Dr. M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
DEEMED TO BE UNIVERSITY
University with Graded Autonomy Status
(An ISO 21001 : 2018 Certified Institution)
Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

FACULTY OF HUMANITIES AND SCIENCE

LEARNING OUTCOME BASED CURRICULUM

Curriculum and Syllabus

B.Sc (Biotechnology)

REGULATION 2022

DEPARTMENT OF BIOTECHNOLOGY

DEPARTMENT OF BIOTECHNOLOGY

Department Vision

To be a key driver of economic growth by stimulating the regional innovation system becomes a hub for development of key innovative industrial products processes leading to the creation of spin out, spin along and spin in companies.

Department Mission

Mission No.	Mission Statements
M1	To provide knowledge in biological processes to apply the learned skills in research discoveries to improve human health, protect environment and to enrich economy.
M2	To provide an outstanding environment of learning where students and faculty can apply the knowledge innovatively to create useful products or processes for the society.
M3	We focus on excellence in research and teaching, as well as service to the community.

Core Values

- Intellectual curiosity
- Individual opportunity
- Integrity, truth and empathy
- Fun

Program Educational Objectives

PEOs reflect the career and professional accomplishments of graduates. The PEOs of the B. sc Biotechnology course follows:

PEO 1: Pursue higher studies or be employed in biotechnology or related disciplines.

PEO2: Be a successful entrepreneur in creating jobs related to applied science and technology

PEO3: Promote ethics, sustainability and environmental responsibility in their practice

PROGRAM OUTCOMES (PO)

PO 1:	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of the undergraduate programme of study.
PO 2:	**PO2: Communication Skills:** Ability to understand and express thoughts and ideas effectively in writing and orally; to present complex information in a clear and concise manner to different groups.
PO 3:	**PO3:Critical thinking and Problem solving:** Capability to analyze and evaluate evidence, arguments, claims, belief son the basis of empirical evidence; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development and apply theircompetency to solve different kinds of problems and apply to real life situations.
PO 4:	**PO4:Analytical and Scientific reasoning**:. Ability to analyze, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
PO 5:	**PO5:Research-related skills**: Ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment or investigation.
PO 6:	**PO6: Team work and Leadership qualities**: Function effectively as an individual, and as a team member or leader in diverse teams, and in multidisciplinary environment.
PO 7:	**PO7: Information/digital literacy:** Capability touse ICT tools in a variety of learning situations, demonstrate abilityto access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data and further presentation.
PO 8:	**PO8: Moral and ethical awareness:** Ability toembrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.
PO 9:	**PO9: Lifelong learning:** Ability to update knowledge and skills, participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives

Program specific outcomes

PSO 1: Graduates will be able to apply to understand the major biological concepts, analyse the problem, design/develop, and apply the appropriate technique and ability to implement in the various sector in the field of biotechnology.

PSO 2: Graduates will be able to apply reasoning informed by the contextual knowledge in societal and environmental contexts and understanding of ethical choices inherent in Biotechnology field

PSO 3: Graduates will be able to put into practice of lifelong learning and apply his/her knowledge in interpersonal and entrepreneurial skills, with strong communication and efficient able to work in team set.

MAPPING PEO WITH MISSION

	M1	M2	M3
PEO1	**3**	**2**	**3**
PEO2	**3**	**2**	**3**
PEO3	**3**	**3**	**3**

MAPPING PEO WITH PO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
PEO 1	3	3	3	3	3	3	3	3	3
PEO 2	3	3	3	3	3	3	3	3	3
PEO 3	2	2	2	2	2	2	2	3	3

MAPPING PEO WITH PSO

	PSO 1	PSO 2	PSO 3
PEO 1	3	3	3
PEO 2	3	3	3
PEO 3	3	3	3

B. SC – Biotechnology (Full Time)
Curriculum and Syllabus
2022 Regulation

Semester: 1

Theory

S.No	Course Code	Course Title	TY/ LB /ETP/IE	L	T/SLr	P/R	C
1	HBTA22001/ HBHI22001/ HBFR22001	LANGUAGE (TAMIL-I/ HINDI-I/FRENCH-I)	Ty	3	0/0	0/0	3
2	HBEN22001	LANGUAGE (ENGLISH – I)	Ty	3	0/0	0/0	3
3	HBCS22ID1	ALLIED I - DATA BASE MANAGEMENT	Ty	3	0/0	0/0	3
4	HBBT22001	MICROBIOLOGY	Ty	3	0/0	0/0	3
5	HBCC22001	ENVIRONMENTAL STUDIES	Ty	3	0/0	0/0	3

Practical

1	HBCC22L01	COMPUTER SOFTWARE LAB	Lb	0	0	3/0	2
2	HBBT22L01	MICROBIOLOGY -LAB	Lb	0	0	3/0	2
3	HBCC22I01	COMMUNICATION SKILLS	IE	0	0	2/0	1
4	HBCC22I02	SOFTSKILLS -I	IE	0	0	2/0	1

Credits Sub Total: 21

Semester: 2

Theory

S.No	Course Code	Course Title	TY/ LB/ ETP/IE	L	T/SLr	P/R	C
1	HBTA21002/ HBHI22002/ HBFR22002	LANGUAGE (TAMIL-I/ HINDI-I/FRENCH-I)	Ty	3	0/0	0/0	3
2	HBEN22002	LANGUAGE (ENGLISH- II)	Ty	3	0/0	0/0	3
3	HBBC22ID1	ALLIED –II BIOCHEMISTRY-I	Ty	3	0/0	0/0	3
4	HBBT22002	CELL BIOLOGY & GENETICS	Ty	3	1/0	0/0	4
5	HBBT22003	MICROBIAL TECHNOLOGY	Ty	3	1/0	0/0	4

Practical

1	HBBT22L02	CELL BIOLOGY & GENETICS	Lb	0	0	3/0	2
2	HBBC22IL1	BIOCHEMISTRY LAB	Lb	0	0	3/0	2
3	HBCC22I03	SOFT SKILL-II(ENGLISH)	IE	0	0	2/0	1

Credits Sub Total: 22

C : Credits L : Lecture T : Tutorial S.Lr : Supervised Learning P : Problem / Practical R : Research Ty/Lb/ETP/IE : Theory/Lab/Embedded Theory and Practice/Internal evaluation

Semester: 3

Theory

S.No	Course Code	Course Title	TY/ LB/ ETP/IE	L	T/SLr	P/R	C
1	HBIT22ID1	ALLIED-III BIOINFORMATICS	Ty	3	0/0	0/0	3
2	HBBT22004	BIOCHEMISTRY-II	Ty	3	1/0	0/0	4
3	HBBT22005	MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY	Ty	3	1/0	0/0	4
4	HBBT22006	INSTRUMENTATION METHODS OF ANALYSIS	Ty	3	0/0	0/0	3
5	HBBT22007	FOOD PROCESSING TECHNOLOGY	Ty	3	0/0	0/0	3

Practical

	HBBT22L03	MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGYLAB	Lb	0	0/0	3/0	2
2	HBIT22IL1	BIOINFORMATICS LAB	Lb	0	0/0	3/0	2
3	HBCC22I04	STATISTICAL AND NUMERICAL METHODS WITH PROGRAMMINGLAB	IE	0	0/0	3/0	2
4	HBCC22I05	SOFT SKILL – III	IE	0	0/0	2/0	1

Credits Sub Total: 24

Semester: 4

Theory

S.No	Course Code	Course Title	TY/LB/ ETP/IE	L	T/SLr	P/R	C
1	HBMA22ID5	ALLIED-IV BIO STATISTICS	Ty	3	0	0	3
2	HBBT22008	BASIC PHARMACEUTICAL SCIENCES	Ty	3	1	0	4
3	HBBT22009	IMMUNOLOGY	Ty	3	1	0	4
4	HBXX22OEX	OPEN ELECTIVE-I	Ty	3	0	0	3
5	HBBT22EXX	PROGRAM ELECTIVE -I	Ty	3	0	0	3

Practical

1	HBXX22OLX	OPEN ELECTIVE LAB	Lb	0	0/0	3/0	2
2	HBBT22L04	IMMUNOLOGY LAB	Lb	0	0/0	3/0	2
3	HBCC22I06	CRITICAL THINKING SKILL	IE	0	0/0	2/0	1
4	HBBT22I01	TECHNICAL SKILL -I	IE	0	0/0	2/0	1

Credits Sub Total: 23

C : Credits L : Lecture T : Tutorial S.Lr : Supervised Learning P : Problem / Practical R : Research Ty/Lb/ETP/IE : Theory/Lab/Embedded Theory and Practice/Internal evaluation

Semester: 5

Theory

S.No	Course Code	Course Title	TY/LB/ ETP/IE	L	T/SLr	P/R	C
1	HBBT22010	PLANT AND ANIMAL BIOTECHNOLOGY	Ty	3	0/0	0/0	3
2	HBBT22011	BIOPROCESS TECHNOLOGY	Ty	3	1/0	0/0	4
3	HBXX22OEX	OPEN ELECTIVE –II	Ty	3	0/0	0/0	3
4	HBBT22EXX	PROGRAM ELECTIVE –II	Ty	3	0/0	0/0	3
5	HBCC22002	ENTREPRENURHIP DEVELOPMENT	Ty	3	0/0	0/0	3

Practical

1	HBBT22L05	BIOPROCESS TECHNOLOGY	Lb	0	0/0	3/0	2
2	HBBT22I02	TECHNICAL SKILL -II	IE	0	0/0	2/0	1
3	HBFL22IXX	FOREIGN LANGUAGE	IE	0	0/0	2/0	1
4	HBCC22I07	NCC/NSS/INTERNSHIP	IE	0	0/0	2/0	1

Credits Sub Total: 21

Semester: 6

Theory

S.No	Course Code	Course Title	TY/LB ETP/IE	L	T/SLr	P/R	C
1	HBBT22012	LEGAL ASPECTS OF BIOTECHNOLOGY	Ty	3	1/0	0/0	4
2	HBBT22EXX	PROGRAM ELECTIVE –III	Ty	3	0/0	0/0	3
3	HBCC22ET1	UNIVERSAL HUMAN VALUES	ETP	2	0/0	2/0	3

Practical

1	HBBT22L06	PROJECT	Lb	0	0	9/9	9

Credits Sub Total: 19

C : Credits L : Lecture T : Tutorial S.Lr : Supervised Learning P : Problem / Practical R : Research Ty/Lb/ETP/IE : Theory/Lab/Embedded Theory and Practice/Internal evaluation

ELECTIVES (THEORY)							
S.No	**Course Code**	**Course Title**	**TY/ LB/ ETP/ IE**	**L**	**T/SLr**	**P/R**	**C**
		PROGRAM ELECTIVE -I					
1	HBBT22E01	Protein chemistry	Ty	3	0/0	0/0	3
2	HBBT22E02	Endocrinology	Ty	3	0/0	0/0	3
3	HBBT22E03	Cancer biology	Ty	3	0/0	0/0	3
		PROGRAM ELECTIVE -II					
4.	HBBT22E04	Animal tissue culture	Ty	3	0/0	0/0	3
5.	HBBT22E05	Nanotechnology	Ty	3	0/0	0/0	3
6.	HBBT22E06	Biofuels	Ty	3	0/0	0/0	3
		PROGRAM ELECTIVE -III					
7	HBBT22E07	Molecular Pathogenesis	Ty	3	0/0	0/0	3
8	HBBT22E08	Biomaterials and Tissue Engineering	Ty	3	0/0	0/0	3
9	HBBT22E09	Human cytogenetics	Ty	3	0/0	0/0	3

List of OPEN ELECTIVE-2022 Regulations.

For All H&S, Management Studies and Computer application faculties-UG Programmes.

Offering Department	S.NO	Theory/Lab	Subject Code	Subject Name
Mathematics	1.	Theory	HBMA22OE1	Graph Theory
	2.	Theory	HBMA22OE2	Optimization Techniques
Physics	3.	Theory	HBPH22OE1	Fundamentals of Optics and Sound
	4.	Theory	HBPH22OE2	Every day Physics
	5.	Lab	HBPH22OL1	Basic Physics lab
Computer Science	6.	Theory	HBCS22OE1	Office Automation
	7.	Theory	HBCS22OE2	Fundamentals of Computer and Internet
	8.	Lab	HBCS22OL1	Multimedia lab
Economics	9.	Theory	HBEM22OE1	Indian Economy
	10.	Theory	HBEM22OE2	Gender Economics

Chemistry	11.	Theory	HBCH22OE1	**Chemistry in our Daily Life**
	12.	Theory	HBCH22OE2	Food Chemistry
	13.	Lab	HBCH22OL1	General Chemistry Lab
English	14.	Theory	HBEN22OE1	English For Media
	15.	Theory	HBEN22OE2	Creative Writing
Geology	16.	Theory	HBGE22OE1	Disaster Mitigation and Management
	17.	Theory	HBGE22OE2	Remote Sensing and GIS
	18.	Lab	HBGE22OL1	Remote sensing and GIS lab
Psychology	19.	Theory	HBPY22OE1	Health & Yoga
	20.	Theory	HBPY22OE2	Organizational Behavior
	21.	Lab	HBPY22OL1	Understanding Self & Others
Fashion Design	22.	Theory	HBFD22OE1	Applications of Textiles
	23.	Theory	HBFD22OE2	Introduction to Fashion
	24.	Lab	HBFD22OL1	Embroidery Practical Lab
Computer Applications	25.	Theory	CBCA22OE1	Web design
	26.	Theory	CBCA22OE2	E-Commerce
	27.	Lab	CBCA22OL1	Web Designing Laboratory
Food Science Nutrition and Dietetics	28.	Theory	HBFS22OE1	Principles of Nutrition
	29.	Theory	HBFS22OE2	Food Safety and Quality Control
	30.	Lab	HBFS22OL1	Community Nutrition Practical

Hotel Management and Catering Technology	31.	Theory	HBHM22OE1	Fundamentals of Food Production and Patisserie
	32.	Theory	HBHM22OE2	Bakery and Confectionery Basics
	33.	Lab	HBHM22OL1	Fundamentals Front office operation practical
Defense and Strategic Studies	34.	Theory	HBDS22OE1	Independent India
	35.	Theory	HBDS22OE2	Human Rights
Financial Planning	36.	Theory	MBFP22OE1	Marketing of Financial Services
	37.	Theory	MBFP22OE2	Business strategy
	38.	Lab	MBFP22OL1	Interview Techniques
Bio Technology	39.	Theory	HBBT22OE1	Food and Nutrition
	40.	Theory	HBBT22OE2	Human Physiology
	41.	Theory	HBBT22OE3	Basic Bioinformatics
	42.	Lab	HBBT22OL1	Basic Bioinformatics Lab
Physical Education and Sports	43.	Theory	HBPE22OE1	Rule of Games and Sports
	44.	Theory	HBPE22OE2	Health and Fitness
Human Resource	45.	Theory	HBHR22OE1	Workplace Counseling
	46.	Theory	HBHR22OE2	Corporate Social Responsibility
Information Science and Cyber forensics	47.	Theory	HBCF22OE1	Introduction to Data Science
	48.	Theory	HBCF22OE2	Data Mining
	49.	Theory	HBCF22OE3	Introduction to IoT
	50.	Theory	HBCF22OE4	Introduction to Big Data
	51.	Lab	HBCF22OL1	Data Science Lab
	52.	Lab	HBCF22OL2	Data Mining Lab
Management Studies	53.	Theory	MBBA22OE1	Principles of Management and Science
	54.	Theory	MBBA22OE2	Business Ethics

LIST OF FOREIGN LANGUAGES

S.NO	SUBJECT CODE	SUBJECT NAME
1	EBFL22I01/ HBFL22I01	FRENCH
2	EBFL22I02/ HBFL22I02	GERMAN
3	EBFL22I03/ HBFL22I03	JAPANESE
4	EBFL22I04/ HBFL22I04	ARABIC
5	EBFL22I05/ HBFL22I05	CHINESE
6	EBFL22I06/ HBFL22I06	RUSSIAN
7	EBFL22I07/ HBFL22I07	SPANISH

CREDIT SUMMARY

Semester: 1 : 21

Semester: 2 : 22

Semester: 3 : 24

Semester: 4 : 23

Semester: 5 : 21

Semester: 6 : 19

Total Credits : 130

Semester: 7

Theory

S.No	Course Code	Course Title	TY/ LB/ ETP/ IE	L	T/SLr	P/R	C
1	HBCC22003	RESEARCH METHODOLOGY	Ty	3	0/0	0/0	3
2	HBBT22013/ HBBC22013	HERBAL DRUG TECHNOLOGY	Ty	3	1/0	0/0	4
3	HBBT22014/ HBBC22014	STEM CELL BIOLOGY	Ty	3	1/0	0/0	4
4	HBBT22015/ HBBC22015	AGRICULTURAL BIOTECHNOLOGY	Ty	3	1/0	0/0	4

Practical

S.No	Course Code	Course Title	TY/ LB/ ETP/ IE	L	T/SLr	P/R	C
1	HBBT22I03	MINI PROJECT	IE	0	0/0	6/0	2
2	HBBT22I04	INTERNSHIP	IE	0	0/0	3/0	1

Credits Sub Total: 18

Semester: 8

Theory

S.No	Course Code	Course Title	TY/ LB/ ETP/ IE	L	T/SLr	P/R	C
1	HBCC22004	STARTUP STRATEGIES	Ty	3	0/0	0/0	3
2	HBCC22005	PRINCIPLES OF DIGITAL MARKETING	Ty	3	0/0	0/0	3
3	HBCC22006	INTELLECTUAL PROPERTY RIGHTS AND PATENT	Ty	3	0/0	0/0	3

Practical

1	HBBT22L07	MAJOR PROJECT	Lb	0	0/0	9/3	6
2	HBBT22I05	RESEARCH PUBLICATION	IE	0	0/0	0/4	2

Credits Sub Total: 17

C : Credits L : Lecture T : Tutorial S.Lr : Supervised Learning P : Problem / Practical R : Research Ty/Lb/ETP/IE : Theory/Lab/Embedded Theory and Practice/Internal evaluation

CREDIT SUMMARY

Semester: 1	: 21
Semester: 2	: 22
Semester: 3	: 24
Semester: 4	: 23
Semester: 5	: 21
Semester: 6	: 19
Semester: 7	: 18
Semester: 8	: 17

Total Credits : 165

Table 1: Credit Distribution Format

S. No	CATEGORY	Description	No.of Courses	Credits	Total	Credit Weightage	Contact hours
1	CORE COURSES	Core Theory	12	44	57	53.07	660
		Core Lab	8	13			315
2	ELECTIVE COURSES	Department Core Electives/ Skill enhancement electives	3	10	10	7.69	150
3	OPEN ELECTIVES	Open Elective theory	2	6	8	6.15	90
		Open Elective Lab	1	2			45
4	INTERDISCIPLINARY/ ALLIED COURSES	Allied Theory	4	12	16	12.30	180
		Allied Lab	2	4			90
5	HUMANITIES & SOCIAL SCIENCES , LIFE SKILLS &SOFT SKILLS	Language 1 & 2	2	6	22	16.15	90
		English 1 & 2	2	6			90
		Soft Skills	4	4			90
		Foreign Language	1	1			30
		Environmental Studies	1	2			30
		Management Papers					0
		Entrepreneurship Development	1	3			45
6	PROJECTS/INTERNSHIP/ CORE SKILL	Core Skills	1	2	13	2.30	45
		Internship / NSS / NCC	1	1			30
		PROJECT	1	10			360
7	ANY OTHER	Human values, ICT tools	2	4	4	2.30	75
8	RESEARCH COMPONENT	Research methodology, Publication, IPR and patents etc.	-	-	-	-	-
Total			**47**	**130**	**130**	**100**	**2415**

Table 2:

Revision/modificationdone in syllabus content:

S.No	Course(Subject) Code	Course (Subject) Name	Concept/ topic if any, removed in current curriculum	Concept/topic added in the new curriculum	% of Revision/ Modification done
1.	HBBT22A01	DBMS	Over all system structure Ntt system structure, mapping constraints, transactions diagrams	Unit I completely revamped according to the current needs	25
2	HBBT22G01	MICROBIOLOGY	NA	In Unit I history and scope introduced. Kingdom and classification .Unit III various fungal genus was introduced. Unit IV bacteriophages introduced	35
3	HBBT22G02	CELL BIOLOGY AND GENETICS	Cell biology and genetics was separately given in the old curriculum now it was clubbed		100
4	HBBT22G03	MICROBIAL TECHNOLOGY		Newly Introduced according to needs of industries	100
5	HBBT22L02	CELL BIOLOGY & GENETICS LAB		Newly Introduced according to needs of industries	100
6	HBBT22A03	BIOINFORMATICS		Molecular visualization tools was introduced in the syllabus	5
7	HBBT22G05	MOLECULAR BIOLOGY& RECOMBINANT DNA	Molecular biology and RDNA technology was		100

		TECHNOLOGY	given separately given in the old curriculum now it was clubbed		
8	HBBT22G06	INSTRUMENTATION METHODS OF ANALYSIS	In old curriculum it was given as instrumentation methods and biophysics now it was given as Instrumentation of methods of analysis		100
9	HBBT22L03	MOLECULAR BIOLOGY & RECOMBINANT DNA TECHNOLOGY LAB	Lab was introduced according to the industry needs		100
10	HBBT22A04	BIOSTATISTICS	Old curriculum Biostatistics I and II was revamped as Biostatistics		100
11	HBBT22G08	BASIC PHARMACEUTICAL SCIENCES	Unit V was completely Revamped	Unit V- pharmaceutical patents was introduced	20
12	HBBT 22L04	IMMUNOLOGY LAB		Determination of rh factor was introduced	15
13	HBBT22G10	PLANT AND ANIMAL BIOTECHNOLOGY	In old curriculum animal biotechnology and plant biotechnology was given separately now it was clubbed together and given as Plant and animal biotechnology		100
14	HBBT22L07	BIOPROCESS TECHNOLOGY LAB		Lab was completely introduced in the new curriculum	100

15	HBBT22E01	PROTEIN SCIENCES		New elective was introduced	100
16	HBCH22E02	ENDOCRINOLOGY		New elective was introduced	100
17	HBCH22E03	CANCER BIOLOGY		New elective was introduced	100
18	HBBT22E04	ANIMAL TISSUE CULTURE		New elective was introduced	100
19	HBBT22E05	NANOTECHNOLOGY		New elective was introduced	100
20	HBBT22E06	BIOFUELS		New elective was introduced	100
21	HBBT22E07	MOLECULAR PATHOGENESIS		New elective was introduced	100
22	HBBT22E08	BIOMATERIALS AND TISSUE ENGINEERING		New elective was introduced	100
23	HBBT22E09	HUMAN CYTOGENETICS		New elective was introduced	100
24	HBBT22OE1	FOOD AND NUTRITION		New elective was introduced	100
25	HBBT22OE2	HUMAN PHYSIOLOGY		New elective was introduced	100
26	HBBT22OE3	BASIC BIOINFORMATICS		New elective was introduced	100

Table3:

List of New courses/value added courses//life skills/Electives/interdisciplinary /courses focusing on Employability/ entrepreneurship/ skill development.

S.no	New courses	Value added courses	Life skill	Electives	Inter Disciplinary	Focus on employability/entrepreneurship/skill development.
1	Microbial technology	ICT tools lab	Universal Human values	Protein chemistry	DBMS	Analytical skill
2	Cell biology & Genetics lab		Communication lab	Endocrinology	Biostatistics	Foreign language
3	Bioprocess technology lab			Cancer biology	Bioinformatics	Entrepreneurship
4				Animal tissue culture		Technical skill-1
5				Nanotechnology		Technical skill-II
6				Biofuels		Bioprocess technology lab
7				Molecular pathogenesis		Bioinformatics lab
8				Biomaterials and tissue Engineering		Critical thinking
9				Human Cytogenetics		Immunology lab
10						Project
11						Soft skill –I
12						Soft skill –II
13						Soft skill –III

SEMESTER - I

Subject Code: HBTA22001	Subject Name : TAMIL-I	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite:	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE: Understand the aims and objectives of teaching Tamil. Understand the rational for learning Tamil. To motivate and stimulate the students to overcome their inferiority complex and improve fluency in the language. Learn significance of spoken skill. The relationship between language &culture and the implications for language teaching.

COURSE OUTCOMES (COs) : The students will be able

CO1	Tamil students are actively engaged in learning Tamil language and culture in a meaningful setting
CO2	Focus on applying the language in real life situations.
CO3	Use proficiency descriptors to motivate learners to progress to the next stage of learning. .
CO4	Lessons are customized to arouse students interest and ignite the joy of learning Tamil language.
CO5	Develop a strong foundation in listening & speaking skills.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	1	1	1	1	1	1	1	1	2			
CO2	1	1	1	1	1	1	1	1	2			
CO3	1	1	1	1	1	1	1	1	2			
CO4	1	1	1	1	1	1	1	1	2			
CO5	1	1	1	1	1	1	1	1	2			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	1		1		1							
CO2	1		1		1							
CO3	1		1		1							
CO4	1		1		1							
CO5	1		1		1							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
			✓									

Subject Code: HBTA22001	Subject Name : TAMIL-I	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite:	Ty	3	0/0	0/0	3

அலகு - 1 — 11 மணி நேரம்

அ) மரபுக்கவிதை

1. செந்தமிழ் நாடு - மகாகவி பாரதியார்
2. தமிழின் இனிமை, இன்பத்தமிழ், எங்கள் தமிழ், சங்கநாதம் - பாரதிதாசன்
3. தமிழ் வளர்க்க சபதம் - நாமக்கல் கவிஞர் வெ.இராமலிங்கம் பிள்ளை
4. கோயில் வழிபாடு, வாழ்க்கைத் தத்துவங்கள் - கவிமணி தேசிக விநாயகம் பிள்ளை
5. கும்மிப்பாடல் - சுத்தானந்த பாரதியார்
6. தமிழ்த்தாய் வாழ்த்து - மனோன்மணியம் பெ.சுந்தரம் பிள்ளை
7. விடுதலை விளைத்த உரிமை - கவியரசர் கண்ணதாசன்
8. அன்பெனும் பிடியுள்... ... ..., முரசறைத்தல் - வள்ளலார் இராமலிங்க அடிகள்

ஆ) புதுக்கவிதை

1. பாட்டாளிகளின் குரல் - பட்டுக்கோட்டை கலியாணசுந்தரம்
2. மகாத்மா காந்தியடிகள் - கவிஞர் வாலி
3. காகிதப் பூக்கள் - நா.காமராசு
4. வள்ளுவர் வழங்கும் விடுதலை - ஈரோடு தமிழன்பன்
5. உலகம் - வைரமுத்து
6. இன்னமுத மாமழை - பேரா. முனைவர் பொற்கோ
7. தமிழ்ப்பற்று - மீரா
8. ஐந்தாம் வகுப்பு அ பிரிவு - நா.முத்துக்குமார்

அலகு - 2 — 7 மணி நேரம்

நாட்டுப்புற இலக்கியம்

1. பொது அறிமுகம்
2. நாட்டுப்புற இலக்கிய வகைகள்
3. நாட்டுப்புறக்கலைகள்

அலகு - 3 — 12 மணி நேரம்

அ) சிறுகதைகள்

1. தேங்காய்த் துண்டுகள் (மு.வரதராசனார்)
2. அறம் (மாலன்)
3. நாற்காலியும் நான்கு தலைமுறைகளும் (திலகவதி)
4. அன்னையும் பிதாவும் (இராஜாஜி)
5. விடியுமா? (கு.ப.ராஜகோபாலன்)

ஆ) உரைநடை

1. மு.வ. என்னும் மந்திரம் (இரா.மோகன்)
2. தமிழிசை இயக்கம் (க.வெள்ளைவாரணனார்)
3. மதுரை மாநகரம் (ரா.பி.சேதுப்பிள்ளை)

அலகு - 4 — 6 மணி நேரம்

1. புதுக்கவிதை - தோற்றமும் வளர்ச்சியும்
2. உரைநடை - தோற்றமும் வளர்ச்சியும்
3. சிறுகதை - தோற்றமும் வளர்ச்சியும்

அலகு - 5 — 9 மணி நேரம்

அ) இலக்கணம்

1. வழக்கு
2. தொகாநிலைத் தொடர்
3. எழுத்துப் போலி
4. பதவியல்

ஆ) மொழிப்பயிற்சி

1. தன்வினை - பிறவினை
2. ஒருமை பன்மை மயக்கம்
3. பிறமொழிச் சொற்களை நீக்குதல்
4. விண்ணப்பம் எழுதுதல்

Subject Code: HBHI22001	Subject Name : HINDI-1	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite:	T	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE: To Understand the Hindi Literature, culture and the usage of language in the various streams
To Build up the Confidence in conversing in Hindi language.
To acquire Knowledge of the usage of Hindi language in the various Government Offices

COURSE OUTCOMES (COs) : The students will be able

CO1	Understand the basic concepts and Origin of Hindi
CO2	Know about the roots of Hindi Literature ands its perspective and methods.
CO3	Elaborate and understand philosophical methods of Hindi Literature.
CO4	Evaluate the concept of Hindi from past to present and to study the society closely through Literature
CO5	Understand the importance of Hindi in the contemporary world.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	1	1	1	1	1	1	1	1	2			
CO2	1	1	1	1	1	1	1	1	2			
CO3	1	1	1	1	1	1	1	1	2			
CO4	1	1	1	1	1	1	1	1	2			
CO5	1	1	1	1	1	1	1	1	2			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	1		1		1							
CO2	1		1		1							
CO3	1		1		1							
CO4	1		1		1							
CO5	1		1		1							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
			✓									

Subject Code: HBHI22001	Subject Name : HINDI-1	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite:	T	3	0/0	0/0	3

UNIT - I **Prose –Understanding the secret of the culture and how to draft the letters in Government offices, technical terms**

1. Sabhyata kaRahasya
2. PersonalApplications
3. LeaveLetters
4. Government Order
5. Administrative Terminology Hindi to English (25 Words)

UNIT - II **Prose-Understanding the human relations and also to know the procedures to open the account in the bank, technical terms**

1. Mitrata
2. Letter to the Editor
3. Opening anA/C
4. Demi Official Letter
5. Administrative Terminology English to Hindi (25 Words)

UNIT-III **Prose-the contribution of youth in developing India, drafting memo and technical things used in memo**

1. YuvavonSe
2. Application for Withdrawal
3. Circular
4. Memo
5. Administrative Terminology Hindi to English (25 Words)

UNIT-IV **Prose-The effect of Nuclear energy and usage of technical terms in offices**

1. Paramanu Oorja evam Khadya Padarth Sanrakshan
2. Transfer of an A/C
3. Missing of Pass Book / ChequeLeaf
4. OfficialMemo
5. Administrative Terminology English to Hindi (25 Words)

UNIT-V **Prose-The Obstacles faced by the youth for getting employment, drafting complaint letters, technical terms**

1. Yougyata aur Vyavasay kaChunav
2. Complaints
3. Ordering forBooks
4. Notification
5. Official Noting Hindi to English (25 words)

REFERENCE:

- Prayojan MoolakHindiDr. Syed Rahamathulla, PoornimaPrakashan4/7, Begum III Street, Royapettah, Chennai – 14
- Hindi Gadhya Mala Dr. Syed Rahamathulla, PoornimaPrakashan4/7, Begum III Street, Royapettah, Chennai – 14

Subject Code: HBFR22001	Subject Name : FRENCH-1	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite:	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE: The students will acquire a different perspective of their own culture in relation to the French culture, The students will discover new attitudes towards familiar practices, The students will acquire a sense of the French language, its music and rhythms and basic usage. The students will acquire a comprehensive view of the European Union and the member states.

COURSE OUTCOMES (COs) : The students will be able

CO1	Identify the French language from other European language and to show and tell French words and expression
CO2	Understand how the language works discovering the pronunciation
CO3	Start writing short dialogues of greetings Try to interact with someone with life skill question –what where, who etc Describe persons and places
CO4	Discover France and its physical tributes; develop an idea about the importance of France in the world affairs, Analyze ideas in the content of short paragraphs, paintings etc., and everyday contexts. Appreciate the culture and uniqueness of France. Discuss in English various aspects of France and a new cultural events and compare with current scenario• Answer with confidence in small sentences on everyday life
CO5	Develop enough confidence to introduce oneself and ask others simple questions about personal details. Interact as long as other person speaks slowly and clearly.
CO6	Plan a rendezvous ,a casual meeting by Interacting with basic sentences and expressions as long as the person to with whom he/she speaks can help to reformulate the sentences
CO7	Write a simple message can fill a simple questionnaire .write ones names, nationality ,address etc. on a hotel registration card /passport etc.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	1	1	1	1	1	1	1	1	2			
CO2	1	1	1	1	1	1	1	1	2			
CO3	1	1	1	1	1	1	1	1	2			
CO4	1	1	1	1	1	1	1	1	2			
CO5	1	1	1	1	1	1	1	1	2			
CO6	1	1	1	1	1	1	1	1	2			
CO7	1	1	1	1	1	1	1	1	2			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	1	1	1				
CO2	1	1	1				
CO3	1	1	1				
CO4	1	1	1				
CO5	1	1	1				
CO6	1	1	1				
CO7	1	1	1				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
			✓									

Subject Code: HBFR22001	Subject Name : FRENCH-1	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite:	Ty	3	0/0	0/0	3

UNIT I **9 Hrs**

- Se saluer, La Graphie- écrire (compréhension orale, expression orale)
- Se Présenter-
- La langue française
- La Graphie – écrire L'alphabet, L'abécédaire
- Les Accents et les Ponctuations
- L'interaction de base.
- Clip audios : Exercices orales, compositions orales et épreuves orales. (20 –durée moins de 2 minutes)
- Audio clips- For oral expressions, oral assignments and oral test-20 duration less than 2 minutes (10 oral exercises, 6 audio reading compositions& 4 tests).

UNIT II **9 Hrs**

- S'informer-Interactions aidant des Compétences De base
- Des modèles interrogatifs
- Les nombres, demander le cout /le prix
- Demander l'heure, Les jours, Les mois de l'année.
- Clip audios : Exercices orales, compositions orales et épreuves orales. (20 –durée moins de 2minutes)
- Audio clips- For oral expressions, oral assignments and oral test-20 duration less than 2 minutes (10 oral exercises, 6 audio reading compositions& 4 tests).

UNIT III **9 Hrs**

- Localiser –La France
- Quelque symbole de la France.
- La carte de l'Europe, La France dansle contexte international, La France et les Fuseaux horaires, La
- francophonie, L'union Européen
- La France physique, industrielle, touristique rt administrative
- Quelque symbole de Paris.
- Clip audios: Exercices orales, compositions orales et épreuves orales. (20 –durée moins de 2minutes)
- Audio clips- For oral expressions, oral assignments and oral test-20 duration less than 2 minutes (10 oral exercises, 6 audio reading compositions& 4 tests).

UNIT IV **9 Hrs**

- Lire et prononcer Le française
- Les son française, les voyelles françaises, les sons nasaux, les consonné, Quelque sons uniques.
- Les syllabus français, Les Rythme de la langue française.
- Clip audios : Exercices orales, compositions orales et épreuves orales.(20 –durée moins de 2minutes)
- Audio clips- For oral expressions, oral assignments and oral test-20 duration less than 2 minutes (10 oral exercises ,6 audio reading

UNIT V **9 Hrs**

- Observer et Comprendre
- La vie de la France quotidienne, En cas d'urgence.
- La grammaire initiale
- Clip audios : Exercices orales, compositions orales et épreuves orales. (20 –durée moins de 2minutes)
- Audio clips - For oral expressions, oral assignments and oral test -20 duration less than 2 minutes (10 oral
- exercises, 6 audio Reading compositions& 4 tests).

REFERENCE BOOKS :

- Parlez-vous français? Partie 1 - Dr.M.Chandrika.V.Unni & Mrs. Meena Mathews 2019 by Universal
- publisher
- CLE INTERNATIONAL Lectures Clé en français facile. (2012) Hachette Paris
- Cosmopolite: Livre d'élève A1 by Nathalie Hirsch sprung, Tony Tricot, Claude Le Ninan
- Latitudes-1 - Régine Mérieux & Yves l'oiseau, Didier 2017
- Alter Ego 1 - Catherine Dolez, Sylvie Pons : (2014) Hachette, Paris

Subject Code: HBEN22001	Subject Name : ENGLISH-1	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: – Plus2 English Language	Ty	3	0/0	0/0	3

Objectives:

1. Demonstrate knowledge of vocabulary and sentence construction in appropriate contexts
2. Understand diverse forms of knowledge as expressed in social, historical and cultural contents
3. Attain a comprehensive knowledge of the communication skills and use it ethically
4. Use analytical and interpretative skills for research and variety of purposes.
5. Develop organized academic and business writing for professional careers

Course Outcomes (Cos)

001	Demonstrate knowledge of vocabulary and sentence construction in appropriate contexts
002	Understand diverse forms of knowledge as expressed in social, historical and cultural contents
003	Attain a comprehensive knowledge of the communication skills and use it ethically
004	Use analytical and interpretative skills for research and variety of purposes.
005	Develop organized academic and business writing for professional careers

Program Specific Objectives

PSO1	Understanding of the basic concepts of English language and literature.
PSO2	Learning through literature in English, diverse historical cultural and social ethics
PSO3	Application of literary critical perspectives to generate original analysis of literature in English
PSO4	Promotion of cultural values and real-life skills through English language and literature

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

(H/M/L indicates the strength of correlation) H= High; M= Medium; L= Low

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
1	H	H	H	L	M	H	--	M	H
2	H	H	H	L	M	H	-	M	H
3	H	H	H	L	M	H	-	H	H
4	H	H	H	H	H	H	-	H	H
5	H	H	H	H	H	H	-	H	H

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others
			✓						

Subject Code: HBEN22001	Subject Name : ENGLISH-1	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: – Plus2 English Language	Ty	3	0/0	0/0	3

Unit I: Prose

1. Beware the Loss of Bio-Diversity
2. The Unsung Hero of COVID-19 in India
3. Grading Down Plastics
4. My Vision for India

Unit II: Poetry

1. On Killing a Tree
2. The Road Not Taken
3. Anthem for Doomed Youth

Unit III: Short Story

1. Portrait of a Lady
2. Uncle Podger Hangs a Picture
3. A Retrieved Information

Unit IV: Drama

1. The Never-Never Nest
2. Frederick Douglass

Unit V: Functional Grammar – Charts & LSRW Development

Functional Grammar: ***(Grammar exercises spread up in all four units)***

Parts of speech- use of articles- prepositions – their uses – verb + prepositions- words followed by prepositions – modals -tenses- active -passive- impersonal passive forms- concord- conditional sentences – question tags - Common errors - Punctuation

Vocabulary development- word formation - prefixes-suffixes – synonyms-antonyms – homophones -homonyms – words often confused

Charts/Diagrams and their interpretation - their use

Tables- Tree diagram - Pie chart- Flow chart- Bar chart

Letters: Formal and Informal

LSRW Development

LSRW development through audio, video and tasks for the content of lessons under each unit.

Course Outcomes:

On completing thecoursethestudents will

1. Possess Language skills (LSRW) to communicate in English without any inhibition.
2. Have learnt vocabulary and syntax to be fluent in English for social and academic communication
3. Demonstrate content knowledge through appropriate language use for academic success.
4. Analyse and interpret any genre of literature in English for research, projects, placement etc.,
5. Engage themselves in organized academic and business writing with a focus on social and professional ethics.

PrescribedText:

- Dr. M. Chandrasena Rajeswaran & Dr. R. Pushkala .Pinnacle: A Skills Integrated EnglishText Book for Under Graduate Students.

Suggested Reading

- Wren and Martin: Grammar and Composition, Chand & Co, 2006

Subject Code: HBCS22ID1	Subject Name :ALLIED –I DATA BASE MANAGEMENT	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: -NIL	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:
To get knowledge in database management , SQL and DB transaction

COURSE OUTCOMES (COs) : The students will be able

CO1	To know the different issues involved in the design
CO2	To learn the implementation of data base systems
CO3	To study the physical and logical database designs
CO4	To understand the , database modeling, relational, hierarchial, and network models.
CO5	To develop an understanding of essential DBMA concepts such as: database security, integrity, and concurrency.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	1	1	1	2	2	1	3	1	1			
CO2	1	1	1	2	2	1	3	1	1			
CO3	1	1	1	2	2	1	3	1	1			
CO4	1	1	1	2	2	1	3	1	1			
CO5	1	1	1	2	2	1	3	1	1			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	3		3		3							
CO2	3		3		3							
CO3	3		3		3							
CO4	3		3		3							
CO5	3		3		3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
						✓						

Subject Code: HBCS22ID1	Subject Name : ALLIED –I DATA BASE MANAGEMENT	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry & Microbial Technology	Ty	3	0/0	0/0	3

UNIT I: PURPOSE OF DATABASE **9 Hrs**

Introduction- Applications – Advantages and Disadvantages- Data abstraction – Database languages – Database uses – Database architecture – Data models – Keys -Entity Relationship Model

UNIT II: STRUCTURED QUERY LANGUAGE **9 Hrs**

Basic Structure - Set Operations - Aggregate Functions - Date, Numeric, and Character Functions - Nested Sub queries -Modification Of Databases - Joined Relations-DDL - Embedded SQL.

UNIT III: NORMALIZATION **9 Hrs**

Pitfalls - Normalization Using Functional Dependencies - First Normal Form-Second Normal Form-Third Normal Form-BCNF - Fourth Normal Form- Fifth Normal form

UNIT IV: INDEXING & HASHING **9 Hrs**

File organization – file operation - file transaction – data dictionary – indexing and hashing basic concepts. static and dynamic hash functions

UNIT V: TRANSACTIONS **9 Hrs**

Transaction Concept- Properties of a Transaction- A Simple Transaction Mode- Concurrent Executions- Schedules- Serial and Non Serial types-Serialization of schedules and views-locks based protocols-time based protocols.

Total Number of Hours: 45

TEXT BOOK:

- Abraham Silberschatz, H.F.Korth and S.Sudarshan-Database System Concepts McGraw Hill Publication.
- Singh-Database systems: Concepts, Design & applications, Pearson Education.

REFERENCE BOOK:

- Gerald V.Post - DBMS-Designing and Business Applications - McGraw Hill Publications
- Michael Abbey and Michael.J.Corey-Oracle- A Beginners guide TMH

Subject Code: HBBT22001	Subject Name : MICROBIOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: -NIL	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:
To understand the basic structure of microorganism such as bacteria, viruses, algae fungi and phage. To have a brief knowledge about the nutrition requirements and growth curve of bacteria and also to understand the various methods to control the Microbes.

COURSE OUTCOMES (COs) : The students will be able to

CO1	Understand the principles of Microbiology
CO2	Know the growth requirement of microbes
CO3	Understand the basic structure and morphology of various classes of microbes
CO4	biochemical aspects of various microbes will be acquired
CO5	Solve the problems in microbial infection and their control

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	1	2	2	2	1	1	1	3			
CO2	3	1	2	2	2	1	1	1	3			
CO3	3	1	2	2	2	1	1	1	3			
CO4	3	1	2	2	2	1	1	1	3			
CO5	3	1	2	2	2	1	1	1	3			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	3	3	3					
CO2	3	3	3					
CO3	3	3	3					
CO4	3	3	3					
CO5	3	3	3					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
	✓											

Subject Code: HBBT22001	Subject Name : MICROBIOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: -NIL	Ty	3	0/0	0/0	3

Unit - I: HISTORY OF MICROBIOLOGY **9 Hrs**

History and scope of Microbiology, Pasteur's contribution and Koch's contribution, Classification of microorganisms – general principles and nomenclature – Haeckel's three kingdom concept, Whittaker's five kingdom concept. Principles of Microscopic Techniques, and staining techniques –Simple staining, Gram staining, acid fast and capsule staining.

Unit - II: BACTERIA **9 Hrs**

Structure of prokaryotic cell morphology and structure. Nutritional requirements of bacteria and different media used for bacterial culture; Bacterial Growth – Bacterial growth curve, factors effecting bacteria growth.

Unit- III: FUNGI **9 Hrs**

Classification of fungi, Oomycetes-water mould, Chytridiomycetes- anearobic rumen fungi ,Zygomycetes-Rhizopusstolonifer, Ascomycetes- Aspergillus and Basidiomycetes-smuts and rusts and lichens. Study of Yeasts – morphology, reproduction and industrial application.

Unit-IV: VIRUS **9 Hrs**

Structure (general morphology, nucleic acids, capsid and envelope), characteristics and Classification of viruses based on genetic material, host and capsid material. Bacteriophages and phage study, Multiplication of bacteriophages; lytic cycle, lysogenic cycle.

Unit- V: CONTROL OF MICROORGANISMS **9 Hrs**

Physical and chemical control of microorganisms; host-microbe interactions; anti-bacterial, anti-fungal and anti-viral agents and its mode of action. Mechanisms of Antibiotic Resistance; Clinically important microorganisms.

Total Number of Hours: 45

TEXT BOOKS

- Michael J. Pelezar, J.R.E.C.S Chan, Noel R. Erieg,2005, "Microbiology " TATA McGraw Hill, 5th Edition
- Anantha Narayan, C.K. JayaramPaniker, 2009, "Text Book of Microbiology" Orient Blackswan, 7th. Edition
- Joanne Willey, 2010. Prescott.s Microbiology, eighth edition, McGraw Hill, Newyork.

Reference Book:

- Jacquelyn and G.Black (2000) Microbiology :Principles and Explorations (7 th Ed) wiley
- *John Webster Roland Weber.(2007) Introduction to fungi Cambridge University Press,*

Subject Code: HBCC22001	Subject Name : ENVIRONMENTAL STUDIES	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: -NIL	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

- To acquire knowledge of the Environment and Ecosystem & Biodiversity
- To acquire knowledge of the different types of Environmental pollution
- To know more about Natural Resources and social issues and the Environment
- To attain familiarity of human population and Environment

COURSE OUTCOMES (COs) : The students will be able to

CO1	To known about Environment and Ecosystem & Biodiversity
CO2	To clearly comprehend air, water, Soil, Marine, Noise, Thermal and Nuclear Pollutions and Solid Waste management and identify the importance of natural resources.
CO3	To know about the natural resources and environmental problems associated with climate change, global warming, acid rain, ozone layer depletion etc., and explain possible solution.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	**2**	1	1	**1**	2	1	1	**2**	**2**			
CO2	**2**	1	1	**1**	2	1	1	**2**	**2**			
CO3	**2**	1	1	**1**	2	1	1	**2**	**2**			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	**2**	**2**	**2**					
CO2	**2**	**2**	**2**					
CO3	**2**	**2**	**2**					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
			✓									

Subject Code: HBCC22001	Subject Name : ENVIRONMENTAL STUDIES	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: -NIL	Ty	3	0/0	0/0	3

UNIT I ENVIRONMENT AND ECOSYSTEMS **9 Hrs**

Definition, scope and importance of environment – need for public awareness – concept, structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem. Biodiversity at National and local levels – India

UNIT II ENVIRONMENTAL POLLUTION **9 Hrs**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Nuclear hazards (g) E-Wastes and causes, effects and control measures

UNIT III NATURAL RESOURCES **9 Hrs**

Forest resources: Use and over-exploitation, deforestation. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT **9 Hrs**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns climate change, global warming, acid rain, ozone layer depletion, nuclear accidents ,central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT **9 Hrs**

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

Total no of Hours: 45

TEXT BOOKS:

- Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education (2004).
- Benny Joseph, 'Environmental Science and Engineering', Tata McGrawHill,NewDelhi, (2006).

Subject Code: **HBCC22L01**	**Subject Name :COMPUTER SOFTWARE LAB (WORD, EXCEL, POWERPOINT, PAINT,INTERNET)**	**Ty/Lb/ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: NIL	Lb	0	0/0	3/0	2

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: CreditsTy/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- To train students how to use MS Office applications use in office work such as creating professional-quality documents; store, organize and analyze information; arithmetic operations and functions.
- MS Excel to enable the students for creating tables, scatter plots, and completing data analysis.
- Gain knowledge in practical applications of Word, Excel, Power point, Paint and Internet.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Demonstrate the usage of various operations in MS Word
CO2	Perform calculations in Microsoft Excel using both manually inputting formulas and built-in functions.
CO3	Develop dynamic slide presentations with animation, narration, images, and much more, digitally and effectively.
CO4	Create drawings to include clipart, color, shape, size, text, enhance text
CO5	Understanding how to search specific website, sending mails etc

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	3	1	2	1	2	3	2	2
CO2	3	2	3	2	2	2	3	2	3
CO3	3	3	1	2	1	2	3	2	2
CO4	3	2	1	1	1	2	2	2	2
CO5	3	3	1	1	1	2	3	2	3

COs / PSOs	**PSO1**	**PSO2**	**PSO3**
CO1	2	2	2
CO2	2	2	2
CO3	2	2	2
CO4	2	2	2
CO5	2	2	2

3/2/1 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others
							✓	✓	

Subject Code: **HBCC22L01**	**Subject Name** :**COMPUTER SOFTWARE LAB (WORD, EXCEL, POWERPOINT, PAINT,INTERNET)**	**Ty/Lb/ETL**	**L**	**T/S.Lr**	**P/R**	**C**
	Prerequisite: NIL	Lb	0	0/0	3/0	2

UNIT 1: **OFFICE APPLICATIONS – I**

MS OFFICE: MS-WORD

UNIT 2: **OFFICE APPLICATIONS - II**

MS OFFICE: MS-EXCEL

UNIT 3: **OFFICE APPLICATIONS - III**

MS OFFICE: MS-POWER POINT

UNIT 4: MICROSOFT PAINT EXERCISES - IV

UNIT 5: INTERNET & ITS APPLICATIONS- V

Subject Code: HBBT22L01	Subject Name : MICROBIOLOGY LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biology	Lb	0	0/0	3/0	2

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:
To teach the basic concept involved in the sterilization, isolation and cultivation, identification of microbes

COURSE OUTCOMES (COs) :At the end of the course

CO1	The students will know about good laboratory practice, this will help them to handle the microorganisms.
CO2	They will familiar with cultural and morphological characteristics of microorganisms grown in pure culture.
CO3	The students can perform dilution techniques
CO4	The students can perform staining techniques
CO5	They will understand the practical knowledge of various biochemical phenomena by demonstrate the experiment, their applications and interpret the results.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	2	3	3	3	3	1	3	2			
CO2	3	2	3	3	3	3	1	3	2			
CO3	3	2	3	3	3	3	1	3	2			
CO4	3	2	3	3	3	3	1	3	2			
CO5	3	2	3	3	3	3	1	3	2			

COs / PSOs	PSO1	PSO2	PSO3						
CO1	3	3	3						
CO2	3	3	3						
CO3	3	3	3						
CO4	3	3	3						
CO5	3	3	3						

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
								✓				

Subject Code: HBBT22L01	Subject Name : MICROBIOLOGY LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biology	Lb	0	0/0	3/0	2

1. Sterilization techniques-Autoclave, Hot air oven, Filter sterilization (lecture/demonstrations).
2. Preparation of culture media (a) broth (b) Agar.
3. Culturing of Microorganisms: Pure culture techniques: Streak plate, pour plate, spread plate method
4. Differential media and selective media of bacteria.
5. Enumeration of micro-organisms- Serial dilution plating
6. Identification of microorganisms. (a) Staining techniques – Simple staining, Gram staining, Capsule staining, Endospore staining
7. Motility of bacteria by Hanging drop method.

TEXT BOOKS

- Monica Chessbrough(1999) *Laboratory Manual in Microbiology(Vol I & II)*Cambridge University Press

REFERENCE BOOKS

- Cappucino (1999) *Microbiology - A laboratory Manual*Benjamin Cummings

Subject Code: HBCC22I01	Subject Name COMMUNICATION SKILLS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite –Plus 2 English	IE	0	0/0	2/0	1

Course Objectives:

1. Understand the concepts of communication and the use of language as a medium of communication.
2. Shed off language anxieties and gain confidence to speak in English with activities focused on grammar and conversation.
3. Listen and speak for interpersonal communication and academic activities.
4. Read and write for lifelong learning, knowledge enhancement and research.
5. Communicate to work in teams and follow social ethics in the global culture.

Course Outcomes (Cos)

1	Use English as a medium of communication for academic and professional attainment
2	Shed off language anxieties and gain confidence to speak with different kinds of people in varied contexts.
3	Listen and speak for interpersonal communication and academic activities.
4	Read and write for lifelong learning, knowledge enhancement and research.
5	Communicate to work in teamsand follow social ethics in the global culture.

Program Specific Objectives

PSO1	Understanding of the basic concepts of English language and literature.
PSO2	Learning through literature in English, diverse historical cultural and social ethics
PSO3	Application of literary critical perspectives to generate original analysis of literature in English
PSO4	Promotion of cultural values and real-life skills through English language and literature

Mapping of course outcomes (COs) with Program Outcomes (POs)
(H/M/L indicates the strength of correlation) H= High; M= Medium; L= Low

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
1	3	3	3	1	3	3	2	2	3
2	3	3	3	1	3	3	2	2	3
3	3	3	3	1	3	3	2	2	3
4	3	3	3	1	3	3	2	2	3
5	3	3	3	1	3	3	2	2	3

Mapping of course outcomes (Cos) with program Specific outcomes (PSOs)

COs	PSO1	PSO2	PSO3	PSO4	
CO1	2	2	2	2	
CO2	2	2	2	2	
CO3	3	3	3	3	
CO4	3	3	3	3	
CO5	3	3	3	3	

H/M//L Indicates Strength of Correlation : H- High; M- Medium; L- Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others
							✓		

Subject Code: HBCC22I01	Subject Name COMMUNICATION SKILLS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite –Plus 2 English	IE	0	0/0	2/0	1

Prefatory note:

The paper seeks to train students in communicative skills and also give a firm foundation in listening and speaking by engaging students with authentic audios and videos ; the students will immensely benefit from strategy instruction for effective reading and writing; they will be able to recognize the importance of grammar and vocabulary for effective reading and writing.The present global scenario requires increasing need for clear and cordial communication with people from different culture. Cultural Intelligence is given as a unit to help students learn about low and high context cultures. It aligns with the University's mission of disseminating knowledge in the pursuit of education, learning and research at the highest international levels of excellence.

Methodology: Flipped Classrooms and Mobile Assisted Language Learning

Course Objective

The students will be facilitated to

1. Use English as a medium of communication for academic and professional attainment
2. Shed off language anxieties and gain confidence to speak with different kinds of people in varied contexts.
3. Listen and speak for interpersonal communication and academic activities.
4. Read and write for lifelong learning, knowledge enhancement and research.
5. Communicate to work in teamsand follow social ethics in the global culture.

Unit-I Listening

- Listening for Social and Academic purposes
- Non-verbal and coverbal communication
- Imitating for pronunciation, intonation, word stress, etc.,

Cognitive Activity: Note taking during lecture sessions

Unit-II Speaking

The art of speaking and negotiating

Interpersonal Communication

1. Opening conversation
2. Introducing oneself
3. Asking about others
4. Making small talk
5. Asking for directions
6. Enquiring
7. Thanking
8. Appreciating
9. Offering help
10. Requesting
11. Persuading
12. Warning
13. Expressing regret
14. Agreeing
15. Disagreeing
16. Ending a conversation
17. Saying what you intend to do
18. Expressing dislikes
19. Comparing

20. Complaining

Academic Communication

1. Instructional conversations
2. Power Point Presentation
3. Narrating about incidents
4. Public speaking– explaining success stories of self and others
5. Group Discussion
6. Interview for Projects and Placement

Unit-III Reading skills

1. Types and mechanics of reading
2. Tips for effective reading
3. Reading Strategies
4. Cognitive Strategy: Note Making, Comprehension exercise,oral and written review,

Unit- IV Writing Skills

- The Process of Writing
  1. Grammar, vocabulary, discourse markers and sentence construction
  2. Writing& Rewriting: drafting, revising, editing.
- Writing as a scaffolding activity
  1. Summarising
  2. Paraphrasing
  3. Precis writing
  4. Short notes and Essay writing

Unit -V Intercultural communication skills

1. Go local
2. Group behaviour
3. E mail and intercultural communication
4. High and low context cultures
5. Cultural diversity in terms of time and space

ASSESSMENT

Clubbed with each unit in the form of Audio listening, watching Videos, quiz, roleplay – public speaking, PPT presentation,reading and writing.

Course Outcome

On completing the course, the students will be able to

- Use English as a medium of communication for academic and professional attainment
- Shed off language anxieties and gain confidence to speak with different kinds of people in varied contexts.
- Listen and speak for interpersonal communication and academic activities.
- Read and write for lifelong learning, knowledge enhancement and research.
- Communicate to work in teams and follow social ethics in the global culture.

Prescribed Text

J. C. Richards with J. Hull &S.Proctor, Interchange, Level 2, Cambridge University Press, 2015

Recommended Reading

- P.D. Chaturvedi & M. Chaturvedi, Communication Skills, Pearson, 2012
- Anderson, Kenneth Joan Maclean and Tony Lynch. Study Speaking , Cambridge: CUP 2004
- Dutt, Kiranmai, P., Geetha Rajeevan, CLN Prakash, A Course in Communication Skills, Delhi: Foundations Books , 2008

- Sethi, J. , P.V. Dhamija. A Course in Phonetics and Spoken English2nd Ed. New Delhi, Prentice Hall of India Pvt Ltd.2005.
- Yadugiri, M.A., The Pronunciation of English, New Delhi, Viva Books, 2013.
- Bailey, Stephen: Academic Writing: A Practical Guide for Students, London and New york: Routledge Falmer,2004.
- M.C. Rajeswaran, Permuting Role play in Oral Skill Assessment, International Journal of Innovative Research & Studies, Vol. 13, Issue 12, pp. 91-100, Dec. 2014

Subject Code: HBCC22I02	Subject Name SOFT SKILL -I	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite –Plus 2 English	IE	0	0/0	2/0	1

Objectives:

1. Become good listeners to get engaged in interactive communication for effective team building.
2. Develop assertive and adaptive behaviour to be leaders
3. Develop peer interaction for a successful lifelong learning.
4. Learn skills necessary for a cooperative living in academic and professional environments
5. Use soft skills for the purposes of research and follow ethics in society and profession.

Course Outcomes (Cos)	
001	Become good listeners to get engaged in interactive communication for effective team building.
002	Develop assertive and adaptive behaviour to be leaders
003	Develop peer interaction for a successful lifelong learning.
004	Learn skills necessary for a cooperative living in academic and professional environments
005	Use soft skills for the purposes of research and follow ethics in society and profession
Program Specific Objectives	
PSO1	Understanding of the basic concepts of English language and literature.
PSO2	Learning through literature in English, diverse historical cultural and social ethics
PSO3	Application of literary critical perspectives to generate original analysis of literature in English
PSO4	Promotion of cultural values and real-life skills through English language and literature

Mapping of course outcomes (COs) with Program Outcomes (POs)
(H/M/L indicates the strength of correlation) H= High; M= Medium; L= Low

COs	POs	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
1	H	H	H	L	M	M	L	M	H
2	H	H	H	L	M	M	L	M	H
3	H	H	H	L	M	M	L	M	H
4	H	H	H	H	H	M	L	M	H
5	H	H	H	H	H	M	L	M	H

Mapping of course outcomes (Cos) with program Specific outcomes (PSOs)

COs	PSO1	PSO2	PSO3	PSO4	
CO1	H	M	M	M	
CO2	M	M	M	M	
CO3	H	M	M	M	
CO4	H	M	M	M	
CO5	H	M	M	M	
H/M//L Indicates Strength of Correlation : H- High; M- Medium; L- Low					

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical / Project/ Internship	Others
							✓		

Subject Code: HBCC22I02	Subject Name SOFT SKILL I	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite –Plus 2 English	IE	0	0/0	2/0	1

Prefatory Note

This paper aims to equip students with skills essential for work place and global environment to which they will move on from the university, once they complete the course. As such, this paper provides students with a set of ten interlinked soft skills: Listening, team work, emotional intelligence, assertiveness, learning to learn, problem solving, attending interviews, adaptability, non-verbal communication and written communication. Students will get engaged in pair work, group work, role play, discussion, presentation, story telling, writing assignments etc.,

Course Objective

The students will be facilitated to

1. Become good listeners to get engaged in interactive communication for effective team building.
2. Develop assertive and adaptive behaviour to be leaders
3. Develop peer interaction for a successful lifelong learning.
4. Learn to learn skills necessary for a cooperative living in academic and professional environments
5. Use soft skills for the purposes of research and follow ethics in society and profession.

Unit -I

Listening, Speaking, Reading and Writing skills (LSRW)

Unit -II

Team work skills: adaptability, emotional intelligence, learning skills

Unit -III

Leadership Qualities: assertiveness, reasoning, compassion and compatibility

Unit -IV

Problem solving: willingness to learn, creative thinking, developing observation skills

Unit -V

Interview skills: employability skills, resume writing

Course outcome

On completion of the course the students will

1. Become good listeners to get engaged in interactive communication for effective team building.
2. Develop assertive and adaptive behaviour to be leaders
3. Develop peer interaction for a successful lifelong learning.
4. Learn skills necessary for a cooperative living in academic and professional environments
5. Use soft skills for the purposes of research and follow ethics in society and profession.

Suggested reading

❖ S.P. Dhanavel, English and Soft Skills, Vol. 1, Orient Blackswan Pvt. Ltd. 2010

Dr. M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
DEEMED TO BE UNIVERSITY
University with Graded Autonomy Status
(An ISO 21001 : 2018 Certified Institution)
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SEMESTER - II

Subject Code: HBTA21002	Subject Name : TAMIL-II	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Plus 2 Tamil	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

- Communicating with friends from around the world via social networking opportunities.
- To develop 21st century learners who love & appreciate Tamil language.
- Learn significance of spoken skill.
- The relationship between language &culture and the implications for language teaching
- Travelling to other countries and learning about other cultures.

COURSE OUTCOMES (COs) : The students will be able

CO1	Strengthen literacy skills
CO2	Engage in learning Tamil language and culture in a meaningful setting
CO3	Engross in independent and life-long learning
CO4	Develop a strong foundation in listening & speaking skills.
CO5	Arouse students interest and ignite the joy of learning Tamil language.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	1	1	1	1	1	1	1	1	2			
CO2	1	1	1	1	1	1	1	1	2			
CO3	1	1	1	1	1	1	1	1	2			
CO4	1	1	1	1	1	1	1	1	2			
CO5	1	1	1	1	1	1	1	1	2			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	1		1		1							
CO2	1		1		1							
CO3	1		1		1							
CO4	1		1		1							
CO5	1		1		1							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
			✓									

Subject Code: HBTA21002	Subject Name : TAMIL-II	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Plus 2 Tamil	Ty	3	0/0	0/0	3

கற்றல் நோக்கம்: 1.தமிழர் பண்பாட்டினை அறியச் செய்தல்

2. கடிதம் எழுதும் திறன் வளர்த்தல்

3.தமிழ் இலக்கிய வரலாற்றினை அறிதல்

அலகு - 1 சங்க இலக்கியம் 9 மணி நேரம்

1. புறநானூறு - பா.எண் - 183,184,192
2. குறுந்தொகை - பா. எண் 2,40,167
3. நெடுநல்வாடை - 1 முதல் 44 வரிகள் வரை
4.கலித்தொகை - பா.எண் 102,133

அலகு - 2 காப்பியம்

1. சிலப்பதிகாரம் - வழக்கு உரை காதை முழுவதும்

அலகு - 3 நீதி இலக்கியம்

1.திருக்குறள் - 34,72,96,102,103,116,124,136,158,395 (10 குறள்கள்)

2.நாலடியார் - 1,11,29,32,43,51,74,103,116,135 (10 பாடல்கள்)

3.ஆசாரக்கோவை - 20,23,25,76,96 (5 பாடல்கள்)

4.திரிகடுகம் - 7,12,27,31,38,(5 பாடல்கள்)

அலகு - 4 தமிழ் இலக்கிய வரலாறு

1. பக்தி இலக்கியம்
2. சிற்றிலக்கியம்

அலகு - 5 இலக்கணம்

1.வல்லினம் மிகும் இடங்கள்

2. வல்லினம் மிகா இடங்கள்

3. வினா வகைகள்

4. விடை வகைகள்

மொழிப்பயிற்சி

1. கடிதம் எழுதும் முறை

2.செய்வினை - செயப்பாட்டு வினை

3.மயங்கொலிப் பிழையை நீக்குக

Subject Code: HBHI22002	Subject Name : HINDI-II	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Plus 2 Hindi	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

1,To Understand the Ancient Hindi plays and its aspects.
2.To understand the medival stories and well known novels
3.To know the techniques in writing Annotation and Translation

COURSE OUTCOMES (COs) : The students will be able

CO1	Introduce students to the real world situation with the help of Plays and stories written by various poets and writers.
CO2	Understand the Literature in broader areas than merely confined to the subject
CO3	Evaluate the concept of Hindi from past to present and to study the society closely through Literature.
CO4	Make the best use of Hindi language in various streams.
CO5	Helps in their Career acquiring knowledge in a language

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	1	1	1	1	1	1	1	1	2			
CO2	1	1	1	1	1	1	1	1	2			
CO3	1	1	1	1	1	1	1	1	2			
CO4	1	1	1	1	1	1	1	1	2			
CO5	1	1	1	1	1	1	1	1	2			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	1	1	1				
CO2	1	1	1				
CO3	1	1	1				
CO4	1	1	1				
CO5	1	1	1				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
			✓									

Subject Code: HBHI22002	Subject Name : HINDI-II	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Plus 2 Hindi	Ty	3	0/0	0/0	3

UNIT – I One Act Play – novel and translation of hindi language)

1. Auranzeb ki AakhiriRaat
2. Mukthidhan
3. Practice of AnnotationWriting
4. Practice of Summary and Literary evaluationWriting

UNIT – II One Act Play – novel and translation of hindi language)

1. Laksmi kaSwagat
2. Mithayeewala
3. Practice of AnnotationWriting
4. Practice of Summary and Literary evaluationWriting

UNIT-III One Act Play – novel and translation of hindi language)

1. Basant Ritu kaNatak
2. Seb Aur Dev
3. Practice of AnnotationWriting
4. Practice of Summary and Literary evaluationWriting

UNIT-IV One Act Play – novel and translation of hindi language)

1. Bahut BadaSawal
2. Vivah ki TeenKathayen
3. Practice of AnnotationWriting
4. Practice of Summary and Literary evaluationWriting

UNIT-V(Translation of Hindi Lanaguage to English language-paragraph, technical terms)

1. Translation Practice. (English to Hindi)

REFERENCE:

- 1.Aath Ekanki, Edited by Devendra Raj Ankur, Mahesh Anand Vaani prakashan, 4695, 21- A Dariyagunj, New Delhi-110002
- Swarna Manjari, Edited by Dr.Chitti Annapurna, Rajeshwari Publications 21/3, Mothilal street, (opp.Ranganthan Street) Tnagar Chennai-600017
- 3.Prayojan Mulak Hindi : Dr.Syed Rahmathullah, Poornima Prakashan,7, Begum III street, Royapettah, Chennai-14
- 4.Anuvad Abhyas Part III Dakshin Hindi Prachar Sabha, T.Nagar ,Chennai -17

Subject Code: HBFR22002	Subject Name : FRENCH-II	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Plus 2 French	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

Students will be able to understand the familiar words and expressions when someone talks slowly and distinctly.
2. The students will be able to reads; he/she will be able to understand the posters, advertisements or catalogues.
3. The students will be able to communicate and ask and reply to simple questions on familiar subjects
4. The students will be able to use expressions and write simple sentences without faults to describe their living spaces

COURSE OUTCOMES (COs) : The students will be able

CO1	Repeating the basics learnt and memorizing new a factors like the conjugations
CO2	Understanding very frequent expressions and vocabulary concerning immediate surrounding and what concerns the speaker. Also understand simple announcements and clear message.
CO3	Can read ,understand and act upon on short announcements classified in papers or catalogues ,menu cards, timings and personal shot and messages
CO4	Can utilize a series of sentences or expressions to describe in simple terms family living conditions studies and actual and recent professional activities
CO5	Can communicate simple and direct exchange originating from simple habitual tasks on familiar activities and subjects.
CO6	Can write notes and simple and short messages, write like on picture postcard messages of personal vacations and thank you letters

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	1	1	1	1	1	1	1	1	2			
CO2	1	1	1	1	1	1	1	1	2			
CO3	1	1	1	1	1	1	1	1	2			
CO4	1	1	1	1	1	1	1	1	2			
CO5	1	1	1	1	1	1	1	1	2			
CO6	1	1	1	1	1	1	1	1	2			

COs / PSOs	PSO1	PSO2	PSO3						
CO1	1	1	1						
CO2	1	1	1						
CO3	1	1	1						
CO4	1	1	1						
CO5	1	1	1						
CO6	1	1	1						

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
			✓									

Subject Code: HBFR22002	Subject Name : FRENCH-II	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Plus 2 French	Ty	3	0/0	0/0	3

UNIT I **9hrs**

Compétences communicatives, phonologiques, linguistiques, grammaticales et culturelles

- Se saluer, prendre congé, se présenter quelqu'un/quelque chose, Salutations, présentatifs, détails d'identité, professions, quartiers
- Genres, nombres, articles, présentatifs, pluriels des noms, c'est/il est, pronoms toniques
- Salutations française, comportement des salutations, les quartiers parisiens, le peintre Monet
- ❑ Clip audios: Exercices orales, compositions orales et épreuves orales. (20 –durée moins de 2 minutes)
- ❑ Audio clips- For oral expressions, oral assignments and oral test-20- duration less than 2 minutes (10 oral exercises, 6 audio reading compositions& 4 tests).

UNIT II **9hrs**

Compétences communicatives, phonologiques, linguisiques, grammaticales et culturelles

•Dialogue de la vie d'étudiant, des liens familiaux, de l'appartenance, des habitudes; poème, le son « eu » énonces a répéter, lecture guidée.

•S'exprimer de la fréquence, des habitudes, articles, present de l'indicatif, verbes a la terminaison – er, adjectifs possessifs et qualificatifs, locutions avec « avoir »

- Demander l'heure, Les jours, Les mois de l'année.
- ❑ Clip audios: Exercices orales, compositions orales et épreuves orales.(20 –durée moins de 2 minutes)
- ❑ Audio clips- For oral exercises, oral assignments and oral test-20 duration less than 2 minutes (10 oral excercises ,6 audio reading compositions& 4 tests).

UNIT III **9hrs**

Compétences communicatives, phonologiques, linguistiques, grammaticales et culturelles

- Parler des voyages, identifier les vêtements, caractériser de personnes, faire des exclamations, s'informer sur la vie d'étudiant français.
- Poème, le « son i », décrire des personnes, prononcer le nom des pays et des nationalités, Appréciation/exclamation
- Transport et voyages, les pays, nationalités, la mode, la partie du corps ,Adjectifs de nationalités et genres, adjectifs réguliers/irréguliers, prépositions de lieux, verbes aller- venir et verbes a la terminaison –ir
- L'aéroport de Roissy, a la douane, les vêtements, a mode a paris, quelques professions, le sport et la sante ; a Joconde, la BD,

- ❑ Clip audios: Exercices orales, compositions orales et épreuves orales. (20 –durée moins de 2 minutes)
- ❑ Audio clips- For oral expressions, oral assignments and oral test-20-duration less than 2 minutes (10 oral exercises ,6 audio Reading compositions& 4 tests)

UNIT IV **9hrs**

Compétences communicatives, phonologiques, linguistiques, grammaticales et culturelles

- Communication au restaurant, des recettes, le gout et les préférences identifier le type des restaurants.
- Poème, le son « o » énonces simples, des sons nasaux, exercices de répétition
- Les repas français recette activités et sportives
- ❑ Clip audios: Exercices orales, compositions orales et épreuves orales.(20 –durée moins de 2 minutes)
- ❑ Audio clips- For oral expressions, oral assignments and oral test-20 duration less than 2 minutes (10 oral exercises ,6 audio reading

UNIT V **9hrs**

Compétences communicatives, phonologiques, linguistiques, grammaticales et culturelles

- Planifier des vacances, parler des concours, du sport, du temps qu'il fait, s'exprimer au comparatif
- Poème le son « yu », répétition d'énonces, lire de noms de quelques villes
- Activités de vacances, mots de localisation, plan de Paris, le climat et l'écologie, un concours international, les saisons
- Adjectifs de couleur, nombres ordinaux, quelques verbes irréguliers,
- 3 temps autour du présent « de » et « a » et des verbes. Différentes formes du négatif, « il fait » le comparaient le superlatif absolu
- Auberges de jeunesse, vacance, plan de Parise arrondissements quelques monuments parisiens, tourisme fluvial français

- Clip audios : Exercices orales, compositions orales et épreuves orales. (20 –durée moins de 2 minutes)
- Audio clips- For oral expressions, oral assignements and oral test-20 duration less than 2 minutes (10 oral exercices ,6 audio Reading compositions& 4 tests).

Reference Books:

- Parlez-vous français? Partie 1 - Dr.M.Chandrika.V.Unni &Mrs. Meena Mathews 2019 by Universal publisher
- CLE INTERNATIONAL Lectures Clé en français facile. (2012) Hachette Paris
- Cosmopolite: Livre de eleve A1 by Nathalie Hirsch sprung, Tony Tricot, Claude Le Ninan
- Latidudes-1 by Régine Mérieux & Yves l'oiseau, Didier 2017
- Alter Ego 1 - Catherine Dolez, Sylvie Pons : (2014) Hachette, Paris

HBEN 22002	LANGUAGE II - ENGLISH II (Common to all UG Courses under H&S)	Ty/Lb/ ETP	L	T/ S.Lr	P/R	C
	Total contact hours – 45	Ty	3	0/0	0	3
	Prerequisite – English Language					
	T/L/:Theory/LabL:LectureT:TutorialP:Practical/ProjectR:ResearchC:Credits					

Course Objectives

1. Develop four language skills appropriate to the level of education.
2. Demonstrate knowledge of vocabulary and sentence construction in appropriate contexts.
3. Express diverse forms of knowledge in different social and cultural contexts.
4. Attain a comprehensive knowledge of communication skills to use ethically.
5. Develop organized academic and business writing for professional careers.

Course Outcomes (COs)

1. Develop four language skills appropriate to the level of education.
2. Demonstrate knowledge of vocabulary and sentence construction in appropriate contexts.
3. Express diverse forms of knowledge in different social and cultural contexts.
4. Attain a comprehensive knowledge of communication skills to use ethically.
5. Develop organized academic and business writing for professional careers.

Program Specific Outcomes (PSOs)

- Demonstrating mastery of the components of English language and literature.
- Explaining through literature in English, diverse historical cultural and social ethics
- Applying literary critical perspectives to generate original analysis of literature in English
- Promoting cultural values and real-life skills through English language and Literature

Mapping of course outcomes (COs) with Program Outcomes (POs)& Program Specific Outcomes

(3/2/1 indicates the strength of correlation) 3= High; 2= Medium; 1= Low

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2	PSO 3	PSO 4
1	3	3	3	3	3	3	3	1	3	3	3	3	3
2	3	3	3	3	3	3	3	1	3	3	3	3	3
3	3	3	3	3	3	3	3	1	3	3	3	3	3
4	3	3	3	3	3	3	3	1	3	3	3	3	3
5	3	3	3	3	3	3	3	1	3	3	3	3	3

3. Category	H&S	Program core	Program Elective	Open Elective	Interdisciplinary/ Allied	Skill enhancing Elective	Skill component	Practical	Project	Internship	Others
	√	√									

Subject Code: HBEN22002	Subject Name : ENGLISH-II	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: – Plus2 English Language	Ty	3	0/0	0/0	3

Course Objective

1. Develop four language skills appropriate to the level of education.
2. Demonstrate knowledge of vocabulary and sentence construction in appropriate contexts.
3. Express diverse forms of knowledge in different social and cultural contexts.
4. Attain a comprehensive knowledge of communication skills to use ethically.
5. Develop organized academic and business writing for professional careers.

Unit I: **9 Hours**

1. All the World's a Stage – William Shakespeare
2. Speech of Barack Obama
3. The Verger- Somerset Maugham

Unit II: **9 Hours**

1. Spider and the Fly - Mary Howitt
2. "They thought that a bullet would silence us, but they failed". - Malala Yousafzai
3. Refund – Fritz Karinthy

Unit III: **9 Hours**

1. Night of the Scorpion-Nissim Ezekiel
2. On Running after one's hat- G.K.Chesterton
3. The Last Leaf – O. Henry

Unit IV: **9 Hours**

1. Polonius Advice to Laertes-William Shakespeare
2. 'We Must Continue to Dream Big': An open letter from Serena Williams
3. The Necklace - Guy de Maupassant

Unit V: **9 Hours**

1. Functional English: Letter Writing (Formal, Informal, Email)
2. Resume
3. Précis
4. Reading Comprehension
   Developing the hints

Course Outcome: On completion of the course, the students will be able to

1. Develop four language skills appropriate to the level of education.
2. Demonstrate knowledge of vocabulary and sentence construction in appropriate contexts.
3. Express diverse forms of knowledge in different social and cultural contexts.
4. Attain a comprehensive knowledge of communication skills to use ethically.
5. Develop organized academic and business writing for professional careers.

Prescribed Text:

- 'Greatest Speeches of the Modern World', Rupa Publications India, 2018.
- Woudhuysen H.R. 'The Arden Shakespeare third series', the Arden Shakespeare Publishers, 2020.
- Karinthy. Fritz, 'Refund: A Play in One Act', French. Samuel, 1938.
- Simpson H. C & Wilson E. H, 'A Senior Anthology of Poetry', Macmillan Education, 1952.
- O'Brien. Terry, '50 Greatest Short Stories', Rupa Publications India; First Edition, 2015.
- J. C. Richards with J. Hull & S.Proctor, Interchange, Level 3, Cambridge University Press, 2021.
- Mark Hancock, English Pronunciation in Use, CUP, 2016.
- M. Chandrasena Rajeswaran &R. Pushkala, Communication Lab Work book 2022.
- M. Chandrasena Rajeswaran, R. Pushkala & S. Bhuvaneswari Pinnacle: A Skills Integrated Text,2022
- Dutt, K, Rajeevan, G & Prakash, , *A Course on Communication Skills*, 1st edn,CUP, Chennai,2008

Suggested Links:

- https://www.poetrybyheart.org.uk/poems/the-spider-and-the-fly/Reference.
- https://poets.org/poem/unknown-citizen

Subject Code: HBBC22ID1	Subject Name : ALLIED –II BIOCHEMISTRY-I	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Chemistry	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:
To develop understanding and provide scientific basics of the life processes at the molecular level and explain the structure, function and inter-relationships of Bio molecules.

COURSE OUTCOMES (COs) : The students will be able

CO1	Understand the structure, organization and classification of carbohydrates.
CO2	Understand the structure, organization and classification of proteins,
CO3	Understand the structure, organization and classification of lipids,
CO4	Understand the distribution and biological importance of various vitamins and minerals.
CO5	Understand their functions and role in life processes.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	1	2	2	2	1	1	1	3			
CO2	3	1	2	2	2	1	1	1	3			
CO3	3	1	2	2	2	1	1	1	3			
CO4	3	1	2	2	2	1	1	1	3			
CO5	3	1	2	2	2	1	1	1	3			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	3	3	3					
CO2	3	3	3					
CO3	3	3	3					
CO4	3	3	3					
CO5	3	3	3					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
	✓											

Subject Code: HBBC22ID1	Subject Name : ALLIED-II BIOCHEMISTRY-I	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Chemistry	Ty	3	0/0	0/0	3

UNIT - I: CARBOHYDRATES **9 Hrs**

Introduction and classification, Structure and properties of mono, di and Polysaccharides with examples

UNIT - II: PROTEINS AND NUCLEIC ACIDS **9 Hrs**

Structure and properties of amino acids, classification and properties of proteins, structure and organization of proteins-primary, secondary, tertiary and quaternary structure. Nucleic acids- Structure of purines, pyrimidines, nucleosides and nucleotides. Structure, types and biological role of RNA and DNA.

UNIT- III: LIPIDS **9 Hrs**

Structure and classification of lipids, Distribution and biological importance of fats and fatty acids. Structure and function of triacylglycerols, phospholipids, glycolipids, sphingolipids, steroids

UNIT- IV: VITAMINS AND MINERALS **9 Hrs**

Structure and Biological functions of Vitamins and Minerals

UNIT – V: BIOCHEMISTRY OF ENDOCRINE SYSTEM **9 Hrs**

Hormones of pituitary, Thyroid, Pancreas, Adrenal and Sex glands (only Biochemical functions of hormones)

Total Number of Hours: 45

TEXT BOOKS

❖ *A.C. Deb* (2001)*Fundamentals of Biochemistry* , (7th Ed)Aggarwal Book Company

REFERENCE BOOKS

❖ Nelson, L. D. and M. M Cox, (2002), *Lehninger's Principle of Biochemistry*: (3rd Ed) Macmillan, Worth Publication Inc.

Subject Code: HBBT22002	Subject Name : CELL BIOLOGY & GENETICS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Ty	3	1/0	0/0	4

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:
To recollect the knowledge on prokaryotic and eukaryotic cells, cell division and cell organelles. To understand transport mechanism across cell membrane. To learn the basics of cell signaling through binding of a ligand to its receptor

COURSE OUTCOMES (COs) : The students will be able

CO1	Would have deeper understanding of cell at structural and functional level..
CO2	Understand the cell membrane endomembrane systems and peroxisomes,
CO3	Would have broad knowledge on the molecular interaction between cells and signal transduction and hormonal signaling
CO4	Would demonstrate a clear understanding of the chromosomes and genetics
CO5	Understand their sex chromosomes and inherited diseases

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	1	2	2	2	1	1	1	3			
CO2	3	1	2	2	2	1	1	1	3			
CO3	3	1	2	2	2	1	1	1	3			
CO4	3	1	2	2	2	1	1	1	3			
CO5	3	1	2	2	2	1	1	1	3			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	2	3	3				
CO2	2	3	3				
CO3	2	3	3				
CO4	2	3	3				
CO5	2	3	3				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
	✓											

Subject Code: HBBT22002	Subject Name : CELL BIOLOGY & GENETICS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Ty	3	1/0	0/0	4

UNIT I: CELLS AND ORGANELLES **12 Hrs**

Cells and organelles, transport across membranes – simple diffusion, facilitated diffusion through carrier proteins and channel proteins, active transport, energetics of transport, Cell division in prokaryotes and eukaryotes (mitosis and meiosis), Cell cycle, and cell cycle regulation.

UNIT II: ENDOMEMBRANE SYSTEMS AND PEROXISOMES **12 Hrs**

Structure of ER and glogi complex; Role of ER and golgi complex in protein glycosylation, secretary pathways, protein trafficking, exocytosis, endocytosis, coated vesicles in cellular transport processes; Lysosomes and cellular digestion. Role of plant vacuole and peroxisomes.

UNIT III: INTRODUCTION TO CELL SIGNALLING **12 Hrs**

Signaling molecules and their receptors, functions, pathways of intracellular signal transduction – the Cell Cycle – Mitosis and Meiosis –Cell death and cell renewal-Programmed cell death-Stem cells- Embryonic stem cells and therapeutic cloning (**Basic introduction to be known).**

UNITIV-INTRODUCTIONTOGENETICS **12 Hrs**

Nature of genetic material, Mendelian laws of inheritance, law of segregation and laws of independent assortment. Dominance and lethal genes-Dominance relationships, lethal gene action, gene interactions and Epistasis –Types of gene interaction and molecular basis of gene interaction. Structural organization, variation in the number and structure of chromosome- Haploids, missing and Euploid and aneuploid, Deletion, Duplication, Translocation and structural rearrangements.

UNIT V - SEX CHROMOSOMES AND INHERITED DISEASES **12 Hrs**

Vehicles of heredity, sex determination in plants and animals, Autosomal dominant disorders sex linked inheritance, non-disjunction of X chromosomes, linkage and crossing over, interference, coincidence. Molecular diseases Hemoglobinopathies, disorders of coagulation, colour blindness, hemophilia. Multiple alleles ABO blood groups, Rh group system

Total Number of Hours: 60

References/ Text books

- Cell Biology, De Roberties& De Roberties, Blaze publishers & Distributors Pvt. Ltd., New Delhi, 2001.
- Molecular cell Biology (III rd Edition), Harvey Lodish, David Baltimore et al., W.H. Freeman, 2000.
- Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, 2007. Molecular Biology of the Cell, Fifth edition. Garland Science.
- Hartl L D and Jones B, Analysis of genes and genomes, 3rd Edition, Jones and Bartlett Publishers, 1994.
- Principles of Genetics. 8th edition by Gardner, Simmons and Snustad. 2002.

Subject Code: HBBT22003	Subject Name : MICROBIAL TECHNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Ty	3	1/0	0/0	4

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To make the students aware of the bulk production of commercially important modern Bioproducts, Industrial Enzymes, Products of plant and animal cell cultures

COURSE OUTCOMES (COs) : The students will be able to

CO1	Get familiar in the exciting area of biology of microbes
CO2	Understand the habitual and application of microbes in different products and process
CO3	Would have broad knowledge on the various microbial metabolic products
CO4	Demonstrate a clear understanding of bioremediation process by microbes
CO5	Understand the sources, production and industrial application of enzymes

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	3	3	3	3	3	1	1	1	3			
CO2	3	3	3	3	3	1	1	1	3			
CO3	3	3	3	3	3	1	1	1	3			
CO4	3	3	3	3	3	1	1	1	3			
CO5	3	3	3	3	3	1	1	1	3			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	2	3	3				
CO2	2	3	3				
CO3	2	3	3				
CO4	2	3	3				
CO5	2	3	3				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
	✓											

Subject Code: HBBT22003	Subject Name : MICROBIAL TECHNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Ty	3	1/0	0/0	4

UNIT I - HISTORY AND SCOPE **12 Hrs**

History and scope of microbial biotechnology, Microbial biodiversity and its use. Berge's manual of systemic bacteriology. Mass cultivation and preservation of microorganisms. Mycotechnology, Classification in microbial biomass.

UNIT II - MICROBIAL METABOLITES **12 Hrs**

Synthesis of primary and secondary metabolites, Production of primary metabolites - organic acids (citric acid, itaconic acid, acetic acid, gluconic acid), Amino acids (glutamic acid, lysine, aspartic acid, phenylalanine), alcohols (Ethanol, 2,3-butanediol), microbial enzymes and its applications. Production of secondary metabolites - microbial production of antibiotics.

UNIT III - ROLE OF MICROBES **12 Hrs**

Role of microorganisms for industrial, agricultural and environmental use. Production of Bio fertilizers and Biopesticides, Application of Microbes in Waste Water Treatment Technology, microbes in mining, ore leaching

UNIT IV - MICROBES IN BIOREMEDIATION AND IN GENERATION OF ENERGY **12 Hrs**

Bioremediation of Xenobiotic and natural compounds, Biodegradation of non cellulose and cellulosic wastes for environmental conservation. Lignocellulosic waste degradation. Microbes as alternative energy sources by microbial fuel cells and biofuels.

UNIT V – SRAIN IMPROVEMENT CASE STUDIES AND CURRENT ISSUES **12 Hrs**

Strain improvement- Isolation, screening and genetic improvement of industrially important organisms. production of single cell proteins – Commercially available forms of single cell protein for food and feed. Case studies on Industrial contamination (Only for discussion)

Total Number of Hours: 60

TEXT BOOKS:

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

REFERENCES:

- A.H. Patel " Industrial Microbiology" Macmillan
- Presscott, S.C. and Cecil G. Dunn, "Industrial Microbiology", Agrobios (India), 2005.
- Cruger,Wulf and AnnelieseCrueger, "Biotechnology: A Textbook of Industrial Microbiology", 2nd Edition, Panima Publishing, 2000.

Subject Code: HBBT22L02	Subject Name : CELL BIOLOGY & GENETICS LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Lb	0	0/0	3/0	2

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To study the different cellular architecture of plant and animal cells. The objective also includes their enumeration physiology and multiplication

COURSE OUTCOMES (COs) : The students will be able to

CO1	To study the cellular architecture
CO2	To study the process of cell dicvision
CO3	To understand the physiology of cells

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	2	3	3	3	3	1	3	2			
CO2	3	2	3	3	3	3	1	3	2			
CO3	3	2	3	3	3	3	1	3	2			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	3	3	3					
CO2	3	3	3					
CO3	3	3	3					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
								✓				

Subject Code: HBBT22L02	Subject Name : CELL BIOLOGY & GENETICS LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Lb	0	0/0	3/0	2

1. Identification of blood smear
2. Identify the no. of cells present in the given samples using Haemocytometer
3. Prepare onion epidermis for identifying different parts of cell present in it
4. Study and demonstrate mitosis by preparing a mount of onion root tip.
5. Identify the presence of barr body in the female buccal cavity.
6. To Identify Membrane permeability in Beetroot or potato
7. Identification of plant cell – Xylem and Phloem

REFERENCES:

- Cell Biology, De Roberties& De Roberties, Blaze publishers & Distributors Pvt. Ltd., New Delhi, 2001
- Principles of Genetics. 8th edition by Gardner, Simmons and Snustad. 2002.

Subject Code: HBBC22IL1	Subject Name : ALLIED LAB - BIOCHEMISTRY LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Chemistry	Lb	0	0/0	3/0	2

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:
To learn and understand the principles behind the qualitative and quantitative estimation of biomolecules

COURSE OUTCOMES (COs) : The students will be able to

CO1	Basic Biochemistry qualitative analysis of carbohydrates
CO2	Qualitative analysis of proteins and amino acids
CO3	Qualitative analysis of lipids and steroids

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	3	2	3	3	3	3	1	3	2			
CO2	3	2	3	3	3	3	1	3	2			
CO3	3	2	3	3	3	3	1	3	2			
COs / PSOs	PSO1		PSO2		PSO3							
CO1	3		3		3							
CO2	3		3		3							
CO3	3		3		3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
								✓				

Subject Code: HBBC22IL1	Subject Name ALLIED LAB - BIOCHEMISTRY LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Chemistry	Lb	0	0/0	3/0	2

1. Laboratory Safety and Hygiene: Standard Operating Procedures, Units and Measurements, Use of Instruments, Concept of pH and Buffers (Preparation of Phosphate Buffer)
2. Basic calculations in Biochemistry - Normality, Molarity, Molality, percent solutions (v/v, w/v), calculation of working solution from stock.
3. Qualitative analysis of Monosaccharide
4. Qualitative analysis of Disaccharide
5. Qualitative analysis of Polysaccharide
6. Qualitative analysis of Proteins
7. Estimation of proteins – Lowry and Biuret Method
8. Biological Preparations: Isolation of casein and starch

TEXT BOOKS AND REFERENCES

❖ Practical Biochemistry byKeith Wilson and John walker 2005
❖ An introduction to practical biochemistry Plummer,Tata-mcgraw Hill1987

Subject Code: HBCC22I03	Subject Name : SOFT SKILL – II	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Higher Secondary Mathematics	IE	0	0/0	2/0	1

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

1. Cultivate employability skills that they get employed even before they leave the university.
2. Build self-esteem and a sense of self-worth to be good team members
3. Cultivate empathy to think from others' point of view to be good team leaders.
4. Evolve as good global citizens with insights into social and professional ethics.
5 Develop lifelong learning skills to adapt in the multicultural context of workplaces.

COURSE OUTCOMES (COs) : The students will be able to

CO1	Cultivate employability skills that they get employed even before they leave the university
CO2	Build self-esteem and a sense of self-worth to be good team members
CO3	Cultivate empathy to think from others' point of view to be good team leaders.
CO4	Evolve as good global citizens with insights into social and professional ethics
CO5	Develop lifelong learning skills to adapt in the multicultural context of workplaces.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	3	2	3	3	3	2	1	2	3			
CO2	2	3	2	3	3	2	1	2	2			
CO3	3	2	3	2	3	1	2	1	3			
CO4	3	1	2	3	2	3	3	2	2			
CO5	3	2	3	2	3	2	1	2	3			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	1	1	1				
CO2	1	1	1				
CO3	1	1	1				
CO4	1	1	1				
CO5	1	1	1				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
								✓				

Subject Code: HBCC22I03	Subject Name : SOFT SKILL – II	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Higher Secondary Mathematics	IE	0	0/0	2/0	1

Prefatory Note

This paper aims to equip the advanced learners with skills essential for work place and global environment to which they will move on from the university, once they complete the course. As such, it covers a range of indispensable soft skills and values such as, self-esteem, empathy, public relations, positivity, reliability, professionalism, leadership and intercultural communication, interview skills, etc.. Together with the effective English communication in global contexts, these skills, if cultivated and strengthened, can immensely help the students become employable in the multinational companies as good global citizens abiding the social and professionalethics in cross-cultural diversity.

Course Objective

The students will be facilitated to

1. Cultivate employability skills that they get employed even before they leave the university.
2. Build self-esteem and a sense of self-worth to be good team members
3. Cultivate empathy to think from others' point of view to be good team leaders.
4. Evolve as good global citizens with insights into social and professional ethics.
5. Develop lifelong learning skills to adapt in the multicultural context of workplaces.

Unit -I

Conversational skills, Self-esteem skills, empathy, public relations

Unit -II

Positivity, reliability, professionalism

Unit -III

Leadership

Problem solving

Unit -IV

Intercultural communication skills

Global Manthra: Go local, Cultural sensitivity, Group behaviour

Cultural intelligence : Low and High context, e mail and inter cultural communication

Unit -V

Group discussion &Interview skills

Course Outcome

On completion of the course the students will be able to

1. Cultivate employability skills that they get employed even before they leave the university.
2. Build self-esteem and a sense of self-worth to be good team members
3. Cultivate empathy to think from others' point of view to be good team leaders.
4. Evolve as good global citizens with insights into social and professional ethics.
5. Develope lifelong learning skills to adapt in the multicultural context of workplaces.

Suggested reading

1. S.P. Dhanavel, English and Soft Skills, Vol.2 Orient Blackswan Pvt. Ltd. 2010
2. P.D. Chaturvedi and M. Chaturvedi, Communication Skills , Pearson, 2012

Dr. M.G.R.
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(An ISO 21001 : 2018 Certified Institution)
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SEMESTER - III

Subject Code: HBIT22ID1	Subject Name ALLIED –III BIOINFORMATICS	TY/ LB/ ETP/IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	TY	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To learn nucleotide, protein and genome databases and know about the file formats. To understand pair wise and multiple sequence alignment and the principle and to gain knowledge on approaches for gene prediction methods in prokaryotes and eukaryotes

COURSE OUTCOMES (COs) : The students will be able to

CO1	Develop bioinformatics tools with programming skills.
CO2	Apply computational based solutions for biological perspectives.
CO3	Demonstrate a clear understanding of pairwise and multiple sequence alignment
CO4	Understand the gene prediction and protein prediction methods
CO5	Get familiarize with the topic Nutrigenomics

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9			
CO1	3	1	2	2	2	1	3	1	3			
CO2	3	1	2	2	2	1	3	1	3			
CO3	3	1	2	2	2	1	3	1	3			
CO4	3	1	2	2	2	1	3	1	3			
CO5	3	1	2	2	2	1	3	1	3			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	3		3		3							
CO2	3		3		3							
CO3	3		3		3							
CO4	3		3		3							
CO5	3		3		3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
	✓											

Subject Code: HBIT22ID1	Subject Name ALLIED –III BIOINFORMATICS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	TY	3	0/0	0/0	3

UNIT I: BIOLOGICAL DATABASES AND DATA RETRIEVAL **9Hrs**

Nucleotide databases (Genbank, EMBL), Sequence submission Methods and tools (Sequin, Sakura), Sequence retrieval systems (Entrez), Protein (Swiss-Prot, Tr-EMBL, Expasy), Genome (NCBI, EBI, TIGR), Metabolic Pathway DB (KEGG)

UNIT II: PAIRWISE SEQUENCE ALIGNMENT **9Hrs**

Similarity, Identity and Homology, Global Alignment, Local Alignment, Database Search methods & tools, Scoring Matrices,

UNIT III: MULTIPLE SEQUENCE ALIGNMENT **9Hrs**

Significance of MSA, Scoring of MSA, PSI/PHI-BLAST.

UNIT IV: GENE PREDICTION AND PROTEIN PREDICTION **9Hrs**

Structure in Prokaryotes and Eukaryotes, Gene prediction methods, Neural Networks, Pattern Discrimination methods, Signal sites Predictions (Promoter, Splice, UTR, CpG-islands), Molecular visualization - protein conformation and visualization tool (RASMOL), Methods of Construction of Phylogenetic trees.

UNIT V: NUTRIGENOMICS **9Hrs**

Introduction to Nutrigenomics and Nutraceuticals

Total Number of Hours 45

REFERENCES

- Introduction to Bioinformatics - A. Lesk 2002, Oxford University Press
- Fundamental concepts of Bioinformatics by D.E. Krane and M.L Raymer, Pearson Education 2003 ISBN 81-297-0044-1
- Current Protocols in Bioinformatics, Edited by A.D. Baxevaniset. al., Wiley Publishers 2005
- Introduction to Computational Molecular Biology by Joao Carlos Setubal, Joao

Subject Code: HBBT22004	Subject Name BIOCHEMISTRY-II	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Ty	3	1/0	0/0	4

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:
To develop understanding and provide scientific basics of the life processes at the molecular level and inter-relationships of biomolecules and their deviation from normal and their consequences for interpreting and solving clinical problems.

COURSE OUTCOMES (COs) : The students will be able to

CO1	Understand the various metabolic reactions undergone by the carbohydrates
CO2	Understand the various metabolic reactions undergone by the Proteins
CO3	Understand the various metabolic reactions undergone by the lipids
CO4	Understand the process of Biological oxidation involved in the energy production by burning the food materials.
CO5	Understand the various diseases associated with the errors of metabolism of the biomolecules.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	3	1	2	2	2	1	1	1	3			
CO2	3	1	2	2	2	1	1	1	3			
CO3	3	1	2	2	2	1	1	1	3			
CO4	3	1	2	2	2	1	1	1	3			
CO5	3	1	2	2	2	1	1	1	3			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	3		3		3							
CO2	3		3		3							
CO3	3		3		3							
CO4	3		3		3							
CO5	3		3		3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
	✓											

Subject Code: HBBT22004	Subject Name BIOCHEMISTRY-II	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: chemistry	Ty	3	1/0	0/0	4

UNIT - I: CARBOHYDRATE METABOLISM **12Hrs**

Glycolysis,TCA cycle, Glycogenesis, glycogenolysis, Gluconeogenesis, and physiological significance of pentose phosphate pathway. Diseases associated with Carbohydrate metabolism - Diabetes mellitus and Glycogen storage diseases .

UNIT - II: BIOENERGETICS **12Hrs**

Basic Concepts and Design. Electron transport chain and oxidative phosphorylation: Structure of mitochondria, the mitochondrial respiratory chain, ATP production, inhibitors and uncouplers of electron transport chain

UNIT- III:PROTEIN METABOLISM **12Hrs**

Degradation of proteins, Oxidative, Non- Oxidative deamination ,transamination and trans deamination of amino acids and Urea Cycle. Diseases of protein metabolism, inborn errors of amino acid metabolism(Phenylketonuria and Alkaptanuria).

UNIT-IV: LIPID METABOLISM **12 Hrs**

Uptake of lipids in animals**,** transport and hydrolysis of triglycerides, transport of fatty acids into mitochondria, Fatty acid oxidation**:** β-oxidation of saturated unsaturated fatty acids Ketone bodies formation, Biosynthesis and degradation of cholesterol, Lipids and lipoproteins in diseases.

UNIT- V: NUCLEIC ACID METABOLISM **12 Hrs**

Biosynthesis and degradation of purine and pyrimidine. Diseases associated with purine and pyrimidine metabolism.

Total Number of Hours: 60

TEXT BOOKS

- *A.C. Deb* (2001)*Fundamentals of Biochemistry* ,(7th Ed)Aggarwal Book Company

REFERENCE BOOKS

- Nelson, L. D. and M. M Cox, (2002), *Lehninger's Principle of Biochemistry*: (3rd Ed) Macmillan, Worth Publication Inc.

Subject Code: HBBT22005	Subject Name MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Ty	3	1/0	0/0	4

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:
To Understand the mechanism of replication, transcription and translation. To deeply learn the molecules involved in synthesis of DNA, RNA and proteins.

COURSE OUTCOMES (COs) : The students will be able to

CO1	Acquire basic fundamental knowledge of molecular biology .
CO2	Understand and and explore skills in molecular biology and become aware of the complexity and harmony of the cells
CO3	Emphasize the molecular mechanism of DNA replication, repair, transcription.
CO4	Understand the process of protein synthesis and gene regulation in various organisms.
CO5	Articulate applications of molecular biology in the modern world.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	3	3	3	3	3	3	3	3	2			
CO2	3	3	3	3	3	3	3	3	2			
CO3	3	3	3	3	3	3	3	3	2			
CO4	3	3	3	3	3	3	3	3	2			
CO5	3	3	3	3	3	3	3	3	2			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	3	3	3				
CO2	3	3	3				
CO3	3	3	3				
CO4	3	3	3				
CO5	3	3	3				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
	✓											

Subject Code: HBBT22005	Subject Name MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Nil	Ty	3	1/0	0/0	4

UNIT I - STRUCTURE, REPLICATION AND REPAIR MECHANISM 12 Hrs

DNAStructure, RNAstructure, Replication process of prokaryotic and eukaryotic, Replication errors-Mutagens- their repair mechanism. Recombination mechanism in prokaryoteand eukaryotes.

UNIT II - TRANSCRIPTION AND TRANSLATION 12 Hrs

Types of RNA polymerases- prokaryotic and eukaryotic transcription- splicing and editing, mRNAtransport, inhibitors of transcription, Mechanism of Prokaryotic and Eukaryotic translation process, Wobble hypothesis, Deviations from the universal genetic code.

III - GENE REGULATION 12 Hrs

Gene regulation in Prokaryotes phage lambda regulation of lytic and lysogenic lifecycle, LAC Operon, Trip Operon; Gene regulation in Eukaryotes – Homeo-domain proteins, Zn containing DNA binding domains, leucine zipper motifs, helix – loop helix proteins, RNAi, siRNA, microRNAs.

UNIT IV - ENZYMES IN RECOMBINANT TECHNOLOGY AND CLONING VECTORS 12 Hrs

Restriction Endonucleases,DNA manipulating enzymes, Hybridization techniques: Southern, Northern hybridization,Plasmid Vectors: PBR 322, PUC19 vectors, Bacteriophage vectors: Cosmids, M13 Vectors, Expression vectors, yeast vectors, artificial chromosome vectors, Methods for introducing DNA into cells.

UNIT V - CONSTRUCTION OF LIBRARIES AND DNA SEQUENCING 12 Hrs

Construction of Genomic and cDNA Libraries, Screening of libraries, labeling of DNA probes, Principles of DNA Sequencing and its types, PCR, Types and application of PCR:Real time PCR, Reverse transcriptase PCR, nested PCR.

Total Number of Hours: 60

TEXT BOOK

- Watson et al (2004) Molecular Biology of the Gene, (5th Ed).,Pearson Education.
- David freifelder (1987) Molecular biology Jones & Bartlett Publishers,
- Karp, Gerald “Cell and Molecular Biology: Concepts and Experiments” 4th Edition, John Wiley, 2005.

REFERENCE BOOKS

- Baltimore (2000) Molecular biology (4th Ed): W. H. Freeman New York\
- Lodish (2000) Molecular cell biology (4th Ed): W. H. Freeman New York
- Bernard R. Glick, Molecular Biotechnology: Principles and Applications of Recombinant DNA, ASM Press (2010)

Subject Code: HBBT22006	Subject Name: INSTRUMENTATION METHODSOF ANALYSIS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Physics	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:
To impart adequate knowledge of scientific understanding of the basic concepts in instrumentation used in Biotechnology and also to impart a basic understanding about the biophysical phenomenon involved physiological systems.

COURSE OUTCOMES (COs) : The students will be able to

CO1	To provide an understanding and skills in advanced methods of separation
CO2	To provide practical experience in selected instrumental methods of analysis
CO3	To familiarize with advanced methods of analysis of separated molecules
CO4	To make the students to know the principle behind each instruments
CO5	To develop skills of students in instrumentation and biological techniques

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	3	3	3	3	3	3	3	3	2			
CO2	3	3	3	3	3	3	3	3	2			
CO3	3	3	3	3	3	3	3	3	2			
CO4	3	3	3	3	3	3	3	3	2			
CO5	3	3	3	3	3	3	3	3	2			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	3	3	3				
CO2	3	3	3				
CO3	3	3	3				
CO4	3	3	3				
CO5	3	3	3				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
	✓											

Subject Code: HBBT22006	Subject Name: INSTRUMENTATION METHODS OF ANALYSIS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Physics	Ty	3	0/0	0/0	3

UNIT I: SPECTROSCOPY - I & THERMAL METHODS **9 Hrs**

Introduction to principles and applications of spectroscopic methods – UV-Vis, IR, Fluorescence &Phosphorescence ORD, CD, DSC

UNIT II: SPECTROSCOPY - II & DIFFRACTION **9 Hrs**

Introduction to principles and applications of spectroscopic methods ESR, AAS, AFS, AES, Mass spectrometry, NMR, XRD

UNIT III: MICROSCOPY – TECHNIQUES **9 Hrs**

Introduction to principles and applications of Polarised light microscopy, phase contrast microscopy, interference microscopy, Fluorescence microscopy, confocal microscopy, electron microscopy - TEM, SEM

UNIT IV: CHROMATOGRAPHY & CENTRIFUGATION **9 Hrs**

Introduction to principles and applications of Chromatography - adsorption, affinity, partition - GLC, GC, HPLC, TLC, HPTLC, RPC.

UNIT V: ELECTROPHORETIC – TECHNIQUES **9 Hrs**

Introduction to principles and applications of Electrophoresis of proteins and nucleic acids - 1D & 2D gels, SDS-PAGE, Agarose gel electrophoresis, Western Blotting, Gel documentation

Total Number of Hours: 45

REFERENCES

- Principles of Instrumental Analysis, Skoog DA, Thomspon Brooks and Cole, 5th Edition
- Instrumental Methods of Chemical Analysis, Chatwal GR, Himalaya Publishing House
- Instrumental Methods of Chemical Analysis, Sharma BK, Krishna Prakashan Media PvtLtd
- Instrumental methods of analysis by Willard, Merit Dean & Settle, CBS Publishers and Distributers, 6th Edition

Subject Code: HBBT22007	Subject Name :FOOD PROCESSING TECHNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry and Microbiology	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:
To study of nutrients in food, how the body uses them, and the relationship between diet, health, and disease. Nutritionists use ideas from molecular biology, biochemistry, and genetics to understand how nutrients affect the human body.

COURSE OUTCOMES (COs) : The students will be able

CO1	To provide an understanding about basic concept of nutrition of food and its importance
CO2	To provide an overview about the food microbes
CO3	To familiarize with dairy technology
CO4	To make the students to know the food safety concepts
CO5	To make them to know the food spoilage and their preservation

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	3	3	3	3	3	3	3	2			
CO2	3	3	3	3	3	3	3	3	2			
CO3	3	3	3	3	3	3	3	3	2			
CO4	3	3	3	3	3	3	3	3	2			
CO5	3	3	3	3	3	3	3	3	2			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	3	3	3					
CO2	3	3	3					
CO3	3	3	3					
CO4	3	3	3					
CO5	3	3	3					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
	✓											

Subject Code: HBBT22007	Subject Name: FOOD PROCESSING TECHNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry and Microbiology	Ty	3	0/0	0/0	3

UNIT I: INTRODUCTION **9 Hrs**

History and Scope of Food Biotechnology, Nutritive value of food, Role of microbes in food biotechnology – bacteria, fungi and yeast. Fermented foods – Types, Changes during Fermentation, Nutritive value of fermented foods.

UNIT II: FOOD MICROBIOLOGY **9 Hrs**

Primary Sources of Microorganisms in food. Food borne bacteria, Molds and Yeasts. Intrinsic and Extrinsic Parameters of food affecting microbial count. Detection of Microorganisms in food - SPC, Membrane filters, Dry films. Bacterial Toxin - Botulism and Staphylococcal toxin. Fungal Toxins - Aflatoxin.

UNIT III: DAIRY BIOTECHNOLOGY **9 Hrs**

Milk - Definition, Composition and Types. Fermented milk products - Butter, Yoghurt and Cheese. Preservation of milk by heat treatment - Pasteurization and Ultra High Temperature. Physiochemical characterization of milk. Milk Tests - Dye Reduction (MBRT and Resazurin).

UNIT IV: FOOD PRODUCTION **9 Hrs**

Food safety - HACCP System to food protection, Responsibility for food safety. Food Additives - Definition, Types and Functional characteristics. Natural Colors -Types, Applications, Advantages of natural colors. Sweeteners - Types and Applications.

UNIT V:FOOD SPOILAGE AND PRESERVATION **9 Hrs**

Causes of Food Spoilage, Spoilage of Fruits, Vegetables, Meat, Soft Drinks, Eggs, Dairy products. Food Preservation through chemicals - Acids, Salts, Sugars, Antibiotics, Ethylene oxide, Antioxidants. Other Methods of Food Preservation -Radiations, Low and High temperature and Drying.

Total Number of Hours: 45

TEXT BOOKS:

- Adam, M.R. and Moss, M.O., 2003. Food Microbiology, New Age International Pub.New Delhi, India.
- Frazier, W.C. and Westhoff, D.C., 2005. Food Microbiology, IV Ed.,Tata Mc Graw Hill Pub. Company Ltd. New Delhi, India.

REFERENCES:

- Harrigan, W. F 1998.Laboratory methods in Food Microbiology, III Ed. Academic press New York,USA.
- Jay, J.M., 1992. Modern Food Microbiology, IV Ed. Chapman and Hall, New York, USA

Subject Code: HBBT22L03	Subject Name MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry and Microbiology	Lb	0	0/0	3/0	2

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:
To apply the knowledge gained in Recombinant DNA technology and Molecular biology subjects regarding DNA, RNA and gene manipulation.

COURSE OUTCOMES (COs) : The students will be able

CO1	To provide an understanding about basic DNA isolation technique
CO2	To provide an overview about the plasmid isolation
CO3	To familiarize with PCR
CO4	To make the students to know the restriction digestion
CO5	To make them to know the transformation

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	3	3	3	3	3	3	3	3	2			
CO2	3	3	3	3	3	3	3	3	2			
CO3	3	3	3	3	3	3	3	3	2			
CO4	3	3	3	3	3	3	3	3	2			
CO5	3	3	3	3	3	3	3	3	2			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	3	3	3				
CO2	3	3	3				
CO3	3	3	3				
CO4	3	3	3				
CO5	3	3	3				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
								✓				

Subject Code: HBBT22L03	Subject Name MOLECULAR BIOLOGY ANDRECOMBINANT DNA TECHNOLOGY LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry and Microbiology	Lb	0	0/0	3/0	2

1. Isolation of Plasmid DNA
2. Competent Cell preparation and transformation
3. Quantitation of DNA by agarose gel electrophoresis and spectroscopy
4. Isolation of Plant cell and / or genomic DNA
5. Restriction Enzyme Digestion
6. Principles of Colony hycridization
7. PCR
8. Principles of RNA isolation and northern hybridization

REFERENCE BOOKS:

- Sam brook, Frisch and Maniatis, Vol I, II and III (1989) Molecular Cloning (2nd Ed) Cold Spring Harbor Laboratory,

Subject Code: HBIT22IL1	Subject Name ALLLIED LAB - BIOINFORMATICS LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry and Microbiology	Lb	0	0/0	3/0	2

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To enable the students to understand basic commands in UNIX OS.To understand different biological databases.
To carry out sequence and phylogenetic analysis.

COURSE OUTCOMES (COs) : The students will be able

CO1	To demonstrate the protein/DNA sequence search methods and sequence alignment databases
CO2	To understand and hands-on-training on the genome sequence analysis and annotation.
CO3	To analyze the comparative genomics.
CO4	To make the students to know computational tools for expression analysis
CO5	To use various tools to study open reading frames, mutations, conserved region

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	1	2	2	3	2	3	2	2			
CO2	3	1	2	2	3	2	3	2	2			
CO3	3	1	2	2	3	2	3	2	2			
CO4	3	1	2	2	3	2	3	2	2			
CO5	3	1	2	2	3	2	3	2	2			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	3		3		3							
CO2	3		3		3							
CO3	3		3		3							
CO4	3		3		3							
CO5	3		3		3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
								✓				

Subject Code: HBIT22IL1	Subject Name :ALLIED LAB - BIOINFORMATICS LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: Biochemistry and Microbiology	Lb	0	0/0	3/0	2

1. Demonstration of Entrez and SRS
2. Pairwise Sequence Alignment - EMBOSS
3. BLAST P
4. Multiple sequence Alignment- CLUSTAL OMEGA
5. PSI- BLAST
6. Primer BLAST
7. Phylogenetic analysis

References

- *Bioinformatics for Dummies* by Claverie and Notredame, 2003, Wiley Publishing
- Bioinformatics – Sequence and Genome Analysis: D avid W. Mount
- Bioinformatics - A practical guide to the analysis of genes and proteins - 2nd Edition,AndreasE.Baxevanis, B.F.Francis Oullette. 2001.

Subject Code: HBCC22I04	Subject Name :STATISTICAL AND NUMERICALMETHODS WITH PROGRAMMING LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Higher Secondary Mathematics	IE	0	0/0	3/0	2

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

- To understand the Basic concepts in Measures of Central Tendency
- To understand the Basic concepts in Correlation and Regression
- To understand the methods of solving Algebraic and Transcendental equations
- To understand the basic concepts in R Programming language

COURSE OUTCOMES (COs) : The students will be able

CO1	Understand the basic concepts in Measures of Central Tendency
CO2	Understand the basic concepts in Correlation and Regression
CO3	Try to solve Algebraic equations
CO4	Try to solve system of Linear Equations
CO5	Learn how to apply R programming to solve Statistical and Numerical problems

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	3	2	3	3	2	2	1	2	3			
CO2	3	2	2	3	3	1	1	2	3			
CO3	2	2	3	2	3	2	2	1	2			
CO4	3	2	3	3	3	2	1	1	3			
CO5	2	2	3	3	2	1	1	2	2			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	1		1		1							
CO2	1		1		1							
CO3	1		1		1							
CO4	1		1		1							
CO5	1		1		1							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
								✓				

Subject Code: HBCC22I04	Subject Name :STATISTICAL AND NUMERICALMETHODS WITH PROGRAMMING LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Higher Secondary Mathematics	IE	0	0/0	3	2

UNIT I MEASURES OF CENTRAL TENDENCY & VARIABILITY

Mean, Median, Mode – Range, Quartile Deviation – Mean Deviation - Standard Deviation

UNIT II CORRELATION AND REGRESSION

Correlation Coefficient – Spearman's Rank Correlation – Linear Regression

UNIT III SOLUTION OF EQUATIONS

Solution of Algebraic equations – Method of false position – Iteration method – Newton-Raphson method

UNIT IV SOLUTION OF LINEAR SYSTEM OF EQUATIONS

Solution of Linear system of equations – Gauss Elimination method – Gauss-Jordan method .

UNIT V PROGRAMMING IN R

Algorithm to find Mean, Median, Mode and Standard Deviation Using R, Algorithm to find Correlation coefficient using R, Algorithm to solve System of Equations.

References

- Veerarajan T., *Probability, Statistics and, Random Processes*, Tata McGraw Hill Publishing Co., (2008).
- Gupta S.C., Kapoor V.K., *Fundamentals of Mathematical Statistics*, S.Chand& Co., (2007).
- Sastry S.S., *Introductory Methods of Numerical Analysis*, Prentice Hall of India, (2012).
- Kandasamy P., Thilagavathy, Gunavathy K., *Numerical Methods (Vol.IV)*, S.Chand& Co., (2008).
- Victor A. Bloomfield, Using R for Numerical Analysis in Science and Engineering, CRC Press, Taylor & Series Group(2014).

Subject Code: HBCC22I05	Subject Name : SOFT SKILL – III	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Higher Secondary Mathematics	IE	0	0/0	2/0	1

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To understand the Basic concepts in Logical Reasoning
To understand the Basic concepts in Arithmetical Reasoning
To understand the Basic concepts in Data Interpretation

COURSE OUTCOMES (COs) : The students will be able to

CO1	Understand the basic concepts of Logical Statements and Arguments
CO2	Understand the concept of Logical conclusions
CO3	Understand the Basic concepts in Number system
CO4	Understand the basic concepts of Permutations and Combinations
CO5	Learn how to analyze the data using Pictorial representation

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	2	3	3	3	2	1	2	3			
CO2	2	3	2	3	3	2	1	2	2			
CO3	3	2	3	2	3	1	2	1	3			
CO4	3	1	2	3	2	3	3	2	2			
CO5	3	2	3	2	3	2	1	2	3			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	1	1	1					
CO2	1	1	1					
CO3	1	1	1					
CO4	1	1	1					
CO5	1	1	1					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
							✓					

Subject Code: HBCC22I05	Subject Name : SOFT SKILL – III	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Higher Secondary Mathematics	IE	0	0/0	2/0	1

UNIT 1 Logical Reasoning I
Logical Statements – Arguments – Assumptions – Courses of Action.

UNIT 2 Logical Reasoning II
Logical conclusions – Deriving conclusions from passages – Theme detection.

UNIT 3 Arithmetical Reasoning I
Number system – H.C.F & L.C.M – Problem on ages – Percentage – Profit & Loss – Ratio & Proportion – Partnership.

UNIT 4 Arithmetical Reasoning II
Time & Work – Time & Distance – Clocks – Permutations & Combinations – Heights & Distances – Odd man out and Series.

UNIT 5 Data Interpretation
Tabulation – Bar graphs – Pie graphs – Line graphs.

Reference Book:

- R.S.Agarwal, A modern approach to Logical Reasoning, S.Chand& Co., (2017).
- R.S.Agarwal, A modern approach to Verbal and Non verbal Reasoning, S.Chand& Co., (2017).
- R.S.Agarwal, Quantitative Aptitude for Competitive Examinations, S.Chand& Co., (2017).
- A.K.Gupta, Logical and Analytical Reasoning, Ramesh Publishing House, (2014).
- B.S.Sijwali, Indusijwali, A new approach to Reasoning (Verbal and Non verbal), Arihant Publishers(2014).

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SEMESTER - IV

Subject Code: HBMA22ID5	Subject Name : ALLIED-IV BIO STATISTICS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Higher Secondary Mathematics	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

- To understand the Basic concepts in Statistics
- To understand the Basic concepts in Probability
- To understand the Basic concepts in Probability distributions
- To understand the Basic concepts in Sampling theory
- To understand the Basic concepts in Design of Experiments

COURSE OUTCOMES (COs) : The students will be able to

CO1	Understand the basic concepts of Statistics and Graphical representation of Data
CO2	Understand the basic concepts of Probability
CO3	Learn the Standard probability distributions
CO4	Learn how to analyze the sample data with various sampling methods
CO5	Learn the concept of Design of Experiments

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	3	2	3	3	2	2	1	2	3			
CO2	3	1	3	3	2	2	1	1	2			
CO3	3	2	2	3	3	1	1	2	3			
CO4	2	2	2	3	2	2	2	1	3			
CO5	3	2	3	2	3	2	1	2	3			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	2	2	2				
CO2	2	2	2				
CO3	2	2	2				
CO4	2	2	2				
CO5	2	2	2				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
			✓			✓						

Subject Code: HBMA22ID5	Subject Name : ALLIED BIO STATISTICS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Higher Secondary Mathematics	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION TO STATISTICS (9 hrs)

Definition of Statistics – Importance and Scope of Statistics - Mean – Median - Mode – Range – Standard Deviation - Coefficient of Variation.

UNIT II PROBABILITY (9 hrs)

Mathematical and Statistical definition of Probability - Theorems of addition and multiplication laws of Probability (Without proof) - Conditional probability- Probability mass function - Probability density function (Simple problems).

UNIT III PROBABILITY DISTRIBUTIONS (9 hrs)

Binomial – Poisson - Normal distribution - Mean and variance - Properties (Without proof) (Simple problems).

UNIT IV TESTING OF HYPOTHESIS (9 hrs)

Tests of Significance – Large Sample Tests – Mean – Proportions – Small Sample Tests – t, F, Chi-square Tests: Independence of Attributes, Goodness of Fit.

UNIT V DESIGN OF EXPERIMENTS (9 hrs)

One Way & Two-Way Classification – Design of Experiments – Randomized Block Design – Completely Randomized Block Design – Latin Square Design.

Total no. of hrs: 45

Reference Books:

- Gupta S.C., Kapoor V.K., *Fundamentals of Mathematical Statistics*, S.Chand & Co., (2007).
- Robert M. Leekley., *Applied Statistics for Business and Economics*, Taylor & Francis, S.Chand Publishing Co., (2015).
- Arora P.N., *Business Statistics*, S.Chand & Co., (2007).
- Sharma J.K., *Business Statistics*, Vikas Publishing., (2016).
- Veerarajan T., *Probability, Statistics and, Random Processes*, Tata McGraw Hill Publishing Co., (2008).
- Singaravelu, *Probability and Random Processes*, Meenakshi Agency, (2017).

Subject Code: HBBT22008	Subject Name : BASIC PHARMACEUTICAL SCIENCES	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry and Microbiology	Ty	3	1/0	0/0	4

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

The goal is to emphasize the importance of pharmaceutical research and its usefulness in biotechnology.
To impart basic concepts of drug metabolism and pharmocokinetics, manufacturing principles, and biopharmaceuticals.

COURSE OUTCOMES (COs) : The students will be able to

CO1	About the pharmaceutical industries and process of new drug discovery
CO2	To understand the pharmacokinetic aspects of drugs
CO3	To understand the pharmacodynamic aspects of drugs.
CO4	To acquire basic knowledge about the preparations of various therapeutic agents
CO5	To study basics about the antimicrobial products.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	1	2	2	2	1	1	1	3			
CO2	3	1	2	2	2	1	1	1	3			
CO3	3	1	2	2	2	1	1	1	3			
CO4	2	1	2	2	2	1	1	1	3			
CO5	3	1	2	2	2	1	1	1	3			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	3	3	3					
CO2	3	3	3					
CO3	3	3	3					
CO4	3	3	3					
CO5	3	3	3					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
	✓											

Subject Code: HBBT22008	Subject Name : BASIC PHARMACEUTICAL SCIENCES	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : : Biochemistry and Microbiology	Ty	3	1/0	0/0	4

UNIT I: INTRODUCTION **9 Hrs**

Introduction to Pharmaceutical Industry, Regulatory aspects, Routes of Administration of Drugs and types of therapeutic agents.

UNIT II: PHARMACOKINETICS **9 Hrs**

Basic aspects of Pharmacokinetics. Absorption, Distribution, Biotransformation and Excretion. Factors affecting pharmacokinetics.

UNIT III: PHARMACODYNAMICS **9 Hrs**

Basic aspects of Pharmacodynamics. Mechanism of drug action

UNIT IV: NEW DRUG DISCOVERY **9 Hrs**

Steps involved in new drug discovery. Preclinical and clinical trials**.**

UNIT V: CHEMOTHERAPY **9 Hrs**

Antibacterial, Antifungal, Antiviral and Cancer Chemotherapy

Total No of hours: 45

References:

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

Subject Code: HBBT22009	Subject Name : IMMUNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : : Biochemistry and Microbiology	Ty	3	1/0	0/0	4

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To understand the role of immune system, to gain knowledge on different lymphoid organs and types of immunity and immune responses produced. To acquire knowledge on development, maturation, activation and differentiation of T-cells and B-cells

COURSE OUTCOMES (COs) : The students will be able to

CO1	Acquire basic fundamental knowledge in the immune system
CO2	Know about the different types of lymphoid organs and its functions
CO3	Understand the pathological events due to wrong immune responses
CO4	Know about the different types of vaccination schedule
CO5	Understand the transplantation and tumor immunity

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	2	1	3	3	3	1	1	1	3			
CO2	2	1	3	3	3	1	1	1	3			
CO3	2	1	3	3	3	1	1	1	3			
CO4	2	1	3	3	3	1	1	1	3			
CO5	2	1	3	3	3	1	1	1	3			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	3	3	3					
CO2	3	3	3					
CO3	3	3	3					
CO4	3	3	3					
CO5	3	3	3					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
	✓											

Subject Code: HBBT22009	Subject Name : IMMUNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : : Biochemistry and Microbiology	Ty	3	1/0	0/0	4

UNIT I: INTRODUCTION **12 Hrs**

Components of innate and acquired immunity; Organs and cells of the immune system - primary and secondary lymphoid organs; antigens: chemical and molecular nature; haptens; adjuvants; types of immune responses; theory of clonal selection.

UNIT II: CELLULAR RESPONSES **12 Hrs**

Development, maturation, activation and differentiation of T-cells and B-cells; T-Cell receptors; Functional T-cell subsets; Immunoglobulins: basic structure, classes, and functions; Generation of antibody diversity; Antigen processing and presentation: Monoclonal antibodies: Principle and Applications

UNIT III: INFECTION AND IMMUNITY **12 Hrs**

Injury and inflammation; Immune responses to infections: Immune response to infectious agents: Viruses, bacteria, fungi and parasites; Cytokines secreted by Th1 and Th2 subsets; Complement; Immunosuppression, tolerance,

UNIT IV: IMMUNE DISORDERS AND IMMUNIZATION METHODS **12 Hrs**

Hypersensitivity (Type I to IV); AIDS and Immunodeficiencies; Immunisation; Vaccines and types: Common vaccines for humans

UNIT V: TRANSPLANTATION, TUMOR IMMUNOLOGY & AUTO IMMUNITY **12 Hrs**

Transplantation: Different types of transplants; Mechanism of graft rejection; Tumor immunology : Tumor antigens, Immune response to tumors and tumor evasion; Autoimmunity, Autoimmune disorders and diagnosis

Total no of Hours : 45

REFERENCES/TEXT BOOKS

- Roitt's Essential Immunology, 12th Edition, Wiley-Blackwell., 2011.
- Kuby J, Immunology, 5th edition, WH Freeman & Co., New York., 2003.
- Janeway CA, Travers P, Walport M, and Shlomchik M. Immunobiology, 6th edition, Garland Science., 2001.
- Animated pictures & Videos : www.roitt.com

Subject Code: HBBT22L04	Subject Name : IMMUNOLOGY LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry & Microbiology Lab	Lb	0	0/0	3/0	2

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To enable the students to understand the specificities of antibodies and mechanism of antibody diversity.
To give laboratory training in different immunological and immune technological techniques.

COURSE OUTCOMES (COs) :

CO1	The students would be aware of immune system cells and tissues
CO2	The students would have knowledge on immunological /clinical tests
CO3	The students would be able to isolate lymphocytes and monocytes

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	2	3	3	3	3	1	3	2			
CO2	3	2	3	3	3	3	1	3	2			
CO3	3	2	3	3	3	3	1	3	2			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	3	3	3					
CO2	3	3	3					
CO3	3	3	3					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
								✓				

Subject Code: HBBT22L04	Subject Name : IMMUNOLOGY LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry & Microbiology Lab	Lb	0	0/0	3/0	2

1. Identification of blood group
2. Identification of Rh factor
3. Immuno diffusion
4. Immunoelectrophoresis
5. Testing for typhoid antigens by Widal test
6. Isolation of monocytes from blood

REFERENCES

- Kuby J, (2003), Immunology (5thEd), WH Freeman & Co., Newyork

Subject Code: HBCC22I06	Subject Name : CRITICAL THINKING SKILL	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry & Microbiology Lab	IE	0	0/0	2/0	1

L : Lecture T : Tutorial P : Project C: Credits

OBJECTIVE:

- Students will learn to do literature survey and from the literature they will learn how to read and write research paper

COURSE OUTCOMES (COs) : The students will have to know

CO1	About the surveying of literature
CO2	About the technical procedure to be followed for reading
CO3	About the execution and presentation of the research paper

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7		
CO1	M	M	M	M	M	M	M		

COs / PSOs	PSO1	PSO2	PSO3						
CO1	M	M	M						
CO2	M	M	M						
CO3	M	M	M						

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
							✓					

Subject Code: HBCC22I06	Subject Name : CRITICAL THINKING SKILL	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry & Microbiology Lab	IE	0	0/0	2/0	1

Students will be trained for reading different research articles and their understanding capability will be evaluated by a committee of faculty

Subject Code: HBBT22I01	Subject Name : TECHNICAL SKILL-I	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : All core papers	IE	0	0/0	2/0	1

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

Students are expected to understand the technical knowledge in the core domains of biotechnology such as Biochemistry, Microbiology and Chemical Engineering

COURSE OUTCOMES (COs) : The student will be exposed

CO1	About the chemistry of biological process taking place in the biological systems
CO2	About the modifications done in the living organisms for the production of beneficial products
CO3	Design of experiments and Equipments required for the production of useful products for the Society.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	2	3	3	3	3	1	3	2			
CO2	3	2	3	3	3	3	1	3	2			
CO3	3	2	3	3	3	3	1	3	2			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	3	3	3				
CO2	3	3	3				
CO3	3	3	3				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
							✓					

Subject Code: HBBT22I01	Subject Name : TECHNICAL SKILL-I	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : All core papers	IE	0	0/0	2/0	1

OBJECTIVES

To impart domain specific knowledge to students

To improve the hands on skill in the advanced techniques of Biotechnology

To expose students with emerging technology.

From the list of skill development courses declared by the department, the students are expected to acquire the skill and get certified. This will be evaluated at the end of the semester by the faculty.

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SEMESTER - V

Subject Code: HBBT22010	Subject Name : PLANT AND ANIMAL BIOTECHNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : : Biochemistry and Microbiology	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

- To gain knowledge on plant gene transfer, stress, defense and various plant tissue culture methods
  To give an idea about the techniques development of transgenic animals and also its uses in treating animal diseases

COURSE OUTCOMES (COs) : The students will be able to

CO1	Understanding of plant genome and gene transfer methods
CO2	Understanding of plant defense and mechanism involved in plant stress response
CO3	Understand the various plant tissue and culturing methods
CO4	Understanding the concepts of micromanipulation technology
CO5	Understanding the therapy for animal diseases

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	3	2	3	2	3	3	3	3	3			
CO2	3	2	3	2	3	3	3	3	3			
CO3	3	2	3	2	3	3	3	3	3			
CO4	3	2	3	2	3	3	3	3	3			
CO5	3	2	3	2	3	3	3	3	3			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	3		3		3							
CO2	3		3		3							
CO3	3		3		3							
CO4	3		3		3							
CO5	3		3		3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
	✓											

Subject Code: HBBT22010	Subject Name : PLANT AND ANIMAL BIOTECHNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : : Biochemistry and Microbiology	Ty	3	0/0	0/0	3

UNIT I **9 Hrs**

An overview of nuclear and organelle gene structure, function, and expression. Development of Arabidopsisas a model for molecular genetic studies in plant biology. Direct gene transfer techniques, Agro bacterium mediated gene transfer.

UNIT II: **9 Hrs**

Types of pathogen and their mode of action, Plant defense system, Constitutive and inducible defence, Genetic basis of plant pathogen interaction. Abiotic and biotic stress, Osmotic adjustment and its role in drought and salinity tolerance, genetically modified plants -Golden rice, Bt. Cotton

UNIT III: 9 **Hrs**

Plasticity and Totipotency, Plant Cell culture media, Plant growth regulators and function, Culture types- Callus, Protoplast culture, Somaclonal variation, Somatic Embryogenesis

UNIT IV **9 Hrs**

Concepts of transgenic animal technology; strategies for the production of transgenic animals using DNA microinjection, nuclear transfer, Applications of transgenic livestock

UNIT V: **9 Hrs**

Recombinant cytokines and their use in the treatment; Principle and types of gene therapy, Advantages and disadvantages of viral vectors used in gene transfer; Non viral vector systems for gene therapy.

Total no of Hours: 45

TEXT BOOKS

- Westhoff et al. 1998. *Molecular Plant Development: From gene to plant.* Oxford University Press, Oxford. Selected parts available for purchase at the UBC Bookstore.
- Buchanan et al. 2000. *Biochemistry & Molecular Biology of Plants.* American Society of Plant Physiologists, Rockville MD
- Heldt HW. Plant Biochemisty and Molecular Biology Oxford University Press. 1997.
- Ian Freshney (2010) Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, (6th Ed) Wiley-Blackwell.
- Culture of Animal Cells: A Manual of Basic Technique and Specialized By R. Ian Freshney(2016)
- Plant and Animal tissue culture by Dr. Seema J Patel

Subject Code: HBBT22011	Subject Name : BIOPROCESS TECHNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Microbial Technology/Chemical Reaction Engineering/Enzyme technology	Ty	3	1/0	0/0	4

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To develop bioengineering skills by explain the different aspects of bioreactors for the production of biochemical product using integrated biochemical processes.

COURSE OUTCOMES (COs) : The students will be able to

CO1	Get an overview of industrial fermentation process and process flow sheet.
CO2	Study Media requirement, formulation and optimization for fermentation.
CO3	Learn functions and various types of a fermentors and its applications in various industries
CO4	Learn the different sterilization kinetics

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	2	1	3	3	3	1	1	1	3			
CO2	2	1	3	3	3	1	1	1	3			
CO3	2	1	3	3	3	1	1	1	3			
CO4	2	1	3	3	3	1	1	1	3			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	3		3		3							
CO2	3		3		3							
CO3	3		3		3							
CO4	3		3		3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
	✓											

Subject Code: HBBT22011	Subject Name : BIOPROCESS TECHNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Microbial Technology/Chemical Reaction Engineering/Enzyme technology	Ty	3	1/0	0/0	4

UNITI: INTRODUCTION TO INDUSTRIAL BIOPROCESS **12 Hrs**

A brief survey of organisms, processes, products relating to modern biotechnology, General requirements of fermentation process

UNIT II: RAW MATERIALS AND MEDIA DESIGN FOR FERMENTATION PROCESS **12 Hrs**

Medium requirements for fermentation processes, Media optimization, simple and complex media, design of various commercial media for industrial fermentation

UNIT III:DESIGN OF A FERMENTOR **12 Hrs**

Basic functions of a fermentor for microbial or animal cell culture, Bioreactors: Batch, fed batch reactor, continuous stirred tank reactors, residence time distribution.

UNIT IV:STERILIZATION KINETICS **12 Hrs**

Thermal death kinetics of microorganisms, batch and continuous heat sterilization, filter sterilization , air sterilization and design of sterilization equipment for batch and continuous.

UNIT V: APPLICATIONS **12 Hrs**

Production of Industrially important enzymes(Cellulase and Protease) and Antibiotics(Penicillin and Streptomycin)

TEXT BOOKS

❖ Peter F. Stanbury, Stephen J. Hall & A. Whitaker, Principles of Fermentation Technology, Science & Technology Books.

REFERENCES:

❖ Bailey and Ollis, " Biochemical Engineering Fundamentals", McGraw Hill (2nd Ed.), 1986.
❖ Shule and Kargi, " Bioprocess Engineering ", Prentice Hall, 1992.
❖ Harvey W. Blanch, Douglas S. Clark, Biochemical Engineering, Marcel Dekker, Inc.

Subject Code: HBCC22002	Subject Name : ENTREPRENURSHIP DEVELOPMENT	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Basic knowledge in entrepreneurship development	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

1. To enrich the students towards the knowledge of entrepreneurial skills and to make the students understand the approaches to attain the goals of the business.
2. To recognize the value of problem solving, effective business management and entrepreneurial thinking to business development.
3. To identify the key factors and be able to apply the key entrepreneurial process – command and control, calculated risk-taking and opportunity recognition to business development

COURSE OUTCOMES (COs) : The students will be able to

CO1	Provide information related to entrepreneurship
CO2	Make students state the importance of entrepreneurial development
CO3	State the importance of business idea generations
CO4	Gain knowledge on various EDP organized by Government Sectors
CO5	Provide them the nature of economic development and entrepreneurial growth.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	2	3	2	3	3	3	3	2	3			
CO2	3	3	3	3	3	3	3	3	3			
CO3	3	2	3	3	2	3	3	3	2			
CO4	2	3	2	3	3	3	3	2	3			
CO5	3	3	3	3	2	3	2	3	3			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	3		3		2							
CO2	2		2		3							
CO3	3		3		2							
CO4	3		3		3							
CO5	3		2		3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
			✓									

Subject Code: HBCC22002	Subject Name : ENTREPRENURSHIP DEVELOPMENT	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Basic knowledge in entrepreneurship development	Ty	3	0/0	0/0	3

UNIT I: Concept of Entrepreneurship **9 Hrs**

Entrepreneurship - Meaning - Types - Qualities of an Entrepreneur - Classification of Entrepreneurs - Factors influencing Entrepreneurship - Functions of Entrepreneurs.

UNIT II: Entrepreneurial Development Agencies. **9 Hrs**

Commercial Banks - District Industries Centre - National Small Industries Corporation Small Industries Development Organisation - Small Industries Service Institute. All India Financial Institutions. SIPCOT and its objectives.MSME Sector and its coverage Objectives of Ministry of MSME.Role and Functions of MICRO Small and Medium Enterprises - Development Organisation (MSME - DO) - Objectives of SIDCO - Functions of Tamil Nadu SIDCO - IRBI and its Role. NABARD and its role in the Rural Development of India - Introduction to Micro Units Development Refinance Agency (MUDRA)

UNIT III: Project Management **9 Hrs**

Business idea generation techniques - Identification of Business opportunities – Feasibility study - Marketing, Finance, Technology & Legal Formalities - Preparation of Project Report- Tools of Appraisal.

UNIT IV - Entrepreneurial Development Programmes **9 Hrs**

Entrepreneurial Development Programmes (EDP) - Role, relevance and achievements – Roleof Government in organizing EDPs- Critical evaluation

UNIT V - Economic Development and Entrepreneurial growth **9 Hrs**

Role of Entrepreneur in Economic growth - Strategic approaches in the changing Economicscenario for small scale Entrepreneurs - Networking, Niche play, Geographic Concentration,Franchising / Dealership - Development of Women Entrepreneurship. Self-help groups andempowerment of Women in India - Financing SHG and their role in Micro-financing.Financial inclusion and its penetration in India, Challenges and Government role in Financial inclusion–Pradhan Mantri Jan-DhanYojana - Six Pillars of Its Mission objectives

Books for Study :

- Saravanavel, P. Entrepreneurial Development, Principles, Policies and Programmes, EssPee Kay Publishing House - 1997, Chennai.
- Tulsian, P.C & Vishal Pandey, Business Organization and Management, PearsonEducation India, 2002, Delhi.

Books for Reference :

- Janakiram, B, and Rizwana, M, Entrepreneurship Development, Text and Cases, ExcelBooks India, 2011, Delhi.
- Arun Mittal & Gupta, S.L - Entrepreneurship Development, International Book HousePvt. Ltd, 2011, Mumbai.
- Anil Kumar, S, Poornima, S, Abraham, K, Jayashree, K - Entrepreneurship Development, Newage International (P) Ltd, 2012, Delhi
- Gupta C B and Srinivasan NP, Entrepreneurial Development,

Subject Code: HBBT22L05	Subject Name : BIOPROCESS TECHNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry & Microbiology Lab	Lb	0	0/0	3/0	2

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:
To enable the students to understand the up streaming process experiment. .

COURSE OUTCOMES (COs) :

CO1	The students would be aware of media preparation and standardization
CO2	The students would have knowledge on the production of specific biological products
CO3	The students would be able to know about the kinetics of the reactants

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	3	2	3	3	3	3	1	3	2			
CO2	3	2	3	3	3	3	1	3	2			
CO3	3	2	3	3	3	3	1	3	2			
COs / PSOs	PSO1		PSO2		PSO3							
CO1	3		3		3							
CO2	3		3		3							
CO3	3		3		3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
								✓				

Subject Code: HBBT22L05	Subject Name : BIOPROCESS TECHNOLOGY LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry & Microbiology Lab	Lb	0	0/0	3/0	2

1. Amylase production
2. Protease production
3. Immobilization Technique
4. Thermal Death Kinetics
5. Estimation of glucose by DNS method
6. Batch growth kinetics

REFERENCE BOOK

- Ponmurugan Experimental Procedures In Bioprocess Technology & Downstream Processing (1st Ed)
- Bioprocess Engineering: Kinetics, Sustainability, and Reactor Design By Shijie Liu

Subject Code: HBBT22I02	Subject Name : TECHNICAL SKILL-II	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : All core papers	IE	0	0/0	2/0	1

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

Students are expected to understand the technical knowledge in the core domains of biotechnology such as Biochemistry, Microbiology and Chemical Engineering

COURSE OUTCOMES (COs) : The student will be exposed

CO1	About the chemistry of biological process taking place in the biological systems
CO2	About the modifications done in the living organisms for the production of beneficial products
CO3	Design of experiments and Equipments required for the production of useful products for the Society.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	2	3	3	3	3	1	3	2			
CO2	3	2	3	3	3	3	1	3	2			
CO3	3	2	3	3	3	3	1	3	2			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	3		3		3							
CO2	3		3		3							
CO3	3		3		3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
							✓					

Subject Code: HBBT22I02	Subject Name : TECHNICAL SKILL-II	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : All core papers	IE	0	0/0	2/0	1

OBJECTIVES

To impart domain specific knowledge to students

To improve the hands on skill in the advanced techniques of Biotechnology

To expose students with emerging technology.

From the list of skill development courses declared by the department, the students are expected to acquire the skill and get certified. This will be evaluated at the end of the semester by the faculty.

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Foreign Language

Foreign language is introduced in the curriculum to make the students globally employable. Students should select and register for any one of the foreign languages from the given list. At the end of the course students should be able to read, write and converse the language in the basic level. At the end of the semester the assessment will be done through internal examination by the examiner duly appointed by the head of the department.

S.NO	COURSE CODE	COURSE NAME
1	EBFL22I01/HBFL22I01	FRENCH
2	EBFL22I02/ HBFL22I02	GERMAN
3	EBFL22I03/ HBFL22I03	JAPANESH
4	EBFL22I04/ HBFL22I04	ARABIC
5	EBFL22I05/ HBFL22I05	CHINESE
6	EBFL22I06/HBFL22I06	RUSSIAN
7	EBFL22I07/HBFL22I07	SPANISH

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SEMESTER - VI

Subject Code: HBBT22012	Subject Name : LEGAL ASPECTS OF BIOTECHNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : All core papers	Ty	3	1/0	0/0	4

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To gain knowledge about the importance of IPR. To learn the process involved in patenting and claims. To understand the requirements of disclosure and patent litigation. They have to also gain knowledge in biosafety and bioethics requirements

COURSE OUTCOMES (COs) : The student will be exposed

CO1	The IPR issues related to biotechnology products
CO2	About the basics of patents and concept of prior art and
CO3	And be Familiar about the biosafety and bioethics requirements for carrying out research work

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	2	1	1	1	2	1	1	3	2			
CO2	2	1	1	1	2	1	1	3	2			
CO3	2	1	1	1	2	1	1	3	2			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	3		3		3							
CO2	3		3		3							
CO3	3		3		3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
			✓									

Subject Code: HBBT22012	Subject Name : LEGAL ASPECTS OF BIOTECHNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : All core papers	Ty	3	1/0	0/0	4

UNIT I: INTRODUCTION TO INTELLECTUAL PROPERTY **9 Hrs**

Types of IP: Patents, Trademarks, Copyright & Related Rights, Industrial Design Protection of GMOs, IP as a factor relevance to Biotechnology and few Case Studies;

UNIT II: AMENDMENTS AND AGREEMENT **9 Hrs**

History of GATT & TRIPS Agreement; Madrid Agreement; Hague, Agreement; WIPO Treaties; Budapest Treaty; PCT; Indian Patent, Act 1970 & recent amendments.

UNIT III: PATENT FILING PROCEDURES **9 Hrs**

National & PCT filing procedure; Time frame and cost; Status of the patent applications filed; Precautions while patenting

UNIT IV: BIOSAFETY **9 Hrs**

Introduction to Biological Safety Cabinets; Primary Containment for Biohazards; Biosafety Levels; Biosafety Levels of Specific Microorganisms; RecommendedBiosafety Levels for Infectious Agents and Infected Animals.

UNITV: BIOETHICS **9 Hrs**

Human genome project and its ethical issues.Gene testing, prenatal diagnosis, genetic manipulations, germline therapy, genetic studies on ethnic races.

Total no of Hours: 45

TEXTS/REFERENCES

- BAREACT, (2007) *Indian Patent Act 1970 Acts & Rules*, Universal Law Publishing Co. Pvt. Ltd.,
- Kankanala C.(2007*) Genetic Patent Law & Strategy,* (1st Ed), Manupatra Information Solution Pvt. Ltd.,

IMPORTANT LINKS:

- http://www.w3.org/IPR/
- http://www.wipo.int/portal/index.html.en
- http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html
- www.patentoffice.nic.in

Subject Code: HBCC22ET1	Subject Name : UNIVERSAL HUMAN VALUES	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : None	ETP	2	0/0	2/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

Describe meaning, purpose, and relevance of universal human values.
Understand the importance of values in individual, social, career, and national life.
Learn from lives of great and successful people who followed and practiced human values and achieved self-actualization.
Understand and practice professional ethics with the goal for the universal wellness

COURSE OUTCOMES (COs) : The students will be able to

CO1	Become conscious practitioners of values
CO2	Realize their potential as human beings and conduct themselves properly in the ways of the world.
CO3	Develop integral life skills with values
CO4	Inculcate and practice them consciously to be good human beings.
CO5	Practice professional ethics with the goal for the universal wellness

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	**1**	**1**	**1**	**1**	**1**	3	**1**	**3**	**1**			
CO2	**1**	**1**	**1**	**1**	**1**	3	**1**	**3**	**1**			
CO3	**1**	**1**	**1**	**1**	**1**	3	**1**	**3**	**1**			
CO4	**1**	**1**	**1**	**1**	**1**	3	**1**	**3**	**1**			
CO5	**1**	**1**	**1**	**1**	**1**	3	**1**	**3**	**1**			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	**1**	**1**	**1**					
CO2	**1**	**1**	**1**					
CO3	**1**	**1**	**1**					
CO4	**1**	**1**	**1**					
CO5	**1**	**1**	**1**					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
			✓									

Subject Code: HBCC22ET1	Subject Name : UNIVERSAL HUMAN VALUES	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : None	ETP	2	0/0	2/0	3

UNIT 1 LOVE AND COMPASSION: 9 Hrs

Love and its forms: love for self, parents, family, friend, spouse, community, nation, humanity, nature and other beings—living and non-living. Love and compassion and inter-relatedness, Individuals who are remembered in history for love and compassion and what will learners gain if they practice love and compassion

Related activities: Sharing learner's individual and/or group experience(s), community outreach program to manifest love and compassion toward people and nature, Simulated Situations, Case studies

UNIT 2: TRUTH AND RIGHTEOUSNESS 9 Hrs

: Universal truth, truth as value (artha), truth as fact (satya), veracity, sincerity, honesty among others.

Understanding righteousness, Righteousness and dharma, righteousness and propriety, Individuals who are remembered in history for practicing truth and righteousness and what will learners gain if they practice Truth and Righteousness

Sharing learner's individual and/or group experience(s), exercises on ease with truth can be recalled consistently, Simulated Situations, Case studies

UNIT 3: NON-VIOLENCE AND PEACE 9 Hrs

Non-Violence and Peace; pre-requisites for non-violence- Love, compassion, empathy, and sympathy, Ahimsa as non-violence and non-killing, the impact of practicing non-violence-Peace, harmony and balance, Individuals and organizations that are known for their commitment to non- violence and peace, and what will learners gain if they practice non-violence and work towards peace

Sharing learner's individual and/or group experience(s), Simulated Situations, Case studies

UNIT 4: RENUNCIATION (SACRIFICE) TYAGA 9 Hrs

: Renunciation and sacrifice, developing a balance between enjoyment and sacrifice, Bhoga(enjoyment) with tyagabhava and tyaga (Sacrifice) with bhogabhava is the root of all human and literary values, enjoying life and freedom with responsibility and What will learners learn/gain if they practice renunciation and sacrifice

Social outreach programs for sharing and caring experience, expressing gratitude, Sharing learner's individual and/or group experience(s), Simulated Situations , Case studies

UNIT 5: PROFESSIONAL ETHICS: 9 Hrs

Professional Ethics: Understanding Acceptance of human values and Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Developing Competence in professional ethics and practicing it, to utilize the professional competence for augmenting universal human order and create people friendly eco-friendly identify the scope and characteristics of people friendly and eco-friendly systems for the wellness of the universe as a whole. Exercises to propagate people friendly eco-friendly activities both creative and functional, Brain storming, Sharing learner's individual and/or group experience(s), Simulated Situations , Case studies

Total no of Hours: 45

REFERENCES AND SUGGESTED READINGS:

- Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books,New Delhi, 2010
- The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
- Basham, A.L. 1954. The Wonder That Was India. London: Picador Press.
- Basu, D.D. 2015. Workbook on the Constitution of India, Paperback Edition. Nagpur: Lexisnexis.
- Ghosh, Sri Aurobindo. 1998. The Foundations of Indian Culture. Pondicherry: Sri Aurobindo Ashram.
- Joshi, Kireet. 1997. Education for Character Development. Delhi: Dharam Hinduja Centre of Indic Studies.
- Milton, Rokeach. 1973. The Nature of Human Values. New York: The Free Press.
- Mookerji, Radha K. 1989. Ancient Indian Education. Delhi: Motilal Banarasidass
- Saraswati, Swami Satyananda .2008. Asana Pranayama Mudra Bandha. Munger, India: Bihar School of Yoga.

Subject Code: HBBT22L06	Subject Name : PROJECT	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	Lb	0	0/0	9/9	9

T/L Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

- The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue, address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs) : The students will have to know

CO1	Apply the knowledge and skills acquired in the course of study addressing a specific problem or issue.
CO2	To encourage students to think critically and creatively about societal issues and develop user friendly and reachable solutions
CO3	To refine research skills and demonstrate their proficiency in communication skills.
CO4	To take on the challenges of teamwork, prepare a presentation and demonstrate the innate talents.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	3	3	3	3	3	3	2	2			
CO2	3	3	3	3	3	3	3	2	2			
CO3	3	3	3	3	3	3	3	2	2			
CO4	3	3	3	3	3	3	3	2	2			

COs / PSOs	PSO1	PSO2	PSO3						
CO1	3	3	3						
CO2	3	3	3						
CO3	3	3	3						
CO4	3	3	3						

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
								✓				

Subject Code: HBBT22L06	Subject Name : PROJECT	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	Lb	0	0/0	9/9	9
T/L Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits						

Students in a group is expected to choose a research problem and execute it with proper data. He/ She will explain their research project to a committee of faculty members

Dr. M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
DEEMED TO BE UNIVERSITY
University with Graded Autonomy Status
(An ISO 21001 : 2018 Certified Institution)
Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

ELECTIVES

Subject Code: HBBT22E01	Subject Name : PROTEIN CHEMISTRY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To impart knowledge on the different aspects of protein such as structure characterization and diseases associated with the protein folding and misfolding

COURSE OUTCOMES (COs) : The students will be able to

CO1	To recapitulate the knowledge on protein structure and its properties
CO2	To learn different methods in characterizing proteins.
CO3	To remember the protein structure determination
CO4	To Understand the mechanism of protein folding and misfolding
CO5	To learn protein structure prediction and modeling

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	3	3	3	3	3	3	**1**	**1**	3			
CO2	3	3	3	3	3	3	**1**	**1**	3			
CO3	3	3	3	3	3	3	**1**	**1**	3			
CO4	3	3	3	3	3	3	**1**	**1**	3			
CO5	3	3	3	3	3	3	**1**	**1**	3			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	3		3		3							
CO2	3		3		3							
CO3	3		3		3							
CO4	3		3		3							
CO5	3		3		3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
		✓										

Subject Code: HBBT22E01	Subject Name : PROTEIN CHEMISTRY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry	Ty	3	0/0	0/0	3

UNIT I - PROTEIN STRUCTURE AND CLASSIFICATION **9 Hrs**

Protein Structure and Classification: Amino acids classification, primary, secondary, tertiary and quaternary structure of proteins, protein stability and denaturation. General classes of protein structures and function. Protein folding patterns. Protein databases, Molecular Viewers to display protein structures.

UNIT II - METHODS OF CHARACTERIZING PROTEINS IN SOLUTION **9 Hrs**

Methods of Characterizing Proteins in solution, Absorbance and fluorescence of proteins, Fluoresence resonance energy transfer, circular dichroism, Protein structure determination – X-ray crystallogaphy, Nuclear magnetic resonance spectroscopy, Low temperature electron microscopy, Mass spectrometry, Protein Sequencing, Catalysis by enzymes- serine proteases; protein conformational changes, control of protein activity.

UNIT III - MOTIFS **9 Hrs**

MOTIFS, helix turn helix motifs, BETA structures, folding and flexibility , signal transduction, Membrane proteins fibrous proteins.

UNIT IV - PROTEIN ENGINEERING **9 Hrs**

Protein Engineering, folding, prediction and design-Protein folding, effect of denaturants on rate of folding and unfolding, chaperones, folding funnels, protein misfolding and GroEL – GroES chaperone protein. Protein structure prediction and modelling – CASP, homology modeling, threading, prediction of novel folds, prediction of protein function. evolution of NAD-binding domain of dehydrogenases; mechanisms of protein evolution – divergence, recruitment and mixing and matching of domains.

UNIT V - PROTEIN INTERACTIONS AND PROTEINS IN DISEASE **9 Hrs**

Protein Interactions and Proteins in disease – General properties of protein-protein interfaces, protein-DNA interaction& transcription factors eg. – Lambda cro, leucine zippers, zinc fingers, membrane proteins. Diseases due to Absent or dysfunctional proteins and protein aggregation.

Total no of hours: 45

TEXT BOOK:

❖ *Arthur M. Lesk, (2004) Introduction to Protein Science: Architecture, Function and Genomics. Oxford \ University Press*

REFERENCE BOOK

❖ *Carl Barnden and Tooze, (1999) Introduction to Protein Structure , (2nd Ed) Garland publishing Inc*

Subject Code: HBBT22E02	Subject Name :ENDOCRINOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry and physiology	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To understand the basics of hormones, classification its role in biological metabolism

COURSE OUTCOMES (COs) : The students will be able to

CO1	To recapitulate the knowledge on Hormones
CO2	To learn different classification of hormones .
CO3	To gain insights about the role and function of Peptide hormones
CO4	To Understand the function of steroid hormones
CO5	To learn pathophysiology of hormone deficiency or over production

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	3	3	3	3	3	3	**1**	**1**	3			
CO2	3	3	3	3	3	3	**1**	**1**	3			
CO3	3	3	3	3	3	3	**1**	**1**	3			
CO4	3	3	3	3	3	3	**1**	**1**	3			
CO5	3	3	3	3	3	3	**1**	**1**	3			

COs / PSOs	PSO1	PSO2	PSO3						
CO1	3	3	3						
CO2	3	3	3						
CO3	3	3	3						
CO4	3	3	3						
CO5	3	3	3						

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
		✓										

Subject Code: HBBT22E02	Subject Name :ENDOCRINOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry and physiology	Ty	3	0/0	0/0	3

Unit I HORMONES **9 Hrs**

Hormones- definition, classification. Plasma membrane receptors. Mechanism of steroid hormone and peptide hormone - Adenylate cyclase, Role of G-proteins. Protein kinases, tyrosine, kinase, Inositol phosphate. Calcium, calmodulin.

Unit II HYPOTHALAMUS AND PITUITARY HORMONES **9 Hrs**

Hypothalamus and pituitary hormones: Hypothalamic releasing factors, Anterior pituitary hormones, Posterior Pituitary hormones-Vasopressin and oxytocin- biological effects and diseases

UNIT III THYROID HORMONES **9 Hrs**

Hormones of the thyroid- Biosynthesis and biological actions of thyroid hormones. Thyroid disease- thyrotoxicosis, Goiter, Grave's disease, Hashimoto's thyroiditis. Parathyroid hormone- Biological actions regulation of calcium and phosphorous metabolism. Calcitonin. Calcitriol- Biological functions. Hyperparathyroidism, hypoparathyroidism.

UNIT IV PANCREATIC HORMONES **9 Hrs**

Pancreatic hormones- Insulin- Biosynthesis and biological actions. Mechanism of action of insulin. Glucagon

UNIT V ADRENAL AND GONAD HORMONES **9 Hrs**

Adrenal hormones - Glucocorticoids, Mineralocorticoids- biological effects. Catecholamines: biological effects Abnormal secretion of adrenal hormones, Addison's disease. Cushing's syndrome, phaeochromocytoma. Gonadal hormones - Androgens and estrogens. Ovarian cycle.

Total Number of Hours: 45

REFERENCE BOOKS:

- Textbook of Endocrinology –8th edn. Wilson and Foster,1998.
- Principles of Biochemistry – Mammalian Biochemistry – Smith et al, Mc Graw Hill, 1982.
- Mechanisms of Hormone Action, Estelle Jones, Hardcover - 2015
- Harper's Biochemistry – Murray et al. 26th ed. McGraw Hill, 2003.
- Principles of Biochemistry – Mammalian Biochemistry – Smith et al. McGraw Hill 7th ed.
- Textbook of Endocrinology- Williams et al, 2015.

Subject Code: HBBT22E03	Subject Name :CANCER BIOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry and physiology	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To understand the fundamentals of cancer biology regarding cell cycle, mutational changes in signaling molecules, types of cancer, early detection methods and cancer screening methods, etc

COURSE OUTCOMES (COs) : The students will be able to

CO1	To understand the basic knowledge about the environmental factors causing cancer
CO2	To learn their mode of entry and carcinogenesis
CO3	To Understand the molecular biology of cancer cells
CO4	To learn the cancer metastatic pathways
CO5	To learn overview of cancer chemotherapy

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	3	3	3	3	3	3	**1**	**1**	3			
CO2	3	3	3	3	3	3	**1**	**1**	3			
CO3	3	3	3	3	3	3	**1**	**1**	3			
CO4	3	3	3	3	3	3	**1**	**1**	3			
CO5	3	3	3	3	3	3	**1**	**1**	3			

COs / PSOs	PSO1	PSO2	PSO3							
CO1	3	3	3							
CO2	3	3	3							
CO3	3	3	3							
CO4	3	3	3							
CO5	3	3	3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
		✓										

Subject Code: HBBT22E03	Subject Name :CANCER BIOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry and physiology	Ty	3	0/0	0/0	3

UNIT -1 FUNDAMENTALS OF CANCER BIOLOGY **9 Hrs**

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

UNIT II - PRINCIPLES OF CARCINOGENESIS **9 Hrs**

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

UNIT III - PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER **9 Hrs**

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

UNIT IV - PRINCIPLES OF CANCER METASTASIS **9 Hrs**

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

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

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

Total no of Hours: 45

TEXT BOOK

- L M Franks and N M Teich. (1991)“An Introduction Top Cellular And Molecular Biology Of Cancer“, Oxford Medical Publications,
- Robin Hesketh, Introduction to Cancer Biology, Cambridge University Press (2013)
- Raymond W. Ruddon, Cancer Biology, Oxford University Press,

REFERENCE BOOKS

- Maly B.W.J,(1987) “ Virology A Practical Approach “, IRLl Press, Oxford,
- Dunmock N.J And Primrose S.B., (1988) “ Introduction To Modern Virology “,Blackwell Scientific Publications, Oxford. Press
- Roger J. B. King, Cancer Biology, Prentice Hall (2000)
- Maika G. Mitchell, Cell Biology: Translational Impact in Cancer Biology and Bioinformatics, Academic Press (2016)

Subject Code: HBBT22E04	Subject Name : ANIMAL TISSUE CULTURE	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry and physiology	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To be aware of tissue culture laboratory practices and maintaining sterility in lab To learn the composition and preparation of plant and animal tissue culture medium To apply the concepts learned in biochemistry and microbiology for understanding the role of medium in animal cell culture

COURSE OUTCOMES (COs) : The students will be able

CO1	To familiarize with laboratory equipment and Design
CO2	To understand the media requirement for culturing cells
CO3	To know the different types of cell cultures
CO4	To understand the applications of cell culture
CO5	To know the scale up process in cell culture

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	3	3	3	3	3	**1**	**1**	3			
CO2	3	3	3	3	3	3	**1**	**1**	3			
CO3	3	3	3	3	3	3	**1**	**1**	3			
CO4	3	3	3	3	3	3	**1**	**1**	3			
CO5	3	3	3	3	3	3	**1**	**1**	3			

COs / PSOs	PSO1	PSO2	PSO3						
CO1	3	3	3						
CO2	3	3	3						
CO3	3	3	3						
CO4	3	3	3						
CO5	3	3	3						

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
		✓										

Subject Code: HBBT22E04	Subject Name : ANIMAL TISSUE CULTURE	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Biochemistry and physiology	Ty	3	0/0	0/0	3

UNIT I - CELL CULTURE LABORATORY DESIGN & EQUIPMENTS **9 Hrs**

Cell culture lab Layout; Sterile handling area; Incubation; Hot room; Air circulation; Service bench; Laminar flow; Sterilizer; Incubator; CO2 incubator; Refrigerators and freezers; Centrifuge; Inverted stage microscope; Magnetic stirrer; Liquid nitrogen freezers; Slow cooling system for cell freezing; Washing, packing and sterilization of different materials used in animal cell culture; Aseptic concepts; Maintenance of sterility; Cell culture vessels.

UNIT II - MEDIA AND REAGENTS **9 Hrs**

Types of cell culture media; Ingredients of media; Physiochemical properties; CO2 and bicarbonates; Buffering; Oxygen; Osmolarity; Temperature; Surface tension and foaming; Balance salt solutions; Antibiotics growth supplements; Fetal bovine serum; Serum free media; Trypsin solution; Selection of medium and serum; Conditioned media; Other cell culture reagents; Preparation and sterilization of cell culture media, serum and other reagents.

UNIT III - DIFFERENT TYPES OF CELL CULTURES **9 Hrs**

History of animal cell culture; Different tissue culture techniques; Types of primary culture; Chicken embryo fibroblast culture; Chicken liver and kidney culture; Secondary culture; Trypsinization; Cell separation; Continuous cell lines; Suspension culture; Organ culture etc.; Behavior of cells in culture conditions: division, growth pattern, metabolism of estimation of cell number; Development of cell lines; Characterization and maintenance of cell lines, stem cells; Cryopreservation; Common cell culture contaminants.

UNIT IV - APPLICATIONS **9 Hrs**

Cell cloning and selection; Transfection and transformation of cells; Commercial scale production of animal cells, stem cells and their application; Application of animal cell culture for in vitro testing of drugs; Testing of toxicity of environmental pollutants in cell culture; Application of cell culture technology in production of human and animal viral vaccines and pharmaceutical proteins.

UNIT V - SCALE-UP **9 Hrs**

Cell culture reactors; Scale-up in suspension; Scale and complexity; Mixing and aeration; Rotating chambers; Perfused suspension cultures; Fluidized bed reactors for suspension culture; Scale-up in monolayers; Multisurface propagators; Multiarray disks, spirals and tubes; Roller culture; Microcarriers; Perfused monolayer cultures; Membrane perfusion; Hollow fiber perfusion; Matrix perfusion; Microencapsulation; Growth monitoring

Total no of Hours: 45

TEXT BOOK

- FreshneyRI(2005) Culture of Animal Cells, (5th Ed) Wiley-Liss.
- Plant And Animal Tissue Culture By Dr.Seema J Patel
- Animal tissue Culture by Anil M Manae(2015)

REFERENCE BOOKS

- John R.W. Masters (2000) Animal Cell Culture: Practical Approach (3rdEd) Oxford.
- Clynes M, (1998) Animal Cell Culture Techniques (1st Ed) Springer.
- Culture of Animal Cells: A Manual of Basic Technique and Specialized ...By R. Ian Freshney(2016)

Subject Code: HBBT22E05	Subject Name : NANOTECHNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Material science	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

The students will have a elaborate knowledge about different nanomaterials used in health science

COURSE OUTCOMES (COs) : The students will be able

CO1	To know about different types of biomaterials
CO2	To understand the biocompatibility of biomaterials
CO3	To get familiarize with structural & functional principles of bionanotechnology
CO4	To study the protein and DNA based nanomaterials
CO5	To know the analysis of nanomaterials

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	3	3	3	3	3	**1**	**1**	3			
CO2	3	3	3	3	3	3	**1**	**1**	3			
CO3	3	3	3	3	3	3	**1**	**1**	3			
CO4	3	3	3	3	3	3	**1**	**1**	3			
CO5	3	3	3	3	3	3	**1**	**1**	3			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	3	3	3					
CO2	3	3	3					
CO3	3	3	3					
CO4	3	3	3					
CO5	3	3	3					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
		✓										

Subject Code: HBBT22E05	Subject Name : NANOTECHNOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: : Material science	Ty	3	0/0	0/0	3

UNIT I: NANOBIOMATERIALS **9hrs**

Surface and Bulk Properties of Bio materials – Nanobiomaterials –NanoCeramics – Nanopolymers – Nano Silica – Hydroxy apatite – Carbon Based nanomaterials Surface modification – Textured and Porous Materials – Surface immobilized biomolecules

UNIT II: NANOBIOMATERIALS AND BIOCOMPATIBILITY **9hrs**

Cell-biomaterial interactions – immune response – In Vitro and In Vivo assessment of tissue compatibility.

UNIT III: STRUCTURAL & FUNCTIONAL PRINCIPLES OF BIONANOTECHNOLOGY **9hrs**

Lipid Bilayers – liposomes – niosomes- Phytosomes, Polysacharides – Peptides –Nucleic acids – DNA scaffolds – Enzymes- Biomolecular motors: linear, rotary mortors – Immunotoxins – Membrane transporters

UNIT IV: PROTEIN AND DNA BASED NANOSTRUCTURES **9hrs**

Nanocircuitry – S-layer proteins: structure, chemistry and assembly – lipid chips – S – Layers as Templates – engineered nanopores – DNA–Protein Nanostructures DNA-based Metallic Nanowires and Networks, DNA–Gold-Nanoparticle Conjugates

UNIT V: NANOBIO-ANALYTICS **9hrs**

Luminescent Quantum Dots for Biological Labeling – Nanoparticle Molecular Labels – Surface Biology: Analysis of Biomolecular Structure by Atomic Force Microscopy and Molecular Pulling – Force Spectroscopy – Biofunctionalized Nanoparticles for Surface – Enhanced Raman Scattering and Surface Plasmon Resonance – Bioconjugated Silica Nanoparticles for Bioanalytical Applications

Total no of Hours: 45

TEXT BOOKS

- Molecular Cell Biology,Harvey Lodish, Published by W.H. Freeman & Company
- Biomaterials: A Nano Approach,S Ramakrishna, M Ramalingam, T.S. Sampath Kumar, Winston O. Soboyejo,Published by CRC Press
- Bionanotechnology: Lessons from Nature, D S. Goodsell, by John Wiley & Sons, Inc.

Subject Code: HBBT22E06	Subject Name : BIOFUELS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite:: Biochemistry and Microbial technology	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To give an introduction to biogas technology .To understand the basics behind the bioethanol and biodiesel production. To give basic idea for the production of green energy from biomass

COURSE OUTCOMES (COs) : The students will be able

CO1	To Know about the biogas produced from different sources
CO2	To understand the production of Bio ethanol
CO3	To know the production of Bio diseal
CO4	To understand the concept of Microbial fuel cell
CO5	To know the production of energy from biomass

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	3	3	3	3	3	**1**	**1**	3			
CO2	3	3	3	3	3	3	**1**	**1**	3			
CO3	3	3	3	3	3	3	**1**	**1**	3			
CO4	3	3	3	3	3	3	**1**	**1**	3			
CO5	3	3	3	3	3	3	**1**	**1**	3			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	3	3	3					
CO2	3	3	3					
CO3	3	3	3					
CO4	3	3	3					
CO5	3	3	3					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
		✓										

Subject Code: HBBT22E06	Subject Name : BIOFUELS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite:: Biochemistry and Microbial technology	Ty	3	0/0	0/0	3

UNIT I- BIOGAS TECHNOLOGY-I **9 Hrs**

Biogas Technology -I Worldwide perspective of anaerobic digestion, Review of anaerobic digesters, Microbiology of biogas production, Methods to enhance the biogas production, Design parameters affecting the success and failure of biogas plants, Structural behavior and stress conditions in fixed dome biogas plant, Performance of different types of gas holders.

UNIT II - BIOGAS TECHNOLOGY-II **9 Hrs**

Biogas Technology-II Alternate constructions material for biogas plant construction, Various techniques for increasing gas production in cold region. Effect of heating , insulation and stirring on gas production, Design optimization for biogas production, Alternate feedstock for biogas production. Effect of pesticides on anaerobic digestion, Effect of herbicide on anaerobic digestion,

UNIT III - BIO-ETHANOL AND BIO-DIESEL TECHNOLOGY **9Hrs**

Bio-Ethanol and Bio-Diesel Technology**:** Production of Fuel Ethanol by Fermentation of Sugars. Gasohol as a Substitute for Leaded Petrol. - Trans-Esterification of Oils to Produce Bio-Diesel.

UNIT IV - GREEN TECHNOLOGY – MICROBIAL FUEL CELL: **9 Hrs**

Green Technology – Microbial Fuel Cell**:** Types of Biological fuel cells – Working Principle - Applications of biological Fuel cells.

UNITV - ENERGY FROM BIOMASS **9 Hrs**

Energy from Biomass – Introduction – Biomass conversion Technologies – Photosynthesis – Biogas generation – Factors affecting Biodigestion – Pyrolysis – Alcohol fuels - Design and operation of Fixed and Fluidized Bed Gasifiers. Combustion of Biomass and Cogeneration Systems: Combustion of Woody Biomass

Total no of Hours: 45

TEXT BOOKS

- G.D.Rai (2011), Non-Conventional Energy Sources , Khanna Publishers.
- B.H.Khan,(2006) Non-conventional Energy Sources , The McGraw Hill Companies.
- Ahindra Nag, Biofuels Refining and Performance, The McGraw Hill Companies (2008)

REFERENCE BOOKS

- Halwagi,(1984) Biogas Technology - Transfer and Diffusion. MNES Publication.
- Chawla, O.P, (1986)Advances in Biogas technology. Publications and Information Division, Indian Council of Agricultural Research.
- David M. Mousdale, Biofuels: Biotechnology, Chemistry, and Sustainable Development (2008)
- Paula Johanson, Biofuels: Sustainable Energy in the 21st Century (2010)

Subject Code: HBBT22E07	Subject Name MOLECULAR PATHOGENESIS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite::Microbiology/ Cell Biology / Molecular Biology	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To understand the fundamentals of pathogenesis at molecular level, mode of entry of pathogens into the host ,its defense mechanism and therapeutic approach etc

COURSE OUTCOMES (COs) : The students will be able

CO1	To understand about the process of pathogenesis
CO2	To Know the host defense mechanism
CO3	To know about the molecular basis of host defense mechanism
CO4	To understand the new and modern therapeutic approaches

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	3	3	3	3	3	**1**	**1**	3			
CO2	3	3	3	3	3	3	**1**	**1**	3			
CO3	3	3	3	3	3	3	**1**	**1**	3			
CO4	3	3	3	3	3	3	**1**	**1**	3			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	3		3		3							
CO2	3		3		3							
CO3	3		3		3							
CO4	3		3		3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
		✓										

Subject Code: HBBT22E07	Subject Name MOLECULAR PATHOGENESIS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite::Microbiology/ Cell Biology / Molecular Biology	Ty	3	0/0	0/0	3

UNIT I - OVERVIEW 9 **Hrs**

Historical perspective - discovery of microscope, Louis Pasteur's contributions, Robert Koch's postulates, early discoveries of microbial toxins, toxic assays, vaccines, antibiotics, Various pathogen types and modes of entry.

UNIT II-HOST-DEFENSE AGAINST PATHOGENS AND PATHOGENIC STRATEGIES 9 Hrs

Host defense: skin, mucosa, cilia, secretions, physical movements, limitation of free iron, antimicrobial compounds, mechanism of killing by humoral and cellular defense mechanisms, complements, inflammation process, general disease symptoms, Pathogenic adaptations to overcome the above defenses.

UNIT III - MOLECULAR PATHOGENESIS (WITH SPECIFIC EXAMPLES) 9 Hrs

Virulence, virulence factors, Vibrio Cholerae: Cholera toxin, co-regulated pili, filamentous phage, survival E.coli pathogens, Shigella: Entry and its cycle, Plasmodium entry and Life cycle, Antimalarials based on transport processes. Influenza virus: Intracellular stages, Neuraminidase & Haemagglutinin in entry, M1 & M2 proteins in assembly and disassembly, action of amantidine.

UNIT IV - EXPERIMENTAL STUDIES ON HOST-PATHOGEN INTERACTIONS 9 Hrs

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

UNIT V - MODERN APPROACHES TO CONTROL PATHOGENS 9 Hrs

Classical approaches based on serotyping. Modern diagnosis : immuno & DNA-based techniques. New therapeutic strategies: Vaccines - DNA, subunit and cocktail vaccines.

Total no of Hours: 45

REFERENCES

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

Subject Code: HBBT22E08	Subject Name BIOMATERIALS AND TISSUE ENGINEERING	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite::Microbiology/ Cell Biology / Molecular Biology	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

This course provides information on different classes and properties of biomaterials, the characterization and modification techniques and applications thereof for the development of artificial organs and biomedical devices

COURSE OUTCOMES (COs) : The students will be able

CO1	To understand about the commonly used different classes of biomaterials, and process of pathogenesis
CO2	To Know the its chemical structure, properties
CO3	To know surface modification to tailor biomaterial for desired biological response
CO4	To understand the interaction between biomaterial and the host in blood and tissue
CO5	To understand the long term and short term interaction between biomaterial and the host

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	3	3	3	3	3	**1**	**1**	3			
CO2	3	3	3	3	3	3	**1**	**1**	3			
CO3	3	3	3	3	3	3	**1**	**1**	3			
CO4	3	3	3	3	3	3	**1**	**1**	3			
CO5	3	3	3	3	3	3	**1**	**1**	3			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	3	3	3				
CO2	3	3	3				
CO3	3	3	3				
CO4	3	3	3				
CO5	3	3	3				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
		✓										

Subject Code: HBBT22E08	Subject Name BIOMATERIALS AND TISSUE ENGINEERING	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite::Microbiology/ Cell Biology / Molecular Biology	Ty	3	0/0	0/0	3

UNIT I: INTRODUCTION **9 Hrs**

Introduction: Biomaterial types-Natural-Artificial biomaterial-Processing-Skin grafts-Organo-typic culture-Cell polymer bioreactor-Functional cell mammalian cell constructs.

UNIT II: NATURAL BIOPOLYMERS **9 Hrs**

Natural biopolymers: Introduction: Collagen, Chitosan, Sodium alginate, Hyaluronic acid, Fibrinogen-Stabilization-Chemical modification-Copolymers-Scaffolds-Porous matrices-Tubules-Cell surface interaction.

UNIT III: SYNTHETIC POLYMERS **9 Hrs**

Synthetic polymers-Introduction: Aliphatic carbonate based polymers-Dioxepanone based polymers-Poly anhydrides-Poly amino acids-Hydrogels-Polymer scaffolds-Processing microencapsulation-Injectable polymers.

UNIT IV: ENGINEERING CELLS AND TISSUES **9 Hrs**

Engineering cells and tissues: Introduction-Reconstruction-Vascular grafts-Synthetic valves-Replacement-Bio-artificial device-Engineering of tissues- Regenerative matrix-implants-Bi-layered skin constructs.

UNIT V: REGULATORY ISSUE AND STANDARDIZATION **9 Hrs**

Regulatory issue and standardization-Safety consideration-Effectiveness consideration-Regulatory activities of FDA-Standardization through the ASTM-future prospects-Ethics and responsibility.

Total no of Hours : 45

REFERENCE BOOK

- Anthony Atala, Robert P. Lanza (2001) *Methods of tissue engineering* .Academic press

Subject Code: HBBT22E09	Subject Name HUMAN CYTOGENETICS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite::Genetics/ Cell Biology / Molecular Biology	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

Cytogenetics is a branch of biology focused on the study of chromosomes and their inheritance, especially as applied to medical genetics.

COURSE OUTCOMES (COs) : The students will be able

CO1	To understand about human inheritance of genes to their off springs
CO2	To Know the human genome project
CO3	To understand the chromosomal abnormalities in human
CO4	To get an overview about gene mapping and disease gene identification
CO5	To understand the process of genetic testing and diagnosis

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	3	3	3	3	3	1	1	3			
CO2	3	3	3	3	3	3	1	1	3			
CO3	3	3	3	3	3	3	1	1	3			
CO4	3	3	3	3	3	3	1	1	3			
CO5	3	3	3	3	3	3	1	1	3			

COs / PSOs	PSO1	PSO2	PSO3							
CO1	3	3	3							
CO2	3	3	3							
CO3	3	3	3							
CO4	3	3	3							
CO5	3	3	3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
		✓										

Subject Code: HBBT22E09	Subject Name HUMAN CYTOGENETICS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite::Genetics/ Cell Biology / Molecular Biology	Ty	3	0/0	0/0	3

UNIT I: HUMAN INHERITANCE **9 Hrs**

History of Human Genetics, Monogenic inheritance; multifactorial inheritance, Mendelian pedigree patterns – five basic pedigree patterns, X-inactivation, mosaicism due to X-inactivation, Complications to basic Mendelian pedigree patterns – incomplete dominance, codominance, uniparentaldisomy, penetrance, expressivity, late-onset diseases, phenocopy, Complications to basic mendelian pedigree patterns – anticipation, imprinting, pleiotropy, heterogeneity and its types, spontaneous mutations, mosaicism, consanguinity, Polygenic theory for quantitative traits, Hardy-Weinberg equilibrium – relating genotype and gene frequencies

UNIT II: HUMAN GENOME **9 Hrs**

Human genome organization – an overview, Protein-coding genes, RNA genes and microRNA, Heterochromatin and transposon repeats, Variation between human genomes – Causes and types 2, Pathogenic DNA variations and their effects

UNIT III: CHROMOSOME ABNORMALITIES IN HUMANS **9 Hrs**

Human chromosomes – banding and cytogenetic analysis, Polyploidy, aneuploidy and mixoploidy – clinical consequences, Chromatid breaks and their consequences, Chromosome translocations and their consequences, Chromosomal disorders - Down syndrome, Turner syndrome, Klinefelter syndrome etc.

UNIT IV: GENETIC MAPPING AND DISEASE GENE IDENTIFICATION **9 Hrs**

Role of recombination in genetic mapping, Markers for human genetic mapping, Linkage analysis – two point mapping and multi point mapping, Positional cloning, Position dependent cloning strategies, Position independent cloning strategies , Genome-wide association studies to identify disease genes

UNIT V: GENETIC TESTING AND DIAGNOSIS **9 Hrs**

Genetic testing – an introduction, Gene tracking, Clinical tests, Personalized medicine, Prenatal diagnosis of genetic disorders, Congenital defects, construction of pedigree, prob and Population screening

Total no of Hours : 45

REFERENCE BOOK

- Human chromosome principle and techniques, Second edition, by Ram S.Verma and Arvind Babu,MacGrwall-Hill (1995)
- Human Cytogenetics, Volume I constitutional analysis – a practical Approach, editor D. E. Rooney andB.H. Czepulkowski, IRL Press (1992)
- Human cytogenetics, Volume IIMalignancy & Acquired Abnormalities- A.practical approach, Editor D.E. Rooney, B.H. Czepulkowski, IRL Press (1992)
- In situ hybridization- Apractical approach, second edition, Editor D.G.Wilkson, Oxford university Press(1999)
- Principles and Practice of Medical Genetics Volume I and II, Editors, Emery and Rimoin, ChurchillLiningstone (1991)
- Medical Genetics, Jorde et al,Mosby Publisher (1997)

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OPEN ELECTIVES

Subject Code: HBBT22OE1	Subject Name FOOD AND NUTRITION	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite::Biology	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

Understanding relationship between food ,nutrition and health

COURSE OUTCOMES (COs) : The students will be able

CO1	Understand about the nutritional significance of carbohydrate
CO2	Understand the nutritive Value of food
CO3	Know about the deficiency of vitamins ,
CO4	Understand the caloric value of food
CO5	Know about the micro and macro nutrients

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	1	2	2	2	1	1	1	3			
CO2	3	1	2	2	2	1	1	1	3			
CO3	3	1	2	2	2	1	1	1	3			
CO4	3	1	2	2	2	1	1	1	3			
CO5	3	1	2	2	2	1	1	1	3			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	3		3		3							
CO2	3		3		3							
CO3	3		3		3							
CO4	3		3		3							
CO5	3		3		3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
				✓								

Subject Code: HBBT22OE1	Subject Name FOOD AND NUTRITION	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite::Biology	Ty	3	0/0	0/0	3

UNIT-I: BASIC TERMS USED IN STUDY OF FOOD AND NUTRITION **9Hrs**

Understanding relationship between food, nutrition and health. Concept of Balanced Diet, Food Groups, Food Pyramid

UNIT-II: NUTRITIONAL SIGNIFICANCE OF CARBOHYDRATES **9Hrs**

Definition and classification of carbohydrates. Digestion and absorption of carbohydrates, Metabolism of carbohydrates (Glycolysis, glycogenesis and Glycogenolysis)

UNIT-III: NUTRITIONAL SIGNIFICANCE OF PROTEINS **9Hrs**

Definition for proteins, building blocks of proteins (Amino acid classification) functions of proteins, Metabolism of proteins (Synthesis and degradation)

UNIT-IV: NUTRITIONAL SIGNIFICANCE OF LIPIDS **9Hrs**

Definition for lipids. Formation of lipids from fatty acids, Classification of lipids. Lipoproteins and their biological role. Biochemical functions of lipids.

UNIT-V NUTRITIONAL SIGNIFICANCE OF VITAMINS AND MINERALS **9Hrs**

Classification, Biochemical function and deficiency diseases of Vitamins and minerals

Total Hours: 45

TEXT BOOK

- Anita Tull (1996). Food and Nutrition.Third Edition. Oxford University Press.
- Jenny Ridgwell (1996). Examining Food and Nutrition.Heinemann.
- Paul Fieldhouse (1995). Food and Nutrition.Second Edition, Published by Chapman & Hall.

REFERENCE

- Bamji MS, Krishnaswamy K, Brahmam GNV (2009). Textbook of Human Nutrition, 3rd Edition. Oxford and IBH Publishing Co. Pvt. Ltd.
- Srilakshmi (2007). Food Science, 4th Edition. New Age International Ltd.
- Srilakshmi,(2005), Dietetics, Revised 5th edition. New Age International Ltd.

Subject Code: HBBT22OE2	Subject Name HUMAN PHYSIOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite::Biology	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To learn about the various physiological mechanism involved in the human system

COURSE OUTCOMES (COs) : The students will be able

CO1	Understand the basic respiratory mechanism , circulatory and digestive system
CO2	Understand the basic mechanism about Circulatory system
CO3	Understand the basic mechanism about Digestive system
CO4	Understand the excretory system
CO5	Understand the Endocrine and Nervous system

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	1	2	2	2	1	1	1	3			
CO2	3	1	2	2	2	1	1	1	3			
CO3	3	1	2	2	2	1	1	1	3			
CO4	3	1	2	2	2	1	1	1	3			
CO5	3	1	2	2	2	1	1	1	3			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	3	3	3					
CO2	3	3	3					
CO3	3	3	3					
CO4	3	3	3					
CO5	3	3	3					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
	✓											

Subject Code: HBBT22OE2	Subject Name HUMAN PHYSIOLOGY	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite::Biology	Ty	3	0/0	0/0	3

UNIT-I: RESPIRATORY SYSTEM **9Hrs**

Components of transport of Oxygen and Carbon dioxide, Role hemoglobin in transport. Mechanism of respiration, Chloride shift, Bhor's effect.

UNIT-II: CIRCULATORY SYSTEM: **9Hrs**

Introduction, function, types, of Circulatory organ. Design of Blood vessels, Blood Flow, blood pressure, Cardiac cycle

UNIT-III: DIGESTIVE SYSTEM **9Hrs**

Components of Digestive system, Digestion, absorption of carbohydrates, protein, lipids. Role of various enzymes involved in digestive process

UNIT-IV: EXCRETORY SYSTEM **9Hrs**

Structure and function of kidney, Structure of a nephron , Mechanism of urine formation and other functions of kidney.

UNIT-V: ENDOCRINE AND NERVOUS SYSTEM **9Hrs**

Brief outline of various endocrine glands and their secretion, physiological role of hormones. Nervous system - Brain, spinal cord, nerve cells, and nerve fibers. Synapse, chemical and electrical synapses, nerve impulses, action potential and neurotransmission.

Total no of Hours: 45

TEXT BOOK

- BJ Mejer, HS Meij, AC Meyer ,Human physiology, 2nd edition- AITBs publishers abd distributers.
- K. Saradha subramanyam, S, A Hand Book of Basic Human physiology. Chand & Co., Ltd.
- Y. Rajakshmi, S , Guide to physiology. Chand & Co., Ltd.

REFERENCE

- Gillian Pocock, Christopher D. Richards, David A. Richards. Third Edition 2006. Oxford University Press.
- David Wright,(2000) Human Physiology and Health. Heinemann Educational Publishers.
- Laurence A. Cole, Peter R. Kramer (2016) Human Physiology, Biochemistry and Basic Medicine Academic Press –Elsevier.

Subject Code: HBBT22OE3	Subject Name BASIC BIOINFORMATICS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite::Biology	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To learn nucleotide, protein and genome databases and know about the file formats .

COURSE OUTCOMES (COs) : The students will be able

CO1	Develop bioinformatics tools with programming skills.
CO2	Importance of pairwise alignment
CO3	Insights about multiple sequence alignment.
CO4	Deep insights about gene prediction tools
CO5	Develop future insilico model for nutrigenomics

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	1	2	2	2	1	1	1	3			
CO2	3	1	2	2	2	1	1	1	3			
CO3	3	1	2	2	2	1	1	1	3			
CO4	3	1	2	2	2	1	1	1	3			
CO5	3	1	2	2	2	1	1	1	3			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	3		3		3							
CO2	3		3		3							
CO3	3		3		3							
CO4	3		3		3							
CO5	3		3		3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/	Others			
				✓								

Subject Code: HBBT22OE3	Subject Name BASIC BIOINFORMATICS	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite::Biology	Ty	3	0/0	0/0	3

UNIT I: BIOLOGICAL DATABASES AND DATA RETRIEVAL **9 Hrs**

Nucleotide databases (Genbank, EMBL), Sequence submission Methods and tools (Sequin, Sakura), Sequence retrieval systems (Entrez), Protein (Swiss-Prot, Tr-EMBL, Expasy), Genome (NCBI, EBI, TIGR), Metabolic Pathway DB (KEGG)

UNIT II:PAIRWISE SEQUENCE ALIGNMENT **9 Hrs**

Similarity, Identity and Homology, Global Alignment, Local Alignment, Database Search methods & tools, Scoring Matrices,

UNIT III:MULTIPLE SEQUENCE ALIGNMENT **9 Hrs**

Significance of MSA, Scoring of MSA, PSI/PHI-BLAST.

UNIT IV:GENE PREDICTION AND PROTEIN PREDICTION **9 Hrs**

Structure in Prokaryotes and Eukaryotes, Gene prediction methods, Neural Networks, Pattern Discrimination methods, Signal sites Predictions (Promoter, Splice, UTR, CpG-islands), Molecular visualization - protein conformation and visualization tool (RASMOL), Methods of Construction of Phylogenetic trees.

UNIT V:NUTRIGENOMICS **9 Hrs**

Introduction to Nutrigenomics and Nutraceuticals

Total no of Hours: 45

REFERENCES

- Introduction to Bioinformatics - A. Lesk 2002, Oxford University Press
- Fundamental concepts of Bioinformatics by D.E. Krane and M.L Raymer, Pearson Education 2003 ISBN 81-297-0044-1
- Current Protocols in Bioinformatics, Edited by A.D. Baxevaniset. al., Wiley Publishers 2005
- Introduction to Computational Molecular Biology by Joao Carlos Setubal, Joao

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OPEN LAB

Subject Code: HBBT22OL1	Subject Name BASIC BIOINFORMATICS LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite::Biology	Lb	0	0/0	3/0	2

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To enable the students to understand basic commands in UNIX OS.To understand different biological databases

COURSE OUTCOMES (COs) : The students will be able

CO1	To demonstrate the protein/DNA sequence search methods and sequence alignment databases.
CO2	To understand and hands-on-training on the genome sequence analysis and annotation.
CO3	To analyze the comparative genomics.
CO4	To carry out sequence and phylogenetic analysis.
CO5	To use various computational tools for expression analysis to identify open reading frames, mutations, conserved region

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	3	1	2	2	3	2	3	1	2			
CO2	3	1	2	2	3	2	3	1	2			
CO3	3	1	2	2	3	2	3	1	2			
CO4	3	1	2	2	3	2	3	1	2			
CO5	3	1	2	2	3	2	3	1	2			
COs / PSOs	**PSO1**		**PSO2**		**PSO3**							
CO1	3		3		3							
CO2	3		3		3							
CO3	3		3		3							
CO4	3		3		3							
CO5	3		3		3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
								✓				

Subject Code: HBBT22OL1	Subject Name BASIC BIOINFORMATICS LAB	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite::Biology	Lb	0	0/0	3/0	2

1. Demonstration of Entrez
2. Demonstration of SRS
3. Exploring nucleotide database Gen Bank
4. Exploring Protein Database Uniprot
5. Database Searches with BLASTP
6. Pair wise Sequence Alignment -EMBOSS
7. Multiple sequence alignment – CLUSTAL OMEGA

REFERENCE BOOK

- Bioinformatics and Functional Genomics by Jonathan Pevsner
- Bioinformatics Data Skills: Reproducible and Robust Research with Open by Vince Buffalo
- Introduction to Bioinformatics Using Action Labs by Jean-Louis Ryan Rossi, Stephen Sheel

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HONOUR PROGRAMS

SEMESTER VII

Subject Code: HBCC22003	Subject Name RESEARCH METHODOLOGY (UG)	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite::none	Ty	3	0/0	0/0	3

Ty/Lb/ : Theory/Lab L : Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

- Design and formulation of research problem.
- Analyze research related information and statistical methods in research.
- Carry out research problem individually in a perfect scientific method
- Understand the filing patent applications processes, Patent search, and various tools of IPR, Copyright, and Trademarks.

COURSE OUTCOMES (COs) : The students will be able

CO1	Design and Formulation of research problem.
CO2	Analyze research related information and statistical methods in research.
CO3	Carry out research problem individually in a perfect scientific method
CO4	Understand Patent Filing application Process.
CO5	Patent Search and various tools used.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	3	3	3	3	2	2	3	3	3			
CO2	3	2	1	3	3	1	1	1	1			
CO3	3	3	2	1	2	2	3	3	3			
CO4	3	3	2	2	1	2	2	2	2			
CO5	3	3	3	3	3	2	3	3	3			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	2	2	2				
CO2	2	2	2				
CO3	2	2	2				
CO4	2	2	2				
CO5	2	2	2				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
			✓									

Subject Code: HBCC22003	Subject Name RESEARCH METHODOLOGY (UG)	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite::none	Ty	3	0/0	0/0	3

UNIT 1 **9 Hrs**

Introduction to research, Definitions and characteristics of research, Types of Research, Research Process, Problem definition, Objectives of Research, Research Questions, Research design, Quantitative vs. Qualitative Approach, Building and Validating Theoretical Models, Exploratory vs. Confirmatory Research, Experimental vs. Theoretical Research, Importance of reasoning in research.

UNIT 2 **9 Hrs**

Problem Formulation, Understanding Modeling & Simulation, Literature Review, Referencing, Information Sources, Information Retrieval, Indexing and abstracting services, Citation indexes, Development of Hypothesis, Measurement Systems Analysis, Error Propagation, Validity of experiments, Statistical Design of Experiments, Data/Variable Types & Classification, Data collection, Numerical and Graphical Data Analysis: Sampling, Observation, Interpretation of Results.

UNIT 3 (This Unit has to be handled by Mathematics Faculty) **9 Hrs**

Statistics: Probability & Sampling distribution, Estimation, Measures of central Tendency, Arithmetic mean, Median, Mode, Standard deviation, Co efficient of variation (Discrete serious and continuous serious), Hypothesis testing & application, Correlation & regression analysis, Orthogonal array, ANOVA, Standard error, Concept of point and interval estimation, Level of significance, Degree of freedom, Analysis of variance, One way and two way classified data, 'F' test.

UNIT 4 **9 Hrs**

Preparation of Dissertation and Research Papers, Tables and illustrations, Guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript. References, Citation and listing system of documents.

UNIT 5 **9 Hrs**

Intellectual property rights (IPR) patents copyrights Trademarks Industrial design geographical indication. Ethics of Research Scientific Misconduct Forms of Scientific Misconduct. Plagiarism, Unscientific practices in thesis work, Ethics in science.

Text Book:

- K. S. Bordens, and B. B.Abbott, , "Research Design and Methods – A Process Approach", 8th Edition, McGraw Hill, 2011.
- C. R. Kothari, "Research Methodology – Methods and Techniques", 2nd Edition, New Age International Publishers

Subject Code: HBBT22013/ HBBC22013	Subject Name : HERBAL DRUG TECHNOLOGY	TY/ LB/ ETP/ IE	L	T /SLr	P/ R	C
	Prerequisite: Biochemistry/Pharmaceutical	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L : Theory/Lab

OBJECTIVE :

To explain the concept of phytochemical technology and various methods of its extraction. The objective also includes the analysis of plant drugs and standardization of herbal drugs.

COURSE OUTCOMES (COs) : After studying this course the student would be able to

CO1	Get an idea about Medicinal Plants
CO2	Know about the different extraction procedures
CO3	Get familiarize with chromatography techniques
CO4	Understand the methods of separation of important phyto molecules
CO5	Understand the standardization procedures for the commercial use of herbal drugs

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	1	3	3	3	3	1	2	3	3			
CO2	1	3	3	3	3	1	2	3	3			
CO3	1	3	3	3	3	1	2	3	3			
CO4	1	3	3	3	3	1	2	3	3			
CO5	1	3	3	3	3	1	2	3	3			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	3	3	3					
CO2	3	3	3					
CO3	3	3	3					
CO4	3	3	3					
CO5	3	3	3					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
	✓											

Subject Code: HBBT22013/ HBBC22013	Subject Name : HERBAL DRUG TECHNOLOGY	TY/ LB/ ETP/ IE	L	T / SLr	P/ R	C
	Prerequisite: Biochemistry/Pharmaceutical	Ty	3	1/0	0/0	4

UNIT I - INTRODUCTION TO MEDICINAL PLANTS **12 Hrs**

Introduction to Medicinal Plants, Classification of secondary metabolites, Medicinal importance of secondary metabolites like Flavonoids, Phenols, Alkaloids, Tannins Terpenes and Saponins.

UNIT II – EXTRACTION **12 Hrs**

Extraction of Phyto pharmaceuticals – Infusion, Decoction, Digestion, Maceration, Percolation, Successive Solvent Extraction, Super Critical Fluid Extraction

UNIT III – EXTRACTION **12 Hrs**

Steam Distillation, Headspace Techniques, Sepbox, Selection of Suitable Extraction Process, Carbohydrates, Proteins, Alkaloids, Glycosides.

UNIT IV– PLANT DRUG ANALYSIS **12 Hrs**

Application of Chromotography and Spectroscopy in Plant Drug Analysis – Infrared Spectroscopy, NMR Spectroscopy, Mass Spectroscopy.

UNIT V– STANDARDIZATION OF HERBAL DRUGS **12 Hrs**

Standardization of Herbal Drugs – Importance of Standardization and Problems Involved in the Standardization of Herbs, Standardization of Single Drugs and Compound Formulations, WHO Guidelines for Quality Standardized Herbal Formulation, Estimation of Parameter Limits used for Standardization, Herbal Extracts.

Total no of Periods: 60

TEXT BOOK

- S.S. Agarwal, M.Paridhavi (2007) Herbal Drug Technology (1st Ed), University press (India) private limited
- N. Raaman, Phytochemical Techniques, New India Publishing Agency (2006)
- Colleen Carkeet, Phytochemicals: Health Promotion and Therapeutic Potential, (2012)

REFERENCE BOOK

- A.P.Purohit, C.K.Kokate , S.B.Gokhale (2001) Pharmacognosy (32nd Edition) Nirali Prakshan pune.
- Trease GE , Evans WC Pharmacognosy (14th Edition) W.B.Sondars & Co Ltd London.
- Kelsey R. Downum, Phytochemical Potential of Tropical Plants, Springer (2013)
- Amlan K. Patra, Dietary Phytochemicals and Microbes, Springer (2012)
- David R Gang, Phytochemicals, Plant Growth, and the Environment, Springer (2012)

Subject Code: HBBT22014/ HBBC22014	Subject Name : STEM CELL BIOLOGY	TY/ LB/ ETP/ IE	L	T / SLr	P/ R	C
	Prerequisite: Biochemistry/Pharmaceutical	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L : Theory/Lab

OBJECTIVE :

To study the principles of developmental biology in the early embryonic development. To study the stem cell processing and its therapeutic applications

COURSE OUTCOMES (COs) : After studying this course the student would be able to

CO1	Developmental biology in terms of embryonic cells.
CO2	The concept and basic knowledge about stem cells.
CO3	Know about the processing and transplantation of stem cells
CO4	To familiarize with stem cell therapy
CO5	Understand the applications of stem cells

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	3	3	3	3	1	1	1	3			
CO2	3	3	3	3	3	1	1	1	3			
CO3	3	3	3	3	3	1	1	1	3			
CO4	3	3	3	3	3	1	1	1	3			
CO5	3	3	3	3	3	1	1	1	3			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	3	3	3					
CO2	3	3	3					
CO3	3	3	3					
CO4	3	3	3					
CO5	3	3	3					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
	✓											

Subject Code: HBBT22014/ HBBC22014	Subject Name : STEM CELL BIOLOGY	TY/ LB/ ETP/ IE	L	T / SLr	P/ R	C
	Prerequisite: Biochemistry/Pharmaceutical	Ty	3	1/0	0/0	4

UNIT I: INTRODUCTION TO EMBRYONIC DEVELOPMENT AND STEM CELLS 12 Hrs

Embryonic development, Blastocyst and inner cell mass, Development of differentiated tissues from embryonic germ layers, Function of placenta, amniotic fluid and umbilical chord; Stem cells : Definition, Classification and Properties; Properties and application of Embryonic stem cells.

UNIT II: HEMATOPOIETIC STEM CELLS 12 Hrs

Haematopoiesis – Hierarchy, Properties of Hematopoietic Stem Cells (HSCs), HSCs, Types of HSCs: Long term HSCs, Short term HSCs; Hematopoietic and Stromal cell differentiation; characteristics of Bone marrow stromal cells; Cell surface Markers for HSCs.

UNIT III: STEM CELL PROCESSING AND TRANSPLANTATION 12 Hrs

Sources of stem cells; Cell types for transplantation: Bone marrow, Peripheral stem cells, cord blood stem cells; Types of transplants; Methods of obtaining bone marrow and peripheral blood for transplant, Stem cell processing and storage; HLA matching; Advantages and drawbacks of autologous and allogeneic transplants.

UNIT IV: ADULT STEM CELLS 12 Hrs

Adult stem cell plasticity, Comparison of adult stem cells vs embryonic stem cells, myogenesis; skeletal muscle stem cells; epidermal stem cells, Liver stem cells, Stem cell therapies in animal models:Their outcome and possible benefits in humans

UNIT V: STEM CELLS AND THERAPY 12 Hrs

Normal stem cells vs. Cancer stem cells, Clinical uses of hematopoietic stem cells in leukaemia, lymphoma and inherited blood disorders; Use of stem cells in diabetes, myocardial infarction, Parkinson's disease.

Total no of Hours: 60

TEXT BOOKS:

- Robert Lonza(2009)*Essentials of Stem CellBiology* (2nd Ed) Academic Press.
- Anthony Atala, Robert Lonza, James A.Thomson, Robert Nerem (2011)*Principles of Regenerative Medicine* (2nd Ed)Academic Press

REFERENCE BOOKS

- DovZipori (2009) *Biology of Stem cells and the Molecular basis of the Stem State*. Humana Press.
- StemBook Cambridge (MA): Harvard Stem Cell Institute; 2008.

Subject Code: HBBT22015/ HBBC22015	Subject Name : AGRICULTURAL BIOTECHNOLOGY	TY/ LB/ ETP/ IE	L	T / SLr	P/ R	C
	Prerequisite: Biochemistry/Pharmaceutical	Ty	3	1/0	0/0	4

L : Lecture T : Tutorial P : Project R : Research C: Credits T/L : Theory/Lab

OBJECTIVE :

To study the principles of developmental biology in the early embryonic development. To study the stem cell processing and its therapeutic applications

COURSE OUTCOMES (COs) : After studying this course the student would be able to

CO1	Know Structure, function of a plant cell
CO2	The recollect the photosynthetic process
CO3	Know about the phyto hormones
CO4	To familiarize with secondary metabolites
CO5	Understand the plant stress process

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	3	3	3	3	1	1	1	3			
CO2	3	3	3	3	3	1	1	1	3			
CO3	3	3	3	3	3	1	1	1	3			
CO4	3	3	3	3	3	1	1	1	3			
CO5	3	3	3	3	3	1	1	1	3			

COs / PSOs	PSO1	PSO2	PSO3					
CO1	3	3	3					
CO2	3	3	3					
CO3	3	3	3					
CO4	3	3	3					
CO5	3	3	3					

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
	✓											

Subject Code: HBBT22015/ HBBC22015	Subject Name : AGRICULTURAL BIOTECHNOLOGY	TY/ LB/ ETP/ IE	L	T / SLr	P/ R	C
	Prerequisite: Biochemistry/Pharmaceutical	Ty	3	1/0	0/0	4

UNIT-I PLANT CELL **12 Hrs**

Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins, stomatal movement, transpiration, photoperiodism and biological clocks, plant movement.

UNIT II PHOTOSYNTHESIS **12 Hrs**

Photosynthetic apparatus, pigments of photosynthesis, Calvin cycle (C3 plants), Hatch slack (C4 plants) & CAM pathways of carbon reduction and its regulation, Structure, function and regulation of RUBISCO, Crassulacean acid metabolism in plants. Photorespiration: photorespiration pathway and significance, cyanide resistance, relationship between photosynthesis, photorespiration.

UNIT III PHYTOHORMONES **12 Hrs**

Biosynthesis, transport, physiological effects, mode of action and signal transduction of auxins, gibberlic acid, abscisic acid, ethylene and cytokinins in germination, embryogenesis, growth and development of plant. Nitrogen metabolism**:** Nitrogen fixation, nitrogenise complex, biochemistry and genetics of nitrogen fixation and ammonium assimilation, structure of 'NIF' genes and its regulation, structural features of nitrate reductase and nitrite reductase, regulation of nitrate and sulphate assimilation.

UNIT –IV SECONDARY PLANT METABOLITES **12 Hrs**

Nature, distribution, biosynthesis and function of plant metabolites, biosynthesis of nicotine. Biochemistry of plant toxins, phytohemagglutinins, lathyrogens, nitriles, protease inhibitors, protein toxins, role of secondary metabolites in chemical defence.

UNIT – V PLANT STRESS PHYSIOLOGY **12 Hrs**

Plant stress, plant responses to abiotic and biotic stresses, salinity, water, heat, chilling, anaerobiosis, heavy metals, radiations and their impact on plant growth and metabolism, mechanisms of resistance to biotic stress and abiotic stress, antioxidative defence mechanism. Plant defence: Genetic basis of plant-pathogen interactions, antio R-Avr gene interactions and isolation of R genes, hypersensitive response (HR), systemic acquired resistance (SAR) and induced systemic resistance (ISR).

Total no of Hours: 60

Books recommended

- Introduction of Plant Biochemistry, by Goodwin T. W. and E.I. Mercer, Pergamon Press, Oxford, 1983.
- Plant Physiology, 5th Edition, by Lincoln Taiz and Eduardo Zeiger, Amazon press, 2012
- Introduction of Plant Biochemistry, by Goodwin T. W. and E.I. Mercer, Pergamon Press, Oxford.
- Buchanan BB, Gruissem W & Jones RL. 2000. *Biochemistry and Molecular Biology of Plants.* 2nd Ed. John Wiley.
- Dey PM &Harborne JB. 1997. *Plant Biochemistry*. Academic Press.
- Heldt HS. 1997. *Plant Biochemistry and Molecular Biology*. Oxford Univ.Press.

Subject Code: HBBT22I03	Subject Name :MINI PROJECT	TY/ LB/ ETP/ IE	L	T / SLr	P/ R	C
	Prerequisite: All core papers	IE	0	0	6/0	2

T/L Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

Students have to choose a research problem in any one of the major domains and should find solutions by doing systematic research procedure.

COURSE OUTCOMES (COs) : The students will have to know

CO1	About the nature of the research problems
CO2	About the technical procedure to be followed for solving it
CO3	About the execution and presentation of the solution he has obtained.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	2	2	2	2	2	2	2	2	2			
CO2	2	2	2	2	2	2	2	2	2			
CO3	2	2	2	2	2	2	2	2	2			

COs / PSOs	PSO1	PSO2	PSO3				
CO1	2	2	2				
CO2	2	2	2				
CO3	2	2	2				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Catego	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
						✓						

Subject Code: HBBT22I03	Subject Name :MINI PROJECT	TY/ LB/ ETP/ IE	L	T / SLr	P/ R	C
	Prerequisite: All core papers	IE	0	0/0	6/0	2

Students will have an opportunity to expose their knowledge and talent to make an innovative project. Students are supposed to do innovative projects useful to industries/society in the area of relevant field, inter and multi-disciplinary areas, under the guidance of a staff member. They have to prepare a project report and submit to the department.

At the end of the semester Viva-Voce examination will be conducted by the internal Examiner duly appointed by the Head of the department and the students will be evaluated.

Subject Code: HBBT22I04	Subject Name :INTERNSHIP	TY/ LB/ ETP/ IE	L	T / SLr	P/ R	C
	Prerequisite: All core papers	IE	0	0/0	3/0	1

Ty/Lb: Theory/Lab L: Lecture T : TutorialP :Practical/ Project R : Research C: Credits

OBJECTIVE:

Students have to choose a research problem in any one of the major domains and should find solutions by doing systematic research procedure.

COURSE OUTCOMES (COs) : The students will have to know

CO1	About the nature of the research problems
CO2	About the technical procedure to be followed for solving it
CO3	About the execution and presentation of the solution he has obtained.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	2	2	2	2	2	2	2	2	2			
CO2	2	2	2	2	2	2	2	2	2			
CO3	2	2	2	2	2	2	2	2	2			

COs / PSOs	PSO1	PSO 2	PSO3				
CO1	2	2	2				
CO2	2	2	2				
CO3	2	2	2				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
								✓				

Subject Code: HBBT22I05	Subject Name :INTERNSHIP	TY/ LB/ ETP/ IE	L	T / SLr	P/ R	C
	Prerequisite: All core papers	IE	0	0/0	3/0	1

Students are supposed to undergo internship in related Industries for a minimum period of 15 days cumulatively during the semester. They have to prepare a report on the Internship with a certificate in proof from competent authority in the industry. At the end of the semester Viva-Voce examination will be conducted by the Examiners duly appointed by the Head of the department and the students will be evaluated.

SEMESTER-VIII

Subject Code: HBCC22004	Subject Name : START UP STRATAGIES	TY/ LB/ ETP/ IE	L	T / SLr	P/ R	C
	Prerequisite: nil	Ty	3	0/0	0/0	3

T/L Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To understand new venture creation opportunities, its resources and requirements for Enterprise Start-up.

COURSE OUTCOMES (COs) : The students will have to know

CO1	Develop a start-up Enterprise with Big Idea Generation.
CO2	Analyze start-up capital requirement by analyzing legal factors.
CO3	Interpret feasibility Analysis towards funding issues.
CO4	Access growth stages in new venture and reasons for scaling ventures.
CO5	Evaluate financial stability and decide on expansion possibilities.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO 9			
CO1	2	3	3	2	2	3	3	3	3			
CO2	2	2	3	2	2	3	3	2	2			
CO3	1	2	3	2	1	3	3	3	2			
CO4	1	2	3	2	1	3	3	2	2			
CO5	1	2	3	2	2	3	3	2	2			

COs / PSOs	PSO1	PSO 2	PSO3				
CO1	1	3	2				
CO2	1	3	2				
CO3	1	3	2				
CO4	1	3	2				
CO5	1	3	2				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
									✓			

Subject Code: HBCC22004	Subject Name : START UP STRATAGIES	TY/ LB/ ETP/ IE	L	T / SLr	P/ R	C
	Prerequisite: nil	T	3	0/0	0/0	3

UNIT I: START-UP OPPORTUNITIES:

The New Industrial Revolution - The Big Idea -Generate Ideas with Brainstorming- Business Start-up - Ideation- Venture Choices - The Rise of the startup Economy- The Six Forces of Change - The Start-up Equation- The Entrepreneurial Ecosystem- Entrepreneurship in India. Government Initiatives.

UNIT II: STARTUP CAPITAL REQUIREMENTS AND LEGAL ENVIRONMENT:

Identifying Startup capital Resources requirements- Estimating startup cash requirements- Develop financial assumptions- Constructing a Process Map- Positioning the venture in the value chain- Launch strategy to reduce risks- Startup financing metrics- The Legal Environment- Approval for New Ventures- Taxes or duties payable for new ventures.

UNIT III: STARTUP FINANCIAL ISSUES: FEASIBILITY ANALYSIS-

The cost and process of raising capital- Unique funding issues of a high- tech ventures – Funding with Equity- Financing with Debt- Funding Startup with bootstrapping- crowd funding- strategic alliances.

UNIT IV: STARTUP SURVIVAL AND GROWTH:

Stages of growth in a new venture- Growing with the market- Growth within the industry- Venture life patterns- Reasons for new venture failures- preparing for change- Leadership succession. Support for the growth and sustainability of the venture.

UNIT V: PLANNING FOR HARVEST AND EXIT:

Dealing with Failure: Bankruptcy, Exit Strategies- Selling the Business- Cashing out but staying in being- Going Public (IPO)-Liquidation.

Reference Books:

- Kathleen R Allen, Launching New Ventures, An Entrepreneurial Approach, Cengage Learning 2016.
- Anjan Raichaudhuri, Managing New Venture Concepts and Cases, Prentice Hall International 2010.
- S. R. Bhowmika& M. Bhowmik, Entrepreneurship, New Age International, 2007.
- Steven Fisher, Ja-nae Duane, The Startup Equation- A Visual Guidebook for Building your Startup, Indian Edition, Mc Graw Hill Education India Pvt. Ltd, 2016.
- Donald F Kuratko, Jeffrey S. Hornsby, New Venture Management: The Entrepreneur's Road Map, 2e, Routledge,2017.
- Vijay Sathe, Corporate Entrepreneurship, le, Cambridge, 2009

Subject Code: **HBCC22005**	Subject Name : **PRINCIPLES OF DIGITAL MARKETING**	**Ty/Lb /ETL/EVL**	**L**	**T/SLr**	**P/R**	**C**
	Prerequisite: Nil	Ty	3	0/0	0/0	3

L : Lecture T : Tutorial S.Lr : Supervised Learning P : Project R : Research C: Credits
Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES :

- This course helps the students to understand the fundamental principles of Digital marketing, the past, present and future potential of Digital marketing.
- At the end of the course students will be able to identify the role of e-marketing in the present context and develop an e-marketing plan with appropriate e-marketing strategies.

COURSE OUTCOMES (COs) : (3- 5)

CO1	Understand the concepts and uses of Digital Marketing
CO2	Develop Strategic Planning for the Market
CO3	Evaluate the Ethical and Legal Values
CO4	Predict the Marketing Trends

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PSO1**	**PSO2**	**PSO3**
CO1	**3**	**2**	**2**	**1**	**1**	**1**	**3**	**1**	**1**	**1**	**1**	**2**
CO2	**3**	**2**	**1**	**2**	**2**	**2**	**3**	**2**	**1**	**1**	**1**	**1**
CO3	**2**	**2**	**2**	**1**	**2**	**2**	**3**	**3**	**2**	**1**	**2**	**2**
CO4	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**1**	**2**	**1**	**1**	**1**

H/M/L indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
						✔						

Subject Code: HBCC22005	Subject Name : PRINCIPLES OF DIGITAL MARKETING	TY/ LB/ ETP/ IE	L	T / SLr	P/ R	C
	Prerequisite: nil	Ty	3	0/0	0/0	3

OBJECTIVES:

- This course helps the students to understand the fundamental principles of Digital marketing, the past, present and future potential of Digital marketing.
- At the end of the course students will be able to identify the role of e-marketing in the present context and develop an e-marketing plan with appropriate e-marketing strategies.

UNIT I: INTRODUCTION **9 Hrs**

Digital-Marketing Past, Present & Future – Digital-Marketing Landscape, Digital-marketing's Past - Web 1.0, Digital Marketing Present - Web 2.0, Future -Web 3.0, Strategic Digital-Marketing, and Digital -Business Models – Online Revenue Models, Value Models, and Strategic Digital-Business Models.

UNIT II: DIGITAL MARKETING PLAN **9 Hrs**

Process, Creating a Digital-Marketing Plan, Seven Steps –Situation Analysis, Strategic Planning, Objectives, Digital-Marketing Strategies – Product, Price, Distribution, Communication, Relationship Management; Implementation plan, Budget, Evaluation.

UNIT III: DIGITAL -MARKETING ENVIRONMENT **9 Hrs**

Overview of Digital-Marketing Environment, Global Digital -Markets, Wireless Internet Access, Digital divide, Building inclusive Digital markets, social networking, Ethical and Legal Issues – Overview, Digital Property, Emerging issues.

UNIT IV:DIGITAL-MARKETING MANAGEMENT **9 Hrs**

Online offer – Creating customer value online, Product Benefits, Digital Marketing enhanced product development, Payment options, Pricing Strategies; Internet as distribution, Digital Marketing Communication – Owned Media, Paid media, Earned Media.

UNIT V: EMERGING TRENDS **9 Hrs**

Emerging trends in Digital-marketing, Content Marketing, Social Media Marketing, Email Marketing, Affiliate Marketing, Video Marketing, Mobile Marketing, Interactive advertising, International Online Marketing, Search Engine Marketing, Online Partnership, Viral Marketing, E-CRM, E-Business, E-Tailing.

Total Hours: 45

TEXT BOOK:

1. Strauss Judy, Frost Raymond (2013), E-Marketing, 7/e; New Delhi: Prentice Hall.

REFERENCE BOOKS:

1. Chaffey Dave and Smith PR (2013), Emarketing Excellence: Planning and Optimizing your Digital Marketing; 4/e; Routledge.
2. Ryan Damian, (2014), Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, 3/e; Kogan Page Limited.

Subject Code: HBCC22006	Subject Name : INTELLECTUAL PROPERTY RIGHTS AND PATENT	TY/ LB/ ETP/ IE	L	T / SLr	P/ R	C
	Prerequisite: nil	Ty	3	0/0	0/0	3

T/L Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.

To develop expertise in the learners in IPR related issues and sensitize the learners with the emerging issues in IPR and the rationale for the protection of IPR.

COURSE OUTCOMES (COs) : The students will have to know

CO1	Imbibe the knowledge of Intellectual Property and its protection through various laws.
CO2	apply the knowledge of IPR for professional development
CO3	develop a platform for protection and compliance of Intellectual Property Rights & knowledge
CO4	create awareness amidst academia and industry of IPR and Copyright compliance
CO5	deliver the purpose and function of IPR and patenting

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	3	2	2	2	3	3	2	2			
CO2	3	3	1	2	3	2	2	2	3			
CO3	3	3	2	2	3	3	2	3	2			
CO4	3	3	2	3	2	2	2	1	2			
CO5	3	2	1	2	2	2	3	2	2			

COs / PSOs	PSO1	PSO 2	PSO3				
CO1	1	3	2				
CO2	1	3	2				
CO3	1	3	2				
CO4	1	3	2				
CO5	1	3	2				

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
			✓				✓					

Subject Code: HBCC22005	Subject Name : INTELLECTUAL PROPERTY RIGHTS AND PATENT	TY/ LB/ ETP/ IE	L	T / SLr	P/ R	C
	Prerequisite: nil	Ty	3	0/0	0/0	3

UNIT – I: **9Hrs**

Introduction to IPRs, Basic concepts and need for Intellectual Property – Meaning and practical aspects of Patents, Copyrights, Geographical Indications, IPR in India and Abroad. Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT – II: **9Hrs**

Intellectual Property Rights. The IPR tool kit, Patents, the patenting process, Patent cooperation treaties: International Treaties and conventions on IPRs: Trade Related Aspects of Intellectual Property Rights Agreement, Patent Cooperation Treaty, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT – III: **9Hrs**

Intellectual Property Protections IPR of Living Species, protecting inventions in biotechnology, protections of traditional knowledge, biopiracy and documenting traditional knowledge, Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection. Case studies: The basmati rice issue, revocations of turmeric patent, revocation of neem patent.

UNIT – IV: **9Hrs**

Exercising and Enforcing of Intellectual Property Rights Rights of an IPR owner, licensing agreements, criteria for patent infringement. Case studies of patent infringement, IPR – contract, unfair competitions and control, provisions in TRIPS,

UNIT- V: **9Hrs**

Role of Patents in Product Development & Commercialization Recent changes in IPR laws impacting patents and copy rights, intellectual cooperation in the science and allied industry. Patentable and non-patentable research. Case studies .

Total no hours:45

Text book:

- Nithyananda, K.V. (2019). Intellectual Property Rights : Protection and Management. India, IN: Cengage Learning India Private Limited.
- Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.

References:

- P.B. Ganguli, Intellectual Property Rights: Unleashing the Knowledge Economy. Tata Mc Graw Hill, 2001. Steve

- Smith, The Quality Revolution.1st ed., Jaico Publishing House, 2002.
- Kompal Bansal and Praishit Bansal. Fundamentals of IPR for Engineers, 1st Edition, BS Publications, 2012.
- Prabhuddha Ganguli. Intellectual Property Rights. 1st Edition, TMH, 2012.
- R Radha Krishnan & S Balasubramanian. Intellectual Property Rights. 1st Edition, Excel Books, 2012.
- M Ashok Kumar & Mohd. Iqbal Ali. Intellectual Property Rights. 2nd Edition, Serial Publications, 2011. VinodV. Scople, Managing Intellectual Property. Prentice Hall of India PvtLtd, 2012.
- Deborah E. Bouchoux. Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets. Cengage Learning, 3rd ed. Edition, 2012.
- Prabuddha Ganguli. Intellectual Property Rights: Unleashing the Knowledge Economy. McGraw Hill Education, 2011. Edited by Derek Bosworth and Elizabeth Webster.The Management of Intellectual Property. Edward Elgar Publishing Ltd., 2013.
- Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
- Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House

E-resources:

- .Subramanian, N., & Sundararaman, M. (2018). Intellectual Property Rights – An Overview. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf
- World Intellectual property Organisation. (2004). WIPO Intellectual property Handbook. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf

Reference Journal:

- Journal of Intellectual Property Rights (JIPR): NISCAIR

Useful Websites:

- Cell for IPR Promotion and Management (http://cipam.gov.in/)
- World Intellectual Property Organisation (https://www.wipo.int/about-ip/en/)
- Office of the Controller General of Patents, Designs & Trademarks (http://www.ipindia.nic.in/)

Subject Code: HBBT22L07	Subject Name : MAJOR PROJECT	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	Lb	0	0/0	9/3	6

Ty/Lb: Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

- The objective of the Main Project is to culminate the academic study and provide an opportunity to explore a problem or issue, address through focused and applied research under the direction of a faculty mentor. The project demonstrates the student's ability to synthesize and apply the knowledge and skills acquired to real-world issues and problems. This project affirms the students to think critically and creatively, find an optimal solution, make ethical decisions and to present effectively.

COURSE OUTCOMES (COs) : The students will have to know

CO1	Apply the knowledge and skills acquired in the course of study addressing a specific problem or issue.
CO2	To encourage students to think critically and creatively about societal issues and develop user friendly and reachable solutions
CO3	To refine research skills and demonstrate their proficiency in communication skills.
CO4	To take on the challenges of teamwork, prepare a presentation and demonstrate the innate talents.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	3	3	3	3	3	3	2	2			
CO2	3	3	3	3	3	3	3	2	2			
CO3	3	3	3	3	3	3	3	2	2			
CO4	3	3	3	3	3	3	3	2	2			

COs / PSOs	PSO1	PSO2	PSO3							
CO1	3	3	3							
CO2	3	3	3							
CO3	3	3	3							
CO4	3	3	3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
								✓				

Subject Code: HBBT22L07	Subject Name : MAJOR PROJECT	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	Lb	0	0/0	9/3	6

Individual student is expected to choose a research problem and execute it with proper data. He/ She will explain their research project to a committee of faculty members

Subject Code: HBBT22I05	Subject Name RESEARCH PUBLICATION	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	IE	0	0/0	0/4	2

T/L Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits

OBJECTIVE:

- The objective is to make students write manuscript and publish it in the form of paper in reputed journals

COURSE OUTCOMES (COs) : The students will have to know

CO1	How to search literature supporting their research findings
CO2	To encourage students to present their findings in the form of abstract
CO3	To write their research findings in the form of introduction materials and methods and results and discussion as per journal format .
CO4	To get familiarize with journal reference writing .

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9			
CO1	3	3	3	3	3	3	3	2	2			
CO2	3	3	3	3	3	3	3	2	2			
CO3	3	3	3	3	3	3	3	2	2			
CO4	3	3	3	3	3	3	3	2	2			

COs / PSOs	PSO1	PSO 2	PSO 3							
CO1	3	3	3							
CO2	3	3	3							
CO3	3	3	3							
CO4	3	3	3							

1/2/3 indicates Strength of Correlation 3- High, 2- Medium, 1-Low

Category	Program core	Program elective	Humanities and Social sciences	Open elective	Skill enhancing elective	Interdisciplinary/ Allied	Skill component	Practical/ Project/ Internship	Others			
							✓	✓				

Subject Code: HBBT22I06	Subject Name RESEARCH PUBLICATION	TY/ LB/ ETP/ IE	L	T / S.Lr	P/ R	C
	Prerequisite: All core papers	IE	0	0/0	0/4	2
T/L Theory/Lab L: Lecture T : Tutorial P :Practical/ Project R : Research C: Credits						

Students are supposed to prepare and publish the article based on his/her area of research in peer reviewed referred journal. Code of research publication ethics should be followed. After publishing the article students should present a seminar in presence of department faculties and PG students. At the end of semester viva examination will be conducted by the examiners appointed by the Head of the department.