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 petent biotechnologist for industrial sectors.

PEO 2: To develop professional skills through life long 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

PO1: Become knowledge able in the subject of Biotechnology and apply the principles of the same to theneedsof thesociety.

PO2: Gain analytical skills in the field of Biotechnology.

PO3: Determine and appreciate professional ethics, community living and Nation building initiatives.

PO4: Justify societal, health, legal, environmental and biosafety related issues and understand his/her responsibilities.

PO5: Analyze, evaluate and inventnew processes and productsin 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: Apply the knowledge of Biotechnology in the domains of Environment, Agriculture, Health care, Bioindustry, Molecular mechanics and interdisciplinary domains.

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 a dmission to the first year Degree course shall be required to have passed PUC/12th Std./10+2/its equivalent with atleast Biology and Chemistryas two optional subjects.

DURATIONOF THE COURSE:

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

OBJECTIVES OFTHE COURSE:

The three-year B.Sc., program is intended to help the students to be the innovative and versatile personalities in the field of Life Science with qualitye ducation 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 better ment of human welfare.

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

After completion of the course, the students can able to acquire the necessary the oretical and practical competencies in Biotechnology whichen able them to under take higher studies in recognized Institutions of higher learning and engage gainful self-employment.

SCHEME OF EXAMINATION

Subjectcode	Subject	Hours of Instruction	Exam duration (Hours)	Maximum Marks			Credit Points
				CA	CE	Total	
First semester							
Part I							
21UTALA101/ 21UHILA101/ 21UFRLA101	Tamil I/ Hindi I/ French I	5	3	25	75	100	3
Part II							
21UENLA101	Communicative English I	5	3	25	75	100	3
Part III							
21UBTM101	DSC I: Concepts of Cell Biology	5	3	25	75	100	4
21UBTMP101	DSC Practical –I	3	3	40	60	100	2
21UCSBTA101	GEC I: Computer Fundamentals and office automation	3	3	25	75	100	2
21UCSBTAP101	GEC Practical I: Office automation techniques	3	3	40	60	100	2
Part IV							
	AECC – I: Professional English For Life Science-I	4	3	25	75	100	4
21UVE101	AECC – II: Yoga	2	3	25	75	100	2
Total		**30**				**800**	**22**
Second semester							
Part I							
21UTALA201/ 21UHILA201/ 21UFRLA201	Tamil II/ Hindi II/ French II	5	3	25	75	100	3
Part II							
21UENLA201	Communicative English II	5	3	25	75	100	3
Part III							
21UBTM201	DSC II: Principles of Genetics	5	3	25	75	100	4
21UBTMP201	DSC Practical –II	3	6	40	60	100	2
21UCHBTA201	GEC II: Chemistry	3	3	25	75	100	2

21UCHBTAP201	GEC Practical II: Chemistry	3	3	40	60	100	2
Part IV							
	AECC –I: Professional English For Life Science-II	4	3	25	75	100	4
21UVE201	AECC – II: Environmental Studies	2	3	25	75	100	2
Total		**30**				**800**	**22**
Third Semester							
Part I							
21UTALA301/ 21UHILA301/ 21UFRLA301	TamilIII/ Hindi III/ French III	4	3	25	75	100	3
Part II							
21UENLA301	Foundation English I	4	3	25	75	100	3
Part III							
21UBTM301	DSC III: Microbiology	5	3	25	75	100	4
21UBTMP301	DSC Practical –III	4	6	40	60	100	2
21UBCBTA301	GEC III: Biochemistry (Biomolecules)	3	3	25	75	100	2
21UBCBTAP301	GEC Practical III: Biochemistry (Biomolecules)	3	3	40	60	100	2
Part IV							
	SEC – I	2	3	25	75	100	2
21UBTSB301	SEC – II : Calculations for Biologist (100% Internal Evaluation)	2	3	100	-	100	2
Non Credit							
21ULS301	NCC – I : Career Competency Skills	1	-	-	-	-	-
Total		**28**				**800**	**20**
Fourth Semester							
Part I							
21UTALA401/ 21UHILA401/ 21UFRLA401	Tamil IV/ Hindi IV/ French IV	4	3	25	75	100	3
Part II							
21UENLA401	Foundation English II	4	3	25	75	100	3

Part III							
21UBTM401	DSC IV: Biophysics and Bio Instrumentation	5	3	25	75	100	4
21UBTMP401	DSC Practical– IV	4	6	40	60	100	2
21UMABTA401	GEC IV: Biostatistics	4	3	25	75	100	2
21UMABTAP401	GEC Practical IV: Statistics (Using MS- Excel)	2	3	40	60	100	2
Part IV							
	SEC – I :	2	3	25	75	100	2
21UBTSB401	SEC – II: Biosafety and Bioethics (100% Internal Evaluation)	2	3	100	-	100	2
Non Credit							
21ULS401	NCC – II Career Competency Skills	1	-	-	-	-	-
	Total	**30**				**800**	**20**
Fifth Semester							
Part III							
21UBTM501	DSC V: Molecular Biology	5	3	25	75	100	5
21UBTM502	DSC VI: Immunology	5	3	25	75	100	5
21UBTM503	DSC VII: Industrial Biotechnology	5	3	25	75	100	5
21UBTM504	DSC VIII: Plant Tissue Culture	5	3	25	75	100	5
	DSE I	4	3	25	75	100	4
21UBTMP501	DSC Practical–V:	3	6	40	60	100	2
Part IV							
21UBTSB501	SEC – II : IPR for Life science (100% Internal Evaluation)	2	3	100	-	100	2
Part V							
21UBTE501	Extension Activity	-	-	-	-	-	2
Non –Credit							
21UBTI501	Internship (100% Internal Evaluation)	-	-	-	-	-	-
21ULS501	NCC– III: Career Competency Skills	1	-	-	-	-	-
	Total	**30**				**700**	**30**

Sixth Semester							
Part III							
21UBTM601	DSC IX: Recombinant DNA Technology	5	3	25	75	100	5
21UBTM602	DSC X: Environmental Biotechnology	5	3	25	75	100	5
21UBTM603	DSC XI: Basics of Animal Cell Culture	5	3	25	75	100	5
	DSE II	4	3	25	75	100	4
21UBTMP601	DSC Practical-VI	3	6	40	60	100	2
21UBTPR601	DSC Project & Viva Voce (Group)	5	-	100	-	100	4
Part IV							
21UBTSB601	SEC-II: :Basics of Research	2	3	25	75	100	2
21ULS601	NCC- IV: Career Competency Skills	1	-	-	-	-	-
Total		**30**				**700**	**27**
Grand Total						**4600**	**141**

DSC - Discipline Specific Course

GEC - Generic Elective Course

DSE - Discipline Specific Elective

AECC – Ability Enhancement Compulsory Course

NCC - Non- Credit Course

ACC - Additional Credit Coruse

SEC COURSE

The Department offers the following two subjects during III and I semesters as Non Major Elective Courses for the students of other departments.

S.No	SubjectCode	Semester	Subject
1.	21UBTNM301	III	Medicinal herbs
2.	21UBTNM401	IV	Fundamentals of Biotechnology

DCE COURSES

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

S.No	Semester	Subject code	Subject
1.	V	21UBTEL501	Nano biotechnology
		21UBTEL502	Bioinformatics
2.	VI	21UBTEL601	Medical Biotechnology
		21UBTEL602	Food Biotechnology

For Course Completion

Language Subjects (Tamil/ Hindi/French, English) in I, II, III and IV semester

Ability Enhancement compulsory course: Yoga and Environmnetal studies in I and II smester respectively

GEC in I, II, III and IV semesters

SEC I in III and IV semesters

SEC II in III, IV, V and VI semsters

Extenstion Activity and Intersnhip in the V semester

DSE courses in the V and VI semesters

Project in the VI semester

NCC in semester III, IV, V and VI.

S.NO	COMPONENT	TOTAL NUMBER OF SUBJECTS	TOTAL MARKS	CREDITS
1.	PART I: Language	4	400	12
2.	PART II: Communicative English	4	400	12
3.	PART III : DSC	17(11t+6p)	1700	63
4.	PART III: DSE	2	200	8
5.	PART III: Project	1	100	4
6	Internship	1	-	-
7	PART III : GEC	8(4t+4p)	800	16
8	PART IV: Professional	2	200	8
9	PART-IV: Value Education	2	200	4
10	PART-IV: SEC	4	400	8
11	PART-IV: NMEC	2	200	4
12	PART-V: Extension Activity	-	-	2
	TOTAL	47	4600	141

FIELD TRAINING:

The students should visit the field of their interest and they have to submit their port which will be evaluated by the subject experts in the department.

Selection Procedure:

Admissions are based on the marks secured in the regular course. The candidate having secured higher marks in the qualifying examination. The intake to the **Career Oriented Courses** shall be 40. It will be introduced during the 3rd Semester.One Add-on Course must consist of two subjects. Both subjects are subject to External Evaluation. The results of the course will not be considered for CGPA.

Duration of the courseis 50 hours for eachsubject. Separate fees will be applicable**.** A separate Library Card shall be issued in such cases. Saturdays and Sundays may be utilized at the discretion of the concerned Department. To qualify for the Career Oriented Course, the candidate must secure a passing minimum of 40 marks in ever y subject.

Advanced Learners Course (ALC)

ALC to be introduced in the 4th and 5th Semesters

S.No	Semester	Course	Sub Code	Subject
1	V	ALC	21UBTAL501	Genes and Humans
			21UBTAL502	Omics –Science

Minimum Eligibility Conditions and Qualifying Requirements:

The Candidate should have completed the regular course in first attempt of his/her first three semesters. The Candidate having good academic track record (i.e. 75.00% and above). Re-admitted students are not eligible. The candidate should not have been punished for any disciplinary activity.

Rules and Regulations:

ALC will be conducted during the 4th & 5th Semesters. ALC will be a self-study course. ALC will be the credited course. If the candidate has not passed in the 4th semester, he/she will not beeligible for appearing ALC in the 5th semester. Non-appearance of the candidate for ALC Exam shall disqualify him/her for next ALC.

21UTALA101	இடைக்கால இலக்கியம்	பருவம் – I

நோக்கம்

1. பக்தி இலக்கியத்தின் சிறப்புகளை எடுத்துரைத்தல்
2. சிற்றிலக்கியம் மற்றும் நாட்டுப்புற இலக்கியங்களின் வழி வாழ்க்கை கூறுகளை உணர்த்துதல்
3. இலக்கியம், இலக்கணத்தின் சிறப்புகளை உணர்த்துதல்.

Total Hours : 50

அலகு	பொருளடக்கம்	நேரம்	CO
1	**சைவம்** கண்ணப்பநாயனார் புராணம் – இளையான்குடி நாயனார் புராணம். **வைணவம்** மதுரகவி ஆழ்வார் – கண்ணி நூல் சிறு தாம்பு	10	CO1
2	**சிற்றிலக்கிங்கள்** 1. திருக்குற்றாலக் குறவஞ்சி – குறத்திவருகை 2. முக்கூடற்பள்ளு – பள்ளியர்செயல் 3. நந்திக்கலம்பகம் – முதல் 3 பாடல்கள்	10	CO2
3.	**நாட்டுப்புற இலக்கியம்** 1. தாலாட்டுப் பாடல் 2. தொழில் பாடல் 3. ஒப்பாரிப் பாடல் 4. காதல் பாடல்	10	CO3
4	**இலக்கிய வரலாறு** பக்தி இலக்கியம் தோற்றம் வளர்ச்சி – நாயன்மார்கள் மற்றும் ஆழ்வார்கள் – சிற்றிலக்கியத்தின் தோற்றம் மற்றும் வளர்ச்சி – நாட்டுப் புறப்பாடல்அறிமுகம்	10	CO4
5	**இலக்கணம்** 1. வல்லினம்மிகும் இடங்கள் 2. வல்லினம்மிகாத இடங்கள் 3. சார்பு எழுத்துக்கள்	10	CO5

Text book

1	தமிழ்த் துறைவெளியீடு, கே.எஸ்.ரங்கசாமி கலை மற்றும் அறிவியல் கல்லூரி (தன்னாட்சி) திருச்செங்கோடு

COURSE OUTCOMES (CO)

இப்பாடத்தைக் கற்ப தன் வாயிலாக மாணவர்கள் பெறும் பயன்களாவன

CO1	பக்தி இலக்கியத்தின் வழி இறைப்பண்பை அறிதல்
CO2	சிற்றிலக்கியத்தின் சிறப்புகளை அறிதல்
CO3	நாட்டுப்புற இலக்கியத்தின்வழி பழங்கால வாழ்க்கை முறையை அறிதல்
CO4	இலக்கிய வரலாற்றின் தோற்றம்வளர்ச்சியினை அறிதல்
CO5	அடிப்படைத்தமிழ் இலக்கணத்தை அறிதல்

21UENLA101	COMMUNICATIVE ENGLISH I	SEMESTER – I

Course Objectives:

- To enable the students to develop their comprehensive skill.
- To introduce the students to know about Communication skills.
- To introduce the students to know about Grammar.

Total Hours: 50

UNIT	CONTENTS	Hrs	CO
I	1. Listening and Speaking a. Introducing self and others b. Listening for specific information c. Pronunciation 2. Reading and Writing a. Reading short articles – newspaper reports / fact based articles b. Diction and tone c. Reading aloud: Reading an article/report d. Journal (Diary)Writing 3. Study Skills -1 Using Encyclopedias, Thesaurus 4. Grammar in Context: **Naming and Describing** ● Nouns & Pronouns ● Adjectives	**10**	**CO1**
II	**1. Listening and Speaking** a. Listening with a Purpose b. Effective Listening c. Tonal Variation d. Listening for Information **2. Reading and Writing** a. Strategies of Reading:Skimming and Scanning b. Types of Reading :Extensive and Intensive eading c. Reading a prose passage d. Reading a poem e. Reading a short story **3. Study Skills II:** Using the Internet as a Resource a. Refine your search b. Guidelines for using the Resources	**10**	**CO2**

	c. e-learning resources of Government of India **4. Grammar in Context** Involving Action-I a. Verbs b. Concord		
III	1. Listening and Speaking a. Giving and following instructions b. Asking for and giving directions c. Continuing discussions with connecting ideas 2. Reading and writing a. Reading feature articles(from newspapers and magazines) b. Reading to identify point of view and perspective (opinion pieces, editorials etc.) c. Descriptive writing – writing a short descriptive essay of two to three paragraphs. 3. Grammar in Context: **Involving Action – II** Verbals - Gerund, Participle, Infinitive Modals	**10**	**CO3**
IV	1. Listening and Speaking a. Giving and responding to opinions 2. Reading and writing a. Note taking b. Narrative writing – writing narrative essays of two to three paragraphs 3. Grammar in Context: **Tenses** Present Past Future	**10**	**CO 4**
V	1. Listening and Speaking a. Participating in a Group Discussion 2. Reading and writing a. Reading diagrammatic information – interpretation maps, graphs and pie charts b. Writing short essays using the language of comparison and contrast **Grammar in Context:** Voice (showing the relationship between Tenses and Voices)	**10**	**CO5**

Text Book	
1.	Tamil Nadu State Council for Higher Education (TANSCHE)

COURSE OUTCOMES (CO)

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

CO1	Know the different skills in English
CO2	Develop theirs Communication skill
CO3	Enrich grammar knowledge
CO4	Stimulate their writing skills
CO5	Deserve appreciation for their communication

21UBTM101	**DSC I: CONCEPTS OF CELL BIOLOGY**	**SEMESTER - I**

Course Objectives:

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

Credits: 5 **Total Hours: 50**

UNIT	**CONTENTS**	**Hrs**	**CO**
I	Discovery of Cell, 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 of 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 Chromosomes– Polytene and Lamp-brush 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, Cellular basis of development: Gametogenesis, Fertilization, Events during Fertilization, Early Embryonic Development. Cell death- types- Necrosis and apoptosis (Regulatory aspects not needed), Stem cells – definition and types.	**12**	**CO5**

Text Book

1	*Gupta, P.K, and Jangir M.L*., 2003. **Cell Biology: Fundamentals and Application.** Student Edition, India.

Reference Books

1	*Geoffrey M. Cooper and Hausman R.E*. 2007. **The Cell - A Molecular Approach.** [Fourth Edition]. ASM Press, Washington, D.C.
2	*Sadava, D.E*. 2004. **Cell Biology: Organelle Structure and Function.** Reprint, [First Edition]. Panima Publishing Corp., India.
3	*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, andPeter 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

PSO / CO	**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

21UBTMP101	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 Guide lines 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	**04**	

Reference Book

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

COURSE OUTCOMES (CO)

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

CO1	Explain about Laboratory safety and Microscope maintenance.
CO2	Operate Micrometer and Haemocytometer.
CO3	Demonstrate about TS of Stem, Root and Leaf and stages of cell division.
CO4	Show buccal epithelial cells and Cyanobacteria under microscope.
CO5	Depict the types of staining and salivary gland chromosome.

21UCSBTA101	GEC I: COMPUTER FUNDAMENTALS AND OFFICE AUTOMATION	SEMESTER - I

Course Objectives:

The Course aims

- 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.

Credits: 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 - Software Definition, Role and Categories. **The Processor:** The Central Processing Unit. **Computer Memory and Storage:** What is Computer's Memory? Primary Memory (Main Memory) – Read Only Memory Auxiliary Memory.	10	CO1
II	**The Input-Output Media:** Inputs and Outputs: CRT Monitors- Flat Panel Monitors-Keyboards-Graphics and Graphical Terminals - Printers. **Introduction to the Internet:** A Brief History of the Internet- TCP/IP-IP Address and Domain Name System (DNS)- Client-Server Architecture-Electronic Mail (Email)-File Transfer Protocol (FTP)-World Wide Web (WWW).	10	CO2
III	**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	10	CO3

	Option- Printing your Document-Editing the Document-Editing Tools- Auto Correct-AutoFormat- Find and Replace-Find-Replace Text-Page Numbering- Header and Footer-Foot Notes and End Notes-Splitting Panes- Tiling of the Document- Using Mail Merge in Word 2007-Opening Screen of Microsoft Word Screen.		
IV	**Introduction to Microsoft Office Excel 2007:** Understanding Spread sheets-Creating a Worksheet in Excel 2007-Copying Formula-Formulas that Make Decisions-Styles- Functions in Excel-Using Autocalculate-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**	**CO4**
V	**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, Handouts and Masters for Presentation-Packing Presentation to Go-Add a Caption to a	**10**	**CO5**

	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.		

Text Books

1	*Atul Kahate.* 2008**. Information Technology. [**Third Edition]. Tata McGraw-Hill Edition Ltd, New Delhi. (UNIT I, II).
2	*LawPoint.* 2008. **Microsoft Office 2007**. [First Edition]. Ashok Lodha Publication, Kolkata. (UNIT III, IV and V).

Reference Books

1	*Alexis Leon and Mathews Leon***. 1999. Introduction to Computers.** [First Edition]**.** Leon Tech world, New Delhi.
2	*Dennis, P. Curtin, Kim Foley, Kunal Sen and Cathleen Morin*. 2001**. Information Technology: The Breaking Wave.** [Ninth Reprint].Tata McGraw-Hill Edition, New Delhi.
3	*Sanjay Saxena.* 2007. **MS-Office 2000 for Everyone**. [Second Reprint]. Vikas Publishing House Pvt. Ltd., New Delhi.

Web References

1	https://en.wikipedia.org/wiki/Microsoft_Word
2	https://products.office.com/en-in/word
3	https://www.greycampus.com/opencampus/ms-excel/what-is-ms-excel

COURSE OUTCOMES (CO)

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

CO1	Explore the fundamental components of computer such as Input and output.
CO2	Create well defined documents with various tools in MS Word.
CO3	Interpret the various formulas, functions and chart preparations in MS Excel.
CO4	Enable a full featured Database Management System that organizes stagering information about Personal and Business Life.
CO5	Create slides, overhead transparencies, Handouts and Speaker Notes.

Mapping

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

H-High; M-Medium; L-Low

21UCSBTAP101	**GEC PRACTICAL I:** **OFFICE AUTOMATION TECHNIQUES**	**SEMESTER-I**

Course Objectives:

The Course aims

- Basic concepts of MS Word and its applications.
- Importance of MS Excel in real time applications.
- Role of PowerPoint for the current needs.

Credits:2 **Total Hours:36**

S.No	**EXPERIMENT**	**Hrs**	**CO**
INTERNET			
1.	Creating E-mail ID and Working with Basic Options.	**03**	**CO1**
MS – Word			
2.	Creating a Personal Profile.	**03**	**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.	**03**	**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.	**03**	**CO3**

5.	Mail Merge–Invitation to Multiple Recipients for Conducting Seminar in the Department.	**03**	**CO4**
MS-Excel			
6.	Entering Data for Stock Analysis and Formatting the Cells.	**03**	**CO5**
7.	Working with Sorting and Filtering.	**03**	
8.	Creating a Chart for an Experiment with sample data.	**03**	
9.	Stock Maintenance for Lab Equipments.	**03**	
MS-PowerPoint			
10.	Creating a Presentation for the given topic.	**03**	**CO1**
11.	Creating a Presentation for the Department Profile.	**03**	**CO1**
12.	Creating a Presentation with Animation.	**03**	**CO1**

COURSE OUTCOMES (CO)

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

CO1	Create a resume using wizard in MS Word.
CO2	Create a document with font face, formats, styles, header, footer and page numbers.
CO3	Create a newspaper format with images in multiple columns.
CO4	Create a mail merge document with various options.
CO5	Create a worksheet to process student mark list.

-

Mapping

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

H-High; M-Medium; L-Low

21UPEC101	AECC-I: PROFESSIONAL ENGLISH	SEMESTER – I

Course Objectives:

- To develop the language skills of students by offering adequate practice inprofessionalcontexts.
- To develop strategic competence that will help inefficient communication
- To sharpen students'critical thinking skills and make students culturally aware of the target situation.

Total Hours: 50

UNIT	CONTENTS	Hrs	CO
I	**COMMUNICATION** **Listening**: Listening to audio text and answering questions – Listening to Instructions **Speaking**: Pair work and small group work. **Reading:** Comprehension passages–Differentiate between facts And opinion **Writing:** Developing a story with pictures**.** **Vocabulary:** Register specific –Incorporated in to the LSRW tasks	**10**	**CO1**
II	**DESCRIPTION** **Listening:** Listening to process description.- Drawing a flowchart. **Speaking:** Role play (formal context) **Reading:** Skimming / Scanning- Reading passageson products, Equipment and gadgets. **Writing:** Process Description–Compareand Contrast Paragraph- Sentence Definition and Extended definition- Free Writing. **Vocabulary:** Register specific –Incorporated in to the LSRW tasks.	**10**	**CO2**
III	**NEGOTIATION STRATEGIES** **Listening:** Listening to interviews of specialists / Inventors in Fields (Subject specific) **Speaking:** Brain storming. (Mindmapping). Small group Discussions (Subject-Specific) **Reading:** Longer Readingtext. **Writing**: EssayWriting (250words) **Vocabulary:** Register specific-Incorporated in to the LSRW tasks	**10**	**CO3**

IV	**PRESENTATION SKILLS** **Listening**: Listening to lectures. **Speaking:** Shorttalks. **Reading:** Reading Comprehension passages **Writing:** Writing Recommendations Interpreting Visuals inputs **Vocabulary:** Register specific-Incorporated into the LSRW tasks	**10**	**CO 4**
V	**CRITICALTHINKING SKILLS** **Listening:** Listening comprehension-Listening for information. **Speaking**: Making presentations (with PPT-practice). **Reading:** Comprehension passages–Notemaking. Comprehension: Motivational article on Professional Competence, Professional Ethicsand Life Skills) **Writing:** Problemand Solution essay–Creative writing–Summary writing **Vocabulary:** Register specific –Incorporated into the LSRW tasks	**10**	**CO5**
Text Book			
1.	Tamil Nadu State Council for Higher Education (TANSCHE)		

COURSE OUTCOMES (CO)

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

CO1	Recognize their own ability to improve their own competence in using the language
CO2	Use language for speaking with confidence in an intelligible and acceptablemanner
CO3	Understand the importance of reading for life
CO4	Read independently unfamiliar texts with comprehension
CO5	Write simple sentences without committing error of spellingor grammar.

21UVE101	AECC – II: YOGA	SEMESTER - I

Course Objectives:

The course aims

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

Credits: 2 **Total Hours: 30**

UNIT	CONTENTS	Hrs
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, Acu pressure, Relaxation exercises - Yogasanas – Surya namaskar - Padmasana - Vajrasana - Ardha katti Chakrasana - Viruchasana - Yogamudra - Patchimothasana - Ustrasana - Vakkarasana – Salabasana	6
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 - Meditation and its Benefits	6
III	**Personality Development – Sublimation:** Purpose and Philosophy of Life - Introspection - Analysis of Thought - Moralization of Desire - Analysis and practice - Neutralization of Anger - Strengthening of will-power	6
IV	**Human Resources Development:** Eradication of Worries - Analysis and Eradication practice - Benefits of Blessings – Effect of good vibrations - Greatness of Friendship - Guidance for good Friendship – Individual Peace and world peace - Good cultural behavioral patterns	6
V	**Law of Nature:** Unified force - Cause and effect system - Purity of thought deed and Genetic Centre – Love and Compassion - Gratitude - Cultural Education - Fivefold culture.	6

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	*Vethathiri Maharishi*, 2014, 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

21UTALA201	**காப்பியம், உரைநடை, நாடக இலக்கியம்**	**பருவம் – II**	
நோக்கம் 1. ஐம்பெருங்காப்பியங்களின் மூலம் பழங்காப்பிய நிகழ்வுகள் மற்றும் அமைப்பு முறையை எடுத்துரைத்தல் 2. உரைநடை, நாடக இலக்கியத்தின் வழி வாழ்வியல் முறையை உணர்த்துதல் 3. பழந்தமிழ் இலக்கியத்தின் சிறப்பை உணரச்செய்தல்			
			Total Hours: 50
அலகு	**பொருளடக்கம்**	**நேரம்**	**CO**
1	1. மணிமேகலை – சிறைக்கோட்டம் அறச்சாலையாக மாற்றம் 2. சீவக சிந்தாமணி – விமலைமார் இலம்பகம்	10	CO1
2	1. பாரதிதாசன் – புரட்சிக்கவி	10	CO2
3.	**உரைநடை** 1. குன்றக்குடி பொன்னம்பல அடிகளார் தமிழ்ப்பற்று 2. குக்கூ கவிதை உணர்த்தும் உலகநீதி	10	CO3
4	**இலக்கிய வரலாறு** காப்பியம் விளக்கம் – ஐம்பெருங்காப்பியம் – ஐஞ்சிறுங்காப்பியம்- பிற காப்பியங்கள் – உரைநடை தோற்றம் வளர்ச்சி – நாடகத்தின் தோற்றம் மற்றும் வளர்ச்சி	10	CO4
5	**இலக்கணம்** யாப்பு மற்றும் அணி இலக்கணம்(நான்கு பா வகைகள்), தன்மை, உவமை, உருவகம், வாழ்த்து மற்றும் பாவிக அணிகள்.	10	CO5
Text book			
1	தமிழ்த்துறை வெளியீடு, கே.எஸ்.ரங்கசாமி கலை மற்றும் அறிவியல் கல்லூரி (தன்னாட்சி) திருச்செங்கோடு		

COURSE OUTCOMES (CO)

இப்பாடத்தைக் கற்பதன் வாயிலாக மாணவர்கள் பெறும் பயன்களாவன

CO1	தமிழ் காப்பியங்களின் வரலாற்றை அறிதல்
CO2	நாடக இலக்கியத்தின் சிறப்புகளை அறிதல்

CO3	உடைநடையின் பயன்களை அறிதல்
CO4	இலக்கிய வரலாற்றினை அறிதல்
CO5	தமிழ் இலக்கணத்தின் வகைகளை அறிதல்

21UENLA201	COMMUNICATIVE ENGLISH II	SEMESTER – II

Course Objectives:

To enable the students to develop their comprehensive skill.
To introduce the students to know about Communication skills.
To introduce the students to know about Grammar.

Total Hours: 50

UNIT	CONTENTS	Hrs	CO
I	**1. Listening and Speaking** a. Listening and responding to complaints (formal situation) b. Listening to problems and offering solutions (informal) **2. Reading and writing** a. Reading aloud (brief motivational anecdotes) b. Writing a paragraph on a proverbial Expression/motivational idea. **3. Word Power/Vocabulary** a. Synonyms & Antonyms **4. Grammar in Context** a. Adverbs b. Prepositions	**10**	**CO1**
II	**1. Listening and Speaking** a. Listening to famous speeches and poems b. Making short speeches- Formal: welcome speech and Vote of thanks. c. Informal occasions- Farewell party, graduation speech **2. Reading and Writing** a. Writing opinion pieces (could be on travel, food, film / book reviews or on any contemporary topic) b. Reading poetry i. Reading aloud: (Intonation and Voice Modulation) ii. Identifying and using figures of speech - simile, Metaphor, personification etc. **3. Word Power** a. Idioms & Phrases **4. Grammar in Context** Conjunctions and Interjections	**10**	**CO2**
III	**1. Listening and Speaking** a. Listening to Ted talks b. Making short presentations – Formal presentation with PPT, analytical presentation of graphs and reports of	**10**	**CO3**

	multiple kinds c. Interactions during and after the presentations **2. Reading and writing** a. Writing emails of complaint b. Reading aloud famous speeches **3. Word Power** a. One Word Substitution **4. Grammar in Context:** Sentence Patterns		
IV	**1. Listening and Speaking** a. Participating in a meeting: face to face and online b. Listening with courtesy and adding ideas and giving opinions during the meeting and making concluding Remarks. **2. Reading and Writing** a. Reading visual texts – advertisements b. Preparing first drafts of short assignments **3. Word Power** a. Denotation and Connotation **4. Grammar in Context:** Sentence Types	**10**	**CO 4**
V	**1. Listening and Speaking** a. Informal interview for feature writing b. Listening and responding to questions at a formal interview **2. Reading and Writing** a. Writing letters of application b. Readers' Theatre (Script Reading) c. Dramatizing everyday situations/social issues through Skits. (writing scripts and performing) **3. Word Power** a. Collocation **4. Grammar in Context:** Working With Clauses	**10**	**CO5**

Text Book	
1.	Tamil Nadu State Council for Higher Education (TANSCHE)

COURSE OUTCOMES (CO)

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

CO1	Know the different skills in English
CO2	Develop theirs Communication skill
CO3	Enrich grammar knowledge
CO4	Stimulate their writing skills
CO5	Deserve appreciation for their communication

21UBTM201	DSC II: PRINCIPLES OF GENETICS	SEMESTER– II

Course Objectives:

The Course aims

- To study the basic principles of genetics, mutations and gene related diseases.

Credits:5 **Total Hours:50**

UNIT	CONTENTS	Hrs	CO
I	Basic concepts of genetics: Introduction, Scope and importance of genetics Branches-transmission genetics, molecular genetics and population genetics. Milestones of genetics: – from Mendelian genetics to genetic engineering.	**10**	**CO1**
II	Mendelian genetics: Mendel's experiment, principle of segregation, monohybrid crosses- dominance, recessiveness and co-dominance, Principles of independent assortment, Incomplete dominance, Epistasis.	**10**	**CO2**
III	Molecular genetics: DNA as genetic material, Transformation, Transduction and Conjugation. RNA as genetic material, Structure of DNA – Watson and Crick double helical model, forms of DNA	**10**	**CO3**
IV	Linkage and crossing over, Chromosomal aberration in humans: - Euploidy and aneuploidy, Turner's syndrome, Klinefelter syndrome. Mendelian inheritance in humans – Recessive traits (Albinism), dominant traits (Achondroplasia).	**10**	**CO4**
V	Population genetics: Introduction to genetic variation, Hardy Weinberg law, inbreeding, outbreeding and assertive mating, changes in allele frequency- Mutation, migration, selection, genetic drift and speciation.	**10**	**CO5**

COURSE OUTCOMES (CO) After completion of the course, the students will be able to	
CO1	Explain the history, growth & scope of genetics.
CO2	Describe the Mendel's principles & experimental evidences.
CO3	Differentiate DNA and RNA.
CO4	Explain the evolutionary changes of organisms and their effects in population genetics.
CO5	Explain the common genetic disorders of human beings.

Text Book	
1	*Russel, P.J.* 1998. **Genetics.** [Fifth Edition]. The Benjamin /Cummings Publishing company, Inc.
Reference Books	
1	*Gardner E.J, Simmons, M.J and Snustad. D.P*. 2005. **Principles of Genetics.** [Eighth Edition]. John Wiley and Sons, INC, New York.
2	*Weaver R.F* and *Hedrick P.W*, 1995. **Basic genetics.** [Second Edition]. Wm.C.Brown Publishers.

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

21UBTMP201	DSC PRACTICAL-II	SEMESTER– II

Course Objectives:

The Course aims

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

Credits:2 **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	**05**	**CO3**
6.	Mutagenesis by radiation exposure	**05**	
7.	Bacterial Conjugation – Transfer of Antibiotic-resistant plasmid	**05**	
8.	Monohybrid and Dihybrid ratio	**05**	**CO4**
9.	Culturing of different kinds of *Drosophila*	**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.

COURSE OUTCOMES (CO)

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

CO1	Isolate and estimate DNA.
CO2	Isolate the mutants by different methods.
CO3	Perform mutagenesis and bacterial conjugation.
CO4	Compute the Monohybrid and Dihybrid ratio.
CO5	Perform Karyotyping.

21UCHBTA201	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-Antibonding-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 – measurementof 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 Tuli G. 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]. ShobanLalNagin Chand and Co., New delhi.

Reference Books

1 *Lee J.D.* 2008 **A New Concise Inorganic Chemistry.** [Fifth edition]. Chapmann and Hall, London.

2 *Morrison R.T. and Boyd.R.N.* 2010. **Organic Chemistry.** [Seventh edition]. Prentice-Hall of India (P) Ltd, New Delhi.

3 *Mukherjee. S. M. Singh .S. P. and Kapoor .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 in organic 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

PSO / CO	**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

21UCHBTAP201	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.	Monocarboxylic 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,New Delhi.

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.

21UPE201	AECC-I: PROFESSIONAL ENGLISH II	SEMESTER – II

Course Objectives:

- Develop their competence in the use of English with particular reference tothe workplace situation.
- Enhance the creativity of the students, which will enable them to think ofinnovative ways to solve issues in the workplace.
- Develop their competence and competitiveness and thereby improve theiremployability skills.

Total Hours: 50

UNIT	CONTENTS	Hrs	CO
I	**Unit 1- Communicative Competence** **Listening:** Listening to two talks/lectures by specialists on selected subject specific topics -(TED Talks) and answering comprehension exercises (inferential questions) **Speaking:** Small group discussions (the discussions could be based on the listeningand reading passages- open ended questions **Reading:** Two subject-based reading texts followed by comprehension activities/exercises **Writing:** Summary writing based on the reading passages. **NOTE: Grammar and vocabulary exercises/tasks to be designed based on the discourse patterns of the listening and reading texts in the book. This isapplicable for all the units.**	**10**	**CO1**
II	**Persuasive Communication** **Listening:** listening to a product launch- sensitizing learners to the nuances of persuasive Communication **Speaking:** debates – Just-A Minute Activities **Reading:** reading texts on advertisements (on products relevant to the subjectareas) and answering	**10**	**CO2**

	inferential questions **Writing:** dialogue writing- writing an argumentative /persuasive essay.		
III	**Digital Competence** **Listening:** Listening to interviews (subject related) **Speaking:** Interviews with subject specialists (using video conferencing skills) Creating Vlogs (How to become a vlogger and use vlogging to nurture interests–subject related) **Reading:** Selected sample of Web Page (subject area) **Writing:** Creating Web Pages **Reading Comprehension:** Essay on Digital Competence for Academic andProfessional Life. **NOTE:** The essay will address all aspects of digital competence in relation to MS Officeand how they can be utilized in relation to work in the subject area	**10**	**CO3**
IV	**Unit 4 - Creativity and Imagination** **Listening :** Listening to short (2 to 5 minutes) academic videos (prepared by EMRC/ other MOOC videos on Indian academic sites – E.g. https://www.youtube.com/watch?v=tpvicScuDy0) **Speaking:** Making oral presentations through short films – subject based **Reading:** Essay on Creativity and Imagination (subject based) **Writing –** Basic Script Writing for short films (subject based) - Creating webpages, blogs, flyers and brochures (subject based) **Poster making –** writing slogans/captions(subject based)	**10**	**CO 4**
V	**Workplace Communication & Basicsof Academic Writing** **Speaking:** Short academicpresentation using Power Point **Reading&Writing:** Product Profiles, Circulars, Minutes of Meeting. Writing anintroduction,paraphrasing.	**10**	**CO5**

	Punctuation (period, questionmark, exclamationpoint, comma, semicolon, colon, dash, hyphen, parentheses, brackets, braces, apostrophe, quotationmarks, and ellipsis) **Capitalization** (use of upper case)		

Text Book	
1.	Tamil Nadu State Council for Higher Education (TANSCHE)

COURSE OUTCOMES (CO)

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

CO1	Know the different skills in English
CO2	Develop their Communication skill
CO3	Attendinterviewswithboldnessandconfidence.
CO4	Adapteasily intothe workplacecontext, having becomecommunicatively competent.
CO5	Apply to the Research & Development organisations/sections in companies offices with winning proposals.

21UVE201	AECC 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: 2 **Total Hours: 30**

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 and ecological pyramids– Concept of sustainabledevelopment.	06	CO1
II	Natural resources: Renewable- air, water, soil, land and wildlife resources. Non–renewable – Mineral coal, oil and gas. Environmental problems related to the extraction and use of natural resources.	06	CO2
III	Biodiversity– Definition– Values– Consumption use, productive social, ethical, aesthetic and option values threats to bio diversity – hotspots of bio diversity– conservation of bio-diversity: in– situ Ex– situ. Bio– wealth - National and Global level.	06	CO3
IV	Environmental Pollution :Definition– causes, effects and mitigation measures– Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution– Nuclear hazards – Solid wastes acid rain–Climate change and global warming environmental laws and regulations in India– Earth summit.	06	CO4

V	Population and environment – Population explosion – Environment and human health – HIV/AIDS – Women and Child welfare – Disaster Management - Resettlement and Rehabilitation of people, Role of information technology in environmental health – Environmental awareness.	**06**	**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. **Textbook of Environmental studies**. Universities press. PVT. Ltd.		

COURSE OUTCOMES (CO)

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

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

21UTALA301	சங்க இலக்கியங்களும் பக்தி இலக்கியங்களும்	பருவம் -III

இப்பாடத்திட்டத்தின்நோக்கங்களாவன

- எட்டுத்தொகை மற்றும் பத்துப்பாட்டு மூலமாக சங்ககாலமக்களின் வாழ்க்கையைஅறியசெய்தல்
- பக்தி இலக்கியம்மூலம்சைவ-வைணவவழிப்பாட்டு முறைகளை அறியச்செய்தல்
- அகத்திணைகள் புறத்திணைகள் வாயிலாகமக்களின் ஒழுக்கநெறிமுறைகளை எடுத்துரைத்தல்.

Credits:3 Total hrs: 50

UNIT	CONTENTS	Hrs	CO
I	எட்டுத்தொகை அ) குறுந்தொகை - 02, 167 (2 -பாடல்கள்) ஆ) நற்றிணை - 01, 110 (2 -பாடல்கள்) இ) புறநானூறு - 74, 195 (2 -பாடல்கள்) ஈ) ஐங்குறுநூறு - 44, 277 (2 -பாடல்கள்)	10	CO1
II	பத்துப்பாட்டு அ) முல்லைப்பாட்டு - (முழுவதும்)	10	CO2
III	பக்திஇலக்கியம் அ) பெரியபுராணம் - சேக்கிழார் (மெய்ப்பொருள்நாயனார்புராணம்) ஆ) நாலாயிரதிவ்யப்பிரபந்தம் - பூதத்தாழ்வார் (இரண்டாம்திருவந்தாதி – முதல் 5 பாடல்கள்) இ) இரட்சணியயாத்திரிகம்- எச்.ஏ. கிருட்டிணப்பிள்ளை (சிலுவைப்பாடு -முதல் 7 பாடல்கள்)	10	CO3
IV	இலக்கியவரலாறு அ)எட்டுத்தொகை ஆ)பத்துப்பாடல் இ)சைவம்தோற்றம்வளர்ச்சி ஈ)வைணவம்தோற்றம்வளர்ச்சி உ)கிறித்துவம்தோற்றம்வளர்ச்சி	10	CO4
V	இலக்கணம் அ)ஆகுபெயர்கள் ஆ)அகத்திணை இ)புறத்திணை	10	CO5

பாடநூல்	**செய்யுள்திரட்டு -** **தமிழ்த்துறைவெளியீடு, கே.எஸ்.ரங்கசாமிகலைமற்றும்அறிவியல்கல்லூரி (தன்னாட்சி)**

B.A Tamil students admitted from 2021-2022 onwordS

சங்கஇலக்கியங்களும்பக்திஇலக்கியங்களும்

COURSE OUTCOMES(CO)

இப்பாடத்தைக்கற்பதன்வாயிலாகமாணவர்கள்பெறும்பயன்களாவன:

CO1	சங்ககாலமக்களின்அகப்புறவாழ்க்கைமுறைகளைஅறியச்செய்தல்
CO2	**சங்ககாலமக்களின்ஒழுக்கமுறைகளைஎடுத்துரைத்தல்.**
CO3	**பக்திஇலக்கியத்தின்சிறப்புகளைகூறுதல்**
CO4	**இலக்கியவரலாறுமூலம்நூல்கள், ஆசிரியர்களைப்பற்றிஅறிமுகம்செய்தல்.**
CO5	**இலக்கணஅமைப்புமுறைகளைஎடுத்துரைத்தல்.**

21UENLA301	**FOUNDATION ENGLISH-I**	**SEMESTER – III**

Course Objectives:

- To enable the student to develop their competency in English.
- To promote Language Skills through Literature.

Credit: 3 **Total Hours: 50**

UNIT	CONTENTS	**Hrs**	**CO**
I	**Unit I POETRY** 1. Shakespeare - Sonnet-130	**10**	**CO1**

	2. Robert Burns - A Red ,Red Rose 3. P.B.Shelley - Ozymandias 4. Robert Frost - Stopping by woods on a Snowing Evening		
II	**Unit II PROSE** 1. A.G.Gardiner - On Keyhole Morals 2. Martin Luther King - I have a dream- 3. A.P.J.Abdul Kalam - Dimensions of creativity	**10**	**CO2**
III	**Unit III ONE ACT PLAY** 1. J.M. Synge - Riders to the sea 2. Anton Chekov - The Proposal	**10**	**CO3**
IV	**Unit IV FUNCTIONAL SKILLS.** 1. Punctuation- Error Analysis. 2. Determiners. 3. Sentence Patterns 4. Voices (Active & Passive).	**10**	**CO 4**
V	**Unit V COMPOSITION & COMMUNICATION** **COMPOSITION:** 1. Jumbled Sentence. 2. Hints Development. 3. Precise Writing. **COMMUNICATION**: 1. Describe a Picture. 2.Imagining (A Object or Product) 3.Meadia (Film Review proverb Expansion)	**10**	**CO5**

Text Book

1. H.H.Anniah Gowda and J.M.Synge *Two Irish Plays*. Published by Amitabh Nagpal for Macmillan Publishers India Lcd, Haryana.2013.
2. Shakespeare, William, *Sonnet 130*, Project Gutenberg, 2007.

3.	King Martin Luther *I have a dream*. MPI Home Video, 1986.
Reference Book:	
1.	Melvan Jacqueline. *English Grammar and Error correction (Guide and phrasal verb)* book 2016.print.
2.	Krishnaswamy.N *Modern English A Book of Grammar, Usage and Composition,* Macmillan Publishers India Lcd, Haryana.2011.

COURSE OUTCOMES (CO)

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

CO1	Develop the imagination skill of the students.
CO2	Understand the philosophical ideas to the writers and apply that ideas in their life.
CO3	Promote the dramatic skills and learn the dramatic devices required for the plays.
CO4	Stimulate the writing skills.
CO5	Enable the students to enhance their writing skills by excessing composition and communication.

Reference Book	
1	*Christopher, J. Woolveerton, Joanne Wiley* and *Linda Sherwood*.2007. **Prescott'sMicrobiology.** [FourthEdition].TataMcGraw Hill,NewDelhi.

21UBTM301	**DSC III: MICROBIOLOGY**	**SEMESTER-III**

Course Objectives: The Course aims is 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 Book	
1	*Pelczar Jr. M. J. Chan, E.C.S and N.R. Kreig*.1995.**Microbiology**.Tata McGraw HillNewDelhi.

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

21UBTMP301	DSC PRACTICAL-III	SEMESTER–III

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 McGraw-Hill Companies.

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	Perform various biochemical tests and also can apply antibiotic sensitivity test 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

21UBCBTA301	**GEC III : BIOCHEMISTRY (BIOMOLECULES)**	**SEMESTER - III**

Course Objectives:

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 homo polysaccharides – Starch and Glycogen. Hetero polysaccharides - 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. Factors affecting enzyme activity (pH, Temperature and substrate concentration).	8	CO4
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			
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

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

H-High; M-Medium; L-Low

21UBCBTAP301	**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: 27**

S.No.	**EXPERIMENT**	**Hrs**	**CO**
I. Qualitative Analysis			
1.	Carbohydrates: Glucose, fructose, xylose, sucrose, lactose, and starch.	9	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.

COURSEOUTCOMES(CO)

Afterthecompletionofthecoursethestudentwillbeableto

CO1	Performqualitativeanalysisforidentificationof Biomolecules.
CO2	Doquantificationofbiomoleculesbytitrimetricmethods.

21UBTSB301	SEC I: CALCULATIONS FOR BIOLOGIST (100% INTERNAL EVALUATION)	SEMESTER-III

Course Objectives:

The Course aims

- To develop the student skills.
- To apply the basic knowledge about the scientific calculations.

Credits:2 **Total Hours: 25**

UNIT	CONTENTS	Hrs	CO
I	**Scientific notation and metric prefixes:** Significant digits,exponents and scientific notation, converting numbers fromscientific notation to decimal notation. Adding, subtracting, multiplying and dividing numbers written in scientific notation, Metric prefixes.	05	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.	05	CO2
III	**Cell growth:** Bacterial growth curve–Manipulating cell concentration, linear graph, Calculating generation time, Measuring cell concentrations on Hemocytometer.	05	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 280nm.Quantitating protein at A280 in nucleic acid contamination. PCR calculations – template and amplification, Calculating Tm, DNA Polymerase–CalculatingPolymeraseerrorrate.	05	CO4
V	**Centrifugation-** Relative centrifugal force (g Force), converting g Force to RPM, calculating sediment times. Alleles and Genotypes–calculating allele and genotype Frequency.	05	CO5

Text book	
1	*Frank H. Stephenson,* **2003. Calculations for Molecular biology and Biotechnology-**Academicpress.

COURSE OUTCOMES (CO)

Aftercompletionofthecourse,thestudentswillbeableto

CO1	SummarizethebasicknowledgeofScientific notation.
CO2	Solvethebiologicalcalculationstopreparethesolution.
CO3	Interpretthemechanismofbacterialcellgrowth.
CO4	Developtheskillstoquantitatethebiologicalmacromolecules.
CO5	Apply the knowledge for the population genetics.

MAPPING

PSO / CO	**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

H-High;M-Medium;L-Low

21ULS301	CAREER COMPETENCY SKILLS I	SEMESTER– III

CourseObjectives:

TheCourseaims

- Tounderstandthebasicneedsof Communication
- ToutilizethecommunicationskillsforachievingatthetimeofInterview

TotalHours: 15

UNIT	CONTENTS	Hrs	CO
I	Basic Grammar – Usage ofEnglish–Listening and Speaking(Level-1) Tensesand Voices(Present,PastandFuture)	**03**	**CO1**
II	SentenceCorrection –SentencePattern-Reading Comprehension(Level-1)	**03**	**CO2**
III	ExpansionofProverbs–ClosetTest (Level-1)	**03**	**CO3**
IV	SentenceImprovement(EssayWriting,Now-a–Days Vocabulary),StoryWriting	**03**	**CO4**
V	E-MailBuilding(Sendingcallletters),Letters(Formaland Informal)	**03**	**CO5**

Text Books

1	*AnneSeaton,MewY.H.***BasicEnglishGrammarforEnglish-Book1.**LearnersSaddle pointPublishers.
2	*MarkNewson.***BasicEnglishSyntaxwithExercises.**(E-Copy)

ReferenceBook

1	*ChandS,AgarwalR.S.***ObjectiveGeneralEnglish.**ArihantPublications(India) Limited.

COURSEOUTCOMES(CO)

Aftercompletionofthecourse,thestudentswillbeableto

CO1	RecallthebasicgrammarinEnglish
CO2	Concentration SentenceCorrection
CO3	UnderstandParagraphWriting
CO4	ImprovetheabilityofSentenceConstructionandStoryWriting
CO5	FormatWebWritingandFormalWritingofletters.

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	M	H	H	M	H	M	H	H
CO3	M	H	M	H	H	H	M	M	H	H
CO4	M	H	H	H	H	H	M	H	H	H
CO5	H	H	H	H	H	H	H	H	M	H

H-High; M-Medium; L-Low

21UTALA401	காப்பியங்களும் அறஇலக்கியங்களும்	பருவம் -IV

இப்பாடத்திட்டத்தின் நோக்கங்களாவன

- **சிலப்பதிகாரத்தின் வழி பெண்ணுரிமையைப் பற்றி உணரச்செய்தல்.**
- **காப்பியங்களைப் பற்றி மாணவர்கள் அறியச் செய்தல்.**
- **அற இலக்கியங்கள் வாயிலாக நீதிக்கருத்துக்களை அறிய உணர வைத்தல்.**
- **தமிழ் இலக்கணங்களை மாணவர்களுக்கு அறியவைத்தல்.**

Credits: 3 Total Hours:50

UNIT	CONTENTS	Hrs	CO
I	காப்பியம் அ. சிலப்பதிகாரம் - வழக்குரைக்காதை ஆ. மணிமேகலை – ஆதிரை பிச்சையிட்டகாதை	10	CO1
II	அறஇலக்கியம் அ. திருக்குறள் - செய்நன்றி அறிதல் ஆ. நாலடியார் - கல்வி (முதல் 5 பாடல்கள்) இ. இனியவை நாற்பது – முதல் 5 பாடல்கள் ஈ. ஆசாரக் கோவை – முதல் 5 பாடல்கள்	10	CO2
III	பிற்காலநீதிஇலக்கியம் அ. மூதுரை - 2,9,10,12,28 (5பாடல்கள்) ஆ. கொன்றை வேந்தன் - முதல் 20 பாடல்கள் இ. ஆத்திசூடி - 21 முதல் 40 பாடல்கள்வரை ஈ. நல்வழி - முதல் 5 பாடல்கள்	10	CO3
IV	இலக்கிய வரலாறு அ.காப்பியங்கள்- அறிமுகம் (ஐம்பெருங் காப்பியங்கள்,ஐஞ்சிறு காப்பியங்கள்) ஆ. பதினெண்கீழ்க் கணக்கு நூல்கள் - அறிமுகம் இ. பிற் காலநீதி இலக்கியங்கள் - அறிமுகம்	10	CO4

V	**இலக்கணம்** **அ. தொகை நிலைத்தொடர்,தொகா நிலைத்தொடர்** **ஆ. நேர்காணல்** **இ. கடிதம் எழுதுதல் (அலுவலகக் கடிதம்,விண்ணப்பக் கடிதம்)**	10	CO5
Text Books			
1.	**செய்யுள் திரட்டு – தமிழ்த்துறை வெளியீடு,** **கே.எஸ்.ரங்கசாமிகலைஅறிவியல்கல்லூரி (தன்னாட்சி).**		

சங்கஇலக்கியங்களும்பக்திஇலக்கியங்களும்

COURSE OUTCOMES(CO)

இப்பாடத்தைக் கற்ப தன்வாயிலாக மாணவர்கள் பெறும் பயன்களாவன:

CO1	சங்க கால மக்களின் அகப்புற வாழ்க்கை முறைகளை அறியச் செய்தல்
CO2	**சங்க கால மக்களின் ஒழுக்கமுறைகளை எடுத்துரைத்தல்.**
CO3	பக்தி இலக்கியத்தின் சிறப்புகளை கூறுதல்
CO4	**இலக்கிய வரலாறு மூலம்நூல்கள், ஆசிரியர்களைப் பற்றி அறிமுகம் செய்தல்.**
CO5	**இலக்கண அமைப்பு முறைகளை எடுத்துரைத்தல்.**

21UENLA401	**FOUNDATION ENGLISH-II**	**SEMESTER -IV**

Course Objectives:

- To promote language skills through literature and communication skills.

- To enhance the language learning through activities.

Credit:3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**POEM** 1. A.E.Stalling - The Doll House. 2. John Keats - La Belle Dame Sans Merci 3. Sonnet 65 - William Shakespeare. 4.I Know why the caged Bird Sings - Maya Angelou 5. This is a Photograph of me - Margaret Atwood.	**10**	**CO1**
II	**PROSE** 1. Herman Wouk - A talk on Advertising 2. Ngugi wa Thiong'o - From Decolonising the Mind 3. A.G. Gardiner - On Habits	**10**	**CO2**
III	**ONE ACT PLAY** 1. Edward Alwee - The Zoo Story 2. Beth Henley - Am I Blue	**10**	**CO3**
IV	**Grammar (Functional Skills)** 1.Degrees of Comparison 2.Conditional Clauses 3.Simple, Compound and Complex	**10**	**CO 4**

21UBTM401	DSC IV:	SEMESTER-IV

V	**COMPOSITION &COMMUNICATION** 1.Resume Writing 2.Report Writing 3.MOC – (Specific Jorgen)	**10**	**CO5**
Text Book			
1. 2.	Damodar,G, D Venkateshwarlu, M, Narendra, M.Sarat Babu, G.M. Sundaravalli, *English for Empowerment* Published by orient Black swan private Limited. Hyderabad-500 029, 2009. Aslam Mohammed A.H.Tak. *Experience and Emotion.* Published by Cambrige university press Pvt.Ltd.New Delhi-110 002, 2006.		
Reference Books:			
1. 2.	Melvan Jacqueline. *English Grammar and Error correction (Guide and phrasal verb)* book 2016.print. Krishnaswamy.N *Modern English A Book of Grammar, Usage and Composition,* Macmillan Publishers India Lcd, Haryana.2011.		

COURSE OUTCOMES (CO)

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

CO1	Develop the imagination skill of the students.
CO2	Understand the philosophical ideas to the writers & apply that ideas in their life.
CO3	Promote the dramatic skills and learn the dramatic devices required for the plays.
CO4	Stimulate the writing skills.
CO5	Enable the students to enhance their writing skills by excessing composition and communication.

21UBTM401	BIOPHYSICS AND BIOINSTRUMENTATION	SEMESTER–IV

Course Objectives:

The Course aims

- To study the basic techniques and principle of instrumentation.

Credits:5 **TotalHours: 50**

UNIT	CONTENTS	Hrs	CO
I	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, electro static forces, vander waals interaction.	**10**	**CO1**
II	Care and general maintenance of laboratory instrumentation Weighing balance, pHmeter, Laminar flow chambers, Hot air oven, Auto clave and Incubator. Introduction, principles and applications of spectroscopy:– Colorimeter, UV-visible spectro photometer,pH meter.	**08**	**CO2**
III	Chromatography– Paper Chromatography, Thin Layer Chromatography, column chromate graphy, Ion Exchange Chromato graphy, High Performance Liquid Chromato graphy, Gas Chromato graphy and LC-MS.	**10**	**CO3**
IV	Electrophoresis–Agarose Gel Electrophoresis, SDS-PAGE. Blotting techniques- Southern, Northern. Types of centrifuges.	**12**	**CO4**
V	Physical methods of imaging intact biological structures (X-ray, CAT Scan, ECG, EEG) Radioactive Decay – Principles, Types, applications of Giger Muller Counter.	**10**	**CO5**

Text Books

1	*Freifelder,.D.*1976.Physical Biochemistry, Applications to Biochemistry and MolecularBiology General Biophysics, Vol.I&II–H.V.Volkones.
2	*Boyer,. R.F.*1993. **Modern Experimentsin Biochemistry.** [SecondEdition]. T he Benjamin /Cummings Publishing Company, Redwood City, California.
3	*Ghatak, K.L.* 2003. Techniques and Methods in Biology. PHI Learning Private Ltd. New Delhi.
Reference Books	
1	*Upadhyay*. 2005. **BiophysicalChemistry.**HimalayaPublications.
2	*Wilson,. K.andWalker*,2003. **PracticalBiochemistry.**[FirstEdition]. Cambridge University Press.

COURSEOUTCOMES (CO)

Aftercompletionofthecourse,thestudentswillbeableto

CO1	Explainthepresenceofbondsisessentialto studychemistryinhumanbody.
CO2	Differentiatetheinstrumentsbasedonitsworkingprincipleandlearnabout Handlingwithcare.
CO3	Demonstratethetechniquesofseparationandpurificationofbiomolecules Basedon I sownproperty.
CO4	Illustrateblottingtechniqueandcentrifugationprocess
CO5	Findthetechniqueforvisualrepresentationofinteriorpartsofthebodyfor Clinicalanalysis

MAPPING

H-High; M-Medium; L-Low

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

21UBTMP401	DSC PRACTICAL-IV	SEMESTER–IV

Course Objectives:

The Courseaims

- 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 **TotalHours:36**

S.No	EXPERIMENT	Hrs	CO
1.	Principles and operation of pHmeter–calibration and buffer preparation	**03**	**CO1**
2.	Principles and operation of colorimeter ands pectrophotometer (Application: Chlorophyll estimation)	**03**	
3.	Determination of Kmand Vmax	**03**	**CO2**
4.	Principles of Diffusionand Osmosis (through semi-permeable membrane)	**03**	
5.	Haemolysis	**03**	**CO3**
6.	Paper Electrophoresis	**03**	
7.	Column chromatography	**03**	
8.	Paper chromatography (plantextract)	**03**	
9.	Identification of amino acids by Thin-layer chromatography method	**03**	
10.	SDS PAGE	**06**	**CO4**
11.	Western blotting -Demonstration	**03**	**CO5**

ReferenceBook

1	Anbalagan,K.1999. **An introduction to Electrophoresis**. The Electrophoresis institute ,Biotech-Yercaud.

COURSEOUTCOMES(CO)

Aftercompletionofthecourse,thestudentswillbeableto

CO1	HandlepHmeter,colorimeterandspectrophotometer.
CO2	DeterminekmandVmaxandextendtheknowledgeontheprinciplesofDiffusionand Osmosis.
CO3	ApplyhaemolysisanddifferenttypesofChromatographictechniques.
CO4	IsolateproteinsusingSDS-PAGE.
CO3	Demonstratewesternblotting.

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	H	H	H	M	M	H	H
CO3	H	H	H	H	H	H	H	H	H	H
CO4	H	H	H	H	M	H	H	H	H	H
CO5	H	M	H	H	H	M	H	H	M	H

H-High; M-Medium; L-Low

21UMABTA401	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 Sqaure). **(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 o fhypothesis –Test of significance of small samples (t and F)–Chi-square test (Problems only). **(Chapter 10 Sections: 10.1, 10.5) (Chapter 11)**	08	CO5

Text Book

1	*Palanichamy.SandManoharan.M,* 2001. **Statistical methods for Biologists.** [ThirdEdition].Palani Paramount Publications, Palani.

ReferenceBooks

1	*DanielW.W.*1987.**Biostatistics.** John Wiley and Sons, Newyork.
2	*Arora,P.N.andMalhan, P.K.*2006. **Biostatistics.** HimalayaPublishingHouse, Mumbai.

Course Outcomes (CO)

Aftercompletionofthecourse,thestudentswillbeableto

CO1	Learn the importance of statistics
CO2	Underset and 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

21UMABTAP401	DSC PRACTICAL IV: STATISTICS (USINGMS-EXCEL)	SEMESTER– IV

Course Objectives:

The Course aims

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

Credits:2 **TotalHours: 21**

PROGRAM	CONTENTS	Hrs	CO
1	Diagramsandgraphs	03	CO1
2	MeasuresofLocations	03	CO2
3	MeasuresofDispersion	03	CO2
4	Correlationcoefficient(KarlPearsonandRankmethod)	03	CO3
5	Regressionlines	03	CO3
6	Smallsampletest(tandF)	03	CO4
7	Chi-squaretestforindependenceofattributes.	03	CO4

ReferenceBooks

1	*BhattacharjeeDibyojyoti.***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 india grammatic 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

21UBTSB401	SEC II: BIOSAFETY AND BIOETHICS (100% INTERNAL EVALUATION)	SEMESTER-IV

Course Objectives:

- To develop the student skills to work in the laboratory and to learn thebasicethics.
- Toacquirethebasicknowledgeonaboutthelaboratorychemicals,containment sandissuesregarding ther-DNA.

Credits:2 **Total Hours: 25**

UNIT	CONTENTS	Hrs	CO
I	**Biosafety:**Definition of Biosafety. Biosafety for human health and environment, Good Laboratory Practices(GLP), Social and ethical issues.	05	CO1
II	Risk and risk assessments, biosafetylevel, Basic laboratory, laboratory design, General guide lines for r-DNA research Activities–containment facilities and biosafety practices.	05	CO2
III	Guidelines for research in transgenic plants and animals and its applications. Use of genetically modified organisms and Their release into the environment.	05	CO3
IV	Environmental safety of genetically modified organisms, Special procedures for r-DNA based products, safety issues In genetically modified foods and organisms.	05	CO4
V	Bioethics in Biotechnology-Society,Risks,Ethics. ELSI of Biotechnology,Genetic modifications-recombinant foods, Recombinant therapeutic products for human health care.	05	CO5

Referencebook

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

COURSEOUTCOMES(CO)

Aftercompletionofthecourse,thestudentswillbeableto

CO1	Gain knowledge about the biosafety and its uses for environment and human health.
CO2	Identify the risk inlaboratory 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

21ULS401	CAREER COMPETENCY SKILLS II	SEMESTER– IV

Course Objectives:

The Course aims

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

Total Hours: 15

UNIT	CONTENTS	Hrs	CO
I	Aptitude: Speed Maths- Multiplication of Numbers- Simplification- Squaring of numbers -Square roots and cube roots – HCF & LCM – Decimals-Averages, Powers and Roots.	03	CO1
II	Aptitude: Problems on Numbers – Problems on Ages – Surds & Indices – Percentage–Profit& Loss–Ratio& Proportion–Partnership–Chain Rule.	03	CO2
III	Aptitude: Simple & Compound Interest –Alligationor Mixture- Permutation and Combination.	03	CO3
IV	Aptitude: Probability –Missing Number series–Wrong Number Series –Races & GamesofSkill.	03	CO4
V	Aptitude: Time & Work – Pipes & Cistern – Time & Distance – ProblemsonTrains–Boats and Streams.	03	CO5

Text Book

1	*Aggarwal.R.S.*2017. **Quantitative Aptitude***, SChandand Company Limited,New Delhi.*

ReferenceBook

1	*Abhijith Guha.*2015. **Quantitative Aptitude for Competitive Examinations**,*5th Edition,Tata Mc GrawHill, New Delhi.*

COURSEOUTCOMES(CO)

Aftercompletionofthecourse,thestudentswillbeableto

CO1	Carryoutmathematicalcalculationsusingshortcuts.
CO2	Calculateproblemsonage,surdsandindices withshortcuts
CO3	UnderstandthecoreconceptsofSIandCI,PermutationandCombination.
CO4	Obtain knowledge onshortcutstocalculatenumber series.
CO5	Performnewmethodsforaptitudecalculations.

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	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

H-High; M-Medium; L-Low

21UBTM501	DSC V: MOLECULAR BIOLOGY	SEMESTER-V

Course Objectives:

The Course aims

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

Credits:5 **TotalHours: 50**

UNIT	CONTENTS	Hrs	CO
I	Molecular basis of life– An introduction, Central dogma of molecular biology, DNA replication–Evidences for semi conservative model, DNA replication in prokaryotes and Eukaryotes initiation, elongation and termination, Rolling circle model and the ta model.	**10**	**CO1**
II	Mutation–Definition, mutagen, typesofmutation– insertion and deletion, Point mutation – sense, mis-sense, andnon-sense mutation. DNA repair mechanism – Excision repair, recombination repair and SOS repair. Recombination-Homologous and Holliday model.	**12**	**CO2**
III	Transcription in prokaryotes – RNA polymerase and promoters, Transcription in Eukaryotes–RNA polymerase, promoters, enhancers, and silencer, Mechanism of Transcription- initiation, elongation and termination, Post transcriptional modifications- capping, Poly adenylation and splicing.	**12**	**CO3**
IV	RNA – structure and function of rRNA, mRNA and tRNA, Genetic code, Wobble hypothesis, Translation in prokaryotes and Eukaryotes- Post translational modification.	**08**	**CO4**
V	Regulation of gene expression–lac and trp operons, Transposons–types, Oncogenes–proton cogene and tumor suppressor genes. Molecular chaperones.	**08**	**CO5**

Text Book

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

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

COURSEOUTCOMES(CO)

Aftercompletionofthecourse,thestudentswillbeableto

CO1	Explaintheconceptsofmolecularbiology
CO2	Demonstratethemechanismbehindthemutations
CO3	Describethetransferofgeneticinformationfromparenttooffspring
CO4	Explaintheproteinsynthesisandmodifications,itsactionsincellularlevels.
CO5	Illustratethegeneticlevelchangesofproteinsandenzymes.

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-High;M-Medium;L-Low

21UBTM502	DSC VI: 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	Mile stones in Immunology, Immunity: Types–innate and acquired immunity, Cells of immune system, Primary and Secondary lymphoid organs.	10	CO1
II	Antigens- antigenicity and immunogenicity. Immuno globulin– basic structure, function and classes, Hybridoma technology-Production of Mono clonal antibody, Complement systems.	10	CO2
III	Antigen– Anti body interaction, Precipitation– Mancini method and Ouchterlony method, Immuno electro phoresis, Agglutination - Haem agglutination and Bacterial agglutination, Immuno fluorescence, ELISA.	10	CO3
IV	MHC complex– structure and function of MHC, Antigen Processing and presentation–Cyto solic pathway and Endocytic pathway, Cytokines –types and functions.	10	CO4
V	Hyper sensitivity – definition and itst ypes, Auto immunity –Organs pecific and systemic autoimmune disease, Transplantation immunology – immunologic basis of graftrejection, Vaccines– Live vaccine, killed vaccine, whole organism vaccine and purified macro molecule vaccine.	10	CO5

Text Book

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

ReferenceBooks

1. *IanRTizard,*2006.**Immunologyanintroduction.[**FourthEdition].Advanced ImmunologyDavidmale.
2. *KalusD.Elgert*, 2004. **Immunology understanding the Immunesystem.** [SecondEdition].Wiley-BlackwellPublication.

COURSEOUTCOMES(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 for mof 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 Hyper sensitivity, 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

21UBTM503	DSC VII: INDUSTRIAL BIOTECHNOLOGY	SEMESTER-V

Course Objectives:

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

Credits:5 **TotalHours: 50**

UNIT	CONTENTS	Hrs	CO
I	History and scope of Industrial Biotechnology, Isolation And Screening of industrially important microorganism, Strain development, Substrates for industrial fermentation.	10	CO1
II	Industrial sterilization methods, Design of bioreactor, Parts and their functions. Types of bioreactor. Methods of fermentation- Batch, fedbatch, continuous fermentation, Growth kinetics.	10	CO2
III	Fermentors operations and applications–common measurements and control systems–speed, temperature, Gas supply, pH, Dissolved oxygen and foam control.	10	CO3
IV	Production of Organic acids–Citric acid and Lactic acid, Amino acids -Glutamic acid and Lysine, Enzymes– Amylase, and Protease, Antibiotics– β lactam antibiotics.	10	CO4
V	Separation of microbial cells and suspended solids, Intracellular product recovery, Cell disruption, Centrifugation, Chromatography, Solvent extraction, Distillation, crystallization, Evaporation and drying.	10	CO5

Text Book

1 *Crueger, W, and Crueger,A*.2002.**A Text Book of Industrial Microbiology.** [SecondEdition].ScienceTechPublishers, USA.

ReferenceBooks

1 *Shuler,M. L. and Kargi. F*.2004. **Bioprocess Engineering: Basic Concepts.** [SecondEdition].Prentice Hall.Pvt.Ltd., NewDelhi.

2 *Aiba,S, Humphrey,A.EandMillis,N.F*,1973,**BiochemicalEngineering** [SecondEdition], Academic Press, NewYork.

3 *Stanbury,P.F,Hall.S, and Whitaker,A*. 1995. **Principles of Fermentation Technology** [SecondEdition],. Elsevier Science Ltd

4	*El-MansiE.M.T.,Bryce C.F.A.,DemainA.L.AllmanA.R.,*2007. **Fermentation Microbiology and Biotechnology.** [SecondEdition].CRCPress.

COURSEOUTCOMES(CO)

Aftercompletionofthecourse,the students will be able to

CO1	Explaintheisolation,screeningandimprovementofindustriallyimportant microorganisms
CO2	Demonstratethedesign,functionsandtypesofbioreactoraswellasvarious fermentationmethods.
CO3	Explainabouttheoperationsandapplicationsofbioreactor.
CO4	Illustrateabouttheproductionofanorganicacids,aminoacids,enzymesand antibioticsatan industriallevel.
CO5	Describeaboutdownstreamprocessing.

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

21UBTM504	DCS VIII: PLANT TISSUE CULTURE	SEMESTER-V

Course Objectives:

The Course aims

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

Credits:5 **TotalHours:50**

UNIT	CONTENTS	Hrs	CO
I	Introduction to plant tissue culture- Definition, Applications, History and organization of plant tissue culture laboratory, Preparation of media- MS medium, White'smedium, Gamborg's medium and Nitsch and Nitsch medium, Growth Regulators and sterilization techniques.	10	CO1
II	Micro propagation- Applications, types and stages, Callus and cell culture-Callus induction, Callus culture and cell suspension culture, Transformation- *Agrobacterium tumefaciens* and *A.rhizogens* mediated transformation. Direct gene transfer methods – electro poration, micro injection and particle bombardment.	10	CO2
III	Embryo culture- Introduction, types of embryo culture, applications and embryo culture techniques, Production of haploid plants - Anther and pollen culture, Ovary and ovule culture, Production of resistant plants-Herbicid eresistance, Insect resistance, Production of stresstolerant plants-Drought, Temperature and salt	10	CO3
IV	Somatic embryo genesis-Developmental stages of embryo genesis, Germ plasm preservation and synthetic seed technology, Genetic engineering for improvement of protein, lipids, carbohydrates, and vitamins, Plant genome organization, Roleof RFLP in plant breeding. DNA bar coding in plants, Transposable elements in plant.	10	CO4
V	Protoplast culture- Introduction, Protoplast isolation, protoplast culture and Protoplast fusion, Production of virusfree plants, Somaclonal variation, Secondary metabolites fromplants- Alkaloids, flavonoids and phenolic compounds, Production of therapeutic antibodies, edible vaccine.	10	CO5

Text Book	
1	*Bhojwani, S.S., and Razdan, M.K.2008*. Plant Tissue Culture-Theoryand Practice. ElsevierPublishers, New Delhi.
ReferenceBooks	
1	*Chawla,H.S*. 1998. Biotechnology in crop improvement. International book Distribution co. NewDelhi.
2	*Jain,V.K.,*2013.Fundamentalsofplantphysiology.(Fifth edition).S.Chand And company, NewYork.
3	*Trivedi, P.C.* 2004. Advances in plant physiology. (Third edition).I.K. Internationalpublicationspvt Ltd, NewDelhi.
4	*Slater,ScottandFowler*.2003.PlantBiotechnology(The genetic manipulation Of plants),Oxford University,UK.

COURSEOUTCOMES(CO)

Aftercompletionofthecourse, the students will be able to

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 *invitro* condition and Transformation techniques
CO3	Describe the embryo culture, Production of haploid, resistant and stress Tolerant plants
CO4	Explain about somatic embryo genesis, Germ plasm 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.

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

21UBTEL501	DSE I: NANO BIOTECHNOLOGY	SEMESTER-V

CourseObjectives:

TheCourseaims

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

Credits: 4 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	Nanobiology–concepts, definitions, prospects; nano particles – size, shape, properties. Bio nanoparticles –nano starch, nano composites– dendrimers. Hot–Dot nano particles. Types of bio materials. Bio degradable polymers.	08	CO1
II	Methods of nano biotechnology – Analysis of bimolecular nano structures by Atomic Force Microscopy, Scanning Probe Electron Microscopy. Nano fabrication - lithography. Drug nanoparticles - structure and preparation, Liposomes, Cubo somes and hexosomes. Lipid based nano particles- Liquid nano dispersion, solid liquid nano particles	08	CO2
III	Nanotubes, Nanorods, Nanofibers and Fullerenes for nano scale drug. Bio nano electronics. Applications of nano biotechnology in medicine, drug designing and cancer treatment. Medical, social and ethical considerations of Nano biotechnology.	08	CO3
IV	Nanopores, Applications of Nano Molecules in Biosystems –Nano scale Elements for Delivery of Materials into Cells. Peptides Coupled Nano particles. DNA Based Artificial Nano structure. Proteins as Components in Nano devices- Nano particle synthesis inplants, bacteria, and yeast.	08	CO4
V	Nano technology for Cancer Diagnostics and Treatment: Cancer Biology; Clinical Aspects, Current Approaches and Challenges. Nano technology for Cancer Research and Therapy. Si RNA. Tumor-targeted Drug Delivery Systems. Nano technology for Imaging and Detection	08	CO5

ReferenceBooks	
1	*Christof M.Niemayer, Chad A.Mirkin,* 2004. **Nano biotechnology:Concepts, Applications and perspectives.**Wiley VCHpublishers
2	*DavidS.Goodsell.*,2006.**Bionanotechnology:LessonsfromNature**.JohnWiley &Sons,NewJersey.
3	*JainK.K.,*2005**.NanobiotechnologyinMolecularDiagnostics:Current TechniquesandApplications.**Tailor L.FrancisGroup.
4	*TuanVo-Dinh,*2007**.NanotechnologyinBiologyandMedicine:Methods, DevicesandApplications.** CRC Press,TaylorandFrancisInc.,London.
5	*TorchilinVladimirP.*2006**.NanoparticulatesasDrugCarriers**.WorldScientific.ImperialCollegePress,WorldScientificPublishingCo.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 themethods and drug nanoparticles
CO3	Apply the applications of nanoparticles in medicine
CO4	Synthesize nano particles using biological materials
CO5	Diagnose and treat cancer and improve their Current Approaches and Challenges in nano technology

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

21UBTEL502	DCE I: BIO INFORMATICS	SEMESTER-V

Course Ob jectives: To understandand gain both the theoretical and practical concepts in Bioinformatics.

Credits: 4 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	Basic computer components-Hardware, software, operating systems, computer networks, programming, internet, browsers, search engines, email, databases. Basic concepts of biomolecules and computers: Basic concepts of biomolecules–Protein and aminoacid, DNAand RNA -Sequence, Structure and function.	**08**	**CO1**
II	Introduction: Definitions, Objectives, Scope, Applications of Bioinformatics, History and milestones of bioinformatics, Genome sequencing projects–Steps, Human Genome Project and other genome projects.	**08**	**CO2**
III	Biological Database–classification and Properties, Data Formats (FASTA, GENBANK, PDB), Format conversion. Sequence Database: GENBANK and EMBL– divisions, retrieval system, and depositingsystem, PIR and SWISSPROT– Features, Sequence retrieval and depositing system, Structural databases (PDB, SCOP, CATH), Literature Database: OMIM, Pubmed and Medline.	**08**	**CO3**
IV	Database searching and Sequence Alignment: Similarity searching programs- BLAST, Sequence alignment - Pair-wise and Multiple-sequence alignment (Methods and Algorithms), CLUSTAL-W, Protein structure alignment (Methods,algorithms-DALI) Phylogenetic analysis (Methods, algorithms).	**08**	**CO4**
V	Gene prediction: Gene prediction in prokaryote and eukaryotes. Extrinsic approaches and Abinitio approaches. Predicting the protein secondary structure (Domain, blocks, motifs), Predicting protein tertiary structure (Homology, Ab-initio, threading and fold Recognition) and visualization of predicted structure.	**08**	**CO5**

Text Books	
1	*JinXiong*,2006.**EssentialBioinformatics**.CambridgeUniversityPress.UK.
2	*Attwood,K.*and*SmithJ.P.*2003.**Introduction toBioinformatics.**Pearson Education,Singapore.
ReferenceBooks	
1	*RajaramanV.*,2003.**Introductiontoinformationtechnology.**PrenticeHallof IndiaPvt.Ltd,NewDelhi.
2	*Lesk,A.M.*,2002.**IntroductiontoBioinformatics**.OxfordUniversityPress, London.
3	*AttwoodT.K.*and*Parry-SmithDJ.*2005.**IntroductiontoBioinformatics**.[First Edition].PearsonEducation,UK.
4	*KothekarV.*and*NandiT,*2007.**AnIntroductiontoBioinformatics**.[Second Edition].Duckworthpress-BiosciencePublishers,NewDelhi.
5	*DavidWMount,*2004.**Bioinformatics:SequenceandGenomeAnalysis**.CSHL Press,NewYork.

COURSEOUTCOMES(CO)

Aftercompletionofthecourse,the students will be able to

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

MAPPING

H-High;M-Medium;L-Low

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

21UBTMP501	DSC PRACTICAL-V	SEMESTER-V

Course Objectives:

The Course aims

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

Credits:3 **TotalHours:42**

S.No	EXPERIMENT	Hrs	CO
1.	Differential identification of Bloodcells	03	CO1
2.	Bloodcell counting –RBC and WBC	03	
3.	ABO Blood grouping	03	
4.	Ouchterlony Double Diffusion	03	CO2
5.	Radial Immuno diffusion	03	
6.	Immuno electro phoresis	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'smethod	03	CO4
11.	Wine production and alcohol estimation	03	
12.	Preparation of medium for plant tissue culture technology	03	CO5
13.	Sterilization of explant sand Callus induction	03	
14.	Micro propagation	03	

ReferenceBooks

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 Manualon Fermentation Technology.TKPublishers, NewDelhi.
3. *FrankC.H., and OlwynM.R.W.,*2002.PracticalImmunology.Blackwell PublishingCompany. UK.
4. *Lindsey,K.,*1997.Plant Tissue Culture Manual. Springer,Dordrecht,UK

COURSEOUTCOMES(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

21UBTSB501	SEC III: IPR FOR LIFE SCIENCE (100% INTERNAL EVALUATION)	SEMESTER- V

Course Objectives:

The Course aims

- To acquire the knowledge on intellectual property rights (IPR).

Credits: 2 **Total Hours: 25**

UNIT	CONTENTS	Hrs	CO
I	**IPR–**IPRandits types, WTO, GATT, TRIPS, WIPO.	05	CO1
II	**Patents–**History of Patents, Kinds of patent, Invention, Novelty, terms of patent, specifications, filling patent applications.	05	CO2
III	**Patents in Biotechnology–**Biotechnology products, Biotechnology Process, Patenting microorganisms ,multicellularorganism, patenting genes, patenting cells And tissue.	05	CO3
IV	Design– industrial design, essential requirement, duration of registration, Trade secret–importance objectives, meaning benefits of registering a trademark, Functions, trademark.	05	CO4
V	**Copyrights–**coverage by copyrights, filing copyright in India, in fringement. Plant breeder's rights. Open source Biotechnology, pros And cons of open source.	05	CO5

ReferenceBook

1 *Sathyanarayana.U.*2010.**Biotechnology**.Books and Allied (P) LTD.

COURSE OUTCOMES (CO)

Aftercompletionofthecourse, the students will be able to

CO1	Explainabout IPRanditstypes, WTO, GATT,TRIPSand WIPO.
CO2	Describe about kinds of patents and inventions.
CO3	Elucidate about Patenting microorganisms, multi cellular organism, patenting genes, patenting cells and tissue.
CO4	Describe about trademark and trade secret.
CO5	Explain about copyrights.

MAPPING

H-High;M-Medium;L-Low

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

21ULS501	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-Verbal Reasoning: Series Completion-Analogy and Classification-Completion of Incompletion Pattern.	3	CO2
III	Non-Verbal Reasoning: Mirror Image and Water Image– State ment and Arguments-Cubes and Dices.	3	CO3
IV	Reasoning: Puzzle Arrangement-Syllogism-Input and Output.	3	CO4
V	Verbal Reasoning: Linear Arrangement - Circular Arrangement–MatrixArrangement.	3	CO5

Text Book

1	Test of Reasoning– RSAggarwal ,SChandandCompanyLimited,2017 Edition, NewDelhi.

ReferenceBook

1	Verbal&Non-VerbalReasoningForCompetitiveExams-GajendraKumar, AbhishekBanerjee, Dishapublication,NewDelhi.

COURSE OUTCOMES(CO)

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

CO1	Understand the core concepts of Verbal Reasoning
CO2	Formulate NonVerbal Reasoning with short cuts
CO3	Find Mirror Image, Cubes and Dices
CO4	Obtain the knowledge on shortcuts tos olve Puzzles.
CO5	Solve Linear Arrangement and Matrices with shortcuts.

21UBTM601	DCS IX: RECOMBINANT DNA TECHNOLOGY	SEMESTER-VI

Course Objectives:

The Course aims

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

Credits:5 **TotalHours: 50**

UNIT	CONTENTS	Hrs	CO
I	Recombinant DNA technology–history and scope, Enzymes in recombinant DNA technology – DNA manipulative enzymes, DNA Modifying enzymes, Restriction endonucleases and Ligases.	**10**	**CO1**
II	Plasmids: Definition, classification. Plasmid vectors – pBR322 & pUC vectors. Vectors for cloning - lambda phage vectors, Phagemids, Cosmids, YAC and BAC vectors.	**10**	**CO2**
III	Construction of cDNA library and genomic DNA library, screening of gene libraries – screening by DNA hybridization, immunological assay and protein activity.	**10**	**CO3**
IV	Expression of cloned genes in *E.coli* & yeast. Production of recombinant insulin, somatostatin, TPA and factor VIII.	**10**	**CO4**
V	DNA sequencing - types and application, PCR and its variations, Forensic analysis– DNA fingerprinting.	**10**	**CO5**

TEXT BOOK

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

REFERENCEBOOKS

1	*Brown.T.A.*2005. **Genomes**. [Third Edition]. Garland Science Pub., New York.
2	*Primrose, S.B.* and *Twyman, R. M.* 2006. Principles of gene manipulation and genomics [Seventh Edition]. Blackwell Publication.
3	*Reece,R.J.* 2004. Analysis of Genes and Genomes. John Wiley & Sons. Inc.

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

21UBTM602	DSC: 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 **TotalHours:50**

UNIT	CONTENTS	Hrs	CO
I	Environmental Biotechnology- definition and history, Microbes in relation to environment - viruses, Bacteria, Fungi and Protozoa, Bacteriology of water and sewage.	**10**	**CO1**
II	Biotechnological methods of pollution detection - General bioassay and molecular techniques for monitoring the environment, Biosensor in environmental analysis, Biosystems for conventional waste water treatment – Activated sludge, rotating biological contractor, Fluidized beds and Anaerobic digester.	**10**	**CO2**
III	Biotechnology in CO_2 reduction – Higher plants and algal photosynthesis, Biological calcification, eutrophication, Solid waste management and biological phosphorous removal.	**12**	**CO3**
IV	Biomechanisms of metal chelation and detoxifications, Metal pollution and its Bioabatement– Plants and microbes, Biodegradation – aerobic, anaerobic, sequential degradation, Xenobiotics - Biodegradation of Herbicides, pesticides and hydrocarbons.	**08**	**CO4**
V	Eco friendly bio-products for environmental health – Bioenergy and Biofuels, Sources, Advantages, Biodegradable plastics, Future energy needs and direction of research.	**10**	**CO5**

Text Book

1 *Chatterji, A.K,* 2002. **Introduction to Environmental Biotechnology**. Prentice-Hall of India Pvt. Ltd., New Delhi.

ReferenceBooks

1 *Rittmann, B. E. and McCarty P. L.* 2001. **Environmental Biotechnology Principles and Applications**. McGraw Hill, USA.

2 *Alan Scragg,* 2005. **Environmental Biotechnology**. [Second Edition].

3	Pearson Education Ltd, England. *Sharma, P.D.* 2009. **Ecology and Environment**. Rastogi Publications, Meerut, U.P, India.

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 methods and 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 Eco friendly 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

21UBTM603	DSC XI: BASICS OF ANIMAL CELLCULTURE	SEMESTER-VI

Course Objectives

The course aims

- To learn basic concepts about animal tissue culture.

Credits:5 **TotalHours: 50**

UNIT	CONTENTS	Hrs	CO
I	History, Scope and importance of animal cell culture, Types of animal cell culture, Animal cell culture Laboratory-Design and layout, Equipment and materials.	**10**	**CO1**
II	Types of culture media, composition, preparation and metabolic functions, Culture vessels and substrate, Serum, supplements, growth factors (EGF, PDGF, NGF, and Gap-43), Serum and protein free defined media, Aseptic practices in animal cell culture.	**10**	**CO2**
III	Basic techniques of animal cell culture *in vitro*, disaggregation of tissue and primary culture, subculture and establishment of cell line, Cloning and selection, Cell separation, Characterization, Differentiation, Transformation and immortalization, Quantification of cell culture. Scale-up and cell synchronization	**12**	**CO3**
IV	Cytotoxicity: Viability, toxicity and survival assay, Cryopreservation and cell banks, Organotypic culture and histotypic culture, Stem cells and Tissue Engineering: Scope, embryonic and adult stem cells, properties, identification, stem cells culture, techniques and their applications in modern clinical sciences. Tissue engineering - skin, bone and neuronal tissues.	**08**	**CO4**
V	Gametogenesis- Spermatogenesis and Oogenesis, Mechanism of fertilization, *In vitro* fertilization (IVF), Embryo transfer and test tube babies. Transgenic Animals: Production of fish, cattle, pig and chicken.	**10**	**CO5**

Text Book

1	*Brown,T.A.*2010.**GeneticloningandDNAanalysisanIntroduction.**[Sixth Edition].WileyBlackwellPublication,UK.

ReferenceBooks	
1	*Freshney, R.I.*, 2005. **Culture of animal cells: A Manual of Basic Technique**. [5th Edition]. John Wiley and Sons, New Jersey.
2	*John R.W. Masters*., 2000. **Animal cell culture**. 3rd Edition, Oxford University Press.
3	*Nigel Jenkins,* 2005. **Animal cell Biotechnology - Methods and Protocols**. Humana press.
4	*Florence PR*. 2006. **Animal Biotechnology.** Dominant Publishers and Distributors, Delhi.
5	*Sandy Primrose, Richard Twyman and Bob Old,* 2001. **Principles of Gene Manipulation**. [Sixth Edition]. Blackwell Science Ltd.

COURSEOUTCOMES(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

21UBTEL601	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	Medical Biotechnology- Need and Scope, Genetic disease and its classification, Molecular basis of single gene disorder, lysosomal storage disease, single gene disorder with non classical patterns of inheritance-mutation in mitochondrial genes, trinucleotide repeat expansion disorder.	08	CO1
II	DNA in disease diagnosis and medical forensics – Detecting infectious disease: detection and identification of microorganisms – sample preparation, bacterial targets of molecular based tests. Antimicrobial agents, Molecular epidemiology, virus – nucleic acid blotting technique for virus detection. Molecular detecting of inherited disease – Molecular diagnosis of single gene disorders i) Factor V ii) Cystic fibrosis.	08	CO2
III	Molecular oncology: Classification of neoplasms, molecular basis of cancer, Analytical targets for molecular testing, Gene rearrangements in Leukemia and lymphoma. DNA based tissue typing: HLA polymorphism.	08	CO3
IV	Pharmaceutical products from recombinant DNA technology. Human protein replacements – Insulin and Human growth hormone. Therapeutic agents – tissue plasminogen activator and interferons. Recombinant vaccines – Subunit vaccine, attenuated recombinant vaccine and vector recombinant vaccine.	08	CO4
V	Stem Cells therapy and tissue engineering strategies in regenerative medicine – Introduction, Basic component of tissue engineering –Native cells, embryonic stem cells, placental and amniotic fluid stem cells. Tissue engineeringforspecifictissuesandorgan	08	CO5

Text Book	
1	*Lela Buckingham* and *Maribeth L. Flaws.* 2007. **Molecular diagnostics-Fundamentals, methods and clinical applications.** FA Davis Company. Philadelphia.
ReferenceBooks	
1	*Jean-Louis Sersa.* 2002. **Diagnostic techniques in genetics**. John wiley and sons, Ltd.
2	*Danny L. Wiedbrauk* and *Daniel H. Farka.*, 1995. **Molecular Methods for virus detection**. Academic press.
3	*Brown.T.A*. 2005. **Genomes.** [Third Edition]. New York : Garland Science Pub.
4	*Primrose ,S.B.* and *Twyman,R.M*. 2006. **Principles of gene manipulation and genomics**. [Seventh Edition]. Blackwell Publication.
5	*Sathyanarayana, U*. 2009. **Biotechnology**. Books and Allied Private Ltd, Kolkatta.

COURSEOUTCOMES(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

21UBTEL601	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	Constituents of food and dietary sources of food – Carbohydrates, Lipids, Proteins, Water, Vitamins and Minerals. Intrinsic and extrinsic factors of food that affect microbial growth.	08	CO1
II	Role of microbes in food industry – Production of culture for food fermentation, Food fermentation- Bread, fermented vegetables, pickles, cheese, Soy Sauce, Idli	08	CO2
III	Principles and methods of food preservation: Asepsis removal, Anaerobic conditions, Preservation by temperature, evaporation and drying, food additives, radiation, Pasteurization.	08	CO3
IV	Food microbiology: Role of microbes in food spoilage, Food Borne disease, Microbial toxins. Detection of microbes in food sample.	08	CO4
V	Food Safety, Quality and Regulatory issues: Definition of food safety, Characterization of food hazards – Physical, chemical and biological. Food aduit.	08	CO5

Text Book

1 *Frazier, W.S. and Weshoff, D.C.,* 1988. **Food Microbiology**. [Fourth Edition]. McGraw Hill Book Co., New York.

2 *Toledo, R.T.,* 2000. **Fundamentals of Food Processing.** [Third Edition]. AVI Publishing Company, USA.

ReferenceBooks

1 *Khetarpaul, Neela,* 2006. ***Food Microbiolgy,*** Daya Publishing.

2 *Singh,R.Paul and D.R.Heldman.* 2009. **Introduction to Food Engineering.** [Fourth Edition] Scademic Press.

COURSEOUTCOMES(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

H-High;M-Medium;L-Low

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

21UBTMP601	DSC PRACTICAL-VI	SEMESTER-VI

Course Objectives:

The Courseaims

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

Credits:3 **TotalHours:42**

S.No	EXPERIMENT	Hrs	CO
1.	Isolation of plasmid DNA	**03**	**CO1**
2.	Restriction Digestion	**03**	
3.	Ligationof digested DNA	**03**	
4.	Blotting of DNA fromagarosegel	**03**	
5.	Bacterial Transformation a. CompetentCellpreparation b. TransformationofpUCVectorintoacompetentcell.	**03**	**CO2**
6.	Polymeras eChain Reaction (DemonstrationandHandson programming)	**03**	**CO3**
7.	Preparationof medium for plant tissue culture technology	**03**	**CO4**
8.	Sterilization of explants and Callus induction	**03**	
9.	Micropropagation	**03**	
10.	Media preparation fo AnimalCellCulture	**03**	**CO5**
11.	Primary culture of Chickembryofi broblast	**03**	
12.	Determination of viability of cells using Trypanbluestain	**03**	
13.	Introduction to ALCOA Documentation Practice	**03**	

ReferenceBooks

1	*Joseph Sambrook and David W. Russell*,2001. **Molecular cloning– A laboratory manual Volume1to3**.[ThirdEdition].ColdSpringHarbor LaboratoryPress,NewYork.
2	Aneja, K.R. 2003. **Experiments in Microbiology, Plant pathology andBiotechnology.**[FourthEdition].Newageinternational.
3	*Cappucino, J.G and Sherman, N.* 2012. **Microbiology–Alaboratory manual.**[SeventhEdition].PearsonEducationInc.
4	*Freshney, R.I.,* 2005. **Culture of Animal Cells: A Manual of Basic Technique.**[FifthEdition].JohnWileyandSons,NewJersey.

COURSEOUTCOMES(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.

21UBTSB601	**SBC IV:BASICSOF RESEARCH (100 % INTERNALEVALUATION)**	**SEMESTER-VI**

CourseObjectives:

The Course aims

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

Credits:2 **TotalHours: 25**

UNIT	CONTENTS	Hrs	CO
I	Research– Planning and Classification, Components of research report, Essential steps in research.	**05**	**CO1**
II	Problem Identification & Formulation, Research Question, Investigation Question, Measurement Issues, Hypothesis- Qualities of a good Hypothesis, Null Hypothesis & Alternative Hypothesis.	**05**	**CO2**
III	Literature collection, Literature citation, Different Systems for citing reference- Name, yearsystems.	**05**	**CO3**
IV	Journals–StandardofResearchjournals–impactfactors–citationindex,searchscientificinformation–Google, pubmed–Scientificinformation.	**05**	**CO4**
V	ComponentofResearchreport-Report,Table,Figures, FormatofThesis.	**05**	**CO5**

ReferenceBook

1 *Gurumani,N.* 2006. **Research Methodology**.MJPPublishers.

COURSEOUTCOMES(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– impactfactors,and citation index.
CO5	Elucidate about thesis Report, Table,Figures, Format of Thesis.

21ULS601	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

TotalHours: 15

UNIT	CONTENTS	Hrs	CO
I	Basic Grammar-Englishusage-ReadingandWriting (Level-2) Direct and Indirect Speech	3	CO1
II	Spotting Errors–Parts of speech and Punctutation	3	CO2
III	Role Play–Justa Minute (JAM) -GroupDiscussion	3	CO3
IV	Interview Presentation (Self-Introduction)- Critical thinking, problem solving.	3	CO4
V	Dress Codeand Body Language- Leadership	3	CO5

Text Books

1	*BasicEnglishGrammarforEnglish-Book1,Learners,AnneSeaton,Y.H.Mew,Saddlepoint Publishers(E-Copy)*
2	*BasicEnglishSyntaxwithExercises,MarkNewson(E-Copy)*

ReferenceBook

1	*ObjectiveGeneralEnglish,S.Chand,Dr.R.S.Agarwal*

COURSEOUTCOMES(CO)

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

CO1	Recallthebasicgrammarinlanguage
CO2	Concentrateonsentencecorrection
CO3	Recognizethedifferencesamongfacts,opinionsandjudgements
CO4	Developtheirpersonalskillsthroughinterview
CO5	Appropriatelyapplytheirlearningandleadershipstyleandstrength

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

21UBTNM301	**SEC I: MEDICINAL HERBS**	**SEMESTER-III**

CourseObjectives:

TheCourseaims

- Toapplythebasicknowledgeofcommonmedicinalplants.

Credits:2 **TotalHours:30**

UNIT	CONTENTS	Hrs	CO
I	Introduction to Medicinal Plants; Traditional medicinal systems-AYUSH.	**06**	**CO1**
II	Herbs-*Aloevera*, Green chirayta , Gulfleafflower, Tridax daisy, *Vinca*, GreatBasil, Tulsi, Mint & Ajwain.	**06**	**CO2**
III	**Climbing plants:** Betel, Ivygourd, Butter fly pea,Veldtgrape, Climbing Brinjal, Indravalli, pepper &Madraspeapumpkin.	**06**	**CO3**
IV	**Shrubs:** Indian mallow, Shikakai, Desert cotton, Rose mallow, Turkey berry & Copper leaf.	**06**	**CO4**
V	Cashcrops- Sugarcane, Tobacco ,Cotton, Jute ,rice, wheat And corn.	**06**	**CO5**

ReferenceBook

1 *AryaVaidyaSala.,*1994. **IndianMedicinalPlants**.VolII.UniversitiesPress.

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	Describ eabout Climbing plants.
CO4	Explicate the importance of Shrubs.
CO5	Explain about cash crops.

21UBTNM401	SEC II : FUNDAMENTALS OF BIO TECHNOLOGY	SEMESTER-IV

Course Objectives:

The Course aims

- To understand the basics about Biotechnology and its day to day application indailylife.

Credits:2 **TotalHours: 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, usesand 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 andcons–Bt cotton and Bt brinjal, Golden rice, *Aloevera*gel, SCP Spirulina, Spirulinapickle , mushroom cultivation, A zolla, Composting, and Biofertilizer.	**06**	**CO4**
V	Proposal to bank for loan, MSME, Quality control- FSSAI, AGMARK, and ISO.	**06**	**CO5**

Referencebook

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

2 *GlickR.Bernard*and*PasternakJJack.*2007.**Molecular Biotechnology**.[Third Edition].ASMpress, 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.

21UBTAC301	ADD ON COURSE I: MEDICAL TRANSCRIPTION	SEMESTER-III

Course Objectives:

The Course aims

- To study about human Anatomy and physiology and its medical terminology
- To understand the concept of process of medical transcription.

TotalHours: 25

UNIT	CONTENTS	Hrs	CO
I	Introduction: Basics of medical transcription, medical transcription types, process of medical transcription, responsibilities of medical transcriptionist, advantages and Disadvantages of medical transcription.	**05**	**CO1**
II	Anatomy and physiology: Tissues and Organ Systems, Integumentary System, Musculoskeletal System, Neurological System, Cardiovascular System, Reproductive System	**05**	**CO2**
III	Medical Terminology: Definition and Origin of Medical Terms, Components of Medical Terms, Prefixes, Suffixes, Roots and Combining forms, External Anatomy and Internal Anatomy.	**05**	**CO3**
IV	EmdatIn Scribe software: Transcription Technology, Medical Reports, Medical Transcriptionist's Tool Box, E-mail and Security, Medical Transcription Report Editing,	**05**	**CO4**
V	International Classificationof Diseases(ICD-10) and Surgical Procedures (ICD-9CM), CPT, HCPCS, Ethics and confidentiality /HIPAAlaws.	**05**	**CO5**

Referencebook

1 *MarcyOtisDiehl*.2011.**MedicalTranscription:Techniques and Procedures**,[SeventhEdition],Kindle Edition.

2 *AliceG.Ettinger, BalancheEttinger*,2009. **Medical Transcription: Techniques, Technologies, and Editing Skills** [third revised edition] EMC Paradigm, US.

3 *ArnouldTaylorW.E.*1988. **A Textbook of Anatomy and Physiology**[secondedition]NelsonThornesLtd.

4 *FredericH.Martini,JudiL.Nath,EdwinF.Bartholomew*.2017.**Fundamentals of Anatomy & Physiology** [11thEdition].

COURSEOUTCOMES(CO)

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

CO1	Gainknowledgeaboutthe typesandprocessofmedicaltranscription.
CO2	Explainaboutanatomyandphysiology.
CO3	Describeaboutmedicalterminology
CO4	ExplainaboutEmdatInScribesoftware.
CO5	Describeaboutvarioussurgicalproceduresandethics.

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

21UBTAC302	ADD ON COURSE I: ELECTRO PHORESIS	SEMESTER-III

Course Objectives:

The Course aims

- To study basics of electrophoresis technique.
- To understand the different types of electrophoresis technique and its applications.

TotalHours: 25

UNIT	CONTENTS	Hrs	CO
I	Electrophoresis: Origin, Introduction, Principle of electrophoresis, Requirement of Electrophoresis–Electrophoretic mobility, EEO, Electrical field strength, Friction, Netcharge, convertion of AC to DC, Voltage, Ammeter, and Electrode for electrophoresis, Cathode reaction, Anode reaction. Buffer-bufferingaction, Buffering capacity and iso electricpoint.	05	CO1
II	Zone electrophoresis: Introduction, Principle, Advantage. Media for zone electrophoresis–Agar, Agarose, Starch, Celluloseacetate. Polyacrylamide - salient features, Cross-linking agent, Polymerization of acrylamide–chemical & photochemical polymerization, Optimum temperature for gelation, evacuation, Chaotro picagents, Poresize, Gelrods, Gelslabs.	05	CO2
III	Ferguson plot – Optimal gel concentration, PAGE, SDS. Gradientgels–Introduction, Advantages, Types–Linear & Concavegradient. Principle, Preparationofre agent, Experimental procedure for Disc electrophoresis, Slabg elelectrophoresis, Agarose gel electrophoresis, Starch gel electrophoresis, Cellulose acetate electrophoresis, 2-Dgelelectrophoresis, SDS-PAGE, Common buffers ystem for separating native proteins, Pulse field Electro phoresis,Iso electri cfocusing, Capillary electrophoresis.	05	CO3
IV	Apparatus forzone electrophoresis: Paper electrophoresis apparatus–Hanging strip inverted V type, Horizontals trip type, High voltage paper electrophoresis apparatus, Starch gelapparatus–Agargel electrophoresis, Agaroseg elelectrophoresis, Submarinegel electrophoresis, Preparativeel ectrophoresis, Pulse field gelelectro phoresis, Field inversion Gel electrophoresis,Types of slab gel apparatus, Sequencing	05	CO4

	apparatus–Manual method for DNA sequencing, Automated DNA sequencer.		
V	Marker dye – Bromophenol Blue, Xylene cyanol FF, Analysis ofBands: Directphotometric scanning, staining methods, Radio labelling & auto radio graphy, Enzyme assay, Immunological methods, Directextraction, Blotting and Detection.	**05**	**CO5**
Referencebook			
1	Anbalagan,K.1999.*AnintroductiontoElectrophoresis*.TheElectrophoresis instituteBiotech-Yercaud.		

COURSE OUTCOMES (CO)

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

CO1	Gain knowledge about the principles of electrophoresis.
CO2	Explain about the various types medium used in zone electrophoresis.
CO3	Describe about the types of electrophoresis.
CO4	Explain about the types of apparatu sused in electrophoresis.
CO5	Describe about the types of dye sused in electrophoresis and also can analyse the bands.

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	M	H	H	H	H	M
CO4	H	H	H	H	H	M	H	M	H	M
CO5	H	H	H	H	H	M	H	M	M	M

H-High;M-Medium;L-Low

21UBTAC401	ADD ON COURSE II: CORPORATE BIOTECHNOLOGY	SEMESTER–IV

Course Objectives:

The Course aims

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

TotalHours:25

UNIT	CONTENTS	Hrs	CO
I	Corporate Biotechnology-Introduction, Applications. Intellectual property rights-Copyrights, Patent, Trade mark and Legal aspects. Preparation of Project for loans through Government and banking agencies.	**05**	**CO1**
II	Genetically modified crops: Transgenic plants-viral resistance plants,pest resistance plants, saline tolerance plants, Btcotton, Bt brinjal, goldenrice, Flavr Savr^{R}	**05**	**CO2**
III	Animal breeding - Care and maintenance of laboratory animals-mice, rabbit, monkey, guineapig. Advantages of Transgenic animals. Laboratory animal's ethics–Anesthesia. Ethical guide lines for use of Animal sinscientific Research–in-vitro System store place animals.	**05**	**CO3**
IV	Aquaculture-Transgenic fishes, Silvi culture-Principles and establishment of silvi culture system. Arbori culture-Introduction, Applications. Recent and traditional advances in Various types of culture practices.	**05**	**CO4**
V	Biofertilizers and Biopesticides – scale up, quality control and marketing. Single cell proteins – spirulina production. Organic farming-Certification procedures, organic certification, annual Inspections, feeding the world 21st century, applications.	**05**	**CO5**

Text Book	
1	*G.RangaswamiandD.J.Bagyaraj,*1998.**AgriculturalMicrobiology**.[Second Edition].Prentice, Hall ofIndiaPvt.Ltd., NewDelhi.
ReferenceBooks	
1	*Purohit, S.S.* 2009. **Biotechnology**: **Fundamentals and Applications**.[FourthEdition].
2	*KeshavTrehan*,1997. **Biotechnology .**New age International Pvt.Ltd. Publication.
3	*Freshney, R.I.* 2005. **Culture of Animal cells***:* A manual of basic technique. [FifthEdition].Johnwiley and Sons, NewJersey.

COURSEOUTCOMES(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 aqua culture and arboriculture.
CO5	Produce biofertilizers and bio pesticides.

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

MAPPING

H-High;M-Medium;L-Low

21UBTAC402	ADD ON COURSE II: ANIMAL PHYSIOLOGY	SEMESTER–IV

Course Objectives:

The Course aims

- To acquire the knowledge on Animal physiology.

TotalHours:25

UNIT	CONTENTS	Hrs	CO
I	Animal physiology-Introduction, History, Biological systems-Scope and Importance.	**05**	**CO1**
II	Digestive system: Digestive organs–Digestive enzymes–Ingestion–Digestion– Absorption–Defecation. Disorders: Pepticulcers, Gastro enteritis.	**05**	**CO2**
III	Respiratory system: Organs of respiratory system–Gaseous exchange – Transport of O2 and CO2 - Gas diffusion and cellular respiration. Disorders: Asthma, Chronic Obstructive Pulmonary Disease (COPD).	**05**	**CO3**
IV	Nervous system: Neurons – Neurotransmitters, Nerve impulse, Central nervous system & Peripheral nervous system. Disorders: Alzheimer'sdisease, Parkinson'sdisease.	**05**	**CO4**
V	Integumentory system: Organs of integumentorysystem – Protection–Sensoryfunction–Thermoregulation–VitDsynthesis. Disorders: Eczema, Psoriasis.	**05**	**CO5**

ReferenceBooks

1 *Chandicharanchatterjee.* 1994. **Human Physiology**.Specialreprintedition.

2 *VermaP.S.*and*AgarwalV.K.*1979.**Animal Physiology.**Chand&companyLtd, NewDelhi.

3 *Saradasubrahmanyam*.1989. **Aconcise textbook of Physiology.** Reprint,OrientlongmanLtd, Chennai.

COURSE OUTCOMES (CO)

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

CO1	Explain about the basics of animal physiology.
CO2	Demonstrate about digestive system.
CO3	Describe about respiratory system.
CO4	Explain about nervous system.
CO5	Depict about integumentory system.

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	H	H	H	H	H	H
CO3	H	H	H	H	H	H	H	H	H	H
CO4	H	H	H	H	H	M	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H	M

H-High;M-Medium;L-Low

21UBTAL401	ADVANCED LEARNERS COURSE I: DNA SCIENCE AND DRUG DISCOVERY	SEMESTER-IV

Course Objectives:

The Courseaims

- To acquire the knowledge about basics of DNA and its uses modern research.
- To apply the knowledge of drug discovery in developing novel drugs.

UNIT	CONTENTS	CO
I	History and discovery of DNA. Properties of DNA, DNA double helix structure and features, chemical modifications Replication - types, Proof of DNA as genetic material.	**CO1**
II	Squeezing in to the chromosomes, organization, types of DNA Cytoplasmic DNA, Chloroplast DNA, Mitochondrial DNA. Biological functions, Interactions with proteins.	**CO2**
III	DNA technology-DNA isolation, DNA profiling, Genetic engineering, Restriction enzymes, Nucleic acid electrophoresis, DNA polymorphism.	**CO3**
IV	Drug Discovery: History, Definition, and Scope of drug discovery. Screening and designing of drugs. Traditional and Alternative System of Medicine	**CO4**
V	Classification of Crude Drugs, Drug containing secondary metabolites. Plant derived, microbial metabolites, marine invertebrates. Methods of Drug Evaluation; chemical Characterization .Screening,s tructural elucidation.	**CO5**

Referencebooks

1. *Tarek K.*2017.**The DNA molecule Structure and Features**.CarioUniversity press.
2. *JamesD.Watson.*1967.**The Double Helix-Personal Account of the Discovery of the Structure of DNA**. HarvardUniversitypress.Cambridge.
3. *KokateC.K,Purohit A.P,GokhaleS.B.* 2008.**Pharmacognosy**.NiraliPrakashan publishers,PuneIndia.
4. *JamesSwarbrick.* 2003.**Drugs and the Pharmaceutical Sciences**, Marcel Dekkerpublishers,France.

COURSEOUTCOMES(CO)

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

CO1	Explain about the structure, properties and replication of DNA.
CO2	Describe about the types of DNA and its functions.
CO3	Isolate and amplify the DNA.
CO4	Explain about screening and designing of drugs.
CO5	Illustrate about secondary metabolites and drug evaluation.

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

21UBTAL402	ADVANCED LEARNERS COURSEI: STEM CELL BIOLOGY	SEMESTER–IV

Course Objectives:

The Course aims

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

UNIT	CONTENTS	CO
I	Stem Cells–introduction, properties, Important sources of stemcells, Regulation of stem cells self-renewal and molecular markers, Cellular and molecular basis of stem cell differentiation.	CO1
II	*Invitro* fertilization, Human embryonic stemcells(hES)-Isolation, culturing, identification and characterization of hEScells, Cloning And maintenance of hES; Applications of ES cells.	CO2
III	Adult stem cells-types-Hematopoietic stemcells, Bone marro wstromal stem cells, Liver stem cells, Skeletal muscle stem cells, Bone marrow derived stem cell sand its applications, identification and Differentiation of adults temcells.	CO3
IV	Therapeutic need for stem cells, Stem cells and progenitors for drugtesting, Genetically engineered stem cells for drug discovery & genetherapy,Common signaling pathways in cancer and Path ways involved in cancer & stem cell renewal, Pathways involved instem Cell differentiation.	CO4
V	Disease and disorders requiring stem cells, Clinical trials, Stem celltherapy in neurodegenerative disorders, cardiovascular disorders,metabolic/diabetic/systemicdisorders, hematopoietic & autoimmune diseases, organ disorders, reproductive failures, Stem Cell preservation in cancer patients.	CO5

ReferenceBook

1	*KaushikD.Deb, SatishM.Totey.2009.* **Stem cells :Basics and Applications.**Tata MCGrawHillEducationPrivateLimited.

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 stemcells.
CO3	Describe about the types of stem cell sand its applications.
CO4	Explain about the rapeutic need for stemcells.
CO5	Illustrate about stemcell therapy and preservation of stemcells.

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

21UBTAL501	ADVANCED LEARNER SCOURSE II: GENESAND HUMANS	SEMESTER-V

Course Objectives:

The Course aims

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

UNIT	CONTENTS	CO
I	Introductiontogenes: Historyofgenes–characteristics, formation and structure of genes. Genes and chromosomes. RoleofgenesinHuman body anditsfunctions.	**CO1**
II	Human cyto-genetics: Human karyotype, Banding techniques, classification, use of HCG in medica lscience. Chromosomal abnormalities. Genetics of chromosomal inversions and translocations, human traits. Genomic position and effects of Gene expression.	**CO2**
III	Genetic inheritance: Introduction to genetic inheritance-types: Single gene Inheritance: Cystic fibrosis, Sickle Cell Anemia, Multifactorial Inheritance: Heartdisease, Alzheimer's disease. Chromosomal abnormalities: Klinefelter syndrom. Mitochondrial inheritance: Leber's hereditary opticatrophy, MERRF.	**CO3**
IV	Genetic testing and Diagnosis: An introduction to genetic testing-gene tracking-clinical tests-personalized medicine- types and methods of diagnosis-pre natal diagnosis of genetic Disorders.	**CO4**
V	Control of Human genetic diseases: Guide lines by WHO, Prevention and control of genetic diseases. Gene therapy: Somatic gene therapy, Germlinegene therapy. Human Genome Project an Introduction- Goals of HGP.	**CO5**

Text Book

1	*Mahabal Ram,*2010. **Fundamentals of cytogenetics and genetics**.PHI learning Pvt,NewDelhi.

ReferenceBook

1	*TomStrachan*and*AndrewRead*,2007.**Human molecular genetics** [Third Edition].BIO SscientificPublishersLtdOxford.

COURSE OUTCOMES (CO)

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

CO1	Explain the Structure and Function of genes.
CO2	Describe human karyotype, Banding techniques and Chromosomal Abnormalities.
CO3	Illustrate the genetic inheritance and chromo somal abnormalities
CO4	Demonstrate genetic testing and diagnosis
CO5	Explain the control of human genetic disease

MAPPING

H-High; M-Medium;L-Low

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

21UBTAL502	ADVANCED LEARNERS COURSE II: OMICS-SCIENCE	SEMESTER-V

Course Objectives:

The Course aims

- To introduce genome archi tecture, its functions and proteome analysis.

UNIT	CONTENTS	CO
I	**Genomics** Genomics – Definition and its types, Structural organization of Prokaryotic genome, Eukaryotic genome – Nuclear and organellar genome. Deep sequencing of DNA, NGS, Epigenetics, HGP, ELSI.	CO1
II	**Trans criptomics** Introduction to Trans criptomics, Types and function of Trans criptome–rRNA, tRNA, mRNA, siRNA, miRNA, RNAi, Catalytic RNA, RNA editing, RISC. Microarrays, Sequencing RNA, Transcriptomics and disorders, Impact of Transcriptomics in pharma ceutical research.	CO2
III	**Proteomics** Organization of protein structure, Domains, Fold, Motif, PSSM, Classification of proteins, Ramachandran plot, Protein sequencing, Protein microarray, Mass Spectro metry for Protein and peptide analysis: MALDI-TOF Analyzers.	CO3
IV	**Proteomics** Protein targeting, Protein- protein interaction, Protein-DNA interaction, Interaction with other molecules like lipids, carbohydrates, meta lIons. Phage display,Protein profiling, Molecular Docking.	CO4
V	**Meta bolomics** Meta bolic profiling and fingerprinting, Metabolic pathway Analysis and metabolic networks, Single cell meta bolomics.	CO5

	REFERENCEBOOKS	
1	*Brown.T.A.*2007. **Genomes**. [ThirdEdition]. Garland SciencePub., New **York.**	
2	*Primrose,S.B. and Twyman,R.M.*2006. **Principles of gene manipulation Andgenomics** [Seventh Edition].BlackwellPublication.	
3	Lehninger,**Principles of Biochemistry** [Fifthedition].W.H.Freeman **And Company, NewYork**	
4	David.E.Sadava.**Cell Biology: Organelle Structureand Function**. Jones & Bartlett publishers.	

COURSE OUTCOMES (CO)

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

CO1	Demonstrate the structural organization of the genome
CO2	Extend their knowledge in the field of Transcriptomics.
CO3	Analyze the structure of the proteins
CO4	Descri be the protein function
CO5	Apply the skills in Meta bolomics.

MAPPING

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

H-High;M-Medium;L-Low

GUIDELINES

1. SUBMISSION OF RECORD NOTE BOOKS:

Candidates appearing for Practical Examinations shall submit Bonafide Record Note Books prescribed for Practical Examinations, other wise 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 witha passing minimum of 30 marks in External out of 75.

***InternalMarksDistribution** [CA-TotalMarks:25]*

Attendance	: 5 Marks
Assignment	: 5
MarksInternalExaminations	: 15
Marks**Total**	**:25Marks**

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

The candidate shall be declared to have passed the Examination, if the candidate secures notless than 40marks out of 100 in the Comprehensive Examination (InternalEvaluation only).

***Internal Marks Distribution** [CA-TotalMarks: 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 securenot less than 40 marks put together out of 100 in the Comprehensive Examination ineachPractical paper withapassing minimumof 24marksinExternaloutof 60.

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

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

3. INTERNSHIP

- The Internship shall be carried out by students individually during the VI semester and by attending a minimum of 15 days training at any institute.
- The Student has to attend 2 reviews before completing his/her Internshipand it will be evaluated by an internal examiner.
- The assessment of student performance in a semester is calculated by Continuous Internal Assessment (CA) for 40 marks and External Assessment for 60 marks.
- Up on completion of the internship work the candidate shall be required to appear for a Viva-Voce conductedby 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 Internship 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	:	30 Marks
2.	Review presentation	:	20 Marks
3.	Internship report	:	30 Marks
4.	Viva Voce	:	20 Marks
	Total	**:**	**100 Marks**

4. CAREER COMPETENCY SKILLS

SemesterIII and VI-Viva voce

- The student has to come inproper dress code for theViva 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 IVand 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 PATTERNANDMARK DISTRIBUTION

(i)THEORY **(For75marks)**

Question Paper Pattern and Mark Distribution

1. **PART– A (10 x 2 =20 Marks)**
   Answer ALL questions
   Two questions from eachUNIT

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-TotalMarks: 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