preparation and also fuel assessments.	Understand
CO2.	To obtain the methods of biogas production and biogas plants.	Understand
CO3.	To apply the concepts of combustion processes and fuel handling systems.	Apply
CO4.	To apply the techniques for preparation of biogases and coals.	Apply
CO5.	To apply the techniques for preparation of biodiesels from vegetables.	Apply

Mapping with Programme Outcomes and Programme Specific Outcomes

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO12	PSO 1	PSO 2	PSO 3
CO1	S	M	L	M	L	L							L	-	-
CO2	S	M	S	M	M	M							L	-	-
CO3	S	M	M	L	M	L							L	-	-
CO4	S	M	S	M	S	S							L	-	-
CO5	S	M	S	M	S	S							L	-	-

S- Strong; M-Medium; L-Low

SYLLABUS :

INTRODUCTION

Biomass: types – advantages and drawbacks – Indian scenario – characteristics – carbon neutrality – conversion mechanisms – fuel assessment studies – densification technologies – Comparison with coal – Proximate & Ultimate Analysis - Thermo Gravimetric Analysis – Differential Thermal Analysis – Differential Scanning Calorimetry

BIOMETHANATION

Microbial systems – phases in biogas production – parameters affecting gas production – effect of additives on biogas yield – possible feed stocks. Biogas plants – types – design – constructional details and comparison – biogas appliances – burner, luminaries and power generation – effect on engine performance

COMBUSTION

Perfect, complete and incomplete combustion - stoichiometric air requirement for biofuels - equivalence ratio – fixed Bed and fluid Bed combustion – fuel and ash handling systems – steam cost comparison with conventional fuels

GASIFICATION,PYROLYSIS AND CORBONISATION

Chemistry of gasification - types – comparison – application – performance evaluation – economics – dual fuelling in IC engines – 100 % Gas Engines – engine characteristics on gas mode – gas cooling and cleaning systems - Pyrolysis - Classification - process governing parameters – Typical yield rates. Carbonization Techniques – merits of carbonized fuels

LIQUID BIOFUELS

History of usage of Straight Vegetable Oil (SVO) as fuel - Biodiesel production from oil seeds, waste oils and algae - Process and chemistry - Biodiesel health effects / emissions / performance. Production of alcoholic fuels (methanol and ethanol) from biomass – engine modifications

TEXT BOOKS

1. Tom B Reed, Biomass Gasification – Principles and Technology, Noyce Data Corporation, 1981
2. David Boyles, Bio Energy Technology Thermodynamics and costs, Ellis Hoknood Chichester, 1984.
3. Khandelwal KC, Mahdi SS, Biogas Technology – A Practical Handbook, Tata McGraw Hill, 1986

Reference Books

1. Mahaeswari, R.C. Bio Energy for Rural Energisation, Concepts Publication,1997
2. Best Practises Manual for Biomass Briquetting, I R E D A, 1997 .
3. Eriksson S. and M. Prior, The briquetting of Agricultural wastes for fuel, FAO Energy and Environment paper, 1990
4. Iyer PVR et al, Thermochemical Characterization of Biomass, M N E S

Course Designers

S.No	Faculty Name	Designation	Department/ Name of the College	Email id
1	R.MAHESH	ASSISTANT PROFESSOR (GR-II)	Mechanical/AVIT	mahesh@avit.ac.in

CATEGORY ‘D’ –
PROJECT (9 CREDITS) AND INTERNSHIP + INDUSTRY ELECTIVES COURSES (9 CREDITS)
TOTAL – 18 CREDITS

-

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISIT E
1	17BTPI01	PROJECT	BTE	PI	0	0	18	9	NIL

CATEGORY ‘D’ –

INTERNSHIP + INDUSTRY ELECTIVES - CREDITS (9)

SL. NO	CODE	COURSE	OFFERING DEPT.	CATEGORY	L	T	P	C	PREREQUISITE
1	17BTPI02	MINI PROJECT	BTE	PI	0	0	6	3	NIL

17BTPI03	INDUSTRIAL ENZYMOLOGY	Category	L	T	P	Credit
		PI	3	0	0	3

PREAMBLE

The course helps the students to render immense knowledge about enzymes, their kinetics, and application of enzymes along the techniques in Industries. It also deals about the use of fermentation technology in production of the various biological compounds and their uses.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To state the basic knowledge on enzyme and classification of enzymes
2	To discuss about the enzyme kinetics and Immobilizations
3	To perform the
4	To implement the basics enzymes used in food industries
5	To outline the students to basic knowledge concerning the uses of enzymes in various industries

COURSE OUTCOMES

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

CO1. List and classify the different enzymes in industry	Remember
CO2. Describe about the enzyme kinetics and immobilization methods	Understand
CO3. Illustrate the various uses of enzymes in Biochemical and pharmaceutical Industry	Apply
CO4. Demonstrate the uses of enzyme in food industry	Apply
CO5. Appraise different enzymes and uses in various industries	Analyse

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	-	-	-	M	-	L	-	-	-	L	L	-	-	-
CO2	M	L	L	M	S	-	-	-	-	-	M	L	L	-	-
CO3	M	-	M	L	-	S	L	-	-	-	S	-	-	-	-
CO4	L	M	L	L	-	S	M	-	-	-	M	S	L	-	-
CO5	L	L	M	L	-	-	-	-	-	-	S	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

ENZYMES

Classification - IUB system- Characteristics of enzymes, enzyme substrate complex. Concept of active center, binding sites, stereospecificity and ES complex formation. Effect of temperature, pH and substrate concentration on reaction rate. Transition state theory. Enzyme activity.

ENZYME KINETICS & IMMOBILIZED ENZYMES

Enzyme Kinetics-Michaelis - Menten Equation - form and derivation, steady state enzyme kinetics.

Significance of Vmax and Km. Enzyme inhibition - types of inhibitors - competitive, noncompetitive and uncompetitive, their mode of action and experimental determination. Methods of immobilization techniques - Immobilized multi enzyme systems. Industrial application, analytical application, clinical application of enzymes.

BIOCHEMICAL AND PHARMACEUTICAL APPLICATIONS

Role of soluble and immobilized enzymes in the synthesis and production of amino acids and chiral compounds; use of enzymes as detergents. Pharmaceuticals: Role of soluble and immobilized enzymes in production of antibiotics, steroids, and other important intermediates of biotechnological industry; role of soluble and immobilized enzymes in diagnosis and treatment of diseases; enzyme therapy.

APPLICATIONS IN FOOD INDUSTRY

Soluble and immobilized enzymes - food production and processing, amylases, pectinases, proteases, lipases, glucoisomerases.

ANALYTICAL APPLICATIONS

Theory and applications of various enzyme electrodes e.g. enzyme sensors, enzyme membranes, biochips/bio-semiconductors.

TEXT BOOKS:

1. Fundamentals of Enzymology: The cell and Molecular Biology of Catalytic Proteins by N.C. Price and L. Stevens, Oxford University, 2000.
2. Enzymology Lab Fax by P.C. Engel, Academic Press, 2003.
3. Enzyme Structure and Function by A, Fersht, W.H. Freeman and Co., NY, 1999.
4. Enzymes, Biomass, Food and Feed (Biotechnology 2E, Vol. 9) by Rehm, Reed, and A. Phuler, Wiley-VCH, Berlin, 2001.

REFERENCE BOOKS:

1. *Enzyme Kinetics: Principles and Methods* by H. Bisswanger and L. Bubenheim, 3rd edition, Wiley, USA, 2017.
2. *Industrial Enzymology: The Application of Enzymes in Industry* by T. Godfrey and S. May, McMillan publishers, 2001.
3. *Enzyme Technology* by M.F. Chaplin and C. Bucke, Cmabrigde University Press, NY, 1990.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. A. Nirmala	Assistant professor (Gr-II)	Biotechnology	nimmi_arua@yahoo.com
2	Mr.N.Jawahar	Assistant professor	Biotechnology	jawahar@vmkvec.edu.in

17BTPI04	BIOPHARMACEUTICALS	Category	L	T	P	Credit
		PI	3	0	0	3

PREAMBLE

Biopharmaceutical Technology is the study that how the pharmaceutical expression of certain drugs can impact their pharmacokinetic and pharmacodynamics behavior. It is branch of pharmaceutical science and technology, that utilizes the concept of both biotechnology and pharmaceutical science to design, develop and manufacture pharmaceutical drugs to satisfy the constant growing demand of medicines and save the mankind from the deadly clutches of known and unknown diseases. This course is designed to prepare professionals for employment in pharmaceutical manufacturing and related industries.

PREREQUISITE – NIL

COURSE OBJECTIVES

1	To state the basics of drug development and regulatory aspects
2	To describe the physical and chemical property of drug and their metabolism
3	To Outline the bulk drug manufacturing and their regulatory aspects
4	To develop the product form in manufacturing industry
5	To assess the therapeutics like vitamins, Antibiotics and Hormones.

COURSE OUTCOMES

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

CO1: Recall the basic information about drug industry and drug developments.	Remember
CO2: Describe the physical and chemical property , pharmacokinetics and	Understand
CO3: Analyze the different process involved in bulk drug manufacturing	Analyze
CO4: Assess the product developed from manufacturing industry	Evaluate
CO5: Validate the therapeutics developed from pharma industry like vitamins, Antibiotics and Hormones	Evaluate

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	-	L	-	L	-	-	-	-	-	-	L	-	-
CO2	L	L	-	-	L	-	-	-	-	-	-	-	-	-	-
CO3	M	L	L	L	L	L	-	-	-	-	-	-	-	-	-
CO4	S	M	-	-	M	L	L	L	-	-	-	S	M	-	-
CO5	S	-	-	L	M	L	-	S	-	-	-	S	M	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION

Development of Drug and Pharmaceutical industry, Types of therapeutic agents and their uses, Economics and regulatory aspects

DRUG METABOLISM AND PHARMACOKINETICS

Physico-chemical principles of Drug metabolism, Radioactivity, Pharmacokinetics – different mechanisms of Drug action

UNIT PROCESSES AND THEIR APPLICATIONS
Bulk drug manufactures, Types of reactions in Bulk drug manufacture and Processes, Special requirements for Bulk Drug Manufacture and its regulatory aspects

PRODUCT FORMS AND DEVELOPMENT
Tablets – Compression, Granulation, Presses, Coating, Dosage forms, Topical applications, Preservation of Drugs, Analytical methods and test for various drugs and pharmaceuticals, Packing and Labeling, Quality management, GMP.

BIOPHARMACEUTICALS
Therapeutics – Vitamins, Laxatives, Analgesics, Contraceptives, Antibiotics, Hormones

TEXT BOOKS:

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

REFERENCES:

3. Leon Lachman, 1986. Theory and Practice of Industrial Pharmacy. 3rd Edn., *Lea and Febger*.
4. Remington, 1991. Pharmaceutical Science. *Mark Publishing and Co*.
5. Walsh, G., 2003. Biopharmaceuticals : Biochemistry and Biotechnology, 2nd Edn., *John Wiley & Sons Ltd.*
6. Michael E. Aulton, Aulton's Pharmaceutics : The Design and Manufacture of Medicines, 2007, *Elsevier Limited*, Oxford
7. Lieberman, H. A., Lachman, L. and Schwartz, J. B., 1990. Pharmaceutical Dosage Forms : Tablets. Vol. 3, 2nd Edn., *Marcel Dekker Inc*.,.

COURSE DESIGNERS

S.No.	Name of the Faculty	Designation	Department	Mail ID
1	Dr. A. Nirmala	Assistant Professor (G-II)	Biotechnology	nimmi_aruan@yahoo.com
2	Mr.N.Jawahar	Assistant professor	Biotechnology	jawahar@vmkvec.edu.in

17BTPI05	INDUSTRIAL BIOSAFETY	Category	L	T	P	Credit
		PI	3	0	0	3

PREAMBLE

Industrial biosafety deals with the microbial hazards caused to an individual and to the society. In the subject the learners could grasp the knowledge on biosafety levels and the roles of various regulatory committees in avoiding the risk. Biosafety often use pioneering techniques along with other applied fields of research like biotechnology, genetic engineering, biochemistry to study microbes and their complex mechanisms. Knowledge of these principles will enable practice well in handling pathogenic microorganisms carefully in the laboratory.

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To recognize the basic knowledge on biosafety levels.
2	To discuss various hazards caused by the GMOs.
3	To classify the role of regulatory committees in controlling the risk
4	To outline the risk involved in using GMOs and LMOs.
5	To design the biosafety procedure in lab and research institutions on handling pathogenic microorganisms.

COURSE OUTCOMES

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

CO1: Recall the various biosafety levels.	Remember
CO2: Explain the various biosafety guidelines	Understand
CO3: Identify the role of regulatory committees in controlling the risk	Understand
CO4: Analyze the risk involved in using GMOs and LMOs products	Analyse
CO5: Differentiate the various safety procedures followed in various industries.	Analyse

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	L	L	L	L	-	-	-	-	-	L	-	L	L	L	-
CO2	M	M	-	M	-	-	-	-	-	-	L	L	-	-	L
CO3	S	-	M	L	M	-	-	L	-	-	-	-	-	-	-
CO4	L	L	L	L	L	-	-	M	-	-	-	-	-	M	-
CO5	L	L	L	-	L	-	-	-	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

PRINCIPLES OF BIOSAFETY

Introduction, Historical Background, Introduction to Biological Safety Cabinets, Primary Containment for Biohazards, Biosafety Levels, Biosafety Levels of Specific Microorganisms, Biosafety guidelines - Overview of National Regulations and relevant International Agreements including Cartegana Protocol.

BIOSAFETY IN BIOTECHNOLOGY INDUSTRIES

Hazard assessment, Use of genetically modified organisms & their release in environment; special procedures for rDNA based product production (Vaccine and Insulin); Biosafety in laboratory, Laboratory associated infections and other hazards; Prudent biosafety practices in laboratory

BIOSAFETY – REGULATORY FRAMEWORKS

Biotechnology and bio-safety concerns at the level of individuals, institutions, society, region, country and world. Regulatory framework in India governing GMOs-Recombinant DNA Advisory Committee (RDAC), Institutional Biosafety Committee (IBC), Review Committee on Genetic Manipulation, Genetic Engineering Approval Committee (GEAC), State Biosafety Coordination Committee (SBCC), District Level Committee (DLC). Rules for the manufacture, use/import/export and storage of hazardous microorganisms/genetically engineered organisms or cells.

RISK ASSESMENT

Definition of GMOs & LMOs, GMO applications in food and agriculture, Risk Analysis, Risk Assessment, Risk management and communication Risk assessment in various industries- pharmaceuticals, food and beverages etc., steps towards minimizing the risk operations in industries.

SAFETY AND BIOSAFETY - CASE STUDIES

Recommended Biosafety Levels for Infectious Agents and Infected Animals, Rules and regulation for handling of microbes in laboratory purposes, lab construction procedure, decontamination and discarding procedure of laboratory used microorganisms. Case studies -swine flu spreading, Bhopal tragedy etc.,

TEXT BOOKS:

1. R.C. Dubey., 2014. A Text Book of Biotechnology Fifth Revised *Edition*, S. Chand Publications

2. Anupam Singh, Ashwani Singh, 2012. Intellectual property rights and Bio-Technology (Biosafety and Bioethics), Published by Bio-Green Books, New Delhi.

3. Mueller, M.J., "Patent Law", 3rd Edition, Wolters Kluwer Law & Business, 2009.

REFERENCES:

1. V Sreekrishna, 2017. Bioethics and Biosafety in Biotechnology by New age International publishers.
2. Sateesh, M.K., 2008. Bioethics and Biosafety, IK International Publishers.

COURSE DESIGNERS

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1	Dr. Chozhavendhan. S	Associate professor	Biotechnology	chozhavendhan@avit.ac.in
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17BTPI06	WASTE MANAGEMENT	Category	L	T	P	Credit
		PI	3	0	0	3

PREAMBLE

Waste management are the activities and actions required to manage waste from its inception to its final disposal. This includes the collection, transport, treatment and disposal of waste, together with monitoring and regulation of the waste management process

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To state the basic knowledge on waste management
2	To discuss about the principle and properties of waste
3	To demonstrate the minimization of waste in Industries
4	To outline the handling and transport of waste in Industries
5	To develop the modern techniques for waste dispose

COURSE OUTCOMES

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

CO1. Recall the characterisation of waste in society	Remember
CO2. Discuss the benefits and life cycle of waste	Understand
CO3. Illustrate the waste minimizing technique in Industries	Apply
CO4. Inspect the transport of waste in developing countries	Analyse
CO5. Measure the resource efficiency of waste	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	L	-	L	-	-	-	-	S	L	-	-
CO2	-	L	L	-	-	L	M	L	-	-	-	M	L	-	-
CO3	-	L	M	M	M	L	M	-	-	-	-	S	S	M	M
CO4	-	L	L	L	M	L	S	-	-	L	-	L	M	M	M
CO5	L	L	L	L	-	-	M	L	-	L	-	M	S	M	-

S- Strong; M-Medium; L-Low

SYLLABUS

GENERATION AND CHARACTERISTICS OF WASTE

Types and characteristics of wastes- Domestic, Industry, Commercial, Agriculture, and Health care centre and e-waste.

PRINCIPLES OF WASTE MANAGEMENT

Waste hierarchy, Life cycle of Products, Resource efficiency, Polluter Pays principles, Waste to energy, Benefits of waste management.

WASTE MINIMIZATION AND MONITORING

Waste minimization techniques in the developed and developing countries. Waste minimization techniques adopted in few industries-Sugar, Paper, Textile, Leather, Breweries and Pharmaceuticals.

WASTE HANDLING AND TRANSPORT

Methods of waste handling, transport and disposal in various sectors of waste generation- Sugar, Paper, Textile, Leather, Breweries, health care centre and Pharmaceuticals

RESOURCE RECOVERY

Methods of resource3 recovery-3Rs, Landfills, Biological reprocessing, Energy recovery. Modern techniques of disposal-Incineration, Pyrolysis

TEXT BOOK:

1. Jacqueline Vaughn, Waste Management: A reference Handbook, Science, 2009

REFERENCE BOOKS:

1. Nicky Scott, Reduce, Reuse, Recycle, McGraw-Hill, 2007.
2. George Techobanoglous, Handbook of solid waste management, McGraw-Hill, 2002.

COURSE DESIGNERS

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17BTPI07	PROCESS ECONOMICS AND INDUSTRIAL MANAGEMENT	Category	L	T	P	Credit
		PI	3	0	0	3

PREAMBLE

The objective of this course is to teach principles of cost estimation, feasibility analysis, management, organization and quality control that will enable the students to perform as efficient managers

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To state the basics of measurement techniques involved in organization management
2	To describe the cost and budget analysis for building a process
3	To outline the analysis of project based on profitability /loss
4	To develop the concept of accounting based on the performance and growth
5	To assess the importance of economic balance

COURSE OUTCOMES

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

CO1: Recall the basic information about cost and asset of accounting	Remember
CO2: Describe the time value of money and project feasibility	Understand
CO3: Analyses the alternative investment methods	Analyze
CO4: Assess the importance of financial ratios and rate of return	Evaluate
CO5: Validate the sensitivity and risks involved in the process plant	Evaluate

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L	L	L	L	-	-	-	-	-	-	-	-	L
CO2	S	M	S	S	M	L	-	-	-	-	-	-	-	-	L
CO3	L	L	M	L	L	L	-	-	-	-	-	-	-	-	-
CO4	S	L	L	L	L	M	-	-	-	-	-	-	-	-	-
CO5	M	L	L	L	L	M	-	-	-	-	-	-	-	-	-

S- Strong; M-Medium; L-Low

SYLLABUS

PRINCIPLES OF MANAGEMENT AND ORGANISATION

Planning, organization, staffing, coordination, directing, controlling, communicating, organization as a process and a structure; types of organizations. Method study; work measurement techniques; basic procedure; motion study; motion economy; principles of time study; elements of production control; forecasting; planning; routing; scheduling; dispatching; costs and costs control, inventory and inventory control.

INVESTMENT COSTS AND COST ESTIMATION

Time Value of money; capital costs and depreciation, estimation of capital cost, manufacturing costs and working capital, capital budgeting and project feasibility.

PROFITABILITY, INVESTMENT ALTERNATIVE AND REPLACEMENT
Estimation of project profitability, sensitivity analysis; investment alternatives; replacement policy; forecasting sales; inflation and its impact.

ANNUAL REPORTS AND ANALYSIS OF PERFORMANCE
Principles of accounting; balance sheet; income statement; financial ratios; analysis of performance and growth

ECONOMIC BALANCE
Economic decisions in Chemical Plant - Economics of size - Essentials of economic balance – Economic balance approach, economic balance for insulation, evaporation, heat transfer

TEXT BOOK:
1. Allen, L.A., “Management and Organization”, McGraw Hill.

REFERENCE BOOKS:

1. Peters, M. S. and Timmerhaus, C. D. RE West, “Plant Design and Economics for Chemical Engineers”, III Edn, McGraw Hill, 2003.
2. Holand, F.A., Watson, F.A. and Wilkinson, J.K., "Introduction to process Economics", 2nd Edn, John Wiley, 1983.
3. Narang, G.B.S. and Kumar, V., “Production and Costing”, Khanna Publishers, New Delhi.
4. Banga T.R., and Sharma S.C., Industrial organisation and engineering economics, Khanna Publishers, New Delhi.

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17BTPI08	FERMENTATION AND BREWING TECHNOLOGY	Category	L	T	P	Credit
		PI	3	0	0	3

PREAMBLE

Fermentation is the process by which yeast converts the glucose in the wort to ethyl alcohol and carbon dioxide gas -- giving the beer both its alcohol content and its carbonation. Since fermentation takes at least two weeks, the capacity of the brewery is limited by how many tanks they have

PREREQUISITE - NIL

COURSE OBJECTIVES

1	To state the basic knowledge on fermentation and brewing technology
2	To discuss about the principle of microbial growth kinetics
3	To classify the types of sterilization
4	To outline the design of bioreactor and power consumption
5	To develop the modern techniques for product recovery and purification

COURSE OUTCOMES

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

CO1. Recall the range of fermentation and microbial isolation	Remember
CO2. Interpret the batch and continuous cultivation	Understand
CO3. Illustrate the different types of sterilization and filtration process	Apply
CO4. Calculate the KLa value and to design the bioreactor for power consumption	Analyse
CO5. Compare the amount of product recovery and purification process	Evaluate

MAPPING WITH PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	L	L	L	L	-	-	-	-	-	-	-	-	-
CO2	S	M	S	S	M	L	-	-	L	-	-	-	-	-	-
CO3	L	L	M	L	L	L	-	L	-	-	-	-	-	-	-
CO4	S	L	L	L	L	M	-	-	L	-	-	-	-	-	-
CO5	M	L	L	L	L	M	-	-	L	-	-	-	-	-	M

S- Strong; M-Medium; L-Low

SYLLABUS

INTRODUCTION TO FERMENTATION AND BREWING TECHNOLOGY

Introduction, range of fermentation process, microbial isolation and development, media requirements, Media formulation and process development

MICROBIAL GROWTH KINETICS

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

STERILIZATION

Introduction, types of sterilization (Moist and Dry heat), Medium sterilization, Design of batch sterilization processes, Design of continuous sterilization processes, Sterilization of the fermenter, Sterilization of the feeds, Sterilization of liquid wastes, Sterilization by filtration.

DESIGN OF BIOREACTOR AND POWER CONSUMPTION

Introduction, Basic functions of a fermenter, Fermenter body construction, Aeration and agitation, Achievement and maintenance of aseptic conditions, Valves and steam traps, Oxygen requirements of industrial fermentations, Oxygen supply, Determination of KLa values, Fluid rheology, Factors affecting KLa values in fermentation vessels, Balance between oxygen supply and demand, Scale-up and scale-down

PRODUCT RECOVERY AND PURIFICATION PROCESS

Product recovery, primary purification process, product purification process

TEXT BOOK:

1. Bailey, James E. and David F. Ollis, "Biochemical Engineering Fundamentals", 2nd Edition. McGraw Hill 1986.

REFERENCE BOOKS:

1. Peter F. Stanbury, Stephen J. Hall & A. Whitaker, Principles of Fermentation Technology, Science & Technology Books, 1995. 3. Jens Nielson, John Villadsen and Gun.

COURSE DESIGNERS

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