BACHELOR OF SCIENCE (BIOTECHNOLOGY)

VISION

To nurture the young minds with a potential to innovate, invent and disseminate knowledge for the benefit of the society and environment.

MISSION

To motivate the learners to take up challenging tasks in biotechnology and to prepare for the self-employment through environmental friendly biotechnology enterprises. To innovate and explore novel solutions for the existing problems in the fields of environment, agriculture, animal biotechnology and health sector.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 1: To become potent biotechnologist for industrial sectors.

PEO 2: To develop professional skills through lifelong learning and higher education in their area of interest.

PEO 3: To cater to the needs of the industry and society so as to contribute for the development of the country.

PROGRAMME OUTCOMES (PO)

After completion of the programme, the graduates will be able to

PO 1: Become knowledgeable in the subject of Biotechnology and apply the principles of the same to the needs of the society.

PO 2: Gain analytical skills in the field of Biotechnology.

PO 3: Determine and appreciate professional ethics, community living and Nation building initiatives.

PO 4: Justify societal, health, legal, environmental and Biosafety related issues and understand his/her responsibilities.

PO 5: Analyze, evaluate and invent new processes and products in the field of Biotechnology.

PROGRAMME SPECIFIC OUTCOMES (PSO)

After completion of the programme, the graduates will be able to

PSO 1: Assess and apply the basic concepts of Cell biology, Genetics, Biochemistry, Microbiology, Molecular biology and all the inter-disciplinary domains of Biotechnology.

PSO 2: Assess and apply the basic concepts of Cell biology, Genetics, Biochemistry, Microbiology, Molecular biology and all the inter-disciplinary domains of Biotechnology.

PSO 3: Apply the Contextual knowledge of Biotechnology to function effectively as an individual or a leader in multidisciplinary environments.

PSO 4: Perform procedures as per laboratory standards in all life science related domains.

PSO 5: Synthesis, Compare and evaluate the mechanism involved and employed in life science domains.

REGULATIONS

ELIGIBILITY FOR ADMISSION:

Candidates seeking admission to the first year Degree course shall be required to have passed PUC/12th Std./10+2/its equivalent with at least Biology and Chemistry as two optional subjects.

DURATION OF THE PROGRAMME:

The duration of the course is THREE academic years divided into six semesters under Choice Based Credit System with OBE pattern.

OBJECTIVES OF THE PROGRAMME:

The three-year B.Sc., programme is intended to help the students to be the innovative and versatile personalities in the field of Life Science with quality education and provide the skilled manpower required by Research & Development, Institutions of higher learning and Industrial sectors.

The programme deals with broad area of living things used into technological sector for the betterment of human welfare.

It is designed to develop a sustained interest among the students and enthusiasm to learn and develop the concepts in Biotechnology in logical and stepwise manner.

After completion of the course, the students can able to acquire the necessary theoretical and practical competencies in Biotechnology which enable them to undertake higher studies in recognized Institutions of higher learning and engage gainful self- employment

MAXIMUM DURATION FOR THE COMPLETION OF THE PROGRAMME

The maximum duration for the completion of the UG programme shall not exceed 12 semesters

B.Sc Biotechnology

SCHEME OF EXAMINATION

Subject code	Subject	Hours of Instruction	Exam duration (Hours)	Maximum Marks			Credit Points
				CA	CE	Total	
First semester							
Part I							
24UTAL101/ 24UHIL101/ 24UFRL101	Tamil I/ Hindi I/ French I	5	3	25	75	100	3
Part II							
24UENLA101	English for Arts and Science I	5	3	25	75	100	3
Part III							
24UBTM101	DSC I: Concepts of Cell Biology	5	3	25	75	100	4
24UBTM102	DSC II: Biosafety and Bioethics	4	3	25	75	100	3
24UBTMP101	DSC Practical–I	4	6	40	60	100	2
24UCSBTA101	GEC I: Computer Fundamentals and Artificial Intelligence	4	3	25	75	100	2
24UCSBTAP101	GEC Practical I: Office Automation Techniques	2	3	40	60	100	2
Part IV							
24UVE101	VAC–I:Yoga	1	3	25	75	100	1
Total		**30**				**800**	**20**
Second semester							
Part I							
24UTAL201/ 24UHIL201/ 24UFRL201	Tamil II/ Hindi II/ French II	5	3	25	75	100	3
Part II							
24UENLA201	English for Arts and Science II	5	3	25	75	100	3
Part III							
24UBTM201	DSC III: Microbiology	5	3	25	75	100	4

24UBTM202	DSC IV: Calculations for Biologist	4/3*	3	25	75	100	3
24UCHBTA201	GEC II: Chemistry	4	3	25	75	100	2
24UBTMP201	DSC Practical–II	3	6	40	60	100	2
24UCHBTAP201	GEC Practical II: Chemistry	3	3	40	60	100	2
Part IV							
24UVE201	VAC II-Environmental Studies	1	3	25	75	100	1
25UVE201	VAC: Disaster Management (100% Internal Evaluation)	1*	3	100	-	100	1*
Total		**30**	**900**				**21**
Third Semester							
Part I							
24UTAL301/ 24UHIL301/ 24UFRL301	Tamil III/ Hindi III/ French III	4	3	25	75	100	3
Part II							
24UENLA301	English for Arts and Science III	4	3	25	75	100	3
Part III							
24UBTM301	DSC V: Genetics	5	3	25	75	100	4
24UBCBTA301	GEC III: Biochemistry	4	3	25	75	100	2
24UBTMP301	DSC Practical–III	3	6	40	60	100	3
24UBCBTAP301	GEC Practical III: Biochemistry	3	3	40	60	100	2
Part IV							
24UBTSB301	SEC –I: Mushroom cultivation and Vermitechnology (100% Internal Evaluation)	2/1*	3	100	-	100	2
	MDC–I	2	3	25	75	100	2
24UVE301	VAC III – Understanding India	1	3	25	75	100	1
25UVE301	VAC: Health and Wellness (100% Internal Evaluation)	1*	3	100	-	100	1*

24ULS301	AEC–I: Career Competency Skills I	2	-	100	-	100	1
Total		**30**	**1100**				**24**

Fourth Semester							
Part I							
24UTAL401/ 24UHIL401/ 24UFRL401	Tamil IV/ Hindi IV/ French IV	4	3	25	75	100	3
Part II							
24UENLA401	English for Arts and Science IV	4	3	25	75	100	3
Part III							
24UBTM401	DSC VI: Biophysics and Bio Instrumentation	5	3	25	75	100	4
24UMABTA401	GEC IV:Biostatistics	4	3	25	75	100	2
24UBTMP401	DSC Practical–IV	4	6	40	60	100	3
24UMABTAP401	GEC Practical IV: Statistics (Using MS-Excel)	2	3	40	60	100	2
Part IV							
24UBTSB401	SEC – II: Basics of Research (100%Internal Evaluation)	2	3	100	-	100	2
	MDC–II	2	3	25	75	100	2
24UVE401	VAC IV–Digital and Technological Solutions	1	3	25	75	100	1
24ULS401	AEC–II: Career Competency Skills II	2	-	100	-	100	1
	Total	**30**				**1000**	**23**
Fifth Semester							
Part III							
24UBTM501	DSC VII: Molecular Biology	5	3	25	75	100	4
24UBTM502	DSC VIII: Immunology	5	3	25	75	100	4
24UBTM503	DSC IX: Industrial Biotechnology	5	3	25	75	100	4

24UBTM504	DSC X: Plant Tissue Culture Technology	5	3	25	75	100	4
24UBTEL501	DSE I:Bioinformatics	4	3	25	75	100	4
24UBTEL502	DSE I: Stem Cell Biology						
24UBTEL503	DSE I: NanoBiotechnology						
24UBTMP501	DSC Practical–V:	3	6	40	60	100	3
24UBTI501	Internship (100% Internal Evaluation)	-	-	100	-	100	2
Part IV							
24UBTSB501	SEC–III: Entrepreneurial Biotechnology	2	3	25	75	100	2
24ULS501	AEC– III: Career Competency Skills III	1	-	100	-	100	1
Part V							
24UBTE501	Extension Activity	-	-	-	-	-	2
	Total	**30**				**900**	**30**
Sixth Semester							
Part III							
24UBTM601	DSC XI: Recombinant DNA Technology	5	3	25	75	100	5
24UBTM602	DSC XII: Environmental Biotechnology	5	3	25	75	100	4
24UBTM603	DSC XIII: Basics of Animal Cell Culture Techniques	5	3	25	75	100	5
24UBTEL601	DSE II– Medical Biotechnology	4	3	25	75	100	4
24UBTEL602	DSE II– Food Biotechnology						
24UBTEL603	DSE II: Corporate Biotechnology						
24UBTMP601	DSC Practical-VI	3	6	40	60	100	3
24UBTPR601	Project and Viva Voce	5	-	40	60	100	4
Part IV							
24UBTSB601	SEC-IV: IPR for Life Science	2	3	25	75	100	2
24ULS601	AEC– IV: Career Competency Skills IV	1	-	100	-	100	1
	Total	**30**				**800**	**28**

Grand Total	**5500**	**146**

SKILL ENHANCEMENT COURSE (SEC)

The Department offers the following subjects as skill enhancement course to our students

S.No	Semester	Subject Code	Subject
1.	III	24UBTSB301	SEC – I: Mushroom cultivation and Vermitechnology
2.	IV	24UBTSB401	SEC–II: Basics of Research
3.	V	24UBTSB501	SEC–III: Entrepreneurial Biotechnology
4.	VI	24UBTSB601	SEC-IV: IPR for Life science

DISCIPLINE SPECIFIC ELECTIVE COURSE (DSE)

The Department offers the following subjects during V and VI semesters as Elective Courses. The students can opt anyone subject as their Elective Course in the respective semester.

S.No	Semester	Subject code	Subject
1.	V	24UBTEL501	DSE I: Bioinformatics
		24UBTEL502	DSE I: Stem Cell Biology
		24UBTEL503	DSE I: NanoBiotechnology
2.	VI	24UBTEL601	DSE II–Medical Biotechnology
		24UBTEL602	DSE II–Food Biotechnology
		24UBTEL603	DSE II: Corporate Biotechnology

MULTI-DISCIPLINARY COURSE (MDC)

The Department offers the following two subjects during III and IV

semesters as Multi Disciplinary Courses for the students of other departments.

S.No	Subject Code	Semester	Subject	NPTEL Course	Duration / Credits
1.	**24UBTNM301**	III	Medicinal herbs	Biotechnology	12 weeks / 2 Credits
2.	**24UBTNM401**	IV	Fundamentals of Biotechnology	Biotechnology	12 weeks / 2 Credits

INTERNAL CREDIT TRANSFER SCHEME

The equivalent credits earned by completion of MOOC (NPTEL/SWAYAM) courses can be used to SEC courses provided by the department. However, the equivalent MOOC Course must be completed during the earlier semester of the offered SEC Course.

S.No	Semester IV& V	
1.	ACC -MOOC Courses offered in SWAYAM/ NPTEL/ CEC etc.,	COMPLETED STUDENTS GET EXTRA 2 CREDITS

Abbreviations:

DSC: Discipline Specific Course
DSE: Discipline Specific Elective Course GEC: Generic Elective Course
SEC: Skill Enhancement Course
MDC: Multi-Disciplinary Course
VAC: Value Added Course
AEC : Ability Enhancement Course ACC : Additional Credit Course

FOR COURSE COMPLETION

Students should complete

- Language subjects (Tamil/Hindi/French) in semesters I, II, III and IV.
- Language subject English offered in semesters I, II, III and IV
- Value Education offered in semesters I, II, III and IV.
- GEC subjects offered in semesters I, II, III and IV.

- Skill Enhancement Courses offered in semesters III, IV, V and VI.
- Multidisciplinary courses offered in semesters III and IV
- Ability Enhance Courses offered in semesters III, IV, V and VI.
- Discipline Specific Elective Courses offered in fifth and sixth semesters. Students can choose any one out of three courses.
- Extension activity offered in semester V.
- The summer internship was offered in the V semester (100% Internal Evaluation).
- Project and Viva-Voce in VI semester.

TOTAL MARKS AND MARK DISTRIBUTION

Component	Subject	No of Course x Marks	Total Marks	Papers x Credits	Cumulative Credits
Part I	Language	4x100	400	4x3 Credits	12
Part II	English	4x100	400	4x3 credits	12
Part III	DSC Theory	2x100	200	2x5 credits	10
		9x100	900	9x4 credits	36
		2x100	200	2x3 credits	06
	DSC Practical	2x100	200	2x2 credits	04
		4x100	400	4x3 credits	12
	DSE	2x100	200	2x4 credits	08
	GEC Theory	4x100	400	4x2 credits	08
	GEC Practical	4x100	400	4x2 credits	08
	Project & Viva-voce	1x100	100	1x4 credits	04
	Summer Internship	1x100	100	1x2 Credits	02
Part IV	SEC	4x100	400	4x2 credits	08
	MDC	2x100	200	2x2 Credits	04
	VAC	4x100	400	4x1 Credits	04
	AEC	4x100	400	4x1 Credits	04
Part V	Extension Activity	-	-	1x2 Credits	02
Total		**53**	**5300**		**144**

24UTAL101	**nghJj;jkpo; - I**	**□□□□□□ - I**

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- jw;fhy ,yf;fpa tiffis khzth;fSf;Ff; fw;gpj;jy;
- fhye;NjhWk; jkpo; ftpij tsh;rprp epiyfs; kw;Wk; rpWfijfis mwpKfg;gLj;Jjy;.
- ehl;Lg;Gw ,yf;fpaq;fspd; top tho;f;if $WfisAk;> ,yf;fpak;> ,yf;fzj;jpy; rpwg;GfisAk; czh;j;Jjy;.

Credits: 3 **Total Hours: 50**

UNIT	**CONTENTS**	**Hrs**	**CO**
I	ftpijfs; m) nghz; fz;zf p– fhyk; khwpg;Nghr;R M) mwpTkjp – (Njh;e;njLf;fg;gl;l 30 ftpij – Gy;ypd ;Edpapy; gdpj;Jspi`f;$ftpijfs;) ,) ituKj;J–kuq;fisg;ghLNthk; <) rpw;gp–mq;fPfhpf;fglhj fhjy;	10	**CO1**
II	rpWfijfs; m) GJikg;gpj;jd; - flTSk; fe;jrhkpgps;isAk; M) Mz;lhs; gphpajh;\pdp–khj;jpiu ,) Gypf;fiyQd; - mNrhfkpj;jpud; <) uh[h te;jpUf;fpwhh; - F.mofphprhkp	10	**CO2**
III	ehl;Lg;Gwtpay; - ghly;fs;>tpisahl;Lfs; m) jhyhl;Lg;ghly;fs; - jhapd; fdTfs; M) fhjy; ghly;fs; - fpspak;kh>fUj;jGs;s. ,) njhopy; ghly;fs; - fisnaLg;G <) xg;ghhpghly;fs; c) rpWth;> rpWkpah; tpisahl;L– Mlth;> kfsph; tpisahl;Lfs;	10	**CO3**
IV	,yf;fpa tuyhW m) kuGf;ftpij Njhw;wk; tsh;r;rp M) GJf;ftpij Njhw;wk; tsh;r;rp ,) rpWfij Njhw;wk; tsh;r;rp <) ehl;Lg;Gwtpay;> ghly;fs;> tpisahl;Lfs; mwpKfk;	10	**CO4**
V	,yf;fzk; - nghUs; ,yf;fzk; m) gFgj cWg;gpyf;fzk; M) gpwnkhopr; nrhw;fis jkpo; nrhw;fshf khw;Wjy; ,) mfj;jpiz> Gwj;jpiz	10	**CO5**

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1.jkpo;j;Jiw ntspaPL

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jkpoz;zy;>Gjpa Nehf;fpy; jkpo; ,yf;fpa tuyhW> kPdhl;rp Gj;jf epiyak;> kJiu– 2017.
ituKj;J ftpijfs;> ituKj;J gjpg;gfk; jpUkfs; epiyak;.

COURSE OUTCOMES (CO)

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CO1	ftpijfspd; rpwg;Gfis $Wjy;
CO2	rpWfijfspd; jd;ikfis $Wjy;
CO3	ehl;Lg;Gw ,yf;fpaq;fspd; top tho;f;if $Wfis mwpjy;
CO4	,yf;fpa tuyhw;wpd; Njhw;w tsh;r;rpid mwpjy;
CO5	mbg;gil ,yf;fzj;ij mwpjy;.

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**
CO2	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**
CO3	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**
CO4	**H**	**L**	**L**	**L**	**L**	**L**	**H**	**M**	**M**	**M**
CO5	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**

H – High; M – Medium ; L - Low

Prepared By
(Course Coordinator)

Approved By
(BoS Chairman)

24UENLA101	ENGLISH FOR ARTS AND SCIENCE -I	SEMESTER–I

Course Objectives:

The course aims,

- To develop strategies and skills to enhance the ability to read and comprehend technical texts.
- To foster ability to write convincing job applications and effective reports.
- To develop speaking skills to make technical presentations, participate in impromptu speeches.
- To strengthen listening skill this will help them comprehend lectures and talks in their areas of specialization.

Credits:3 **Total Hours:50**

UNIT	CONTENTS	Hrs	CO
I	**1. Listening** a. Listening- short texts- short formal and informal conversations **2. Speaking** a. Pair work and small group work **3. Reading** a. Reading Newspaper Article **4. Writing** a. Purpose statements b. Check lists c. Instructions **5. Grammar**: Sentence and Noun a. Sentences-Kinds of Sentences b. Sentence Patterns c. Classification of Noun **6. Vocabulary in Context** a. Synonyms & Antonyms b. Compound words.	10	CO1
II	**1. Listening** Listening to science invention talks and completing exercises based on them **2. Speaking** Asking for and giving directions	10	CO2

	3. Reading Reading longer technical texts-identifying the various transitions in a text **4. Writing** a. Developing a story with pictures b. Paragraph writing **5. Grammar**: Pronouns and Adjectives **a.** Pronouns: Types of Pronouns b. Types of Adjectives, Correct use of Adjectives, Position of Adjectives **6. Vocabulary in Context** a. Single word substitute b. Phrasal verbs		
III	**1. Listening** Listening to documentaries and making notes **2. Speaking** Mechanics of presentations **3. Reading** Longer texts both general and technical practice in speed reading **4. Writing** a. Job application – Cover Letter –Resume preparation b. Note-Making **5. Grammar**: Verb and Adverb **a.** Types of Verbs: Finite and Non-Finite Verbs b. Strong and Weak Verbs **c.** Primary and Modal Auxiliary Verbs d. Adverb-Kinds of adverbs **6. Vocabulary in Context** a. Different forms and use of words b. Cause and Effect words	**10**	**CO3**
IV	**1. Listening** Listening to broadcast and telecast from Radio and TV **2. Speaking** Giving impromptu talks	**10**	**CO4**

	3. Reading Reading–Critical reading **4. Writing** Creative writing, Poster making **5. Grammar**: Prepositions, Conjunction and Interjection **6. Vocabulary in Context** a. Use of abbreviations and acronyms b. Mis spelt words		
V	**1. Listening** Listening to different accents. **2. Speaking** a. Role-play b. Simulation **3. Reading** Making inference from the reading passage **4. Writing** Precis Writing **5. Grammar**: Voice **6. Vocabulary in Context** Lexical items(fixed/semi fixed expressions)	**10**	**CO5**

Reference Books	
1.	Technical Communication–Principles and Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ.Press, 2016, New Delhi.
2..	A Course Book on Technical English By Lakshminarayanan, Sci tech Publications (India) Pvt. Ltd
Web sources	
1	https://www.cambridgeenglish.org/why-choose-us/
2	https://ieeexplore.ieee.org/Xplore/home.jsp
3	https://www.acronymfinder.com/

COURSE OUTCOMES (CO)

On completion of this course, the students should be able to

CO1	Develop the ability to listen to a conversation in English
CO2	Demonstrate confidence and proficiency in communication.
CO3	Analyze and restate the meaning of a text in English
CO4	Deliver impactful presentations.
CO5	Ability to speak clearly in standard academic English

Prepared By
(Course Coordinator)

Approved By
(BoS Chairman)

24UBTM101	**DSC I: CONCEPTS OF CELLBIOLOGY**	**SEMESTER-I**

Course Objectives:

To study the basic concepts and functions of cells and their organelles.

Credits:5 **Total Hours: 50**

UNIT	CONTENT	Hrs	CO
I	**Cells as a basic unit of living systems:** the cell theory, Origin and Evolution of Cell, Diversity of Cell size and shape – classification, structure and function of Prokaryotic and Eukaryotic cell, Comparison of microbial, plant and animal cells.	**08**	**CO1**
II	**Structure and functions:** cell wall, plasma membrane, Mitochondria, Endoplasmic reticulum, Chloroplast, plastids, vacuoles, Peroxisomes (Glyoxysomes), Lyzosome and ribosomes, Golgi apparatus, Biogenesis of mitochondria and chloroplast.	**12**	**CO2**
III	**Nuclear ingredients:** Nuclear Membrane, Nature of the genetic material, Histone proteins. DNA Packaging in Eukaryotic cells, Structure and ultra – structure of Chromosome. Heterochromatin and euchromatin, polytene chromosomes.	**10**	**CO3**
IV	**Cytoskeleton and cell motility:** Microtubules, microfilaments and Intermediate elements, Cell Locomotion; Amoeboid, Flagella, Cilia and Cytoplasmic streaming.	**08**	**CO4**
V	**Overview of Cell Cycle –** steps in cell cycle, cell cycle check points. Mitosis and Meiosis. **Cell death**- types- Necrosis and apoptosis (Regulatory aspects not needed), **Stem cells –** definition and types. Prions. Endocytic pathways– endocytosis, phagocytosis; Membrane trafficking.	**12**	**CO5**
Text Book			
1	*Gupta,P.K, and JangirM.L.*,2003.Cell Biology: Fundamentals and Application. Student Edition, India.		
Reference Books			
1 2 3	*Geoffrey M.Cooper and HausmanR.E.*2007.The Cell-A Molecular Approach. [Fourth Edition]. ASM Press, Washington, D.C. *Sadava, D.E*. 2004. Cell Biology: Organelle Structure and Function. Reprint, [First Edition]. Panima Publishing Corp., India. *Karp G*. 2007. Cell and Molecular Biology: Concepts and Experiments. [Fourth Edition]. John Wiley and Sons, INC, New York.		

4	*Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter*.2002.Molecular Biology of the Cell. [Fourth Edition]. New York: Garland Science.		
5	*David Baltimore, Harvey Lodish*.2002. Molecular Cell Biology. [Fourth Edition]. Hardcover Publisher: W H Freeman & Co.		

COURSE OUTCOMES (CO)

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

CO1	Explain the cell and its classification system.
CO2	Demonstrate the basic cellular organelles those constitute the cells.
CO3	Gain knowledge about the nuclear ingredients and its arrangements
CO4	Explain the cytoskeleton system and motility of the cell
CO5	Illustrate the process of cell cycle, Gametogenesis, Fertilization, Early Embryonic Development and Cell death.

Mapping

CO PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	H	H	H	H	H	H	H	H
CO2	M	H	H	H	H	H	H	H	H	H
CO3	H	M	H	H	H	H	M	H	H	H
CO4	H	H	M	M	H	M	H	M	H	H
CO5	H	H	H	H	M	M	H	H	M	H

High; M-Medium; L-Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBTM102	DSC II: BIOSAFETY AND BIOETHICS	SEMESTER-I

Course Objectives:

- To develop the student skills to work in the laboratory and to learn the basic ethics.
- To acquire the basic knowledge on about the laboratory chemicals, containment and issues regarding the DNA.

Credits:3 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Biosafety:** Definition of Biosafety. Biosafety for human health and environment, Good Laboratory Practices (GLP), Social and ethical issues.	08	CO1
II	**Risk and risk assessments,** Biosafety level, Basic laboratory, Laboratory design, General guidelines for r-DNA research Activities–containment facilities and Biosafety practices.	08	CO2
III	Guidelines for research in transgenic plants and animals and its applications. Use of genetically modified organisms and their release into the environment.	08	CO3
IV	Environmental safety of genetically modified organisms, Special procedures for r-DNA based products, safety issues in genetically modified foods and organisms.	08	CO4
V	**Bioethics in Biotechnology** - Society, Risks, Ethics. ELSI of Biotechnology, Genetic modifications – recombinant foods, Recombinant therapeutic products for human health care.	08	CO5

Reference book

1 *Satheesh,M.K.*2011. **Bioethics and Biosafety**. I.K.International, New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Gain knowledge about the Biosafety and its uses for environment and human health.
CO2	Identify the risk in laboratory and extend the knowledge on rDNA research.
CO3	Use genetically modified organisms
CO4	Illustrate about rDNA – based products.
CO5	Describe about bioethical issues.

MAPPING

PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	H	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H	H	H	H
CO3	H	M	H	H	H	M	H	H	H	H
CO4	M	H	M	M	H	H	M	M	H	H
CO5	H	M	H	H	M	M	H	H	M	H

H-High; M-Medium; L-Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBTMP101	DSC PRACTICAL-I	SEMESTER-I

Course Objectives:

The Course aims

- To identify the structure, properties and stages of cell division.
- To learn the steps involved in microscopy.
- To acquire the concepts of staining.

Credits:2 **Total Hours: 48**

S.No	EXPERIMENT	Hrs	CO
1.	Introduction to Laboratory Guidelines and Laboratory Safety	04	CO1
2.	Operation and Maintenance of Microscope	04	
3.	Micrometry	04	CO2
4.	Haemocytometer–Yeast cell counting	04	
5.	TS of Stem, Root and Leaf	04	CO3
6.	Mitosis	04	
7.	Meiosis	04	
8.	Mounting Buccal Epithelium	04	CO4
9.	Observation of Cyanobacteria – Wet mount preparation	04	
10.	Simple staining of Bacterial cell and DPX mount	04	CO5
11.	Chironomous–Salivary gland chromosome – squash preparation	04	
12.	Stains used in cell biology – Monochrome and Differential staining	04	

Reference Book

1	*Aneja,K.R.* 2003.Experiments in Microbiology, Plant pathology and Biotechnology.[Fourth Edition]. New age international.

Prepared By
(Course Coordinator)

Approved By
(BoS Chairman)

24UCSBTA101	**GEC I:COMPUTER FUNDAMENTALS AND ARTIFICIAL INTELLIGENCE (For the students of B.Sc.,Biotechnology)**	**SEMESTER-I**

COURSE OBJECTIVES:

The subject aims to

- To enable students to be familiar with fundamental knowledge of computers.
- To provide knowledge and essential skills for using the office programs separately such as MS Word, MS Excel, and MS Power Point.
- To Understand the basics of Artificial Intelligence.

Credit Points:2 **Total Hours:50**

UNIT	CONTENTS	Hrs	CO
I	**Introduction to Computers:** History and Generations of Computers- Characteristics of Computers - Applications of Computers – Classification of Computers - Organization of Computer System - Computer Hardware- Computer Memory and Storage: What is Computer's Memory? (Main Memory) -Read Only Memory - Auxiliary Memory-The Input – Output Media: Inputs and Outputs: CRT Monitors - Flat Panel Monitors –Key boards – Graphics and Graphical Terminals-Printers.	10	CO1
II	**Introduction to Microsoft Office Word 2007:** Working with Documents in Microsoft Word 2007 - Saving the File-Formatting the Text – Alignment of Text- Applying Fonts - Spell Checking-Consulting Thesaurus-Assign a Character Style -Borders and Shading – Closing of the File Save as Option -Printing your Document – Editing the Document - Editing Tools-Auto Correct – Auto Format – Find and Replace -Find – Replace Text – Page Numbering. Header and Footer – Foot Notes and End Notes – Splitting Panes-	10	CO2

	Tiling of the Document -Using Mail Merge in Word 2007- Opening Screen of Microsoft Word Screen.		
III	**Introduction to Microsoft Office Excel 2007:** Understanding Spread sheets- Creating a Work sheet in Excel 2007- Copying Formula - Formulas that Make Decisions - Styles – Functions in Excel – Using Auto calculate - References- Sum Function- Average Function- Creating Charts in Excel-Auditing a Workbook- Comments Inserting - Outlines-Worksheet Fitting on a Page-Function Wizard- Goal Seeking – Scenarios Manager-Creating a Pivot Table Report-Typing with AutoFill-Formatting Numbers and Labels-Changing the Size of Rows and Columns-Adding and Deleting Rows and Columns-Inserting (and Removing) Page Breaks-Applying Themes-Add or Remove a Sheet Background – Convert Text to Columns – Protect Worksheet or Workbook Elements-Functions in Excel.	**10**	**CO3**
IV	**Working with Microsoft Office Power Point 2007:**Creating Presentation from Template – Creating a New Presentation - Power Point Views-Entering the Text- Moving the Text-Changing the Color – Adding Graphics to a Slide- Reordering Slides-Duplicating Slides-Deleting Slides-Adding a Animated Cartoon to a Slide-Adding Slide Transitions -Adding Text Transitions - Viewing a Presentation – Making Slide Shows – Hiding a Slide - Notes, Hand outs and Masters for Presentation – Packing Presentation to Go – Add a Caption to a Picture in a Photo Album - Overview of Creating a Photo Album - Add a Picture to a Photo Album - Change the Appearance of a Picture in a Photo Album.	**10**	**CO4**

V	**Introduction:** Definitions of Artificial Intelligence –Artificial Intelligence problems –Topics of Artificial Intelligence– Timelines of Artificial Intelligence - Branches of Artificial Intelligence–Applications of Artificial Intelligence.	**10**	**CO5**
TEXT BOOKS:			
1	*Atul Kahate.*2008**. Information Technology. [**Third Edition].Tata McGraw-Hill Edition Ltd, New Delhi.(UNIT I)		
2	Law Point.2008. **Microsoft Office 2007**. [First Edition]. Ashok Lodha Publication, Kolkata.(UNIT II, III and IV).		
3	*Tom Taulli,*2019.**Artificial Intelligence Basics – A Non-Technical Introduction**, A Press.(UNITV)		
REFERENCE BOOKS:			
1	*Anita Goel*.2010.**Computer Fundamentals.** [First Edition].Pearson Publications **2007**. Dream tech Press, New Delhi.		
2	*Pradeep K. Sinha, Priti Sinha*. 2016.[Fourth Edition].**Computer Fundamentals**. BPB Publications		
3	*J.B Dixit. 2011[Kindle Edition].***Fundamentals of Computer Program and Information Technology.** Laxmi Publishers		
4	*Lisa A.Bucki, John Walkenbach, Faithe Wempen, Micheael Alexender, Dick Kusleika. 2013*. Reprint. **Microsoft Office 2013 Bible.** Wiley Publications		
5	*John Walkenbach.2010.*Reprint. **Microsoft Excel 2010 Bible**. Wiley India Pvt. Limited		
6	*Tracy Syrstad.2015.[First Edition].* ***Excel 2013 Absolute Beginners Guide****. Pearson Publications*		
WEB REFERENCES:			
1	https://www.tutorialspoint.com		
2	https://www.free-computer-tutorials.net		
3	https://www.edu.getglobal.org		
4	https://www.w3schools.com		

COURSE OUTCOMES (CO):

On successful completion of this course, the student will be able to

CO1	Explore the fundamental components of computer.
CO2	Create well defined documents with various tools in MS-Word.
CO3	Interpret the various formula, functions and chart preparations in MS -Excel.
CO4	Understand basic Powerpoint using templates, animations and slide transitions.
CO5	Understand the basics of Artificial Intelligence.

MAPPING:

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	M	M	M	M	H
CO2	M	M	M	M	H
CO3	M	M	M	M	H
CO4	M	M	M	H	H
CO5	M	M	M	M	H

H– High; M– Medium ;L-Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UCSBTAP101	**GEC PRACTICAL I: OFFICE AUTOMATION TECHNIQUES (For the students of B.Sc.,Biotechnology)**	**SEMESTER-I**

COURSE OBJECTIVES:

The subject aims

- To acquire basic concepts of MS-Word and its applications.
- To understand importance of MS-Excel in real time applications.
- To apply the role of Power Point for the current needs.

Credit Points:2 **Total Hours: 36**

S.No.	PROGRAMS	Hrs	CO
INTERNET			
1	Creating E-mail ID and Working with Basic Options.	**3**	**CO1**
	MS– Word		
2	Creating a Personal Profile.	**3**	**CO1**
3	Designing a Document for Lab Requirements using following options • Font styles. • Page layout, Page Setup (Setting Margins, Changing Page Size, Changing Page Orientation and Applying Page Background). • Table.	**3**	**CO2**
4	Creating a Document for topic presentation with following options • Single and Double Column. • Page numbers. • Headers and Footers. • Date and time, Pictures and Shapes.	**3**	**CO2**
5	Mail Merge–Invitation to Multiple Recipients for Conducting Seminar in the Department.	**3**	**CO2**
	MS-Excel		
6	Entering Data for Stock Analysis and Formatting the Cells.	**3**	**CO3**

7	Working with Sorting and Filtering.	**3**	**CO3**
8	Creating a Chart for an Experiment with sample data.	**3**	**CO3**
9	Stock Maintenance for Lab Equipment.	**3**	**CO3**
MS-PowerPoint			
10	Creating a Presentation for the given topic.	**3**	**CO4**
11	Creating a Presentation for the Department Profile.	**3**	**CO4**
12	Creating a Presentation with Animation.	**3**	**CO5**
WEBREFERENCES:			
1.	https://www.tutorialspoint.com		
2.	https://www.free-computer-tutorials.net		
3	https://www.edu.getglobal.org		
4	https://www.w3schools.com		

COURSE OUTCOMES (CO):

On successful completion of this course, the student will be able to

CO1	Create professional and academic documents by applying different formats and styles.
CO2	Effectively utilize the table and Mail Merge concepts.
CO3	Create, edit and enhance basic Excel spread sheet using formula and charts.
CO4	Understand basic power point using templates, animations and slide transitions.
CO5	Create and manipulate slides with text and graphics.

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UVE101	VAC I: YOGA	SEMESTER-I

Course Objectives:

The course aims

- To understand physical body and Health concepts
- To have the basic Knowledge on Simplified Physical Exercises, Asanas and Meditation
- To Introspect and improve the behaviors
- To inculcate cultural behavioral patterns

Credits: 1 **Total Hours: 15**

UNIT	CONTENTS	Hr	CO
I	**Yoga and Physical Health:** Health- Meaning and Definition- Physical Structure-Three bodies -Five limitations-Simplified Physical Exercises- Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana 1,2, Massage, Acupressure, Relaxation exercises – Yogasanas – Surya namaskar.	3	CO1
II	**Greatness of Life Force and Mind:** Maintaining youthfulness - Postponing the ageing process - Sex and spirituality - Significance of sexual vital fluid – Married life –Chastity - Development of mind in stages –Mental Frequencies –Methods for Concentration.	3	CO2
III	**Personality Development–** Sublimation: Purpose and Philosophy of Life - Introspection – Analysis of Thought – Moralization of Desire – Analysis and practice – Neutralization of Anger.	3	CO3
IV	**Human Resources Development:** Eradication of Worries –Analysis and Eradication practice - Benefits of Blessings – Effect of good vibrations - Guidance for good Friendship –Individual Peace and world peace.	3	CO4
V	**Law of Nature: Unified force** - Cause and effect system - Purity of thought Deed and Genetic Centre – Love and Compassion - Gratitude- Cultural Education- Five fold culture.	3	CO5

Text Book

1.	**Value Education**-World Community Service centre, Vethathiri Publications, Erode.

Reference Books

1	*Vethathiri Maharishi*, 2011, Journey of Consciousness, Erode, Vethathiri Publications.
2	*VethathiriMaharishi*,2022, Simplified Physical Exercises, Erode, Vethathiri Publications.
3	*Vethathiri Maharishi*, 2004,Unified force, Erode, Vethathiri Publications

4	Yoga for Modern age – Thathuvagnani Vethathiri Maharishi
5	Sound Health through yoga –Dr.K.Chandrasekaran, November 1999 Prem Kalyan Publications, Madurai
6	Light on yoga - BKS. Lyenger
7	Thathuvagnani Vethathiri Maharishi – Kayakalpa yoga– First Edition 2009 Vethathiri Publications, Erode.
8	Environmental Studies- Bharathidasan University Publication Division

COURSE OUTCOMES (CO)

After completion of the course, the student will be able to

CO1	Understand the physical structure and simplified physical exercises.
CO2	Nurture the life force and mind
CO3	Introspect and improve the moral values
CO4	Realize the importance of human resources development
CO5	Enhance purity of thought and deed

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UTAL201	**nghJj;jkpo; - II**	**□□□□□□ - II**

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- Ik;ngUq;fhg;gpaq;fspd; %yk; goq;fhg;gpa epfo;Tfs; kw;Wk; mikg;G Kiwfis vLj;Jiuj;jy;.
- gpwfhg;gpaq;fs; %yk; tuyhw;W epfo;Tfis khzth;fSf;F mwpKfk; nra;jy;
- rpw;wpyf;fpaq;fspy; top tho;tpay; Kiwia czh;j;Jjy;

Credits: 3 **Total Hours: 50**

UNIT	*CONTENTS*	Hrs	CO
I	rpyg;gjpfhuk; - tof;Fiu fhij kzpNkfiy–kyh;tdk; Gf;f fhij	**10**	**CO1**
II	**Gpw fhg;gpaq;fs;** m) fk;guhkhazk; - thyptij glyk; M) nghpaGuhzk; - ,isahd;Fbkhw ehadh; Guhzk;	**10**	**CO2**
III	**rpw;wpyf;fpaq;fs;** m) fypq;fj;Jg;guzp–Nghh; gbahJ M) Fw;whyf; FwtQ;rp–kiytsk;	**10**	**CO3**
IV	m) fhg;gpaj;jpd; Njhw;wk; tsh;r;rp – Ik;ngUk ;fhg;gpaq;fs;> IQ;rpW fhg;gpaq;fs; - mwpKfk; M) rpw;wpyf;fpak; Njhw;wk; tsh;r;rp	**10**	**CO4**
V	**,yf;fzk;** m) MFg;ngah; M) kaq;nfhypr;nrhw;fs; - 8 (u>w NtWghLfs;) ,) mYtyfk; rhh;e;j fbjq;fs;> kDf;fy; vOJjy;	**10**	**CO5**

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1.jkpo;j;Jiw ntspaPL

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jkpoz;zy;> Gjpa Nehf;fpy; jkpo; ,yf;fpatuyhW> kPdhl;rp Gj;jf epiyak;> kJiu – 2017.
rpyg;gjpfhuk; –GypA+h;Nfrpfd;> ghhp epiyak;> nrd;id– 2015.
fypq;fj;Jg;guzp–rhujh gjpg;gfk;> nrd;id- 2021.

COURSE OUTCOMES (CO)

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CO1	fhg;gpaq;fspd; rpwg;Gfis mwpjy;
CO2	Gpw fhg;gpaq;fspd; jd;ikfis mwpjy;
CO3	rpw;wpyf;fpaq;fs; gw;wpmwpjy;
CO4	fhg;gpaq;fs;> rpw;wpyf;fpaq;fspd; Njhw;wk;> tsh;r;rpapid mwpjy;
CO5	fbjk; vOJjy;> ,yf;fzk; gw;wp mwpjy;

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**
CO2	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**
CO3	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**
CO4	**H**	**H**	**H**	**H**	**H**	**L**	**H**	**M**	**M**	**M**
CO5	**H**	**L**	**L**	**L**	**L**	**H**	**H**	**M**	**M**	**M**

H– High; M– Medium ;L-Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UENLA201	ENGLISH FOR ARTS AND SCIENCE - II	SEMESTER–II

Course Objectives:
The course aims,

- To develop strategies and skills to enhance ability to read and comprehend technical texts.
- Tofosterabilitytowriteconvincingjobapplicationsandeffectivereports.
- To develop speaking skills to make technical presentations, participate in group discussions.
- Tostrengthenlisteningskillthiswillhelpthemtocomprehendlecturesand talks in their areas of specialization.

Credits:3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**1. Listening** Listening- Listening to talks of a scientific/technical nature and completing information **2. Speaking** Role–play on Scientific invention **3.Reading** Reading short technical texts from journals **4. Writing** - Purpose statements -Dialogue writing Scientific inventions/Technology **5.Grammar& Vocabulary in Context:** a. Present Tense (simple and progressive)/Past Tense (Simple and progressive) b. Question types: Wh /Yes or No/and Tags. c. Synonyms & Antonyms, One word substitution.	**10**	**CO1**
II	**1. Listening** a.Listening to two talks/lectures by specialists on selected subject specific topics - (TED Talks) and answering comprehension exercises (inferential questions) **2.Speaking:** a.Small group discussions (the discussions can be based on the listening and reading passages- open ended questions. **3. Reading** Reading biographies, travelogues,	**10**	**CO2**

	4. Writing a. General Essay on Scientific/technical topics b. Short Report on an event (field trip etc.) **Grammar & Vocabulary in Context** a. Present tense and past tense (Perfect) b. Subject – Verb Agreement; c. Word forms (prefixes & suffixes) d. Phrasal verbs.		
III	**1.Listening** a. Listening for Product description b. Process description **2.Speaking** a. Describing process b. Continuing discussions with connecting ideas **3. Reading** Reading advertisements, gadget review user Manuals. **4. Writing** Writing emails/Report writing **Grammar & Vocabulary in Context:** a. Present Tense & Past Tense (Perfect continuous) b. Synonyms & Antonyms, One-word substitution	**10**	**CO3**
IV	**1. Listening** Giving and responding to opinions **2. Speaking** Opinion sand facts. **3. Reading** Newspaper articles; Journal reports **4. Writing** a. Hints Development b. Recommendations c. Extracting information from info graphics (charts and graph) **Grammar & Vocabulary in Context:** a. Voice (showing the relationship between Tenses and Voices) b. Collocations; Fixed/Semi fixed expressions.	**10**	**CO4**

V	**1. Listening** Listening to factual and abstract information. **2. Speaking** Group Discussion **3. Reading** Reading Editorials; and Opinion Blogs **4. Writing** Drafting advertisement **Grammar & Vocabulary in Context:** a. Punctuation b. Negation (Statements & Questions) c. Cause & Effect Expressions –Content vs Function words.	**10**	**CO5**
Reference Books			
1	Technical Communication–Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.		
2..	A Course Book On Technical English By Lakshminarayanan, Sci tech Publications (India) Pvt. Ltd		
WebSources			
1	https://www.linkedin.com/learning/		
2	https://www.ego4u.com/		
3	https://www.grammarly.com/		

COURSE OUTCOMES (CO)

On completion of this course, the students should be able to

CO1	Develop the ability to listen to a conversation in English
CO2	Demonstrate confidence and proficiency in communication.
CO3	Analyse and restate the meaning of a text in English
CO4	Deliver impactful presentations.
CO5	Ability to speak clearly in standard academic English

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBTM201	**DSC III: MICROBIOLOGY**	**SEMESTER-II**

Course Objectives:

The Course aims to learn the basics of Microbiology and to acquire

The basic knowledge on staining, sterilization and antimicrobial chemotherapy.

Credits:5 **Total Hours:50**

UNIT	CONTENTS	Hrs	CO
I	Definition of Microbiology– Scope and Branches of Microbiology–**Contributions**– Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch, Alexander Fleming. Classification of microorganisms – Three kingdom concept and Whittaker's five kingdom concept and Molecular taxonomy.	**10**	**CO1**
II	**Microscopy–**Simple and compound microscope, Dark field microscope, Phase contrast microscope, Fluorescence microscope, Electron microscope, Confocal microscope. **Principles and types of stain**–Simple stain, differential stain – Cell wall of Gram positive and Gram-negative bacteria and principle of Gram staining, Endospore & Capsular Staining.	**10**	**CO2**
III	**Media preparation**–Liquid media, Solid Media, Selective Media, enriched, enrichment and Differential Media; **Isolation Of pure culture** – Pour, Spread plate and Streak plate methods.	**10**	**CO3**
IV	**Sterilization–**Principles–dry heat–moist heat–Radiation– UV rays – gamma rays Filtration-Depth, membrane and HEPA, ULFA filters. Disinfection and disinfected agents – Alcohol, Aldehydes, Phenol.	**10**	**CO4**

V	Bacterial Growth curve, bacteriostatic, bactericidal and fourth generation antibiotics, Antimicrobial chemotherapy-mode of action - cell wall, Protein and nucleic acid synthesis inhibitors-antibiotic susceptibility test–Kirby-Bauer & Stokes methods.	**10**	**CO5**

Text Books	
1	Pelczar M. J. Jr., Chan E.C.S. and Krieg N. R. (2010). Microbiology: An application based Approach. McGraw-Hill Education (India) Private Limited, New Delhi, India.
2	Dubey R. C. and D. K. Maheshwari. (2012). A textbook of Microbiology. S Chand and Company. New Delhi, India
3	.Kapoor K. K., Tauro P. and Yadav K. S. (2016). An Introduction to Microbiology. New Age International (P) Limited, New Delhi, India
Reference Books	
1	Klein D. A., Harley J. P. And Prescott L. (2001). Microbiology. United Kingdom: McGraw Hill Higher Education.
2	Tortora G. J., Funke B. R. and Case C. L. (2016). Microbiology: an Introduction. Twelfth edition. Pearson, London.
3	Smith H. and Brown A. (2023). Benson's Microbiological Applications, Laboratory Manual,15 th Edition. McGraw Hill.

COURSE OUTCOMES (CO)

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

CO1	Contrast the contributions made by the Microbiologist.
CO2	Recognizes the parts of microscopy and apply the principles of staining techniques.
CO3	Use the compositions of different media and for isolation of microbes.
CO4	Extend the knowledge on sterilization techniques for practical applications.
CO5	Evaluate the properties of antimicrobial agents.

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	H	H	M	M	H	H	H
CO2	H	H	H	M	H	H	M	H	H	M
CO3	H	H	H	M	H	H	H	H	H	M
CO4	H	M	M	M	H	H	H	H	H	M
CO5	H	H	H	H	H	H	H	M	M	M

H-High; M-Medium; L-Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBTM202	DSC IV:CALCULATIONS FOR BIOLOGIST	SEMESTER-II

Course Objectives:

The Course aims

- To develop the students kills.
- To apply the basic knowledge about the scientific calculations.

Credits:3 **Total Hours:40**

UNIT	CONTENTS	Hrs	CO
I	**Scientific notation and metric prefixes:** Significant digits, exponents and scientific notation, converting numbers from scientific notation to decimal notation. Adding, subtracting, multiplying and dividing numbers written in scientific notation, Metric prefixes.	08	CO1
II	**Solutions, mixtures and media:** Dilutions calculation, concentrations by a factor of X, preparing percent solution, Moles and Molecular weight, Molarity – Diluting Molar solutions, Converting Molarity to Percentage, Converting Percentage to Molarity, Normality.	08	CO2
III	**Cell growth:** Bacterial growth curve– Manipulating cell concentration, linear graph, Calculating generation time, Measuring cell concentrations on Hemocytometer.	08	CO3
IV	**Quantitation of Nucleic acid, Proteins and PCR calculations**: Quantitation of nucleic acid by U V spectrometry– dsDNA, ssDNA, RNA. Quantitation of protein by measuring at 280 nm. Quantitating protein at A280 in nucleic acid contamination. PCR calculations – template and amplification, Calculating Tm, DNA Polymerase – Calculating Polymerase error rate.	08	CO4

V	**Centrifugation-** Relative centrifugal force (g Force), Converting g Force to RPM, calculating sediment times. Alleles and Genotypes–calculating allele and genotype Frequency.	**08**	**CO5**
Text Books			
Frank H. Stephenson, 2003. Calculations for Molecular biology and Biotechnology –Academic press.			
Mathematics for Biological Scientists, M.Aitken, B.Broadhursts, S. Haldky, Garland Science (2009)			
Introduction to Mathematics for Life Scientists, E.Batschelet, Springer Verlag, 3rd edition (2003)			

COURSE OUTCOMES (CO)

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

CO1	Summarize the basic knowledge of Scientific notation.
CO2	Solve the biological calculations to prepare the solution.
CO3	Interpret the mechanism of bacterial cell growth.
CO4	Develop the skills to quantitate the biological macromolecules.
CO5	Apply the knowledge for the population genetics.

Mapping

CO / PSO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	H	M	H	M	H	H	H	H
CO2	H	H	H	M	H	M	H	H	H	H
CO3	H	M	H	M	H	H	M	M	H	H
CO4	H	M	H	H	H	H	M	M	H	H
CO5	H	H	H	H	H	H	H	M	M	H

High;M-Medium;L-Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBTMP201	**DSC PRACTICAL-II**	**SEMESTER–II**

Course Objectives:

The Course aims

- To learn the basic microbiological techniques and various Staining methods.

Credits: 2 **Total Hours: 33**

S.No	EXPERIMENT	Hrs	CO
1.	Media preparation–Liquid, Solid Media and Slant preparation	03	CO1
2.	Pure Culture Techniques: i. Spread plate method. ii. Pour plate method. iii. Streak Plate Method iv. Settle plate procedure	06	CO2
3.	Simple staining	03	CO3
4.	Gram's staining	03	CO3
5.	Spore staining	03	CO4
6.	Motility test	03	
7.	Biochemical tests– IMViC test	03	
8.	Triple Sugar Iron Test	03	CO5
9.	Oxidase and Catalase test	03	
10.	Antibiotic Susceptibility test–Kirby—Bauer method.	03	

Reference Book

1	*Sundararaj,T.* **Microbiology Laboratory Manual.** Dr.A.L.Mudaliyar Post Graduate Institute of Basic Medical Sciences, Chennai.
2	*Benson.* **Microbiological applications laboratory manual in general Microbiology.**[Eighth Edition].The Mc Graw-Hill Companies.
3	Aneja K. R. (2007). Experiments in Microbiology, Plant Pathology And Biotechnology. New Age International, New Delhi, India

4	Cappuccino J. G. and Welsh C. T. (2016). Microbiology: A Laboratory Manual. Pearson Education
5	Atlas R. M. (2005). Handbook of Media for Environmental Microbiology. United States: Taylor and Francis.

COURSE OUTCOMES (CO)

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

CO1	Handle microbes and perform molecular taxonomy.
CO2	Prepare solid and liquid media.
CO3	Isolate pure colonies using various pure culture techniques.
CO4	Perform various staining methods.
CO5	Performvariousbiochemicaltestsandalsocanapplyantibioticsensitivitytest For diagnosis.

MAPPING:

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	H	M	H	M	M	H	H	H
CO2	H	H	H	H	H	M	M	H	H	M
CO3	H	H	H	H	H	M	H	H	H	M
CO4	H	H	H	H	H	H	H	M	H	M
CO5	H	H	H	H	H	H	H	M	M	M

H-High; M-Medium; L-Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UCHBTA201	GEC II:CHEMISTRY	SEMESTER–II

Course Objectives:

The Course aims

- To understand the bonding in simple organic and inorganic molecules
- To Study the chemistry of heterocyclic ring system
- To understand the basic ideas in Co-ordination Compounds
- To Study the Solution and its types
- To understand the elementary ideas in Electrochemistry

Credits:2 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Chemical Bonding:** Molecular Orbital Theory – Bonding-Anti bonding-Non-bonding orbitals - M.O. Diagram of Hydrogen molecule-Helium molecule-Nitrogen molecule-Discussion of bond order-magnetic properties - Covalent bonds- Orbitals overlap – Hybridisation–SP–Acetylene-SP^2–Ethylene-SP^3-Methane.	08	CO1
II	**Heterocyclic Chemistry:** Heterocyclic compounds-Structure of five membered ring-Preparation, Properties and uses of Furan, Pyrrole, Thiophene - Structure of six membered ring- Preparation, Properties and uses of Pyridine-Condensed Heterocyclic ring-Preparation, Properties and uses of Indole and Quinoline.	08	CO2
III	**Co-ordination Chemistry:** Definition – classification of Ligands - Werner's theory - Sidgwick's theory - Effective atomic number-Pauling's theory (VB theory) – Chelation-Chelate effect–Haemoglobin – definition and biological role – Chlorophyll – definition and biological role – EDTA - its applications.	08	CO3

IV	**Solutions:** Types – Liquid in Liquid - Raoult's law for ideal Solution – Positive and negative deviation from Raoult's law- Reason and Example – Colloids – Types-Optical Property- Electrical property – Coagulation – Emulsions – Gel- Applications of colloids. **Phase rule** – Important Terminologies - One component system- Water.	**08**	**CO4**
V	**Electrochemistry:** Kohlrausch's law – measurement of Conductance - determination of P^H - Conductometric titration - Hydrolysis of salts-Elementary ideas – Examples- Galvanic cell - **Galvanic cell –** EMF-Standard electrode potential- Electrochemical series –its applications – Principal of Electroplating – Corrosion – Corrosion prevention.	**08**	**CO5**

Text Books	
1	*Madan.R.L. and TuliG.D.*2005.**Simplified course in Physical chemistry.** [Sixth edition].S.Chand and company Ltd., New Delhi.
2	*Puri. B. R. Sharma .L. R. and Pathania*. M. S. 2017. **Principles of Physical Chemistry.** [Forty Seventh edition]. Shoban Lal Nagin Chand and Co., New delhi.
Reference Books	
1	*LeeJ.D.*2008.**A New Concise Inorganic Chemistry.** [Fifth edition]. Chapmann and Hall, London.
2	*MorrisonR.T.andBoyd.R.N.*2010. **Organic Chemistry.** [Seventh edition]. Prentice-Hall of India (P) Ltd, New Delhi.
3	*Mukherjee.S.M.Singh.S.P.andKapoor.R.P.*1985.**Organic Chemistry.** [Fifth edition]. New Age International (P) Ltd., New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Analyse the bond formation inorganic molecules.
CO2	Learn the mechanism of the reactions.
CO3	Compute the chemistry of co-ordination compounds.
CO4	Predict the chemistry behind polymers.
CO5	Demonstrate the working principles of cells and batteries.

Mapping

CO / PSO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H	M	H	H	M	H
CO2	M	M	H	H	M	M	H	H	M	H
CO3	M	H	M	H	H	H	H	H	H	H
CO4	M	H	H	M	M	H	H	M	H	H
CO5	H	H	H	H	H	M	H	H	M	H

H-High; M-Medium; L-Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UCHBTAP201	**GEC PRACTICAL II: CHEMISTRY**	**SEMESTER-II**

Course Objectives:

The Course aims

- To enable the students to acquire the quantitative skills in volumetric analysis.
- To know the inorganic preparation

Credits:2 **Total Hours: 30**

EXPT NO.	**CONTENTS**	**CO**
	Titrimetric Quantitative Analysis	
1.	Estimation of HCl using standard oxalic acid.	**CO1**
2.	Estimation of Ferrous sulphate using Mohr's salt.	
	Organic Qualitative Analysis	
1.	Mono carboxylic acid	**CO2**
2.	Monoamide	
3.	Diamide	
4.	Carbohydrate	
5.	Aromatic aldehyde	

Text books

1	*Kamboj.P.C.*2013.**University Practical Chemistry.** [First Edition (reprint)]. Vishal publications, Jalandhar, Punjab.
2	*Venkateshwara,V.,Veerasamy.R.Kulandaivel.R.,*2012.**Basic Principles of Practical Chemistry.** [Second Edition]. S.Chand & sons, NewDelhi.

COURSE OUTCOME (CO)

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

CO1	Analyse quantitatively by titration techniques.
CO2	Analyse systematically an organic compound by laboratory techniques.

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UVE201	**VAC II: ENVIRONMENTAL STUDIES**	**SEMESTER–II**

Course Objectives:

The course aims

- To enable the students acquire knowledge, values, attitudes, commitment and skills needed to protect and improve the environment.
- To implicate awareness among young minds for safeguarding environment from manmade disasters.

Credits: 1 **Total Hours: 15**

UNIT	CONTENTS	Hrs	CO
I	**Environment**– Definition – Scope – Structure and function of ecosystems - producers, consumers and decomposers - Energy flow in the ecosystem – Ecological succession – food chain, food webs.	**03**	**CO1**
II	**Natural resources:** Renewable - air, water, soil, land and wild life resources. Non–renewable–Mineral, coal, oil and gas.	**03**	**CO2**
III	**Biodiversity**–Definition–Values–Consumption use, productive social, ethical, aesthetic and option values threats to biodiversity – hot spots of biodiversity – conservation of bio-diversity:	**03**	**CO3**
IV	**Environmental Pollution:** Definition – causes, effects and Mitigation measures –Air pollution, Water pollution, Soil pollution, Noise pollution. Acid rain – Climate change and global warming	**03**	**CO4**
V	**Population and environment**–Population explosion –Women And Child welfare – Disaster Management – Role of information Technology in environmental health.	**03**	**CO5**

Text Book

1. Department of Biochemistry. Environmental Studies (Study Material).Published By K.S.Rangasamy College of Arts & Science (Autonomous).Tiruchengode.

Reference Book

1. *Erach Bharucha*.2005. **Text book of Environmental studies**. Universities press. PVT. Ltd.

COURSE OUTCOMES (CO)

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

CO1	Describe the types of ecosystem and concepts in sustainable development
CO2	Explain the importance of natural resources
CO3	Recite about the biodiversity, hot spots of biodiversity and its Conservation
CO4	Be conscious on the effects of pollution and global warming
CO5	Implement the preventive measures for environmental issues

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

25UVE202	VAC: DISASTER MANAGEMENT	SEMESTER – II

Course Objectives

The course aims

- To introduce the basic concepts of disaster, hazard, vulnerability, and risk.
- To understand the types and causes of various natural and anthropogenic disasters.
- To provide knowledge of disaster management strategies, phases, and mitigation techniques.
- To understand the types, causes, effects and mitigation of Man-made and industrial hazards.
- To familiarize students with institutional frameworks like NDMA, NDRF and SDMA with awareness and preparedness in handling the disasters effectively.

Credits: 1 **Total Hours: 15**

UNIT	CONTENTS	Hrs.	CO
I	**Fundamentals of Disaster Management:** Concept of disaster and hazard: definition and distinctions. Types of disasters: Natural geological, hydrological, climatological; Biological and Man-made. Disaster Management Cycle: preparedness, response, recovery and mitigation. Risk and Vulnerability analysis: Types of vulnerability, Risk and Resilience.	3	CO 1
II	**Geological Disasters Earthquakes:** Causes, effects, and mitigation strategies. Tsunami: generation, impact zones, and early warning systems. Volcanoes: types, causes, effects, and risk zones. Landslides: mechanisms, triggers, and mitigation.	3	CO 2
III	**Hydrological Disasters:** Avalanches definition, causes and facts. Floods causes, types, impacts, and flood control measures. **Climatological Disasters**: global warming, climate change, droughts, cyclones types, effects and warning systems. **Biological Disasters:** epidemics and pandemics causes, spread and control measures (e.g., COVID-19, Dengue, Cholera etc..).	3	CO 3
IV	**Man-Made Disasters:** Famine, Transport road, rail and air accidents, Conflicts, Terrorism and their impact on society. chemical, nuclear, mine explosion, IV Industrial Disasters pollution, acid rain and oil spills. Urban Disasters - stampede, building collapse and effluence. Fire accidents causes, effects, and safety regulations.	3	CO 4
V	**Disaster Management Framework and Institutions in India** Disaster prone regions of India. National Disaster Management Act and Policy. Role of NDMA, NDRF and SDMA. Disaster preparedness plan awareness, mitigation and management.	3	CO 5

Text Books
1. *Kapur, A.* (2010). **Vulnerable India: A Geographical Study of Disasters.** SAGE India Pvt. Ltd., New Delhi. 2. Vulnerability Atlas of India (1997). **Building Materials & Technology Promotion Council**, Ministry of Urban Development, Government of India, New Delhi. 3. *Singh, R.B.* (2006). **Natural Hazards and Disaster Management: Vulnerability and Mitigation** (Edited Volume). Rawat Publications, New Delhi.
Reference Books
1. *Modh, S.* (2010).**Managing Natural Disaster: Hydrological, Marine and Geological Disasters**. Macmillan, New Delhi. 2. *Srivastava, H.N. & Gupta, G.D.* (2006). **Management of Natural Disasters in Developing Countries**. Delhi: Daya Publishers. 3. *Coppola, D.P,* (2007). **Introduction to International Disaster Management**. London: Elsevier Science (B/H). 4. *David Alexander.* (1999). **Natural Disasters**. London: Kluwer Academic. 5. *Murthy, D.B.N.* (2012).**Disaster Management.** New Delhi: Deep and Deep Publication
Web Source
1. NDMA Guidelines (available at: www.ndma.gov.in) 2. NIDM (available at: www.nidm.gov.in) 3. NDRF (available at: www.ndrf.gov.in) 4. SDMA (available at: www.cra.tn.gov.in)

COURSE OUTCOMES (CO)

After completion of the course, the student will be able to

CO 1	Know about the Nature of Disasters and Hazards.
CO 2	Know about the Earthquakes, Volcanic Eruption and Landslides etc....
CO 3	Understand the Causes and effects of Cyclones, Floods, and Droughts.
CO 4	Acquired the knowledge of Fire Accidents, Explosions, Road Accidents and Stampede.
CO 5	Know about the Role Agencies in Disaster Management.

Course Prepared by
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Assistant Professor

Course Approved by
Mr.K.S.Shanmugam
BOS Chairman

24UTAL301	**nghJj;jkpo; - III**	**□□□□□□ - III**

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- rkaq;fs; gw;wp mwpKfk; nra;jy;
- rka ,yf;fpaq;fs; gw;wp khzth; mwpAkhW nra;jy;
- gpwePjp ,yf;fpaq;fs; %yk; khzth;fSf;F mwj;jpid typAWj;Jjy;

Credits: 3 **Total Hours: 50**

UNIT	*CONTENTS*	**Hrs**	**CO**
I	irtk;>itzk; m) jpUQhdrk;ge;jh; - NfhsWgjpfk; M) nghpaho;thh; - jpUg;gy;yhz;L (Kjy; 5 ghly;fs;) ,)Mz;lhs; - jpUkzf; fdT	10	**CO1**
II	fpUj;Jt ,];yhkpa ,yf;fpaq;fs; m) fz;zjhrd; - ,NaRfhtpak; -rpYitg;ghL (Kjy; 10 ghly;fs;;) M) ehafk; xUfhtpak;- ghk;gpd; NerKk; Njhohpd; ghrKk; (Kjy; 10 ghlyfs;;)	10	**CO2**
III	Gpw ePjp ,yf;fpaq;fs; m) nfhd;iwNte;jh; - Kjy; 20 ghly;fs; M) ntw;wpNtw;if-Kjy; 20 ghly;fs; ,) ePjpnewptpsf;fk; - Kjy; 5 ghly;fs; <) cyfePjp - Kjy; 5 ghly;fs; c)%Jiu -Kjy; 5 ghly;fs;	10	**CO3**
IV	rka ,yf;fpa tuyhW m) irtk; Njhw;wk; tsh;r;rp M) itztk; Njhw;wk; tsh;r;rp ,) fpwpj;JtNjhw;wk; tsh;r;rp <) ,];yhk; Njhw;wk; tsh;r;rp c)gpw;fhyePjp ,yf;fpaq;fs; mwpKfk;	10	**CO4**
V	,yf;fzk; m) mzpapyf;fzk; 1. jw;Fwpg;Ngw;wmzp 2. ctikazp 3. gpd;tUepiyazp 4. cUtfmzp 5. tQ;rGfo;r;rpazp M) MFngah;fs; ,) ty;ypdk; kpFk;>kpfh ,lq;fs;	10	**CO5**

□□□□□□□

1.jkpo;j;Jiw ntspaPL

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j.Nfh.Nte;jd;>ehyhapujpt;agpuge;jk;>rhujhgjpg;gfk;>nrd;id> 2017
jkpoz;zy;>GjpaNehf;fpy; jkpo; ,yf;fpatuyhW>kPdhl;rpGj;jfepiyak;>kJiu– 2017.
jz;bayq;fhuk;> fof ntspaPL.

COURSE OUTCOMES (CO)

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CO1	gf;jp ,yf;fpaq;fs;> nkhop tsh;r;rpf;F cjtpaijf; $Wjy;.
CO2	rka ,yf;fpaq;fs; gw;wpmwpjy;
CO3	ePjp ,yf;fpaq;fs; top mwj;ijtypAWj;Jjy;
CO4	rka ,yf;fpaq;fs; Njhw;wk; tsh;r;rpiamwpjy;.
CO5	nkhopapd; mbg;gil ,yf;fzj;ijmwpjy;.

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**
CO2	**H**	**L**	**L**	**L**	**L**	**L**	**H**	**M**	**M**	**M**
CO3	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**
CO4	**H**	**M**	**M**	**M**	**M**	**M**	**H**	**M**	**M**	**M**
CO5	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**

H – High; M – Medium ; L - Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UENLA301	ENGLISH FOR ARTS AND SCIENCE - III	SEMESTER–III

Course Objectives

The course aims to

- Use English to communicate effectively in familiar and routine academic, professional and social contexts.
- Demonstrate effective listening skills to interpret academic and real-life situations.
- Apply grammatical rules and sentence structures accurately in speaking and writing.
- Select technical terms and general vocabulary to express ideas clearly.

Credit:3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	1. Listening : Listening to conversations and instructions. 2. Speaking : Role Play-Seeking and sharing information 3. Reading : Critical reading 4. Writing : Extended Definitions, Dialogue writing, Film/Book review 5. Grammar : Modals 6.Vocabulary : Business Jargon (Synonyms & Antonyms)	10	CO1
II	1. Listening : Listening to advertisements and Short Documentary films 2. Speaking : Brainstorming (mind mapping) Small group discussions (subject- specific) 3. Reading : Reading visual texts – Advertisements 4. Writing : Hints development, Advertisement Writing. 5. Grammar : Concord 6.Vocabulary : Homophones, Homonyms	10	CO2
III	1. Listening : Listening to interviews 2. Speaking : Small Talks, Non-Technical presentation 3. Reading : Short passage. 4. Writing : Process description, Blog Writing. 5. Grammar : Conditional Clause 6.Vocabulary : Portmanteau Words	10	CO3
IV	1. Listening : Listening to TED talks. 2. Speaking : Giving ideas and opinions on launching a gadget/instrument 3. Reading : Reading biography (eminent speakers and writers) 4. Writing : Creative writing, Check list. 5. Grammar : Reported speech 6.Vocabulary : Idioms and Phrasal Verbs	10	CO4

V	1. Listening : Listening to gadget presentation. Listening to lectures on scientific inventions. 2. Speaking : Technical presentation (PPT) 3. Reading : Reading to interviews. 4. Writing : Narrative writing – writing narrative essays 5. Grammar : Simple, Compound and Complex sentences 6.Vocabulary : Discourse Markers		

Text Books

1. Thimmesha, L., Victor, R. 2022. **A Textbook of English Language Communication Skills,** [Revised Edition], Infinite Learning Solutions.
2. *Gajendra Singh Chauhan.* 2018. **Technical Communication,** [Latest Revised Edition], Cengage learning India Pvt Limited.

Reference Books

1. *Sanjay Kumar, Pushp Lata.* 2019. **Communication Skills**, Oxford University Press.
2. *Shoba, K.N., Praveen. Sam, D.* 2020. **A Course in Technical English**, Cambridge University Press.
3. *Sudharshana, N.P., Savitha, C.* 2018. English for Engineers, Cambridge University Press.
4. *Nick Bell.* 2015. **Reading Skills: How to Read Better and Faster- Speed Reading, Reading Comprehension & Accelerated Learning**. [2nd Edition], Create Space Independent Publishing Platform.
5. *Michael McCarthy, Felicity O'Dell,* 2017. **English Vocabulary in Use Upper-Intermediate Book with Answers Vocabulary Reference and Practice.** Cambridge University Press.

Web Reference

1. https://learnenglish.britishcouncil.org/skills/listening/a2-listening/four-conversations
2. https://www.csuohio.edu/writing-center/critical-reading-what-critical-reading-andwhy-do-ineed-do-.
3. https://learnenglish.britishcouncil.org/grammar/b1-b2-grammar/reported-speech-statements
4. https://www.youtube.com/watch?v=TdWcUi4RjtA
5. https://hbr.org/2013/06/how-to-give-a-killer-presentation

COURSE OUTCOMES (CO)

On completion of this course, the students should be able to

CO1	Recall key vocabulary words, grammar rules, and language structures.
CO2	Interpret the meaning of texts, including implicit and explicit information.
CO3	Apply grammar rules and vocabulary knowledge to create sentences and express ideas accurately.
CO4	Analyze the structure and organization of texts, identifying elements such as main ideas, supporting details, and transitions.
CO5	Evaluate the effectiveness of communication strategies in different contexts.

Course Prepared by
Ms. P. JANANI
Assistant Professor

Course Approved by
Dr. V. V. MALINEE
BOS Chairman

24UBTM301	**DSC II: GENETICS**	**SEMESTER - III**

Course Objectives:

To study the principles and applications of Genetics

Credits: 4 **Total Hours: 50**

UNIT	CONTENT	Hrs	CO
I	History of Genetics. Mendel's experiments, Punnett Square, Monohybrid cross, Dihybrid cross, Law of Dominance, Law of Segregations and Law of Independent assortment, Test cross, Back cross, Pleiotrophy, Incomplete and Co-dominance.	**10**	**CO1**
II	Gene interaction – Epistasis and its types. Lethality and Lethal genes. Multiple alleles (Eye color of Drosophila and Human Blood group antigens). Linkage (linkage in Drosophila, factors affecting linkage) and crossing over (Types and mechanism of crossing over).	**10**	**CO2**
III	Sex - Linked Inheritance, Pedigree Analysis. Sex Determination in *Drosophila*, cat and human. Chromosomal theory of inheritance and maternal inheritance. Chromosomal aberration - change in number and structure. Dosage compensation theory.	**10**	**CO3**
IV	Transposons and transposable elements in prokaryotes and eukaryotes. Introduction to Transposable elements in human. Mendelian Inheritance in Man (Autosomal dominant and Autosomal recessive).	**10**	**CO4**
V	Population Genetics - Hardy Weinberg principle, gene frequency, genotype frequency and factors affecting gene frequency. Population bottle neck, Founders effect, Natural Selection, Genetic drift, Mutation and Migration.	**10**	**CO5**

Text Book

1	Dr. Veer Bala Rastogi, 2020, Elements of Genetics, 11th Revised & Enlarged Edition, Kedar Nath Ram		
2	Nath Publications, Meerut, 250001. www.knrnpublications.com, ISBN-978- 81-907011-2-9		
3	Verma, P.S. and Agarwal, V.K., 1995. Genetics, 8th edition, S.Chand & Co., New Delhi – 10055.		
4	Verma, P.S., and Agarwal, V.K., 1995. Cell and Molecular Biology, 8th edition, S.Chand and Co., New Delhi, 110055.		
5	Verma PS and Agarwal VK. 2010 Genetics. S. Chand & company PVT. Ltd		

Reference Books

1	Gardener E.J. Simmons M.J. Slustad D. P. 2006. Principles of Genetics		
2	Lewis, R.2001. Human Genetics- Concepts and application. 4th edition. McGraw Hill.		
3	Griffiths, Miller, J.H., An Introduction to Genetic Analysis W.H.Freeman. New York.		
4	Winter, P.C., Hickey, G.J. and Fletcher, H.L.2000. Instant notes in Genetics. Viva books, Ltd		
5	Good enough U. 1985. Genetics. Hold Saunders international.		

Web References

1	https://onlinecourses.swayam2.ac.in/cec21_bt02/preview		
2	https://www.dnaftb.org/#organization		

COURSE OUTCOMES (CO)

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

CO1	To make students familiar with history of genetics and basic principles of Mendelian's laws.
CO2	To make students familiar with gene interaction of Drosophila as Model organism.
CO3	To understand about chromosomal structure variation and sex linked inheritance.
CO4	To understand about ploidy and transposable elements
CO5	To understand about population genetics and pedigree analysis.

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**
CO2	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**H**
CO3	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**
CO4	**H**	**M**	**M**	**H**	**H**	**M**	**H**	**M**	**H**	**H**
CO5	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**

H – High; M – Medium ; L - Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBTMP301	**DSC PRACTICAL-III**	**SEMESTER– III**

Course Objectives:

The Course aims

- To learn the mutant isolation in different methods.
- To acquire the handling techniques of chamber, plates and spectrophotometer.

Credits:3 **Total Hours:50**

S.No	**EXPERIMENT**	**Hrs**	**CO**
1.	Isolation of Genomic DNA from yeast – large scale spool out DNA	05	CO1
2.	Estimation of DNA using spectrophotometer	05	
3.	Isolation of mutants by replica plating	05	CO2
4.	Isolation of mutants by Gradient plate methods (Streptomycin)	05	
5.	Chemical Mutagenesis - EMS	05	CO3
6.	Mutagenesis by radiation exposure	05	
7.	Bacterial Conjugation – Transfer of Antibiotic-resistant plasmid	05	
8.	Culturing of different kinds of *Drosophila sp*	05	CO4
9.	Monohybrid and Dihybrid ratio	05	CO5
10.	Karyotyping	05	

Reference Book

1 *Gregore Koliantz,DanielB.Szymanski*,2006. Genetics: A Laboratory Manual ASA-CSSA-SSSA publisher.

2 *Murray, R.G.F., Wood, W.A. and Krieg, N.B.* 1994. Methods for General and Molecular Bacteriology. American society for Microbiology.

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBCBTA301	**GEC III : BIOCHEMISTRY (BIOMOLECULES)**	**SEMESTER - III**

Course Objectives:

The Course aims

- To enable the learners to have a strong foundation in the structural and metabolic aspects of biomolecules which is the basic requirement of all life sciences.

Credits: 2 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Carbohydrates:** Introduction, classification. Monosaccharide – Structure and importance of glucose and fructose. Isomers: stereo and structural isomers. Mutarotation and chemical reactions- reduction, oxidation and osazone formation. Oligosaccharides – Disaccharides - Structure and importance of sucrose, lactose. Polysaccharides - Structure and importance of homopolysaccharides – Starch and Glycogen. Heteropolysaccharides - Hyaluronic acid and Heparin.	8	CO1
II	**Amino acids:** Classification, Structure and properties. Essential, Non- essential and Non-protein amino acids. **Protein:** Classifications and Functions: Structural organization of Proteins - Primary, secondary, tertiary and quaternary structure. Forces involved in stabilization of tertiary structure of proteins.	8	CO2
III	**Lipids:** Classification. Triacylglycerol – Structure, physical & chemical properties. Phospholipids - Structure of lecithin. Phospholipids in cell membrane – Fluid Mosaic model. Derived lipids. Essential fatty acids, Saturated and unsaturated fatty acids: - Structure. Sterol – Structure of Cholesterol.	8	CO3
IV	**Enzymes** – Definition, IUB classification with examples. Active site - Definition, Mechanism of enzyme action - Lock & key model and induced fit hypothesis. Enzyme units - IU, katal.	8	CO4

	Factors affecting enzyme activity (pH, Temperature and substrate concentration).		
V	**Vitamins** - Classification, Sources, daily requirements, physiological functions and deficiency of fat and water soluble vitamins. **Minerals and Trace elements**: Macro and micro minerals. Sources, daily requirements, physiological functions and deficiency diseases of calcium, phosphorous, sodium, potassium, iron.	**8**	**CO5**
Text Book			
1.	*Jain, J. L.* 2002. **Fundamentals of Biochemistry.** [Fifth Edition]. S. Chand & Company Ltd., New Delhi.		
Reference Books			
1.	*Deb, A. C.* 2000**. Fundamentals of Biochemistry.** Books and GEC (P) Ltd., Calcutta.		

COURSE OUTCOMES (CO)

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

CO1	Explain the structure of carbohydrates and their functions
CO2	Describe the nature of Nature of amino acids, functions and structural organization of proteins
CO3	Illustrate on characterization of lipids and their functions
CO4	Interpret the classification, characteristics and basic concepts of enzyme action
CO5	Elucidate the classification and clinical significance of micronutrients

MAPPING

PO,PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	M	H	M	M	M	H	M
CO2	H	M	M	M	H	M	M	M	H	M
CO3	H	M	M	M	H	M	M	M	H	M
CO4	H	M	M	M	H	M	M	M	H	M
CO5	H	M	M	M	H	M	M	M	H	M

H – High; M – Medium ; L - Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBCBTAP301	**GEC PRACTICAL III: BIOCHEMISTRY (BIOMOLECULES)**	**SEMESTER – III**

Course Objectives:

The Course aims

- To enable the learners to have a strong foundation in understanding chemical nature of biomolecules.

Credits: 2 **Total Hours: 30**

S.No.	**EXPERIMENT**	**Hrs**	**CO**
I. Qualitative Analysis			
1.	Carbohydrates: Glucose, fructose, xylose, sucrose, lactose, and starch.	12	1
2.	Amino acids: Tyrosine, tryptophan, histidine, methionine and cysteine.	6	1
3.	Proteins: Solubility test, coagulation test, ninhydrin test, biuret test, folin's phenol test, precipitation by metals.	3	1
4.	Lipids: Solubility, grease spot, Oil spot, emulsification, halogenations, colour reactions.	3	1
II. Quantitative Analysis			
5.	Estimation of Glycine by Formal titration method.	3	2
6.	Determination of Saponification Value	3	2

Reference Books

1. *Sadasivam, S.* and *Manickam, A*. 2010. **Biochemical Methods.** [Third Edition]. New Age International (P) Ltd., New Delhi.
2. *Jayaraman, J.* 2008. **Laboratory Manual in Biochemistry**. [First Edition Reprint]. New Age International (P) Ltd., New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Perform qualitative analysis for identification of Biomolecules
CO2	Do quantification of biomolecules by titrimetric methods

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBTNM301	**MDC I: MEDICINAL HERBS**	**SEMESTER-III**

Course Objectives:

The Course aims

- To apply the basic knowledge of common medicinal plants.

Credits:2 **Total Hours:30**

UNIT	CONTENTS	Hrs	CO
I	Introduction to Medicinal Plants; Traditional medicinal Systems - AYUSH. Application of medicinal plants,	**06**	**CO1**
II	Herbs- *Aloe vera*, Green chirayta,, Tridax, Daisy, *Vinca*, Mint, Cumin & Ajwain.	**06**	**CO2**
III	**Climbing plants:** Betel, Ivy gourd, Butter fly pea, Veldt grape, Climbing Brinjal, Indra valli, Pepper & Madras pea, pumpkin.	**06**	**CO3**
IV	**Shrubs and Tree:** Indian mallow, Shikakai, Desert cotton, Turkey berry & Copper leaf, Moringa plant and Amla.	**06**	**CO4**
V	Cash crops-Sugarcane, Tobacco, Rice, wheat and corn. Asafetida and sweet potato	**06**	**CO5**

Reference Book

1	*Arya Vaidya Sala.,* 1994. **Indian Medicinal Plants**. Vol II. Universities Press.
2	*S.K. Bhattacharjee, 2020, Hand book of Medicinal plants: 4th revised and enlarged edition, Pointer publishers.*

COURSE OUTCOMES (CO)

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

CO1	Describe about Medicinal Plants.
CO2	Gain knowledge about various important medicinal herbs.
CO3	Describe about Climbing plants.
CO4	Explicate the importance of Shrubs.
CO5	Explain about cash crops.

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBTSB301	**SEC –I : MUSHROOM CULTIVATION AND VERMITECHNOLOGY (100% INTERNAL VALUATION)**	**SEMESTER - III**

Course Objectives:

The Course aims

- Students can start small scale industry of Mushroom cultivation- Students study the morphology and types of Mushrooms. They are aware of the identification of edible and poisonous Mushrooms.
- To learn the prospects and scope of mushroom cultivation in small scale industry.
- To learn the life cycle of *Agaricus* species
- To know the spawn production technique.
- To understand the Diseases. Post harvesting techniques of Mushrooms.

Credits :2 **Total Hours: 30**

UNIT	CONTENTS	Hrs	CO
I	Introduction: Morphology, Types of Mushroom, Nutritive values, life cycle of mushrooms, Prospects, and scope of Mushroom cultivation in small scale Industry.	6	**CO1**
II	Spawn production, spawn running, diseases and harvesting of mushrooms, post harvesting technology and marketing. Medicinal properties and value added products from edible and non edible mushrooms.	6	**CO2**
III	Diseases and post harvest technology, Insect pests, nematodes, mites, viruses, fungal competitors.	6	**CO3**
IV	Introduction to Vermitechnology: Types, Collection and Preservation of earthworms - *Eisenia fetida*, Role of earthworms. Culturing techniques of earthworms and composting materials, Factor affecting culturing of earthworm and Vermicomposting materials,	6	**CO4**
V	Small scale techniques of Vermicomposting -Types of vermicomposting - Physical, chemical and biological properties of vermicompost, Large scale techniques of Vermicomposting. Vermiwash and Economics - Chemical composition of vermiwash; Techniques of vermiwash production: Advantages of Vermicomposting,	6	**CO5**

Text Books

1	Handbook of Mushroom Cultivation. 1999. TNAU publication.
2	Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R. (1991). Oyster Mushrooms, Department of Plant Pathology, Tamil

	Nadu Agricultural University, Coimbatore.
3	Swaminathan, M. 1990. Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
4	Nita Bahl. 2002. Handbook on Mushroom 4th edition Vijayprimlani for oxford &IBH publishing co., Pvt., Ltd., New Delhi. 5. Dr.C. Sebastian Rajesekaran Reader in Botany Bishop Heber College, Trichy – 17.
5	Bahl, N. (1984-1988). Hand book of Mushrooms, II Edition, Vol. I & Vol. II.
Reference Books	
1	Suman. 2005. Mushroom Cultivation Processing and Uses, M/s. IBD Publishers and Distributors, New Delhi.
2	Sing. 2005. Modern Mushroom Cultivation, International Book Distributors, Dehradun.
3	Handbook of Edible Mushroom Today and Tomorrows printers and publishers.
4	Sharma V.P. 2006. Diseases and Pests of Mushrooms, M/s. IBD Publishers and Distributors, New Delhi.
5	Tewari, P and Kapoor, S.C.1988. Mushroom cultivation, Mittal Publications New Delhi.

COURSE OUTCOMES (CO)

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

CO1	To know the nutrient value of mushroom- To study the morphology and types of Mushrooms.
CO2	To learn the prospects and scope of mushroom cultivation in small scale industry.
CO3	To understand the Diseases and post harvest technology
CO4	To know about Vermitechnology and role of earthworms in it.
CO5	To understand the types and advantages of vermicomposting.

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	H	H	M	H	H	M	H
CO2	M	M	H	H	M	M	H	H	M	H
CO3	M	H	H	H	H	H	H	H	H	H
CO4	M	H	H	M	M	H	H	M	H	H
CO5	H	H	H	H	H	M	H	H	M	H

H-High;M-Medium;L-Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UVE301	**VAC III : UNDERSTANDING INDIA**	**SEMESTER – III**

Course Objectives

The course aims

- Identify India's geographical location, neighboring countries and major geographical features.
- Recognize the components of the Indian social structure, including caste, community, class and gender.
- Analyze the evolution of social hierarchies in India over different periods.

Credits: 1 **Total Hours: 15**

UNIT	CONTENTS	Hrs.	CO
I	**Geography & Cultures of India:** Physical Features of India – Landscape – Mountains – Rivers - Population, its growth, distribution - Migration People - Culture of India - Major Festivals, Culinary traditions – Costumes.	3	CO 1
II	**Architecture of India:** Ancient Architecture - Indus Valley Civilization, Mauryan, Gupta – Architecture - An introduction to Indian knowledge systems.	3	CO 2
III	**Freedom Struggle:** Revolt of 1857 - Formation of Indian National Congress – Swadeshi Movement - Gandhian Movements - Subhas Chandra Bose and INA - Independence and Partition of India.	3	CO 3
IV	**Communicating Culture:** Oral narratives – Myths - Tales and Folklore - Introduction to the Tribal Cultures of India	3	CO 4
V	**Indian Economy:** Economic Liberalization - Mixed Economy - Planning Commission	3	CO 5

Text Books

4. *Chauhan, Abha.* 2021. **Understanding Culture and Society in India: A Study of Sufis, Saints and Deities in Jammu Region**. Springer Nature.

Reference Books

6. *Hussain, Majid.* 2022. **Geography of India**. Edited by Tasawwur Husain Zaidi. Noida: McGraw Hill.
7. *Ramesh Dutta Dikshit,* 2020. **Political Geography: Politics of Place and Spatiality of Politics**, Macmillan Education.
8. *Thapar, Romila.* 2021. **Indian Cultures as Heritage: Contemporary Pasts.** London, Seagull Books.

COURSE OUTCOMES (CO)

After completion of the course, the student will be able to

CO 1	Identify India's geographical location, neighboring countries, and major geographical features.
CO 2	Interpret the significance of different types of architectural structures and Indian Knowledge Systems in shaping philosophical thought.
CO 3	Illustrate the role of different freedom fighters and their contributions to India’s independence.
CO 4	Demonstrate how oral narratives contribute to the preservation of tribal cultures.
CO 5	Assess the impact of economic liberalization on India's development.

Course Prepared by
Mr. J. SIBI CHAKARAVARTY
Assistant Professor

Course Approved by
Dr. V. V. MALINEE
BOS Chairman

25UVE302	VAC: HEALTH AND WELLNESS	SEMESTER – III

Course Objectives

The course aims to enhance students' overall health and well-being by focusing on thefollowing key areas:

- Stress management.
- Breaking unhealthy habits and promoting positive lifestyle changes.
- Improving interpersonal relationships and communication skills.
- Building physical fitness, mental resilience, and inner strength.

Credits: 1 **Total Hours: 15**

UNIT	CONTENTS	Hrs.	CO
	GUIDED ACTIVITIES		
I	**Introduction to Holistic Well-being:** 1. Introduce the core components of Health & Well-being namely Physical, mental and emotional well-being 2. Provide worksheets on all the four components individually and explain the interconnectedness to give an overall understanding.	1	CO 1
II	**Wellness Wheel Exercise (Overall Analysis)** • Guide students to assess their well-being in various life dimensions through exercises on various aspects of well-being, and explain the benefits of applying wellness wheel. • Introduce Tech Tools: • Explore the use of technology to support well-being. • Introduce students to apps for meditation, sleep tracking, or healthy recipe inspiration.	1	CO 1
III	**Breaking Bad Habits (Overall Analysis)** • Open a discussion on bad habits and their harmful effects. • Provide a worksheet to the students to identify their personal bad habits. • Discuss the trigger, cause, consequence and solution with examples. • Guide them to replace the bad habits with good ones through worksheets.	1	CO 2
IV	**Physical Well-being** 1. **Fitness:** Introduce the different types of fitness activities such as basic exercises, cardiovascular exercises, strength	2	CO 2

	training exercises, flexibility exercises, so on and so forth.(Include theoretical explanations and outdoor activity). 2. **Nutrition:**Facilitate students to reflect on their eating habits, their body type, and to test their knowledge on nutrition, its sources and the benefits. 3. **Yoga & Meditation:** Discuss the benefits of Yoga and Meditation for one's overall health - Demonstrate different yoga postures and their benefits on the body through visuals (pictures or videos) 4. **Brain Health:** Discuss the Importance of brain health for daily life. Habits that affect brain health (irregular sleep, eating, screen time) - Habits that help for healthy brains (reading, proper sleep, exercises) - Benefits of breathing exercises and meditation for healthy lungs. 5. **Healthy Lungs:** Discuss the importance of lung health for daily life. Habits that affect lung health (smoking, lack of exercises). Benefits of breathing exercises for healthy lungs. 6. **Hygiene and Grooming:** Discuss the importance of hygienic habits for good oral, vision, hearing and skin health - Discuss the positive effects of grooming on one's confidence level and professional growth. **Suggested Activities (sample):** **Nutrition:**Invite a nutritionist to talk among the students on the importance of nutrition to the body or show similar videos shared by experts on social media. Organize a 'Stove less/fireless cooking competition' for students where they are expected to prepare a nutritious dish and explain the nutritive values in parallel.		
V	**Emotional Well-being** 1. **Stress Management:** Trigger a conversation or provide self-reflective worksheets to identify the stress factors in daily life and their impact on students' performance - Introduce different relaxation techniques like deep breathing, progressive muscle relaxation, or guided imager (use audio recordings or visuals to guide them through these techniques) - After practicing the techniques, have them reflect on how these methods can help manage stress in daily life. 2. **Importance of saying 'NO':** Explain the students that saying 'NO' is important for their Physical and mental	2	CO 3

	well-being, Academic Performance, Growth and Future, Confidence, Self-respect, Strong and Healthy Relationships, building reputation for self and their family (avoid earning a bad name) - Factors that prevent them from saying 'NO' - How to practice saying 'NO". **3. Body Positivity and self-acceptance** Discuss the following with the students - What is body positivity and self-acceptance? - Why is it important? - Be kind to yourself - Understand that everyone's unique. **Suggested Activities (Sample):**(Importance of saying 'NO') Provide worksheets to self-reflect on.... ...how they feel when others say 'no' to them ...the situations where they should say 'no' Challenge students to write a song or rap about the importance of saying no and how to do it effectively.Students can perform their creations for the class.		
VI	**Social Well-Being** **1. Practicing Gratitude:** Discuss the importance of practicing gratitude for building relationships with family, friends, relatives, mentors and colleagues - Discuss how one can show gratitude through words and deeds - Explain how practicing gratitude can create 'ripple effect. **2. Cultivating Kindness and Compassion:** Define and differentiate between kindness and compassion - Explore practices that cultivate these positive emotions - Self-Compassion as the Foundation - The power of small gestures - Understanding another's perspective -The fruits of compassion. **3. Practising Forgiveness:** Discuss the concept of forgiveness and its benefits - Forgiveness: What is it? and What it isn't? - Benefits of forgiveness - Finding forgiveness practices. **4. Celebrating Differences:** Appreciate the value of individual differences and foster inclusivity - The World: A Tapestry of Differences (cultures, backgrounds, beliefs, abilities, and appearances) - Finding strength in differences (diverse perspectives and experiences lead to better problem-solving and innovation) - Celebrating differences, not ignoring them (respecting and	2	CO 3

	appreciating the unique qualities) - Activities for celebrating differences (share culture, learn about others, embrace new experiences). **5. Digital Detox** **Introduce the students to:**The concept of a digital detox and its benefits for social well-being. How to disconnect from devices more often to strengthen real-world connections. **Suggested Activities (sample):**(Practicing Gratitude) Provide worksheets to choose the right ways to express gratitude - Celebrate 'gratitude day' in the college and encourage the students to honour the house keeping staff in some way to express gratitude for their service.		
VII	**Intellectual Well-being** **1. Being a lifelong Learner - Give students an understanding on:**The relevance of intellectual well-being in this 21st century to meetthe expectations in personal and professional well-being - The Importance of enhancing problem-solving skills - Cultivating habits to enhance the intellectual well-being (using the library extensively, participating in extra-curricular activities, reading newspaper etc.) **2. Digital Literacy** **Discuss:**The key aspects of digital literacy and its importance in today's world - It is more than just liking and sharing on social media - The four major components of digital literacy (critical thinking, communication, problem-solving, digital citizenship) - Why is digital literacy important? - Boosting one's digital skills. **3. Transfer of Learning:** Connections between different subjects How knowledge gained in one area can be applied to others. **Suggested Activities (sample):** Intellectual Well-being -Provide worksheets to students for teaching them how to boost intellectual well-being - Ask the students to identify a long-standing problem in their locality, and come up with a solution and present it in the classroom. Also organize an event like 'Idea Expo' to display the designs, ideas, and suggestions, to motivate the students to improve their intellectual well-being.	2	CO 4
VIII	**Environmental Well-being:** The Importance of initiating a change in the environment. **The session could be around:**Defining Environmental well-being (physical, chemical, biological, social, and psychosocial factors) People's behaviour, crime, pollution, political activities,	1	CO 4

	infra-structure, family situation etc. Suggesting different ways of initiating changes in the environment (taking responsibility, creating awareness, volunteering,approaching administration). **Suggested Activities (sample);** Providing worksheets to self-reflect on how the environment affects their life, and the ways to initiate a change. Dedicate a bulletin board or wall space (or chart work) in the classroom for students to share their ideas for improving environmental well-being - Creating a volunteers' club in the college and carrying out monthly activities like campus cleaning, awareness campaigns against noise pollution, (loud speakers in public places), addressing anti-social behaviour on the campus or in their locality.		
IX	**Mental Well-being** **1. Importance of self-reflection** **Discuss:** Steps involved in achieving mental.well-being (self-reflection, self-awareness, applying actions, achieving mental well-being) - Different ways to achieve mental well-being (finding purpose, coping with stress, moral compass, connecting for a common cause) - The role of journaling in mental well-being. **2. Mindfulness and Meditation Practices** Benefits of practicing mindful habits and meditation for overall well-being. • **Connecting with nature:** Practising to be in the present moment Nature walk, feeling the sun, listening to the natural sounds - Exploring with intention Hiking, gardening to observe the nature - Reflecting on the emotions, and feeling kindled by nature. • **Serving people:** Identifying the needs of others - Helping others -Volunteering your time, skills and listening ear - Finding joy in giving. • **Creative Expressions:** Indulging in writing poems, stories, music making/listening, creating visual arts to connect with inner selves. **Suggested Activities (Sample):**(Mindfulness and Meditation) Conducting guided meditation every day for 10 minutes and directing the students to record the changes they observe.	1	CO 5
X	**Situational Awareness (Developing Life Skills)** **1. Being street smart** **Discuss:**Who are street smarts? - Why is it important	1	CO 5

	to be street smart?-Characteristics of a street smart person: Importance of acquiring life skills to become street smart (General First-aid procedure, CPR Procedure, Handling emergency situations like fire, flood etc). **2. Digital Awareness** **Discuss:**Cyber Security - Information Literacy - Digital Privacy - Fraud Detection **Suggested Activities (sample):** (Street Smart) Inviting professionals to demonstrate the CPR Procedure - Conducting a quiz on Emergency Numbers		
XI	**Understanding Addiction - Plan this session around** Identifying the environmental cues, triggers that lead to picking up this habit - Knowing the impact of substance abuse Adverse health conditions, social isolation, ruined future, hidden financial loss and damaging the family reputation - Seeking help to get out of this addiction. **Suggested Activities:** Provide Worksheets to check the students' level of understanding about substance addiction and their impacts - Share case studies with students from real-life - Play/share awareness videos on addiction/de-addiction, experts talk - *Conduct awareness programmes on Drugs and its ill effects.(Arrange Experts from the concerned government departments and NGOs working in drug addiction issues) and maintain the documents of the program.	1	CO 5

Closure: Each student should submit a Handwritten Summary of their Learnings& Action Plan for the future.

Assessments:

5. Use Self-reflective worksheets to assess their understanding.
6. Submit the worksheets to internal audit/external audit.
7. Every student's activities report should be documented and the same have to be assessed by the Physical Director with the mentor.
8. The evaluation should be for 100 marks.
9. No examination is required.

Scheme of Evaluation

Part	Description	Marks
A	Report	40
B	Attendance	20

C	Activities (Observation During Practice)	40
Total		**100**

Web Reference

1. United Nations Sustainable Development Goals - Goal 3 - Good Health & Well-Being: https://www.un.org/sustainabledevelopment/health/
2. Mindfulness and Meditation: Stanford Health Library offers mindfulness and meditation resources: https://healthlibrary.stanford.edu/books-resources/mindfulness-meditation.html
3. Breaking Bad Habits: James Clear provides a guide on how to build good habits and break bad ones: https://jamesclear.com/habits
4. 6 Ways to Keep Your Brain Sharp
5. https://www.lorman.com/blog/post/how-to-keep-your-brain-sharp
6. What Is Social Wellbeing? 12+ Activities for Social Wellness https://positivepsychology.com/social-wellbeing/
7. How Does Your Environment Affect Your Mental Health?
8. https://www.verywellmind.com/how-your-environment-affects-your-mental-health-5093687
9. How to say no to others (and why you shouldn't feel guilty) https://www.betterup.com/blog/how-to-say-no

COURSE OUTCOMES (CO)

After completion of the course, the student will be able to

CO 1	Demonstrate proficiency in sports training methods, physical fitness practices, and healthy lifestyle management.
CO 2	Apply physical fitness principles to improve overall health, endurance, strength, and flexibility.
CO 3	Enhance mental and emotional well-being, fostering a positive attitude towards health, discipline, and life balance.
CO 4	Develop professional competence and commitment in the field of health, fitness, and wellness practices.
CO 5	Create awareness of drug addiction and its harmful effects, promoting healthy choices and responsible behavior.

Course Prepared by
Dr.P.Govindan
Assistant Professor

Course Approved by
Dr.S. Maheskumar
BOS Chairman

24ULS301	**AEC I: CAREER COMPETENCY SKILLS I**	**SEMESTER – III**

Course Objectives

The course aim

- To develop and improve the problem solving skill.

Credits: 1 **Total Hours: 25**

UNIT	CONTENTS	Hrs.	CO
I	Pipes and Cisterns – Time and Work **Chapter 16, 17**	5	CO 1
II	Time and Distance – Boat and Streams **Chapter 18, 19**	5	CO 2
III	Problem on Trains – Alligation and Mixture **Chapter 20, 21**	5	CO 3
IV	Simple Interest - compound interest **Chapter 22, 23**	5	CO 4
V	Calendar – Clock – Permutation and combination **Chapter 27, 28, 30**	5	CO 5

Text Books

1. *Aggarwal R.S.* 2025. **Quantitative Aptitude.** [Revised Edition]. S. Chand & Co., New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the student will be able to

CO 1	Solve problems involving the concepts of Simplification and average.
CO 2	Solve problems involving the concepts of Surds and Indices
CO 3	Solve problems involving the concepts of Ratio and Proportion
CO 4	Solve problems involving the concepts of Profit and loss, Partnership.
CO 5	Solve problems involving the concepts of Age and Percentage.

Course Prepared by
Ms.A. ISWARYA
Assistant Professor

Course Approved by
Mr. T. RAJENDRAKUMAR
(BOS Chairman)

24UTAL401	**nghJj;jkpo; - IV**	**□□□□□□ - IV**

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- rq;f ,yf;fpaq;fis mwpKfk; nra;jy;.
- mw ,yf;fpaq;fs; gw;wp khzth;fs; mwpanra;jy;
- ,yf;fpa tuyhWfis mwpa itj;jy;

Credits: 3 **Total Hours: 50**

UNIT	***CONTENTS***	**Hrs**	**CO**
I	rq;f ,yf;fpak; (vl;Lj;njhif) m) FWe;njhif–ghly; 2>3>4>40>167 M) fypj;njhif–ghly; 1-5 ,) GwehD}W –ghly; 3>112 <) Iq;FWE}W –mk;kthopg;gj;J	10	**CO1**
II	rq;f ,yf;fpak; (gj;Jg;ghl;L) m) FwpQ;rpg;ghl;L (106thpfs;kl;Lk;;)	10	**CO2**
III	mw ,yf;fpak; m) jpUf;Fws; - kUe;J M) ehybahh; - Fbg;gpwg;G (Kjy; 5 ghly;fs;) ,) ,d;dhehw;gJ–Kjy; 5 ghly;fs; <) KJnkhopf;fhQ;rp–jz;lhg;gj;J	10	**CO3**
IV	,yf;fpatuyhW m) Kr;rq;ftuyhWmwpKfk; M) vl;Lj;njhif E}y;fs; ,) gj;Jg;ghl;L E}y;fs; <) gjpndz;fPo;f;fzf;F E}y;fs;	10	**CO4**
V	,yf;fzk; m) mfj;jpizfs; M)Gwj;jpizfs; ,) jd;tpid>gpwtpid>nra;tpid> nra;ghl;Ltpidthf;fpaq;fs	10	**CO5**

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1.jkpo;j;Jiw ntspaPL

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r.Nt.Rg;gpukzpak;> gjpnzd;fPo;f;fzf;F E}y;fs;>kzpthrfh; gjpg;gfk;> nrd;id> 2012.
GypA+h; Nfrpfs;> FWe;njhif> rhujh gjpg;gfk;>nrd;id- 2010
Ky;iyg;ghl;L> kiwkiyabfs;> ,uhikah gjpg;gfk;> nrd;id-

COURSE OUTCOMES (CO)

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CO1	vl;Lj;njhif E}y;fs; gw;wpmwpjy;.
CO2	gj;Jg;ghl;L E}y;fs; gw;wpmwpjy;.
CO3	mw ,yf;fpaq;fs; top tho;f;if $Wfisczh;j;Jjy;
CO4	,yf;fpatuyhw;wpd; Njhw;wk; tsh;r;rpiamwpjy;
CO5	mbg;gil ,yf;fzj;ijmwpjy;.

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**
CO2	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**
CO3	**H**	**L**	**L**	**L**	**L**	**L**	**H**	**M**	**M**	**M**
CO4	**H**	**M**	**M**	**M**	**M**	**M**	**H**	**M**	**M**	**M**
CO5	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**

H – High; M – Medium ; L - Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UENLA401	**ENGLISH FOR ARTS AND SCIENCE - IV**	**SEMESTER – IV**

Course Objectives

The course aims to

- Integrate language skills effectively in professional and academic contexts.
- Analyze and apply domain-specific registers to communicate with clarity and precision in subject-related discussions.
- Enhance proficiency by expanding vocabulary and evaluating its formal usage.
- Construct context-appropriate responses using advanced grammar, vocabulary, and technical terms in academic and professional settings.

Credits: 3 **Total Hours: 50**

UNIT	CONTENTS	Hrs.	CO
I	1. Listening : Listening to technical Style of communication, ABC of technical communication 2. Speaking : Public speaking and Extempore. 3. Reading : Reading scientific and technical texts 4. Writing : Proposals 5. Grammar : Determiners 6. Vocabulary : Fixed Expressions	10	CO 1
II	1. Listening : Listening and Note taking 2. Speaking : Techniques for neutralization of Mother Tongue Influence (MTI) 3. Reading : News magazines, Pamphlets, Reading words with accuracy. 4. Writing : Summary writing 5. Grammar : Common errors. 6. Vocabulary : Compare and Contrast expressions.	10	CO 2
III	1. Listening : Listening to accent of English – British & American 2. Speaking : Debate 3. Reading : Short narratives and descriptions excerpts interview. 4. Writing : Essay Writing. 5. Grammar : Mood, Modifiers. 6. Vocabulary : Changing words from one form to another.	10	CO 3
IV	1. Listening : Radio News / TV –News telecast 2. Speaking : Watch or Listen to documentaries 3. Reading : Reading Motivational Stories (Success stories in subject areas) 4. Writing : Report writing (Investigative and Progress report) 5. Grammar : Negation (Statements & Questions) 6. Vocabulary : Sequence of words	10	CO 4

V	1. Listening : Listening to health problems and advice, Stress in responses, Listening to restaurant Orders 2. Speaking and : Expressing Likes and dislikes, Agreeing disagreeing, Table manners. 3. Reading : Reading about the new hobby of geo coaching 4. Writing : Meeting Minutes 5. Grammar : Relative clause 6. Vocabulary in Context :Subject-Specific Vocabulary – Science / Arts	10	CO 5

Text Books

1. Thimmesha, L., Victor, R. 2022. **A Textbook of English Language Communication Skills,** [Revised Edition], Infinite Learning Solutions.

Reference Books

1. *Jack C. Richards., Jonathan Hull.,* 2015. **Interchange**. Cambridge University Press.
2. *Lakshminarayanan*., **A Course Book On Technical English**, Scitech Publications (India) Pvt. Ltd.

Web Reference

1. https://www.fluentu.com/blog/educator-english/esl-listening-websites/
2. https://americanenglish.state.gov/resources/teachers-corner-listening

COURSE OUTCOMES (CO)

After completion of the course, the student will be able to

CO 1	Understand and share information and ideas clearly in writing and speaking across different situations.
CO 2	Speak clearly and confidently in real-life situations using suitable communication methods.
CO 3	Analyze different texts to understand both their meaning and language use.
CO 4	Evaluate their own English language skills to identify strengths and areas for improvement.
CO 5	Create effective conversations and written pieces for different communication situations.

Course Prepared by
Mr. R. PACHAGOUNDAN
Assistant Professor

Course Approved by
Dr. V. V. MALINEE
BOS Chairman

24UBTM401	DSC VI: BIOPHYSICS AND BIOINSTRUMENTATION	SEMESTER-IV

Course Objectives:

The Course aims

- To study the basic techniques and principle of instrumentation.

Credits:4 **Total Hours:50**

UNIT	CONTENTS	Hrs	CO
I	**Introduction to Biophysics:** Nature of chemical bonds, Intra and inter molecular interactions in biological systems. Proteins: Amino acids – Conformations. Phi and Psi angles. Ramachandran plot. Peptides: peptide bond isomerisation. Disulphide bonds, electrostatic forces, vanderwaals interaction.	10	CO1
II	**Care and general maintenance of laboratory Instrumentation:** Weighing balance, pH meter, laminar flow chambers, Hot air oven, Autoclave and Incubator. Centrifugation – Types, Principle and Application. Relation between RCF and g.	10	CO2
III	**Chromatography**–Paper Chromatography, Thin Layer Chromatography, column chromatography, Ion Exchange Chromatography, High Performance Liquid Chromatography, Gas Chromatography and LC-MS.	10	CO3
IV	**Spectroscopy:** Electromagnetic Spectrum, Beer - Lambert's law, Principles of spectroscopy, types of UV-visible spectroscopy, Infrared spectroscopy, Atomic, NMR, Flourescence, **Electrophoresis** – Agarose Gel Electrophoresis, SDS-PAGE. Blotting techniques -Southern, Northern and immunoblotting.	10	CO4
V	Biosensors-principle and applications Electrochemical, thermometric, potentiometric - optical, piezo-electric and amperometric biosensors. Imaging techniques - principle and applications: X-ray, CAT Scan, ECG, EEG. Radioactive Decay – Principles, Types, applications of Gieger Muller Counter and Scintillation Counter.	10	CO5

Text Books

1 Pranav Kumar,. 2021. **Biophysics and Molecular Biology. (4th edition). Path finder Publication, India.**

2	*Boyer,.R.F.*1993. **Modern Experiments in Biochemistry.** [Second Edition]. The Benjamin/Cummings Publishing Company, Red wood City, California.
3	*Ghatak,K.L.* 2003. Techniques and Methods in Biology.PHI Learning Private Ltd. New Delhi.
Reference Books	
1	*Upadhyay.*2005. **Biophysical Chemistry.** Himalaya Publications.
2	*Wilson,.K. and Walker*,2003.**Practical Biochemistry.**[First Edition].Cambridge University Press.

COURSE OUTCOMES (CO)

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

CO1	Explain the presence of bonds is essential to study chemistry in human body.
CO2	Differentiate the instruments based on its working principle and learn about Handling with care.
CO3	Demonstrate the techniques of separation and purification of biomolecules based on its own property.
CO4	Illustrate blotting technique and centrifugation process
CO5	Find the technique for visual representation of interior parts of the body for Clinical analysis

MAPPING

PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	H	H	H	M	H	H	H	H
CO2	H	H	H	M	H	H	M	M	H	H
CO3	H	M	H	H	H	H	H	M	H	M
CO4	H	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H	H

H-High; M-Medium; L-Low

Prepared By
(Course Coordinator)

Approved By
(BoS Chairman)

24UBTMP401	**DSC PRACTICAL-IV**	**SEMESTER–IV**

Course Objectives:

The Course aims

- To understanding and the handling of biological instruments with care.
- To identify the unknown components in the test sample using photometric method.
- To separate the bio-molecules based on its individual property.

Credits:3 **Total Hours:36**

S.No	**EXPERIMENT**	**Hrs**	**CO**
1.	Principles and operation of pH meter–calibration and buffer Preparation	**03**	**CO1**
2.	Principles and operation of colorimeter and spectrophotometer (Application: Chlorophyll estimation)	**03**	
3.	Determination of Km and Vmax (Radish Peroxidase)	**03**	**CO2**
4.	Principles of Diffusion and Osmosis (through semi-permeable membrane)	**03**	
5.	Haemolysis	**03**	**CO3**
6.	Paper Electrophoresis	**03**	
7.	Column chromatography	**03**	
8.	Paper chromatography (plant extract)	**03**	
9.	Identification of amino acids by Thin-layer chromatography Method	**03**	
10.	SDS-PAGE	**06**	**CO4**
11.	Western blotting–Demonstration	**03**	**CO5**

Reference Book

1	Veerakumari .(2006).Bioinstrumentation,1st Edition, MJP Publishers.

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UMABTA401	**GEC IV:BIOSTATISTICS**	**SEMESTER– IV**

Course Objectives:

The Course aims

- To learn the strategies of research field and also to provide knowledge to understand the role of statistics in research.

Credits:2 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Introduction:** Definition – Function of Statistics – Limitations of Statistics–Collection of data–Classification and Tabulation. **(Chapter 1 Sections:1.3,1.7,1.8) (Chapter 2 Sections:2.1,2.3)**	**08**	**CO1**
II	**Measures of Central Tendency:** Arithmetic Mean–Median–Mode–Geometric mean –Harmonic mean. **(Chapter 3 Sections: 3.1.1,3.2 -3.5)**	**08**	**CO2**
III	**Measures of Dispersion and Variability:** Range–Inter Quartile Range and Quartile Deviation– Mean Deviation – Standard deviation– Coefficient of variation. **(Chapter 4 Sections :4.1 – 4.4)**	**08**	**CO3**
IV	**Correlation Analysis:** Types of correlation–Methods of studying Correlation (Excluding Correlation of grouped data).**Regression Analysis:** Regression line – Regression equations (Excluding Method of Least Square). **(Chapter 6 Sections:6.1 –6.2)(Chapter 7 Sections:7.1–7.2)**	**08**	**CO4**
V	**Sampling and Test of Significance:** Steps in test of hypothesis –Test of significance of small samples (t and F)–Chi-square test (Problems only). **(Chapter 10 Sections: 10.1,10.5)(Chapter11)**	**08**	**CO5**

Text Book

1	*Palanichamy. S and Manoharan.M,* 2001. **Statistical methods for Biologists.** [Third Edition]. Palani Paramount Publications, Palani.

Reference Books

1	*DanielW.W.*1987. **Biostatistics.** John Wiley and Sons, New york.
2	*Arora,P.N. and Malhan,P.K.*2006.**Biostatistics.** Himalaya Publishing House, Mumbai.

Course Outcomes (CO)

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

CO1	Learn the importance of statistics
CO2	Understand the concepts of measures of central tendency
CO3	Know the concepts of measures of dispersion
CO4	Gain knowledge on correlation and regression analyses
CO5	Test the samples using testing of hypothesis

MAPPING

PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	H	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H	H	H	H
CO3	M	H	H	M	H	H	H	H	H	H
CO4	H	M	H	H	M	H	M	M	H	H
CO5	H	H	M	H	H	M	H	H	M	H

H-High; M-Medium; L-Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UMABTAP401	**DSC PRACTICAL IV: STATISTICS (USING MS-EXCEL)**	**SEMESTER– IV**

Course Objectives:

The Course aims

- To give a good grip on concepts in analyzing the data using statistical software

Credits:2 **Total Hours: 21**

PROGRAM	CONTENTS	Hrs	CO
1	Diagrams and graphs	**03**	**CO1**
2	Measures of Locations	**03**	**CO2**
3	Measures of Dispersion	**03**	**CO2**
4	Correlation coefficient (Karl Pearson and Rank method)	**03**	**CO3**
5	Regression lines	**03**	**CO3**
6	Small sample test (t and F)	**03**	**CO4**
7	Chi-square test for independence of attributes.	**03**	**CO4**

Reference Books

1	*Bhattacharjee Dibyojyoti.* **Practical Statistics Using Microsoft Excel.** Asian Books Private Ltd.
2	*ApteD.P.*2008.**Statistical Tools for Mangers using MS-EXCEL.** Excel Books.

Course Outcomes (CO)

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

CO1	Demonstrate the data in diagrammatic and graphical representation
CO2	Find the averages and measures of dispersion
CO3	Calculate correlation and regression for huge amount of data
CO4	Gain knowledge about test of significance

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBTNM401	**MDC II: FUNDAMENTALS OF BIOTECHNOLOGY**	**SEMESTER-IV**

Course Objectives:

The Course aims

- To understand the basics about Biotechnology and its day to day application in daily life.

Credits:2 **Total Hours: 30**

UNIT	Contents	Hrs	CO
I	Introduction to Biotechnology –Origin and Evolution of Biotechnology, Old biotechnology and New biotechnology.	**06**	**CO1**
II	Food Biotechnology - Introduction, products, curd, idly, pickles, Cheese, wine.	**06**	**CO2**
III	Pharmaceutical Biotechnology – Introduction to antibiotics, uses and abuses of antibiotics. Vaccines– introduction, vaccine against common disease, vaccination schedule, edible Vaccine, Transgenic animals–fish and chicken.	**06**	**CO3**
IV	Agricultural Biotechnology–Genetically modified crops, pros and cons –Bt cotton and Bt brinjal, Golden rice, *Aloe vera* gel, SCP Spirulina, Spirulina pickle, mushroom cultivation, Azolla, Composting and Biofertilizer.	**06**	**CO4**
V	Proposal to bank for loan, MSME, Quality control - FSSAI, AGMARK, and ISO.	**06**	**CO5**

Reference book

1 *DaanJ.A.Crommelin, Robert D. Sindelar,* and *Bernd Meibohm,* 2008. **Pharmaceutical Biotechnology–Fundamentals and applications.** Informa Health care USA,Inc.

2 *Glick R. Bernard* and *Pasternak J Jack.*2007.**Molecular Biotechnology**.[Third Edition].ASM press, Washington D.C.

COURSE OUTCOMES (CO)

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

CO1	Gain knowledge about the basics of Biotechnology.
CO2	Explain about various food products.
CO3	Describe about the types of vaccines.
CO4	Illustrate about GMO and its products.
CO5	Explain about quality control.

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBTSB401	SEC II: BASICS OF RESEARCH (100%INTERNAL EVALUATION)	SEMESTER-IV

Course Objectives:

The Course aims

- To develop the basic knowledge about the research for the students.

Credits:2 **Total Hours: 25**

UNIT	CONTENTS	Hrs	CO
I	Research–Definition, Types of research, Research approaches, Criteria for good research, Essential steps in research.	**05**	**CO1**
II	Literature collection, Literature citation, Search Engines-Google scholar, PuBMed, Science Direct, Scopus. Referencing styles, Reference tools-Mendeley.	**05**	**CO2**
III	Research problem-Techniques involved in research problem, Hypothesis-Null & Alternative hypothesis. Experimental design – Basic principle, Sampling Unit, Controls.	**05**	**CO3**
IV	Research report-Types of research report (Thesis, Journal, Project proposal report), Components of research report, Formatting Table & Figures, Format of Thesis. Plagiarism. Funding Agencies (National and International) – Government , Private and NGO.	**05**	**CO4**
V	Journals- Impact factor, citation index, H-index, i10-index. Types of Manuscript- Research Article, Review article, Perspective, Short communications.	**05**	**CO5**

Reference Book

1	*Gurumani,N.*2006. **Research Methodology**.MJP Publishers.
2	*C.George Thomas.*2021. Research Methodology and Scientific Writing, 2nd Edition, Springer jointly published with ANE Books India.
3	*C.R.Kothari, Gaurav Garg.* 2022. Research Methodology, Methods and Techniques.

COURSE OUTCOMES (CO)

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

CO1	Depict about research and its classification.
CO2	Describe about Problem Identification & Formulation, Research Question, Investigation Question and hypothesis.
CO3	Explain about Literature collection and Literature citation.
CO4	Describe about Standard of Research journals–impact factors and citation index.
CO5	Elucidate about thesis Report, Table, Figures, Format of Thesis.

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H	H	H	H
CO3	H	M	H	H	H	M	H	H	H	H
CO4	M	H	M	M	H	H	M	M	H	H
CO5	H	M	H	H	M	M	H	H	M	H

H-High; M-Medium; L-Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UVE401	VAC IV: DIGITAL AND TECHNOLOGICAL SOLUTIONS	SEMESTER – IV

Course Objectives

The course aims

- To build familiarity with key digital paradigms.
- To create awareness about the importance and impact of digital technology.
- To impart knowledge of communication and network systems.
- To promote awareness and understanding of e-Governance and Digital India initiatives

Credits: 1 **Total Hours: 15**

UNIT	CONTENTS	Hrs.	CO
I	**Evolution of Digital Systems:** Introduction and Evolution of Digital Systems - Role and Significance of Digital Technology - Information and Communication Technology – Tools.	3	CO 1
II	**Computer System:** Computer System - Software and its types - Operating systems: Types and Functions. **Problem Solving:** Algorithms and Flowcharts.	3	CO 2
III	**Communication System:** Principles, Model & Transmission Media. **Internet:** Concepts - Application - WWW - Web Browsers and Search Engines – Messaging - Email and Social Networking.	3	CO 3
IV	**E-commerce & Digital Marketing:** Basic Concepts – Benefits of E-commerce – Challenges in Digital Marketing. **Computer Based Information System:** Significance and Types.	3	CO 4
V	**Digital India and e-Governance:** Initiatives, Infrastructure, Services and Empowerment. **Digital Financial Tools:** Unified Payment Interface - Aadhar Enabled Payment System – USSD - Credit / Debit Cards - e-Wallets - Internet Banking - NEFT/RTGS and IMPS - Online Bill Payments and PoS.	3	CO 5

Text Books

1. *Rajaraman, V.* 2018. **Introduction to Information Technology**, [3rd Edition], PHI Learning private Limited.
2. *Behrouz A. Forouzan,* 2022. **Data Communications and Networking**, [4th Edition], McGraw Hill.
3. *Balagurusamy, E.* 2009. **Fundamentals of Computers**, Tata McGraw Hill.

Reference Books

1. *Pramod Kumar, Anuradha Tomar, Sharmila, R.* 2021. **Emerging Technologies in Computing Theory, Practice, and Advances**, [1st Edition], Chapman and Hall/CRC Imprint.
2. *Stuart Jonathan Russell, Peter Norvig*. 2014. **Artificial Intelligence - A Modern Approach**, Pearson Education
3. *Samuel Greengard,* 2021. **Internet of Things**, [Revised and Updated Edition], MIT Press.
4. *Murthy, C.S.V*. 2002. **E-Commerce (Concepts, Models, Strategies),** Himalaya Publishing House.
5. *Judith S. Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman*, 2013. **Big Data for Dummies**, Wiley & Sons-Wiley.

COURSE OUTCOMES (CO)

After completion of the course, the student will be able to

CO 1	Understand digital systems, technology and the effective use of ICT tools.
CO 2	Gain knowledge of computer systems, software, operating systems, and problem-solving techniques.
CO 3	Learn about communication systems, computer networks, the internet, and various online platforms.
CO 4	Know about computer-based information systems, e-commerce, and digital marketing concepts.
CO 5	Gain awareness of Digital India initiatives, e-governance services and digital financial tools.

Course Prepared by
Dr. S. NITHYA
Assistant Professor

Course Approved by
Dr. J. TAMILSELVAN
(BOS Chairman)

24ULS401	AEC II: CAREER COMPETENCY SKILLS II	SEMESTER – IV

Course Objectives

The course aim

- Analyze the structure and function of English grammar for effective communication in diverse contexts.
- Demonstrate appropriate linguistic expressions and soft skills required for formal and informal interactions.
- Use effective communication techniques for professional speaking, writing, and interactions at the workplace

Credits: 1 **Total Hours: 25**

UNIT	CONTENTS	Hrs.	CO
I	**Advanced Functional Grammar in Context** Tense usage in Professional Settings - Present perfect - Past perfect - Future forms – Conditionals - Reported Speech	5	CO 1
II	**Professional Communication & Writing** Resume and Cover Letter writing - Writing memos, Meeting minutes	5	CO 2
III	**Soft Skills** Goal setting: SMART goals, planning and prioritization - Conflict resolution and problem-solving approaches	5	CO 3
IV	**Speaking Skills for Workplace** Debates - Group discussions	5	CO 4
V	**Advanced Professional Communication** Business Reports - Proposals	5	CO 5

Text Books

1. *Biber, Douglas, et al.* 2020. **Longman Grammar of Spoken and Written English**. Pearson Education,
2. *Vickers, Rachel. 2021.* **The Art of Writing a CV: A Practical Guide to Writing a Winning CV and Cover Letter**. [2nd Edition]. Kogan Page.

Reference Book

1. *Eastwood, John*. 2022. **Oxford Practice Grammar: Basic.** [3rd Edition]. Oxford University Press.
2. *Bailey, Stephen*. 2022. **Academic Writing: A Handbook for International Students**. [5th Edition]. Routledge.

COURSE OUTCOMES (CO)

After completion of the course, the student will be able to

CO 1	Identify and apply basic rules of English grammar in everyday communication.
CO 2	Construct clear and well-organized short pieces of writing for different purposes.

CO 3	Demonstrate appropriate social and professional expressions in spoken interactions.
CO 4	Develop effective verbal and non-verbal communication skills for various contexts.
CO 5	Engage in everyday conversations and workplace communication by applying appropriate language and etiquette.

Course Prepared by
Mr. J. SIBI CHAKARAVARTY
Assistant Professor

Course Approved by
Dr. V. V. MALINEE
BOS Chairman

24UBTM501	DSC VII: MOLECULARBIOLOGY	SEMESTER-V

Course Objectives:

The Course aims

- To know the molecular basis of cell and to obtain knowledge about various molecular mechanisms.

Credits:5 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	Genetic material: Central dogma of molecular biology. Evidences showing DNA and RNA as genetic material; DNA- Chemical composition & molecular structure, Watson and Crick's model - its biological significance; Forms of DNA (A, B, C, D & Z).	10	CO1
II	Origin & Models of - Meselson and Stahl's experiment - types of replication - Mechanism of DNA replication in prokaryotes (Rolling circle model and theta model) and eukaryotes (initiation, elongation and termination) - Enzymology of replication. DNA repair mechanisms: Photo reactivation, Excision repair (base excision and Nucleotide excision repairs), Recombination repair and SOS repair. Homologous recombination- Holliday model.	12	CO2
III	RNA polymerase and its types & promoters in prokaryotes and eukaryotes**.** Mechanism of Transcription in prokaryotes & eukaryotes - initiation, elongation and termination. Post transcriptional modifications - Prokaryotes (Capping and polyadenylation) and eukaryotes (Capping, Polyadenylation and splicing). tRNA editing.	12	CO3
IV	Translation & Protein synthesis: RNA – structure and function of rRNA, mRNA and tRNA. Genetic code: Properties of genetic code; codon- anticodon interaction- Wobble hypothesis. Elucidation of genetic code. Translation in prokaryotes and eukaryotes; Post translational modification of proteins & molecular chaperonins.	08	CO4
V	Regulation of gene expression–Concept of operon. (Inducible-lac and repressible-trp operon). Regulation of gene expression in eukaryotes – Zinc fingers motifs and Leucine zippers. Epigenetic regulation (DNA methylation & Histone modification).	08	CO5

Text Book

1 *RastogiS. C., 2006*. **Molecular Biology.**CBS Publishers and Distributors, New Delhi.

2 *Ajoypaul*, 2007.**Textbook of Cell and Molecular Biology**. Books and Allied Pvt.Ltd., Kolkatta.

COURSE OUTCOMES (CO)

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

CO1	Explain the concepts of molecular biology
CO2	Demonstrate the mechanism behind the mutations
CO3	Describe the transfer of genetic information from parent to off spring
CO4	Explain the protein synthesis and modifications, its actions in cellular levels.
CO5	Illustrate the genetic level changes of proteins and enzymes.

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H	H	H	H
CO3	M	H	H	H	M	H	M	H	H	H
CO4	H	M	H	M	H	M	H	M	H	H
CO5	H	H	H	H	M	M	H	H	M	H

H -

H-Hgh; M - Medium; L - Low

24UBTM502	DSC VIII: IMMUNOLOGY	SEMESTER-V

Course Objectives:

- To understand the basic principles of immune system and its response.

Credits:5 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**HISTORY AND SCOPE OF IMMUNOLOGY:** Types of Immunity. Cells of Immune system. Organs of Immune response and their functions. Haematopoiesis. Antigen- properties, classes, epitopes, haptens and adjuvants. Factors influencing antigenicity. Immunoglobulin- Structure, types, properties and functions.	10	CO1
II	**IMMUNOGLOBULINS:** Immunoglobulin- Structure, types, properties and functions. Antigen– Antibody interactions: Agglutination &Precipitation,Immunoelectrophoresis, Immuno fluorescence, RIA, ELISA &Hybridoma technology and its applications.	10	CO2
III	**ANTIGEN PROCESSING AND PRESENTATION:** MHC – types and importance- distribution and function. Antigen processing and presentation to T- lymphocytes (cytosolic pathway and endocytic pathway). Major classes of MHC genes and its regulation.	10	CO3
IV	**CYTOKINES, IMMUNE CELL ACTIVATION AND ALLERGIC REACTIONS:** Definition of cytokines, classification and types of cytokine, Biological functions of cytokines. Cytokine receptors. T-cell and B-cell activation and differentiation. Hypersensitivity reactions and its types.	10	CO4
V	**AUTOIMMUNITY:** Definition, types of autoimmune disorders. Mechanism of autoimmunity. Vaccines and its types. Immune response to bacterial, protozoal, parasitic diseases. Immuno deficiency diseases (HIV). Transplantation immunology – types of grafts. Mechanism of graft rejection. Immune suppression.	10	CO5

Text Book

1. *Nandhini Shetty*. 2007. **Immunology – Introductory text book**. New Age International Pvt. Ltd., New Delhi.
2. *Kindt, Goldsby and Osborne*. 2006 **Kuby Immunology.** [Sixth Edition]. W.H. Freeman Publication.

Reference Books

1. *IanRTizard,* 2006. **Immunology an introduction. [**Fourth Edition]. Advanced Immunology David male.
2. *KalusD. Elgert*, 2004.**Immunology understanding the Immune system.** [Second Edition].Wiley-Blackwell Publication.

COURSE OUTCOMES (CO)

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

CO1	Describe the types of Immunity and lymphoid organs.
CO2	Illustrate the antigens and antibodies.
CO3	Explain the Antigen –Antibody interaction in the form of Precipitation and Agglutination reaction by electrophoresis and diffusion processes and also by ELISA.
CO4	Demonstrate the MHC complex, Antigen processing and presentation and cytokines.
CO5	Explain the Hypersensitivity, Autoimmunity, Transplantation immunology and vaccines.

MAPPING

PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	M	M	H	H	M	H	H	H
CO2	H	H	M	H	M	H	H	H	H	M
CO3	H	H	H	H	H	M	H	M	H	M
CO4	H	H	H	H	H	M	H	M	H	M
CO5	H	H	H	H	H	H	H	M	M	M

H-High; M-Medium; L-Low

24UBTM503	DSC IX: INDUSTRIAL BIOTECHNOLOGY	SEMESTER-V

Course Objectives:

- To learn about the various bioprocess and engineering technology and to implement in industries.

Credits: 4 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**BASICS OF BIOPROCESS TECHNOLOGY:** Introduction, Definition, Scope and applications of Bioprocess. Introduction to fermentation and downstream processing technology. Isolation and screening of industrially important microorganism (enzymes, antibiotics and growth promoters). Strain improvement (mutation, recombination, selective enrichment protocols), preservation of microorganisms.	10	CO1
II	**DESIGN OF FERMENTOR:** Fermentation types. Design of fermentor – parts and its functions. Types of Bioreactors (Air lift, cyclone, column, packed tower) Mixed bioreactor systems. Methods of fermentation- Batch, fed batch, continuous fermentation. Validation of fermented product.	10	CO2
III	**UPSTREAM PROCESSING:** Substrates used in industrial fermentation and sterilization methods. Inoculum development, Bioconversion process. Common measurements and control systems (pH, temperature, dissolved oxygen & foam control). Instrumentation for process control – Heat and mass transfer (HMT) & Oxygen transfer mechanism (OTM).	10	CO3
IV	**DOWN STREAM PROCESSING:** Principles of Downstream processing – microbial cell disruption methods (Centrifugation, filtration). Intracellular product recovery-cell separation techniques (Ultra filtration, Liquid-Liquid extraction). Chromatographic techniques: (Column & Ion exchange), Physical methods (Evaporation, Distillation, Fluid extraction and Electro dialysis). Drying methods and crystallization.	10	CO4
V	Industrial production of value added products: Production of alcohol (ethanol &butanol), production of Organic acids (citric acid and acetic acid), Amino acids (lysine, glutamic acid), Enzymes (amylase and protease), antibiotics (penicillin and streptomycin) and vitamins (ascorbic acid & B12).	10	CO5

Text Book

1	*Crueger, W, and Crueger,A*. 2002. **A Text Book of Industrial Microbiology.** [Second Edition].Science Tech Publishers, USA.
Reference Books	
1	*Shuler, M.L. and Kargi.F.*2004. **Bioprocess Engineering: Basic Concepts.** [Second Edition].Prentice Hall. Pvt. Ltd., New Delhi.
2	*Aiba,S, Humphrey,A.E and Millis,N.F*,1973,**Biochemical Engineering** [Second Edition], Academic Press, New York.
3	*Stanbury,P.F,Hall.S,and Whitaker,A.*1995.**Principles of Fermentation Technology** [Second Edition],.Elsevier Science Ltd

COURSE OUTCOMES (CO)

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

CO1	Explain the isolation, screening and improvement of industrially important Microorganisms
CO2	Demonstrate the design, functions and types of bioreactor as well as various Fermentation methods.
CO3	Explain abou the operations and applications of bioreactor.
CO4	Illustrate about the production of an organic acids, amino acids, enzymes and Antibiotics at an industrial Level.
CO5	Describe about downstream processing.

MAPPING

PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	M	M	H	H	M	H	H	H
CO2	H	H	M	H	M	H	H	H	H	M
CO3	H	H	H	H	H	M	H	M	H	M
CO4	H	H	H	H	H	M	H	M	H	M
CO5	H	H	H	H	H	H	H	M	M	M

H-High; M-Medium; L-Low

24UBTM504	DSC X: PLANT TISSUE CULTURE TECHNOLOGY	SEMESTER-V

Course Objectives:

The Course aims

- To acquire knowledge about principles, technical requirement, scientific and commercial applications of plant tissue culture.

Credits: 4 **TotalHours:50**

UNIT	CONTENTS	Hrs	CO
I	**INTRODUCTION TO PLANT TISSUE CULTURE:** Plant tissue culture history, Laboratory organization sterilization methods, media preparation & types of media (MS, White's Gamborg's & Nitsch), plant growth regulators & Sterilization techniques. Applications of crop improvement in agriculture, horticulture and forestry.	10	CO1
II	**PLANT TISSUE CULTURE TECHNIQUES**: Micropropagation, Callus induction. Cell culture techniques, Protoplast culture and fusion. Organogenesis and somatic embryogenesis. Haploid production of plants (Anther, Pollen, embryo, Ovary & Ovule cultures). Somatic embryogenesis.	10	CO2
III	**GENE TRANSFER METHODS**: *Agrobacterium mediated gene transfer*. (*A.tumefaciens* and *A.rhizogens*). Production of virus free plants. Physical methods of gene transfer - Microinjection, Macroinjection and Particle bombardment (Biolistic). Chemical methods of gene transfer – calcium chloride, and liposome mediated. Electrical methods (Electro fusion, electroporation).	10	CO3
IV	**GENETIC ENGINEERING IN PLANTS:** Plant gene expression cassette systems - selectable markers, reporter genes and promoters in plant vectors. Production of elite varieties in plants - Development of Insect resistant (BT-cotton), Herbicide resistant, virus resistant, Stress tolerant, drought tolerant and saline tolerant plants. Cytoplasmic Male sterility (CMS).	10	CO4
V	**APPLICATIONS OF PLANT GENETIC TRANSFORMATION AND MOLECULAR FARMING:** Post-harvest losses: long shelf life of fruits and flowers, use of ACC synthase, polygalacturonase, ACC oxidase. RNAi, Reverse genetics and CRISPR/Cas9: A powerful tool for crop genome editing. Biodegradable plastics, polyhydroxybutyrate, therapeutic proteins, edible vaccines, Oleosin partitioning technology.	10	CO5

Text Book

1. Plant Biotechnology: The genetic manipulation of plants. Second edition. Slater, Scott, and Fowler, 2008, Oxford University Press, UK.
2. Plant cell culture. A practical approach. Second edition. Edited by R.A. Dixon and R.A. Gonzales.1994. Oxford University Press. UK.
3. An Introduction to Plant Tissue Culture, Third Edition, M.K. Razdan, Oxford and IBH Publishing Co., 2003.
4. Introduction to plant biotechnology, Third edition, H S Chawla, 2009

Reference Books

1	*Chawla,H.S*. 1998. Biotechnology in crop improvement. International book Distribution co. NewDelhi.
2	*Jain,V.K.,*2013.Fundamentals of plant physiology.(Fifth edition). S. Chand And company, NewYork.
3	*Trivedi, P.C.* 2004. Advances in plant physiology. (Third edition).I.K. International publications pvt Ltd, New Delhi.
4	*Slater, Scott and Fowler* .2003. Plant Biotechnology(The genetic manipulation Of plants), Oxford University, UK.
5	An introduction to genetic engineering in plants, Mantel, Mathews, and Mickee, 1985. Blackwell Scientific Publishers. UK.
6	In Vitro Culture of higher plants, Pierik, 1987. MartinusNijhoff Publisher, Germany.
7	Plant Molecular Biology by Grierson and Convey.1984. Blackie and Son Limited. USA
8	Plant Biotechnology and Transgenic Plants, Edited by Kirsi-MarjaOksman-Caldentey and Wolfgang Barz. 2002, Marcel Dekker, Inc. USA.
9	Song et. al. (2016) CRISPR/Cas9: A powerful tool for crop genome editing, The Crop Journal, 4: 75-82
10	Horn, M. E., Woodard, S. L., & Howard, J. A. (2004). Plant molecular farming: systems and products. Plant cell reports, 22(10), 711-720.
11	Sedeek, K. E., Mahas, A., & Mahfouz, M. (2019). Plant genome engineering for targeted improvement of crop traits. Frontiers in plant science, 10, 114.

COURSE OUTCOMES (CO)

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

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	M	H	H	M	H	H	H
CO2	H	H	M	H	M	H	H	H	H	M
CO3	H	H	H	H	H	M	H	M	H	M
CO4	H	H	H	H	H	M	H	M	H	M
CO5	H	H	H	H	H	H	H	M	M	M

MAPPING

CO1	Explain the applications, history of plant tissue culture and preparation of Various types of plant tissue culture medium
CO2	Illustrate the methods of propagation of plants under *in vitro* condition and Transformation techniques
CO3	Describe the embryo culture, Production of haploid, resistant and stress Tolerant plants
CO4	Explain about somatic embryogenesis, Germplasm preservation, plant genome organization, synthetic seed technology and Genetic engineering for Improvement of protein, lipids, carbohydrates and vitamins.
CO5	Explain about Protoplast culture, Production of virus free plants, Somaclonal Variation and Plant secondary metabolites.

H-High; M-Medium; L-Low

24UBTEL501	DSE I:BIOINFORMATICS	SEMESTER-V

Course Objectives: To understand and gain both the theoretical and practical concepts in Bioinformatics.

Credits: 3 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Bioinformatics: an overview** - Introduction to Computational Biology and Bioinformatics; some of the biological problems that require computational methods for their solutions; Role of internet and www in bioinformatics. Biological Databases Acquisition –Primary and Secondary databases, Nucleotide sequence databases. Types of DNA sequences – genomic DNA, cDNA, Expressed sequence tags (ESTs).	08	CO1
II	**Sequence Analysis** – Methods of sequence alignment: Dot plots; Scoring matrices – identify matrix, genetic code matrices (GCM); Substitution matrices, Percentage accepted Mutation (PAM). Block Substitution Matrices (BLOSUM), dynamic programming algorithms; Needlman-Wunch and Smith Waterman; alignment scores and gap penalties; Database searching (BLAST and FASTA). Multiple Sequence alignment (MSA) – signifiance. Softwares : ClustalW and Meme.	08	CO2
III	**Phylogenetic analysis** – Phylogenetics, cladistics and ontology; Phylogenetic representations – graphs, trees and cladograms; Classification and ontologies; Steps in phylogenetic analysis; Methods of phylogenetic analysis – similarity and distance tables, distance matrix method; Calculating distance matrix (UPGMA, WPGMA); The Neighbor Joining Method; The Fitch/Margoliash method.	08	CO3
IV	**Structure prediction**: protein- Methods for prediction of secondary and tertiary structures of proteins – knowledge-based structure prediction; fold recognition; *ab initio* methods for structure prediction, Comparative protein modeling. Identification of motifs and domains, protein family database. RNA structure prediction.	08	CO4
V	**Applications of bioinformatics in Drug discovery**: Finding new drug targets to treat diseases – Pharmacophore identification - Structure based drug design. Mining of sequence data: Mining data from Yeasts. Microarray and genome wide expression analysis: transcriptomes, proteome: Genomics in medicine, disease monitoring, profile for therapeutic molecular targeting.	08	CO5

Text Books	
1	*JinXiong*, 2006. **Essential Bioinformatics**. Cambridge University Press. UK.
2	*Attwood,K.* and *SmithJ.P.*2003.**Introduction to Bioinformatics.** Pearson Education, Singapore.
Reference Books	
1	*RajaramanV*.,2003.**Introduction to information technology.** Prentice Hall of India Pvt. Ltd, New Delhi.
2	*Lesk,A.M.*, 2002. **Introduction to Bioinformatics**. Oxford University Press, London.
3	*AttwoodT.K.* and *Parry-SmithDJ.* 2005. **Introduction to Bioinformatics**. [First Edition].Pearson Education, UK.
4	*KothekarV.* and *NanditT* ,2007.**An Introduction to Bioinformatics**. [Second Edition].Duck worth press – Bioscience Publishers, New Delhi.
5	*David W Mount* ,2004. **Bioinformatics: Sequence and Genome Analysis**. CSHL Press,New York.

COURSE OUTCOMES (CO)

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

CO1	Gain knowledge about basic computer components and concepts of Biomolecules in computer
CO2	Understand the basic concepts and applications of Bioinformatics
CO3	Apply the ideas in deposition & retrieval of data's in biological database
CO4	Compare several data's for analyzing evolutionary relationship
CO5	Do the prediction of protein structure by several methods

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	M	H	H	M	H	H	H
CO2	H	H	M	H	M	H	H	H	H	M
CO3	H	H	H	H	H	M	H	M	H	M
CO4	H	H	H	H	H	M	H	M	H	M
CO5	H	H	H	H	H	H	H	M	M	M

H-High; M-Medium; L-Low

24UBTEL502	DSE I: STEM CELL BIOLOGY	SEMESTER-V

Course Objectives:

The Course aims

- To equip students with a solid frame work of knowledge in stem cell biology.

UNIT	CONTENTS	CO
I	**Introduction to Stem Cells:** Definition, history, and significance of stem cells. Properties: self-renewal, potency, clonality. Types of stem cells: Totipotent, pluripotent, multipotent, unipotent. Sources of stem cells: Embryonic, adult, fetal, cord blood. Stem cell niche and microenvironment. Basic techniques in stem cell culture.	**CO1**
II	**Embryonic Stem Cells & Development:** Early embryonic development (zygote to blastocyst). Isolation and culture of embryonic stem cells (ESCs). Molecular basis of pluripotency: Key transcription factors (Oct4, Sox2, Nanog). Epigenetic regulation in stem cells. Differentiation pathways and lineage commitment. Organoids and 3D culture systems	**CO2**
III	**Adult Stem Cells & Induced Pluripotent Stem Cells:** Adult stem cells: Hematopoietic stem cells, Mesenchymal stem cells, Neural stem cells, Bone marrow stromal cells, Skeletal muscle stem cells, Liver stem cells,. Stem cell plasticity and trans-differentiation. Induced pluripotent stem cells (iPSCs): Reprogramming techniques, Yamanaka factors. Comparison: ESCs vs iPSCs. Stem cells in aging and cancer.	**CO3**
IV	**Stem Cell Techniques & Applications:** Stem cell culture and characterization techniques. Cell sorting (FACS, MACS). Tissue engineering and biomaterials. Stem cells in: Regenerative medicine, Drug screening and toxicology, Disease modeling (diabetes, neurodegenerative diseases). Gene editing (CRISPR-Cas9 in stem cells).	**CO4**
V	**Clinical Applications, Ethics & Regulations:** Stem cell therapy: Bone marrow transplantation, Cardiovascular repair, Neurodegenerative disorders. Clinical trials and challenges. Cancer stem cells. Ethical issues: Embryonic stem cell controversies. Regulatory guidelines: ICMR & DBT guidelines (India), Global regulations. Future perspectives in stem cell research.	**CO5**

Reference Book

1 *Kaushik D.Deb, Satish M.Totey.2009.***Stem cells: Basics and Applications.** Tata MC Graw Hill Education Private Limited.

2 **Rodrigues, G. & Roelen, B.A.J. (2020)** – *Concepts and Applications of Stem Cell Biology* (Springer)

3 **Brand-Saberi, B. (2020)** – *Essential Current Concepts in Stem Cell Biology* (Springer)

4 **Lanza, R. et al. (Latest Edition)** – *Essentials of Stem Cell Biology* (Elsevier)

COURSE OUTCOMES (CO)

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

CO1	Gain knowledge about properties and sources of stem cells.
CO2	Explain about isolation, culturing, identification and characterization of human Embryonic stem cells.
CO3	Describe about the types of stem cells and its applications.
CO4	Explain about therapeutic need for stem cells.
CO5	Illustrate about stem cell therapy and preservation of stem cells.

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	M	H	H	M	H	H	H
CO2	H	H	M	H	M	H	H	H	H	M
CO3	H	H	H	H	H	M	H	M	H	M
CO4	H	H	H	H	H	M	H	M	H	M
CO5	H	H	H	H	H	H	H	H	H	M

H- High; M- Medium; L-Low

24UBTEL503	DSE I: NANOBIOTECHNOLOGY	SEMESTER-V

Course Objectives:

The Course aims

- To know the basis of nanobiotechnology and to obtain knowledge about various applications.

Credits: 3 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Nanobiotechnology:** Definition, prospects and challenges; Topology of DNA, protein and lipids and self-assembly from Natural to artificial structures. Top up and bottom down approaches in nanomaterial fabrication.	08	CO1
II	**Nanomaterials and its properties**: Carbon nanotubes and nanorods, Quantom dots, metal based nanostructures (Iron oxide nanoparticles), nanowires, polymer based nanostructures (dendrimers), Gold nanostructures (nanorods, nanocages, nanoshells), nanocomposites.	08	CO2
III	**Fabrication and Analysis of biomolecular nanostuructures:** Atomic Force Microscopy, Scanning Probe Electron Microscopy and Lithography. Nanoscale detection: Lab on a Chip. Fabrication of bio-nanochip & Microarray technology.	08	CO3
IV	**Miniaturized devices in nanobiotechnology:** Types and applications; Nanobiosensors: different classes, molecular recognition elements (MRE), transducing elements, applications of MRE in nanosensing of different analytes.	08	CO4
V	**Applications of Nanobiotechnology:** Nanomedicine, Diagnosis and treatment of infectious diseases, cancer research and therapy, tissue engineering and regenerative therapy; Nanostructures in drug discovery & drug delivery.	08	CO5

Reference Books

1. Nano-biotechnology: concepts, applications and perspectives. Christ of M. Niemayer, chad A. Mirkin, Wiley VCH publishers 2004.
2. Bio-nanotechnology: Lessons from Nature, David. S. Goodshell, John wiley 2006.
3. Buddy, D.R. Allan, S.H. Frederick, J.S. and Jack, E.L. Biomaterials Sciences: An Introduction to Materials in Medicine. 2nd edition.
4. David, L.N. and Michael, M.C. (2006). Lehninger‟s principles of Biochemistry. 4th edition.
5. David, S. and Goodshell, J. (2006). Bionanotechnology: Lessons from Nature.
6. Molecular Design and Synthesis of Biomaterials. (2005). Biological Engineering Division, MIT Open Course Ware.
7. *Christ of M.Niemayer, Chad A.Mirkin,* 2004.**Nano biotechnology:Concepts, Applications and perspectives.** Wiley VCH publishers.

8. *Tuan Vo-Dinh*,2007**. Nanotechnology in Biology and Medicine: Methods Devices and Applications.** CRC Press,TaylorandFrancisInc.,London.
9. *Torchilin VladimirP.*2006**. Nanoparticulates as Drug Carriers**. World Scientific. Imperial College Press, World Scientific Publishing Co.Pt.Ltd, London.

COURSE OUTCOMES (CO)

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

CO1	Understand the basic concepts and biomaterials
CO2	Gain knowledge about the methods and drug nanoparticles
CO3	Apply the applications of nanoparticles in medicine
CO4	Synthesize nanoparticles using biological materials
CO5	Diagnose and treat cancer and improve their Current Approaches and Challenges in nanotechnology

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	M	H	H	M	H	H	H
CO2	H	H	M	H	M	H	H	H	H	M
CO3	H	H	H	H	H	M	H	M	H	M
CO4	H	H	H	H	H	M	H	M	H	M
CO5	H	H	H	H	H	H	H	M	M	M

H-High;M-Medium;L-Low

24UBTMP501	DSC PRACTICAL-V	SEMESTER-V

Course Objectives:

The Course aims

- To develop handling and understand the principle workings in the field of Molecular Biology, Immunology, Industrial Biotechnology and Plant tissue culture technology.

Credits: 2 **Total Hours: 42**

S.No	EXPERIMENT	Hrs	CO
1.	Differential identification of Blood cells	03	CO1
2.	Blood cell counting –RBC and WBC	03	
3.	ABO Blood grouping	03	
4.	Ouchterlony Double Diffusion	03	CO2
5.	Radial Immuno diffusion	03	
6.	Immuno electrophoresis	03	
7.	Enzyme Linked Immuno sorbent Assay (ELISA)	03	
8.	Isolation of enzyme (Amylase)producing bacteria from soil sample	03	CO3
9.	Cell disruption – Sonication	03	
10.	Protein estimation by Lowry's method	03	CO4
11.	Wine production and alcohol estimation	03	
12.	Preparation of medium for plant tissue culture technology	03	CO5
13.	Sterilization of explants and Callus induction	03	
14.	Micropropagation	03	

Reference Books

1. *Robert,F.S., and Pieter, C.W.,* 2016. Practical Methods in Molecular Biology.16 Edition, Springer Verlag, NewYork.
2. *Kulandaivel,S.and Janarthanan,S.*2012.Practical Manual on Fermentation Technology.TK Publishers, NewDelhi.
3. *Frank C.H.,and Olwyn M.R.W.*,2002. Practical Immunology.Blackwell Publishing Company. UK.
4. *Lindsey,K.*,1997.Plant Tissue Culture Manual. Springer, Dordrecht, UK

COURSE OUTCOMES (CO)

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

CO1	Identify and count the blood cells and perform blood grouping
CO2	Perform ODD, RID, immune electrophoresis and ELISA
CO3	Isolate amylase producing bacteria and disrupt the cells
CO4	Estimate the amount of protein and alcohol present in a particular sample
CO5	Perform plant tissue culture

24UBTSB501	SEC III: ENTREPRENEURIAL BIOTECHNOLOGY	SEMESTER–V

Course Objectives:

The Course aims

- To know about the knowledge of standard in the corporate world.
- To study about the transgenic plants and animals.

Total Hours: 25

UNIT	CONTENTS	Hrs	CO
I	**Unit-1: Introduction to Entrepreneurship in Biotechnology**- Concept and importance of entrepreneurship. Types of entrepreneurship: technology-based, social, rural, women entrepreneurship. Scope of biotechnology entrepreneurship in India and global level. Traits of successful biotech entrepreneurs. Innovation and ideation in biotechnology. Overview of biotech startup ecosystem (incubators, accelerators, biotech parks).	05	CO1
II	**Unit-2: Business Planning and Start-up Development -** Opportunity identification in biotechnology sectors. Market analysis and feasibility study. Business models in biotechnology (B2B, B2C, licensing, CROs). Preparation of business plan: Executive summary, Product/service description and, Marketing and financial planning. Startup lifecycle: idea → validation → scaling. Case studies of successful biotech startups.	05	CO2
III	**Intellectual Property Rights (IPR) & Technology Transfer –** Introduction to Intellectual Property Rights. Types: patents, trademarks, copyrights, trade secrets. Patent process: filing, examination, commercialization. IPR in biotechnology (biologics, GMOs, diagnostics). Technology transfer and licensing agreements. Role of institutions: Biotechnology Industry Research Assistance Council (BIRAC) and Department of Biotechnology (DBT).	05	CO3
IV	**Funding, Finance & Regulatory Affairs –** Sources of funding: seed funding, venture capital, angel investors. Government funding schemes (India): BIRAC, DBT, Startup India. Financial management basics for startups. Regulatory requirements in biotechnology: Drug and vaccine approval process, Clinical trials overview. Role of regulatory authorities: Central Drugs Standard Control Organization (CDSCO) and Food Safety and Standards Authority of India (FSSAI). Biosafety and bioethics regulations	05	CO4

V	**Commercialization, Ethics & Emerging Trends** – Product development and commercialization strategies. Scaling up and manufacturing in biotechnology. Marketing strategies for biotech products. Entrepreneurship in emerging areas: Synthetic biology, Bioinformatics startups, Agricultural biotechnology. Ethical issues in biotech entrepreneurship. Social entrepreneurship and sustainability. Success stories and challenges in biotech startups.	**05**	**CO5**

Text Books

1.G. Rangaswami and D.J. Bagyaraj, 1998. **Agricultural Microbiology**.[Second Edition]. Prentice, Hall of India Pvt. Ltd., New Delhi.

2.Shimasaki, C. – *Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies*, Academic Press

3.Kumar, V. – *Entrepreneurship Development in Biotechnology*, New India Publishing

4.Hisrich, R.D., Peters, M.P. & Shepherd, D.A. – *Entrepreneurship*, McGraw-Hill

Reference Books

1. Purohit, S.S. 2009. **Biotechnology**: **Fundamentals and Applications**.[Fourth Edition].

2. KeshavTrehan,1997. **Biotechnology.** New age International Pvt. Ltd. Publication.

3. Freshney, R.I. 2005. **Culture of Animal cells***:* A manual of basic technique. [Fifth Edition].John wiley and Sons, New Jersey.

COURSE OUTCOMES (CO)

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

CO1	Explain about Corporate Biotechnology.
CO2	Recall about genetically modified crops.
CO3	Describe about the animal breeding and ethical guidelines.
CO4	Explain about aquaculture and arboriculture.
CO5	Produce biofertilizers and biopesticides.

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	M	H	H	M	M	H	H
CO2	H	H	M	H	M	H	H	M	H	M
CO3	H	H	M	H	H	M	H	H	M	M
CO4	H	H	H	H	H	M	H	H	M	M
CO5	H	H	H	H	H	H	H	H	H	M

H-High; M-Medium; L-Low

24ULS501	CAREER COMPETENCY SKILLS-III	SEMESTER– V

Course Objectives:

The course aims

- To impart knowledge on the logical reasoning.
- To enhance employability skills and to develop career competency.

Total Hours: 15

UNIT	CONTENTS	Hrs	CO
I	**Verbal Reasoning:** Number Series Completion-Alpha Series Completion- Blood Relation-Distance and Direction - Analogy-Inequality- Classification.	3	CO1
II	**Non-Verba l Reasoning:** Series Completion-Analogy and Classification – Completion of Incompletion Pattern.	3	CO2
III	**Non-Verbal Reasoning**: Mirror Image and Water Image– Statement and Arguments-Cubes and Dices.	3	CO3
IV	**Reasoning:** Puzzle Arrangement-Syllogism-Input and Output.	3	CO4
V	**Verbal Reasoning:** Linear Arrangement - Circular Arrangement–Matrix Arrangement.	3	CO5

Text Book

1	Test of Reasoning–R S Aggarwal, S Chand and Company Limited, 2017 Edition, New Delhi.

Reference Book

1	Verbal &Non-Verbal Reasoning For Competitive Exams- Gajendra Kumar, Abhishek Banerjee, Disha publication, New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Understand the core concepts of Verbal Reasoning
CO2	Formulate Non Verbal Reasoning with shortcuts
CO3	Find Mirror Image, Cubes and Dices
CO4	Obtain the knowledge on shortcuts to solve Puzzles.
CO5	Solve Linear Arrangement and Matrices with shortcuts.

24UBTM601	DSC XI: RECOMBINANT DNA TECHNOLOGY	SEMESTER-VI

Course Objectives:

The Course aims

- To introduce gene cloning and r-DNA techniques to undergraduates

Credits: 5 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**SCOPE AND MILESTONES OF GENETIC ENGINEERING**: Biomolecular tools and their applications in genetic engineering: Restriction endonucleases and its types, DNA polymerases, DNA Ligase, Methylase, Taq polymerase, Reverse transcriptase. DNA modifying enzymes (Alkaline phosphatase, Polynucleotide kinase, Terminal deoxy nucleotidyl transferase). S1nuclease, RNAse H and DNAse I.	10	CO1
II	**GENE CLONING VECTORS**: Plasmids (PBR322, PUC and BAC), Lambda vectors, Phagemids, Cosmids, M13 vectors, Shuttle vectors. DNA sequencing (Maxam-Gilbert and Dideoxy) methods. DNA amplification: PCR (Principles & types - RT PCR, Real time PCR and Nested PCR). cDNA synthesis.	10	CO2
III	**CLONING STRATEGIES**: Cloning of interacting genes - Yeast two hybrid systems. Cloning of differentially expressed genes - Nucleic acid micro arrays and Site directed mutagenesis. Methods to study gene regulation: DNA transfection & S1 mapping.	10	CO3
IV	**INTRODUCTION TO CLONING**: Detection & Screening of clones. Expression strategies for heterologous genes. Vector engineering and codon optimization. In-vitro transcription, expression of cloned genes in prokaryotes (bacteria – Glucose promoter) and eukaryotes (Yeast – Alcohol promoter).	10	CO4
V	**APPLICATIONS OF rDNA TECHNOLOGY**: Processing of recombinant proteins, Purification and refolding, characterization of recombinant proteins. T-DNA tagging and transposon tagging: Role of gene tagging in gene analysis, Transgenic technologies: Targeted gene replacement technology.	10	CO5

TEXT BOOK

1	*Brown,T.A.* 2006. **Gene cloning and DNA analysis an Introduction.** [Fourth Edition].Blackwell Publication.

REFERENCEBOOKS

1. Molecular cloning: a laboratory manual. J. Sambrook, EF. Frisch and T. Maniatis, Cold Spring Harbor Laboratory Press, New York.2000.
2. DNA cloning: a practical approach, DM. Glover and BD Hames, IRL Press, Oxford,

1995.
3. Molecular and Cellular Methods in Biology and Medicine, PB. Kaufman, W.Wu. D, Kim and L.J Cseke, CRC Press, Florida, 1995.
4. Methods of Enzymology vol. 152, Guide to molecular cloning techniques, SL. Berger and AR. Kimmel Academic Press, Inc. An Diego, 1998.
5. Methods in Enzymology. Vol 185, gene expression technology, DV. Goeddel Academic Press, inc. San Deigo, 1990.
6. DNA science. A first Course in Recombinant Technology. DA. Mickloss and GA. Freyer; CokJ Spring Harbor Laboratory Press, New York, 1990.
7. Molecular Biotechnology. SB. Primrose, Blackwell Scientific Publishers, Oxford, 1994.
8. Milestones in Biotechnology. Classic papers on genetic Engineering. JA. Davis and WS. Reznikoff, Butterworth-Heinemann, Boston, 1992.
9. Route maps in Gene technology, MR. Walker and R. Rapley, BlackwelScience Ltd., Oxford, 1997.
10. Genetic Engineering. An Introduction to gene analysis and exploitation in eukaryotes, SM. Kingsman and AJ. Kingsman, Blackwell Scientific Publications, Oxford, 1998.
11. Molecular Biotechnology - Glick and Pasternak.
12. Principles of gene manipulations - Old & Primrose.

COURSE OUTCOMES (CO)

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

CO1	Enlist the functions of enzymes used in Recombinant DNA technology
CO2	Extend the usage of DNA cloning vectors
CO3	Produce DNA libraries & use the screening methods
CO4	Express the recombinant proteins.
CO5	Apply the skills for the molecular techniques.

MAPPING

PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	M	M	H	H	M	H	H	H
CO2	H	H	M	H	M	H	H	H	H	M
CO3	H	H	H	H	H	M	H	M	H	M
CO4	H	H	H	H	H	M	H	M	H	M
CO5	H	H	H	H	H	H	H	M	M	M

H-High; M-Medium;L-Low

24UBTM602	DSC XII: ENVIRONMENTAL BIOTECHNOLOGY	SEMESTER-VI

Course Objectives:

The Course aims

- Understanding of the environment and advancing through the applications of Biotechnology to protect the environment.

Credits:5 **Total Hours:50**

UNIT	CONTENTS	Hrs	CO
I	**Fundamentals of Environmental Biotechnology**: Scope and importance of environmental biotechnology. Basic ecological concepts: ecosystem, food chain, food web, energy flow. Biogeochemical cycles: carbon, nitrogen, sulfur, phosphorus. Microbial ecology: role of microorganisms in environment. Environmental pollutants: classification (air, water, soil). Environmental monitoring techniques.	10	CO1
II	**Wastewater Treatment and Bioprocess Technology:** Sources and characteristics of wastewater. Primary, secondary, and tertiary treatment processes. Aerobic and anaerobic treatment systems. Activated sludge process, trickling filters, oxidation ponds. Anaerobic digestion and biogas production. Bioreactors for wastewater treatment.	10	CO2
III	**Bioremediation and Biodegradation:** Principles of bioremediation. *In situ* and *ex situ* bioremediation. Bioaugmentation and biostimulation. Biodegradation of xenobiotics (pesticides, hydrocarbons). Heavy metal detoxification mechanisms. Role of fungi and bacteria in pollutant degradation.	12	CO3
IV	**Solid Waste Management and Environmental Applications:** Types of solid waste: municipal, biomedical, industrial. Composting and vermicomposting. Landfills and waste-to-energy technologies. Phytoremediation and green technologies. Biosensors in environmental monitoring. Biofertilizers, biopesticides, and sustainable agriculture.	08	CO4
V	**Advanced Environmental Biotechnology and Sustainability:** Biofuels: bioethanol, biodiesel, biogas, hydrogen energy. Bioplastics and biodegradable materials. Carbon capture and climate change mitigation. Environmental impact assessment (EIA). Biodiversity conservation and biosafety. Environmental laws and regulations.	10	CO5

Text Book

1. Rittmann, B. E., & McCarty, P. L. *Environmental Biotechnology: Principles and Applications.***2nd Edition**, McGraw-Hill Education, New York, **2020**.
2. Jogdand, S. N. *Environmental Biotechnology*.**3rd Edition**, Himalaya Publishing House, Mumbai, **2010**.

3. Fulekar, M. H. *Environmental Biotechnology*. **2nd Edition**, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, **2010**.
4. Chatterjee, A. K. *Introduction to Environmental Biotechnology*. **1st Edition**, PHI Learning Pvt. Ltd., New Delhi, **2002**.

Reference Books

1. Pepper, I. L., Gerba, C. P., & Gentry, T. J. *Environmental Microbiology*. **3rd Edition**, Academic Press (Elsevier), **2015**.
2. Evans, G. M., & Furlong, J. C. *Environmental Biotechnology: Theory and Application*. **2nd Edition**, John Wiley & Sons, **2011**.
3. Levin, M. A., & Gealt, M. A. *Biotreatment of Industrial and Hazardous Waste*. **1st Edition**, McGraw-Hill, **1997**.
4. Tchobanoglous, G., Stensel, H. D., Tsuchihashi, R., & Burton, F. L. *Wastewater Engineering: Treatment and Resource Recovery*. **5th Edition**, McGraw-Hill Education, **2014**.
5. Grady, C. P. L., Daigger, G. T., & Lim, H. C. *Biological Wastewater Treatment*. **3rd Edition**, CRC Press, **2011**.
6. Hurst, C. J., et al. *Manual of Environmental Microbiology*. **4th Edition**, ASM Press, **2016**.

COURSE OUTCOMES (CO)

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

CO1	Describe the various kinds of microorganisms
CO2	Explain the concept of pollution detection method sand waste water treatment methods
CO3	Illustrate about Biological calcification, eutrophication, and Solid waste Management
CO4	Elaborate about metal pollution and biodegradation concepts in environment
CO5	Describe the Ecofriendly bio-products in environmental health.

MAPPING

PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	M	M	H	H	M	H	H	H
CO2	H	H	M	H	M	H	H	H	H	M
CO3	H	H	H	H	H	M	H	M	H	M
CO4	H	H	H	H	H	M	H	M	H	M
CO5	H	H	H	H	H	H	H	M	M	M

H-High; M-Medium; L-Low

24UBTM603	DSC XIII: BASICS OF ANIMAL CELL CULTURE	SEMESTER-VI

Course Objectives

The course aims

- To learn basic concepts about animal tissue culture.

Credits:5 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Introduction to Animal Cell Culture:** Definition, scope and history of animal cell culture. Laboratory requirements and aseptic techniques. Basic requirements for cell culture: temperature, pH, CO_2, humidity. Types of culture: primary culture, secondary culture, cell lines. Adherent vs suspension cultures. Advantages and limitations of animal cell culture.	10	CO1
II	**Culture Media and Growth Conditions:** Composition of culture media: natural and synthetic media. Role of CO2, Role of serum, protein-free defined media, growth factors, vitamins, salts and buffers. Balanced salt solutions and chemically defined media. Physicochemical parameters affecting cell growth. Sterilization techniques and preparation of media.	10	CO2
III	**Cell Culture Techniques:** Isolation of animal cells: enzymatic and mechanical disaggregation. Culturing and maintenance of different animal cell lines (Primary and established cell lines). Primary culture techniques (explant and suspension culture). Subculture (passaging) and maintenance of cell lines. Cell counting and viability assays (trypan blue exclusion). Cryopreservation and revival of cells. Contamination and its control.	12	CO3
IV	**Advanced Cell Culture and Characterization:** Cell synchronization and cloning. Cell differentiation and transformation. Stem cell culture and applications.Three-dimensional (3D) cell culture systems. Apoptosis and cell death assays. Cytotoxicity testing.	08	CO4
V	**Applications of Animal Cell Culture:** Vaccine production and pharmaceutical proteins. Monoclonal antibody production. Gene expression and gene therapy. Tissue engineering and regenerative medicine.In vitro fertilization and embryo culture. Toxicity testing and drug screening.	10	CO5

Text Books

1. Freshney, R. I. *Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications.* **8th Edition**, John Wiley & Sons, USA, **2016**.
2. Masters, J. R. W. *Animal Cell Culture: A Practical Approach.* **3rd Edition**, Oxford University Press, UK, **2000**.
3. Doyle, A., & Griffiths, J. B. *Cell and Tissue Culture: Laboratory Procedures in*

Biotechnology. **1st Edition**, John Wiley & Sons, **1998**.
4. Butler, M. *Animal Cell Culture and Technology*. **2nd Edition**, Taylor & Francis, **2004**.

Reference Books

1. Freshney, R. I. *Basic Principles of Animal Cell Culture*. **Revised Edition**, Wiley-Liss, **2005**.
2. Phelan, M. C. *Basic Techniques in Mammalian Cell Culture*. **1st Edition**, Current Protocols (Wiley), **2007**.
3. Davis, J. M. *Animal Cell Culture: Essential Methods*. **1st Edition**, John Wiley & Sons, **2011**.
4. Portner, R. (Ed.). *Animal Cell Biotechnology: Methods and Protocols*. **1st Edition**, Humana Press (Springer), **2007**.
5. Mitry, R. R., & Hughes, R. D. *Human Cell Culture Protocols*. **2nd Edition**, Humana Press (Springer), **2012**.
6. Butler, M. *Animal Cell Cultures: Recent Advances*. **1st Edition**, BIOS Scientific Publishers, **2000**.

COURSE OUTCOMES (CO)

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

CO1	Explain the history and types of animal tissue culture.
CO2	Describe the preparation of animal tissue culture medium and growth factors.
CO3	Illustrate the basic techniques of animal cell culture.
CO4	Depicts the cytotoxicity, tissue engineering and stem cells.
CO5	Explain about IVF and transgenic animals.

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	M	H	H	M	H	H	H
CO2	H	H	M	H	M	H	H	H	H	M
CO3	H	H	H	H	H	M	H	M	H	M
CO4	H	H	H	H	H	M	H	M	H	M
CO5	H	H	H	H	H	H	H	M	M	M

H-High; M-Medium; L-Low

24UBTEL601	DSE II: MEDICAL BIOTECHNOLOGY	SEMESTER-VI

Course Objectives:

The course aims

- To understand the application of Biotechnology in the field of medicine.

Credits:4 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Introduction to Medical Biotechnology:** Definition, scope and importance of medical biotechnology. History and milestones in biotechnology. Basic concepts of human physiology and disease. Molecular basis of diseases (genetic, infectious, metabolic disorders). Role of biotechnology in modern medicine.	08	CO1
II	**Molecular Diagnostics and Techniques:** Principles of molecular diagnostics. PCR, RT-PCR, qPCR and their clinical applications. DNA sequencing and next-generation sequencing (NGS). Microarrays and biosensors. Immunological techniques: ELISA, Western blot, immunofluorescence. Point-of-care diagnostic technologies.	08	CO2
III	**Therapeutics and Drug Development:** Recombinant DNA technology in therapeutics. Production of biopharmaceuticals (insulin, vaccines, hormones). Monoclonal antibodies and their applications. Gene therapy: principles and strategies. Drug discovery and development pipeline. Clinical trials and regulatory aspects.	08	CO3
IV	**Stem Cells and Regenerative Medicine:** Types of stem cells: embryonic, adult, induced pluripotent stem cells (iPSCs). Stem cell culture and differentiation. Tissue engineering and organ regeneration. Applications in degenerative diseases and injuries. Ethical issues in stem cell research.	08	CO4
V	**Advanced Medical Biotechnology and Applications:** Personalized medicine and pharmacogenomics. Cancer biotechnology: biomarkers, targeted therapy. Nanobiotechnology in medicine (drug delivery systems). Vaccine development and immunotherapy. Bioinformatics in medical research. Biosafety, bioethics and regulatory guidelines.	08	CO5

Text Books

1. Glick, B. R., Pasternak, J. J., & Patten, C. L. *Molecular Biotechnology: Principles and Applications of Recombinant DNA.* **5th Edition**, ASM Press, USA, **2018**.
2. Primrose, S. B., & Twyman, R. M. *Principles of Gene Manipulation and Genomics.* **8th Edition**, Wiley-Blackwell, UK, **2013**.
3. Walker, J. M., & Rapley, R. *Medical Biotechnology.* **2nd Edition**, Royal Society of Chemistry, UK, **2009**.
4. Dunham, I. *Genome Mapping and Genomics in Health and Disease.* **1st Edition**, Academic Press (Elsevier), **2015**.

Reference Books

1. Walsh, G. *Biopharmaceuticals: Biochemistry and Biotechnology*. **3rd Edition**, John Wiley & Sons, **2018**.
2. Brown, T. A. *Gene Cloning and DNA Analysis: An Introduction.* **7th Edition**, Wiley-Blackwell, **2016**.
3. Green, M. R., & Sambrook, J. *Molecular Cloning: A Laboratory Manual.* **4th Edition**, Cold Spring Harbor Laboratory Press, **2012**.
4. Freshney, R. I. *Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications.* **8th Edition**, John Wiley & Sons, **2016**.
5. Lanza, R., Langer, R., & Vacanti, J. *Principles of Tissue Engineering.* **4th Edition**, Academic Press (Elsevier), **2014**.
6. Karp, G. *Cell and Molecular Biology: Concepts and Experiments.* **8th Edition**, John Wiley & Sons, **2015**.

COURSE OUTCOMES (CO)

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

CO1	Explain about genetic disease.
CO2	Demonstrate DNA in disease diagnosis
CO3	Describe the molecular basis of cancer, Gene rearrangements in Leukemia and Lymphoma and DNA based tissue typing
CO4	Explain about pharmaceutical products.
CO5	Illustrate about stem Cells therapy and tissue engineering.

MAPPING

PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	M	M	H	H	M	H	H	H
CO2	H	H	M	H	M	H	H	H	H	M
CO3	H	H	H	H	H	M	H	M	H	M
CO4	H	H	H	H	H	M	H	M	H	M
CO5	H	H	H	H	H	H	H	M	M	M

H-High; M-Medium; L-Low

24UBTEL601	DSE II:FOOD BIOTECHNOLOGY	SEMESTER-VI

Course Objectives:

The Course aims

- To get knowledge in the field of food processing and its application.

Credits:4 **TotalHours:40**

UNIT	CONTENTS	Hrs	CO
I	**Introduction to Food Biotechnology:** Definition, scope and importance of food biotechnology. History and development of food biotechnology. Microorganisms used in food processing (bacteria, yeast, fungi). Nutritional aspects of food and functional foods. Food spoilage and preservation principles.	08	CO1
II	**Fermentation Technology in Food Processing:** Principles of fermentation technology. Types of fermentation: batch, fed-batch, continuous. Starter cultures and their preparation. Production of fermented foods: dairy (yogurt, cheese), beverages, bakery products. Probiotics and prebiotics.	08	CO2
III	**Food Processing and Preservation Techniques:** Conventional and modern food processing methods. Thermal processing, refrigeration, freezing, drying. Non-thermal methods: irradiation, high-pressure processing. Food packaging technologies. Enzymes in food processing (amylases, proteases, lipases).	08	CO3
IV	**Food Safety and Quality Control:** Food-borne pathogens and toxins. Hazard Analysis and Critical Control Points (HACCP). Good Manufacturing Practices (GMP). Detection of food contaminants (microbial, chemical, allergenic). Biosensors and molecular methods in food safety.	08	CO4
V	**Advanced Food Biotechnology and Applications:** Genetically modified foods (GMOs) and transgenic crops. Nutraceuticals and functional foods. Single-cell protein (SCP). Biotechnology in food fortification and bioavailability enhancement. Food regulations, labeling, and ethical issues. Emerging trends: personalized nutrition, alternative proteins.	08	CO5

Text Book

1. Yaradoddi, J. S., Meti, B. S., Mudgulkar, S. B., & Agsar, D. (Eds.). *Frontiers in Food Biotechnology*. **1st Edition**, Springer Nature Singapore, **2024**.
2. Kumar, A., Patruni, K., & Singh, V. (Eds.). *Recent Advances in Food Biotechnology*. **1st Edition**, Springer Nature Singapore, **2022**.
3. Shetty, K., Paliyath, G., Pometto, A., & Levin, R. E. *Food Biotechnology*. **2nd Edition**, CRC Press (Taylor & Francis), **2006**.
4. Ray, B., & Bhunia, A. *Fundamental Food Microbiology*. **5th Edition**, CRC Press, **2014**.

Reference Books

1. Cifuentes, A. (Ed.) *Comprehensive Foodomics.* **1st Edition**, Elsevier, **2020**.
2. Sharma, T. R., Deshmukh, R., & Sonah, H. (Eds.) *Advances in Agri-Food Biotechnology.* **1st Edition**, Springer Nature, **2020**.
3. Singh, R. P., & Heldman, D. R. *Introduction to Food Engineering.* **6th Edition**, Academic Press (Elsevier), **2023**.
4. Fellows, P. J. *Food Processing Technology: Principles and Practice.* **4th Edition**, Woodhead Publishing (Elsevier), **2017**.
5. Jay, J. M., Loessner, M. J., & Golden, D. A. *Modern Food Microbiology.* **8th Edition**, Springer, **2005**.
6. Motarjemi, Y., & Lelieveld, H. *Food Safety Management: A Practical Guide for the Food Industry.* **1st Edition**, Academic Press (Elsevier), **2014**.

COURSE OUTCOMES (CO)

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

CO1	Find the knowledge about constituents of food
CO2	Understand about production of food fermentation and food processing
CO3	Demonstrate the principles and various methods of food preservation
CO4	Describe the role of food pathogens
CO5	Gain knowledge about different types of food hazards in food industry

MAPPING

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PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	M	M	H	H	M	H	H	H
CO2	H	H	M	H	M	H	H	H	H	M
CO3	H	H	H	H	H	M	H	M	H	M
CO4	H	H	H	H	H	M	H	M	H	M
CO5	H	H	H	H	H	H	H	M	M	M

H -High; M-Medium; L-Low

23UBTEL603	DSE II: CORPORATE BIOTECHNOLOGY	SEMESTER–VI

Course Objectives:

The Course aims

- To know about the knowledge of standard in the corporate world.
- To study about the transgenic plants and animals.

Total Hours: 25

UNIT	CONTENTS	Hrs	CO
I	**Introduction to Corporate Biotechnology:** Definition, scope and evolution of biotechnology industry. Structure of biotech companies (startups, SMEs, MNCs). Overview of global and Indian biotechnology sectors. Role of government agencies and funding bodies (DBT, BIRAC, ICMR). Career opportunities in corporate biotechnology.	05	CO1
II	**Biotechnology Business and Entrepreneurship:** Basics of entrepreneurship in biotechnology. Business plan development and business models. Startup ecosystem in biotechnology. Technology transfer and commercialization. Venture capital, angel investors and funding mechanisms.	05	CO2
III	**Intellectual Property Rights (IPR) and Regulatory Affairs:** Introduction to intellectual property rights (IPR). Patents, copyrights, trademarks in biotechnology. Patent filing process and international treaties (TRIPS, PCT). Regulatory agencies: CDSCO, FDA, EMA. Biosafety, bioethics and compliance.	05	CO3
IV	**Bioprocess Scale-Up and Industrial Management:** Scale-up of bioprocesses from lab to industry. Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP). Quality control and quality assurance (QC & QA). Supply chain and production management. Documentation and validation.	05	CO4
V	**Marketing, Finance and Emerging Trends in Biotechnology:** Marketing strategies for biotech products. Pricing, branding and market access. Financial management and cost analysis. Global trends: personalized medicine, AI in biotech, digital health. Corporate social responsibility (CSR) and sustainability.	05	CO5

Text Book

1. Thieman, W. J., & Palladino, M. A. *Introduction to Biotechnology*. **4th Edition**, Pearson Education, USA, **2019**.
2. Shimasaki, C. D. *Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies.* **2nd Edition**, Academic Press (Elsevier), **2020**.
3. Burns, M., & Moulton, G. *Business Development for the Biotechnology and Pharmaceutical Industry*. **2nd Edition**, Springer Nature, **2018**.
4. Kumar, S., & Singh, A. *Biotechnology: Industrial and Environmental Applications.* **1st Edition**, Springer, **2015**.

Reference Books

1. Pisano, G. P. *Science Business: The Promise, the Reality, and the Future of Biotech.* **1st Edition**, Harvard Business Review Press, **2006**.
2. Friedman, Y. *Building Biotechnology: Starting, Managing, and Understanding Biotech Companies.* **2nd Edition**, Logos Press, **2004**.
3. Dutta, S. *Intellectual Property Rights in Biotechnology.* **1st Edition**, Springer, **2011**.
4. Wagner, R. *Biopharmaceutical Production Technology*. **1st Edition**, Wiley-VCH, **2012**.
5. Walsh, G. *Biopharmaceuticals: Biochemistry and Biotechnology*. **3rd Edition**, John Wiley & Sons, **2018**.
6. World Intellectual Property Organization (WIPO). *WIPO Intellectual Property Handbook.* **Latest Edition**, WIPO Publications, **2022**.

COURSE OUTCOMES (CO)

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

CO1	Explain about Corporate Biotechnology.
CO2	Recall about genetically modified crops.
CO3	Describe about the animal breeding and ethical guidelines.
CO4	Explain about aquaculture and arboriculture.
CO5	Produce biofertilizers and biopesticides.

MAPPING

PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	M	H	M	H	H	M	M	H	H
CO2	H	H	M	H	M	H	H	M	H	M
CO3	H	H	M	H	H	M	H	H	M	M
CO4	H	H	H	H	H	M	H	H	M	M
CO5	H	H	H	H	H	H	H	H	H	M

H-High; M-Medium; L-Low

24UBTMP601	DSC PRACTICAL-VI	SEMESTER-VI

Course Objectives:

The Course aims

- To learn the various techniques in the field of Molecular Biology, Immunology, Industrial Biotechnology and Plant tissue culture technology.

Credits: 3 **Total Hours:42**

S.No	EXPERIMENT	Hrs	CO
1.	Isolation of plasmid DNA	**03**	**CO1**
2.	Restriction Digestion	**03**	
3.	Ligation of digested DNA	**03**	
4.	Blotting of DNA from agarose gel	**03**	
5.	Bacterial Transformation a. Competent Cell preparation b. Transformation of pUC Vector into a competent cell.	**03**	**CO2**
6.	Polymerase Chain Reaction (Demonstration and Handson programming)	**03**	**CO3**
7.	Preparation of medium for plant tissue culture technology	**03**	**CO4**
8.	Sterilization of explants and Callus induction	**03**	
9.	Micropropagation	**03**	
10.	Media preparation of Animal Cell Culture	**03**	**CO5**
11.	Primary culture of Chick embryo fibroblast	**03**	
12.	Determination of viability of cells using Trypan blue stain	**03**	
13.	Introduction to ALCOA Documentation Practice	**03**	

ReferenceBooks

1 *Joseph Sambrook and David W. Russell*,2001. **Molecular cloning– A laboratory manual Volume 1 to 3**.[Third Edition].Cold Spring Harbor Laboratory Press, NewYork.

2 Aneja, K.R. 2003. **Experiments in Microbiology, Plant pathology And Biotechnology.**[Fourth Edition].New age international.

3 *Cappucino, J.G and Sherman, N.* 2012. **Microbiology–A laboratory manual.**[Seventh Edition].Pearson Education Inc.

4 *Freshney, R.I.,* 2005. **Culture of Animal Cells: A Manual of Basic Technique.**[Fifth Edition].John Wiley and Sons, New Jersey.

COURSE OUTCOMES (CO)

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

CO1	Isolate plasmid DNA, Restriction Digestion and Ligation of digested DNA.
CO2	Perform Bacterial Transformation
CO3	Demonstrate Polymerase Chain Reaction
CO4	Perform plant tissue culture
CO5	Perform animal cell culture and ALCOA Documentation Practice.

24UBTSB601	**SEC IV: IPR FOR LIFE SCIENCE (100% INTERNAL EVALUATION)**	SEMESTER-VI

Course Objectives:

The Course aims

- T oacquire the knowledge on intellectual property rights (IPR).

Credits:2 **Total Hours:25**

UNIT	CONTENTS	Hrs	CO
I	**Introduction to Intellectual Property Rights:** Concept, need and evolution of Intellectual Property Rights (IPR). Types of IPR: patents, copyrights, trademarks, geographical indications, trade secrets. Importance of IPR in life sciences and biotechnology. International organizations: World Intellectual Property Organization (WIPO), World Trade Organization (WTO). Overview of TRIPS Agreement.	05	CO1
II	**Patents in Biotechnology:** Basics of patents: definitions, criteria (novelty, inventive step, industrial applicability). Patentable and non-patentable subject matter in life sciences. Patent filing process (provisional, complete specification). Patent databases and search (e.g., Indian Patent Office). Case studies in biotechnology patents.	05	CO2
III	**Copyrights, Trademarks and Geographical Indications:** Copyrights in scientific publications and databases. Trademarks and branding in biotech products. Geographical indications in biological products. Trade secrets and confidential information. Protection of traditional knowledge and biodiversity.	05	CO3
IV	**Regulatory Framework and Bioethics:** National IPR policies and laws (India). Role of Council of Scientific and Industrial Research (CSIR), Department of Biotechnology (DBT). Biosafety regulations and ethical issues in biotechnology. Convention on Biological Diversity (CBD). Access and benefit sharing (ABS).	05	CO4
V	**Commercialization and Technology Transfer:** Technology transfer and licensing agreements. Startup ecosystem and IPR management. Valuation of intellectual property. Patent infringement and litigation. Emerging trends: open innovation, data protection, AI in IPR.	05	CO5

Text Books

1. Ganguli, P. *Intellectual Property Rights: Unleashing the Knowledge Economy.* **1st Edition**, Tata McGraw-Hill, New Delhi, **2001**.
2. Cornish, W., Llewelyn, D., & Aplin, T. *Intellectual Property: Patents, Copyrights, Trademarks and Allied Rights.* **9th Edition**, Sweet & Maxwell, UK, **2019**.
3. Bently, L., Sherman, B., Gangjee, D., & Johnson, P. *Intellectual Property Law.* **5th Edition**, Oxford University Press, UK, **2018**.
4. Dutfield, G., & Suthersanen, U. *Global Intellectual Property Law.* **2nd Edition**, Edward

Elgar Publishing, UK, **2020**.

Reference Book

1. WIPO. *WIPO Intellectual Property Handbook.* **Latest Edition**, World Intellectual Property Organization Publications, **2022**.
2. Nair, M. D. *Intellectual Property Rights in India.* **1st Edition**, Allied Publishers, New Delhi, **2010**.
3. Singh, R. *Law Relating to Intellectual Property: A Complete Comprehensive Material.* **3rd Edition**, Universal Law Publishing, **2019**.
4. Holyoak, J., & Torremans, P. *Intellectual Property Law.* **9th Edition**, Oxford University Press, **2022**.
5. Bagley, M. A., Okediji, R. L., & Reichman, J. H. *International Patent Law and Policy.* **2nd Edition**, West Academic Publishing, **2020**.
6. Watal, J. *Intellectual Property Rights in the WTO and Developing Countries.* **1st Edition**, Oxford University Press, **2001**.

COURSE OUTCOMES (CO)

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

CO1	Explain about IPR and its types, WTO, GATT, TRIPS and WIPO.
CO2	Describe about kinds of patents and inventions.
CO3	Elucidate about Patenting microorganisms, multicellular organism, patenting Genes, patenting cells and tissue.
CO4	Describe about trade mark and trade secret.
CO5	Explain about copyrights.

MAPPING

PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	M	M	H	H	M	H	H	H
CO2	H	H	M	H	M	H	H	H	H	M
CO3	H	H	H	H	H	M	H	M	H	M
CO4	H	H	H	H	H	M	H	M	H	M
CO5	H	H	H	H	H	H	H	M	M	M

H-High;M-Medium;L-Low

24ULS601	AEC IV: CAREER COMPETENCY SKILLS -IV	SEMESTER– VI

Course Objectives:

The course aims

- To understand the basic needs of Communication
- To utilize the communication skills for achieving at the time of Interview

Total Hours: 15

UNIT	CONTENTS	Hrs	CO
I	Basic Grammar-English usage-Reading and Writing (Level-2) Direct and Indirect Speech	3	CO1
II	Spotting Errors–Parts of speech and Punctuation	3	CO2
III	Role Play–Just a Minute (JAM) –Group Discussion	3	CO3
IV	Interview Presentation (Self- Introduction)-Critical thinking, problem solving.	3	CO4
V	Dress Code and Body Language-Leadership	3	CO5

Text Books

1	*Basic English Grammar for English - Book1, Learners, Anne Seaton,Y.H.Mew,Saddlepoint Publishers (E-Copy)*
2	*Basic English Syntax with Exercises, Mark Newson(E-Copy)*

Reference Book

1	*Objective General English, S. Chand, Dr. R. S. Agarwal*

COURSE OUTCOMES (CO)

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

CO1	Recall the basic grammar in language
CO2	Concentrate on sentence correction
CO3	Recognize the differences among facts, opinions and judgments
CO4	Develop their personal skills through interview
CO5	Appropriately apply their learning and leadership style and strength

MAPPING

PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	M	M	H	H	M	H	H	H
CO2	H	H	M	H	M	H	H	H	H	M
CO3	H	H	H	H	H	M	H	M	H	M
CO4	H	H	H	H	H	M	H	M	H	M
CO5	H	H	H	H	H	H	H	M	M	M

H- High; M- Medium; L- Low

GUIDELINES

1. SUBMISSION OF RECORD NOTEBOOKS:

Candidates appearing for Practical Examinations shall submit Bonafide Record Note Books prescribed for Practical Examinations, otherwise the candidates will not be permitted to appear for the Practical Examinations.

2. PASSING MINIMUM AND INTERNAL MARK DISTRIBUTION (Theory and Practical)

(i) THEORY

The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in each theory paper with a passing minimum of 30 marks in External out of 75.

Internal Marks Distribution [CA-TotalMarks:25]

Attendance	:	5 Marks
Assignment	:	5 Marks
Internal Examinations	:	15 Marks
Total	**:**	**25 Marks**

(ii) THEORY (If Internal Evaluation is for 100 Marks)

The candidate shall be declared to have passed the Examination, if the candidate secures not less than 40 marks out of 100 (Internal Evaluation only).

Internal Marks Distribution [CA-Total Marks: 100]

Attendance	: 10Marks
Assignment	: 30 Marks (3 Assignments Compulsory)
Internal Examinations	: 60 Marks
Total	: 100 Marks

(iii) PRACTICAL

The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in each Practical paper with a passing minimum of 24 marks in External out of 60.

***Internal Marks Distribution* [CA- Total Marks: 40]**

Experiment	: 10 Marks
Record	: 5 Marks

Attendance : 5 Marks
Internal Examinations : 20 Marks
Total : 40Marks

3. INTERNSHIP

- The Internship shall be carried out by the students individually at the end of IV semester and by attending a minimum of 15 days training at any institute.
- The Student has to attend 1 review after completing his/her Internship, presentation of their report and it will be evaluated by an internal examiner.

4. PROJECT

- The Project shall be carried out by the students as groups during their VI semester.
- The Student has to attend 2 reviews before completing his/her Project.
- The assessment of student performance in a semester is calculated by Continuous Internal Assessment (CA) for 40 marks and External Assessment for 60 marks.
- Upon completion of their research work the candidate shall be required to appear for a Viva-Voce conducted by an external examiner.
- The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in Project with a passing minimum of 24 marks in External out of 60.

Mark Distribution Pattern

Internal Mark Distribution **Continuous Assessment (CA)**

Total Marks: 40

1. Attendance : 10 Marks
2. Review presentation : 20 Marks
3. Literature survey : 10 marks

External Mark Distribution

Total Marks: 60

1. Project report : 20 Marks
2. Presentation : 10 Marks
3. Viva Voce : 30 Marks

4. CAREER COMPETENCY SKILLS Semester III and VI- Viva voce

- The student has to come in proper dress code for the Viva Voce
- Questions will be asked to evaluate the reading, speaking and listening skills of the students.
- E-mail and Letter drafting exercises will be given.

Semester IV and V- Online Objective Examination (Multiple Choice questions)

- 100 questions- 100 minutes
- Twenty questions from each UNIT.
- Online examination will be conducted at the end of the IV and V Semester.

5. QUESTION PAPER PATTERN AND MARK DISTRIBUTION (External)

(i)THEORY **(For 75marks)**

Question Paper Pattern and Mark Distribution

1. PART– A (10 x 2 =20 Marks)

   Answer ALL questions

   Two questions from each UNIT

2. PART– B (5 x5 = 25Marks)

   Answer ALL questions

   One question from each UNIT with Internal Choice

3. **PART – C (3 x 10 = 30 Marks)**

   Answer ANY THREE questions Open Choice–3 out of 5 questions one question from each UNIT

ii) **PRACTICAL**

External Marks Distribution [CE-Total Marks: 60]

For each practical question the marks shall be awarded as follows:

Question Paper Pattern and Mark Distribution **(For60marks)**

S.No	Component	Mark
1	Major	1x25=25
2	Minor	1x15=15
3	Spotters	5x03=15
4	Viva-Voce	05
	Total	**60**

Key for evaluation of Practical Examination

1. **Major (25Marks)**
   Procedure : 15 Marks
   Performance : 05 Marks
   Result : 05Marks

2. Minor (15Marks)
   Procedure : 10 Marks
   Performance : 03 Marks
   Result : 02 Marks

3. **Spotters** :5x3=15Marks

4. **Viva – Voce** **:** 05 Marks

24UBTNM301	**MDC I: MEDICINAL HERBS**	**SEMESTER-III**

Course Objectives:

The Course aims

- To apply the basic knowledge of common medicinal plants.

Credits:2 **Total Hours:30**

UNIT	CONTENTS	Hrs	CO
I	Introduction to Medicinal Plants; Traditional medicinal Systems - AYUSH. Application of medicinal plants,	**06**	**CO1**
II	Herbs- *Aloe vera*, Green chirayta,, Tridax, Daisy, *Vinca*, Mint, Cumin & Ajwain.	**06**	**CO2**
III	**Climbing plants:** Betel, Ivy gourd, Butter fly pea, Veldt grape, Climbing Brinjal, Indra valli, Pepper & Madras pea, pumpkin.	**06**	**CO3**
IV	**Shrubs and Tree:** Indian mallow, Shikakai, Desert cotton, Turkey berry & Copper leaf, Moringa plant and Amla.	**06**	**CO4**
V	Cash crops-Sugarcane, Tobacco, Rice, wheat and corn. Asafetida and sweet potato	**06**	**CO5**

Reference Books

1	*Arya Vaidya Sala.*, 1994. **Indian Medicinal Plants**. Vol II. Universities Press.
2	*S.K. Bhattacharjee, 2020, Hand book of Medicinal plants: 4th revised and enlarged edition, Pointer publishers.*

COURSE OUTCOMES (CO)

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

CO1	Describe about Medicinal Plants.
CO2	Gain knowledge about various important medicinal herbs.
CO3	Describe about Climbing plants.
CO4	Explicate the importance of Shrubs.
CO5	Explain about cash crops.

Prepared By
(Course Coordinator)

Approved By
(BoS Chairman)

24UBTNM401	**MDC II: FUNDAMENTALS OF BIOTECHNOLOGY**	**SEMESTER-IV**

Course Objectives:

The Course aims

- To understand the basics about Biotechnology and its day to day application in daily life.

Credits:2 **Total Hours: 30**

UNIT	Contents	Hrs	CO
I	Introduction to Biotechnology –Origin and Evolution of Biotechnology, Old biotechnology and New biotechnology.	**06**	**CO1**
II	Food Biotechnology - Introduction, products, curd, idly, pickles, Cheese, wine.	**06**	**CO2**
III	Pharmaceutical Biotechnology – Introduction to antibiotics, uses and abuses of antibiotics. Vaccines– introduction, vaccine against common disease, vaccination schedule, edible Vaccine, Transgenic animals–fish and chicken.	**06**	**CO3**
IV	Agricultural Biotechnology–Genetically modified crops, pros and cons –Bt cotton and Bt brinjal, Golden rice, *Aloe vera* gel, SCP Spirulina, Spirulina pickle, mushroom cultivation, Azolla, Composting and Biofertilizer.	**06**	**CO4**
V	Proposal to bank for loan, MSME, Quality control - FSSAI, AGMARK, and ISO.	**06**	**CO5**

Reference books

1 *DaanJ.A.Crommelin, Robert D. Sindelar,* and *Bernd Meibohm,* 2008. **Pharmaceutical Biotechnology–Fundamentals and applications.** Informa Health care USA,Inc.

2 *Glick R. Bernard* and *Pasternak J Jack.*2007.**Molecular Biotechnology**.[Third Edition].ASM press, Washington D.C.

COURSE OUTCOMES (CO)

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

CO1	Gain knowledge about the basics of Biotechnology.
CO2	Explain about various food products.
CO3	Describe about the types of vaccines.

CO4	Illustrate about GMO and its products.
CO5	Explain about quality control.

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

VISION

To nurture the young minds with a potential to innovate, invent and disseminate knowledge for the benefit of the society and environment.

MISSION

To motivate the learners to take up challenging tasks in biotechnology and to prepare for the self-employment through environmental friendly biotechnology enterprises. To innovate and explore novel solutions for the existing problems in the fields of environment, agriculture, animal biotechnology and health sector.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 1: To become potent biotechnologist for industrial sectors.

PEO 2: To develop professional skills through lifelong learning and higher education in their area of interest.

PEO 3: To cater to the needs of the industry and society so as to contribute for the development of the country.

PROGRAMME OUTCOMES (PO)

After completion of the programme, the graduates will be able to

PO 1: Become knowledgeable in the subject of Biotechnology and apply the principles of the same to the needs of the society.

PO 2: Gain analytical skills in the field of Biotechnology.

PO 3: Determine and appreciate professional ethics, community living and Nation building initiatives.

PO 4: Justify societal, health, legal, environmental and Biosafety related issues and understand his/her responsibilities.

PO 5: Analyze, evaluate and invent new processes and products in the field of Biotechnology.

PROGRAMME SPECIFIC OUTCOMES (PSO)

After completion of the programme, the graduates will be able to

PSO 1: Assess and apply the basic concepts of Cell biology, Genetics, Biochemistry, Microbiology, Molecular biology and all the inter-disciplinary domains of Biotechnology.

PSO 2: Assess and apply the basic concepts of Cell biology, Genetics, Biochemistry, Microbiology, Molecular biology and all the inter-disciplinary domains of Biotechnology.

PSO 3: Apply the Contextual knowledge of Biotechnology to function effectively as an individual or a leader in multidisciplinary environments.

PSO 4: Perform procedures as per laboratory standards in all life science related domains.

PSO 5: Synthesis, Compare and evaluate the mechanism involved and employed in life science domains.

REGULATIONS

ELIGIBILITY FOR ADMISSION:

Candidates seeking admission to the first year Degree course shall be required to have passed PUC/12th Std./10+2/its equivalent with at least Biology and Chemistry as two optional subjects.

DURATION OF THE PROGRAMME:

The duration of the course is THREE academic years divided into six semesters under Choice Based Credit System with OBE pattern.

OBJECTIVES OF THE PROGRAMME:

The three-year B.Sc., programme is intended to help the students to be the innovative and versatile personalities in the field of Life Science with quality education and provide the skilled manpower required by Research & Development, Institutions of higher learning and Industrial sectors.

The programme deals with broad area of living things used into technological sector for the betterment of human welfare.

It is designed to develop a sustained interest among the students and enthusiasm to learn and develop the concepts in Biotechnology in logical and stepwise manner.

After completion of the course, the students can able to acquire the necessary theoretical and practical competencies in Biotechnology which enable them to undertake higher studies in recognized Institutions of higher learning and engage gainful self- employment

MAXIMUM DURATION FOR THE COMPLETION OF THE PROGRAMME

The maximum duration for the completion of the UG programme shall not exceed 12 semesters

UG SCHEME OF EXAMINATION

Subject code	Subject	Hours of Instruction	Exam duration (Hours)	Maximum Marks			Credit Points
				CA	CE	Total	
First semester							
Part I							
24UTAL101/ 24UHIL101/ 24UFRL101	Tamil I/ Hindi I/ French I	5	3	25	75	100	3
Part II							
24UENLA101	English for Arts and Science I	5	3	25	75	100	3
Part III							
24UBTM101	DSC I: Concepts of Cell Biology	5	3	25	75	100	4
24UBTM102	DSC II: Biosafety and Bioethics	4	3	25	75	100	3
24UBTMP101	DSC Practical–I	4	6	40	60	100	2
24UCSBTA101	GEC I: Computer Fundamentals and Artificial Intelligence	4	3	25	75	100	2
24UCSBTAP101	GEC Practical I: Office Automation Techniques	2	3	40	60	100	2
Part IV							
24UVE101	VAC–I:Yoga	1	3	25	75	100	1
Total		**30**				**800**	**20**
Second semester							
Part I							
24UTAL201/ 24UHIL201/ 24UFRL201	Tamil II/ Hindi II/ French II	5	3	25	75	100	3
Part II							
24UENLA201	English for Arts and Science II	5	3	25	75	100	3
Part III							
24UBTM201	DSC III: Microbiology	5	3	25	75	100	4

24UBTM202	DSC IV: Calculations for Biologist	4	3	25	75	100	3
24UBTMP201	DSC Practical–II	3	6	40	60	100	2
24UCHBTA201	GEC II: Chemistry	4	3	25	75	100	2
24UCHBTAP201	GEC Practical II: Chemistry	3	3	40	60	100	2
Part IV							
24UVE201	VAC II-Environmental Studies	1	3	25	75	100	1
Total		**30**				**800**	**20**
Third Semester							
Part I							
24UTAL301/ 24UHIL301/ 24UFRL301	Tamil III/ Hindi III/ French III	4	3	25	75	100	3
Part II							
24UENLA301	English for Arts and Science III	4	3	25	75	100	3
Part III							
24UBTM301	DSC V:Genetics	5	3	25	75	100	4
24UBTMP301	DSC Practical–III	3	6	40	60	100	3
24UBCBTA301	GEC III: Biochemistry	4	3	25	75	100	2
24UBCBTAP301	GEC Practical III: Biochemistry	3	3	40	60	100	2
Part IV							
	MDC–I	2	3	25	75	100	2
24UBTSB301	SEC –I : Mushroom cultivation and Vermitechnology (100% Internal valuation)	2	3	100	-	100	2
24UVE301	VAC III – Understanding India	1	3	25	75	100	1
24ULS301	AEC–I: Career Competency Skills I	2	-	100	-	100	1
Total		**30**				**1000**	**23**

Fourth Semester							
Part I							
24UTAL401/ 24UHIL401/ 24UFRL401	Tamil IV/ Hindi IV/ French IV	4	3	25	75	100	3
Part II							
24UENLA401	English for Arts and Science IV	4	3	25	75	100	3
Part III							
24UBTM401	DSC VI: Biophysics and Bio Instrumentation	5	3	25	75	100	4
24UBTMP401	DSC Practical–IV	4	6	40	60	100	3
24UMABTA401	GEC IV:Biostatistics	4	3	25	75	100	2
24UMABTAP401	GEC Practical IV: Statistics (Using MS- Excel)	2	3	40	60	100	2
Part IV							
	MDC–II	2	3	25	75	100	2
24UBTSB401	SEC – II: Basics of Research(100%Internal Evaluation)	2	3	100	-	100	2
24UVE401	VAC IV–Digital and Technological Solutions	1	3	25	75	100	1
24ULS401	AEC–II: Career Competency Skills II	2	-	100	-	100	1
	Total	**30**				**1000**	**23**
Fifth Semester							
Part III							
24UBTM501	DSC VII: Molecular Biology	5	3	25	75	100	4
24UBTM502	DSC VIII: Immunology	5	3	25	75	100	4
24UBTM503	DSC IX: Industrial Biotechnology	5	3	25	75	100	4
24UBTM504	DSC X: Plant Tissue Culture Technology	4	3	25	75	100	4
24UBTEL501	DSE I:Bioinformatics	4	3	25	75	100	4
24UBTEL502	DSE I: Stem Cell Biology						
24UBTEL503	DSE I: NanoBiotechnology						
24UBTMP501	DSC Practical–V:	3	6	40	60	100	3
24UBTI501	Summer Internship (100% Internal Evaluation)	-	-	100	-	100	2

Part IV							
24UBTSB501	SEC–III: Entrepreneurial Biotechnology	2	3	25	75	100	2
24ULS501	AEC– III: Career Competency Skills III	1	-	100	-	100	1
Part V							
24UBTE501	Extension Activity	-	-	-	-	-	2
	Total	**30**				**900**	**30**
Sixth Semester							
Part III							
24UBTM601	DSC XI: Recombinant DNA Technology	5	3	25	75	100	5
24UBTM602	DSC XII: Environmental Biotechnology	4	3	25	75	100	4
24UBTM603	DSC XIII: Basics of Animal Cell Culture Techniques	5	3	25	75	100	5
24UBTEL601	DSE II– Medical Biotechnology	4	3	25	75	100	4
24UBTEL602	DSE II– Food Biotechnology						
24UBTEL603	DSE II: Corporate Biotechnology						
24UBTMP601	DSC Practical-VI	3	6	40	60	100	3
24UBTPR601	Project & Viva Voce	5	-	40	60	100	4
Part IV							
24UBTSB601	SEC-IV: IPR for Life science	2	3	25	75	100	2
24ULS601	AEC– IV: Career Competency Skills IV	1	-	100	-	100	1
	Total	**30**				**800**	**28**
Grand Total						**5300**	**144**

SKILL ENHANCEMENT COURSE (SEC)

The Department offers the following subjects as skill enhancement course to our students

S.No	Semester	Subject Code	Subject
1.	III	24UBTSB301	SEC – I: Mushroom cultivation and Vermitechnology
2.	IV	24UBTSB401	SEC–II: Basics of Research
3.	V	24UBTSB501	SEC–III: Entrepreneurial Biotechnology
4.	VI	24UBTSB601	SEC-IV: IPR for Life science

DISCIPLINE SPECIFIC ELECTIVE COURSE (DSE)

The Department offers the following subjects during V and VI semesters as Elective Courses. The students can opt anyone subject as their Elective Course in the respective semester.

S.No	Semester	Subject code	Subject
1.	V	24UBTEL501	DSE I: Bioinformatics
		24UBTEL502	DSE I: Stem Cell Biology
		24UBTEL503	DSE I: NanoBiotechnology
2.	VI	24UBTEL601	DSE II–Medical Biotechnology
		24UBTEL602	DSE II–Food Biotechnology
		24UBTEL603	DSE II: Corporate Biotechnology

MULTI-DISCIPLINARY COURSE (MDC)

The Department offers the following two subjects during III and IV semesters as Multi Disciplinary Courses for the students of other departments.

S.No	Subject Code	Semester	Subject	NPTEL Course	Duration / Credits
1.	**24UBTNM301**	III	Medicinal herbs	Biotechnology	12 weeks / 2 Credits
2.	**24UBTNM401**	IV	Fundamentals of Biotechnology	Biotechnology	12 weeks / 2 Credits

INTERNAL CREDIT TRANSFER SCHEME

The equivalent credits earned by completion of MOOC (NPTEL/SWAYAM) courses can be used to SEC courses provided by the department. However, the equivalent MOOC Course must be completed during the earlier semester of the offered SEC Course.

S.No	Semester IV& V	
1.	ACC -MOOC Courses offered in SWAYAM/ NPTEL/ CEC etc.,	COMPLETED STUDENTS GET EXTRA 2 CREDITS

Abbreviations:

DSC: Discipline Specific Course
DSE: Discipline Specific Elective Course
GEC: Generic Elective Course
SEC: Skill Enhancement Course
MDC: Multi-Disciplinary Course
VAC: Value Added Course
AEC : Ability Enhancement Course
ACC : Additional Credit Course

FOR COURSE COMPLETION

Students should complete

- Language subjects (Tamil/Hindi/French) in semesters I, II, III and IV.
- Language subject English offered in semesters I, II, III and IV
- Value Education offered in semesters I, II, III and IV.
- GEC subjects offered in semesters I, II, III and IV.
- Skill Enhancement Courses offered in semesters III, IV, V and VI.
- Multidisciplinary courses offered in semesters III and IV
- Ability Enhance Courses offered in semesters III, IV, V and VI.
- Discipline Specific Elective Courses offered in fifth and sixth semesters. Students can choose any one out of three courses.
- Extension activity offered in semester V.
- The summer internship was offered in the V semester (100% Internal Evaluation).
- Project and Viva-Voce in VI semester.

TOTAL MARKS AND MARK DISTRIBUTION

Component	Subject	No of Course x Marks	Total Marks	Papers x Credits	Cumulative Credits
Part I	Language	4x100	400	4x3 Credits	12
Part II	English	4x100	400	4x3 credits	12
Part III	DSC Theory	2x100	200	2x5 credits	10
		9x100	900	9x4 credits	36
		2x100	200	2x3 credits	06
	DSC Practical	2x100	200	2x2 credits	04
		4x100	400	4x3 credits	12
	DSE	2x100	200	2x4 credits	08
	GEC Theory	4x100	400	4x2 credits	08
	GEC Practical	4x100	400	4x2 credits	08
	Project & Viva-voce	1x100	100	1x4 credits	04
	Summer Internship	1x100	100	1x2 Credits	02
Part IV	SEC	4x100	400	4x2 credits	08
	MDC	2x100	200	2x2 Credits	04
	VAC	4x100	400	4x1 Credits	04
	AEC	4x100	400	4x1 Credits	04
Part V	Extension Activity	-	-	1x2 Credits	02
Total		**53**	**5300**		**144**

24UTAL301	**nghJj;jkpo; - III**	**பருவம் - III**

இப்பாடத்திட்டத்தின் நோக்கங்களாவன

- rkaq;fs; gw;wp mwpKfk; nra;jy;
- rka ,yf;fpaq;fs; gw;wp khzth; mwpAkhW nra;jy;
- gpwePjp ,yf;fpaq;fs; %yk; khzth;fSf;F mwj;jpid typAWj;Jjy;

Credits: 3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	irtk;>itzk; m) jpUQhdrk;ge;jh; - NfhsWgjpfk; M) nghpaho;thh; - jpUg;gy;yhz;L (Kjy; 5 ghly;fs;) ,)Mz;lhs; - jpUkzf; fdT	10	**CO1**
II	fpUj;Jt ,];yhkpa ,yf;fpaq;fs; m) fz;zjhrd; - ,NaRfhtpak; -rpYitg;ghL (Kjy; 10 ghly;fs;;) M) ehafk; xUfhtpak;- ghk;gpd; NerKk; Njhohpd; ghrKk; (Kjy; 10 ghlyfs;;)	10	**CO2**
III	Gpw ePjp ,yf;fpaq;fs; m) nfhd;iwNte;jh; - Kjy; 20 ghly;fs; M) ntw;wpNtw;if-Kjy; 20 ghly;fs; ,) ePjpnewptpsf;fk; - Kjy; 5 ghly;fs; <) cyfePjp - Kjy; 5 ghly;fs; c)%Jiu -Kjy; 5 ghly;fs;	10	**CO3**
IV	rka ,yf;fpa tuyhW m) irtk; Njhw;wk; tsh;r;rp M) itztk; Njhw;wk; tsh;r;rp ,) fpwpj;JtNjhw;wk; tsh;r;rp <) ,];yhk; Njhw;wk; tsh;r;rp c)gpw;fhyePjp ,yf;fpaq;fs; mwpKfk;	10	**CO4**
V	,yf;fzk; m) mzpapyf;fzk; 1. jw;Fwpg;Ngw;wmzp 2. ctikazp 3. gpd;tUepiyazp 4. cUtfmzp 5. tQ;rGfo;r;rpazp M) MFngah;fs; ,) ty;ypdk; kpFk;>kpfh ,lq;fs;	10	**CO5**

பாடநூல்

1.jkpo;j;Jiw ntspaPL

பார்வை நூல்கள்

j.Nfh.Nte;jd;>ehyhapujpt;agpuge;jk;>rhujhgjpg;gfk;>nrd;id> 2017 jkpoz;zy;>GjpaNehf;fpy; jkpo; ,yf;fpatuyhW>kPdhl;rpGj;jfepiyak;>kJiu– 2017. jz;bayq;fhuk;> fof ntspaPL.

COURSE OUTCOMES (CO)

இப்பாடத்தைக் கற்பதன் வாயிலாக மாணவர்கள் பெறும் பயன்களாவன

CO1	gf;jp ,yf;fpaq;fs;> nkhop tsh;r;rpf;F cjtpaijf; $Wjy;.
CO2	rka ,yf;fpaq;fs; gw;wpmwpjy;
CO3	ePjp ,yf;fpaq;fs; top mwj;ijtypAWj;Jjy;
CO4	rka ,yf;fpaq;fs; Njhw;wk; tsh;r;rpiamwpjy;.
CO5	nkhopapd; mbg;gil ,yf;fzj;ijmwpjy;.

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**
CO2	**H**	**L**	**L**	**L**	**L**	**L**	**H**	**M**	**M**	**M**
CO3	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**
CO4	**H**	**M**	**M**	**M**	**M**	**M**	**H**	**M**	**M**	**M**
CO5	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**

H – High; M – Medium ; L - Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UENLA301	ENGLISH FOR ARTS AND SCIENCE - III	SEMESTER–III

Course Objectives

The course aims to

- Use English to communicate effectively in familiar and routine academic, professional and social contexts.
- Demonstrate effective listening skills to interpret academic and real-life situations.
- Apply grammatical rules and sentence structures accurately in speaking and writing.
- Select technical terms and general vocabulary to express ideas clearly.

Credit:3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	1. Listening : Listening to conversations and instructions. 2. Speaking : Role Play-Seeking and sharing information 3. Reading : Critical reading 4. Writing : Extended Definitions, Dialogue writing, Film/Book review 5. Grammar : Modals 6.Vocabulary : Business Jargon (Synonyms & Antonyms)	10	CO1
II	1. Listening : Listening to advertisements and Short Documentary films 2. Speaking : Brainstorming (mind mapping) Small group discussions (subject- specific) 3. Reading : Reading visual texts – Advertisements 4. Writing : Hints development, Advertisement Writing. 5. Grammar : Concord 6.Vocabulary : Homophones, Homonyms	10	CO2
III	1. Listening : Listening to interviews 2. Speaking : Small Talks, Non-Technical presentation 3. Reading : Short passage. 4. Writing : Process description, Blog Writing. 5. Grammar : Conditional Clause 6.Vocabulary : Portmanteau Words	10	CO3
IV	1. Listening : Listening to TED talks. 2. Speaking : Giving ideas and opinions on launching a gadget/instrument 3. Reading : Reading biography (eminent speakers and writers) 4. Writing : Creative writing, Check list. 5. Grammar : Reported speech 6.Vocabulary : Idioms and Phrasal Verbs	10	CO4

V	1. Listening : Listening to gadget presentation. Listening to lectures on scientific inventions. 2. Speaking : Technical presentation (PPT) 3. Reading : Reading to interviews. 4. Writing : Narrative writing – writing narrative essays 5. Grammar : Simple, Compound and Complex sentences 6.Vocabulary : Discourse Markers		

Text Books

1. Thimmesha, L., Victor, R. 2022. **A Textbook of English Language Communication Skills,** [Revised Edition], Infinite Learning Solutions.
2. *Gajendra Singh Chauhan.* 2018. **Technical Communication,** [Latest Revised Edition], Cengage learning India Pvt Limited.

Reference Books

1. *Sanjay Kumar, Pushp Lata.* 2019. **Communication Skills**, Oxford University Press.
2. *Shoba, K.N., Praveen. Sam, D.* 2020. **A Course in Technical English**, Cambridge University Press.
3. *Sudharshana, N.P., Savitha, C.* 2018. English for Engineers, Cambridge University Press.
4. *Nick Bell.* 2015. **Reading Skills: How to Read Better and Faster- Speed Reading, Reading Comprehension & Accelerated Learning**. [2nd Edition], Create Space Independent Publishing Platform.
5. *Michael McCarthy, Felicity O'Dell,* 2017. **English Vocabulary in Use Upper-Intermediate Book with Answers Vocabulary Reference and Practice.** Cambridge University Press.

Web Reference

1. https://learnenglish.britishcouncil.org/skills/listening/a2-listening/four-conversations
2. https://www.csuohio.edu/writing-center/critical-reading-what-critical-reading-andwhy-do-ineed-do-.
3. https://learnenglish.britishcouncil.org/grammar/b1-b2-grammar/reported-speech-statements
4. https://www.youtube.com/watch?v=TdWcUi4RjtA
5. https://hbr.org/2013/06/how-to-give-a-killer-presentation

COURSE OUTCOMES (CO)

On completion of this course, the students should be able to

CO1	Recall key vocabulary words, grammar rules, and language structures.
CO2	Interpret the meaning of texts, including implicit and explicit information.
CO3	Apply grammar rules and vocabulary knowledge to create sentences and express ideas accurately.
CO4	Analyze the structure and organization of texts, identifying elements such as main ideas, supporting details, and transitions.
CO5	Evaluate the effectiveness of communication strategies in different contexts.

Course Prepared by
Ms. P. JANANI
Assistant Professor

Course Approved by
Dr. V. V. MALINEE
BOS Chairman

24UBTM301	**DSC II: GENETICS**	**SEMESTER - III**

Course Objectives:

To study the principles and applications of Genetics

Credits: 4 **Total Hours: 50**

UNIT	CONTENT	Hrs	CO
I	History of Genetics. Mendel's experiments, Punnett Square, Monohybrid cross, Dihybrid cross, Law of Dominance, Law of Segregations and Law of Independent assortment, Test cross, Back cross, Pleiotrophy, Incomplete and Co-dominance.	**10**	**CO1**
II	Gene interaction – Epistasis and its types. Lethality and Lethal genes. Multiple alleles (Eye color of Drosophila and Human Blood group antigens). Linkage (linkage in Drosophila, factors affecting linkage) and crossing over (Types and mechanism of crossing over).	**10**	**CO2**
III	Sex - Linked Inheritance, Pedigree Analysis. Sex Determination in *Drosophila*, cat and human. Chromosomal theory of inheritance and maternal inheritance. Chromosomal aberration - change in number and structure. Dosage compensation theory.	**10**	**CO3**
IV	Transposons and transposable elements in prokaryotes and eukaryotes. Introduction to Transposable elements in human. Mendelian Inheritance in Man (Autosomal dominant and Autosomal recessive).	**10**	**CO4**
V	Population Genetics - Hardy Weinberg principle, gene frequency, genotype frequency and factors affecting gene frequency. Population bottle neck, Founders effect, Natural Selection, Genetic drift, Mutation and Migration.	**10**	**CO5**
Text Book			
1	Dr. Veer Bala Rastogi, 2020, Elements of Genetics, 11th Revised & Enlarged Edition, Kedar Nath Ram		
2	Nath Publications, Meerut, 250001. www.knrnpublications.com, ISBN-978- 81-907011-2-9		
3	Verma, P.S. and Agarwal, V.K., 1995. Genetics, 8th edition, S.Chand & Co., New Delhi – 10055.		
4	Verma, P.S., and Agarwal, V.K., 1995. Cell and Molecular Biology, 8th edition, S.Chand and Co., New Delhi, 110055.		
5	Verma PS and Agarwal VK. 2010 Genetics. S. Chand & company PVT. Ltd		
Reference Books			
1	Gardener E.J. Simmons M.J. Slustad D. P. 2006. Principles of Genetics		
2	Lewis, R.2001. Human Genetics- Concepts and application. 4th edition. McGraw Hill.		
3	Griffiths, Miller, J.H., An Introduction to Genetic Analysis W.H.Freeman. New York.		
4	Winter, P.C., Hickey, G.J. and Fletcher, H.L.2000. Instant notes in Genetics. Viva books, Ltd		
5	Good enough U. 1985. Genetics. Hold Saunders international.		
Web References			
1	https://onlinecourses.swayam2.ac.in/cec21_bt02/preview		
2	https://www.dnaftb.org/#organization		

COURSE OUTCOMES (CO)

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

CO1	To make students familiar with history of genetics and basic principles of Mendelian's laws.
CO2	To make students familiar with gene interaction of Drosophila as Model organism.
CO3	To understand about chromosomal structure variation and sex linked inheritance.
CO4	To understand about ploidy and transposable elements
CO5	To understand about population genetics and pedigree analysis.

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**
CO2	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**H**
CO3	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**
CO4	**H**	**M**	**M**	**H**	**H**	**M**	**H**	**M**	**H**	**H**
CO5	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**H**

H – High; M – Medium ; L - Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBTMP301	**DSC PRACTICAL-III**	**SEMESTER– III**

Course Objectives:

The Course aims

- To learn the mutant isolation in different methods.
- To acquire the handling techniques of chamber, plates and spectrophotometer.

Credits:3 **Total Hours:50**

S.No	**EXPERIMENT**	**Hrs**	**CO**
1.	Isolation of Genomic DNA from yeast – large scale spool out DNA	05	CO1
2.	Estimation of DNA using spectrophotometer	05	
3.	Isolation of mutants by replica plating	05	CO2
4.	Isolation of mutants by Gradient plate methods (Streptomycin)	05	
5.	Chemical Mutagenesis - EMS	05	CO3
6.	Mutagenesis by radiation exposure	05	
7.	Bacterial Conjugation – Transfer of Antibiotic-resistant plasmid	05	
8.	Culturing of different kinds of *Drosophila sp*	05	CO4
9.	Monohybrid and Dihybrid ratio	05	CO5
10.	Karyotyping	05	

Reference Book

1 *Gregore Koliantz,DanielB.Szymanski*,2006. Genetics: A Laboratory Manual ASA-CSSA-SSSA publisher.

2 *Murray, R.G.F., Wood, W.A. and Krieg, N.B.* 1994. Methods for General and Molecular Bacteriology. American society for Microbiology.

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBCBTA301	**GEC III : BIOCHEMISTRY (BIOMOLECULES)**	**SEMESTER - III**

Course Objectives:

The Course aims

- To enable the learners to have a strong foundation in the structural and metabolic aspects of biomolecules which is the basic requirement of all life sciences.

Credits: 2 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Carbohydrates:** Introduction, classification. Monosaccharide – Structure and importance of glucose and fructose. Isomers: stereo and structural isomers. Mutarotation and chemical reactions- reduction, oxidation and osazone formation. Oligosaccharides – Disaccharides - Structure and importance of sucrose, lactose. Polysaccharides - Structure and importance of homopolysaccharides – Starch and Glycogen. Heteropolysaccharides - Hyaluronic acid and Heparin.	8	CO1
II	**Amino acids:** Classification, Structure and properties. Essential, Non- essential and Non-protein amino acids. **Protein:** Classifications and Functions: Structural organization of Proteins - Primary, secondary, tertiary and quaternary structure. Forces involved in stabilization of tertiary structure of proteins.	8	CO2
III	**Lipids:** Classification. Triacylglycerol – Structure, physical & chemical properties. Phospholipids - Structure of lecithin. Phospholipids in cell membrane – Fluid Mosaic model. Derived lipids. Essential fatty acids, Saturated and unsaturated fatty acids: - Structure. Sterol – Structure of Cholesterol.	8	CO3
IV	**Enzymes** – Definition, IUB classification with examples. Active site - Definition, Mechanism of enzyme action - Lock & key model and induced fit hypothesis. Enzyme units - IU, katal.	8	CO4

	Factors affecting enzyme activity (pH, Temperature and substrate concentration).		
V	**Vitamins** - Classification, Sources, daily requirements, physiological functions and deficiency of fat and water soluble vitamins. **Minerals and Trace elements**: Macro and micro minerals. Sources, daily requirements, physiological functions and deficiency diseases of calcium, phosphorous, sodium, potassium, iron.	**8**	**CO5**
Text Book			
1.	*Jain, J. L.* 2002. **Fundamentals of Biochemistry.** [Fifth Edition]. S. Chand & Company Ltd., New Delhi.		
Reference Books			
1.	*Deb, A. C.* 2000**. Fundamentals of Biochemistry.** Books and GEC (P) Ltd., Calcutta.		

COURSE OUTCOMES (CO)

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

CO1	Explain the structure of carbohydrates and their functions
CO2	Describe the nature of Nature of amino acids, functions and structural organization of proteins
CO3	Illustrate on characterization of lipids and their functions
CO4	Interpret the classification, characteristics and basic concepts of enzyme action
CO5	Elucidate the classification and clinical significance of micronutrients

MAPPING

PO,PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	M	H	M	M	M	H	M
CO2	H	M	M	M	H	M	M	M	H	M
CO3	H	M	M	M	H	M	M	M	H	M
CO4	H	M	M	M	H	M	M	M	H	M
CO5	H	M	M	M	H	M	M	M	H	M

H – High; M – Medium ; L - Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBCBTAP301	**GEC PRACTICAL III: BIOCHEMISTRY (BIOMOLECULES)**	**SEMESTER – III**

Course Objectives:

The Course aims

- To enable the learners to have a strong foundation in understanding chemical nature of biomolecules.

Credits: 2 **Total Hours: 30**

S.No.	**EXPERIMENT**	**Hrs**	**CO**
I. Qualitative Analysis			
1.	Carbohydrates: Glucose, fructose, xylose, sucrose, lactose, and starch.	12	1
2.	Amino acids: Tyrosine, tryptophan, histidine, methionine and cysteine.	6	1
3.	Proteins: Solubility test, coagulation test, ninhydrin test, biuret test, folin's phenol test, precipitation by metals.	3	1
4.	Lipids: Solubility, grease spot, Oil spot, emulsification, halogenations, colour reactions.	3	1
II. Quantitative Analysis			
5.	Estimation of Glycine by Formal titration method.	3	2
6.	Determination of Saponification Value	3	2

Reference Books

1. *Sadasivam, S.* and *Manickam, A*. 2010. **Biochemical Methods.** [Third Edition]. New Age International (P) Ltd., New Delhi.
2. *Jayaraman, J*. 2008. **Laboratory Manual in Biochemistry**. [First Edition Reprint]. New Age International (P) Ltd., New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Perform qualitative analysis for identification of Biomolecules
CO2	Do quantification of biomolecules by titrimetric methods

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBTNM301	**MDC I: MEDICINAL HERBS**	**SEMESTER-III**

Course Objectives:

The Course aims

- To apply the basic knowledge of common medicinal plants.

Credits:2 **Total Hours:30**

UNIT	CONTENTS	Hrs	CO
I	Introduction to Medicinal Plants; Traditional medicinal Systems - AYUSH. Application of medicinal plants,	**06**	**CO1**
II	Herbs- *Aloe vera*, Green chirayta,, Tridax, Daisy, *Vinca*, Mint, Cumin & Ajwain.	**06**	**CO2**
III	**Climbing plants:** Betel, Ivy gourd, Butter fly pea, Veldt grape, Climbing Brinjal, Indra valli, Pepper & Madras pea, pumpkin.	**06**	**CO3**
IV	**Shrubs and Tree:** Indian mallow, Shikakai, Desert cotton, Turkey berry & Copper leaf, Moringa plant and Amla.	**06**	**CO4**
V	Cash crops-Sugarcane, Tobacco, Rice, wheat and corn. Asafetida and sweet potato	**06**	**CO5**

Reference Book

1	*Arya Vaidya Sala.,* 1994. **Indian Medicinal Plants**. Vol II. Universities Press.
2	*S.K. Bhattacharjee, 2020, Hand book of Medicinal plants: 4th revised and enlarged edition, Pointer publishers.*

COURSE OUTCOMES (CO)

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

CO1	Describe about Medicinal Plants.
CO2	Gain knowledge about various important medicinal herbs.
CO3	Describe about Climbing plants.
CO4	Explicate the importance of Shrubs.
CO5	Explain about cash crops.

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBTSB301	**SEC –I : MUSHROOM CULTIVATION AND VERMITECHNOLOGY (100% INTERNAL VALUATION)**	**SEMESTER - III**

Course Objectives:

The Course aims

- Students can start small scale industry of Mushroom cultivation- Students study the morphology and types of Mushrooms. They are aware of the identification of edible and poisonous Mushrooms.
- To learn the prospects and scope of mushroom cultivation in small scale industry.
- To learn the life cycle of *Agaricus* species
- To know the spawn production technique.
- To understand the Diseases. Post harvesting techniques of Mushrooms.

Credits :2 **Total Hours: 30**

UNIT	CONTENTS	Hrs	CO
I	Introduction: Morphology, Types of Mushroom, Nutritive values, life cycle of mushrooms, Prospects, and scope of Mushroom cultivation in small scale Industry.	6	**CO1**
II	Spawn production, spawn running, diseases and harvesting of mushrooms, post harvesting technology and marketing. Medicinal properties and value added products from edible and non edible mushrooms.	6	**CO2**
III	Diseases and post harvest technology, Insect pests, nematodes, mites, viruses, fungal competitors.	6	**CO3**
IV	Introduction to Vermitechnology: Types, Collection and Preservation of earthworms - *Eisenia fetida*, Role of earthworms. Culturing techniques of earthworms and composting materials, Factor affecting culturing of earthworm and Vermicomposting materials,	6	**CO4**
V	Small scale techniques of Vermicomposting -Types of vermicomposting - Physical, chemical and biological properties of vermicompost, Large scale techniques of Vermicomposting. Vermiwash and Economics - Chemical composition of vermiwash; Techniques of vermiwash production: Advantages of Vermicomposting,	6	**CO5**

Text Books	
1	Handbook of Mushroom Cultivation. 1999. TNAU publication.
2	Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayarajan. R. (1991). Oyster Mushrooms, Department of Plant Pathology, Tamil

	Nadu Agricultural University, Coimbatore.
3	Swaminathan, M. 1990. Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
4	Nita Bahl. 2002. Handbook on Mushroom 4th edition Vijayprimlani for oxford &IBH publishing co., Pvt., Ltd., New Delhi. 5. Dr.C. Sebastian Rajesekaran Reader in Botany Bishop Heber College, Trichy – 17.
5	Bahl, N. (1984-1988). Hand book of Mushrooms, II Edition, Vol. I & Vol. II.
Reference Books	
1	Suman. 2005. Mushroom Cultivation Processing and Uses, M/s. IBD Publishers and Distributors, New Delhi.
2	Sing. 2005. Modern Mushroom Cultivation, International Book Distributors, Dehradun.
3	Handbook of Edible Mushroom Today and Tomorrows printers and publishers.
4	Sharma V.P. 2006. Diseases and Pests of Mushrooms, M/s. IBD Publishers and Distributors, New Delhi.
5	Tewari, P and Kapoor, S.C.1988. Mushroom cultivation, Mittal Publications New Delhi.

COURSE OUTCOMES (CO)

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

CO1	To know the nutrient value of mushroom- To study the morphology and types of Mushrooms.
CO2	To learn the prospects and scope of mushroom cultivation in small scale industry.
CO3	To understand the Diseases and post harvest technology
CO4	To know about Vermitechnology and role of earthworms in it.
CO5	To understand the types and advantages of vermicomposting.

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	H	H	M	H	H	M	H
CO2	M	M	H	H	M	M	H	H	M	H
CO3	M	H	H	H	H	H	H	H	H	H
CO4	M	H	H	M	M	H	H	M	H	H
CO5	H	H	H	H	H	M	H	H	M	H

H-High; M-Medium; L-Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UVE301	**VAC III : UNDERSTANDING INDIA**	**SEMESTER – III**

Course Objectives

The course aims

- Identify India's geographical location, neighboring countries and major geographical features.
- Recognize the components of the Indian social structure, including caste, community, class and gender.
- Analyze the evolution of social hierarchies in India over different periods.

Credits: 1 **Total Hours: 15**

UNIT	CONTENTS	Hrs.	CO
I	**Geography & Cultures of India:** Physical Features of India – Landscape – Mountains – Rivers - Population, its growth, distribution - Migration People - Culture of India - Major Festivals, Culinary traditions – Costumes.	3	CO 1
II	**Architecture of India:** Ancient Architecture - Indus Valley Civilization, Mauryan, Gupta – Architecture - An introduction to Indian knowledge systems.	3	CO 2
III	**Freedom Struggle:** Revolt of 1857 - Formation of Indian National Congress – Swadeshi Movement - Gandhian Movements - Subhas Chandra Bose and INA - Independence and Partition of India.	3	CO 3
IV	**Communicating Culture:** Oral narratives – Myths - Tales and Folklore - Introduction to the Tribal Cultures of India	3	CO 4
V	**Indian Economy:** Economic Liberalization - Mixed Economy - Planning Commission	3	CO 5

Text Books

1. *Chauhan, Abha.* 2021. **Understanding Culture and Society in India: A Study of Sufis, Saints and Deities in Jammu Region**. Springer Nature.

Reference Books

1. *Hussain, Majid.* 2022. **Geography of India**. Edited by Tasawwur Husain Zaidi. Noida: McGraw Hill.
2. *Ramesh Dutta Dikshit,* 2020. **Political Geography: Politics of Place and Spatiality of Politics**, Macmillan Education.
3. *Thapar, Romila.* 2021. **Indian Cultures as Heritage: Contemporary Pasts.** London, Seagull Books.

COURSE OUTCOMES (CO)

After completion of the course, the student will be able to

CO 1	Identify India's geographical location, neighboring countries, and major geographical features.
CO 2	Interpret the significance of different types of architectural structures and Indian Knowledge Systems in shaping philosophical thought.
CO 3	Illustrate the role of different freedom fighters and their contributions to India’s independence.
CO 4	Demonstrate how oral narratives contribute to the preservation of tribal cultures.
CO 5	Assess the impact of economic liberalization on India's development.

Course Prepared by
Mr. J. SIBI CHAKARAVARTY
Assistant Professor

Course Approved by
Dr. V. V. MALINEE
BOS Chairman

24ULS301	**AEC I: CAREER COMPETENCY SKILLS I**	**SEMESTER – III**

Course Objectives

The course aim

- To develop and improve the problem solving skill.

Credits: 1 **Total Hours: 25**

UNIT	CONTENTS	Hrs.	CO
I	Pipes and Cisterns – Time and Work **Chapter 16, 17**	5	CO 1
II	Time and Distance – Boat and Streams **Chapter 18, 19**	5	CO 2
III	Problem on Trains – Alligation and Mixture **Chapter 20, 21**	5	CO 3
IV	Simple Interest - compound interest **Chapter 22, 23**	5	CO 4
V	Calendar – Clock – Permutation and combination **Chapter 27, 28, 30**	5	CO 5

Text Books

1. *Aggarwal R.S.* 2025. **Quantitative Aptitude.** [Revised Edition]. S. Chand & Co., New Delhi.

COURSE OUTCOMES (CO)

After completion of the course, the student will be able to

CO 1	Solve problems involving the concepts of Simplification and average.
CO 2	Solve problems involving the concepts of Surds and Indices
CO 3	Solve problems involving the concepts of Ratio and Proportion
CO 4	Solve problems involving the concepts of Profit and loss, Partnership.
CO 5	Solve problems involving the concepts of Age and Percentage.

Course Prepared by
Ms.A. ISWARYA
Assistant Professor

Course Approved by
Mr. T. RAJENDRAKUMAR
(BOS Chairman)

24UTAL401	**nghJj;jkpo; - IV**	**பருவம் - IV**

இப்பாடத்திட்டத்தின் நோக்கங்களாவன

- rq;f ,yf;fpaq;fis mwpKfk; nra;jy;.
- mw ,yf;fpaq;fs; gw;wp khzth;fs; mwpanra;jy;
- ,yf;fpa tuyhWfis mwpa itj;jy;

Credits: 3 **Total Hours: 50**

UNIT	***CONTENTS***	**Hrs**	**CO**
I	rq;f ,yf;fpak; (vl;Lj;njhif) m) FWe;njhif–ghly; 2>3>4>40>167 M) fypj;njhif–ghly; 1-5 ,) GwehD}W –ghly; 3>112 <) Iq;FWE}W –mk;kthopg;gj;J	10	**CO1**
II	rq;f ,yf;fpak; (gj;Jg;ghl;L) m) FwpQ;rpg;ghl;L (106thpfs;kl;Lk;;)	10	**CO2**
III	mw ,yf;fpak; m) jpUf;Fws; - kUe;J M) ehybahh; - Fbg;gpwg;G (Kjy; 5 ghly;fs;) ,) ,d;dhehw;gJ–Kjy; 5 ghly;fs; <) KJnkhopf;fhQ;rp–jz;lhg;gj;J	10	**CO3**
IV	,yf;fpatuyhW m) Kr;rq;ftuyhWmwpKfk; M) vl;Lj;njhif E}y;fs; ,) gj;Jg;ghl;L E}y;fs; <) gjpndz;fPo;f;fzf;F E}y;fs;	10	**CO4**
V	,yf;fzk; m) mfj;jpizfs; M)Gwj;jpizfs; ,) jd;tpid>gpwtpid>nra;tpid> nra;ghl;Ltpidthf;fpaq;fs	10	**CO5**

பாடநூல்

1.jkpo;j;Jiw ntspaPL

பார்வை நூல்கள்

r.Nt.Rg;gpukzpak;> gjpnzd;fPo;f;fzf;F E}y;fs;>kzpthrfh; gjpg;gfk;> nrd;id> 2012.
GypA+h; Nfrpfs;> FWe;njhif> rhujh gjpg;gfk;>nrd;id- 2010
Ky;iyg;ghl;L> kiwkiyabfs;> ,uhikah gjpg;gfk;> nrd;id-

COURSE OUTCOMES (CO)

இப்பாடத்தைக் கற்பதன் வாயிலாக மாணவர்கள் பெறும் பயன்களாவன

CO1	vl;Lj;njhif E}y;fs; gw;wpmwpjy;.
CO2	gj;Jg;ghl;L E}y;fs; gw;wpmwpjy;.
CO3	mw ,yf;fpaq;fs; top tho;f;if $Wfisczh;j;Jjy;
CO4	,yf;fpatuyhw;wpd; Njhw;wk; tsh;r;rpiamwpjy;
CO5	mbg;gil ,yf;fzj;ijmwpjy;.

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**
CO2	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**
CO3	**H**	**L**	**L**	**L**	**L**	**L**	**H**	**M**	**M**	**M**
CO4	**H**	**M**	**M**	**M**	**M**	**M**	**H**	**M**	**M**	**M**
CO5	**H**	**H**	**H**	**H**	**H**	**H**	**H**	**M**	**M**	**M**

H – High; M – Medium ; L - Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UENLA401	**ENGLISH FOR ARTS AND SCIENCE - IV**	**SEMESTER – IV**

Course Objectives

The course aims to

- Integrate language skills effectively in professional and academic contexts.
- Analyze and apply domain-specific registers to communicate with clarity and precision in subject-related discussions.
- Enhance proficiency by expanding vocabulary and evaluating its formal usage.
- Construct context-appropriate responses using advanced grammar, vocabulary, and technical terms in academic and professional settings.

Credits: 3 **Total Hours: 50**

UNIT	CONTENTS	Hrs.	CO
I	1. Listening : Listening to technical Style of communication, ABC of technical communication 2. Speaking : Public speaking and Extempore. 3. Reading : Reading scientific and technical texts 4. Writing : Proposals 5. Grammar : Determiners 6. Vocabulary : Fixed Expressions	10	CO 1
II	1. Listening : Listening and Note taking 2. Speaking : Techniques for neutralization of Mother Tongue Influence (MTI) 3. Reading : News magazines, Pamphlets, Reading words with accuracy. 4. Writing : Summary writing 5. Grammar : Common errors. 6. Vocabulary : Compare and Contrast expressions.	10	CO 2
III	1. Listening : Listening to accent of English – British & American 2. Speaking : Debate 3. Reading : Short narratives and descriptions excerpts interview. 4. Writing : Essay Writing. 5. Grammar : Mood, Modifiers. 6. Vocabulary : Changing words from one form to another.	10	CO 3
IV	1. Listening : Radio News / TV –News telecast 2. Speaking : Watch or Listen to documentaries 3. Reading : Reading Motivational Stories (Success stories in subject areas) 4. Writing : Report writing (Investigative and Progress report) 5. Grammar : Negation (Statements & Questions)	10	CO 4

	6. Vocabulary : Sequence of words		
V	1. Listening : Listening to health problems and advice, Stress in responses, Listening to restaurant Orders 2. Speaking and : Expressing Likes and dislikes, Agreeing disagreeing, Table manners. 3. Reading : Reading about the new hobby of geo coaching 4. Writing : Meeting Minutes 5. Grammar : Relative clause 6. Vocabulary in Context :Subject-Specific Vocabulary – Science / Arts	10	CO 5

Text Books

1. Thimmesha, L., Victor, R. 2022. **A Textbook of English Language Communication Skills,** [Revised Edition], Infinite Learning Solutions.

Reference Books

1. *Jack C. Richards., Jonathan Hull.,* 2015. **Interchange**. Cambridge University Press.
2. *Lakshminarayanan*., **A Course Book On Technical English**, Scitech Publications (India) Pvt. Ltd.

Web Reference

1. https://www.fluentu.com/blog/educator-english/esl-listening-websites/
2. https://americanenglish.state.gov/resources/teachers-corner-listening

COURSE OUTCOMES (CO)

After completion of the course, the student will be able to

CO 1	Understand and share information and ideas clearly in writing and speaking across different situations.
CO 2	Speak clearly and confidently in real-life situations using suitable communication methods.
CO 3	Analyze different texts to understand both their meaning and language use.
CO 4	Evaluate their own English language skills to identify strengths and areas for improvement.
CO 5	Create effective conversations and written pieces for different communication situations.

Course Prepared by
Mr. R. PACHAGOUNDAN
Assistant Professor

Course Approved by
Dr. V. V. MALINEE
BOS Chairman

24UBTM401	DSC VI: BIOPHYSICS AND BIOINSTRUMENTATION	SEMESTER-IV

Course Objectives:

The Course aims

- To study the basic techniques and principle of instrumentation.

Credits:4 **Total Hours:50**

UNIT	CONTENTS	Hrs	CO
I	**Introduction to Biophysics:** Nature of chemical bonds, Intra and inter molecular interactions in biological systems. Proteins: Amino acids – Conformations. Phi and Psi angles. Ramachandran plot. Peptides: peptide bond isomerisation. Disulphide bonds, electrostatic forces, vanderwaals interaction.	10	CO1
II	**Care and general maintenance of laboratory Instrumentation:** Weighing balance, pH meter, laminar flow chambers, Hot air oven, Autoclave and Incubator. Centrifugation – Types, Principle and Application. Relation between RCF and g.	10	CO2
III	**Chromatography**–Paper Chromatography, Thin Layer Chromatography, column chromatography, Ion Exchange Chromatography, High Performance Liquid Chromatography, Gas Chromatography and LC-MS.	10	CO3
IV	**Spectroscopy:** Electromagnetic Spectrum, Beer - Lambert's law, Principles of spectroscopy, types of UV-visible spectroscopy, Infrared spectroscopy, Atomic, NMR, Flourescence, **Electrophoresis** – Agarose Gel Electrophoresis, SDS-PAGE. Blotting techniques -Southern, Northern and immunoblotting.	10	CO4
V	Biosensors-principle and applications Electrochemical, thermometric, potentiometric - optical, piezo-electric and amperometric biosensors. Imaging techniques - principle and applications: X-ray, CAT Scan, ECG, EEG. Radioactive Decay – Principles, Types, applications of Gieger Muller Counter and Scintillation Counter.	10	CO5

Text Books

1 Pranav Kumar,. 2021. **Biophysics and Molecular Biology. (4th edition). Path finder Publication, India.**

2	*Boyer,.R.F.*1993. **Modern Experiments in Biochemistry.** [Second Edition]. The Benjamin/Cummings Publishing Company, Red wood City, California.
3	*Ghatak,K.L.* 2003. Techniques and Methods in Biology.PHI Learning Private Ltd. New Delhi.
Reference Books	
1	*Upadhyay.*2005. **Biophysical Chemistry.** Himalaya Publications.
2	*Wilson,.K. and Walker*,2003.**Practical Biochemistry.**[First Edition].Cambridge University Press.

COURSE OUTCOMES (CO)

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

CO1	Explain the presence of bonds is essential to study chemistry in human body.
CO2	Differentiate the instruments based on its working principle and learn about Handling with care.
CO3	Demonstrate the techniques of separation and purification of biomolecules based on its own property.
CO4	Illustrate blotting technique and centrifugation process
CO5	Find the technique for visual representation of interior parts of the body for Clinical analysis

MAPPING

PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	H	H	H	M	H	H	H	H
CO2	H	H	H	M	H	H	M	M	H	H
CO3	H	M	H	H	H	H	H	M	H	M
CO4	H	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H	H

H-High; M-Medium; L-Low

Prepared By
(Course Coordinator)

Approved By
(BoS Chairman)

24UBTMP401	**DSC PRACTICAL-IV**	**SEMESTER–IV**

Course Objectives:

The Course aims

- To understanding and the handling of biological instruments with care.
- To identify the unknown components in the test sample using photometric method.
- To separate the bio-molecules based on its individual property.

Credits:3 **Total Hours:36**

S.No	**EXPERIMENT**	**Hrs**	**CO**
1.	Principles and operation of pH meter–calibration and buffer Preparation	**03**	**CO1**
2.	Principles and operation of colorimeter and spectrophotometer (Application: Chlorophyll estimation)	**03**	
3.	Determination of Km and Vmax (Radish Peroxidase)	**03**	**CO2**
4.	Principles of Diffusion and Osmosis (through semi-permeable membrane)	**03**	
5.	Haemolysis	**03**	**CO3**
6.	Paper Electrophoresis	**03**	
7.	Column chromatography	**03**	
8.	Paper chromatography (plant extract)	**03**	
9.	Identification of amino acids by Thin-layer chromatography Method	**03**	
10.	SDS-PAGE	**06**	**CO4**
11.	Western blotting–Demonstration	**03**	**CO5**

Reference Book

1	Veerakumari .(2006).Bioinstrumentation,1st Edition, MJP Publishers.

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UMABTA401	**GEC IV:BIOSTATISTICS**	**SEMESTER– IV**

Course Objectives:

The Course aims

- To learn the strategies of research field and also to provide knowledge to understand the role of statistics in research.

Credits:2 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Introduction:** Definition – Function of Statistics – Limitations of Statistics–Collection of data–Classification and Tabulation. **(Chapter 1 Sections:1.3,1.7,1.8) (Chapter 2 Sections:2.1,2.3)**	**08**	**CO1**
II	**Measures of Central Tendency:** Arithmetic Mean–Median–Mode–Geometric mean –Harmonic mean. **(Chapter 3 Sections: 3.1.1,3.2 -3.5)**	**08**	**CO2**
III	**Measures of Dispersion and Variability:** Range–Inter Quartile Range and Quartile Deviation– Mean Deviation – Standard deviation– Coefficient of variation. **(Chapter 4 Sections :4.1 – 4.4)**	**08**	**CO3**
IV	**Correlation Analysis:** Types of correlation–Methods of studying Correlation (Excluding Correlation of grouped data).**Regression Analysis:** Regression line – Regression equations (Excluding Method of Least Square). **(Chapter 6 Sections:6.1 –6.2)(Chapter 7 Sections:7.1–7.2)**	**08**	**CO4**
V	**Sampling and Test of Significance:** Steps in test of hypothesis –Test of significance of small samples (t and F)–Chi-square test (Problems only). **(Chapter 10 Sections: 10.1,10.5)(Chapter11)**	**08**	**CO5**

Text Book

1	*Palanichamy. S and Manoharan.M,* 2001. **Statistical methods for Biologists.** [Third Edition]. Palani Paramount Publications, Palani.

Reference Books

1	*DanielW.W.*1987. **Biostatistics.** John Wiley and Sons, New york.
2	*Arora,P.N. and Malhan,P.K.*2006.**Biostatistics.** Himalaya Publishing House, Mumbai.

Course Outcomes (CO)

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

CO1	Learn the importance of statistics
CO2	Understand the concepts of measures of central tendency
CO3	Know the concepts of measures of dispersion
CO4	Gain knowledge on correlation and regression analyses
CO5	Test the samples using testing of hypothesis

MAPPING

PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	H	H	H	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H	H	H	H
CO3	M	H	H	M	H	H	H	H	H	H
CO4	H	M	H	H	M	H	M	M	H	H
CO5	H	H	M	H	H	M	H	H	M	H

H-High; M-Medium; L-Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UMABTAP401	**DSC PRACTICAL IV: STATISTICS (USING MS-EXCEL)**	**SEMESTER– IV**

Course Objectives:

The Course aims

- To give a good grip on concepts in analyzing the data using statistical software

Credits:2 **Total Hours: 21**

PROGRAM	CONTENTS	Hrs	CO
1	Diagrams and graphs	**03**	**CO1**
2	Measures of Locations	**03**	**CO2**
3	Measures of Dispersion	**03**	**CO2**
4	Correlation coefficient (Karl Pearson and Rank method)	**03**	**CO3**
5	Regression lines	**03**	**CO3**
6	Small sample test (t and F)	**03**	**CO4**
7	Chi-square test for independence of attributes.	**03**	**CO4**

Reference Books

1	*Bhattacharjee Dibyojyoti.* **Practical Statistics Using Microsoft Excel.** Asian Books Private Ltd.
2	*ApteD.P.*2008.**Statistical Tools for Mangers using MS-EXCEL.** Excel Books.

Course Outcomes (CO)

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

CO1	Demonstrate the data in diagrammatic and graphical representation
CO2	Find the averages and measures of dispersion
CO3	Calculate correlation and regression for huge amount of data
CO4	Gain knowledge about test of significance

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBTNM401	**MDC II: FUNDAMENTALS OF BIOTECHNOLOGY**	**SEMESTER-IV**

Course Objectives:

The Course aims

- To understand the basics about Biotechnology and its day to day application in daily life.

Credits:2 **Total Hours: 30**

UNIT	Contents	Hrs	CO
I	Introduction to Biotechnology –Origin and Evolution of Biotechnology, Old biotechnology and New biotechnology.	**06**	**CO1**
II	Food Biotechnology - Introduction, products, curd, idly, pickles, Cheese, wine.	**06**	**CO2**
III	Pharmaceutical Biotechnology – Introduction to antibiotics, uses and abuses of antibiotics. Vaccines– introduction, vaccine against common disease, vaccination schedule, edible Vaccine, Transgenic animals–fish and chicken.	**06**	**CO3**
IV	Agricultural Biotechnology–Genetically modified crops, pros and cons –Bt cotton and Bt brinjal, Golden rice, *Aloe vera* gel, SCP Spirulina, Spirulina pickle, mushroom cultivation, Azolla, Composting and Biofertilizer.	**06**	**CO4**
V	Proposal to bank for loan, MSME, Quality control - FSSAI, AGMARK, and ISO.	**06**	**CO5**

Reference book

1 *DaanJ.A.Crommelin, Robert D. Sindelar,* and *Bernd Meibohm,* 2008. **Pharmaceutical Biotechnology–Fundamentals and applications.** Informa Health care USA,Inc.

2 *Glick R. Bernard* and *Pasternak J Jack.*2007.**Molecular Biotechnology**.[Third Edition].ASM press, Washington D.C.

COURSE OUTCOMES (CO)

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

CO1	Gain knowledge about the basics of Biotechnology.
CO2	Explain about various food products.
CO3	Describe about the types of vaccines.
CO4	Illustrate about GMO and its products.
CO5	Explain about quality control.

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBTSB401	**SEC II: BASICS OF RESEARCH (100% INTERNAL EVALUATION)**	**SEMESTER-IV**

Course Objectives:

The Course aims

- To develop the basic knowledge about the research for the students.

Credits:2 **Total Hours: 25**

UNIT	CONTENTS	Hrs	CO
I	Research–Definition, Types of research, Research approaches, Criteria for good research, Essential steps in research.	**05**	**CO1**
II	Literature collection, Literature citation, Search Engines-Google scholar, PuBMed, Science Direct, Scopus. Referencing styles, Reference tools-Mendeley.	**05**	**CO2**
III	Research problem-Techniques involved in research problem, Hypothesis-Null & Alternative hypothesis. Experimental design – Basic principle, Sampling Unit, Controls.	**05**	**CO3**
IV	Research report-Types of research report (Thesis, Journal, Project proposal report), Components of research report, Formatting Table & Figures, Format of Thesis. Plagiarism. Funding Agencies (National and International) – Government , Private and NGO.	**05**	**CO4**
V	Journals- Impact factor, citation index, H-index, i10-index. Types of Manuscript- Research Article, Review article, Perspective, Short communications.	**05**	**CO5**

Reference Book

1	*Gurumani,N.*2006. **Research Methodology**.MJP Publishers.
2	*C.George Thomas.*2021. Research Methodology and Scientific Writing, 2nd Edition, Springer jointly published with ANE Books India.
3	*C.R.Kothari, Gaurav Garg.* 2022. Research Methodology, Methods and Techniques.

COURSE OUTCOMES (CO)

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

CO1	Depict about research and its classification.
CO2	Describe about Problem Identification & Formulation, Research Question, Investigation Question and hypothesis.
CO3	Explain about Literature collection and Literature citation.
CO4	Describe about Standard of Research journals–impact factors and citation index.
CO5	Elucidate about thesis Report, Table, Figures, Format of Thesis.

MAPPING

PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H	H	H	H
CO3	H	M	H	H	H	M	H	H	H	H
CO4	M	H	M	M	H	H	M	M	H	H
CO5	H	M	H	H	M	M	H	H	M	H

H-High; M-Medium; L-Low

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UVE401	VAC IV: DIGITAL AND TECHNOLOGICAL SOLUTIONS	SEMESTER – IV

Course Objectives

The course aims

- To build familiarity with key digital paradigms.
- To create awareness about the importance and impact of digital technology.
- To impart knowledge of communication and network systems.
- To promote awareness and understanding of e-Governance and Digital India initiatives

Credits: 1 **Total Hours: 15**

UNIT	CONTENTS	Hrs.	CO
I	**Evolution of Digital Systems:** Introduction and Evolution of Digital Systems - Role and Significance of Digital Technology - Information and Communication Technology – Tools.	3	CO 1
II	**Computer System:** Computer System - Software and its types - Operating systems: Types and Functions. **Problem Solving:** Algorithms and Flowcharts.	3	CO 2
III	**Communication System:** Principles, Model & Transmission Media. **Internet:** Concepts - Application - WWW - Web Browsers and Search Engines – Messaging - Email and Social Networking.	3	CO 3
IV	**E-commerce & Digital Marketing:** Basic Concepts – Benefits of E-commerce – Challenges in Digital Marketing. **Computer Based Information System:** Significance and Types.	3	CO 4
V	**Digital India and e-Governance:** Initiatives, Infrastructure, Services and Empowerment. **Digital Financial Tools:** Unified Payment Interface - Aadhar Enabled Payment System – USSD - Credit / Debit Cards - e-Wallets - Internet Banking - NEFT/RTGS and IMPS - Online Bill Payments and PoS.	3	CO 5

Text Books

1. *Rajaraman, V.* 2018. **Introduction to Information Technology**, [3rd Edition], PHI Learning private Limited.
2. *Behrouz A. Forouzan,* 2022. **Data Communications and Networking**, [4th Edition], McGraw Hill.
3. *Balagurusamy, E.* 2009. **Fundamentals of Computers**, Tata McGraw Hill.

Reference Books

1. *Pramod Kumar, Anuradha Tomar, Sharmila, R.* 2021. **Emerging Technologies in Computing Theory, Practice, and Advances**, [1st Edition], Chapman and Hall/CRC Imprint.
2. *Stuart Jonathan Russell, Peter Norvig*. 2014. **Artificial Intelligence - A Modern Approach**, Pearson Education
3. *Samuel Greengard,* 2021. **Internet of Things**, [Revised and Updated Edition], MIT Press.
4. *Murthy, C.S.V*. 2002. **E-Commerce (Concepts, Models, Strategies),** Himalaya Publishing House.
5. *Judith S. Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman*, 2013. **Big Data for Dummies**, Wiley & Sons-Wiley.

COURSE OUTCOMES (CO)

After completion of the course, the student will be able to

CO 1	Understand digital systems, technology and the effective use of ICT tools.
CO 2	Gain knowledge of computer systems, software, operating systems, and problem-solving techniques.
CO 3	Learn about communication systems, computer networks, the internet, and various online platforms.
CO 4	Know about computer-based information systems, e-commerce, and digital marketing concepts.
CO 5	Gain awareness of Digital India initiatives, e-governance services and digital financial tools.

Course Prepared by
Dr. S. NITHYA
Assistant Professor

Course Approved by
Dr. J. TAMILSELVAN
(BOS Chairman)

24ULS401	AEC II: CAREER COMPETENCY SKILLS II	SEMESTER – IV

Course Objectives

The course aim

- Analyze the structure and function of English grammar for effective communication in diverse contexts.
- Demonstrate appropriate linguistic expressions and soft skills required for formal and informal interactions.
- Use effective communication techniques for professional speaking, writing, and interactions at the workplace

Credits: 1 **Total Hours: 25**

UNIT	CONTENTS	Hrs.	CO
I	**Advanced Functional Grammar in Context** Tense usage in Professional Settings - Present perfect - Past perfect - Future forms – Conditionals - Reported Speech	5	CO 1
II	**Professional Communication & Writing** Resume and Cover Letter writing - Writing memos, Meeting minutes	5	CO 2
III	**Soft Skills** Goal setting: SMART goals, planning and prioritization - Conflict resolution and problem-solving approaches	5	CO 3
IV	**Speaking Skills for Workplace** Debates - Group discussions	5	CO 4
V	**Advanced Professional Communication** Business Reports - Proposals	5	CO 5

Text Books

1. *Biber, Douglas, et al.* 2020. **Longman Grammar of Spoken and Written English**. Pearson Education,
2. *Vickers, Rachel. 2021.* **The Art of Writing a CV: A Practical Guide to Writing a Winning CV and Cover Letter**. [2nd Edition]. Kogan Page.

Reference Book

1. *Eastwood, John*. 2022. **Oxford Practice Grammar: Basic.** [3rd Edition]. Oxford University Press.
2. *Bailey, Stephen*. 2022. **Academic Writing: A Handbook for International Students**. [5th Edition]. Routledge.

COURSE OUTCOMES (CO)

After completion of the course, the student will be able to

CO 1	Identify and apply basic rules of English grammar in everyday communication.
CO 2	Construct clear and well-organized short pieces of writing for different purposes.
CO 3	Demonstrate appropriate social and professional expressions in spoken interactions.
CO 4	Develop effective verbal and non-verbal communication skills for various contexts.
CO 5	Engage in everyday conversations and workplace communication by applying appropriate language and etiquette.

Course Prepared by
Mr. J. SIBI CHAKARAVARTY
Assistant Professor

Course Approved by
Dr. V. V. MALINEE
BOS Chairman

GUIDELINES

1. SUBMISSION OF RECORD NOTE BOOKS:

Candidates appearing for Practical Examinations shall submit Bonafide Record Note Books prescribed for Practical Examinations, otherwise the candidates will not be permitted to appear for the Practical Examinations.

2. PASSING MINIMUM AND INTERNAL MARK DISTRIBUTION (Theory and Practical)

(i) THEORY

The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in each theory paper with a passing minimum of 30 marks in External out of 75.

Internal Marks Distribution [CA-Total Marks: 25]

Attendance	: 5 Marks
Assignment	: 5 Marks
Internal Examinations	: 15 Marks
Total	**: 25 Marks**

Comprehensive Examination:

Descriptive type **: 75**

(ii) THEORY(If Internal Evaluation is for 100 Marks)

The candidate shall be declared to have passed the Examination, if the candidate secures not less than 40 marks out of 100 in the Comprehensive Examination (Internal Evaluation only).

Internal Marks Distribution [CA-Total Marks: 100]

Attendance	: 10 Marks
Assignment	: 30 Marks (3 Assignments Compulsory)
Internal Examinations	: 60 Marks
Total	**: 100 Marks**

(iii) PRACTICAL

The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in each Practical paper with a passing minimum of24marksinExternaloutof 60.

Internal Marks Distribution [CA-Total Marks: 40]

Experiment	:10 Marks
Attendance	: 5 Marks
Record	: 5 Marks
Internal Examinations	: 20 Marks
Total	**: 40 Marks**

Comprehensive Examination:

Practical **: 75**

3. INTERNSHIP

- The Internship shall be carried out by students individually at the end of IV semester and by attending a minimum of 15 days training at any institute.
- The Student has to attend 1 review after completing his/her Internship, presentation of their report and it will be evaluated by an internal examiner.

Mark Distribution Pattern

***Internal Mark Distribution [*Total Marks: 100]**

Attendance:	30Marks
Review presentation:	20Marks
Internship report:	30 Marks
Viva-Voce:	20 Marks
Total:	**100 Marks**

4. PROJECT

- The project work shall be carried out by the students as groups during their VI semester.
- The student has to attend 2 reviews before completing the project.
- The assessment of student performance in a semester is calculated by Continuous Internal Assessment (CA) for 40 marks and External Assessment for

60 marks.

- Upon completion of their project work the candidate shall be required to appear for a Viva-Voce conducted by an external examiner.
- The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in project with a passing minimum of 24 marks in External out of 60.

Mark Distribution Pattern

Comprehensive Examination (CE)	**:60Marks**
Continuous Assessment (CA)	**:40 Marks**

Internal Mark Distribution **[CA-Total Marks: 40Marks]**

1. Research work done	:	20Marks
2. Attendance	:	05Marks
3. Observation Note	:	05Marks
4. Review	:	10 Marks
Total	**:**	**40Marks**

External Mark Distribution [CE - Total Marks: 60 Marks]

Project report	:30Marks
Presentation	:15Marks
Viva-Voce	:15Marks
Total	**: 60 Marks**

5. QUESTIONPAPERPATTERNANDMARK DISTRIBUTION

(i) THEORY **(For 75 marks)**

Question Paper Pattern and Mark Distribution

1. **PART–A (10 x1=10 Marks)**
   Answer ALL questions (MCQ)
   Two questions from each UNIT

2. PART–B (5 x7=35 Marks)

Answer ALL questions

One question from each UNIT with Internal Choice

3. PART– C (3 x10 =30 Marks)

Answer ANY THREE questions

Open Choice– 3 out of 5 questions one question from each UNIT

***ii) PRACTICAL* (DSC)**

Candidates appearing for Practical Examinations shall submit Bonafide Record Note Books prescribed for Practical Examinations, otherwise the candidates will not be permitted to appear for the Practical Examinations.

External Marks Distribution [CE-Total Marks: 60]

For each practical question the marks shall be awarded as follows:

***Question Paper Pattern and Mark Distribution* (For 60 marks)**

Component	**Mark**
Major	1x25=25
Minor	1x15=15
Spotters	5x03=15
Viva-Voce	05
Total	**60**

Key for evaluation of Practical Examination

1. **Major(25Marks)**

Procedure	: 15 Marks
Performance	: 05 Marks
Result	: 05 Marks

2. **Minor (15Marks)**

Procedure	: 10 Marks
Performance	: 03 Marks
Result	: 02 Marks

3. **Spotters** :5x3=15 Marks

4. **Viva– Voce** **:**05 Marks

AEC: CCS (100% Internal Evaluation)

CCS Internal Marks Distribution (CA-Total Marks: 100)

Attendance:	**10 Marks**
Assignment / Listening / Speaking:	**50 Marks (5 Assignments Compulsory)**
Class test:	**40 Marks (2 Test Compulsory)**
Total:	100 Marks

The candidate shall be declared to have passed the examination if he / she secure at least 40 marks for UG Programme and at least 50 marks for PG Programme, out of a total of 100 marks.

24UBTNM301	**MDC I: MEDICINAL HERBS**	**SEMESTER-III**

Course Objectives:

The Course aims

- To apply the basic knowledge of common medicinal plants.

Credits:2 **Total Hours:30**

UNIT	CONTENTS	Hrs	CO
I	Introduction to Medicinal Plants; Traditional medicinal Systems - AYUSH. Application of medicinal plants,	**06**	**CO1**
II	Herbs- *Aloe vera*, Green chirayta,, Tridax, Daisy, *Vinca*, Mint, Cumin & Ajwain.	**06**	**CO2**
III	**Climbing plants:** Betel, Ivy gourd, Butter fly pea, Veldt grape, Climbing Brinjal, Indra valli, Pepper & Madras pea, pumpkin.	**06**	**CO3**
IV	**Shrubs and Tree:** Indian mallow, Shikakai, Desert cotton, Turkey berry & Copper leaf, Moringa plant and Amla.	**06**	**CO4**
V	Cash crops-Sugarcane, Tobacco, Rice, wheat and corn. Asafetida and sweet potato	**06**	**CO5**

Reference Book

1	*Arya Vaidya Sala.,* 1994. **Indian Medicinal Plants**. Vol II. Universities Press.
2	*S.K. Bhattacharjee, 2020, Hand book of Medicinal plants: 4th revised and enlarged edition, Pointer publishers.*

COURSE OUTCOMES (CO)

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

CO1	Describe about Medicinal Plants.
CO2	Gain knowledge about various important medicinal herbs.
CO3	Describe about Climbing plants.
CO4	Explicate the importance of Shrubs.
CO5	Explain about cash crops.

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**

24UBTNM401	**MDC II: FUNDAMENTALS OF BIOTECHNOLOGY**	**SEMESTER-IV**

Course Objectives:

The Course aims

- To understand the basics about Biotechnology and its day to day application in daily life.

Credits:2 **Total Hours: 30**

UNIT	Contents	Hrs	CO
I	Introduction to Biotechnology –Origin and Evolution of Biotechnology, Old biotechnology and New biotechnology.	**06**	**CO1**
II	Food Biotechnology - Introduction, products, curd, idly, pickles, Cheese, wine.	**06**	**CO2**
III	Pharmaceutical Biotechnology – Introduction to antibiotics, uses and abuses of antibiotics. Vaccines– introduction, vaccine against common disease, vaccination schedule, edible Vaccine, Transgenic animals–fish and chicken.	**06**	**CO3**
IV	Agricultural Biotechnology–Genetically modified crops, pros and cons –Bt cotton and Bt brinjal, Golden rice, *Aloe vera* gel, SCP Spirulina, Spirulina pickle, mushroom cultivation, Azolla, Composting and Biofertilizer.	**06**	**CO4**
V	Proposal to bank for loan, MSME, Quality control - FSSAI, AGMARK, and ISO.	**06**	**CO5**

Reference book

1 *DaanJ.A.Crommelin, Robert D. Sindelar,* and *Bernd Meibohm,* 2008. **Pharmaceutical Biotechnology–Fundamentals and applications.** Informa Health care USA,Inc.

2 *Glick R. Bernard* and *Pasternak J Jack.*2007.**Molecular Biotechnology**.[Third Edition].ASM press, Washington D.C.

COURSE OUTCOMES (CO)

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

CO1	Gain knowledge about the basics of Biotechnology.
CO2	Explain about various food products.
CO3	Describe about the types of vaccines.
CO4	Illustrate about GMO and its products.
CO5	Explain about quality control.

Prepared By **Approved By**

(Course Coordinator) **(BoS Chairman)**