ACADEMIC CURRICULA

UNDERGRADUATE DEGREE PROGRAMME

(Regulations 2022)

Bachelor of Science

B.S. Biotechnology
(Four Years)

B.S. Honours Biotechnology
(Four Years)

Learning Outcomes Based Curriculum framework (LOCF)

Academic Year

2022 - 2023



SRM INSTITUTE OF SCIENCE AND TECHNOLOGY

(Deemed to be University u/s 3 of UGC Act, 1956)

Kattankulathur- 603203, Chengalpattu District, Tamil Nadu, India

Contents

1. DEPARTMENT VISION STATEMENT IV

2. DEPARTMENT MISSION STATEMENT IV

3. PROGRAM EDUCATION OBJECTIVES (PEO) IV

4. PROGRAM SPECIFIC OUTCOMES (PSO) IV

5. CONSISTENCY OF PEO'S WITH MISSION OF THE DEPARTMENT IV

6. CONSISTENCY OF PEO'S WITH PROGRAM LEARNING OUTCOMES (PLO) IV

CURRICULUM B.S. BIOTECHNOLOGY V

1. PROGRAMME STRUCTURE V

2. IMPLEMENTATION PLAN VII

3. PROGRAM ARTICULATION MATRIX VIII

HONOURS IN BIOTECHNOLOGY XI

4. PROGRAMME STRUCTURE XI

5. IMPLEMENTATION PLAN XI

MINOR CERTIFICATION IN BIOTECHNOLOGY XII

6. PROGRAMME STRUCTURE XII

7. IMPLEMENTATION PLAN XII

8. PROGRAM ARTICULATION MATRIX XII

SEMESTER I 1

ULT22G01J TAMIL-I 1

ULH22G01J HINDI-I 3

ULF22G01J FRENCH-I 5

ULE22AE1T ENGLISH 7

UPY22101J PHYSICS-I 9

UCY22101T GENERAL CHEMISTRY - I 11

UMA22101T MATHEMATICS-I 13

UBT22101T MATHEMATICAL CALCULATIONS IN BIOLOGY 15

UBT22102J BIOLOGY-I 17

SEMESTER II 19

ULT22G02J TAMIL-II 19

ULH22G02J HINDI-II 21

ULF22G02J FRENCH-II 23

UPY22201J PHYSICS-II 25

UCY22201J GENERAL CHEMISTRY - II 27

UMA22201T MATHEMATICS II 29

UBT22201T BIOSTATISTICS 31

UBT22202J BIOLOGY-II 33

UJK22201L COMMUNICATION SKILLS 35

UNS22201L/ UNC22201L/ UNO22201L/UYG22201L NSS/NCC/NSO/YOGA 38

SEMESTER III 39

UBT22301J CELL BIOLOGY 39

UBT22302J BIOCHEMISTRY 41
UBT22303J MICROBIOLOGY 43
UBT22S01T GOOD LABORATORY PRACTICES- I 45
UES22AE1T ENVIRONMENTAL STUDIES 46
UJK22301T UNIVERSAL HUMAN VALUES 48
UBT22D01T TAXONOMY 51
UBT22D02T GROWTH AND REPRODUCTION 53
SEMESTER IV
UBT22401J MOLECULAR BIOLOGY 54
UBT22402J ENZYMOLOGY 56
UBT22403T SYSTEMS PHYSIOLOGY 58
UBT22S02T GOOD LABORATORY PRACTICES- II 60
UBT22S03T MUSHROOM CULTIVATION 61
UBT22S04T ALGAL CULTIVATION 62
UMI22401L MY INDIA PROJECT 63
UJK22401T PROFESSIONAL SKILLS 64
UBT22D03T PHARMACOGENOMICS 66
UBT22D04T ANIMAL BEHAVIOUR 67
SEMESTER V 68
UBT22501J COMPUTATIONAL BIOLOGY 68
UBT22502J IMMUNOLOGY 70
UBT22503T GENETICS 72
UBT22D05J INDUSTRIAL BIOTECHNOLOGY 74
SEMESTER VI 76
UBT22601J ANALYTICAL TECHNIQUES 76
UBT22602J PLANT BIOTECHNOLOGY 78
UCY22G01T MATERIAL SCIENCE AND NANOTECHNOLOGY 80
UMA22G01T FOUNDATIONS OF STATISTICS 82
UPY22G01T LASER PHYSICS 83
UBT22D06T BIOPHYSICS 85
UBT22D07T NANOBIOTECHNOLOGY 86
SEMESTER VII 87
UBT22701J ANIMAL BIOTECHNOLOGY 87
UBT22702J GENETIC ENGINEERING 89
UBT22703T SIGNAL TRANSDUCTION AND INTERMEDIARY METABOLISM 91
UBT22D08T TUMOR BIOLOGY 92
UBT22D09T MEDICAL BIOTECHNOLOGY 93
UBT22P01L INTERNSHIP 94
UBT22P02L MASSIVE OPEN ONLINE COURSE ..... ERROR! BOOKMARK NOT DEFINED.
UCY22AE1T RESEARCH METHODOLOGY 95
SEMESTER VIII 102
UBT22P03L MAJOR PROJECT 102
UBT22G01T ENTREPRENEURSHIP IN BIOTECHNOLOGY 103

HONOURS IN BIOTECHNOLOGY **104**
UBT22H01T TISSUE ENGINEERING **104**
UBT22H02T BIOMATERIALS **106**
UBT22H03T AQUATIC BIOTECHNOLOGY **107**

1.	Department Vision Statement
Stmt - 1	To be recognized nationally and internationally as an exemplary department of Biotechnology
Stmt - 2	To provide core instruction in pure and applied physics to train new generation of leading Biotechnologists
Stmt - 3	To emerge as a hub of world class research to disseminate our knowledge through interaction with industry, academia and society at large

2.	Department Mission Statement
Stmt - 1	To provide world class teaching and state of art research environment to highly talented young minds
Stmt - 2	To perform frontier research in life science, and to serve the society through technological advances
Stmt - 3	To provide an outstanding educational and research experience for the students, researchers and technologists
Stmt - 4	To enable the students to have wide range of career choices through outstanding learning experience
Stmt - 5	To infuse best scientific methods in teaching theoretical and experimental concepts of Biotechnology

3.	Program Education Objectives (PEO)
PEO - 1	Acquiring knowledge and skill of various fields of Biotechnology ranging from fundamental core courses to application-based subjects
PEO - 2	To employ critical thinking, analytical and problem solving skills in the multidisciplinary areas pertaining to application of Biotechnology
PEO - 3	Capable of working effectively in diverse teams both in class-room and outside world and able to identify appropriate resources required for management and completion of project with ethical scientific conduct
PEO - 4	To emphasize the relevance of Physics as the important discipline for sustaining the existing industries and establishing new ones to self-empowering the students to create job opportunities and entrepreneurships
PEO - 5	To develop a national and international perspective in core and applied Physics to enable them for improving knowledge and skill for their career development in the chosen field of Biotechnology

4.	Program Specific Outcomes (PSO)
PSO - 1	Graduates will acquire a comprehensive knowledge and sound understanding of fundamentals of Biotechnology
PSO - 2	Graduates will develop practical and analytical skills in Biotechnology
PSO - 3	Graduates will be prepared to acquire a range of general skills, to solve problems, to evaluate information, to use computers productively, to communicate with society effectively and learn independently through out life

5.	Consistency of PEO's with Mission of the Department				
	Mission Stmt. - 1	Mission Stmt. - 2	Mission Stmt. - 3	Mission Stmt. - 4	Mission Stmt. - 5
PEO - 1	H	H	H	H	H
PEO - 2	H	H	H	M	H
PEO - 3	M	H	H	H	L
PEO - 4	H	H	M	H	M
PEO - 5	H	H	M	H	M

H – High Correlation, M – Medium Correlation, L – Low Correlation

6.	Consistency of PEO's with Program Learning Outcomes (PLO)														
	Program Learning Outcomes (PLO)														
	1.	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*	*9.*	*10.*	*11.*	*12.*	*13.*	*14.*	*15.*
	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	Ethical Reasoning	Community Engagement	PSO - 1	PSO - 2	PSO - 3
PEO - 1	H	M	H	H	M	L	H	L	H	L	M	L	L	L	H
PEO - 2	H	H	H	H	M	M	H	M	H	L	M	L	H	M	H
PEO - 3	H	H	H	H	H	H	H	H	H	H	H	H	H	M	H
PEO - 4	H	M	H	H	H	H	H	H	H	M	H	H	M	M	M
PEO - 5	H	L	H	H	H	H	H	H	H	M	M	M	M	M	M

CURRICULUM B.S. BIOTECHNOLOGY

1. Programme Structure

1. Professional Core Courses (C)
(22 Courses)

Course Code	Course Title	Hours/ Week			
		L	T	P	C
UPY22101J	Physics-I	3	0	2	4
UCY22101T	General Chemistry-I	3	0	0	3
UMA22101T	Mathematics-I	3	1	0	4
UBT22101T	Mathematical calculations in Biology				
UBT22102J	Biology-I	3	0	2	4
UPY22201J	Physics-II	3	0	2	4
UCY22201J	General Chemistry-II	3	0	4	5
UMA22201T	Mathematics-II	3	1	0	4
UBT22201T	Biostatistics				
UBT22202J	Biology-II	3	0	2	4
UBT22301J	Cell Biology	3	0	2	4
UBT22302J	Biochemistry	4	0	4	6
UBT22303J	Microbiology	4	0	4	6
UBT22401J	Molecular Biology	4	0	4	6
UBT22402J	Enzyme Technology	3	1	0	4
UBT22403T	System Physiology	3	1	0	4
UBT22501J	Computational Biology	3	0	2	4
UBT22502J	Immunology	4	0	4	6
UBT22503T	Genetics	4	0	4	6
UBT22601J	Analytical Techniques	2	0	4	4
UBT22602J	Plant Biotechnology	4	0	4	6
UBT22701J	Animal Biotechnology	4	0	4	6
UBT22702J	Genetic Engineering	4	0	4	6
UBT22703T	Signal Transduction and Intermediary Metabolism	3	1	0	4
Total Learning Credits					**104**

2. Discipline Specific Elective Courses (D)
(9 Courses)

Course Code	Course Title	Hours/ Week			
		L	T	P	C
UBT22D01T	Taxonomy	2	0	0	2
UBT22D02T	Growth And Reproduction				
UBT22D03T	Pharmacogenomics	2	0	0	2
UBT22D04T	Animal Behavior				
UBT22D05J	Industrial Biotechnology	3	0	4	5
UBT22D06T	Biophysics	3	0	0	3
UBT22D07T	Nano Biotechnology				
UBT22D08T	Tumor Biology	2	0	0	2
UBT22D09T	Medical Biotechnology				
Total Learning Credits					**14**

3. Generic Elective Courses (G)
(5 Courses))

Course Code	Course Title	Hours/ Week			
		L	T	P	C
ULT22G01J	Tamil-I	2	0	2	3
ULH22G01J	Hindi-I				
ULF22G01J	French -I				
ULT22G02J	Tamil-II	2	0	2	3
ULH22G02J	Hindi-II				
ULF22G02J	French -II				
UCY22G01T	Material Science and Nanotechnology	3	0	0	3
UMA22G01T	Foundation of Statistics				
UPY22G01T	LASER Physics				
UBT22G01T	Entrepreneurship in Biotechnology	2	0	0	2
Total Learning Credits					**11**

4. Skill Enhancement Courses (S)
(3 Courses)

Course Code	Course Title	Hours/ Week			
		L	T	P	C
UBT22S01T	Good Laboratory practices I	0	1	0	1
UBT22S02T	Good Laboratory practices I	0	1	0	1
UBT22S03T	Mushroom Cultivation	0	0	2	1
UBT22S04T	Algal Cultivation				
Total Learning Credits					**3**

5. Ability Enhancement Courses (AE)
(3 Courses)

Course Code	Course Title	Hours/ Week			
		L	T	P	C
ULE22AE1T	English	4	0	0	4
UES22AE1T	Environmental Studies	3	0	0	3
UCY22AE1T	Research Methodology	3	1	0	4
Total Learning Credits					**11**

6. Life Skill Courses (Jeevan Kaushal) (JK)
(3 Courses)

Course Code	Course Title	Hours/ Week			
		L	T	P	C
UJK22201L	Communication Skills	2	0	0	2
UJK22301T	Universal Human Values	2	0	0	2
UJK22401T	Professional Skills	2	0	0	2
Total Learning Credits					**6**

7. Extension Activity (EA) *(3 Courses)*					
Course Code	Course Title	Hours/ Week			C
		L	T	P	
UNS22201L	*NSS*	*0*	*0*	*0*	*0*
UNC22201L	*NCC*				
UNO22201L	*NSO*				
UYG22201L	*YOGA*				
UMI22401L	*My India Project*	*0*	*0*	*0*	*1*
Total Learning Credits					***1***

8. Internship/ Project/ Community Outreach (P) (4 courses)					
Course Code	Course Title	Hours/ Week			C
		L	T	P	
UBT22P01L	*Internship*	*0*	*0*	*0*	*2*
UBT22P02L	Massive Open Online Course				
UBT22P03L	*Major Project*	*0*	*0*	*24*	*12*
Total Learning Credits					**14**

As SRMIST strongly encourages the use of SWAYAM (Study Web of Active Learning by Learning by Young and Aspiring Minds) platform, the students are encouraged to choose at least one core/ elective course from SWAYAM on the recommendation of the faculty advisor and the credits will be transferred

***For B.S. Biotechnology total number of credits are 164**

****For B.S. Biotechnology (Hons.) total number of credits are 176**

2. Implementation Plan

Semester – I

Code	Course Title	Hours/ Week L	T	P	C
ULT22G01J	Tamil-I	2	0	2	3
ULH22G01J	Hindi-I				
ULF22G01J	French-I				
ULE22AE1T	English	4	0	0	4
UPY22101J	Physics-I	3	0	2	4
UCY22101T	General Chemistry-I	3	0	0	3
UMA22101T	Mathematics-I	3	1	0	4
UBT22101T	Mathematical calculations in Biology				
UBT22102J	Biology-I	3	0	2	4
Total Learning Credits					22
Total number of hours /week					28

Semester – II

Code	Course Title	Hours/ Week L	T	P	C
ULT22G02J	Tamil-II	2	0	2	3
ULH22G02J	Hindi-II				
ULF22G02J	French-II				
UPY22201J	Physics-II	3	0	2	4
UCY22201J	General Chemistry-II	3	0	4	5
UMA22201T	Mathematics-II	3	1	0	4
UBT22201T	Biostatistics				
UBT22202J	Biology-II	3	0	2	4
UJK22201L	Communication Skills	0	0	4	2
UNS22201L	NSS	0	0	0	0
UNC22201L	NCC				
UNO22201L	NSO				
UYG22201L	YOGA				
Total Learning Credits					22
Total number of hours /week					29

Semester – III

Code	Course Title	Hours/ Week L	T	P	C
UBT22301J	Cell Biology	3	0	2	4
UBT22302J	Biochemistry	4	0	4	6
UBT22303J	Microbiology	4	0	4	6
UBT22S01T	Good Laboratory Practices I	0	1	0	1
UES22AE1T	Environmental studies	3	0	0	3
UJK22301T	Universal Human Values	2	0	0	2
UBT22D01T	Taxonomy	2	0	0	2
UBT22D02T	Growth and Reproduction				
Total Learning Credits					24
Total number of hours /week					30

Semester – IV

Code	Course Title	Hours/ Week L	T	P	C
UBT22401J	Molecular Biology	4	0	4	6
UBT22402J	Enzyme Technology	4	0	4	6
UBT22403T	System Physiology	3	1	0	4
UBT22S02T	Good Laboratory Practices II	0	1	0	1
UBT22S03T	Mushroom Cultivation	0	0	2	1
UBT22S04T	Algal Cultivation				
UMI22401L	My India Project	0	0	0	1
UJK22401T	Professional Skills	2	0	0	2
UBT22D03T	Pharmacogenomics	2	0	0	2
UBT22D04T	Animal Behaviour				
Total Learning Credits					23
Total number of hours /week					27

Semester – V

Code	Course Title	Hours/ Week L	T	P	C
UBT22501J	Computational Biology	3	0	2	4
UBT22502J	Immunology	4	0	4	6
UBT22503T	Genetics	3	1	0	4
UBT22D05J	Industrial Biotechnology	3	0	4	5
Total Learning Credits					19
Total number of hours /week					24

Semester – VI

Code	Course Title	Hours/ Week L	T	P	C
UBT22601J	Analytical Techniques	2	0	4	4
UBT22602J	Plant Biotechnology	4	0	4	6
UCY22G01T	Material Science and Nanotechnology	3	0	0	3
UMA22G01T	Foundation of Statistics				
UPY22G01T	LASER Physics				
UBT22D06T	Biophysics	3	0	0	3
UBT22D07T	Nano Biotechnology				
Total Learning Credits					16
Total number of hours /week					27

Semester –VII

Code	Course Title	Hours/ Week L	T	P	C
UBT22701J	Animal Biotechnology	4	0	4	6
UBT22702J	Genetic Engineering	4	0	4	6
UBT22703T	Signal Transduction and Intermediary Metabolism	3	1	0	4
UBT22D08T	Tumor Biology	2	0	0	2
UBT22D09T	Medical Biotechnology				
UBT22P01L	Internship	0	0	0	2
UBT22P02L	Massive Open Online Course				
UCY22AE1T	Research Methodology	3	1	0	4
Total Learning Credits					24
Total number of hours /week					26

Semester –VIII

Code	Course Title	Hours/ Week L	T	P	C
UBT22P03L	Major Project	0	0	24	12
UBT22G01T	Entrepreneurship in Biotechnology	2	0	0	2
Total Learning Credits					14
Total number of hours /week					26

H – High Correlation, M – Medium Correlation, L – Low Correlation

3. Program Articulation Matrix

Course Code	Course Name	Programme Learning Outcomes														
		Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	Ethical Reasoning	Community Engagement	ICT Skills	Leadership Skills	Life Long Learning
UPY22101J	Physics-I	H	-	H	-	-	-	-	-	-	-	-	-	-	-	H
UCY22101T	General Chemistry-I	H	H	-	-	-	-	H	H	-	-	-	-	-	-	H
UMA22101T	Mathematics-I	H	H	H	H	H	-	-	-	-	-	-	-	-	-	H
UBT22101T	Mathematical calculation in Biology	H	-	-	-	-	-	-	-	-	-	-	-	-	-	H
UBT22102J	Biology-I	H	-	H	H	-	-	H	-	-	-	-	-	-	-	-
UPY22201J	Physics-II	H	H	H	H	H	-	-	H	-	-	-	-	-	-	H
UCY22201J	General Chemistry-II	H	H	M	H	-	-	-	-	-	-	-	-	-	-	H
UMA22201T	Mathematics-II	H	-	-	H	-	-	H	-	-	-	-	-	-	-	H
UBT22201T	Biostatistics	H	-	-	-	-	-	-	-	-	-	-	-	-	-	H
UBT22202J	Biology-II	H	-	H	H	-	-	-	-	-	-	-	-	-	-	-
UBT22301J	Cell Biology	H	-	H	H	-	-	-	-	-	-	-	-	-	-	H
UBT22302J	Biochemistry	H	-	-	-	-	-	-	-	-	-	-	-	-	-	H
UBT22303J	Microbiology	-	-	H	H	-	-	-	-	-	-	-	-	-	-	-
UBT22401J	Molecular Biology	H	-	H	H	-	-	-	-	-	-	-	-	-	-	-
UBT22402J	Enzyme Technology	H	H	H	H	-	-	-	-	-	-	-	-	-	-	-
UBT22403T	System Physiology	-	-	H	H	-	-	-	-	-	-	-	-	-	-	-
UBT22501J	Computational Biology	-	-	H	H	-	-	-	-	-	-	-	-	-	-	-
UBT22502J	Immunology	H	H	H	-	-	-	-	-	-	-	-	-	-	-	-
UBT22503T	Genetics	H	-	H	-	-	-	-	-	-	-	-	-	-	-	-
22BTC304T	Analytical Techniques	-	-	H	H	-	-	-	-	-	-	-	-	-	-	-
UBT22602J	Plant Biotechnology	-	H	-	-	-	H	-	-	-	-	-	-	-	-	-
UBT22701J	Animal Biotechnology	-	-	H	H	-	-	-	-	-	-	-	-	-	-	-
UBT22702J	Genetic Engineering	H	-	H	H	-	-	-	H	-	-	-	-	-	-	-
UBT22703T	Signal Transduction and Intermediary Metabolism	-	-	H	H	-	-	-	-	-	-	-	-	-	-	-
UBT22D01T	Taxonomy	H	H	-	H	H	H	H	-	-	-	-	-	-	-	-
UBT22D02T	Growth And Reproduction	H	H	-	-	-	-	-	-	-	-	-	-	-	-	-
UBT22D03T	Pharmacogenomics	H	-	-	H	H	-	-	H	-	-	-	H	-	-	-
UBT22D04T	Animal Behavior	H	-	-	H	H	-	H	-	-	-	-	-	-	-	-
UBT22D05J	Industrial Biotechnology	H	H	-	-	H	-	-	-	-	-	-	-	-	-	-
UBT22D06T	Biophysics	H	-	-	H	H	-	-	-	-	-	-	-	-	-	H
UBT22D07T	Nano Biotechnology	H	-	H	H	-	-	-	H	-	-	-	-	-	-	-
UBT22D08T	Tumor Biology	H	-	H	H	-	-	-	-	-	-	-	-	-	-	-
UBT22D09T	Medical Biotechnology															
ULT22G01J	Tamil-I	H	H	H	H	H	-	-	-	-	-	-	-	-	-	-
ULH22G01J	Hindi-I	H	H	H	H	H	-	-	-	-	-	-	-	-	-	-
ULF22G01J	French -I	H	H	H	H	H	-	-	-	-	-	-	-	-	-	-
ULT22G02J	Tamil-II	H	H	H	H	H	-	-	-	-	-	-	-	-	-	-
ULH22G02J	Hindi-II	H	H	H	H	H	-	-	-	-	-	-	-	-	-	-
ULF22G02J	French -II	H	H	H	H	H	-	-	-	-	-	-	-	-	-	-
UCY22G01T	Material Science and Nanotechnology	H	H	H	M	H	-	-	-	-	-	-	-	-	-	H
UMA22G01T	Foundation of Statistics	H	H	M	H	H	-	-	-	-	-	-	-	-	-	H
UPY22G01T	LASER Physics	H	-	-	H	H	-	-	-	-	-	-	-	-	-	-
UBT22G01T	Entrepreneurship in Biotechnology															
UBT22S01T	Good Laboratory practices I	H	H	H	H	-	-	-	-	-	-	-	-	-	-	H
UBT22S02T	Good Laboratory practices II	H	-	H	H	-	-	-	-	-	-	-	-	-	-	-
UBT22S03T	Mushroom Cultivation	H	H	-	-	H	-	H	-	H	M	-	-	M	-	-
UBT22S04T	Algal Technology															
ULE22AE1T	English	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UES22AE1T	Environmental Studies	-	-	-	-	-	H	H	-	-	-	-	H	-	-	-
UCY22AE1T	Research Methodology	-	H	-	H	H	-	-	H	H	H	-	-	-	-	-
UJK22201L	Communication Skills	H	-	-	-	-	-	-	-	-	-	-	H	-	-	H
UJK22301T	Universal Human Values	H	H	-	H	-	-	-	H	-	H	H	-	-	-	-
UJK22401T	Professional Skills	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UNS22201L	NSS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UNC22201L	NCC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UNO22201L	NSO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UYG22201L	YOGA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UMI22S01L	My India Project	M	-	M	-	-	M	-	M	-	-	-	H	M	M	H
UBT22P01L	Internship	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

UBT22P02L	Massive Open Online Course	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UBT22P03L	*Major Project*	*H*	*H*	*H*	-	*H*	*H*	*H*	*H*	-	-	-	-	*M*	-	*M*
	Program Average	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**H**

Structure of UG Courses in Biotechnology

Distribution of different Courses in each semester with their credits for B.S. Biotechnology

Semester	Core Courses (CC)	Descipline Specific Electives Courses (DSE)	Generic Electives Cources (GE)	Skill Enehacment Courses (S)	Ability Enhancement Courses (AE)	Extension Activity (EA)	Jeevan Kaushal Courses (JK)	Internship/ Project/ Community Outreach (I & P)	
Sem I	**Foundation** Physics-I (4) General Chemistry-I (3) Mathematics-I/Mathematical calculations in Biology (4) Biology-I (4)		GE-1 (3)		AE-1 (4)				**22**
Sem II	**Foundation** Physics-II (4) General Chemistry-II (5) Mathematics-II/ Biostatistics(4) Biology-II (4)		GE-2 (3)			EA-1 (0)	JK-1 (2)		**22**
Sem III	CC-3 (4) CC-4 (6) CC-5 (6)	DSE-1 (3)		S-1 (2)	AE-2 (3)		JK-2 (2)		**24**
Sem IV	CC-6 (6) CC-7 (4) CC-8 (4)	DSE-2 (3)		S-2 (2) S-3/S-4 (2)		EA-1 (2)	JK-3 (2)		**23**
Sem V	CC-9 (4) CC-10 (6) CC-11 (6)	DSE-3 (5)							**19**
Sem VI	CC12 (4) CC-13 (6)	DSE-4 (4) DSE-5 (3)	GE-3 (2)					P-1 (3*)	**16**
Sem VII	CC-15 (5) CC-16 (4) CC-17 (5)	DSE-6 (3)			AE-3 (4)			P-2 (2)	**24**
Sem VIII								P-3 (12)	**14**
Total Credits	**104**	**14**	**11**	**3**	**11**	**0**	**6**	**16**	**164****

*Optional Project

****For B.S. Biotechnology (Hons.) total number of credits are 176**

Honours in Biotechnology

4. Programme Structure

1. Professional Core Courses (C) (3 Courses)					
Course Code	Course Title	Hours/ Week			C
		L	T	P	
UBT22H01T	TISSUE ENGINEERING	4	0	0	4
UBT22H02T	BIOMATERIALS	4	0	0	4
UBT22H03T	AQUATIC BIOTECHNOLOGY	4	0	0	4
Total Learning Credits					**12**

***Student can earn 12 credits from any three Professional Core Courses of their choice to get Honours in Biotechnology**

5. Implementation Plan

Semester – VI					
Code	Course Title	Hours/ Week			C
		L	T	P	
UBT22H01T	TISSUE ENGINEERING	4	0	0	4
Total Learning Credits					4
Total number of hours /week					4

Semester –VII					
Code	Course Title	Hours/ Week			C
		L	T	P	
UBT22H02T	BIOMATERIALS	4	0	0	4
UBT22H03T	AQUATIC BIOTECHNOLOGY	4	0	0	4
Total Learning Credits					8
Total number of hours /week					8

Minor Certification in Biotechnology

(**The minor certification is offered to the other programs except for B.S. Biotechnology**)

6. Programme Structure

1. Professional Core Courses (C)
(1 Courses)

Course Code	Course Title	Hours/ Week			
		L	T	P	C
UBT22601J	Analytical Techniques	2	0	4	4
Total Learning Credits					

2. Discipline Specific Elective Courses (D)
(7 Courses)

Course Code	Course Title	Hours/ Week			
		L	T	P	C
UBT22D05J	Industrial Biotechnology	3	0	4	5
UBT22D06T	Biophysics	3	0	0	3
UBT22D07T	Nano Biotechnology				
UBT22D08T	Tumor Biology	3	0	0	2
UBT22D09T	Medical Biotechnology				
Total Learning Credits					10

3. Generic Elective Courses (G)
(1 Course)

Course Code	Course Title	Hours/ Week			
		L	T	P	C
UBT22G01T	Entrepreneurship in Biotechnology	2	0	0	2

As SRMIST strongly encourages the use of SWAYAM (Study Web of Active Learning by Learning by Young and Aspiring Minds) platform, the students are encouraged to choose at least one core/ elective course from SWAYAM on the recommendation of the faculty advisor and the credits will be transferred

7. Implementation Plan

Semester – V

Code	Course Title	Hours/ Week			C
		L	T	P	
UBT22D05J	Industrial Biotechnology	3	0	4	5
Total Learning Credits					5
Total number of hours /week					7

Semester – VI

Code	Course Title	Hours/ Week			C
		L	T	P	
UBT22601J	Analytical Techniques	2	0	4	4
UBT22D06T	Biophysics	3	0	0	3
UBT22D07T	Nano Biotechnology				
Total Learning Credits					7
Total number of hours /week					9

Semester – VII

Code	Course Title	Hours/ Week			C
		L	T	P	
UBT22D08T	Tumor Biology	2	0	0	2
UBT22D09T	Medical Biotechnology				
Total Learning Credits					2
Total number of hours /week					2

Semester – VII

Code	Course Title	Hours/ Week			C
		L	T	P	
UBT22G01T	Entrepreneurship in Biotechnology	2	0	0	2
Total Learning Credits					2
Total number of hours /week					2

8. Program Articulation Matrix

Course Code	Course Name	Programme Learning Outcomes														
		Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	Ethical Reasoning	Community Engagement	ICT Skills	Leadership Skills	Life Long Learning
UBT22D05J	Industrial Biotechnology	H	M	M	M	H	H	H	M	-	-	H	H	-	-	-
22BTC304T	Analytical Techniques	H	H	H	H	H	H	H	H	H	-	H	-	-	-	H
UBT22D06T	Biophysics	H	M	H	M	M	H	H	M	-	-	H	H	-	-	-
UBT22D07T	Nano Biotechnology	H	M	H	M	M	H	H	M	-	-	H	H	-	-	-
UBT22D08T	Tumor Biology	H	M	M	M	H	H	H	M	-	-	H	H	-	-	-
UBT22D09T	Medical Biotechnology	H	M	M	M	H	H	H	M	-	-	H	H	-	-	-
UBT22G01T	Entrepreneurship in Biotechnology	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
Program Average		**H**	**M**	**H**	**M**	**H**	**H**	**H**	**M**	**H**	**H**	**H**	**H**	**H**	**H**	**H**

SEMESTER I

Course Code	ULT22G01J	Course Name	TAMIL-**I**	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Tamil*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1 :	*To enable them to learn the nuances of modern poetry in Tamil*	
CLR-2 :	To explore new historicism through the works of art written in Tamil to enlighten the students to understand the changes in the modern society	
CLR-3 :	Inculcate ways of life, moralities and ethical factors as an essential part of learning Tamil literature	
CLR-4 :	Develop strategies of comprehension of texts of different origin	
CLR-5 :	Strengthen the language of the students both in oral and written	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	*Bloom's Level*
CLO-1 :	*Extend and expand their savoir-faire through the acquisition of skills to cater the needs of the modern era.*	*4*
CLO-2 :	Enable the students to appreciate their mother tongue and to Enhance their thinking capacity	*4*
CLO-3 :	Make them learn the basic rules of Language and make them communicate better	*4*
CLO-4 :	Develop strategies of comprehension of texts based on different culture and life styles	*4*
CLO-5 :	Strengthen spoken and written skills of the student	*4*

Program Learning Outcomes (PLO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	Ethical Reasoning	Community Engagement	PSO - 1	PSO - 2	PSO - 3
H	-	*M*	-	*H*	-	-	-	-	-	-	-	-	-	-
H	-	*H*	-	*M*	-	-	-	-	-	-	-	-	-	-
M	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-
M	-	*H*	-	*M*	-	-	-	-	-	-	-	-	-	-
-	*H*	-	*M*	*H*	-	-	-	-	-	-	-	-	-	-

அலகு – 1 – கவிதைகள்

தமிழ் இலக்கியப் போக்குகள் – தமிழ்க்கவிதை மரபு

கவிதைகள் - 1. **பாரதியார் – கண்ணன் என் சேவகன்**, 2. **பாரதிதாசன் – தமிழின் இனிமை**, 3. **அப்துல் ரகுமான் – அவதாரம்**

1. **து. நரசிம்மன் – மன்னித்துவிடு மகனே**

அலகு – 2 – கவிதைகள்

நவீன கவிதை தோற்றம் – நவீன கவிதை வரலாறு.

கவிதைகள் 1. **ராஜாசந்திரசேகர் – கைவிடப்பட்ட குழந்தை** , 2. **அனார் – மேலும் சில இரத்தக் குறிப்புகள்**, 3. **சுகிர்தராணி – அம்மா**

4. **நா.முத்துக்குமார் – தூர்**

அலகு – 3 – சிற்றிலக்கியம் & காப்பியம்

1. **கலிங்கத்துப்பரணி – பொருதடக்கைவாள் எங்கே**.... (**பாடல்** – 484)
2. **அழகர் கிள்ளை விடு தூது – இதமாய் மனிதருடனே**.... (**கண்ணி** – 45)
3. **நந்திக்கலம்பகம் – அம்பொன்று வில்லொடிதல்**.... (**பாடல்** – 77)
4. **குற்றாலக் குறவஞ்சி – ஓடக் காண்பது**... (**பாடல்** – 9)
5. **மணிமேகலை – உலக அறவி புக்ககாதை – "மாசு இல் வால்ஒளி**! – **இந்நாள் போலும் இளங்கொடி கெடுத்தனை**" (28 அடிகள்)

அலகு – 4 – தமிழ் இலக்கிய வரலாறு மற்றும் உரைநடை

1. **சிற்றிலக்கியம் – தோற்றமும் வளர்ச்சியும்**
2. **புதுக்கவிதை – தோற்றமும் வளர்ச்சியும்**
3. **சிறுகதை – தோற்றமும் வளர்ச்சியும்**
4. **புதினம் – தோற்றமும் வளர்ச்சியும்**
5. **அச்சு ஊடகம் – தோற்றமும் வளர்ச்சியும்**

உரைநடை

6. **உ.வே. சாமிநாதையர் – சிவதருமோத்திரச் சுவடி பெற்ற வரலாறு**.
7. **தஞ்சாவூர்க் கவிராயர்** – கூஜாவின் கோபம்.

அலகு – 5 – மொழிப்பயிற்சி

1. **அகரவரிசைப்படுத்துதல்**
2. **கலைச்சொல்லாக்கம்**
3. **மரபுத்தொடர்**
4. **பழமொழி**
5. **தமிழில் சொல் வகைகள்** – பெயர்ச்சொற்கள், வினைச்சொற்கள், பெயரடை, வினையடை...

Learning Resources	1. ***குறிஞ்சித்தேன்***, ***தொகுப்பும் பதிப்பும் - தமிழ்த்துறை ஆசிரியர்கள்***, ***எஸ்.ஆர்.எம். அறிவியல் மற்றும் தொழில்நுட்பக் கல்விநிறுவனம்***, ***காட்டாங்குளத்தூர்***, 603203, 2020 2. ***வல்லிக்கண்ணன்***, ***புதுக்கவிதை தோற்றமும் வளர்ச்சியும்***, ***ஆழி பதிப்பகம்***, ***சென்னை***, 2018 3. ***கா. சிவத்தம்பி***, ***தமிழில் சிறுகதை தோற்றமும் வளர்ச்சியும்***, ***என்.சி.பி.எச்.***, ***சென்னை***, 2013 4. ***தமிழ் இணையக் கல்விக்கழகம்*** - http://www.tamilvu.org/ 5. ***மதுரை தமிழ் இலக்கிய மின் தொகுப்புத் திட்டம்*** - https://www.projectmadurai.org/

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	10%	10%	10%	10%	10%	10%	10%	10%	20%	-
Level 2	Understand	10%-	10%-	10%-	10%-	10%-	10%-	10%-	10%-	20%	-
Level 3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	40%	-
Level 4	Analyze	10%	10%	10%	10%	10%	10%	10%	10%	20%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Expert from Higher Technical Institutions	Internal Experts
	1. Dr. R..Srinivasan Associate Professor, Department of Tamil, Presidency College, Chennai,	*1. B.Jaiganesh, Assistant Professor & Head, FSH, SRMIST*
		2. T.R.Hebzibah Beulah Suganthi, Assistant Professor, FSH, SRMIST
		3.S.Saraswathy, Assistant Professor, FSH, SRMIST

Course Code	ULH22G01J	Course Name	HINDI-I	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	***HINDI***	**Data Book / Codes/Standards**		***Nil***	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	**Learning**
CLR-1 :	*To be able to converse well in the Hindi Language*	
CLR-2 :	*To read and write and clarity*	
CLR-3 :	*To be willing listeners and translators –where need be*	
CLR-4 :	*To acquire the values/thought contents of the writers and practice in it in life.*	
CLR-5 :	*To find motivation through the various forms of literature and learn to overcome any challenges of life.*	
CLR-6 :	*To discover the importance of the language in making education as a means of growth in life and not mere literacy.*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	**Blooms Levels**
CLO-1 :	*To appreciate the Hindi language in its various forms.*	*4*
CLO-2 :	*To understand the philosophy of life and living through stories.*	*4*
CLO-3 :	*To help the students learn and develop the fundamentals of life, through One-Act plays.*	*4*
CLO-4 :	*To share the richness of thought and content presented in the Hindi language, into other languages so that the readers would stand to gain.*	*4*
CLO-5 :	*To guide the students in the learning of the technical aspect of the Hindi language, this would help them in the field of administration.*	*4*
CLO-6 :	*To encourage the students to communicate with the public, on a large scale with the medium of Main stream and Documentary films.*	*4*

Program Learning Outcomes (PLO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO -1	PSO -2	PSO-3
H	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-
-	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-
H	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
H	-	*H*	*H*	*H*	-	-	-	-	-	*H*	-	-	-	-
-	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

UNIT – 1
1. Vo Tera Ghar ye Mera Ghar – MALTI JOSHI
2. Mithaivala – SHRI BHAGAVATHY PRASAD VAJPEYI
3. Bachendri Pal – JEEVANI
4. Nadi aur Jeevan – DR. VIVEKI RAI
5. Pachees chauka Ded Sau – OMPRAKASH VALMIKI

UNIT – 2
1. Raat ke rahi – Sri Brajbusan
2. Akhbari vigyapan – Sri Cheerenjit

UNIT – 3
1. PATRKARITA
   a. Arth
   b. Paribhasha
   c. Swarup
   d. Prakar evam Daitava

UNIT – 4
1. FILM SAMIKSHA
a. 2 MAINSTREAM MOVIES
   b. 2 CLASSIC OR DOCUMENTARY

UNIT – 5
1. TECHNICAL TERMINOLOGY

Learning Resources	***The Prescribe Text Book Compiled and Edited by Department of Hindi*** *www.gadyakosh.com* *www.shabdkosh.com*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	10%	10%	10%	10%	10%	10%	10%	10%	20%	-
Level 2	Understand	10%-	10%-	10%-	10%-	10%-	10%-	10%-	10%-	20%	-
Level 3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	40%	-
Level 4	Analyze	10%	10%	10%	10%	10%	10%	10%	10%	20%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Expert from Higher Technical Institutions**	**Internal Experts**
	1. Prof.(Dr.) S.Narayan Raju, Head, Department of Hindi,CUTN, Tamilnadu	*1. Dr.S Preeti. Associate Professor & Head, SRMIST*
		2. Dr. Md.S. Islam Assistant Professor, SRMIST
		3 Dr. S. Razia Begum, Assistant Professor, SRM IST

Course Code	ULF22G01J	Course Name	French-I	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*French*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR): *The purpose of learning this course is to:*

		Blooms Levels
CLR-1 :	*Extend and expand their savoir-faire through the acquisition of current scenario*	
CLR-2 :	Enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French	
CLR-3 :	Make them learn the basic rules of French Grammar.	
CLR-4 :	Develop strategies of comprehension of texts of different origin	
CLR-5 :	Strengthen the language of the students both in oral and written	
CLR-6 :	Express their sentiments, emotions and opinions, reacting to information, situations	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Blooms Levels	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO -1	PSO -2	PSO-3
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
CLO-1 :	*To acquire knowledge about French language*	*4*	*H*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	*To strengthen the knowledge on concept, culture, civilization and translation of French*	*4*	-	*H*	-	*H*	-	*H*	-	-	-	-	*M*	-	-	-	-
CLO-3 :	*To develop content using the features in French language*	*4*	*H*	-	-	*H*	-	*H*	-	-	-	-	*M*	-	-	-	-
CLO-4 :	*To interpret the French language into other language*	*4*	*H*	-	*H*	*H*	*H*	-	-	-	-	-	*H*	-	-	-	-
CLO-5 :	*To improve the communication, intercultural elements in French language*	*4*	-	*H*	-	*H*	-	-	-	-	-	-	*H*	-	-	-	-
CLO-6 :	*To acquire knowledge about French language*	*4*	*H*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-

Unité-I
Bonjour, ça va ? - Les pays et les nationalités - Les animaux domestiques- Les jours de la semaine les mois de l'année - Les nombres de 0 à 69 - La famille (1) - L'accent tonique - Les articles un/une et le/les - Bonjour, - Salut ! Je m'appelle Agnès -Mots et expressions – Entrer en contact- Se présenter.

Unité-II
Salut ! Je m'appelle Agnès Les pronoms personnels sujets - Les verbes être et avoir- Les articles définis et indéfinis - La formation du féminine (1) - La formation du pluriel (1) - Les adjectives possessifs - Entrer en contact : salut, demander et dire comment ça va - Se présenter et présenter quelqu'un - Demander et dire la date.

Unité-III
Qui est –ce ?- les professions - Quelques objets - la fiche d'identité - La liaison - L'élision - Intonation descendre/montante – Qui est-ce ? Dans mon sac – Mots et expressions – Demander et répondre poliment – Demander des informations personnelles.

Unité-IV
Dans mon sac, j'ai… la formation du féminin (3) - la phrase interrogative - *qu'est – ce que.. ?/Qu'est – ce que C'est/Qui est – ce ?- la phrase négative - C'est/il est (1) - Les verbes du premier group* - Les verbes *aller et venir* -Demander et répondre poliment - Demander des informations personnelles

Unité-V
Il est comment ?-L'aspect physique - Le caractère - Les prépositions de lieu (1) -Les nombre à partir de 70 - les sons [ə]/[e]/[ɛ] – Allo ? La formation du féminin(3) - Les articles contractés - Les pronoms personnels tonique - Il y a - Les adverbes interrogatifs - Les nombres - Les prépositions de lieu - Les verbes du deuxième group - Le verbe faire - Décrire l'aspect physique et le caractère - Parler au téléphone

Learning Resources

Theory:
1. **"Génération-AI"** Méthode de français, Marie-Noëlle COCTON, P.DAUDA, L.GIACHINO, C.BARACCO, Les éditions Didier, Paris, 2018.
2. ***Cahier d'activités avec deux discs compacts.***

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	10%	10%	10%	10%	10%	10%	10%	10%	20%	-
Level 2	Understand	10%-	10%-	10%-	10%-	10%-	10%-	10%-	10%-	20%	-
Level 3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	40%	-
Level 4	Analyze	10%	10%	10%	10%	10%	10%	10%	10%	20%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Expert from Higher Technical Institutions**	**Internal Experts**
	1. Dr. C.Thirumurugan Associate Professor, Department of French, Pondicherry University	*1. Kumaravel K. Assistant Professor & Head, SRMIST*
		2. Ponrajadurai M Assistant Professor, SRMIST

Course Code	ULE22AE1T	Course Name	English	Course Category	A	Ability Enhancement Course	L	T	P	C
							4	0	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	English	Data Book / Codes/Standards		Nil	

		Learning
Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	
CLR-1:	*Extend and expand the integrity in an individual which shall never allow him/her to compromise upon a noble way of living*	
CLR-2:	Enable the students to overcome the fear of speaking a foreign language and enable them to think through a foreign language	
CLR-3:	Make them communicate an unbiassed way of thinking in a better manner	
CLR-4:	Develop strategies of comprehension of texts based on different culture and life styles	
CLR-5:	Help them express their sentiments, emotions and opinions, and reactions to information and situations in a civilized, cultured and humane manner.	
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Bloom's Level
CLO-1:	*To acquire knowledge of becoming better beings through the tools of Language and Literature*	*4*
CLO-2:	*To acquire a strong knowledge on concept, culture, civilization through English Literature*	*4*
CLO-3:	*To develop own content and to be able to translate using the features in English Language*	*4*
CLO-4:	*To interpret the contents in the texts presented in English Language*	*4*
CLO-5:	*To present an improved and healthier communication and intercultural elements acquired through English Literature*	*4*

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO -1	PSO -2	PSO-3
H	-	-	-	-	-	-	-	-	-	-	-	-	-	*H*
H	-	-	-	-	-	-	-	-	-	-	-	-	-	*H*
H	-	-	-	-	-	-	-	-	-	-	-	-	-	*H*
H	-	-	-	-	-	-	-	-	-	-	-	-	-	*H*
H	-	-	-	-	-	-	-	-	-	-	-	-	-	*H*

UNIT I

POETRY

1. PUNISHMENT IN KINDERGARTEN – KAMALA DAS
2. PHALLUS I CUT – KALKI
3. OBITUARY _ A. K. RAMANUJAM
4. APOLOGIES FOR LIVING ON – MEENA KANDASAMY

UNIT II

LETTERS BY MATHRABOOTHAM PUBLISHED IN THE HINDU
(LETTERS WITH REGIONAL RELEVANCE AND NATIONAL SIGNIFICANCE)

1. ENJOY WITHIN LIMITS, SAYS MR MATHRUBOOTHAM
2. NOBEL? WHAT NOBEL, ASKS MR MATHRUBOOTHAM
3. MR MATHRUBOOTHAM IS FULLY SUPPORTING ALL NEW TECHNOLOGIES
4. PIZZA MAAVU : WELCOME TO MR MATHRUBOOTHAM FOOD RECIPIE WEBSITE

UNIT III

1. STORY THROUGH IMAGES
2. AUTOBIOGRAPHY OF CONCRETE OBJECTS
3. CAPTION WRITING
4. PUBLIC SPEAKING

UNIT IV

LISTENING AND READING

1. MONOLOGUES
2. CONVERSATIONS
3. LOUD READING

4. READING COMPREHENSION
UNIT V **LANGUAGE COMPONENTS** 1. PARTS OF SPEECH 2. TENSES 3. ARTICLES 4. PREPOSITION 5. ERRORS IN SENTENCES

Learning Resources	***Theory:*** 1. Horizon- English Text Book – Compiled and Edited by the Faculty of English Department, FSH, SRMIST, 2020 ***English Gramar in Use by Raymond Murphy***

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-	20%	-	20%	-
Level 3	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
Level 4	Analyze	20%	-	20%	-	20%	-	20%	-	20%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
		1. Dr. Shanthichitra, Associate Professor, & Head, Department of English, FSH, SRMIST
		2. Dr K B Geetha, Assistant Professor, Department of English, FSH, SRMIST

Course Code	UPY22101J	Course Name	Physics-I	Course Category	C	Professional Core Course	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Physics and Nanotechnology	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	*Understand, explain and derive the various mechanics problems*	Bloom's Level
CLR-2:	*Emphasize the basic mathematical formulation of mechanics problems*	
CLR-3:	*Apply the fundamental concepts of mechanics to solve mechanics problems*	
CLR-4:	*Develop problem solving and critical thinking*	
CLR-5:	*Develop basic understanding of waves and oscillations*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	
CLO-1:	*Understand vector to the language that is useful in physics*	4
CLO-2:	*Understand analogous concepts for rotational motion*	4
CLO-3:	*Learn the laws of mechanics under the force field*	4
CLO-4:	*Basic knowledge on simple harmonic oscillator under damping and driving conditions*	4
CLO-5:	*Gain knowledge on various waveforms and perform mechanics related experiments*	4

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	-	*H*	-	-	-	-	-	-	-	-	-	-	-	-
H	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
H	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
H	-	*H*	-	-	-	-	-	-	-	-	-	-	-	-
H	-	*H*	-	-	-	-	-	-	-	-	-	*H*	-	-

Unit-1: Scalar field and vector field, Vector triple product and Reciprocal sets of vectors, Area of a triangle using vector cross product, Work done in moving object along a vector
Determination a unit vector perpendicular to a plane, Equation for a plane using vector rules, Determination the velocity and acceleration of a particle from its parametric equations
Determination the component of velocity and acceleration in a direction of a particle from its parametric equations, Velocity and acceleration of a particle with a given position vector r, Physics of Gradient in a vector field, Laplacian operator and Grad of a scalar field, Understand the rotational properties from the Curl in a vector field, Reference frames, Inertial frame, Newton's Law of Motion, Galilean Transformation, Transformation equations for a Frame of Reference, Conservation of linear momentum, Conservation of linear angular momentum, Work, Kinetic energy, Concept of power and energy, Problem solving

Experiment no. 1: Newton's 2nd law-Demonstration track with measure Dynamics
Experiment no. 2: Determination of moment of inertia and acceleration due to gravity using Bifilar pendulum

Unit-2: Conservative Force Field, Potential Energy, Impulse, Torque, Conservation of Energy, Non-conservative force, Center of Mass, Center of mass frame of reference, Motion of the Centre of mass, Collision, elastic collision, inelastic collision, Moment of Inertia (MI), Physical significance of MI, Moment of Inertia of a uniform thin rod, Circular lamina, Rectangular lamina, Solid Sphere, Solid Cylinder, and hollow cylinder, Product of moment of Inertia, Principal moments, Problem solving

Experiment no. 3: Determination of rigidity modulus of the suspension wire - Torsional pendulum
Experiment no. 4: Determination of acceleration due to gravity-Compound bar pendulum

Unit-3: : Uniform force field, Uniformly accelerated motion, Weight and acceleration due to gravity, Freely falling bodies, Projectiles, Motion of a projectile in Uniform gravitational field, Potential energy in a uniform force field, Motion in a resisting medium, Friction, Central forces, Properties of central force fields, Equation of Motion for a particle in a central field, Determination of the orbit from central force, Kepler's laws of planetary motion, Law of gravitation from Kepler's laws, Motion in an inverse square field, Problem solving

Experiment no. 5: Determination of spring constant-expansion of a helical spring
Experiment no.6: Determination of Static friction, sliding friction and rolling friction

Unit-4: Oscillations in physical systems, Simple harmonic motion, The force law of simple harmonic motion, Energy in simple harmonic motion, Angular simple Harmonic oscillator, Simple pendulums,
Physical pendulum, Vertical and angular simple harmonic motion, Vibrations of molecules, Vibrations of molecules, Damped simple harmonic motion, Energy in damped oscillations, Driven oscillations, Resonance and its consequences, Power dissipation, Problem solving

Experiment no 7: Determination of Moment of inertia and angular acceleration with precision pivot bearing
Experiment no.8: Measurement of Free fall-Dynamics method

Unit-5: Transverse and Longitudinal waves, Sinusoidal waves, Wave speed on a stretched string, Energy and power of a wave traveling along a string, Wave equation, Principle of superposition, Interference of waves, Standing waves and resonance, Sound waves, Speed of sound waves, Formal derivation, Traveling sound waves, Intensity and sound level, Sources of musical sound: Standing waves with two open ends and one open end pipes, Beats, Doppler effect, Shock waves, Ultrasonics: Production, properties and applications, Problem solving

Experiment no. 9: Determination of Young's Modulus Uniform Bending

Experiment no. 10: Determination of frequency of AC mains using Sonometer.

Learning Resources	1. An Introduction to Mechanics David Kleppner, Robert Kolenkow McGraw Hill Education India, 2007 2. Halliday, Resnick and Walker (2015), "Fundamentals of Physics" – 10th ed. Wiley, New York	3. University Physics with Modern Physics, (12th Ed., H. D. Young and R. A. Freedman, 2011) 4. Mechanics Berkeley Physics course, v.1 Charles Kittel (Tata McGraw Hill, 2007) 5. Theory and Problems of Theoretical Mechanics (Schaum's Outline)1982, Murray R. Spiegel, McGraw Hill Education India

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 2	Understand	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 4	Analyze	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. DK Aswal, NPL, dkaswal@nplindia.org	*Prof. V Subramanian, IIT Madras, manianvs@iitm.ac.in*	Dr. Debabrata Sarkar, SRMIST
Dr. M Sathish, CSIR-CECRI, msathish@cecri.re.in	*Prof. C Venkateshwaran, University of Madras, venkateshwaran@unom.ac.in*	Dr. K Shadak Alee, SRMIST

Course Code	UCY22101T	Course Name	General Chemistry - I	Course Category	C	Professional Core Course	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	gain knowledge on the importance of basic organic chemistry.
CLR-2 :	acquire knowledge about hydrocarbon and their reactions.
CLR-3 :	promote the importance of silicon and metals.
CLR-4 :	understand the principles of gaseous state
CLR-5 :	Acquire in-depth understanding about the colligative properties

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning Level of Thinking (Bloom)	Program Learning Outcomes (PLO) 1 Disciplinary Knowledge	2 Critical Thinking	3 Problem Solving	4 Analytical Reasoning	5 Research Skills	6 Team Work	7 Scientific Reasoning	8 Reflective Thinking	9 Self-Directed Learning	10 Multicultural Competence	11 ICT Skills	12 Life Long Learning	13 PSO -1	14 PSO -2	15 PSO-3
CLO-1 :	understand the basic concepts of organic chemistry	4	H											H			
CLO-2 :	gain knowledge about the organic reactions	4	H	H			H										
CLO-3 :	understand about the importance of silicon and metals	4	H				M										
CLO-4 :	apply the laws and the expressions related to the gaseous state	4	H			H											
CLO-5 :	acquire knowledge about the colligative properties of solutions	4		H					H								

UNIT- I: Introduction of Hybridisation and Isomerism

Hybridisation - sp, sp^2 and sp^3-Bond length- bond angle- dipole moment- inductive effect- mesomeric effect and hyperconjucation - Isomerism- geometrical and optical isomerism- optical activity- asymmetry- dissymmetry, elements of symmetry- R, S notations.

UNIT-II: Hydrocarbons

Methods of preparation of alkanes, properties - Reactions. Free radical mechanism of halogention of alkanes, Methods of preparation of alkenes -Stereochemistry of dehydrohalogenation (E1, E2, E1CB mechanism). Properties of alkenes -Electrophilic and nucleophilic addition mechanisms.

UNIT- III: General Principles of Metallurgy

Ore vs mineral, Principles of metallurgy, Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide. Types of metallurgy, Electrometallurgy - Extraction of Al, Hydrometallurgy with reference to cyanide process, Methods of purification of metals: Electrolytic refining, Vapour phase refining (van Arkel-de Boer process and Mond's process), Zone refining.

UNIT- IV: Gaseous State

Gaseous state - laws of gaseous state- gas constant R in different units - deviation from ideal behaviour- Van der waals equation for real gases - critical phenomenon - PV isotherm of real gases- critical temperature - critical volume. Molecular velocities - root mean square-average and most probable velocities. Maxwell distribution law collision number and mean free path - collision diameter.

UNIT-V: Colligative Properties of Dilute Solutions

Solution - dilute solutions - definition - Raoult's law for vapour pressure lowering (equation only) - Van't Hoff equation (no derivation) - Determination of molar mass from osmotic pressure measurement -Reverse osmosis. Boiling point elevation - Derivation of molal elevation constant (K_b) **- D**etermination of molar mass from boiling point elevation. Freezing point depression - Determination of molar mass from freezing point depression.

Learning Resources

Theory:

1. B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, Shobulal Nagin Chand and Co, 2001.
2. P. L. Soni, A Textbook of Inorganic Chemistry, Sultan Chand and Co., 1977.
3. R. Gopalan, Text Book of Inorganic Chemistry, 2nd edition, Hyderabad, Universities Press, (India), 2012.
4. R.T. Morrison and R.N. Boyd, S. K. Bhattacharjee, Organic Chemistry, 7th edition, Pearson India, 2011.
5. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, 35th edition, New Delhi ShobanLal Nagin Chand and Co, 2013.

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-	20%	-	20%	-
Level 3	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
Level 4	Analyze	20%	-	20%	-	20%	-	20%	-	20%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers		
Expert from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd, sudarshan.m@encubeethicals.com	Prof. G. Sekar, Department of Chemistry, IIT Madras Email: Pgsekar@iitm.ac.in	Prof. M. Arthanareeswari, SRMIST
Dr. Ravikiran Allada, Head R&D, Analytical, Novugen Pharma, Malaysia Email: ravianalytical@gmail.com	Dr. Kanishka Biswas, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru Email: kanishka@jncasr.ac.in	Dr. T. Pushpa Malini, SRMIST

Course Code	UMA22101T	Course Name	Mathematics-I	Course Category	C	Professional Core Course	L	T	P	C
							3	1	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning	Program Learning Outcomes (PLO)

CLR-1:	*Learn the concept of differentiation*	
CLR-2 :	*Apply the concepts of radius of curvature, evolute, envelope in problems of Science and Engineering*	
CLR-3 :	*Learn the concept of integration by means of various methods*	
CLR-4 :	*Apply the concept of integration in area and volume*	
CLR-5 :	*Application of Sequences and Series in all problems involving Science and Engineering*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	**Bloom's Level**	1 Disciplinary Knowledge	2 Critical Thinking	3 Problem Solving	4 Analytical Reasoning	5 Research Skills	6 Team Work	7 Scientific Reasoning	8 Reflective Thinking	9 Self-Directed Learning	10 Multicultural Competence	11 ICT Skills	12 Life Long Learning	13 PSO -1	14 PSO -2	15 PSO-3
CLO-1 :	*Understand the concept of differentiation and its types*	*4*	*H*	*M*	*H*	*H*	*H*	-	-	-	-	-	-	*H*	-	-	-
CLO-2 :	*Gain the knowledge of Radius, Centre, envelopre and Circle of of curvature and apply them in the problems involving Science and Engineering*	*4*	*H*	*H*	*M*	*H*	*H*	-	-	-	-	-	-	*H*	-	-	-
CLO-3 :	*Understand the concept of different methods of solving integrals*	*4*	*H*	*H*	*H*	*H*	*M*	-	-	-	-	-	-	*H*	-	-	-
CLO-4 :	*Associate the rule of integration in finding length and area of a curve*	*4*	*H*	*H*	*M*	*H*	*H*	-	-	-	-	-	-	*M*	-	-	-
CLO-5 :	*Gain the knowledge of convergence and divergence of series using different test and apply sequences and Series*	*4*	*M*	*H*	*M*	*M*	*H*	-	-	-	-	-	-	*M*	-	-	-

Unit-1: Introduction- Derivatives of simple functions- Successive differentiation- Problems on algebraic and trigonometric functions.
Unit-2: Curvature and Radius of Curvature, circle of curvature, Evolutes, Envelope.
Unit-3: Introduction to integration- Methods of integration- Substitution method- Integration by parts- Bernoulli's Formula- Definite Integrals- Properties and applications of definite integrals.
Unit-4: Arc length, area, volume, surface area of revolution.
Unit-5: Introduction to sequences and series- Series of positive terms- Test of Convergence- Comparison test- Integral test- De Alembert's ratio test- Raabe's root test- Alternating series- Leibnitz's test- Absolute convergence- Conditional convergence.

Learning Resources

1. N. Piskunov, Differential and Integral Calculus Vol. 1-2, Mir Publishers, 1996.
2. P. R. Vittal, Allied Mathematics, 4th Edition Reprint, Margham Publications, Chennai, 2012.
3. S. Narayanan and T K Manicavachagom Pillay, Calculus, Vol.I, S. Viswanathan Printers and Publishers Pvt. Ltd., 2009.
4. S. Narayanan and T K Manicavachagom Pillay, Calculus Vol.II, S.Viswanathan Printers and Publishers Pvt. Ltd., 2010
5. T. M. Apostol, Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern 1991.
6. J.E. Marsden, A.J. Tromba, A. Weinstein, Basic Multivariable Calculus, W.H.Freeman & Co Ltd; 3rd edition 2001

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-	20%	-	20%	-
Level 3	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
Level 4	Analyze	20%	-	20%	-	20%	-	20%	-	20%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-

Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100%	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Madhan Shanmugasundaram , Director, Infosys Technologies, Chennai madshan@gmail.com	*Prof. Y.V.S.S. Sanyasiraju,* ***IIT Madras, sryedida@iitm.ac.in***	Dr.B.Vennila, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	*Dr E. Sujatha, SRMIST*

Course Code	UBT22101T	Course Name	Mathematical Calculations In Biology	Course Category	C	Professional Core Course	L	T	P	C
							3	1	0	4

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Biotechnology*	Data Book / Codes/Standards		*Graph sheet needed; t, F and χ^2 table is needed*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning Bloom's Level
CLR-1 :	*Knowledge on GLP and significant digits*	
CLR-2 :	*Knowledge onsolution and mixtures*	
CLR-3 :	*Knowledge on growth kinetics*	
CLR-4 :	*Knowledge on nucluiec acid quantification*	
CLR-5 :	*Knowledge on protein quantification*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	
CLO-1 :	*Learning on GLP and digits*	1
CLO-2 :	*Learning on calculation in solution and mixtures*	4
CLO-3 :	*Calculation on growth kinetics*	4
CLO-4 :	*Learning calculations on nucleic acids and DNA*	4
CLO-5 :	*Learning calculations on proteins*	4

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
L	*L*	*L*	*M*	*L*	-	-	-	*L*	*M*	*H*	*M*	-	-	-
M	*H*	*M*	*M*	*M*	-	-	-	*M*	*M*	*H*	*M*	-	-	-
H	*H*	*M*	*H*	*M*	-	-	-	*M*	*M*	*H*	*H*	-	-	-
M	*H*	*M*	*H*	*M*	-	-	-	*M*	*M*	*H*	*H*	-	-	-
H	*H*	*M*	*H*	*H*	-	-	-	*M*	*M*	*H*	*M*	-	-	-

UNIT I: Introduction to mathematics in biology

History of GLP, Definition of GLP, Significant digits, converting numbers from scientific to decimal notations, conversion factors, Canceling terms, Discussion on overall notations and clarifications, Calculating dilutions concentrations by factor of X

UNIT II: Concentrations, dilutions and molar solutions

concentrations by factor of X, percent solutions, Diluting percent solutions, Moles and molecular weight, Molarity, Gram equivalents, Diluting molar solutions, conversion of molarity to percent solutions, conversion of % solutions to molarity, Normality, pH & pOH Problem solving questions

UNIT III: Calculations in Microbiology

Manipulating cell concentration, calculating generation time, plotting OD vs time on a graph, Measuring cell concentration on a hemocytometer, Multiplicity of phage infection, Measuring phage titer Diluting bacteriophage, Problem solving questions

UNIT IV: Calculations in Nucleic acids

Determination of concentration of dsDNA, Determination of concentration of ssDNA, Determination of concentration of RNA, purity of DNA, oligonucleotide quantification, determination of molecular weight Molarity of DNA, nucleic acid length

UNIT IV: Calculations in Proteins

Protein concentration Bradford assay, Protein quantification by absorbance A280, Protein quantification by absorbance A205, absorbance coefficient, extinction coefficient, importance of extinction coefficient specific activity of enzyme

Learning Resources	*Theory:*
	1. Calculations for Molecular Biology and Biotechnology- A guide to mathematics in the laboratory". by Frank H. Stephenson. Academic Press- 2nd Edition (2014)

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%		10%		10%		10%		10%	
Level 2	Understand	20%		10%		10%		10%		10%	
Level 3	Apply	40%		40%		30%		20%		20%	
Level 4	Analyze	20%		20%		20%		20%		20%	
Level 5	Evaluate	-	-	10%	-	20%	-	20%	-	20%	-

Level 6	Create	-	-	10%	-	10%	-	20%	-	20%	-
	Total	100 %		100 %		100 %		100 %		100%	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. Prasanth Bhatt

Course Code	UBT22102J	Course Name	Biology-I	Course Category	C	Professional Core Course	L	T	P	C
							3	0	2	4

Pre-requisite Courses	NIL	Co-requisite Courses	NIL	Progressive Courses	NIL
Course Offering Department	Biotechnology	Data Book / Codes/Standards	NIL		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1 :	To present the importance of light in life processes	**Bloom's Level**
CLR-2 :	Understand the process of oxygen evolution and its reaction centres	
CLR-3 :	Gain knowledge on the concepts on cells and its structures	
CLR-4 :	Acquire knowledge on the various regulation process in animals	
CLR-5 :	Have introduction on the various macromolecules and its structures	
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	
CLO-1 :	A perspective on the effect of light in life processes	*1*
CLO-2 :	Provides an understanding on the oxygen production and the reaction centres	*2*
CLO-3 :	An insight into the structure of cell and microscopes is obtained	*1*
CLO-4 :	The regulatory system gives an understanding on the basic maintenance of the body	*3*
CLO-5 :	Basic knowledge is gained about the macromolecules	*1*

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary	Critical Thinking	Problem Solving	Analytical	Research Skills	Team Work	Scientific	Reflective Thinking	Self-Directed	Multicultural	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
H	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
H	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
H	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
H	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
H	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-

UNIT- I: Nature of light

Light and its importance in life process, effect of radiation on biological processes (plant and animals), pigments/receptors of light- chlorophylls, phyto-chromes rhodopsin, Photo Biological reactions, Photoreception in animals, evolution of eye and visual processing

PRACTICALS :

1. Moll's half leaf experiment
2. To test / survey for colour blindness using Ishihara charts

UNIT- II: Light and dark reactions

Photolysis of water and oxygen evolution, O2 evolving complex, Oxygenic and An-oxygenic photosynthesis, reaction centres, Bacterial Photosynthesis

PRACTICALS:

1. Demonstration of Hill's reaction
2. Chemical separation of chloroplast pigments

UNIT- III: The Cell

The concept of cell, Prokaryotes and eukaryotes, Ultrastructure of cells (Bacteria, plant & animal), Microscope and its functioning,

PRACTICALS

1. Media preparation for cell growth
2. Preparation of slides for viewing live bacterial cells

UNIT –IV: Homeostasis

Ectothermic animals, Endothermic animals, Temperature regulation, control of blood glucose levels, Liver and its importance in maintaining homeostasis

UNIT - V: Introduction to Macromolecules

Carbohydrates, Lipids, Amino acids, Nucleic acids, Vitamins

PRACTICALS:

1. Qualitative analysis of carbohydrates
2. Qualitative analysis of amino acids

Learning Resources	1. D.J. Taylor, N.P.O. Green, G.W.Stout. Biological Science, Cambridge Publications 2. Lisa A. Urry, Michael L. Cain, Steven Alexander Wasserman, Peter V. Minorsky, Rebecca B. Orr · Pearson. Campbell Biology.

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 2	Understand	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 4	Analyze	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100%	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers	
Experts from Higher Technical Institutions	**Internal Experts**
1. Dr. Sumathi, Associate Professor, MGR University Chennai 2. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai	Dr. N. Prasanth Bhatt, Assistant Professor, SRM institute of Science and Technology

SEMESTER II

Course Code	ULT22G02J	Course Name	Tamil-II	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Tamil*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*

CLR-1 :	*To generate in students a sensitivity to gender marginalization and Eco sensitivity.*
CLR-2 :	*An evolved consciousness in the minds to accommodate all is developed*
CLR-3 :	*The ability to accept all and to co- exist is initiated*
CLR-4 :	*To create community connectivity and interdependence is initiated*
CLR-5 :	*To give them all the historical insights*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Bloom's Level
CLO-1 :	*To acquire knowledge about Tamil Language*	*4*
CLO-2 :	*To strengthen the knowledge on concept, culture, civilization and translation of Tamil*	*4*
CLO-3 :	*To develop content using the features in Tamil language*	*4*
CLO-4 :	*To use Tamil Language and Literature to enhance their creativity*	*4*
CLO-5 :	*To improve communication and creative expression in Tamil language*	*4*

Learning	Program Learning Outcomes (PLO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
M	-	*H*	-	*M*	-	-	-	-	-	-	-	-	-	-
M	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-
H	-	*M*	-	*H*	-	-	-	-	-	-	-	-	-	-
M	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-
M	-	-	*H*	*H*	-	-	-	-	-	-	-	-	-	-

அலகு – 1 – பதினெண் மேற்கணக்கு

எட்டுத்தொகை : தமிழில் காலந்தோறும் அகமரபு – தமிழர் புறமரபு

1. ஐங்குறுநூறு – அன்னாய் வாழி வேண்டு (பாடல் – 203)
2. குறுந்தொகை – நிலந்தொட்டுப் புகார் (பாடல் – 130)
3. அகநானூறு – வந்து வினை முடித்தனன் வேந்தனும் பகைவர் (பாடல் – 44)
4. கலித்தொகை – நிரை திமில் களிறாக (நெய்தற்கலி பாடல் – 149)
5. புறநானூறு – சிறியகள் பெறினே (பாடல் – 235)

பத்துப்பாட்டு - சிறுபாணாற்றுப்படை (அடிகள் – 126 – 143)

அலகு – 2 - பதினெண் கீழ்க்கணக்கு :

களப்பிரர் காலம் – அறமும் வாழ்வியலும் .

1. திருக்குறள் – வினைத்திட்பம் (அதிகாரம் 67), உழவு (அதிகாரம் 104), 2. நாலடியார் – நல்லார் எனத்தான் (221), 3. திரிகடுகம் – கோலஞ்சி வாழும் குடியும் (33), 4. இனியவை நாற்பது (14), 5. களவழி நாற்பது – கவளங்கொள்யானை (14)

அலகு – 3 – பக்தி இலக்கியம்

பல்லவர் காலம் – பல்லவர் கால இலக்கியங்கள் – பக்தியும் தமிழும்.

1. சைவம் – பன்னிருதிருமுறைகள் - திருஞானசம்பந்தர் – வேயுறுதோளிபங்கன், திருநாவுக்கரசர் – மாசில் வீணையும் மாலை மதியமும், மாணிக்கவாசகர் – தந்தது உன் தன்னை கொண்டது என் தன்னை.
2. வைணவம் – நாலாயிரத் திவ்யப்பிரபந்தம் - பெரியாழ்வார் – கருங்கண் தோகை மயிற்பீலி அணிந்து, ஆண்டாள் – கருப்பூரம் நாறுமோ? கமலப்பூ நாறுமோ? ...., தொண்டரடிப்பொடி ஆழ்வார் – பச்சைமாமலை போல் மேனி
3. இஸ்லாமியம் - சீறாப்புராணம் - மானுக்குப் பிணை நின்ற படலம் – 5 பாடல்கள் (பாடல் எண்கள் : 61 – 65)
4. கிறித்துவம் - வேதக்கண் – ஆதி நந்தாவனப் பிரளயம் – ஏதேன் தோட்ட வர்ணனை (3 பாடல்கள்)

அலகு – 4 - தமிழ் இலக்கிய வரலாறு

சங்க கால வரலாறு – சங்க கால மக்களின் வாழ்வியல் – முச்சங்கம் அறிமுகம் – முச்சங்க வரலாறு – செம்மொழி இலக்கியங்கள்

1. சங்க இலக்கியங்கள், 2. நீதி இலக்கியங்கள், 3. ஐம்பெருங்காப்பியங்கள், 4. பக்தி இலக்கியங்கள்

அலகு – 5 - சிறுகதையும் மொழிப்பயிற்சியும்

தமிழ்ச் சிறுகதைப் போக்குகள் – தமிழ்ச் சிறுகதையும் தமிழ்ச்சமூக வாழ்வியலும்

சிறுகதைகள் – 1. புதுமைப்பித்தன் – அகலிகை, 2. அகிலன் – ஒருவேளைச்சோறு, 3. ஆண்டாள் பிரியதர்ஷினி – மாத்திரை, 4. பாரததேவி – மாப்பிள்ளை விருந்து, 5. தவிப்பு – குன்றக்குடி சிங்காரவடிவேல்

மொழிப்பயிற்சி : 1. செய்தி அறிக்கை எழுதுதல் , 2. விமர்சனம், 3. நேர்காணல், 4. பேச்சுக்கலை

Learning Resources

1. *மௌவல், தொகுப்பும் பதிப்பும் - தமிழ்த்துறை ஆசிரியர்கள், தமிழ்த்துறை, எஸ்.ஆர்.எம். அறிவியல் மற்றும் தொழில்நுட்பக் கல்விநிறுவனம், காட்டாங்குளத்தூர்*, 603203, 2020.
2. *தமிழண்ணல், புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு, மீனாட்சி புத்தக நிலையம், மதுரை*, 2017
3. *மு. அருணாசலம், தமிழ் இலக்கிய வரலாறு, நூற்றாண்டு முறை* (9*ஆம் நூ. முதல்* 16 *வரை*), *தி பார்க்கர், சென்னை*, 2005
4. *தமிழ் இணையக் கல்விக்கழகம்* - http://www.tamilvu.org/
5. *மதுரை தமிழ் இலக்கிய மின் தொகுப்புத் திட்டம்* - https://www.projectmadurai.org/

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	10%	10%	10%	10%	10%	10%	10%	10%	20%	-
Level 2	Understand	10%-	10%-	10%-	10%-	10%-	10%-	10%-	10%-	20%	-
Level 3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	40%	-
Level 4	Analyze	10%	10%	10%	10%	10%	10%	10%	10%	20%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Expert from Higher Technical Institutions	Internal Experts
	1. Dr. R..Srinivasan, Associate Professor, Department of Tamil, Presidency College, Chennai.	*1. B.Jaiganesh, Assistant Professor & Head, FSH, SRMIST*
		2. T.R.Hebzibah Beulah Suganthi, Assistant Professor, FSH, SRMIST
		3.S.Saraswathy, Assistant Professor, FSH, SRMIST

Course Code	ULH22G02J	Course Name	HINDI-II	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*HINDI*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1 :	*To be able to converse well in the Hindi Language*	Bloom's Level
CLR-2 :	*To read and write and clarity*	
CLR-3 :	*To be willing listeners and translators –where need be*	
CLR-4 :	*To acquire the values/thought contents of the writers and practice in it in life.*	
CLR-5 :	*To find motivation through the various forms of literature and learn to overcome any challenges of life.*	
CLR-6 :	*To discover the importance of the language in making education as a means of growth in life and not mere literacy.*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Bloom's Level
CLO-1 :	*To acquire knowledge about Medieval and Modern Poetry.*	*4*
CLO-2 :	*To consider the relevance of the present trends in Hindi and their contemporary relevance.*	*4*
CLO-3 :	*To help develop better understanding of the Hindi language by studying the stories with reference to current reality.*	*4*
CLO-4 :	*To understand the usage of the present Advertising trends and its creative angles with the varied skills of Hindi Language.*	*4*
CLO-5 :	*To make translation of good literature and any relevant document from the Hindi Language to English and Vice-versa.*	*4*
CLO-6 :	*To help the learner to tackle Administrative terminologies, help them use Idioms and Phrases in their daily life, with ease.*	*4*

Program Learning Outcomes (PLO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO -1	PSO -2	PSO-3
H	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-
-	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-
H	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
H	-	*H*	*H*	*H*	-	-	-	-	-	*H*	-	-	-	-
-	*H*	-	*H*	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

UNIT – 1

1. KABIR (3Couplets)
2. SURDAS (3Couplets)
3. TULSIDAS (3Couplets)
4. THIRUVALLAVUR (3Couplets)
5. RAHIM (3Couplets)
6. SURYAKANTH TRIPATHI NIRALA - BADAL RAAG
7. NAGARJUN - PRETH KA BAYAAN
8. SOHANLAL DWEDI - LEHRON SE DARKAR NAUKA PAAR NAHI HOTI
9. MAKHANLAL CHATURVEDI - RASHTRA PREM
10. GOONGI MAA - AGNISHEKHAR

UNIT - 2

1. LADKIYAAN – MAMTA KALIYA
2. GUNDA – JAYSHANKAR PRASAD

UNIT – 3

1. VIGYAPAN

a. Bhumika aur Awdaharna
b. Shabd ki Vutpati
c. Paribhasha
d. Madhyam

UNIT – 4

1. TRANSLATION (HINDI TO ENGLISH AND ENGLISH TO HINDI)

2. LETTER WRITING
UNIT – 5 1. TECHNICAL TERMINOLOGY

Learning Resources	***The Prescribe Text Book Compiled and Edited by Department of Hindi*** *www.kavitakosh.org* *www.shabdkosh.com*

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	10%	10%	10%	10%	10%	10%	10%	10%	20%	-
Level 2	Understand	10%-	10%-	10%-	10%-	10%-	10%-	10%-	10%-	20%	-
Level 3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	40%	-
Level 4	Analyze	10%	10%	10%	10%	10%	10%	10%	10%	20%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Expert from Higher Technical Institutions**	**Internal Experts**
	1. Prof.(Dr.) S.Narayan Raju, Head, Department of Hindi,CUTN, Tamilnadu	*1. Dr.S Preeti. Associate Professor & Head, SRMIST*
		2. Dr. Md.S. Islam Assistant Professor, SRMIST
		3 Dr. S. Razia Begum, Assistant Professor, SRM IST

Course Code	ULF22G02J	Course Name	French-II	Course Category	G	Generic Elective Course	L	T	P	C
							2	0	2	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*French*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1 :	Strengthen the language of the students both in oral and written	Bloom's Level
CLR-2 :	Express their sentiments, emotions and opinions, reacting to information, situations	
CLR-3 :	Make them learn the basic rules of French Grammar.	
CLR-4 :	Develop strategies of comprehension of texts of different origin	
CLR-5 :	Enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French	
CLR-6 :	*Extend and expand their savoir-faire through the acquisition of current scenario*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Bloom's Level
CLO-1 :	*To acquire knowledge about French language*	*4*
CLO-2 :	*To strengthen the knowledge on concept, culture, civilization and translation of French*	*4*
CLO-3 :	*To develop content using the features in French language*	*4*
CLO-4 :	*To interpret the French language into other language*	*4*
CLO-5 :	*To improve the communication, intercultural elements in French language*	*4*
CLO-6 :	To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French	*4*

Program Learning Outcomes (PLO)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO -1	PSO -2	PSO-3
CLO-1	*H*	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2	-	*H*	-	*H*	-	-	-	-	-	-	*M*	-	-	-	-
CLO-3	*H*	-	-	*H*	-	-	-	-	-	-	*H*	-	-	-	-
CLO-4	*H*	-	*H*	*H*	*H*	-	-	-	-	-	*H*	-	-	-	-
CLO-5	-	*H*	-	*H*	-	-	-	-	-	-	*H*	-	-	-	-
CLO-6	*H*	-	-	*H*	*H*	-	-	-	-	-	-	-	-	-	-

Unité-I
Les loisirs -Les loisirs -Les activités quotidiennes -Les matières -Le temps et l'heure - Les fréquences- Les sons [u]/ [y] – Les loisirs – La routine – Mots et expressions – Exprimer ses gouts et ses préférence – Décrire sa journée

Unité-II
La routine - Les adjectifs interrogatifs - Les nombres ordinaux - L'heure - Le pronom personnel COD -Les pronominaux -Les verbes du premier groupe en –e_er,é_er,-eler,-eter -Le verbe prendre - Parler de ses gouts et de ses préférences - Décrire sa journée

Unité-III
Où faire ses courses ? -Les aliments - Les quantités - Les commerces et les commerçants - Demander et dire le prix - Les services - Les moyens de paiement - les sons [ã]/ [an] – Découvrez et dégustez ! Mots et expressions – Au restaurant : commander et commenter – Inviter et répondre à une invitation.

Unité-IV
Découvrez et dégustez Les articles partitifs -Le pronom en (la quantité) - Très ou beaucoup ? -La phrase négative (2) - C'est /Il est (2) - L'impératif - Il faut - Les verbes devoir, pouvoir, savoir, vouloir - Au restaurant : Commander et commenter - Inviter et répondre à une invitation

Unité-V
Tout le monde s'amuse- Les sorties - Situer dans le temps - La famille (2) - Les vêtements et les accessoires - Les sons [c]/[ɔn] - Les ados au quotidien - Les adjectifs démonstratifs - La formation du féminin (4) -Le pronom indéfini on -Le futur proche - Le passe composé -Les verbes du premier groupe en – yer -Les verbes voir et sortir Décrire une tenue – écrire un message amical.

Learning Resources	***Theory:***
	1. "**Génération-AI**" Méthode de français, Marie-Noëlle COCTON, P.DAUDA, L.GIACHINO, C.BARACCO, Les éditions Didier, Paris, 2018.
	2. Cahier d'activités avec deux discs compacts.

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	10%	10%	10%	10%	10%	10%	10%	10%	20%	-
Level 2	Understand	10%-	10%-	10%-	10%-	10%-	10%-	10%-	10%-	20%	-
Level 3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	40%	-
Level 4	Analyze	10%	10%	10%	10%	10%	10%	10%	10%	20%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	**Expert from Higher Technical Institutions**	**Internal Experts**
	1. Dr. C.Thirumurugan Associate Professor, Department of French, Pondicherry University	*1. Kumaravel K. Assistant Professor & Head, SRMIST*
		2. Ponrajadurai M Assistant Professor, SRMIST

Course Code	UPY22201J	Course Name	Physics-II	Course Category	C	Professional Core Course	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Physics and Nanotechnology	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning
CLR-1:	**Introduce vector calculus and its application to forces, fields and potentials**	Bloom's Level
CLR-2:	*Acquire knowledge of fundamental concepts electrostatics and electric field in matter*	
CLR-3:	*Learn fundamental concepts of electric field in matter and magnetic fields*	
CLR-4:	*Acquire analytical and problem solving skills on involving currents and magnetic field in matter*	
CLR-5:	*Use the knowledge of electric and magnetic fields to get basic idea of electromagnetic radiation.*	
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	
CLO-1:	*Apply vector calculus to solve problems involving forces and fields.*	4
CLO-2:	*Apply mathematical tools to explain electrostatic interactions.*	4
CLO-3:	*Solve problems related to charges, currents in vacuum and matter.*	4
CLO-4:	*Solve problems in magnetism that require knowledge of magnetic fields in matter.*	4
CLO-5:	*Apply fundamental concepts of electromagnetic phenomenon and radiation.*	4

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	-	H	-	-	-	-	-	-	-	-	-	-	-	-
H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
-	-	H	-	-	-	H	-	-	-	-	-	-	-	-
H	-	-	-	-	-	H	-	-	-	-	-	-	-	-
H	-	-	H	-	-	-	-	-	-	-	-	-	-	-

Unit-1: Fundamental theorems on gradients and divergences, Fundamental theorem on curls, Dirac Delta function, Three dimensional Dirac delta function, Introduction to Cylindrical Coordinates (CC) and Spherical Polar Coordinates (SPC), Introduction to Gradient, divergence and curl in SPC and CC and their applications, Helmoltz theorem and potentials, Scalar and vector potentials, Coulomb's law, Electric field of discrete and continuous charge distributions.

1. Practice problem solving on E field of discrete and continuous charge distributions
2. Calibration of Voltmeter using Potentiometer
3. Calibration of Ammeter using Potentiometer

Unit-2: Divergence of electrostatic field, Gauss's law and applications, Line integral and Curl of Electrostatic field, Conservative nature of electrostatic field, Scalar electric potential, Poisson's and Laplace's equations, Potential of localized charge distribution, Boundary conditions, Work done to move charge, Energy of a point and continuous charge distribution, Basic properties of conductors and dielectrics, Uniqueness theorems, Method of images for calculating potentials

4. Practice problems on Gauss law, electric potential and method of images
5. Determination of Internal resistance of the given cell using Potentiometer
6. Determination of Temperature Coefficient of Resistance using Post Office Box

Unit-3: Polarization in Dielectrics, Induced dipoles and concept of bound charges, Electric Displacement, Gauss law in Dielectrics, Boundary Conditions at Dielectric interface, Susceptibility, Permittivity
Dielectric constant, Energy in dielectrics, Magnetic fields and force: Lorentz force law, Currents: Line, surface and volume current densities, Continuity equation, Biot-Savart law, Magnetic field due to Steady straight-line currents.

7. Practice problem solving on polarization, current density and Biot-Savart law
8. EMF of thermocouple Potentiometer
9. Comparison of EMFs of two cells using Ballistic Galvanometer

Unit-4: Divergence of magnetic field, Curl of magnetic field and Ampere's law, Applications of Ampere's law, Comparison with electrostatics, Magnetic vector potential and arbitrariness, Magnetostatic boundary conditions, Multipole expansion: Electric and Magnetic, Magnetization torque and force on magnetic dipoles, Bound currents: conceptual interpretation, Ampere's law in magnetized materials, Magnetic susceptibility and permeability, Introduction to Ferromagnetism and Magnetic domains.

10. Practice problems on Ampere's law, boundary conditions and magnetization
11. Determination horizontal component of earth magnetic field-Field along the axis of the coil
12. Determination of Magnetic moment and Ratio of magnetic moments by Searle's vibration magnetometer method

Unit-5: Ohm's law and EMF, Faraday's law and induced electric field, Energy in magnetic fields, Maxwell's modification of Ampere's law, Maxwell's equations in vacuum and matter, Boundary Conditions, Sinusoidal waves and complex notation Maxwell's equations, The wave equation for E and B in vacuum, Solution of the wave equation, Transverse nature of EM waves, Energy and momentum in EM waves, Continuity equation, Poynting's theorem.

13. Practice problems on Maxwell's equations and EM waves.
14. Study of resonance in series LCR circuits.Calibration of Voltmeter using Potentiometer
15. Study of resonance in parallel LCR circuits.Calibration of Ammeter using Potentiometer

Learning Resources

1. Introduction to Electrodynamics, 4th Ed., David J. Griffiths (Prentice Hall of India, 2012)
2. Principles of Physics,10th Ed, ISV, R.Resnick, J. Walker, D.Halliday (Wiley, 2015)
3. Electricity and Magnetism: Berkeley Physics Course Vol. 2, Edward M. Purcell (McGraw Hill Education, 2017)
4. University Physics: Electricity and Magnetism, (12th Ed., H. D. Young and R. A. Freedman, 2011)
5. Electromagnetics, Joseph Edminister (McGraw Hill, 2013)
6. Electricity and Magnetism, A Mahajan, (McGraw Hill Education, 2017)

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 2	Understand	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 4	Analyze	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. M Sathish , CSIR-CECRI, msathish@cecri.re.in	Prof. C Vijayan, IIT Madras, cvijayan@iitm.ac.in	Dr. Rohit Dhir, SRMIST
Dr. DK Aswal , NPL, dkaswal@nplindia.org	Prof. V Subramanian, IIT Madras, manianvs@iitm.ac.in	Dr. C. Preferencial Kala, SRMIST

Course Code	UCY22201J	Course Name	General Chemistry - II	Course Category	C	Professional Core Course	L	T	P	C
							3	0	4	5

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	gain knowledge on the importance of basic organic chemistry
CLR-2 :	enable the students to acquire quantitative skills in volumetric analysis.
CLR-3 :	Inculcate the practical and theoretical knowledge about the chemical kinetics
CLR-4 :	acquire knowledge in the fundamentals of electrochemistry
CLR-5 :	promote the importance of industrial chemistry

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning Bloom's Level	Program Learning Outcomes (PLO) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
			Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO -1	PSO -2	PSO-3
CLO-1 :	understand the basic concepts of organic chemistry	4	H											H			
CLO-2 :	gain knowledge and practical skill in the quantitative analysis of wide range of compounds	4	H	H			H										
CLO-3 :	acquaint the fundamental concepts of chemical kinetics with the practical knowledge	4	H				M										
CLO-4 :	Apply the concepts of electrochemistry with the real time analysis	4			H	H											
CLO-5 :	utilize their chemistry knowledge for industrial applications	4				H	H		H		H						

UNIT- I: Carbohydrates, Benzene and Heterocyclic Compounds

Classification of carbohydrates–Properties and uses of glucose and fructose mutarotation - Chemistry of benzene - Preparation, mechanism of electrophillic substitution reactions. Heterocyclic compounds– Preparation and properties of pyrrole and pyridine.

PRACTICALS:

1. Estimation of ascorbic acid
2. Estimation of phenol
3. Estimation of aniline

UNIT- II: PRINCIPLES OF VOLUMETRIC ANALYSIS:

Definitions of Molarity, Molality, Normality and Mole Fraction - Their Calculations - Definition and Examples for Primary and Secondary standards - Calculation of Equivalent Weight of Acid, Base, Oxidising Agent, Reducing Agent and Salts.
Principles of Volumetric Analysis - Theories of Acid- Base, Redox, Complexometric Iodometric and Iodimetric titrations.
Theories of indicators - Acid-base indicators - Choice of indicators - Redox, Metal ion and Adsorption indicators.

PRACTICALS:

1. Estimation of HCl using standard oxalic acid
2. Estimation of NaOH using standard sodium carbonate
3. Estimation of $FeSO_4$ using standard oxalic acid

UNIT- III: Chemical Kinetics

Rate of reaction, order- molecularity, first order rate law and simple problems- Half-life period of first order reaction- pseudo first order reaction- zero and second order reactions. Arrhenius and collision theories.

PRACTICALS:

1. Kinetics of Iodination of Acetone
2. Determination of rate constant of acid –catalysed hydrolysis of an ester
3. Comparison of rate constant of hydrolysis of an ester reaction using two acids.

UNIT –IV: Electrochemistry

Faradays laws of electrolysis - Specific conductance, equivalent conductance - Cell constant - Arrhenius theory Ostwald"s dilution law and Kohlrausch law - Nernst equation - Applications of EMF- Measurements.

PRACTICALS:

1. Determination of concentration of an acid by conductometric method.
2. Determination of concentration of the mixture of acids by conductometric method.
3. Estimation of Iron by potentiometric method.

UNIT - V: Industrial Chemistry

Hardness of water – Temporary and permanent hardness, disadvantages of hard water Boiler scales and sludges - Softening of hard water – Zeolite process - demineralization process and reverse osmosis – Purification of water for domestic use: use of chlorine, Ozone and UV light.

PRACTICALS:

1. Estimation of Chloride in the given water sample.
2. Estimation of Nickel using decinormal solution of EDTA
3. Estimation of hardness in the given water sample

Learning Resources	**Theory:**	**Practicals:**
	1. Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, Shobulal Nagin Chand and Co, 2001. 2. R. Gopalan, S. Sundaram, Allied Chemistry, Sultan Chand and Sons, 1995. 3. Lee, J.D., Concise Inorganic Chemistry, Fifth Edn., Wiley India. 4. Huheey, J.E., Keiter, E.A., Keiter, R. L., Medhi, O.K., Inorganic Chemistry- Principles of Structure and Reactivity, Pearson Education 2009.	**1.** Jeffery, G.H., Bassett, J., Mendham, J., Denney, R.C.,Vogel's Textbook of Quantitative Chemical Analysis, 5th Edn., Longman Scientific & Technical, England, **1989 (John** Wiley and Sons Inc, 605 Third Avenue, NewYork NY 10158) 2. V.Venkateswaran, R. Veeraswamy, A.R.Kulandaivelu, *Basic Principles of Practical Chemistry*, 2nd Edition Sultan Chand and Sons,1997. 3. Daniels et al., *Experimental Physical Chemistry*, 7th edition, New York, McGraw Hill, 1970.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 2	Understand	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 4	Analyze	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

Course Designers

Expert from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Dr. Sudarshan Mahapatra, Encube Ethicals Pvt. Ltd, Email: sudarshan.m@encubeethicals.com	Prof. G. Sekar, Department of Chemistry, IIT Madras Email: Pgsekar@iitm.ac.in	Dr. J. Arockiaselvi, SRMIST
Dr. Ravikiran Allada, Head R&D, Analytical, Novugen Pharma, Malaysia Email: ravianalytical@gmail.com	Dr. Kanishka Biswas, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru Email: kanishka@jncasr.ac.in	Prof. M. Arthanareeswari, SRMIST

Course Code	UMA22201T	Course Name	Mathematics II	Course Category	C	Professional Core Course	L	T	P	C
							3	1	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning Bloom's level
CLR-1:	Learn the concept of Matrices	
CLR-2:	Apply the concepts Eigen values and Eigen vectors to diagonalize a matrix, to reduce it to orthogonal form,	
CLR-3:	Learn various methods to find the roots of an equation	
CLR-4:	Apply the concept of Differential Equations in problems of Science	
CLR-5:	Apply the concept of Taylor series, composite function and Jacobian in problems of science	
Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	
CLO-1:	Understand the concept of Matrices and apply them to solve system of linear equations	4
CLO-2:	Apply the knowledge of Matrices, Eigenvalues and Eigen Vectors, Reduce to Quadratics form to solve problems in field of science	4
CLO-3:	Solve the equations and find their roots applying various methods	4
CLO-4:	Gain knowledge in solution of Differential Equations and Its applications	4
CLO-5:	Gain familiarity in the knowledge of Jacobian, and Taylor series and apply them to the problems involving Science	4

Program Learning Outcomes (PLO)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO -1	PSO -2	PSO-3
CLO-1:	H	M	M	M	-	-	-	-	-	-	-	M	-	-	-
CLO-2:	H	H	M	H	-	-	-	-	-	-	-	H	-	-	-
CLO-3:	H	H	M	H	-	-	-	-	-	-	-	H	-	-	-
CLO-4:	H	H	M	H	-	-	-	-	-	-	-	H	-	-	-
CLO-5:	H	M	M	M	-	-	-	-	-	-	-	M	-	-	-

Unit-1: Introduction to matrices- Types of matrices- Properties- Inverse of matrix- System of linear equation – Cramer's rule- Rank of matrix- Existence and uniqueness of the system of linear equation by rank.
Unit-2: Characteristic equation- Eigen values and Eigen vectors of a real matrix- Cayley Hamilton theorem- Orthogonal reduction of a symmetric matrix to diagonal form.
Unit-3:Polynomial equations- Irrational roots- Complex roots(up to third order)- reciprocal equations- Approximation of a roots of a polynomial equation- Newton's method- finding positive roots- Horner's method for finding the roots
Unit-4: First order differential equation- Variable separable method- substitution method- Homogeneous differential equation- First order linear differential equation- Application of first order differential equation
Unit-5: Introduction- Functions of two variables – Euler's theorem- Total derivative- Taylor's expansion with two variable up to second order terms- Jacobian of two and three variables

Learning Resources	
	1. Erwin kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2010. 2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2010. 3. Hughes-Hallett et al., Calculus - Single and Multivariable, 8th Edition, John-Wiley and Sons 2020.
	4. James Stewart, Calculus, 5th Edition, Thomson, 2003. 5. T. M. Apostol, Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern 1991. 6. T.K. Manicavachagam Pillai, T. Natarajan, K.S. Ganapathy, Algebra, Vol. I, S. Viswanathan Pvt Limited, Chennai, 2009

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-	20%	-	20%	-
Level 3	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
Level 4	Analyze	20%	-	20%	-	20%	-	20%	-	20%	-
Level 5	Evaluate										-

Level 6	Create										-
	Total	100 %		100 %		100 %		100 %		100%	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Madhan Shanmugasundaram , Director, Infosys Technologies, Chennai madshan@gmail.com	*Prof. Y.V.S.S. Sanyasiraju,* ***IIT Madras, sryedida@iitm.ac.in***	Dr.B.Vennila, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	*Dr. E. Sujatha, SRMIST*

Course Code	UBT22201T	Course Name	Biostatistics	Course Category	C	Professional Core Course	L	T	P	C
							3	1	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics and Statistics	Data Book / Codes/Standards	Graph sheets and statistical table		

Course Learning Rationale (CLR):	***The purpose of learning this course is to:***
CLR-1 :	*To provide foundations in Bio Statistics*
CLR-2 :	*To provide a strong foundations of organizing the data, diagrammatic and graphical presentation.*
CLR-3 :	*To apply Statistical techniques for biological problems.*
CLR-4 :	*To understand the characteristics of biological problems.*
CLR-5 :	*To provide the application of correlation and regression in biological sciences.*

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning		
		1	2	3
		Level of Thinking (Bloom)	Expected Proficiency (%)	Expected Attainment (%)
CLO-1 :	*To understand the statistical modeling and its limitations, and have skill in description, interpretation and exploratory analysis of data by graphical and other means;*	*3*	*85*	*80*
CLO-2 :	*To calculate and apply measures of central tendency - grouped and ungrouped data cases.*	*3*	*80*	*75*
CLO-3 :	*To understand and apply measures of dispersion - grouped and ungrouped data cases.*	*3*	*85*	*80*
CLO-4 :	*Find the relationship between two or more variables using correlation and regression.*	*3*	*85*	*80*
CLO-5 :	*Perform Test of Hypothesis for small sample. Learn non-parametric test such as the Chi-Square test for Independence and Goodness of Fit.*	*3*	*85*	*80*
CLO-6 :	Perform the Analysis of Variance - One way Classifications.	3	75	80

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
L	L	L	M	L	-	-	-	L	M	H	M	-	-	-
M	M	M	M	M	-	-	-	M	M	H	M	-	-	-
H	H	M	H	M	-	-	-	M	M	H	H	-	-	-
M	H	M	H	M	-	-	-	M	M	H	H	-	-	-
H	H	M	H	H	-	-	-	M	M	H	M	-	-	-
H	H	M	H	M	-	-	-	M	M	H	M	-	-	-

UNIT I:

Nature and scope of statistical methods, Definition of statistics, Numerical Data, Nature of statistics, Importance of statistics, Functions of statistics, Limitations and Distrust of Statistics

Collection of data

Classification

i. Meanings
ii. Objects
iii. Rules of classification

Classification

i. Types of classification
ii. Characteristics of good classification

Tabulation:

i. Parts of Tabulation
ii. Rules of Tabulation

Types of tables, Objective of Tabulation, Components of Good Table, Rules of construction of the table, Difference between classification and tabulation, Diagrammatic representation of various types of statistical data, Bar Diagram

Types of Bar diagram, One dimensional Diagrams, Two dimensional Diagrams- Pie chart, Histogram, Frequency Polygon, Frequency Curve, Less than O gives, More than O gives, Lorenz Curve

UNIT II:

Measures of Central tendency

i. Definition
ii. Functions of average
iii. Characteristics of a typical average

Arithmetic mean - Individual series, Discrete series, Continuous series, Continuous series, Merits and Demerits

Median

i. Individual series
ii. Discrete series

Median- Continuous series, Median Merits and Demerits

Median- Graphical solution

Mode - Individual series, Discrete series, Continuous series, Meritsand Demerits, Graphical solution

Geometric Mean - Individual Series, Discrete Series, Continuous Series, Merits and Demerits

Harmonic Mean - Individual Series, Discrete Series, Continuous Series, Merits and Demerits

UNIT III:

Measures of Dispersion, Range –Individual, Discrete series and Continuous series, Quartile Deviation - Individual and Discrete series, Continuous series

Mean Deviation about Mean – Individual Series, Discrete series, Continuous series

Mean Deviation about Median – Individual series, Discrete series, Continuous series *Standard Deviation – Individual and Discrete Series, Continuous Series* *Coefficient of Variation, Graphical solution of Dispersion , Lorenz curve* *Graphical solution of Dispersion- Lorenz curve, Skewness, Bowley's coefficient of Skewness, Concept of Kurtosis*
UNIT IV: *Correlation Analysis: Correlation - Definition and uses, Types of correlation, Methods for Finding Correlation Coefficient, Properties of correlation coefficient, Karl Pearson's Correlation Co-efficient, Spearman's Rank Correlation Coefficientwith non-repeated Ranks, Spearman's Rank Correlation Coefficientwith repeated Ranks, Spearman's Rank Correlation Co-efficient , Problems on finding the best pair of judgements, Bivariate Distribution* *Regression Analysis:* *Regression - Definition and Uses, Regression Coefficients, Regression Equations, Types of Regression Equations, Regression Equation of X on Y and Regression Equation of Y on X, Relationship between Correlation and Regression Coefficients, Problems on the Relationship between the Coefficients, Finding the corrected Correlation Coefficient values by correcting the wrongly entered inputs*
UNIT V: *Testing of Hypotheses -Testing Procedures, Definition of test statistic t and its uses t-test, Small Sample tests Testing Procedure, t-test - Test for Single Mean, Test for two Sample Means, t Test Statistic, when sample standard deviations are not known, but Population Standard Deviations are known* *Chi-Square distribution- Definition and its Uses, Testing Procedure, Test based on Goodness of fit, Testing the Independence of Attributes using Chi-Square* *F-test - Test Statistic of F-test, Uses and testing Procedures, Testing the equality of variance using F distribution, Analysis of Variance – Definition and Uses, testing procedure, ANOVA - One Way Classification*

Learning Resources	***Theory:*** *1.* Pillai, R.S.N, Bagavathi, V. (2009),Statistics,Theory and Practice,7thEdition,S.ChandLtd,NewDelhi. *2.* Gupta, S.P. (2012), Statistical Methods, 4th Edition, Sultan Chand & Sons, New Delhi.	*3.* Khan and Khanum, (2008), Fundamentals of Bio Statistics, 3rd Edition, Ukaaz Publications, Hyderabad. *4.* Ken Black, (2013), Business Statistics for Contemporary Decision Making, 7th Edition, John Wiley Publications

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-	20%	-	20%	-
Level 3	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
Level 4	Analyze	20%	-	20%	-	20%	-	20%	-	20%	-
Level 5	Evaluate										-
Level 6	Create										-
	TOTAL	100%		100%		100%		100%		100%	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.

Course Designers	
Experts from Academic	Internal Experts
Dr.M.A.Baskar, Professor & Head, Dept. Of Mathematics, Loyola college, Chennai	S. Suruthi, Assistant Professor, Dept. Mathematics and Statistics, FSH, SRMIST
Dr.P.Dhanavanthan, Professor & Head, Dept. Of statistics, Pondicherry University	

Course Code	UBT22202J	Course Name	Biology-II	Course Category	C	*Professional Core Course*	L	T	P	C
							3	0	2	4

Pre-requisite Courses	NIL	Co-requisite Courses	NIL	Progressive Courses	NIL
Course Offering Department	Biotechnology	Data Book / Codes/Standards	NIL		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning	Program Learning Outcomes (PLO)

		Bloom's Level
CLR-1 :	To know the importance of nutrition and the various forms it is undertaken	
CLR-2 :	Understanding the necessity and importance of gaseous exchange in organisms	
CLR-3 :	To know the various transport mechanisms present in plants and animals	
CLR-4 :	To provide a basic idea of the ecology and its effect on the biosphere	
CLR-5 :	To gain knowledge on the evolutionary path taken by the organisms over a period of time	
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	
CLO-1 :	Candidate gains knowledge on the various nutrition patterns in the living organism	*1*
CLO-2 :	Helps the candidate in knowing the function of respiration	*2*
CLO-3 :	The candidate will gain knowledge on the transport mechanisms in plant and animals	*2*
CLO-4 :	The candidate will come to know the importance of ecology and its conservation	*3*
CLO-5 :	Evolutionary study will give the candidate knowledge on processes undergone during the evolutionary process	*2*

	1 Disciplinary	2 Critical Thinking	3 Problem Solving	4 Analytical	5 Research Skills	6 Team Work	7 Scientific	8 Reflective Thinking	9 Self-Directed	10 Multicultural	11 ICT Skills	12 Life Long Learning	13 PSO - 1	14 PSO - 2	15 PSO – 3
CLO-1 :	*H*	H	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-2 :	*H*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	*H*	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
CLO-5 :	*H*	-	-	-	-	*H*	*H*	*H*	-	-	-	-	-	-	-

UNIT- I: Heterotropic Nutrition

Forms of heterotropic nutrition, Feeding mechanisms, Dietary reference values, Malnutrition

PRACTICALS

1. Measuring rates of photosynthesis
2. To investigate gaseous exchange in leaves

UNIT- II: Gaseous Exchange

Cell Respiration- Aerobic, Anaerobic, Gaseous exchange in invertebrates, Mammals

PRACTICALS

1. Use of respirometer to measure oxygen uptake in small invertebrates
2. To investigate the oxidation of a krebs cycle intermediate

UNIT- III: Transport

Plant water relations, Transpiration, Ascent of water in Xylem, Blood Vascular system, oxygen transport

PRACTICALS:

1. To Investigate Osmosis In Living Plant Cells
2. To determine the water potential of a plant tissue

UNIT –IV: Ecology

Approaches to ecology, Energy flow and Biogeochemical cycles, Food webs, Ecological pyramids, Community ecology, population ecology

PRACTICALS

1. To investigate the air content of a soil sample
2. To investigate the relative proportions of solid particles in a soil sample
3. To investigate the pH of soil and water samples

UNIT - V: Evolution- history of life

Theories of origin of evolution, Nature of the earliest organisms, Theory of evolution, Natural selection, Evidence for theory of evolution

Learning Resources	**1. D.J. Taylor, N.P.O. Green, G.W.Stout. Biological Science, Cambridge Publications** **2. Lisa A. Urry, Michael L. Cain, Steven Alexander Wasserman, Peter V. Minorsky, Rebecca B. Orr · Pearson. Campbell Biology.**

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 2	Understand	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 3	Apply	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 4	Analyze	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers	
Experts from Higher Technical Institutions	**Internal Experts**
1. Dr. Sumathi, Associate Professor, MGR University Chennai 2. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai	Dr. N. Prasanth Bhatt, Assistant Professor, SRM institute of Science and Technology

Course Code	UJK22201L	Course Name	Communication Skills	Course Category	JK	*Life Skill Course*	L	T	P	C
							0	0	4	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	ENGLISH	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	*To make the students learn the native speakers' accent.*	Bloom's Level
CLR-2:	*To educate them about word stress of English*	
CLR-3:	*The enable them to participate in group discussion and debates*	
CLR-4:	To improve the listening and speaking abilities in English	
CLR-5:	*LSRW skills all together is developed in every student*	
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	
CLO-1:	*Master the sound systems of English*	4
CLO-2:	*Have a better Word stress, Rhythm and Intonation*	4
CLO-3:	*Develop Neutral Accent*	4
CLO-4:	*Participate in any conversation with any native speaker*	4
CLO-5:	*Clear any standardized tests conducted to measure the English language ability like IELTS and TOEFL*	4

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
H	-	-	-	-	-	-	-	-	-	-	-	-	-	*H*
H	-	-	-	-	-	-	-	-	-	-	-	-	-	H
H	-	-	-	-	-	-	-	*H*	-	-	-	-	-	-
H	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
H	-	-	-	-	-	-	-	-	-	-	-	-	-	*H*

UNIT I

Listening

Techniques of effective listening

Listening and comprehension

Probing questions

Barriers to listening

Speaking

Pronunciation

Enunciation

Vocabulary

Fluency

Common Errors

UNIT II

Reading

Techniques of effective reading

Gathering ideas and information from a given text

I. Identify the main claim of the text

II. Identify the purpose of the text

III. Identify the context of the text

IV. Identify the concepts mentioned

Evaluating these ideas and information

I. Identify the arguments employed in the text

II. Identify the theories employed or assumed in the text

Interpret the text

I. To understand what a text says

II. To understand what a text does
III. To understand what a text means

UNIT III

Writing and different modes of writing

i) Clearly state the claims
ii) Avoid ambiguity, vagueness, unwanted generalizations and oversimplification of issues
iii) Provide background information
iv) Effectively argue the claim
v) Provide evidence for the claim
vi) Use examples to explain concepts
vii) Follow convention
viii) Be properly sequenced
ix) Use proper signposting technique
x) Be well structured
   a. Well-knit logical sequence
   b. Narrative sequence
   C. Category groupings

xi) Different modes of writing

E-mails
Proposal writing for higher studies
Recording the proceedings of meeting
Any other mode of writing relevant for learners

UNIT IV

Digital Literacy

Role of digital literacy in professional life
Trends and opportunities in using digital technology in workplace
Internet basics
Introduction to MS Office tools

I. Paint
II. Office
III. Excel
IV. Powerpoint

Effective use of social media

Introduction to social media websites
Advantages of social media
Ethics and etiquettes of social media
How to use Google search better
Effective ways of using social media
Introduction to Digital marketing

UNIT V

Non-verbal communication

Meaning of non-verbal communication
Introduction to modes of non-verbal communication
Breaking the misbeliefs
Open and closed body language

Eye contact and facial expression Hand gestures **Learning from experts Activities based learning**

Learning Resources	1. Horizon- English Text Book – Compiled and Edited by the faculty of English Departement, FSH, SRMIST, 2020 2. ***English Grammar in Use by Raymond Murphy*** 3. *Raymond Murphy, Intermediate English Grammar, Cambridge University Press, 2007* 4. *R.P. Bhatnagar, English for Competitive Examinations, Trinity Press, 3rd Edition,2016* ***5.*** *http://www.aptitudetests.org/verbal-reasoning-test* ***6.*** *https://www.assessmentday.co.uk/aptitudetests_verbal.htm*

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)							
		CLA – 1 (20%)		CLA – 2 (20%)		CLA – 3 (30%)		CLA – 4 (30%)#	
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	-	10%	-	10%	-	10%	-	10%
Level 2	Understand	-	10%	-	10%	-	10%	-	10%
Level 3	Apply	-	40%	-	40%	-	40%	-	40%
Level 4	Analyze	-	40%	-	40%	-	40%	-	40%
Level 5	Evaluate	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers	
External Experts	Internal Experts
Prof. Daniel David, Prof & Head, Department of English, MCC, Chennai	*Dr. Shanthichitra, Associate Professor, & Head, Department of English, FSH,SRMIST* *Dr K B Geetha, Assistant Professor, Department of English, FSH, SRMIST*

Course Code	UNS22201L/ UNC22201L/ UNO22201L/ UYG22201L	Course Name	NSS/NCC/NSO/YOGA	Course Category	EA	Extension Activity	L	T	P	C
							0	0	0	0

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	***	Data Book / Codes/Standards	Nil		

Assessment is Fully Internal

Learning Assessment	
Assessment Tools	**Marks**
Continuous Learning Assessment –I (CLA-I)	20 Marks
Continuous Learning Assessment –II (CLA-II)	30 Marks
Continuous Learning Assessment –III (CLA-III)	30 Marks
Continuous Learning Assessment –IV (CLA-IV)	20 Marks
Total Marks	100 Marks

SEMESTER III

Course Code	UBT22301J	Course Name	CELL BIOLOGY	Course Category	C	Professional Core Course	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	**Biotechnology**	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to,
CLR-1 :	Understanding the organization of cells
CLR-2 :	Understanding the function of cells
CLR-3 :	Knowledge on division of cells and proloiferation of cells
CLR-4 :	Knowledge on cell signaling
CLR-5 :	Learning different cell types and their functions

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Bloom's Level
CLO-1 :	To learn about classification of cells and their transport mechanism	2
CLO-2 :	Gathering knowledge on cell organelles	3
CLO-3 :	Applying knowledge on cell division and cell proliferation process	3
CLO-4 :	Applying knowledge on cell signaling process	3
CLO-5 :	Having knowledge on specilaised types of cells and their functions	3

Learning	Program Learning Outcomes (PLO)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
CLO-1 :	H	H	H	H	H	H	M	M	M	L	-	H	-	-	-
CLO-2 :	L	H	H	H	H	H	M	M	M	L	-	H	-	-	-
CLO-3 :	L	H	H	H	H	H	M	M	M	L	-	H	-	-	-
CLO-4 :	L	H	H	H	H	H	M	M	M	L	-	H	-	-	-
CLO-5 :	L	H	H	H	H	H	M	M	M	L	-	H	-	-	-

UNIT 1-INTRODUCTION TO CELL BIOLOGY

Overview of cell biology, Classification of cell, Cell types, Development of cell theory, Different theories on cells, Prokaryotic cell organization, Eukaryotic cell organization, active transport, passive transport, Diffusion, reverse osmosis, osmotic potential, membrane architecture, Vacuoles, peroxisomes, Nuclear compartment. Centrioles,

PRACTICALS:

1. Introduction to the cell biology laboratory- Lab safety discussion,
2. Estimation of hemoglobin by Sahli's method
3. Isolation of Erythrocyte Membrane Proteins

UNIT 2- CELL ORGANELLES

Voltage gated channel, Membrane potential, Introduction to cell organelles, Golgi apparatus, Mitochondria, Micro bodies, endoplasmic reticulum, Cytoskeleton structures, Microtubules, microfilament, Intermediate filament, ribosomes, Lysozymes, basal bodies

PRACTICALS:

1. Identification of giant chromosome in chironomous larvae
2. Cell Counting and viability

UNIT 3- CELL CYCLE AND REGULATION

Introduction Cell cycle, Cell cycle, Regulation of cell cycle, Mitosis-I, Mitosis-II, Meiosis-I, Meiosis-II, Checkpoints in cell cycle, Introduction to apoptosis, Discussion.

PRACTICALS:

1. Observation of Barr bodies
2. Protoplast Isolation.

UNIT 4- SIGNAL TRANSDUCTION

Akt/PKB signaling, Akt/PKB signaling, AMPK signaling, , cAMP dependent pathway, JAK-STAT signaling, cAMP dependent pathway, Enzyme Kinetics, PI3K signaling, Introduction to Kegg's pathway, Cell- ECM interaction

PRACTICALS:

1. Staining for Cell Viability and Apoptosis

UNIT 5- SPECIALIZED CELLS

Introduction to Specialized cells, Nerve cells, Microtubules- motile appendages, Microfilament-based movement- intracellular transport, Muscle cells, Functioning of muscle cells, Importance of calcium in muscle movement, Cells of vision, Cells of vision, Pancreatic cells, Pancreatic cells, Overall revision

PRACTICALS:

1. Blood Smear Preparation
2. Staining for Cell Viability and Apoptosis

Learning Resources	1. *Alberts, Bruce, "Molecular Biology of Cell", 5th Edition, Garland Science, 2008* 2. *Veer Bala Rastogi, "Fundamentals of Molecular Biology"Ane Books Pvt.Ltd, 2008.*	1. *Robert Weaver. "Molecular Biology" 5th edition, 2011.* 2. *Cooper,G.M. "The Cell: A Molecular Approach, 4th Edition, ASM Press, 2007.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 2	Understand	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Apply	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Level 4	Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. *Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai*		DR.D.THIRUMURUGAN, SRM IST DR.N.PRASANTH BHATT, SRM IST

Course Code	UBT22302J	Course Name	BIOCHEMISTRY	Course Category	C	Professional Core Course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	*BIOTECHNOLOGY*	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning
CLR-1 :	*Understanding the classification of carbohydrates*	Bloom's level
CLR-2 :	*Understanding the importance of lipids*	
CLR-3 :	*Understanding the importance of bonds in structure integrity*	
CLR-4 :	*Knowledge on structure of nucleic acid*	
CLR-5 :	*Knowledge on importance of vitamins and minerals*	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning
CLO-1 :	*To analyze the importance of carbohydrates, requirement for living organism*	3
CLO-2 :	*To analyze the importance of lipids for living organism*	3
CLO-3 :	*Strong basis for understanding protein structure*	3
CLO-4 :	*Better knowledge gained in the structure of DNA and RNA*	3
CLO-5 :	*Analyzing ability against the vitamins importance and deficiency disease*	3

Program Learning Outcomes (PLO)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO – 2	PSO – 3
CLO-1 :	*H*	*H*	-	*H*	*M*	-	-	-	H	H	-	-	M	H	H
CLO-2 :	*H*	*H*	*H*	*H*	*H*	-	-	-	H	H	-	-	M	H	H
CLO-3 :	*H*	*H*	-	*H*	*H*	-	-	-	H	H	-	-	M	H	H
CLO-4 :	*H*	*H*	-	*H*	*H*	-	-	-	H	M	-	-	M	H	H
CLO-5 :	*H*	*H*	*H*	*H*	*H*	-	-	-	H	H	-	-	M	H	H

UNIT 1- INTRODUCTION TO *carbohydrates*

Classification of carbohydrates, Structure of carbohydrates- monosacharides (straight chain), monosaccharides (Ring structure), Disaccharides, homoploysaccharides, heteroploysaccharides, Properties of carbohydrates

PRACTICALS:

1. *Introduction to Biochemistry lab-Lab safety guidelines*
2. *Regeant preparation for carbohydrate analysis*
3. *Sugar analysis-Glucose, Fructose, Galactose, lactose, Malatose, Mannose, sucrose, starch & dextrin*

UNIT 2- LIPIDS

Introduction and classification of lipids- simple lipids, Compounds lipids, Derived lipids, Physical and chemical properties of fats.

UNIT 3- AMINO ACIDS

Introduction of amino acids, Classification of amino acids, Properties of amino acids, Protein classification- primary, secondary, tertiary, quarternary

PRACTICALS:

1. *Amino acid analysis-Histidine, tyrosine, cysteine, arginine. tryptophan, methionine*
2. TLC –amino acid

UNIT 4- NUCLEIC ACIDS

Introduction- nucleic acid, Structure of Purines and Pyrmidines, Unusual bases, Nucleotides and Nucleosides, DNA double helical structure, Forms of DNA, Types of RNA, Nucleic acid sequencing.

UNIT 5- ***Vitamins & Minerals***

Classification, Fat soluble vitamins- A, D, E, K, Water soluble vitamins- B1, B2, B3, B5, B6, B12.. Minerals- macro minerals, micro minerals

PRACTICALS:

1. *Paper chromatography*

Learning Resources	
1.	Robert K. Murray, David Bender, Kathleen M. Botham and Peter J. Kennelly,Harpers"Illustrated Biochemistry" 29th Edition, Mc Graw HilL 2012.
2.	Lehninger, Nelson and Cox, "Principles of Biochemistry", 6th edition, W.H. Freeman & Company, 2013.
1.	Voet&Voet, "Fundamentals of Biochemistry", John Willey & Sons, 2010. Jeremy M. Berg, John L. Tymoczko and LubertStryer, Biochemistry, 4th Edition , Freeman and Company, 2011

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%

Level 2	Understand	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Apply	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Level 4	Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers	
Experts from Higher Technical Institutions	**Internal Experts**
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. *Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai*	DR.D.Thirumurugan, SRM IST DR.N.Prasanth Bhatt, SRM IST

Course Code	UBT22303J	Course Name	MICROBIOLOGY	Course Category	C	Professional Core Course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1 :	*Understanding the taxonomic classification of microorganisms based on convention*	Bloom's level
CLR-2 :	*understanding the techniques used for visualizing and identifying microorganism*	
CLR-3 :	*Knowledge on structure and organization of bacteria*	
CLR-4 :	*Knowledge on structure and organization of viruses and fungi*	
CLR-5 :	*Learning techniques on preparation and sterilization of media*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	
CLO-1 :	*To identify the microorganism based on taxonomical rules*	*3*
CLO-2 :	*Application of techniques for identifying microorganism using technologies*	*3*
CLO-3 :	*Applying knowledge to identify bacteria based on structure and functional organelles*	*3*
CLO-4 :	*Applying knowledge to identify viruses and fungi based on structure and functional organelles*	*3*
CLO-5 :	*Having knowledge on media preparation and sterilization in microbiology for maintaining GLP*	*3*

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
H	-	-	*H*	-	-	-	-	*H*	*H*	-	-	-	-	-
H	*H*	*H*	*H*	*H*	-	*M*	-	*H*	*H*	-	-	-	-	-
H	-	-	*H*	-	-	*M*	-	*H*	*H*	-	-	-	-	-
H	-	-	*H*	-	-	-	-	*H*	*M*	-	-	-	-	-
H	*H*	*H*	*H*	*H*	*M*	*M*	-	*H*	*H*	-	*M*	-	-	-

Unit 1 **: Introduction to Microbiology**

Microbiology- Introduction, Biogenesis vs Abiogenesis, Contribution of Louis Pasteur and Anton von Leeuwenhoe, Koch Postulation, Scope of microbiology, classification – Five kingdoms and Three kingdoms, Woese domain system, Microbial Taxonomy: Definition and systematics, Numerical taxonomy, Chemical taxonomy, Serological taxonomy, Genetic taxonomy, Nomenclatural rules and identification

PRACTICALS:

1. Principles and method of sterilization– Heat, Filtration and Radiation
2. Preparation of media (Solid, Semi solid and Liquid)

Unit 2 : **Microscopy and Staining techniques**

Principles of Microscopy, Applications of Microscopy**,** Types of Microscopy- Bright field & Dark Field, Types of Microscopy- Phase Contrast, Fluorescence Microscopy, Smear preparation and simple, Staining: Gram staining, Spore and flagellar staining, Staining: Capsule staining- Negative, Acid-fast staining.

PRACTICALS:

1. Smear preparation and simple staining
2. Gram's staining technique
3. Spore staining technique

Unit 3 : **Microbial Cytoskeleton**

Introduction into morphology of bacteria, Cell wall of Gram negative bacteria, Archaebacterial Cell wall, Cell wall synthesis, Capsule types, composition, function, Cell membranes and Periplasmic space, Structure and function and types of Flagella, Structure and function cilia and pili, Internal membrane systems, Functions of cytoplasmic matrix and nucleoid, Inclusion bodies and Ribosomes

PRACTICALS:

1. capsular staining technique
2. Staining of Fungi – LPCB
3. Demonstration of motility by hanging drop method

Unit 4 : **Fungi and viruses**

Mycoplasma**,** Endospore-Structure & Function, Structure and organization of fungi- cell wall structure and composition, Fungal cell wall synthesis, Structure and organization of viruses, General property of viruses, Viral Replication, Ultra structure– Bacteriophages, Life cycle of Bacteriophages, Sub-viral particles: Virusoids, Prions

PRACTICALS:

1. Enumeration of Bacteria Serial dilution, Pour plate and Spread plate method,
2. Pure culture technique Streak plate method and study of colony morphology
3. Biochemical tests- IMViC

Unit 5 : Sterilization and growth

Sterilization and disinfection**-** Physical sterilization, chemical sterilization, Chemotherapeutical agents action - mode of action, Nutrients and types growth factor - Micro, Macro and growth factor, Growth curve, Nutritional types of microorganisms, Physical factors influencing the growth, Chemical factors influencing the growth

PRACTICALS:

1. Biochemical tests- TSI 2. Antibiotics sensitivity test

Learning Resources	*Text Books:* *1. M.J. Pelezar, E.C.S. Chan and N.R. Krieg "Microbiology"– Krieg Tata McGraw Hill Publications, 2007.* *2. Prescott, Harley and Klein, "Microbiology", McGraw Hill publications, Fifth edition, 2003.*	*Reference:* *1. Jacquelyn G.Black, "Microbiology -Principles and Explorations" Wiley publications 2008.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 2	Understand	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Apply	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Level 4	Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers

Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. *Dr. Sumathi, Associate Professor, SRMC, Porur, Chennai*	Dr.D.Thirumurugan, SRM IST Dr.N.Prasanth Bhatt, SRM IST

Course Code	UBT22S01T	Course Name	GOOD LABORATORY PRACTICES- I	Course Category	S	SKILL BASED	L	T	P	C
							0	1	0	1

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	*To have knowledge on handling of pipettes*	Bloom's Level
CLR-2:	*To gain knowledge on reagent handling*	
CLR-3:	*To have practice on preparing chemical solutions*	
CLR-4:	*To have knowledge on microbiology practices and use of equipments*	
CLR-5:	*To have practice in maintaining cultures and preservation*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning
CLO-1:	*Handle various types of pipettes and maintanence of the same*	4
CLO-2:	*Handle the reagents carefully in a safe manner*	4
CLO-3:	*Prepare solutions required during experiments*	4
CLO-4:	*Handle the microbiology procedures without any difficulty*	4
CLO-5:	*Maintain and preserve microbial cultures*	4

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	*H*	*H*	*H*	*M*	*H*	*M*	*H*	*H*			*H*	-	-	-
H	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*			*H*	-	-	-
H	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*			*H*	-	-	-
H	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*			*H*	-	-	-
H	*H*	*H*	*H*	*H*	*H*	*M*	*H*	*H*			*H*	-	-	-

Practice classes

1. Pipette handling procedure- Glass pipette handling, Micropipette handling, Serological Pipette Controller
2. Reagent handling
3. Chemical Solution Preparation- Preparation of Acids and Alkali solutions, Buffer Solutions, Electrolytic solutions.
4. Microbiology related practices- Petri plate handling, incubator maintenance, Laminar air flow cleaning and maintenance, other equipment's related to microbiology
5. Culture maintenance and handling

Assessment Fully internal

Assessment tools	Marks
Continuous Learning Assessment –I (CLA-I)	20
Continuous Learning Assessment –II (CLA-II)	30
Continuous Learning Assessment –III (CLA-III)	30
Continuous Learning Assessment –IV (CLA-IV)	20
Tota	100

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers	
Experts from Higher Technical Institutions	**Internal Experts**
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. *Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai*	*Dr. N. Prasanth Bhatt*

Course Code	UES22AE1T	Course Name	ENVIRONMENTAL STUDIES	Course Category	AE	Ability Enhancement Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Computer Applications*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1 :	*teach the importance of environment*	
CLR-2 :	*impart the knowledge about ecosystem*	
CLR-3 :	*teach about Biodiversity*	
CLR-4 :	*create awareness about environmental pollution*	
CLR-5 :	*understand about Environment Protection*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Bloom's Level
CLO-1 :	*gain knowledge on the importance of natural resources and energy*	*4*
CLO-2 :	*understand the structure and function of an ecosystem*	*4*
CLO-3 :	*imbibe an aesthetic value with respect to biodiversity, understand the threats and its conservation and appreciate the concept of interdependence*	*4*
CLO-4 :	*understand the causes of types of pollution and disaster management*	*4*
CLO-5 :	*observe and discover the surrounding environment through field work*	*4*

Program Learning Outcomes (PLO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	Ethical Reasoning	Community Engagement	ICT Skills	Leadership Skills	Life Long Learning
-	-	-	-	-	*H*	*H*	-	-	-	-	*H*	-	-	-
-	-	-	-	-	*H*	-	-	-	-	-	*H*	-	-	-
-	-	-	-	-	-	*H*	-	-	-	-	-	-	-	-
-	-	-	-	-	-	*H*	-	-	-	-	-	-	-	-
-	-	-	-	-	*H*	-	-	-	-	-	*H*	-	-	-

UNIT I - INTRODUCTION TO NATURAL RESOURCES/ENERGY

Natural Resources – Definition – Scope and Importance – Need for Public Awareness – Renewable and Non-renewable Resources: Natural resources and associated problems. Forest resources and over-exploitation – Water resources and over-utilization – Mineral resource extraction and its effects - Food resources - food problems and Modern agriculture - Energy resources and its future.

UNIT II – ECOSYSTEMS

Concept of an ecosystem-structure and function of an ecosystem-producers, consumers and decomposers- ecological succession- food chains(any 2 Examples)- food webs(any 2 Examples)-ecological pyramids.

UNIT III-ENVIRONMENTAL POLLUTION /DISASTER MANAGEMENT

Definition-causes, effects and control measures of : Air, Water and Soil pollution- e-waste management- Disaster management: Natural and man-made- food/earthquake/cyclone, tsunami and landslides.

UNIT IV - SOCIAL ISSUES AND THE ENVIRONMENT

Sustainable development- Climate change: global warming, acid rain, ozone layer depletion and nuclear radiation- Environment Protection Act (any 2) air, water, wildlife and forest.

UNIT V - HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations - Population explosion—Family Welfare Programme - Environment and human health - Human rights - Value education - HIV/AIDS - Women and Child Welfare - Role of Information Technology in environment and human health.

FIELD WORK

Students will visit any one of the following place of interest and submit a written report by the end of the semester:

1. Visit to a hospital/industry/canteen for solid waste management
2. Visit to a chemical industry to study about the practices followed there for waste disposal
3. Visit to Vandalur zoo for study of animal conservation/plants- flora and fauna
4. Study of simple ecosystems-lake/hill slopes
5. Naming the trees in the campus at SRM
6. Study of common plants, insects, birds in the neighbourhood
7. Study of common diseases and their prevention
8. Optional: Street plays and rally for awareness of obesity/diabetes/ vitamin D deficiency/health issues/ waste management/ solid waste management/ no plastics/ energy consumption/wild life protection.

Learning Resources	**Theory:** 1. Bharucha Erach, (2013), Textbook of Environmental Studies for Undergraduate Courses (Second edition). Telangana, India: Orient BlackSwan. 2. Basu Mahua, Savarimuthu Xavier, (2017), SJ Fundamentals of Environmental Studies. Cambridge, United Kingdom: Cambridge University Press 3. Dr.R.Jeyalakshmi.2014.,Text book of Environmental Studies, Devi publications, Chennai 4. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380013, India, Email:mapin@icenet.net (R)

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-	20%	-	20%	-
Level 3	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
Level 4	Analyze	20%	-	20%	-	20%	-	20%	-	20%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers

Experts from Industry	Experts from Academic	Internal Experts
1. Mr. Suresh S, Program Head, Hello FM	*1. Dr. G Balasubramania Raja, Prof & Head, Manonmaniam Sundranar University* *Mail- gbs_raja@yahoo.com*	*1. Dr. Rajesh R, Head, SRM IST*
		2.Dr.S.Albert Antony Raj, Associate Professor and Head, SRMIST

Course Code	UJK22301T	Course Name	UNIVERSAL HUMAN VALUES	Course Category	JK	*Life Skill Course*	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	ENGLISH	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	*generate in students a sensitivity to current regional and national issues such as gender marginalization eco sensitivity, vision for the nation and general humanness*	Bloom's Level
CLR-2:	*an expanded consciousness with a mind to accommodate all is developed*	
CLR-3:	*the ability to accept all and to co- exist is initiated*	
CLR-4:	*create community connectivity and interdependence*	
CLR-5:	*instill intrinsic link between freedom and responsibility for both individuals and communities*	
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	
CLO-1:	*become sensitive toward every living life and be able to respect every religion recognizing the universal values*	4
CLO-2:	*every way of life and culture will kindle the curiosity in them to know them and will be able appreciate the beauty in it*	4
CLO-3:	*the presumptuous or prejudiced mentality will be overcome by them*	4
CLO-4:	*critical thinking and accommodative nature will become so natural way of thinking for them*	4
CLO-5:	*will be able to explore their own emotions, hopes & fear and be able to describe them verbally*	4

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	Ethical Reasoning	Community Engagement	ICT Skills	Leadership Skills	Life Long Learning
H	-	-	-	-	-	-	-	-	-	*H*	-	-	-	-
H	-	-	-	-	-	-	-	-	*H*	-	-	-	-	-
H	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
H	*H*	-	-	-	-	-	-	-	-	-	-	-	-	-
H	-	-	-	-	-	-	*H*	-	-	-	-	-	-	-

UNIT I

LOVE & COMPASSION

1. FORMS OF LOVE
2. DEFENITIONS FOR LOVE, COMPASSION, EMPATHY
3. DISCUSSION ON PERSONALITIES LIKE BEGAN, PAARI VENDHAR FROM SANGAM LITERATURE
4. LEE MOKOBE'S POEM 'ON BEING A TRANS'

TRUTH

1. THE VALUE OF TRUTH, UNIVERSAL TRUTH
2. MYTHOLOGY OF HARISHCHANDRAN
3. BACON'S ESSAY OF TRUTH
4. THE POWER OF TRUTH

The students will be introduced to Forms of love – for self, parents, family, friend, spouse, community, nation, humanity and other beings both for living and non-living. Definition for Love, compassion, empathy, sympathy and non-violence will be explained to the students through the texts. Universal truth, truth as value, truth as fact (veracity, sincerity, honesty among others will be introduced. Personalities and individuals from history for practicing compassion and love and truth and narratives and anecdotes from history, literature including local folklore will be discussed for the students to get better understanding of the concepts of Love and Compassion and Truth. What will one gain or lose by practicing or by not practicing these values will be instilled in the learners 'mind through discussions. The learners will be allowed a space to express their experience as an individual and in a group. Situations will be simulated in the class room for the students to get better understanding of Love and Compassion and Truth. Case studies will be discussed in the class room for learners to have a deeper understanding.

UNIT II

NON- VIOLENCE

1. MAHATMA GANDHI'S NON-VIOLENCE
2. D.H LAWRENCE' POEM SNAKE
3. ASHOK MITHRAN'S SHORT STORY – RAT
4. ANECDOTE FROM ANNIE BESANT AND ALBERT CAMU'S LIFE

RIGHTEIUSNESS

1. DISCUSS RIGHTEOUSNESS
2. DHARMA AND ARAM – THE DIFFERENCE
3. RAMA, LAKSHAMAN, RAVANA AND SURPANAKA- A DISCUSSION

4. SIX BLINDMEN AND AN ELEPHANT

The students will be introduced to Non-violence. Its need. Love, compassion, empathy sympathy for others as pre-requisites for non-violence will be explained through the given text. Ahimsa as Non-Violence and Non killing as a virtue is to be instilled in a learner. Righteousness and Dharma and its prioritization is to be discussed through the given text. Personalities and individuals from history for practicing Nonviolence and Righteousness is to be introduced and narratives and anecdotes from history, literature including local folklore will be discussed for the students to get better understanding of the concepts of Nonviolence and Righteousness. What will one gain or lose by practicing or by not practicing these values will be instilled in the learners' mind through discussions. The learners will be allowed a space to express their experience as an individual and in a group. Situations will be simulated in the class room for the students to get better understanding of Non-Violence and Righteousness. Case studies will be discussed in the class room for learners to have a deeper understanding.

.

UNIT III

PEACE

1. DEFINITION OF PEACE
2. HARMONY AND BALANCE WITH ORGANISATION AND SELF
3. MARTIN LUTHER KING'S I HAVE A DREAM
4. PROMETHEUS UNBOUND BY SHELLEY

SERVICE

1. MOTHER THERESA AND HER DARK LETTERS
2. LEE KUAN YEW' S LIFE STORY & NATURE OF DIFFERENT PROFESSIONS
3. THEMES OF TAGORE'S WHERE THE MIND IS WITHOUT FEAR
4. THEMES OF IF POEM BY KIPLING

The students will be introduced to what is peace and service. The need of peace, relation with harmony and balance and Individuals and organizations that are known for their commitment to peace will be discussed through the texts. What is service? Forms of service, for self, parents, family, friend, spouse, community, nation, humanity and other beings- living and non-living, persons in distress or disaster will be discussed through the texts. Peace and service as a virtue is to be instilled in a learner. Personalities and individuals from history for practicing Peace and service is to be introduced and narratives and anecdotes from history, literature including local folklore will be discussed for the students to get better understanding of the concepts of Peace and service. What will one gain or lose by practicing or by not practicing these values will be instilled in the learners' mind through discussions. The learners will be allowed a space to express their experience as an individual and in a group. Situations will be simulated in the class room for the students to get better understanding of Peace and service. Case studies will be discussed in the class room for learners to have a deeper understanding.

UNIT IV

RENUNCIATION

1. SELF- RESTRAIN, WAYS TO OVERCOME GREED, THE ART OF LETTING GO
2. BUDHA'S LIFE STORY
3. THE SHORT STORY OF ANTON CHECKOV- THE BET
4. RAMA THE SON AND BARATHA THE BROTHER AS EPITOMES OF RENUNCIATION

GRATITUDE

1. THE IDEA OF UNIVERSE TO TEACH HUMILITY AND GRATITUDE
2. THANKFULLNESS TO THE GIFT OF LIFE AND THE ABILTY TO COUNT ONE'S BLESSINGS
3. GRATEFUL TO EVERY LIFE TO MAKE OTHERS' LIFE EASIER
4. THEME OF THE POEM THE CRUTCHES BY BERTOLD BRECHT

The students will be introduced to Renunciation and gratitude. Self-restrain and ways of overcoming greed. Renunciation and gratitude with action as true renunciation and practice of gratitude as a virtue will be discussed through the texts. Personalities and individuals from history for practicing renunciation and possessing gratitude is to be introduced and narratives and anecdotes from history, literature including local folklore will be discussed for the students to get better understanding of the concepts. What will one gain or lose by practicing or by not practicing these values will be instilled in the learners' mind through discussions. The learners will be allowed a space to express their experience as an individual and in a group. Situations will be simulated in the class room for the students to get better understanding of renunciation and gratitude. Case studies will be discussed in the class room for learners to have a deeper understanding.

UNIT V

SCREENING OF MOVIES - THE WATER BY DEEPA MEHTA
THE TWO POPES BY FERNANDO MEIRELLES
ASSIGNMENT AND SEMINAR TO CHECK THE PERSONALITY OF THE LEARNER AND TO HAVE AN UNDERSTANDING OF HIS/HER ACQUIRED COGNIZANCE PERTAINING TO HUMAN VALUES.

Learning Resources	***Theory:*** Horizon- English Text Book – Compiled and Edited by the faculty of English Department, FSH, SRMIST, 2020

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-	20%	-	20%	-

Level 3	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
Level 4	Analyze	20%	-	20%	-	20%	-	20%	-	20%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
Prof. Daniel David, Prof & Head, Department of English, MCC, Chennai	Faculty Name, SRMIST
	Dr. Shanthichitra, Associate Professor, & Head, Department of English, FSH,SRMIST
	Dr K B Geetha, Assistant Professor, Department of English, FSH, SRMIST

Course Code	UBT22D01T	Course Name	TAXONOMY	Course Category	D	DISCIPLINE SPECIFIC	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	BIOTECHNOLOGY	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning Outcome
CLR-1 :	To expand knowledge on Evolution and microbial diversity	
CLR-2 :	*To understand bacterial taxonomy*	
CLR-3 :	*To understand plant taxonomy*	
CLR-4 :	*Understand the rulesf or naming of organisms*	
CLR-5 :	*To expand knowledge on biotaxonomy*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Bloom's level
CLO-1 :	*Student will be able to understand the concepts microbial taxonomy and methods of nomenclature.*	1
CLO-2 :	*Student will be able to classify the microorganisms based on classical and advanced methods.*	2
CLO-3 :	*Demonstrate a knowledge on taxonomy*	2
CLO-4 :	*Apply knowledge of the standard rules of classification systems to categorise microorganisms*	2
CLO-5 :	*Understand the rapidly evolving nature of taxonomy and systematic*	3

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
H	*M*	*M*	*H*	*M*	-	-	-	-	-	-	*M*	-	-	-
H	*M*	*M*	*H*	*M*	-	-	-	-	-	-	*M*	-	-	-
H	*M*	*M*	*H*	*H*	-	-	-	-	-	-	*H*	-	-	-
H	*H*	*H*	*H*	*H*	-	-	-	-	-	-	*H*	-	-	-
H	*H*	*H*	*H*	*H*	-	-	-	-	-	-	*H*	-	-	-

UNIT I: GENERAL INTRODUCTION TO MICROBIAL EVOLUTION

Historical resume of systematic, Importance of taxonomy, Aims and tasks of a taxonomist, Principles of classification, systematics and taxonomy, Concept of species, taxa, strain, Conventional, molecular and recent approaches to polyphasic bacterial taxonomy, Evolutionary chronometers, rRNA oligonucleotide sequencing

UNIT II: CLASSIFICATION OF ORGANISMS

Signature sequences, Protein sequences, Introduction to microbial taxonomy, General introduction and overview of Taxonomic ranks, Systems of classification: Hackles Three kingdom - W.H.Whitaker's Five kingdom - Cavalier Smith Six kingdom The three domain concept based on phylogeny, Phenotypic analysis (Morphological, Physiological and metabolic characteristics)

UNIT III: GENE PROFILING

Phenotypic analysis (Biochemical and Ecological characteristics, Fatty acid analysis)
Genetic analysis: i) DNA-DNA hybridization ii) DNA profiling iii) Multilocus sequence analysis iv) G+C ratio v) Genetic finger printing. Amino acid sequencing
Phylogenetic analysis:i) Nucleic acid sequencing ii) Analysis of individual genes iii) Multilocus gene sequence analysis iv) Whole genome sequence analysis

UNIT IV: Taxonomic analysis

Phylogenetic tree: Types
Modern trends in taxonomy:
i) Chemotaxonomy
ii) molecular systematics
iii) Numerical taxonomy
Bergey's manual and its importance,Concepts, Bergey's manual of systematic bacteriology, Binomial Nomenclature, general properties of bacterial groups, Introduction to Plant Taxonomy
Objectives of the science of plant taxonomy, Species definition, Species problems

UNIT V: Plant Identifcation

Botanical Nomenclature, Plant names and naming plants. Handouts Construction and Use of Keys for Plant identification, Vegetative Terminology Taxonomic Keys: their kinds, merits and demerits
Use of taxonomic keys International Code of Zoological Nomenclature (ICZN) Interpretation and application of important rules Zoological nomenclature and formation of scientific names of different taxa

Learning Resources	***Text Books:*** 1. *Judd et al., 2008. Plant Systematics—A Phylogenetic Approach, 3rd ed. Plus additional readings to be provided as PDFs on Canvas.*	***References:*** 1. *Madigan, M. T., Martinko, J. M., Dunlap, P. V. Clark, D. P. 2009. Brock Biology of Microorganisms. Twelfth edition, Pearson Education Inc, Pearson Benjamin Cummings, San Francisco.* 2. *Sneath, A. H. P., Mair, S. N. and Sharpe, E. M., Bergey's Manual of Systematic Bacteriology Vol. 2. Williams & Wilkins Bacteriology Symposium, Series No 2, Academic Press, London/New York*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%		40%		40%		40%		40%	-
Level 2	Understand	40%		40%		40%		40%		40%	-
Level 3	Apply	20%		20%		20%		20%		20%	-
Level 4	Analyze	-	-	-	-	-	-	-	-	-	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.

Course Designers

Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. *Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai*	

Course Code	UBT22D02T	Course Name	GROWTH AND REPRODUCTION	Course Category	D	*Discipline Specific Elective*	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology		Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	***Know about Microbial growth requirements***	
CLR-2:	*Understtand the reproduction in microorganisms*	
CLR-3:	***Know about plant growth requirements and reproduction***	
CLR-4:	*Know about the animal reproduction*	
CLR-5:	*Know about the human reproduction and development*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Bloom's Level
CLO-1:	**Understand about Microbial growth requirements**	2
CLO-2:	Understtand the reproduction in microorganisms	3
CLO-3:	**understand about plant growth requirements and reproduction**	2
CLO-4:	understand about the animal reproduction	2
CLO-5:	understand about the human reproduction and development	2

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
					-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-	-	-	-

Unit 1 **: Microbial Growth**
Microbial growth in response to environment -Temperature (psychrophiles, mesophiles, thermophiles, extremophiles, thermodurics, psychrotrophs), pH (acidophiles, alkaliphiles), solute and water activity (halophiles, xerophiles, osmophilic), Oxygen (aerobic, anaerobic, microaerophilic, facultative aerobe, facultative anaerobe), barophilic. Microbial growth in response to nutrition and energy

Unit 2 : **Microbial Reproduction**
Asexual methods of reproduction, logarithmic representation of bacterial populations, phases of growth, calculation of generation time and specific growth rate

Unit 3 : **Plant Growth and Reproduction**
Plant Growth and development - Differentiation, Dedifferentiation and Redifferentiation. Plant Growth Regulators. Photoperiodism, Mode of reproduction in plants – (a) Vegetative (b) Asexual (c) Sexual

Unit 4 : **Animal Reproduction**
Asexual reproduction- fission, budding, fragmentation, parthenogenesis, sexual reproduction- fertilization, hermaphrodites

Unit 5 : **Human Reproduction and Development**
Male reproductive system, female reproductive system, developmental stages of an embryo

Learning Resources

1. Biochemistry and Molecular Biology of Plants BY Bob B. Buchanan
2. Prescott's Microbiology 11th Edition
3. Human Embryology and Developmental Biology, 6th Edition by Bruce M. Carlson

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%		40%		40%		40%		40%	-
Level 2	Understand	40%		40%		40%		40%		40%	-
Level 3	Apply	20%		20%		20%		20%		20%	-
Level 4	Analyze	-	-	-	-	-	-	-	-	-	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers

Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. *Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai*		

Semester IV

Course Code	UBT22401J	Course Name	MOLECULAR BIOLOGY	Course Category	C	Professional Core	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	**BIOTECHNOLOGY**	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	**The purpose of learning this course is to,**	**Learning**
CLR-1 :	Understanding the basics of Central dogma	Blooms Level
CLR-2 :	Understanding the properties and functions of DNA	
CLR-3 :	Understanding the importance of DNA replication and repair	
CLR-4 :	Knowledge about Transcription	
CLR-5 :	Knowledge on translation	

Course Learning Outcomes (CLO)	**At the end of this course, learners will be able to:**	
CLO-1 :	Acquired basic Knowledge on DNA RNA and gene regulation	2
CLO-2 :	Basic Knowledge on DNA replication and DNA repair	3
CLO-3 :	Strong basis for understanding the transcription in pro and Eukaryotes	3
CLO-4 :	Gaining knowledge on molecular boiology concepts	3
CLO-5 :	Better knowledge gained Signal transductin	3

Program Learning Outcomes (PLO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO – 2	PSO – 3
L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
L	H	H	H	H	-	-	M	M	L	-	H	-	-	-

UNIT I: STRUCTURE OF DNA

Watson and Crick Model, Forms of DNA, RNA – Structure, types and functions, Unusual structures of DNA & RNA, Prokaryotic &Eukaryotic genome, Genome organization in Prokaryotes, Genome organization in Eukaryotes Mitochondrial DNA, Chloroplast DNA, Chromosome types and functions,

PRACTICALS:

1. Isolation of DNA from animal
2. Isolation of DNA from microbial sources
3. Isolation of DNA from blood

Unit II: REPLICATION AND REPAIR

DNA Replication, Mechanism of Replication, Rolling circle replication, Theta replication, D-Loop, DNA Repair mechanisms, Base Excision Repair, Nucleotide Excision Repair, Recombination Repair, SOS Repair

PRACTICALS:

1. DNA quantification using a spectrophotometer.
2. RNA quantification using a spectrophotometer.
3. Isolation of plasmid DNA from bacterial culture

UNIT III: TRANSCRIPTION

Mechanism of Transcription in prokaryotes, eukaryotes, RNA Polymerases, Transcription factors, Regulatory elements, Post-transcriptional modifications- 5' Capping, 3' polyadenylation, splicing mechanisms, alternate splicing, mRNA transport

PRACTICALS:

1. Isolation of RNA from animal
2. Isolation of RNA from microbial source.

UNIT IV:TRANSLATION

Genetic code, Prokaryotic and eukaryotic ribosomes, Prokaryotic translation, Eukaryotic translation- Initiation factors, Elongation factors, Termination, Regulation of translation, Protein folding, Post- translational modifications, Epigenetic modifications, Protein sorting

PRACTICALS:

1. PCR
2. Colony PCR

UNIT V:GENE REGULATION

Operons-Lac Operon, Cis-acting regulatory elements, Trans-regulatory elements, Gene regulation in prokaryotes, Transcriptional regulation, Gene regulation in eukaryotes

Learning Resources	1. DavidFreifelder. "Essnetials of *Molecualr Biology",* 4th edition, 2015. 2. Cooper "The Cell – A molecular approach**", 7th Edition,** 2015. **3.** Lewin's "Genes" – 12th Edition, 2017**.**

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 2	Understand	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Apply	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Level 4	Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	**Dr.N. Prasanth Bhatt,DBT,SRMIST**

Course Code	UBT22402J	Course Name	ENZYMOLOGY	Course Category	C	Professional Core Course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards	Nil		

		Learning	Program Learning Outcomes (PLO)															
Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	*Blooms level*	*1* Disciplinary Knowledge	*2* Critical Thinking	*3* Problem Solving	*4* Analytical Reasoning	*5* Research Skills	*6* Team Work	*7* Scientific Reasoning	*8* Reflective Thinking	*9* Self-Directed Learning	*100* Multicultural Competence	*11* ICT Skills	*12* Life Long Learning	*13* PSO - 1	*14* PSO - 2	*15* PSO – 3
CLR-1 :	Understanding the classification of enzymes & properties																	
CLR-2 :	understanding the techniques used for purification of enzymes																	
CLR-3 :	Knowledge on enzyme involvement in lowering activation energy																	
CLR-4 :	Knowledge on different inhibitors and its role																	
CLR-5 :	Understanding the importance of coenzymes																	
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*																	
CLO-1 :	Sound knowledge on enzyme classification, nomenclature	*3*	*H*	*M*	*L*	*L*	-	-	-	-	*L*	*L*	*L*	*H*	-	-	-
CLO-2 :	Application of techniques for isolation and purification of enzymes	*3*	*H*	*H*	*H*	*H*	*H*	-	-	-	*H*	*H*	*H*	*H*	-	-	-
CLO-3 :	Knowledge on active site amino acids in reactions	*3*	*H*	*H*	*H*	*H*	*H*	-	-	-	*H*	*H*	*H*	*H*	-	-	-
CLO-4 :	Applying knowledge to design drugs	*3*	*H*	*H*	*H*	*H*	*H*	-	-	-	*H*	*H*	*H*	*H*	-	-	-
CLO-5 :	knowledge on coenzymes	*3*	*H*	*H*	*L*	*M*	*L*	-	-	-	*M*	*M*	*M*	*L*	-	-	-

UNIT- I: Classification - IUB system, Characteristics of enzymes, Preparation of buffer., Factors affecting enzyme action- Effect of temperature, pH and substrate concentration on reaction rate., Enzyme specificity: Group specificity, absolute specificity, Stereo-Specificity, Introduction in to lock and key Hypothesis, induced fit Hypothesis, Physical and chemical methods of isolation, Enzyme activity of protease
1.Estimation of protein

UNIT-II: Biological methods, Preliminary purification, purification of soluble enzymes-chromatography, , Calculation for enzyme and specific activity of enzyme, purification of soluble enzymes-electrophoresis, Purification of membrane bound enzymes-chromatography, Purification of membrane bound enzymes- electrophoresis, Optimum pH determination- protease, Enzyme Immobilization – methods, Enzyme Immobilization – Applications
Importance of enzyme immobilization, Industrial application of immobilized enzymes., Optimum temperature determination- protease

UNIT- III: Activation energy, Acid- base catalysis, covalent catalysis, Metal ion , proximity Orientation, Introduction- Chymotrypsin structure ,Chymotrypsin mechanism, Chymotrypsin structure, Enzyme activity of ureas, Application of chymotrypsin, Functions of chymotrypsin, Discussion on various enzyme structures, Optimum pH determination- urease,
1.Estimation of protein- urease

UNIT- IV: Kinetics introduction, Michaelis Menten Equation, Signifiicance of MM equation, Optimum temperature determination- urease, Modifications of MM Equation, Lineweaver Burk plot , Eadie Hofstee plots, Inhibition introduction, Optimum temperature determination- urease, Reversible inhibition- competitive, uncompetitive, Non-competitive, Irreversible inhibiton, allosteric inhibition, feedback inhibition
1. Affinity chromatography

UNIT-V: Introduction-coenzymes, Structure of coenzymes , Functions of coenzymes, NAD, NADP, Repetition lab, FAD, FMN, TPP, Pyridoxal phosphate, Repetition lab, Lipoic acids, THF, Vitamin B12- structure , Functions of Vitamin B12

Learning Resources

1. Nicholas C. Price and Lewis Stevens, *"Fundamentals of Enzymology"*, Oxford University Press, 2003.
2. Trevor Palmer and Philip Bonner, *"Enzymes - Biochemistry, Biotechnology, Clinical chemistry"*, 2nd edition, East-West Press Pvt. Ltd, 2004.
3. Lehninger, Nelson and Cox, *"Principles of biochemistry"*, 6th edition, W.H. Freeman & Company,2013.
4. Prakash M., DigmartiBhaskaraRao,Jena T, Enzyme Biotechnology, 1st edition, Discovery Publication, 2010.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 2	Understand	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Apply	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Level 4	Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, Conf. Paper etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. S. Vijayabharathi,

Course Code	UBT22403T	Course Name	SYSTEMS PHYSIOLOGY	Course Category	c	PROFESSION CORE	L	T	P	C
							3	1	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	BIOTECHNOLOGY		Data Book / Codes/Standards	Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	Know how animals obtain energy from their environment	Bloom's Level
CLR-2:	Understand the unique role of various organs and organ systems in performing various vital functions.	
CLR-3:	Understand the role of physiology in adapting to various environments.	
CLR-4:	Study the importance of homeostasis in different animals.	
CLR-5:	Learn to apply critical thinking and integrate scientific knowledge to understand the basic physiological principles which led to diverse evolutionary adaptations	
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	
CLO-1:	*Appreciate the feeding patterns of animals and different digestive enzymes and acids that help the digestion process and conversion into energy*	1
CLO-2:	*Conceptualize the idea of different systems and their vital functions*	1
CLO-3:	*Cognize the inevitable role of organs that adapt to different environment.*	2
CLO-4:	*Appreciate the importance of homeostasis*	2
CLO-5:	*Analyse the systems function in coordination.*	3

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	M	M	M		-	-	-	-	-	-	-	-	-	-
H	M	M	M		-	-	-	-	-	-	-	-	-	-
H	M	M	M		-	-	-	-	-	-	-	-	-	-
H	M	M	M		-	-	-	-	-	-	-	-	-	-
H	M	M	M		-	-	-	-	-	-	-	-	-	-

UNIT: 1 Production of Energy

Feeding patterns found in different animals; Intracellular and extracellular digestion, digestive enzymes, cellulose digestion in animals – digestive track system.

UNIT:2 Gas exchange in organism

Exchange in unicellular organisms and plants; Respiratory organs in aquatic and terrestrial systems: Physiology of aquatic breathing and aerial breathing; trachea in insects, gills in fishes, lungs in birds; Role of skin in respiration- Spiracles.

UNIT:3 Movements And Bulk Transport

Movements and Bulk Transport Cellular movements, ciliary and flagellar structure and function; Introduction to Musculo skeletal system; Terrestrial, aquatic and aerial locomotion; Locomotory cost; Bulk transport of water and nutrients in plants; General plan of circulatory system in vertebrates and invertebrates; Cardiovascular system; structure and function closed and open system of circulation, single circulation and double circulation: circulation patterns of cockroach, bony fishes and amphibians. Components of blood and its functions. Physiology of vertebrate heart: cardiac output, regulation of heart beat Starling's law.

UNIT:4 Regulatory Physiology

Regulation of water in aquatic and terrestrial animals; Water and solute excretion in organisms, osmoregulatory organs; Transpiration in plants; Excretion of nitrogenous wastes in animals; Patterns of Thermoregulation: Ectotherms and Endotherms; Structural and functional adaptation to stress

UNIT:5 Integrative Physiology

An overview of neuronal structure and function; Sensory physiology –mechano, chemo, thermo, photo and electro receptors; Endocrine systems in animals and their physiological effects; Plant hormones and their physiological effects; Regulation of metabolism and response to environmental cues; Neuronal basis of behaviour; Behaviour concepts

Learning Resources

1. Moyes, C. D., & Schulte, P. M. (2008). Principles of Animal Physiology. San Francisco, CA: Pearson/Benjamin Cummings.
2. Randall, D. C., Burggren, W. W., & French, K. (2002). Eckert Animal Physiology. New York: W. H. Freeman.
3. Schmidt-Nielsen, K. (2010). Animal Physiology: Adaptation and Environment. Cambridge: Cambridge University Press.
4. Prakash, G. (2012). Lab Manual on Blood Analysis and Medical Diagnostics. S. Chand and Co. Ltd.
5. Reece, J. B., & Campbell, N. A. (2011). Campbell Biology. Boston: Benjamin Cummings / Pearson.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%) #			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%		40%		40%		40%		40%	
Level 2	Understand	40%		40%		40%		40%		40%	
Level 3	Apply	20%		20%		20%		20%		20%	
Level 4	Analyze										

Level 5	Evaluate	-	-								-
Level 6	Create	-	-	-		-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. R. Nishanthi

Course Code	UBT22S02T	Course Name	GOOD LABORATORY PRACTICES- II	Course Category	S	SKILL BASED ELECTIVE	L	T	P	C
							0	1	0	1

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	***To have knowledge on molecule;ar biology based techniques and trouble shoot during experiments***	Bloom's Level
CLR-2:	*To give a basic working knowledge on the various plant biotechnology based experiments*	
CLR-3:	*To give a basic working knowledge on the various animal biotechnology based experiments*	
CLR-4:	*To know the basic tenets of an electrophoresis apparatus and handling*	
CLR-5:	*To have a oveall knowledge on biotechnology based maintenance techniques in a laboratory*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning
CLO-1:	*Maintain the basic necessities of conducting a molecular biology experiment*	4
CLO-2:	*Maintain a sterile environment and decontaminate the space in a plant biotechnology laboratory*	4
CLO-3:	*Maintain a sterile environment and decontaminate the space in a animal biotechnology laboratory*	4
CLO-4:	*Knowledge to conduct an electrophoresis experiment with out wastage*	4
CLO-5:	*An overall knowledge on the various maintenance procedures involved in biotechnology laboratory*	4

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	*L*	*H*	*H*	*M*	*H*	*H*	*L*	*L*	*L*	-	*L*	-	-	-
H	*H*	*H*	*H*	*H*	*H*	*H*	*L*	*L*	*L*	-	*L*	-	-	-
M	*H*	*H*	*H*	*H*	*H*	*M*	*L*	*L*	*L*	-	*L*	-	-	-
M	*H*	*H*	*H*	*H*	*H*	*M*	*L*	*L*	*L*	-	*L*	-	-	-
M	*H*	*H*	*H*	*H*	*H*	*M*	*L*	*L*	*L*	-	*L*	-	-	-

Practice classes

1. Molecular Biology - Maintenance of sterility during experiments, avoiding wastage of consumables, Basics of PCR and spectrophometer handling
2. Plant Biotechnology- set up of lab and maintenance, decontamination, sterility maintenance, preparation of materials for plant tissue culture experiments
3. Animal Biotechnology- Media preparation and sterilization, CO2 incubator handling, pressure maintenance, BS Level 2 cabinet handling
4. Analytical Techniques- Agarose Gel Preparation, SDS PAGE gel preparation and handling of electrophoresis units

Assessment Fully internal

Assessment tools	Marks
Continuous Learning Assessment –I (CLA-I)	20
Continuous Learning Assessment –II (CLA-II)	30
Continuous Learning Assessment –III (CLA-III)	30
Continuous Learning Assessment –IV (CLA-IV)	20
Tota	100

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	

Course Code	UBT22S03T	Course Name	MUSHROOM CULTIVATION	Course Category	S		L	T	P	C
							0	0	2	1

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	*Basic Knowledge about the Mushroom*	Bloom's Level
CLR-2:	*Sterilization techniques involved in production*	
CLR-3:	*Knowing about the different types of Mushroom*	
CLR-4:	*Cultivation of Mushroom*	
CLR-5:	*Knowledge about the small scale production*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Bloom's Level
CLO-1:	*Understand about the mushroom production*	4
CLO-2:	*Grow mushroom without contamination*	4
CLO-3:	*Differentiate types of mushroom*	4
CLO-4:	*Production of Spawn*	4
CLO-5:	*Cultivate mushroom in a small scale*	4

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	*L*	*H*	*H*	*M*	*H*	*H*	*L*	*L*	*L*	-	*L*	-	-	-
H	*H*	*H*	*H*	*H*	*H*	*H*	*L*	*L*	*L*	-	*L*	-	-	-
M	*H*	*H*	*H*	*H*	*H*	*M*	*L*	*L*	*L*	-	*L*	-	-	-
M	*H*	*H*	*H*	*H*	*H*	*M*	*L*	*L*	*L*	-	*L*	-	-	-
M	*H*	*H*	*H*	*H*	*H*	*M*	*L*	*L*	*L*	-	*L*	-	-	-

Assessment Fully internal

1. Sterilization methods
2. Media Preparation
2. Spawn Production
3. Cultivation of Oyster Mushroom
4. Cultivation of Milky Mushroom
5. Disease management in cultivated Mushroom
6. Insect-Pest Management
7. Value addition of Mushroom
8. Mushroom growing unit
9. Spent substrates and waste management

Learning Resources		
	1. Mushroom Cultivation, Tripathi, D.P.(2005) Oxford & IBH Publishing Co. PVT.LTD, New Delhi. 2. Mushroom Production and Processing Technology, Pathak Yadav Gour (2010) Published by Agrobios (India).	1. A hand book of edible mushroom, S.Kannaiyan& K.Ramasamy (1980). Today & Tomorrows printers & publishers, New Delhi 2.Handbook on Mushrooms, Nita Bahl, oxford & IBH Publishing Co.

Assessment tools	Marks
Continuous Learning Assessment –I (CLA-I)	20
Continuous Learning Assessment –II (CLA-II)	30
Continuous Learning Assessment –III (CLA-III)	30
Continuous Learning Assessment –IV (CLA-IV)	20
Tota	100

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. Infant Santhose

Course Code	UBT22S04T	Course Name	ALGAL CULTIVATION	Course Category	S	Skill Based Elective	L	T	P	C
							0	0	2	1

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	*Impart knowledge about Algae*	Bloom's Level
CLR-2:	*Different types of Media*	
CLR-3:	*Cultivation methods*	
CLR-4:	*Extraction of Bioactive compounds*	
CLR-5:	*Applications of Algae*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	
CLO-1:	*Isolate algae from the environment*	4
CLO-2:	*Select the potential strain*	4
CLO-3:	*Cultivate algae*	4
CLO-4:	*Extract bioactive compounds*	4
CLO-5:	*Produce Biodiesel from algae in lab scale*	4

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	*L*	*H*	*H*	*M*	*H*	*H*	M	H	M	-	H	-	-	-
H	*H*	*H*	*H*	*H*	*H*	*H*	H	H	M	-	H	-	-	-
M	*H*	*H*	*H*	*H*	*H*	*M*	M	M	M	-	H	-	-	-
M	*H*	*H*	*H*	*H*	*H*	*M*	H	H	M	-	H	-	-	-
M	*H*	*H*	*H*	*H*	*H*	*M*	H	H	M	-	H	-	-	-

Assessment Fully internal

1. Algal collection methods
2. Algal Isolation and Selection
3. Algal Growth Curve
3. Different types of Media
4. Media Preparation
5. Cultivation methods in Lab Scale
6. Harvesting methods and Drying
7. Extraction of Bioactive compounds
8. Biodiesel production from algae
9. Phytoremediation

Learning Resources		
	1.BARSANTI, LAURA AND PAOLO GUALTIERI 2005 Algae-Anatomy, Biochemistry and Biotechnology. Taylor & Francis, London, New York. 2.BECKER, E.W. 1994 Microalgae-Biotechnology and microbiology. Cambridge University Press.	1. TRIVEDI, P.C. 2001 Algal Biotechnology. Pointer publishers, Jaipur, India. 2. VENKATARAMAN, L.V. AND E.W. BECKER 1985. Biotechnology and Utilization of Algae – The Indian Experience. Dept. Science and Technology, New Delhi and Central Food Research Institute, Mysore, India.

Assessment tools	Marks
Continuous Learning Assessment –I (CLA-I)	20
Continuous Learning Assessment –II (CLA-II)	30
Continuous Learning Assessment –III (CLA-III)	30
Continuous Learning Assessment –IV (CLA-IV)	20
Tota	100

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. Infant Santhose

Course Code	UMI22401L	Course Name	MY INDIA PROJECT	Course Category	S	Skill Enhancement course	L	T	P	C
							0	0	0	1

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Dept of Journalism and Mass communications*	Data Book / Codes/Standards	*Nil*		

Assessment Method – Fully Internal

Assessment Tools	Marks
Review – I (Activities)	50
Review – II (Project report and Presentation)	50
Total	100

Course Code	UJK22401T	Course Name	PROFESSIONAL SKILLS	Course Category	JK	*Life Skill Course*	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	*Career Development Centre*	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	*expose students to the requirements of job market*	Bloom's Level
CLR-2:	*develop resume building practice*	
CLR-3:	*increase efficiency in speaking during group discussions*	
CLR-4:	*prepare students for job interviews*	
CLR-5:	*instil confidence in students and develop skills necessary to face audience*	
CLR-6:	*develop speaking and presentation skills in students*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning
CLO-1:	*understand the importance of resume preparation and build resume*	*4*
CLO-2:	*acquire group discussion skills*	*4*
CLO-3:	*face interviews confidently*	*4*
CLO-4:	*Ask appropriate questions during an interview*	*4*
CLO-5:	*understand various types of presentation and use presentation skills in projects*	*4*
CLO-6 :	*build confidence during any presentation*	*4*

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	Ethical Reasoning	Community Engagement	ICT Skills	Leadership Skills	Life Long Learning
M	-	-	-	-	-	-	M	-	-	-	-	*H*	M	*H*
M	-	*M*	-	-	H	-	M	-	H	-	-	*L*	H	*H*
M	-	*M*	-	-	L	-	M	-	H	-	-	*M*	H	*H*
M	-	*M*	-	-	L	-	M	-	M	-	-	*M*	H	*H*
M	-	*M*	-	-	H	-	M	-	M	-	-	*H*	M	*H*
M	-	*M*	-	-	*M*	-	*M*	-	-	-	-	*M*	*H*	*H*

Unit-1: Introduction of resume and its importance, Difference between a CV, Resume and Bio Data, Essential components of a good resume, common errors people make while preparing a resume, Resume building format, Resume building using templates, Resume building activity, Resume building activity – Feedback, Video resume – Tips and tricks, Video resume – Do's and Don'ts, Video resume – Templates
Unit-2: I Meaning and methods of group discussion, Procedure of group discussion, Group discussion – simulation, Group discussion – common errors, Group discussion – types – Topic based, Group discussion – types – Case study based, Group discussion – practice session- Topic based, Group discussion – Feedback, Group discussion – practice session- Topic based, Group discussion – Feedback, Group discussion – practice session- Case study based, Group discussion – Feedback
Unit-3: Meaning and types of interview (face to face, telephonic, video), Dress code, background research, STAR Technique (situation, task, approach and response) for facing an interview, Interview procedure (opening, listening skills, closure, asking questions), Important questions generally asked in an interview, Mock interview – face to face, Mock interview- Feedback
Unit-4: Types - Informative, Instructional, Arousing, Persuasive, Decision-making, Structure of a presentation – Introduction of the event, Introducing the speaker, vote of thanks, Working with audience – ice-breaking, Creating a 'Plan B', Getting the audience in the mood, working with emotions, Improvisation and unprepared presentations, man-woman view, feedback – appreciation and critique, Power point presentation, skit, drama, dance, mime, short films and documentary – Dos and Don'ts, PowerPoint presentation–logical arrangement of content, PowerPoint presentation–using internet source, citations, bibliography,
Unit-5: PowerPoint presentation–body language and stage etiquettes, PowerPoint presentation–practice session

Learning Resources	
1. *Scott Bennett, The Elements of Resume Style: Essential Rules for Writing Resumes and Cover Letters That Work, AMACOM, 2014*	4. *Paul Newton, How to deliver a presentation ; e-book*
2. *David John, Tricks and Techniques of Group Discussions, Arihant, 2012*	5. ***Eric Garner, A-Z of Presentation, Eric Garner and Ventus Publishing ApS, 2012, bookboon.com***
3. *Singh O.P., Art of Effective Communication in Group Discussion and Interview, S Chand & Company, 2014*	

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%) #			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-	20%		20%	
Level 2	Understand	20%	-	20%	-	20%	-	20%		20%	
Level 3	Apply	40%	-	40%	-	40%	-	40%		40%	
Level 4	Analyze	20%	-	20%	-	20%	-	20%		20%	
Level 5	Evaluate	-	-	-	-	-	-	-	-		-
Level 6	Create	-	-	-	-	-	-	-	-		-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA-1, CLA-2 and CLA-3 can be from any combination of these: Online Aptitude Tests, Classroom Activities, Case Studies, Poster Presentations, Power-point Presentations, Mini Talks, Group Discussions, Mock interviews, etc.
CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
1. Ajay Zener, Director, Career Launcher	-	*1. Mr Priyanand, Assistant Professor, CDC, E&T, SRMIST* *2. Ms Sindhu Thomas, Head in charge, CDC, FSH, SRMIST* *3. Ms Mahalakshmi, Assistant Professor, CDC, FSH, SRMIST*

Course Code	UBT22D03T	Course Name	PHARMACOGENOMICS	Course Category	D	DISCIPLINE ELECTIVE	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning Bloom's Level
CLR-1:	Provide the basics of pharmacogenomics, Pharmacodynamics, and toxicogenomics	
CLR-2:	Familarise the students to the stages in drug development.	
CLR-3:	know the concept of drug interactions and drug metabolism in the host	
CLR-4:	Model the target and to use computational tools and software to design a drug.	
CLR-5:	Describe the metabolism of the drug right from administration to excretion and biotransformation.	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning Bloom's Level
CLO-1:	*Understand the genes affecting the efficacy of the drugs in disease treatment*	4
CLO-2:	*Describe the metabolism of the drug right from administration to excretion and biotransformation*	4
CLO-3:	*Understand the genes affecting the efficacy of the drugs in the treatment of some important diseases.*	4
CLO-4:	*Model and validate the target structures In silico identification of lead molecules through docking.*	4
CLO-5:	*Relate the traditional medicinal system to the modern scientific results through Ayugenomics; apply modern research tools in the area of Pharmacogenomics*	4

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
					-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-	-	-	-

Unit 1**: Introduction to Pharmacogenomics** - Introduction to pharmacogenomics, pharmacodynamics, pharmacokinetics, toxicogenomics and ADMET properties

Unit 2: **Drug Design and development – I -** Process of drug development-clinical trials phases. Route of drug administration. Nature of cell membrane, physiological factors related to drug absorption and drug distribution.

Unit 3: **Drug Design and development – II -** 2-D and 3-D database searching. Structure-based and Ligand based drug design for all classes of targets, SPROUT, LUDI.

Unit 4: **Pharmacogenomics in the Disease Treatment -** Pharmacogenomics in the treatment of cancer, neurodegenerative diseases, cardiovascular diseases

Unit 5: **Applications of Pharmacogenomics -** Pharmacogenomics in pharmaceutical industry, Ethical issues related to Pharmacogenomics, Pharmacogenomics and ethanopharmacology. Application of QSAR and microarray in pharmacogenomics.

Learning Resources	1. Pharmacogenomics An Introduction and Clinical Perspective (PHARMACOLOGY) by Joseph S. Bertino (Author), Angela Kashuba (Author), Joseph D. Ma (Author), Uwe Fuhr (Author), C. Lindsay DeVane (Author)	2. Pharmacogenomics in Drug Discovery and Development (2nd Ed., 2nd ed. 2014) Methods in Molecular Biology Series, Vol. 1175 Coordinator: Yan Qing

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%		20%		20%		20%		20%	
Level 2	Understand	20%		20%		20%		20%		20%	
Level 3	Apply	40%		40%		40%		40%		40%	
Level 4	Analyze	20%		20%		20%		20%		20%	
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	

Course Code	UBT22D04T	Course Name	ANIMAL BEHAVIOUR	Course Category	D	DISCIPLINE ELECTIVE	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	Learn about the history and origin of ethology.	Bloom's Level
CLR-2:	Understand the different mechanisms of animal behaviour.	
CLR-3:	Study about reflexes and orientation.	
CLR-4:	Gain knowledge on altruism.	
CLR-5:	Understand about circadian rhythms and its importance.	
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	
CLO-1:	Understand the fundamentals of animal behaviour.	2
CLO-2:	Learn about the mechanisms and patterns of behaviour.	2
CLO-3:	Understand the role of natural selection in the evolution of behaviour.	2
CLO-4:	Analyse about biological clocks and human behaviour.	2
CLO-5:	Apply the knowledge of animal behaviour in academia and industry.	2

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	-	H	-	-	-	-	-	-	-	-	-	-	-	-
H	-	H	H	-	-	-	-	-	-	-	-	-	-	-
H	-	-	-	H	-	-	-	-	-	-	-	-	-	-
-	H	H	H	H	-	-	-	-	-	-	-	-	-	-
-	H	-	H	H	-	-	-	-	-	-	-	-	-	-

Unit-1: Ethology – introduction, origin and history; evolution of social behaviour; evolution of communication; scientific ways and methods for studying animal behaviour; neural basis of behaviour.

Unit-2: Mechanisms of Behaviour - innate behaviour; instinct; stimulus filtering; sign stimuli; code breakers.

Unit-3: Patterns of Behaviour – reflexes; types of reflexes; characteristics of reflexes; orientation - primary and secondary orientation; learning: associative learning, classical and operant conditioning; Habituation.

Unit-4: Social behaviour - society organization; foraging strategies; Altruism - reciprocal altruism; Hamilton's rule and inclusive fitness with suitable examples.

Unit-5: Sexual behaviour - asymmetry of sex; sexual dimorphism mate choice; intra-sexual selection; inter-sexual selection; biological clocks.

Learning Resources

1. David McFarland, "Animal Behaviour", Pitman Publishing Limited, London, UK, 1985.
2. A. Manning and M.S. Dawkins, "An Introduction to Animal Behaviour", Cambridge University Press, UK, 2012.
3. Shawn E. Nordell & Thomas J. Valone, "Animal Behaviour : Concepts, Methods, and Applications", Oxford University Press, 2013.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40	-	40	-	40	-	40	-	40	-
Level 2	Understand	40	-	40	-	40	-	40	-	40	-
Level 3	Apply	10	-	10	-	10	-	10	-	10	-
Level 4	Analyze	10	-	10	-	10	-	10	-	10	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers

Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. G. Swamynathan

SEMESTER V

Course Code	UBT22501J	Course Name	COMPUTATIONAL BIOLOGY	Course Category	C	PROFESSIONAL CORE	L	T	P	C
							3	0	2	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	To familiarize the students with most basic and useful algorithms for sequence analysis	Bloom's Level
CLR-2:	To acquire advanced computational and modelling skills required to address problems of life sciences for computational perspective	
CLR-3:	To understand the algorithms used in Computational Biology	
CLR-4:	To introduce basic genomic and transcriptomic sequence processing algorithms	
CLR-5:	Model the target and to use computational tools and software to design a drug	
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	
CLO-1:	*transform basic molecular data for interpreting their patterns for various analysis*	4
CLO-2:	*Equip students with basic computational skill*	4
CLO-3:	*Aware of the sequence basic file formats*	4
CLO-4:	*Understand the basics of pharmacogenomics, Pharmacodynamics, and toxicogenomics*	4
CLO-5:	Familiarize with the stages in drug development.	4

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
					-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-	-	-	-
					-	-	-	-	-	-	-	-	-	-

Unit I: **Biological data analysis and application** – Biological databases, NCBI, file format. Sequence alignment - sequence analysis, pair wise sequence alignment, multiple sequence alignment. Small molecule databases. Data retrieval systems (SRS, Entrez)
Experiment no. 1 – Retrieval of sequence from NCBI, EMBL, DDBJ
Experiment no. 2 - Retrieval of sequence from Uniprot, PDB

Unit 2: **Methods of Alignment** - pair wise sequence alignment – dot matrix, dynamic programming, word method - Multiple sequence alignment: Need for MSA, n dimensional dynamic programming- Heuristics algorithm for multiple sequence alignment - Progressive alignment, Iterative alignment, Block Based alignment –Tools for local, global and MSA: Muscle, T-Coffee, and Clustal.
Experiment no. 3 – Local Alignment , Global Alignment
Experiment no. 4 – Blast,

Unit 3: **Molecular phylogeny** – Tree concept: Molecular data as molecular fossils; Molecular-clock-hypothesis; The terminology of phylogenetics- Trees, Root, branches, Node, Leaf, Clade; lineage sorting, orthology, paralogy, xenology; "basal" lineages, crown vs. stem groups, Phylogram vs. cladogram. Gene phylogeny vs. species phylogeny; Different types of trees- rooted vs. unrooted trees, dichotomy vs. polytomy, monophyletic vs. paraphyletic, ultrametric vs. unconstrained
Experiment no. 5 – Clustal Omega
Experiment no. 6 – ORF Finder, Glimmer

Unit 4: **Phylogenetic Algorithms**: Clustering based methods-UPGMA and neighbor joining, Optimality based: Fitch-Margoliash and minimum evolution algorithm; Character based methodsMaximum Parsimony (MP) and Maximum Likelihood (ML) methods; Bayesian inference, Evaluation of phylogenetic trees-reliability and significance; Boot strapping; Jackknifing.
Experiment no. 7 – Rasmol

Unit 5: **Drug discovery** – Characteristics of a drug compound, Drug discovery pipeline, Drug development - pre-clinical & clinical studies, ADMET, serendipity, high throughput screening.
Experiment no. 8 – docking tool

Learning Resources		
	1. Bioinformatics: Sequence and Genome Analysis (Mount, Bioinformatics) 2nd Edition by David Mount 2. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids 1st Editionby Richard Durbin (Author), Sean R. Eddy (Author), Anders Krogh (Author), Graeme Mitchison (Author)	3. Essential Bioinformatics 1st Edition by Jin Xiong 4. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins Hardcover – Import, 19 November 2004 by Andreas D. Baxevanis (Editor), B. F. Francis Ouellette (Editor)

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 2	Understand	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Apply	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Level 4	Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. V.G Vidhya

Course Code	UBT22502J	Course Name	IMMUNOLOGY	Course Category	C	*Professional Core Course*	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	Understanding the basics of immune reactions	
CLR-2 :	Understanding the properties of antigens and function of immunoglobulins	
CLR-3 :	Understanding the importance antigrn antibogy interaction in defense action	
CLR-4 :	Knowledge on B & T cell response	
CLR-5 :	Knowledge on immunological basis of AIDS, transplantation	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning
CLO-1 :	Acquired basic Knowledge on immune cells, organs	2
CLO-2 :	Basic Knowledge on antigen, immunoglobulins	3
CLO-3 :	Strong basis for understanding the interactions of antigen & antibody	3
CLO-4 :	Better knowledge gained about immune response	3
CLO-5 :	Better knowledge gained about immune response in disease	3

Program Learning Outcomes (PLO)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO – 2	PSO – 3
CLO-1 :	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-2 :	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-3 :	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-4 :	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
CLO-5 :	L	H	H	H	H	-	-	M	M	L	-	H	-	-	-

UNIT I: Introduction to immunology

Types of immunity-innate, acquired, Types of immunity- acquired, Phagocytosis - O2 dependent, O2 independent, Cells of immune system, organs of immune system-primary, secondary, Associated lymphoid tissues

PRACTICALS:

1. Lab safety rules
2. Agglutination: ABO Blood grouping
3. WiDALtest

UNIT II: Antigens

Antigen- structure, properties, types, Adjuvant, Hapten, Superantigen, Opsonization, Immunoglobulin – structure, function, Complement System- classical, alternate, lectin, Major Histocompatibility Complex

PRACTICALS:

1. Pregnancy test
2. Single Radial immunodiffusion
3. Ouchterlony double immunodiffusion

UNIT III:Antigen - Antibody interaction

Introduction, Agglutination reactions, Precipitation reaction, Immunodiagnosis, Monoclonal antibody- Introduction, production, applications, Cytokines production, functions

PRACTICALS:

1. Counter current immunoelectrophorosis
2. Rocket immunoelectrophorosis
3. DOT ELISA.

UNIT IV: Cell mediated immunity

Introduction, T cell activation, proliferation, differentiation, Humoral immune response, B cell activation, proliferation, differentiation, Hypersensitivity reactions – I, II, III, IV

UNIT V: Autoimmunity

Introduction, Mechanism of induction of organ specific, systemic, **Rheumatoid arthiritis,** Immune response to tumor Immunodeficiency diseases (AIDS), Transplantation- Introduction, Types, Immunologic basis of graft rejection.

Learning Resources	1. Richard A. Goldsby "Immunology"	3. Ivan Roitt. Element of Immunology. Wiley Blackwell publication, 13th edition, 2017
	2. Barbara, A. Osborne, Janis KubyImmunology", 5th Edition, W. H. Freeman & Company, 2006	

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 2	Understand	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Apply	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Level 4	Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-

Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. N. Prasanth Bhatt

Course Code	UBT22503T	Course Name	GENETICS	Course Category	c	PROFESSION CORE	L	T	P	C
							3	1	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	BIOTECHNOLOGY	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	***Understand Mendel's extensive work for genetics and the deviations from Mendel theory***	Bloom's Level
CLR-2:	*Understand the linkage – extension of Law of independent assortment and mapping techniques*	
CLR-3:	*Introduce the students about the organisation of Genome inside the cell and what are the possible variation that leads to abnormalities.*	
CLR-4:	*Focus on the different mutagens and how the cell responds to them*	
CLR-5:	*Comprehend the numerical ability and analysis skill of students by explaining the limitations and assumptions of HW equilibrium*	
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	
CLO-1:	*Know about Mendel's work and their deviation*	1
CLO-2:	*Conceptualise about Linkage and how characters determined using Sex and also about the influence of distance between two genes in determining the trait through gene mapping techniques*	2
CLO-3:	*Know about the different mechanisms through which the genes are exchanged and the abnormalities associated with the improper exchange*	4
CLO-4:	*Explain about the Epigenetics concept and genome imprinting*	4
CLO-5:	*Explain about the genetic flow and different phenomenon that influences them and assumptions of HW equilibrium to understand the concept of bottle neck effect and founders effect.*	4

	Program Learning Outcomes (PLO)														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1:	H	M	H	H	M	-	-	-	-	-	-	-	-	-	-
CLO-2:	H	M	H	H	H	-	-	-	-	-	-	-	-	-	-
CLO-3:	H	M	H	H	H	-	-	-	-	-	-	-	-	-	-
CLO-4:	H	M	H	M	H	-	-	-	-	-	-	-	-	-	-
CLO-5:	H	H	M	H	M	-	-	-	-	-	-	-	-	-	-

Unit-1 INTRODUCTION TO MENDALIAN GENETICS AND EXTENSIONS: Introduction to the basic principles of heredity-Mendel's work on transmission of traits, Genetic variation- Laws of dominance, segregation and independent assortment- monohybrid and dihybrid cross- back cross Vs test cross Extensions of Mendel's principle: Incomplete dominance- Co-dominance- ABO blood grouping- Multiple alleles- Principles of Inheritance: Chromosome theory of inheritance- Epistasis, Pleiotropy Penetrance - Expressivity – Phenocopy

Unit-2: LINKAGE, CROSSING OVER AND MAPPING TECHNIQUES: Linkage and Crossing over, cytological basis of crossing over, Molecular mechanism of crossing over. Recombination frequency as a measure of linkage intensity, coupling and repulsion hypothesis, two factor and three factor crosses, Interference and Coincidence. Sex linked Inheritance: sex limited traits, sex influenced traits- Human Pedigree Analysis- Characteristics of Dominant and Recessive inheritance.

Unit-3: MOLECULAR GENETICS: Mechanism of genetic exchange - conjugation, transformation and transduction. Chromosome structure and Genome organization in eukaryotes – different levels of organisation of chromosome - Genome Dynamics- Transposable Genetic Elements. Prokaryotic transposable elements-IS elements, Eukaryotic transposable elements- Ac-Ds system in maize and P-elements in drosophila, uses of transposons. Chromosomal aberrations: Variations in chromosome number- monosomy and trisomy of sex chromosomes and autosomes. Variations in chromosome structure- inversions, deletions, duplications and translocations

Unit-4: EPIGENETICS AND MUTATION: Mechanism of dosage compensation; X chromosomal inactivation in humans. Monoallelic expressions. Epigenetic mechanisms of transcriptional regulation. Genomic imprinting. **MUTATION:** Introduction- Physical and Chemical mutagens and its applications.

Unit-5: POPULATION GENETICS: Hardy-Weinberg law, predicting allele and genotype frequencies and exceptions to Hardy-Weinberg principle, Random genetic drift, types of inbreeding, polygenic inheritance- characteristics of quantitative traits and types.

Learning Resources	
	1. Griffiths, A. J. F., Wessler, S. R, Carroll, S. B., Doebley, J. (2010). An Introduction to Genetic Analysis (10thed.). W.H. Freeman & Company (New York). ISBN:10: 1- 4292-2943-8
	2. Pierce, B.A. (2012). Genetics - A Conceptual Approach (4thed.). W.H. Freeman & Co. (New York). ISBN:13: 978-1-4292-7606-1 / ISBN:10:1-4292-7606-1.
	3. Snustad, D. P., Simmons, M. J. (2015). Principles of Genetics (7th ed.). ISBN: 978-1- 119-14228-7

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%) #			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%		20%		20%		40%		30%	
Level 2	Understand	40%		20%		20%		40%		30%	
Level 3	Apply	10%		30%		20%		-		20%	
Level 4	Analyze	10%		30%		40%		20%		20%	
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. R. Nishanthi

Course Code	UBT22D05J	Course Name	INDUSTRIAL BIOTECHNOLOGY	Course Category	D	DISCIPLINE-SPECIFIC	L	T	P	C
							3	0	4	5

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	BIOTECHNOLOGY	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to,
CLR-1 :	Understanding the basics of food processing
CLR-2 :	Understanding the building parts and complex of bioreactor designing
CLR-3 :	Understanding the growth kinetics of microorganism
CLR-4 :	Knowledge both Upstream and downstream process
CLR-5 :	Knowledge on tremendous use of microorganism in drug and food production
CLR-6 :	Understanding about the difficulties and pathways byproduct and their effective use in industries

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning *Blooms level*
CLO-1 :	Importance and role and scope of the food production Industries	2
CLO-2 :	Basic Knowledge on design and engineering of bioreactors	3
CLO-3 :	Strong basis for understanding the growth kinetics alteread rate andphase for different products	3
CLO-4 :	Better knowledge gained about process levels and importance of industrial biotechnologist role	3
CLO-5 :	Better knowledge gained about products of day today life	3
CLO-6 :	Overall understanding of Industrial level of production of products and scope of the subject	3

Program Learning Outcomes (PLO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO – 2	PSO – 3
L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
L	H	H	H	H	-	-	M	M	L	-	H	-	-	-

Unit – 1 Basic principles of food processing, Instrumentation of fermenter, Design of various types of fermenters& bioreactors, Types of fermentation, Instrumentation of fermenter, Microbial growth kinetics, Instrumentation of fermenter

Practicals:

1. Design of various types of fermenters& bioreactors

Unit – 2 Microbial growth kinetics, Isolation of and screening of microbes for bioproduct, Preservation of the strain and Strain improvement, Media and sterilization techniques, Media and sterilization techniques, Down stream processing- types,

Practicals:

1. Production of ethanol & wine from grapes
2. Bread - making

Unit – 3 Down stream processing- types, Bread- making, Downstream processing- types/product recovery, Immobilization of enzymes – Techniques -industrially important enzymes,., Immobilization of enzymes – Techniques -industrially important enzymes, Industrial production of Ethanol

Practicals:

1. Isolation of amylase-producing microorganisms and determination of the amylase enzyme
2. Immobilization of cells and enzymes using alginate and polyacrylamide.

Unit 4 Industrial production of Beer and Wine, Comparison on techniques used to prepare the beer and wine – industries that are pioneer in making the beer and wine discussion, Immobilization of cells and enzymes using alginate and polyacrylamide, Industrial production of Citric acid, Industrial production of Glutamic acid, , Industrial production of Penicillin – History, Industrial production of Penicillin – History

Practicals:

1. Sauerkraut production
2. Mushroom cultivation

Unit 5 Industrial production – Vitamin B12importance and need, Industrial production- Steroids, Benefits and Process, , Biotransformation process – introduction, Fermented dairy products - Cheese, yogurt., Microbial Foods – Single cell proteins (SCP),SCO, Microbial production of PHB,

Learning Resources	
	1. Stanbury PF and Whitaker A. Pergamon,*"Principles of Fermentation technology"*, second edition ,Pergamon Press, Oxford, 2005, reprinted 2012
	2. PatelA.H.,*"IndustrialMicrobiology",* Macmillan Publishers India, 2000.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 2	Understand	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Apply	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Level 4	Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-

Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. Infant Santhose

SEMESTER VI

Course Code	UBT22601J	Course Name	ANALYTICAL TECHNIQUES	Course Category	C	Professional Core	L	T	P	C
							2	0	4	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	***Knowledge on instrumentation of analytical techniques.***	Bloom's Level
CLR-2:	*Understanding the applications of analytical techniques.*	
CLR-3:	*Understanding the working principles of analytical techniques.*	
CLR-4:	*Knowledge on biomolecule separation and purification.*	
CLR-5:	*Understanding the safety handling of analytical tools.*	
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	
CLO-1:	*Gains knowledge on selecting suitable method for biomolecules study.*	4
CLO-2:	*Students understand the advantage and disadvantages of separation methods.*	4
CLO-3:	*Students understand the handling procedure of analytical tools.*	4
CLO-4:	*Students understand the interpretation of output.*	4
CLO-5:	*Students understand the importance of all the analytical techniques.*	4

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	H	-	H	H	-	-	-	-	-	-	H	-	-	-
H	H	-	H	H	-	-	-	-	-	-	H	-	-	-
H	H	-	H	H	-	-	-	-	-	-	H	-	-	-
H	H	-	H	H	-	-	-	-	-	-	H	-	-	-
H	H	-	H	H	-	-	-	-	-	-	H	-	-	-

Unit-1: Spectroscopy- Principle of UV-Vis, Beer Lamberts law, instrumentation and applications of UV-Vis spectroscopy, Mass spectroscopy, NMR spectroscopy, absorption and emission spectroscopy.
1.Buffer preparation
2.Purity Check by UV visible spectroscopy.
3.To estimate protein by Lowry's method

Unit-2: Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl gradient, analytical centrifugation, ultracentrifugation, marker enzymes.
4. To estimate DNA by diphenylamine method
5. Isolation of chloroplasts by differential centrifugation.
6. Cellular fractionation

Unit-3: Introduction to the principle of chromatography. Paper chromatography, thin layer chromatography, column chromatography: silica and gel filtration, affinity and ion exchange chromatography, gas chromatography, HPLC.
7. Separation of amino acids by paper chromatography.
8. To separate sugars by thin layer chromatography
9. Plant pigment separation by Column chromatography

Unit-4: Introduction to electrophoresis. Starch-gel, polyacrylamide gel (native and SDS-PAGE), agarose-gel electrophoresis, pulse field gel electrophoresis, immuno- electrophoresis, isoelectric focusing, Western blotting.
10. To separate DNA by AGE
11.To separate Proteins by SDS- PAGE
12. Western blotting

Unit-5: Radioactive decay, Types of radiation, units and detection and measurements of radioactivity, Biosensors.
13. Native gel electrophoresis for Proteins.
14. Protein dialysis
15. Handling and proper disposing of radioisotopes (protocol)

Learning Resources	1. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. Edited by Andreas Hoffmann. Cambridge University Press, 2018.	1. Biophysical Chemistry Principles and Techniques handbook, A. Upadhayay, K. Upadhayay and N. Nath. 2. Analytical Techniques in Biochemistry and Molecular Biology By Rajan Katoch

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 2	Understand	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Apply	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Level 4	Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. N. Prasanth Bhatt

Course Code	UBT22602J	Course Name	PLANT BIOTECHNOLOGY	Course Category	C	Professional Core Course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	BIOTECHNOLOGY	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning
CLR-1 :	Understand about Plant Genome	Bloom's Level
CLR-2 :	Study about the plant tissue culture	
CLR-3 :	Gain knowledge on the gene transfer methods	
CLR-4 :	Learn about the vectors	
CLR-5 :	Learn about Single-cell proteins	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning
CLO-1 :	Understand the basic concepts of plant and organelle genome	3
CLO-2 :	Understand the concepts of tissue culture techniques	3
CLO-3 :	Gain knowledge on genetic engineering of plants	3
CLO-4 :	Apply knowledge vectors and protoplast isolation methods	3
CLO-5 :	Have overall understanding of applications of plant biotechnology	3

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO – 3
H	M	H	H	M	L	L	L	L	L	-	M	-	-	-
H	H	H	H	H	H	H	H	M	M	-	H	-	-	-
M	H	H	H	H	H	M	M	M	L	-	H	-	-	-
M	H	H	H	H	H	M	M	M	L	-	H	-	-	-
M	H	H	H	H	H	M	M	M	L	-	H	-	-	-

Unit I

Introduction of plant genome, Structural organization nuclear genome, Chloroplast genome, CMS in Maize, Mitochondrial genome
Symbiotic associations, molecular biology of N2 fixation, Nome Analysis – Arabidopsis,

1. Isolation of plant genomic DNA
2. Isolation of total RNA from sprouting seeds.

Unit II

Plant biotechnology – overview, History of plant biotechnology, Achievements in plant biotechnology, Media Components, Hormones and Sterilization, Micropropagation, Callogenesis, Organogenesis, Embryogenesis, Somatic Embryogenesis, Protoplast technology, Germination of seed.

1. Isolation of total RNA from sprouting seeds,
2. Preparation of Plant tissue culture media and Stock solutions

Unit III

Genetic engineering in plants – Introduction, methods of gene transfer, Physical methods, Gene Gun, Shoot/ Root induction – organogenesis, Chemical methods, biological methods, Agrobacterium mediated, Transformation, , Agrobacterium Technology, Chloroplast engineering, Transposons in Maize, Somatic embryogenesis.

1. Electroporation
2. Haploid production – Anther & ovule culture

Unit IV

Selectable markers, reporter genes, promoters used in vectors, Transposons in transgenic plants, GURT, Gene silencing, crop improvement, Production of transgenic plants, Molecular farming, GM crops, GM seeds, Agrobacterium mediated transformation.

1. Protoplast isolation – enzymatic method
2. Protoplast fusion by PEG

Unit V

Commercialization of plant biotechnology, improvement of SCP, Algal source, Fungal source, Gus assay/ GFP cloning, **Hydrophonics**, **Aquaphonics**, plant cell bioreactors, **Isolation of Rhizobium from root nodules**, therapeutic vaccines, therapeutic proteins, Biosafety of GM plants, ELSI,

Learning Resources	*Text Books:*	**Reference:**
	3. DoodsD.H.,"Plant Genetic Engineering" Scientific American Books NY 2002. *4. LycettG.W.and Grierson D.,, "Genetic Engineering of crop plants" Butterworth-Heinemann, USA, 2007*	1. ChrispeelsM.J.andSadavaJhones D.F., *"Plants, genes and agriculture",* ASPP Press, 2009. 2. A. Hammond Mcgarvey and Yusibov,, *"Plant biotechnology new products and application"*, Published by Springer, New Delhi, 2009

Learning Assessment											
	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 2	Understand	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Apply	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Level 4	Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. Infant Santhose

Course Code	UCY22G01T	Course Name	MATERIAL SCIENCE AND NANOTECHNOLOGY	Course Category	G	Generic Elective Courses	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Chemistry	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	*Acquire basic knowledge about an emerging nanomaterial*	
CLR-2:	*Learn about various methods for naonmaterials synthesis*	
CLR-3:	*Acquire knowledge diverse analytical techniques for characterization of nanomaterials*	
CLR-4:	*Gain knowledge about importance of functionalization, surface modification of nanomaterials*	
CLR-5:	*Lleam about nanomaterials for energy, environmental and healthcare applications*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	Program Learning Outcomes (PLO)														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
			Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO -1	PSO -2	PSO-3
CLO-1:	*Understand the properties of emerging materials and nanotechnology*	*4*	*H*	-	-	-	-	-	-	-	-	-	-	*H*	-	-	-
CLO-2:	*Understand methods for materials synthesis and identify suitable methods for specific materials*	*4*	*H*	-	-	*M*	-	-	-	-	-	-	-	-	-	-	-
CLO-3:	*Understand suitable analytical techniques for nanomaterial characterization*	*4*	*H*	*H*	-	-	*H*	-	-	-	-	-	-	-	-	-	-
CLO-4:	*Understand importance of doping, surface modification and functionalization of the nanomaterials*	*4*	-	*H*	*H*	*M*	-	-	-	-	-	-	-	-	-	-	-
CLO-5:	*Apply nanomaterials and nanotechnologies towards sustainable goals like energy, environmental and healthcare applications*	*4*	-	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-	-

UNIT- I: Introduction to emerging nanomaterials

An overview and importance of emerging nanomaterials and nanotechnologies, emerging materials–crystalline, amorphous materials, porous carbon-based materials, graphene, silica, silica-based materials, polymeric carbon nitride, conducting polymers, quantum dots, organic – Inorganic hybrid materials, semiconducting materials, types of dimensional (1D,2D, and 3D), core – shell materials, bimetallic systems, metal dichalcogenides, discussion on various phenomenon at nanoscale materials, influence of nano morphologies and micro/macro, nanosizes on the properties.

UNIT- II: Nanomaterials synthetic techniques

Various methods for nanomaterials synthesis – top-down and bottom-up, Sono-chemical, Hydrothermal, Solvothermal, Microwave assisted, grinding - high energy ball milling, Laser Ablation, Flame Ablation, Electrochemical, Chemical Vapour Deposition, Physical Vapour Deposition, Electrodeposition method, calcination, sol gel method- template assisted-non template assisted, self-assembly.

UNIT-III: Analytical techniques for characterization of nanomaterials

Discussion on various techniques for characterization of nanomaterials (to understand optical, structural, composition and surface properties)- Powder X-ray diffraction (PXRD), Solid state UV-Vis, - Diffuse reflectance infrared Fourier transform spectroscopy (DRIFT), X-ray photoelectron X-ray photoelectron spectroscopy (XPS), Scanning Electron Microscope (SEM), High Resolution Transmission Electron Microscopy (HR-TEM), Electron Energy Loss spectra (EELS), STEM, fluorescence, XRF (X-ray fluorescence), introduction (Synchrotron) to X-ray absorption spectroscopy- X-ray absorption near edge structure (XANES), Introduction to extended X-ray absorption fine structure (EXAFS).

UNIT- IV: Surface modification of Nanomaterials and their potential applications

Impact on surface modification-doping, functionalization, effect of heteroatom incorporation, metal sulphide, metal phosphide, introducing impurities to nanomaterials, effect of composition on catalytic efficiency and technological applications, surface modification-impact on nanomaterials properties.

UNIT-V: Nanomaterials for energy and environmental and healthcare applications

Electronics, nanoelectronics, engineering, medicinal application, drug delivery, healthcare products, earth science, membranes, ceramic membranes, environmental applications, including water purification, virus elimination. Sustainable Energy-Solar Energy Conversion, Dye-sensitized solar cells, hydrogen production, carbon-di-oxide conversion, water depollution.

Learning Resources

References:

1. C. N. R. Rao, A. Muller and A. K. Cheetam, (Eds) The Chemistry of Nanomaterials, Vol.1, and 2, Wiley – VCH, Weinheim, 2004.
2. Roco, M. C. "Nanoparticles and nanotechnology research." Journal of Nanoparticle Research 1.1 (1999): 1.
3. C. P. Poole, and Jr. F. J. Owens, Introduction to Nanotechnology, Wiley Interscience, New Jersey. 2003.
4. T. Pradeep, Nano: The Essentials in Understanding Nanoscience and Nanotechnology, Tata McGraw Hill, New Delhi, 2007.
5. K. J. Klabunde, Nanoscale materials in Chemistry, Wiley Interscience, New York, 2001
6. T. Tang and P. Sheng, Nano Science and Technology – Novel Structures and Phenomena,Taylor & Francis, New York, 2004.R. H. Thomson, Chemistry Of Natural Products, 2nd Edition, Springer publication, ISBN-10 : 8181288637

	7. J. Clayden, N. Greeves, S. Warren and P. Wothers, Organic Chemistry, 1st Ed., Oxford University Press, 2001. 8. M.B. Smith & J.March, March's Advanced Organic Chemistry, 5th Ed., John Wiley & Sons, New York, 2001.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-	20%	-	20%	-
Level 3	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
Level 4	Analyze	20%	-	20%	-	20%	-	20%	-	20%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers

Expert from Industry	Experts from Higher Technical Institutions	Internal Experts
Dr. Ravikiran Allada, Head R&D, Analytical, Novugen Pharma, Malaysia Email: ravianalytical@gmail.com	Dr. G. Sekar, Department of Chemistry, IIT Madras, Dr. Kanishka Biswas, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru	Dr. M. Arthanareeswari, SRMIST Dr. Karthikeyan Sekar, SRMIST

Course Code	UMA22G01T	Course Name	FOUNDATIONS OF STATISTICS	Course Category	G	Generic Elective Course	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Mathematics	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning	Program Learning Outcomes (PLO)

		Bloom's Level
CLR-1:	Understand the limitations of statistics	
CLR-2:	Employ frequency histogram and polygon	
CLR-3:	Introduce the concept of central tendency	
CLR-4:	Illustrate the standard deviation and its properties	
CLR-5:	Understand the role of rank correlation and repeated ranks.	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Bloom's Level	1 Disciplinary Knowledge	2 Critical Thinking	3 Problem Soiving	4 Analytical Reasoning	5 Research Skills	6 Team Work	7 Scientific Reasoning	8 Reflective Thinking	9 Self-Directed Learning	10 Multicultural Competence	11 ICT Skills	12 Life Long Learning	13 PSO -1	14 PSO -2	15 PSO-3
CLO-1:	Gain an insight on statistical concepts	*4*	*H*		*H*	*H*	*H*	-	-	-	-	-	-	*H*	-	-	-
CLO-2	Be familiar with the Graphical representation of data	*4*	*H*	*H*	*M*	*H*	*H*	-	-	-	-	-	-	*H*	-	-	-
CLO-3:	Understanding Mean, Median and Mode.	*4*	*H*	*H*	*H*	*H*	*M*	-	-	-	-	-	-	*H*	-	-	-
CLO-4:	Analyze thoroughly the measures of dispersion	*4*	*H*	*H*	*M*	*H*	*H*	-	-	-	-	-	-	*M*	-	-	-
CLO-5:	Classify the role of types of correlation	*4*	*M*	*H*	*M*	*L*	*H*	-	-	-	-	-	-	*L*	-	-	-

Unit-1: Statistics – Definition – Primary and secondary data – Limitations of Statistics – Statistical methods.
Unit-2**:** Graphical representation of data – Bar graph – Pie diagram– Classification of data – frequency histogram – Polygon – Ogive curves
Unit-3: Mean – Median – Mode – Properties – Merits – Demerits – graphical method.
Unit-4: Measures of Dispersion – Range - Mean Deviation about mean – Standard Deviation – Properties – Coefficient of variation.
Unit-5: Simple Correlation – Types of Correlation – Rank correlation – Repeated ranks.

Learning Resources	1. Pillai, R.S.N, Bagavathi, V. (2009), Statistics, Theory and Practice, 7th Edition, S. Chand Ltd, New Delhi. 2. Ken Black, (2013), Business Statistics for Contemporary Decision Making, 7th Edition, John Wiley Publications. 3.Gupta, S.P. (2011), Applied Statistical Methods, 4th Edition, Sultan Chand & Sons, New Delhi.	4.Probability and Statistics for Engineers (4th Edition), I.R. Miller,J.E.Freundand R.Johnson, 2015. 5.Fundamentals of Statistics(Vol. I & Vol. II), A. Gun,M. k.GuptaandB.Dasgupta, 2016 6.Lipschutz. S and Schiller. J, "Schaum's outlines - Introduction to Probability and Statistics", McGraw-Hill, New Delhi, 1998

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (100% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)			
		Theory	Practice	Theory	Practice	Theory	Practice	Practice	Theory	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-	-	20%	20%	-
Level 2	Understand	20%	-	20%	-	20%	-	-	20%	20%	-
Level 3	Apply	40%	-	40%	-	40%	-	-	40%	40%	-
Level 4	Analyze	20%	-	20%	-	20%	-	-	20%	20%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100%	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. Madhan Shanmugasundaram , Director, Infosys Technologies, Chennai	*Prof. Y.V.S.S. Sanyasiraju, IIT Madras, sryedida@iitm.ac.in*	Dr.B.Vennila, SRMIST
	Prof. B. V. Rathish Kumar, IIT Kanpur, bvrk@iitk.ac.in	*Dr. C. Gunasundari, SRMIST*

Course Code	UPY22G01T	Course Name	LASER Physics	Course Category	G	Generic Elective Course	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Physics and Nanotechnology	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	*acquire the knowledge on laser beam characteristics*	Bloom's Level
CLR-2:	*acquire knowledge for solving problems in laser physics*	
CLR-3:	*analyze Fabry-Perot cavity to understand laser resonator*	
CLR-4:	*gain knowledge on Q-switched and mode-locked lasers*	
CLR-5:	*acquire the knowledge on lasers classes and laser safety*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning
CLO-1:	*understand the basic characteristics of a laser*	4
CLO-2:	*analyse Fabry Perot cavity to understand a laser resonator*	4
CLO-3:	*learn Rate equations to understand the dynamics of a laser*	4
CLO-4:	*understand the conditions of stable resonators*	4
CLO-5:	*acquire knowledge on various types of lasers and the physics of higher harmonic generation*	4

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
H	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-
-	-	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-
-	-	*H*	*H*	-	-	-	-	-	-	-	-	-	-	-
H	-	-	*H*	-	-	-	-	-	-	-	-	-	-	-

Unit-1: General Introduction to lasers, Spontaneous and stimulated emission, Stimulated absorption, The laser idea, Gain medium, pumping scheme and optical feedback, Properties of laser beams: Monochromaticity, Directionality, coherence, Modes of a cavity, Black body radiation, Calculation of mode density, Calculating number of photons per mode for black body, Comparison of black body radiation with laser radiation, Line shape functions, Line-broadening mechanisms, Homogeneous and Inhomogeneous broadening, Natural, Doppler and Collison broadening,
Unit-2: Cavity life time and Quality factor, Ultimate line width of a laser, Einstein's A and B Coefficients, Ratio of A and B at thermal equilibrium, Introduction to resonators, Fabry-Perot cavity, Basic apparatus, Elementary theory of Fabry-Perot cavity, Transmission spectrum of a Fabry-Perot cavity, Coefficient of finesse/Quality factor, Fundamental Gaussian beam, Gaussian beam in homogeneous medium, Gaussian beam focusing, Higher order Gaussian beams, Analysis of higher order Hermite Gauss beams
Unit-3: Geometrical optics analysis of optical resonators, Condition for stable resonators, Stability diagram for optical resonators, Sources of resonator loss, Laser rate equations, Introduction to four level laser system, Mathematical formulation of rate equations for four level laser system, Condition for population inversion, Threshold condition for four level system, Calculating threshold for He-Ne laser, Integrating cavity rate equation, Rate equations under steady state condition, Variation of laser power around the threshold, Optimum output coupling, Laser spiking
Unit-4: Introduction to Q-switching, Dynamics of the Q-switching process, Electro-optical Q-switching, Introduction to mode locking, Mathematical interpretation for mode locking, Passive and active mode locking, Gain saturation, Hole burning, Spatial hole burning, Longitudinal and transverse mode selection, Single mode operation, Multi-mode laser, Gain competition, Optical amplification
Unit-5: Coherence properties of laser light, Temporal coherence, Spatial coherence, Specific laser systems: Ruby laser, He-Ne laser, Carbon dioxide laser, Dye lasers, Semiconductor lasers, DBR lasers, Nd:YAG laser, Higher harmonic generation, Physics of second and third harmonic generations, Classification of lasers and precautions.

Learning Resources	
	1. K. Thyagarajan and A.K. Ghatak, Lasers Theory and Applications, 1st Ed., Macmilan Publishers, 2010. 2. O. Svelto, Principles of lasers, 4th Ed., Springer, 1998. 3. A. Yariv, Quantum Electronics, 3rd Ed., John Wiley, New York, 1989 4. Seigman, Lasers, 3rd Ed., Oxford Univ. Press, 1986. 5. B.E.A. Saleh and M.C. Teich, Fundamentals of Phtonics, 2nd Ed., Wiley, 2012.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%		20%		20%		20%		20%	
Level 2	Understand	20%		20%		20%		20%		20%	
Level 3	Apply	40%		40%		40%		40%		40%	
Level 4	Analyze	20%		20%		20%		20%		20%	
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers		
Experts from Industry	Experts from Higher Technical Institutions	Internal Experts
Mr. R Seshadri, Titan Company Limited, seshadri@titan.co.in	Prof. C Vijayan, IIT Madras, cvijayan@iitm.ac.in	Dr. K. Shadak Alee, SRMIST
Dr. N Vijayan, NPL, nvijayan @nplindia.org	Prof. S Balakumar, University of Madras, balakumar@unom.ac.in	Dr. Trilochan Sahoo, SRMIST

Course Code	UBT22D06T	Course Name	BIOPHYSICS	Course Category	D	DISCIPLINE SPECIFIC ELECTIVE	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	BIOTECHNOLOGY	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	Understanding the basics of biomolecule structure	Bloom's Level
CLR-2 :	Understand the principle of various instruments	
CLR-3 :	Understanding the physics involved in human physiology	
CLR-4 :	To understand the concept of Membrane potential	
CLR-5 :	To know about the radiobiology	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Bloom's Level
CLO-1 :	Knowledge on biomolecule structure	2
CLO-2 :	Knowledge on working of instruments	3
CLO-3 :	Knowledge about the human physiology	3
CLO-4 :	Knowledge on propagation of signals among cells	3
CLO-5 :	Knowledge on radiobiology and its usage in imaging	3

Program Learning Outcomes (PLO)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO – 2	PSO – 3
CLO-1	H	H	H	H	H	H	M	M	M	L	-	H	-	-	-
CLO-2	L	H	H	H	H	H	M	M	M	L	-	H	-	-	-
CLO-3	L	H	H	H	H	H	M	M	M	L	-	H	-	-	-
CLO-4	L	H	H	H	H	H	M	M	M	L	-	H	-	-	-
CLO-5	L	H	H	H	H	H	M	M	M	L	-	H	-	-	-

UNIT I:
Introduction to biophysics, Structure of Amino acids and its significance, Peptide bond and its structural importance, Torsional angles, its importance in secondary structure formation, Ramachandran plot, Stretching of macromolecules, Protein folding, Helix coil transition, Nucleic acids, Watson and crick model, polymorphism in DNA

UNIT II:
Bravais lattices, Braggs Law, Millers indices, X-Ray diffraction, Light scattering, Neutron scattering, Principle of NMR, Application of NMR, Principle & Applications of Circular Dichroism, Principle of LC-MS, Application of LC-MS

UNIT III:
Physics behind ventilation, pressure changes in ventilation, pressure volume interrelationship, air flow resistance, Ficks Law, Diffusion capacity, Hemodynamics, Excitation contraction coupling, Electrical properties of heart muscles, Work done by heart, clinical electrocardiography, Electrical properties of heart muscles, Work done by heart, clinical electrocardiography

UNIT IV:
Membrane potential of cell, Development of Membrane potential, Diffusion potential, Magnitude of resting Membrane potential, Action potential, Development of Action potential, Sodium pump, Calcium pump, Propagation of AP, Synaptic potential and End plate potential, Voltage gated channel

UNIT V:
Concept of radiobiology, ionizing radiation and types, Direct and indirect effects, Tumour radiotherapy, RadioImaging techniques, X-Ray, PET scan, MRI, Ultrasonography, GIMG

Learning Resources	1. Principles and techniques of Biochemistry and Molecular biology, Wilson and Walker, 2013	1. Lehninger Principles of Biochemistry, W. H. Freeman, 2005

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	20%	-	40%	-	40%	-
Level 2	Understand	40%	-	30%	-	20%	-	40%	-	40%	-
Level 3	Apply	10%	-	20%	-	30%	-	10%	-	10%	-
Level 4	Analyze	10%	-	20%	-	30%	-	10%	-	10%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	

Course Code	UBT22D07T	Course Name	NANOBIOTECHNOLOGY	Course Category	D	*Discipline Elective Course*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology			Data Book / Codes/Standards	Nil

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	Understanding nanoscience	Bloom's level
CLR-2 :	Understanding the concepts of nanomaterials	
CLR-3 :	Knowledge on characterization of nanomaterials	
CLR-4 :	Knowledge on nanobiotechnology applications in environment	
CLR-5 :	Understanding the applications of nanotechnology	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning
CLO-1 :	To learn about nanoscience and their units and scales	1
CLO-2 :	Gathering knowledge on classes of nanomaterials	2
CLO-3 :	Applying knowledge on characterizing the nanomaterials	3
CLO-4 :	Applying knowledge on waste treatment using nanotechnology	3
CLO-5 :	Having knowledge on applications of nanobiotechnology	3

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO – 2	PSO – 3
H	H	H	H	H	-	-	M	M	L	-	H	-	-	-
H	H	H	H	H	-	-	M	M	L	-	H	-	-	-
H	H	H	H	H	-	-	M	M	L	-	H	-	-	-
H	H	H	H	H	-	-	M	M	L	-	H	-	-	-
H	H	H	H	H	-	-	M	M	L	-	H	-	-	-

Unit – 1 Introduction to nanoscience, Fundamentals of nanoscience, History of nanoscience, History of nanotechnology, Properties of nanoscale, Theory of scale, definitions in nanoscale, Scope and application, concepts of scaling, Applications in medicine, Applications in medicine, Discussion
Unit – 2 Introduction to nanomaterial, Classes of nanomaterials, Metal nanomaterials, Semiconductor Nanomaterials, Quantum Dots, Wells and Wires, Carbon Nanotubes, Organic-based, nanomaterials., Organic-based nanomaterials.,Chemical based nanomaterials, Chemical based nanomaterials, Discussion
Unit – 3 Synthesis of nanomaterials, Characterization of Nanomaterials, Top-down method, Colloidal synthesis solgel method, Self-assembly method, Molecular design and modeling, Physico-chemical, characterization on nanomaterials, optical method UV-vis absorption, electron microscopy techniques, SEM, electron microscopy techniques, SEM, electron microscopy techniques, TEM, scanning probe method
Unit - 4 Environmental issues, Nanotechnology and Environment, Treatment of contaminated surface water, Treatment of contaminated ground water, Treatment of contaminated waste water, Nanofiltration for water purification, nanofilters for air pollution, environmental remediation, environmental remediation, Reduction of metal waste, Other appllications, Discussion
Unit- 5 Applications of Nanomaterials, Application of nanomedicine, Application of biosensors, Nanobiotechnology, Drug Delivery, Green Nanotechnology, Nanomaterials as solution to environmental problems, Nanomaterials for solar cells, Nanomaterials for fuel cells, Role of nanomaterials in drug delivery, Role of nanomaterials in drug delivery, Discussion

Learning Resources	
1.	David S. Goodsell, *"Bionanotechnology"*, John wiley & sons inc., publications, 2004.
2.	Shanmugam.S, *"Nanotechnology"*, MJP publishers, 2010
3.	Niemeyer, C.M. Mirking C.A., "*Nanobiotechnology concepts, Applications and Perpectives*", 2004.
4.	Manasi Karkare, *"Nanotechnology"*, I.K. International publishing House Pvt.Ltd, 2008.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%) #			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%		20%		20%		40%		30%	
Level 2	Understand	40%		40%		40%		40%		40%	
Level 3	Apply	20%		40%		40%		20%		30%	
Level 4	Analyze										
Level 5	Evaluate	-	-	-	-	-		-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	

SEMESTER VII

Course Code	UBT22701J	Course Name	ANIMAL BIOTECHNOLOGY	Course Category	C	Professional Core Course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	BIOTECHNOLOGY	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	Understand the basics of animal cell culture	Bloom's level
CLR-2 :	Understand the development of transgenic animals	
CLR-3 :	Gain knowledge on assisted reproductive techniques	
CLR-4 :	Develop an understanding on the applications of animal biotechnology	
CLR-5 :	Learn the recent techniques in animal biotechnology	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Bloom's level
CLO-1 :	Learn about the culturing of animal cells	3
CLO-2 :	Acquire knowledge on gene transfer methods	3
CLO-3 :	Apply knowledge on the development of transgenic animals	3
CLO-4 :	Apply knowledge on the use of animal models for human genetic disorders	3
CLO-5 :	Gain knowledge on gene therapy and its applications	3

Program Learning Outcomes (PLO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO – 2	PSO – 3
H	-	-	H	-	L	-	-	-	-	-	L	-	-	-
H	-	-	H	-	M	-	-	-	-	-	L	-	-	-
H	H	M	M	H	H	-	M	-	-	-	H	-	-	-
H	H	H	M	H	H	-	M	-	-	-	H	-	-	-
H	M	H	H	H	H	-	M	-	-	-	H	-	-	-

Unit I

Animal Cell Culture – Introduction, Growth in serum & serum-free media, Viral evaluation of animal cell lines used in Biotechnology, Optimizing gene expression in mammalian cells, Recombinant cells, Cell Bank preparation, DNA fingerprinting, Characterization of animal cells, Viability measurements**.**

1. **Setup of cell culture laboratory**
2. **Introduction to Animal Biotechnology Laboratory - Lab Safety discussion**
3. **Isolation of human genomic DNA**
4. **Preparation of animal cell culture media**

Unit II

Transgenic animals – Introduction, Transgenic animals – Development, Transgenic mice and transgenic fish, Transgenic animals – Uses, , Methods of gene transfer, Methods of gene transfer, Baculoviruses and transgenic silkworm, Cloning for conservation of endangered species, Development of cell culture and cell lines, In situ preservation of germplasm, Ex situ preservation of germplasm, Aquafarming,

5. **Filter sterilization of animal cell culture media**
6. **Development of cell culture and cell lines.**

Unit III

Assisted reproductive techniques, Cryopreservation, Pregnancy diagnosis, Pregnancy diagnosis, In utero testing of foetus for genetic defects, Gene knockout technology, Subculturing / passaging,
Animal models for human genetic disorders.

7. **Subculturing / passaging**
8. **Quantitation of animal cells using hemocytometer**

Unit IV

Hybridoma Technique, Probes for diagnosis of Animal diseases, Modern biotechnology Oriented Vaccines, DNA Vaccines in Animal Disease, Animal system as bioreactors, Animal cells for transplantation, Animal biotechnology- Medical applications, Animal biotechnology- Industrial applications, Animal biotechnology- Industrial applications.

9. **Cell viability test**
10. **Differential counting of WBC**
11. **Human lymphocyte culture**

Unit V

Culturing animal cells in Fluidized bed reactors, anchored fusion proteins, Harvesting GPI-Anchored proteins from CHO cells, Gene therapy, Gene therapy, Molecular markers in clinical diagnosis, Molecular markers in tissue typing, Human genome project, Chick embryo fibroblast, Human genome project – applications, Human cloning – ethical limits, Human cloning – regulations and issues

12. **Human lymphocyte culture**

Learning Resources	Animal Biotechnology: Recent Concepts and Developments. P Ramadass. MJP Publications, 2015. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, 6th Edition. Ian Freshney. John Wiley & Sons, 2010. Animal Cell Biotechnology: Methods and Protocols (Methods in Biotechnology). Nigel Jenkins. Totowa, N.J. : Humana Press, 1999.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 2	Understand	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Apply	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Level 4	Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. G. Swamynathan

Course Code	UBT22702J	Course Name	GENETIC ENGINEERING	Course Category	C	Professional Core Course	L	T	P	C
							4	0	4	6

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	BIOTECHNOLOGY	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	The purpose of learning this course is to:	Learning
CLR-1 :	Understanding the enymes involved in Genetic engineering	Bloom's Level
CLR-2 :	Understanding the properties and functions of restriction enzymes	
CLR-3 :	Understanding the importance of vectors	
CLR-4 :	Understanding the DNA amplication techniques	
CLR-5 :	Knowledge on screening methods	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Bloom's Level
CLO-1 :	Acquire basic Knowledge of enzymes in genetic engineering	2
CLO-2 :	Basic Knowledge on restriction enzyme role in genetic engineering	3
CLO-3 :	Understanding the vectors types	3
CLO-4 :	Gain knowledge on PCR techniques	3
CLO-5 :	Gain knowledge on gene transfer methods	3

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Fundamental Knowledge	Application of Concepts	Link with Related Disciplines	Procedural Knowledge	Skills in Specialization	Ability to Utilize Knowledge	Skills in Modeling	Analyze, Interpret Data	Investigative Skills	Problem Solving Skills	Communication Skills	Analytical Skills	PSO - 1	PSO - 2	PSO – 3
L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
L	H	H	H	H	-	-	M	M	L	-	H	-	-	-
L	H	H	H	H	-	-	M	M	L	-	H	-	-	-

Unit I

Impact of genetic engineering in modern society, Restriction enzymes- introduction and types, Star activity of restriction enzymes, DNA modifying enzymes, Linkers and adapters, RNases-RNaseI, RNaseA, RNaseH -, Nucleases – RNase free DNAse-Exonuclease I, Exonuclease III, Mung Bean, Nuclease. Kinases - T4 polynucleotide kinase. Phosphatases Topoisomerase, Restriction Digestion.

1. **Isolation of plasmid DNA from bacterial culture**
2. **Homopolymer tailing Isolation, purification, and identification of protein**

Unit II

Introduction to cloning vectors, Vectors: Prokaryotic Vectors: Plasmids, Phagmid, artificial chromosomes, Yeast vectors. Ligation technique, artificial chromosomes, Yeast vectors, Plant vectors, Animal viral vectors, Ligation technique, Animal viral vectors, Expression vectors, shuttle vectors, plasmid vectors (high copy and low copy), phage vectors, cosmid vectors.

3. **Preparation of competent cell and transform the competent in to EcoKI bacteria**

Unit III

Cloning strategy and Screening methods, Screening methods, Gene transfer techniques: Bacterial Conjugation, Transformation, Gene transfer techniques: Bacterial Conjugation, Transformation, Transduction, Microinjection, Transduction, Microinjection, Electroporation, Microprojectile, Shot Gun, Ultrasonication, Liposome fusion, Identification of recombinants – antibiotic markers, Blue-white colony selection, PCR – technique, designing of primers, types of PCR – multiplex, nested; reverse-transcription PCR, Identification of recombinants – antibiotic markers, Blue-white colony selection.

4. **Preparation of competent cell and transform the competent in into EcoKI bacteria**

Unit IV

Real-time PCR, touchdown PCR, hot-start PCR, colony PCR, asymmetric PCR, Cloning of PCR products, DNA fingerprinting, DNA-protein interactions and analysis, Gene silencing techniques; introduction to siRNA, PCR.

5. **Isolation of RNA**
6. **Quantification of DNA and RNA by spectrophotometer**

Unit V

siRNA technology, Micro RNA, PCR, principle and application of gene silencing, gene knockouts and gene therapy
gene knockouts and gene therapy, CRISPR-CAS

7. **Construction of siRNA vectors**
8. **Blotting techniques**

Learning Resources	1. Old, R. W., Primrose, S. B., & Twyman, R. M. (2001). Principles of Gene Manipulation: an Introduction to Genetic Engineering. Oxford: Blackwell Scientific 2. **Lewin's "Genes" – 12th Edition, 2017**. 3. Brown, T. A. (2006). Genomes (3rd ed.). New York: Garland Science Pub.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 2	Understand	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 3	Apply	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%
Level 4	Analyze	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Short Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. D. Sankari

Course Code	UBT22703T	Course Name	SIGNAL TRANSDUCTION AND INTERMEDIARY METABOLISM	Course Category	C	Profession core	L	T	P	C
							3	1	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards		Nil	

		Learning
Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	
CLR-1:	***To have knowledge on hormone based signaling and hormones***	Bloom's Level
CLR-2:	***Basic knowledge on receptor kinases and homeostasis***	
CLR-3:	***Gain information on glucose metabolism***	
CLR-4:	***Have basic knowledge on fatty acid metabolism***	
CLR-5:	***Basic knowledge on aminoacid metabolism***	
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	
CLO-1:	***The candidate will come to know above hormones and its receptor regulation***	4
CLO-2:	***The candidates understand the mechanism of receptor kinases***	4
CLO-3:	***Apply the knowledge of glucose metabolism***	4
CLO-4:	***Learn the lipid biosynthesis and degradation.***	4
CLO-5:		4

Program Learning Outcomes (PLO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H					-	-	-	-	-	-	-	-	-	-
H					-	-	-	-	-	-	-	-	-	-
H					-	-	-	-	-	-	-	-	-	-
H					-	-	-	-	-	-	-	-	-	-
H					-	-	-	-	-	-	-	-	-	-

Unit-1 Hormones: Chemical classification of hormones. Functions of hormones and their regulation. Chemical signaling - endocrine, paracrine, autocrine, intracrine and neuroendocrine mechanisms, Hormone receptors - extracellular and intracellular,
Unit-2 Receptor tyrosine kinases – EGF, insulin and Ras - MAP kinase cascade, Non receptor tyrosine kinase- erythropoietin receptor JAK - STAT pathway, Steroid hormone Receptor, Receptor regulation, cross talk, calcium homostasis
Unit-3: Introduction to Metabolism, Bioenergetics, Importance of ATP, Glycolysis, TCA, gluconeogenesis, glycogen metabolism, Pentose phosphate pathway.
Unit-4: Fatty acid biosynthesis, Cholestrol biosysthesis, oxidation of fatty acids (α, ß, ω).
Unit-5: Non-essential amino acid biosynthesis, Urea cycle, Nucleic acids- Biosynthesis and degradation

Learning Resources	1. Lehninger: Principles of Biochemistry (2017)7th ed., Nelson, D. L .andCox, M.M. W.H. Freeman & Company (New York). 2. Vander's Human Physiology (2019)15th ed., Widmaier E.P., Raff,H and Strang, K.T. McGraw Hill International Publications (USA).	3. Endocrinology (2007) 6th ed., Hadley, M.C. and Levine, J.E. Pearson Education (New Delhi), Inc.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%		30%		30%		30%		30%	
Level 2	Understand	20%		20%		20%		20%		20%	
Level 3	Apply	40%		40%		40%		40%		40%	
Level 4	Analyze	20%		20%		20%		20%		20%	
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. S. Vijayabharathi

Course Code	UBT22D08T	Course Name	TUMOR BIOLOGY	Course Category	D	*Discipline Elective Course*	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	BIOTECHNOLOGY	Data Book / Codes/Standards	Nil		

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	*Explain the complex nature of cancer and elements that causes cancer*	Bloom's Level
CLR-2:	*Orientation to behavioural changes in cell basic function- growth, division and death cycle*	
CLR-3:	*Comprehensive ideology of genetics behind Cancer*	
CLR-4:	*Explain the meddling and adaptation of cancer cell to microenvironment and its growth*	
CLR-5:	*Push the perceptive limits and throw the lights on possible treatment for cancer*	
Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	
CLO-1:	*Understand the important terminology in cancer and potent carcinogens*	4
CLO-2:	*Have clear idea on the cell basic function*	4
CLO-3:	*Understand role of genes in cell and deregulation of genes in Cancer*	4
CLO-4:	*Cognize the metastasis of cancer and how it survives even at distant site*	4
CLO-5:	*Understand the possible ways involved in detection and treatment of Cancer*	4

Program Learning Outcomes (PLO)															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	L	M	M	M	-	-	-	-	-	-	-	-	-	-
H	L	H	M	M	-	-	-	-	-	-	-	-	-	-
H	L	H	M	M	-	-	-	-	-	-	-	-	-	-
H	L	M	M	M	-	-	-	-	-	-	-	-	-	-
H	L	M	M	M	-	-	-	-	-	-	-	-	-	-

UNIT – I FUNDAMENTALS OF CANCER BIOLOGY

Cancer- Introduction to Cancer: Properties of cancer, Heterogeneity of cancer, pathology: pathological grade based on tumor cell differentiation, different forms and stages of cancer, Carcinogens: factors that influence the cancer.

UNIT – II MOLECULAR CELL BIOLOGY OF CANCER

The Cell-Cycle and Cancer: Cell cycle and regulation: G1/S transition, G2/M transition, DNA damage and Spindle Checkpoint, De-Regulation of cell cycle in cancer, Apoptosis: Defects of apoptosis machinery in cancer cells.

UNIT –III GENETICS OF CANCER

Cancer Critical Genes: Tumor Suppressor Genes: Role of pRb and p53 proteins in cancer. Proto-oncogenes: Mutation that converts proto-oncogenes to oncogenes, Growth regulation and signal transduction: Growth Factor, Growth Factor Receptors and Signal transduction in Cancer, Viral Oncogenesis

UNIT – IV CANCER INVASION AND METASTASIS

Invasion – Three step theory of Invasion, Role of Integrins in ECM remodeling, Proteolytic enzymes involved in Invasion process. Metastatic Cascade and Growth of tumor cells at secondary site

UNIT –V CANCER THERAPY

Cancer Screening, Diagnosis and Prevention: Genetic Markers, Diagnostic and Prognostic biomarkers, Available treatment modalities: Surgery, Chemotherapy, Radiotherapy and Photodynamic therapy.

Learning Resources

1. King R.J.B., *Cancer Biology*, Addision Wesley Longmann Ltd, U.K., 1996.
2. Maly B.W.J., *Virology a practical approach*, IRL press, Oxford, 1987.
3. Dunmock.N.J and Primrose S.B., *Introduction to modern Virology*, Blackwell Scientific Publications.
4. Ruddon.R.W., *Cancer Biology*, Oxford University Press, Oxford, 1995.

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%) #			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%		40%		40%		40%		40%	
Level 2	Understand	40%		40%		40%		40%		40%	
Level 3	Apply	10%		10%		10%		10%		10%	
Level 4	Analyze	10%		10%		10%		10%		10%	
Level 5	Evaluate	-	-	-	-	-		-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers

Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai	
2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	

Course Code	UBT22D09T	Course Name	MEDICAL BIOTECHNOLOGY	Course Category	D	*Discipline Elective*	L	T	P	C
							3	0	0	3

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	*Understanding the basic concepts of medical biotechnology & drug design*
CLR-2 :	*Understanding the techniques used for disease diagnosis*
CLR-3 :	*Knowledge on ART & ACC*
CLR-4 :	*Knowledge on the types of vaccines*
CLR-5 :	*Knowledge on gene therapy & its applications*

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning Bloom's level		
CLO-1 :	*To understand the applications of medical biotechnology*	1	80	70
CLO-2 :	*Application of techniques for the diagnosis of diseases*	1	85	75
CLO-3 :	*Applying knowledge to understand the use of animal cell culture*	1	75	70
CLO-4 :	*Understand the vaccination process and the use of various vaccines*	1	85	80
CLO-5 :	*Having knowledge on gene therapy and stem cell therapy*	2	85	75

Program Learning Outcomes (PLO)														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO – 1	PSO - 2	PSO – 3
H	H	H	H	H	-	-	-	-	-	-	-	H	H	H
H	H	H	H	H	-	-	-	-	-	-	-	H	H	H
H	H	H	H	H	-	-	-	-	-	-	-	H	H	H
H	H	H	H	H	-	-	-	-	-	-	-	H	H	H
H	H	H	H	H	-	-	-	-	-	-	-	H	H	H

Unit – 1 Medical Biotechnology – Introduction, Medical Biotechnology – Basic concepts, Medical Biotechnology – Scope, Medical, Biotechnology – Applications, Drug designing – Introduction, Drug designing – Introduction, Developmental process

Unit – 2 Diagnosis - Invasive techniques, Diagnosis – Non-invasive techniques, Diagnosis of pathogenic microbes, Diagnosis of pathogenic microbes – Classical methods, Diagnosis of pathogenic microbes – Modern methods,, Diagnosis using protein markers, Diagnosis using enzyme markers, DNA markers

Unit – 3 Assisted reproductive technology, diagnosis, Animal cell culture – media, Maintenance of cell lines, Organ culture, Organ culture - applications

Unit - 4 Vaccines -conventional, Vaccines-recombinant, Synthetic peptide, DNA Vaccines, Antibiotics, Antibiotics – mode of action, Antibiotics – applications

Unit- 5 Hybridoma technique, Gene therapy, Gene therapy: *ex vivo,* Gene therapy: *in vivo,* Cell and tissue engineering, Stem cell therapy, Nanomedicines

Learning Resources	*1. Jogdand, S. N. Medical Biotechnology, Himalaya Publishing house, Mumbai, 2005.* *2. Trevan. "Biotechnology: The Biological Principles*	***3.*** *B. R. and Pasternak. Molecular Biotechnology: Principle and applications of recombinant DNA.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	20%	-	40%	-	40%	-
Level 2	Understand	40%	-	30%	-	20%	-	40%	-	40%	-
Level 3	Apply	10%	-	20%	-	30%	-	10%	-	10%	-
Level 4	Analyze	10%	-	20%	-	30%	-	10%	-	10%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	

Course Code	UBT22P01L	Course Name	INTERNSHIP	Course Category	P	Internship/ Project/ Community Outreach	L	T	P	C
							0	0	0	2

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Physics and Nanotechnology*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	*assist the student's professional skill development useful to employer such as teamwork, communications and work ethics & details*
CLR-2:	*provide unique learning opportunities by exposing the student to the environment and expectations of professional performance*
CLR-3:	*expand the student's knowledge of a particular area(s) of interest to enhance employability*
CLR-4:	*help students to explore career alternatives/opportunities prior to their graduation*

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:
CLO-1:	*demonstrate the skill gained through work experience with mentors or successful professionals to support the early stages of their career*

	Continuous Learning Assessment (50% weightage)		Final Evaluation (50% weightage)	
	Review – 1	Review – 2	Project Report	Viva-Voce
Internship	20%	30 %	30%	20 %

==========

Course Code	UBT22P02L	Course Name	MOOC	Course Category	P	Internship/ Project/ Community Outreach	L	T	P	C
							0	0	0	2

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Physics and Nanotechnology*	Data Book / Codes/Standards	*Nil*		

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1:	*encourage initiative by Govt. of India to achieve the three cardinal principles of access, equity and quality in different learning communities.*

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:
CLO-1:	*demonstrate the knowledge and skill gained through learning of professional/elective courses taken on SWAYAM portal*
CLO-2:	*able to develop the professional skill on the subject areas beyond his curriculum*
CLO-3:	*experience unique and independent learning opportunity*
CLO-4:	*expand his/her knowledge of a particular area(s) of interest to enhance employability*

Learning Assessment	*Student shall be allowed to choose one Swayam course on the recommendation of faculty advisor and appropriate credits will be transferred as per BS regulations 2022*
MOOC	

==========

Course Code	UCY22AE1T	Course Name	RESEARCH METHODOLOGY	Course Category	AE	Ability Enhancement Course	L	T	P	C
							3	1	0	4

Pre-requisite Courses	*Nil*	Co-requisite Courses	*Nil*	Progressive Courses	*Nil*
Course Offering Department	*Chemistry*	Data Book / Codes/Standards		*Nil*	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	**Learning**
CLR-1:	practice the basic skills of research paper, review paper and thesis writing	
CLR-2 :	*develop the skill of technical writing*	
CLR-3 :	*evaluate different methods of scientific writing and reporting*	
CLR-4 :	*enable the students to* write conference abstract and research proposals	
CLR-5 :	*inculcate the knowledge of intellectual property and rights*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Level of Thinking (Bloom)	**Program Learning Outcomes (PLO)**													
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
			Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO -1	PSO -2	PSO-3
CLO-1 :	differentiate between various kind of academic writings	*4*	-	*H*	-	-	*M*	-	*H*	-	-	-	-	-	-	-	-
CLO-2 :	Practice the basic skills of performing quality literature review.	*4*	-	*H*	-	-	*H*	-	-	*H*	-	-	-	-	-	-	-
CLO-3 :	target the research work to suitable journal and communicate for publication	*4*	-	-	-	-	-	-	-	-	*H*	-	-	*M*	-	-	-
CLO-4 :	identify and avoid the plagiarism	*4*	-	-	-	*H*	-	-	-	-	*H*	-	-	-	-	-	-
CLO-5 :	*develop competence on data collection and process of scientific documentation*	*4*		*H*	-	-	-	-	*H*	-	*H*	-	-	-	-	-	-

UNIT- I: Academic & research writing
Introduction, Importance of academic writing, Basic rules of academic writing, English in academic writing, Types of academic writing - descriptive, analytical, persuasive and critical.

UNIT-II: Metrics and plagiarism
Plagiarism: Introduction; Tools for the detection of plagiarism; Avoiding plagiarism, Journal Metrics – Types of bibliometric indicators (Generation), Author metrics.

UNIT- III: Literature review and review paper writing
Literature review: Introduction, Source of literature; Process of literature review, Online literature databases; Literature management tools, Review Paper Writing,

UNIT- IV: Research paper and thesis writing
Research paper writing, Referencing and citation, Submission and, Post submission, Thesis Writing, Abbreviations, nomenclature, writing references, Research proposal writing; Abstract/ Conference Paper/ Book/ Book Chapter writing; Open Educational Resources (OERs) for learning & Research.

UNIT-V: Research ethics and intellectual property rights
Challenges in Indian research & writing; Team management (mentor and collaborators), Time Management, Ethics in research – authorship, acknowledgement, competing interest, COPE guidelines, Intellectual property rights – Copy rights and Patent rights.

Learning Resources

Theory:

1. Dawson, C, Practical research methods. UBS Publishers, New Delhi, 2002
2. Walpole R.A., Myers R.H., Myers S.L.and Ye King: Probablity and statstics for engineers and scientist, Pearson Prentice Hall, Pearson Education, Inc. 2007
3. Kothari C.K., Research Methodology-Methods and Techniques (New Age International, New Delhi), 2004

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	20%	-	20%	-	20%	-	20%	-	20%	-
Level 2	Understand	20%	-	20%	-	20%	-	20%	-	20%	-
Level 3	Apply	40%	-	40%	-	40%	-	40%	-	40%	-
Level 4	Analyze	20%	-	20%	-	20%	-	20%	-	20%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers		
Expert from Industry	**Experts from Higher Technical Institutions**	**Internal Experts**
Dr. Ravikiran Allada, Head R&D, Analytical, Novugen Pharma, Malaysia Email: ravianalytical@gmail.com	Prof. G. Sekar, Department of Chemistry, IIT Madras Email: Pgsekar@iitm.ac.in	Dr. T. Pushpa Malini, SRMIST
	Dr. Kanishka Biswas, Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru Email: kanishka@jncasr.ac.in	Prof. M. Arthanareeswari, SRMIST

SEMESTER VIII

Course Code	UBT22P03L	Course Name	MAJOR PROJECT	Course Category	P	Internships/ Project Work	L	T	P	C
							0	0	24	12

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to,	Learning
CLR-1 :	To test the ability to identify research gap	Bloom's Level
CLR-2 :	To test the ability to idetify the problem	
CLR-3 :	To test the ability to devise a plan of study	
CLR-4 :	To teach how to determine the methodology	
CLR-5 :	To test the practical knowledge	
CLR-6 :	To teach how to write a dissertation	

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Program Learning Outcomes (PLO)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
		Fundamental Knowledge	Problem Analysis	Design & Development	Analysis, Design, Research	Modern Tool Usage	Society & Culture	Environment & Sustainability	Ethics	Individual & Team Work	Communication	Project Mgt. & Finance	Life Long Learning	PSO - 1	PSO – 2	PSO – 3
CLO-1 :	Knowledge on reading the review of literature	H	H	H	H	-	-	-	H	H	-	H	H	H	H	H
CLO-2 :	Knowledge on problem solving methods	H	H	H	H	-	-	-	H	H	-	H	H	H	H	H
CLO-3 :	Knowledge on devising methodologies	H	H	H	H	-	-	-	H	H	-	H	H	H	H	H
CLO-4 :	Hands- on knowledge on various techniques	H	H	H	H	-	-	-	H	H	-	H	H	H	H	H
CLO-5 :	Knowlwdge to interpret the results	H	H	H	H	-	-	-	H	H	-	H	H	H	H	H
CLO-6 :	Understanding the importance of presentation and dissertation	H	H	H	H	-	-	-	H	H	-	H	H	H	H	H

Learning Assessment								
	Continuous Learning Assessment (50% weightage)				Final Evaluation (50% weightage)			
	Seminar	Review – 3			Dissertation	Presentation	Research Outcome**	Viva-Voce
		Overview of the Dissertation	Research findings	Oral Presentation and Interaction				
Project Work	10%	10%	20%	10%	20%	10%	10%	10%
Total	50%				50%			

Course Code	UBT22G01T	Course Name	ENTREPRENEURSHIP IN BIOTECHNOLOGY	Course Category	S	Skill Enhancement Courses	L	T	P	C
							2	0	0	2

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	Biotechnology	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	The purpose of learning this course is to:
CLR-1 :	Understanding the scope and concept of entrepreneurship
CLR-2 :	Understanding the principles of sales and marketing
CLR-3 :	Knowledge on funding agencies for start ups and their roles
CLR-4 :	Knowledge on biotechnological sectors for start ups
CLR-5 :	Learning about start ups in pharma and clinical research

Course Learning Outcomes (CLO):	At the end of this course, learners will be able to:	Learning Bloom's level		
CLO-1 :	To understand and develop entrepreneurial traits	2	80	70
CLO-2 :	To develop managing and marketing skills	3	85	75
CLO-3 :	Applying knowledge to identify start up ideas	3	75	70
CLO-4 :	Having knowledge on modern biotechnological sectors for start ups	3	85	80
CLO-5 :	Applying knowledge to create and maintaining a start up	3	85	75

Program Learning Outcomes (PLO)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO – 2	PSO – 3
CLO-1 :	H	H	-	H	-	-	-	-	H	-	-	-	-	-	-
CLO-2 :	H	H	H	H	-	-	-	-	-	-	-	-	-	-	-
CLO-3 :	H	-	-	H	-	-	-	-	-	-	-	-	-	-	-
CLO-4 :	H	-	H	H	-	-	H	-	-	-	-	H	-	-	-
CLO-5 :	H	-	H	H	-	-	H	-	-	-	-	H	-	-	-

UNIT I: Entrepreneurship – Concept, Scope, Entrepreneurial traits, Creativity, Innovation, Problem solving games
UNIT II: Management principles, Functions of a manager, Concept of sales, Concept of marketing, Problem development
UNIT III: Funding agencies for start ups, Funding agencies – types, Funding agencies – roles, Governmental institutions for start ups, types, roles
UNIT IVAgricultural sector, food and nutrition, Mushroom cultivation, polyhouse, Dairy farming, Apiculture, Organic formulation, Animal feed
UNIT V:Start ups - drug designing, Pharma companies, Diagnostic labs, Clinical research, Waste management- solid, biogas, Vermicomposting

Learning Resources	*Theory:*	*Reference:*
	1. *Craig Shimasaki, (2014)."Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies" Academic Press.* 2. *David H. Holt, (1991). "Entrepreneurship: New Venture Creation" Prentice-Hall.*	1. *Getting started in Entrepreneurship. Jack M. Kaplan* 2. *Essentials of Management. H. Koontz, H. Weihrich.*

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%)#			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%	-	30%	-	20%	-	40%	-	40%	-
Level 2	Understand	40%	-	30%	-	20%	-	40%	-	40%	-
Level 3	Apply	10%	-	20%	-	30%	-	10%	-	10%	-
Level 4	Analyze	10%	-	20%	-	30%	-	10%	-	10%	-
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Tech Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications, Conf. Paper etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	

Honours in Biotechnology

Semester VI

Course Code	UBT22H01T	Course Name	TISSUE ENGINEERING	Course Category	c	PROFESSION CORE	L	T	P	C
							4	0	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	BIOTECHNOLOGY	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	Know about the cell interaction and matrix	
CLR-2:	Have knowledge on Tissue organization and its types	
CLR-3:	Understand about stem cells and its importance	
CLR-4:	Know about tissue synthesis	
CLR-5:	Know about curing the diseases	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Bloom's Level
CLO-1:	*Know about the cell interaction and matrix*	1
CLO-2:	*Have knowledge on Tissue organization and its types*	2
CLO-3:	*Understand about stem cells and its importance*	4
CLO-4:	*Know about tissue synthesis*	4
CLO-5:	*Know about curing the diseases*	4

Program Learning Outcomes (PLO)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
H	M	H	H	M	-	-	-	-	-	-	-	-	-	-
H	M	H	H	H	-	-	-	-	-	-	-	-	-	-
H	M	H	H	H	-	-	-	-	-	-	-	-	-	-
H	M	H	M	H	-	-	-	-	-	-	-	-	-	-
H	H	M	H	M	-	-	-	-	-	-	-	-	-	-

Unit-1: CELLS
Cell types, cell-cell interaction, cell differentiations, cell matrix. Biology of cells in culture, cell culture bioreactors. Three-Dimensional organization of Cells in Culture, Organ Culture, Organotypic Culture

Unit-2: TISSUES
Structure and organization of tissues: Epithelial, connective, muscle tissues, Nerve tissues, artificial organs, tissue grafting.

Unit-3: STEM CELL BIOLOGY
Stem cells - properties and Classification. Types of Stem cells - embryonic stem cells, adult stem cells, Hematopoietic Stem Cells, Mesenchymal Stem Cells, Isolation, Culture and Characterization protocol, stem cell therapy

Unit-4:. IN VITRO AND IN VIVO SYNTHESIS OF TISSUES AND ORGANS
Three-Dimensional Scaffolds, Tissue Engineering and Transplantation Techniques - Immunoisolation Techniques, Modes of Cell and Tissue Delivery, Breast reconstruction, Regeneration of Bone and Cartilage, transplantation and Bioartificial Pancreas, regeneration of hepatocytes.

Unit-5:.Bioprinting of Organs and Tissues, Stem Cell therapy - Gastrointestinal, Kidney, Heart, Spinal Cord and Lung disorders and Eye Diseases

Learning Resources

1. Griffiths, A. J. F., Wessler, S. R, Carroll, S. B., Doebley, J. (2010). An Introduction to Genetic Analysis (10thed.). W.H. Freeman & Company (New York). ISBN:10: 1- 4292-2943-8
2. Pierce, B.A. (2012). Genetics - A Conceptual Approach (4thed.). W.H. Freeman & Co. (New York). ISBN:13: 978-1-4292-7606-1 / ISBN:10:1-4292-7606-1.
3. Snustad, D. P., Simmons, M. J. (2015). Principles of Genetics (7th ed.). ISBN: 978-1- 119-14228-7

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%) #			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%		20%		20%		40%		30%	
Level 2	Understand	40%		20%		20%		40%		30%	
Level 3	Apply	10%		30%		20%		-		20%	
Level 4	Analyze	10%		30%		40%		20%		20%	
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers	
Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. N. Prasanth Bhatt

Semester VII

Course Code	UBT22H02T	Course Name	BIOMATERIALS	Course Category	c	PROFESSION CORE	L	T	P	C
							4	0	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	BIOTECHNOLOGY	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Learning
CLR-1:	***Know about the design and synthesis of biomaterials***	Bloom's Level
CLR-2:	**Have knowledge on biodegradable polymeric materials**	
CLR-3:	***Understand about* Polyelectrolyte Hydrogels**	
CLR-4:	***Know about* Biomaterials from Marine Sources**	
CLR-5:	***Know about* Applications of Biomaterials**	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Bloom's Level
CLO-1:	**Know about the design and synthesis of biomaterials**	1
CLO-2:	***Have knowledge on biodegradable polymeric materials***	2
CLO-3:	**Understand about *Polyelectrolyte Hydrogels***	4
CLO-4:	**Know about *Biomaterials from Marine Sources***	4
CLO-5:	**Know about *Applications of Biomaterials***	4

Program Learning Outcomes (PLO)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1:	H	M	H	H	M	-	-	-	-	-	-	-	-	-	-
CLO-2:	H	M	H	H	H	-	-	-	-	-	-	-	-	-	-
CLO-3:	H	M	H	H	H	-	-	-	-	-	-	-	-	-	-
CLO-4:	H	M	H	M	H	-	-	-	-	-	-	-	-	-	-
CLO-5:	H	H	M	H	M	-	-	-	-	-	-	-	-	-	-

Unit-1: Molecular Design and Synthesis of Biomaterials I: Biodegradable Materials and Solid Polymeric Materials, Polyanhydride Degradation Rates, and Degradable Materials with Biological Recognition.

Unit-2: Biodegradable polymeric materials for tissue engineering, Hydrogel Biomaterials: Structure and Physical Chemistry, Gel Swelling Calculations, Physical hydrogels.

Unit-3: Polyelectrolyte Hydrogels, Brannon – Peppas Theory and Swelling in Ionic Hydrogels, Ionization Calculations, Bioengineering Application of Hydrogels: Molecular Imprinting Molecular Design and Synthesis of Biomaterials II: Inorganic Biomaterials, Organic Templating of Inorganic Materials and Bone Bio mimesis.

Unit-4: Biomaterials from Marine Sources: Diatoms, Crustaceans- Barnacles, Bivalves. Seaweeds, Corals, etc. Isolation and Purification of Biomaterials..

Unit-5: Applications of Biomaterials: Nutraceuticals, Cosmetics, Construction industries, Drug Delivery, and Food Industries

Learning Resources

1. Griffiths, A. J. F., Wessler, S. R, Carroll, S. B., Doebley, J. (2010). An Introduction to Genetic Analysis (10thed.). W.H. Freeman & Company (New York). ISBN:10: 1- 4292-2943-8
2. Pierce, B.A. (2012). Genetics - A Conceptual Approach (4thed.). W.H. Freeman & Co. (New York). ISBN:13: 978-1-4292-7606-1 / ISBN:10:1-4292-7606-1.
3. Snustad, D. P., Simmons, M. J. (2015). Principles of Genetics (7th ed.). ISBN: 978-1- 119-14228-7

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%) #			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%		20%		20%		40%		30%	
Level 2	Understand	40%		20%		20%		40%		30%	
Level 3	Apply	10%		30%		20%		-		20%	
Level 4	Analyze	10%		30%		40%		20%		20%	
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers

Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. N. Prasanth Bhatt

Course Code	UBT22H03T	Course Name	AQUATIC BIOTECHNOLOGY	Course Category	c	PROFESSION CORE	L	T	P	C
							4	0	0	4

Pre-requisite Courses	Nil	Co-requisite Courses	Nil	Progressive Courses	Nil
Course Offering Department	BIOTECHNOLOGY	Data Book / Codes/Standards		Nil	

Course Learning Rationale (CLR):	*The purpose of learning this course is to:*	Bloom's Level
CLR-1:	***Understanding the basis of aquaculture***	
CLR-2:	*Knowledge of aquaculture systems*	
CLR-3:	*Knowledge of types of aquacultures*	
CLR-4:	*Understanding the management techniques*	
CLR-5:	*Knowledge of key species of aquaculture*	

Course Learning Outcomes (CLO):	*At the end of this course, learners will be able to:*	Learning Bloom's Level	Program Learning Outcomes (PLO)													
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
			Disciplinary Knowledge	Critical Thinking	Problem Solving	Analytical Reasoning	Research Skills	Team Work	Scientific Reasoning	Reflective Thinking	Self-Directed Learning	Multicultural Competence	ICT Skills	Life Long Learning	PSO - 1	PSO - 2	PSO - 3
CLO-1:	*Students understand the fundamental of aquaculture*	1	H	M	H	H	M	-	-	-	-	-	-	-	-	-	-
CLO-2:	*Gain the* Knowledge of aquaculture systems	2	H	M	H	H	H	-	-	-	-	-	-	-	-	-	-
CLO-3:	*Acquire knowledge about types of aquacultures*	4	H	M	H	H	H	-	-	-	-	-	-	-	-	-	-
CLO-4:	*Gain the* Knowledge of management techniques	4	H	M	H	M	H	-	-	-	-	-	-	-	-	-	-
CLO-5:	*Acquire knowledge regarding key species of aquaculture*	4	H	H	M	H	M	-	-	-	-	-	-	-	-	-	-

Unit-1: Basics of aquaculture, definition and scope. History of aquaculture: Present global and national scenario. Aquaculture vs Agriculture.

Unit-2: Systems of aquaculture - pond culture, pen culture, cage culture, running water culture and zero water exchange system.

Unit-3: Extensive, semi-intensive, intensive and super intensive aquaculture in different types of water bodies viz., freshwater, brackish water inland saline and marine water.

Unit-4; Principles of organic aquaculture. Pre-stocking and post stocking pond management. Carrying capacity of pond, factors influencing carrying capacity. Criteria for selection of candidate species for aquaculture.

Unit-5: Major candidate species for aquaculture: freshwater, brackish-water and marine. Monoculture, polyculture and integrated culture systems. Water and soil quality in relation to fish production. Physical, chemical and biological factors affecting productivity of ponds.

Learning Resources

1. **Garth L. Fletcher, Matthew L. Rise (2012), Aquaculture Biotechnology, John Wiley & Sons.**
2. **Andy Beaumont, Pierre Boudry, Kathryn Hoare(2010), Biotechnology and Genetics in Fisheries and Aquaculture.**
3. **Pramod Kumar Pandey, Janmejay Parhi (2020), Advances in Fisheries Biotechnology.**

Learning Assessment

	Bloom's Level of Thinking	Continuous Learning Assessment (50% weightage)								Final Examination (50% weightage)	
		CLA – 1 (10%)		CLA – 2 (10%)		CLA – 3 (20%)		CLA – 4 (10%) #			
		Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice	Theory	Practice
Level 1	Remember	40%		20%		20%		40%		30%	
Level 2	Understand	40%		20%		20%		40%		30%	
Level 3	Apply	10%		30%		20%		-		20%	
Level 4	Analyze	10%		30%		40%		20%		20%	
Level 5	Evaluate	-	-	-	-	-	-	-	-	-	-
Level 6	Create	-	-	-	-	-	-	-	-	-	-
	Total	100 %		100 %		100 %		100 %		100 %	

CLA – 4 can be from any combination of these: Assignments, Seminars, Scientific Talks, Mini-Projects, Case-Studies, Self-Study, MOOCs, Certifications etc.,

Course Designers

Experts from Higher Technical Institutions	Internal Experts
1. Dr. M. Sujatha, Associate Professor & HOD, Department of Biotechnology, Ethiraj College for Women, Chennai 2. Dr. SUMATHI, Associate Professor, SRMC, Porur, Chennai	Dr. N. Prasanth Bhatt