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 task in biotechnology and to prepare for a career of self employment through environmental friendly biotechnology enterprises.
- To innovate and explore novel solution for the existing problems in the fields of environment, agriculture, animal biotechnology and health sector.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 1: To become competent biotechnologist suitable to industry.
PEO 2: To develop professionally through life long learning, higher education in their area of interest.
PEO 3: To cater to the needs of the industry and society so as to contribute for the development of the country.

PROGRAMME OUTCOMES (PO)

After completion of the programme, the graduates will be able to
PO 1: Become knowledgeable in the subject of Biotechnology and apply the principles of the same to the needs of the society.
PO 2: Gain analytical skills in the field of Biotechnology.
PO 3: Determine and appreciate professional ethics, community living and Nation building initiatives.
PO 4: Justify societal, health, legal, environmental and biosafety related issues and understand his/her responsibilities.
PO 5: Analyze, evaluate and invent new process and products in the field of Biotechnology.

PROGRAMME SPECIFIC OUTCOMES (PSO)

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

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

PSO 2: Apply the knowledge of Biotechnology in the domain of Environment, Agriculture, Health care Bioindustry or Molecular mechanics and interdisciplinary domain.

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 the all life science related domain.

PSO 5: Synthesis, Compare and evaluate the mechanism involved and employed in Life Science domain.

REGULATIONS

ELIGIBILITY

A Candidate who has passed Higher Secondary Examination in any one of the biological sciences (Botany/Zoology, Biology). (Academic/Vocational stream- Agri, Home Science, Poultry) under higher secondary board of examination, Tamil Nadu or as per norms set by the Government of Tamil Nadu or an examination accepted as Equivalent thereto by the Syndicate subject to such conditions as may be prescribed thereto are permitted to appear and qualify for the B.Sc Biotechnology degree examination of this University after a course of study of three academic years.

DURATION OF THE PROGRAMME

The course shall extend over a period of three years comprising of six semesters with two semesters in one academic year. There shall not be less than 90 working days for each semester. Examination shall be conducted at the end of every semester for the respective subjects.

MAXIMUM DURATION FOR THE COMPLETION OF THE UG PROGRAMME

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

SCHEME OF EXAMINATION

Subject code	Subject	Hours of instruction	Exam duration	Maximum marks			Credit points
				CA	CE	Total	
First semester							
Part I							
18UTALA101/ 18UHILA101/ 18UFRLA101	Tamil I/Hindi I/ French I	5	3	25	75	100	3
Part II							
18UENLA101	Foundation English I	5	3	25	75	100	3
Part III							
18UBTM101	Core I: Concepts of Cell Biology	6	3	25	75	100	5
18UBTMP101	Core Practical – I	4	3	40	60	100	2
18UCSBTA101	Allied I: Computer fundamentals and office automation	5	3	25	75	100	2
18UCSBTAP101	Allied Practical I: Office automation techniques	3	3	40	60	100	2
Part IV							
18UVE101	Value Education I: Yoga	2	3	25	75	100	2
	Total	**30**				**700**	**19**
Second semester							
Part I							
18UTALA201/ 18UHILA201/ 18UFRLA201	Tamil II/Hindi II/ French II	5	3	25	75	100	3

Part II							
18UENLA201	Foundation English II	5	3	25	75	100	3
Part III							
18UBTM201	Core II : Principles of Genetics	6	3	25	75	100	5
18UBTMP201	Core Practical – II	5	6	40	60	100	2
18UCHBTA201	Allied II: Chemistry	4	3	25	75	100	2
18UCHBTAP201	Allied Practical II: Chemistry	3	3	40	60	100	2
Part IV							
18UVE201	Value Education II: Environmental Studies	2	3	25	75	100	2
	Total	**30**				**700**	**19**
Third Semester							
Part I							
18UTALA301/ 18UHILA301/ 18UFRLA301	Tamil III/Hindi III/ French III	5	3	25	75	100	3
Part II							
18UENLA301	Foundation English III	5	3	25	75	100	3
Part III							
18UBTM301	Core III: Microbiology	5	3	25	75	100	5
18UBTMP301	Core Practical – III	3	6	40	60	100	2
18UBCBTA301	Allied III: Biochemistry (Biomolecules)	3	3	25	75	100	2
18UBCBTAP301	Allied Practical III: Biochemistry (Biomolecules)	3	3	40	60	100	2
Part IV							
18UBTSB301	SBC I: Calculations for Biologist (100% Internal Evaluation)	2	3	100	-	100	2
	NMEC -I	2	3	25	75	100	2

Non Credit							
18ULS301	Career competency Skills I	1	-	-	-	-	-
	Add on course	1					
	Total	**30**				**800**	**21**
Fourth Semester							
Part I							
18UTALA401/ 18UHILA401/ 18UFRLA401	Tamil IV/ Hindi IV/ French IV	5	3	25	75	100	3
Part II							
18UENLA401	Foundation English IV	5	3	25	75	100	3
Part III							
18UBTM401	Core IV: Biophysics and Bioinstrumentation	5	3	25	75	100	5
18UBTMP401	Core Practical - IV	3	6	40	60	100	3
18UMABTA401	Allied IV: Biostatistics	4	3	25	75	100	2
18UMABTAP401	Allied Practical IV: Statistics (Using MS-Excel)	2	3	40	60	100	2
Part IV							
18UBTSB401	SBC II: Biosafety and Bioethics (100% Internal Evaluation)	2	3	100	-	100	2
	NMEC -II	2	3	25	75	100	2
Non Credit							
18ULS401	Career competency Skills II	1	-	-	-	-	-
	Add on course	1					
	Total	**30**				**800**	**22**
Fifth Semester							
Part III							
18UBTM501	Core V: Molecular Biology	5	3	25	75	100	5
18UBTM502	Core VI: Immunology	5	3	25	75	100	5
18UBTM503	Core VII: Industrial Biotechnology	5	3	25	75	100	5

18UBTM504	Core VIII: Plant tissue culture	5	3	25	75	100	5
	Elective I	4	3	25	75	100	4
18UBTMP501	Core Practical -V	3	6	40	60	100	3
Part IV							
18UBTSB501	SBC III: IPR for Life science (100% Internal Evaluation)	2	3	100	-	100	2
18ULS501	Career competency skills III	1	-	-	-	-	-
Part V							
18UBTE501	Extension Activity	-	-	-	-	-	2
	Total	**30**				**700**	**31**
Sixth Semester							
Part III							
18UBTM601	Core IX: Recombinant DNA Technology	5	3	25	75	100	5
18UBTM602	Core X : Environmental Biotechnology	5	3	25	75	100	5
18UBTM603	Core XI: Basics of Animal Cell culture	5	3	25	75	100	5
	Elective II	4	3	25	75	100	4
18UBTMP601	Core Practical-VI	3	6	40	60	100	3
18UBTPR601	Internship	5	-	40	60	100	4
Part IV							
18UBTSB601	SBC IV: Basics of Research	2	3	25	75	100	2
18ULS601	Career competency Skills IV	1	-	-	-	-	-
	Total	**30**				**700**	**28**
				Grand Total		**4400**	**140**

ELECTIVE 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	Elective	Subject code	Subject
1.	V	Elective I	18UBTEL501	Nanobiotechnology
			18UBTEL502	Bioinformatics
2.	VI	Elective II	18UBTEL601	Medical Biotechnology
			18UBTEL602	Food Biotechnology

Advanced Learners courses: (Career Oriented Courses)

The Department offers the following subjects during V semester as ALC. The students can opt any one subject in the respective semester.

S.No	Semester	Course	Subject code	Subject
1.	V	ALC	18UBTAL501	Genes and Humans
			18UBTAL502	Omics- Science

TOTAL CREDIT DISTRIBUTION

S.No	Component	Total Number of Subjects	Total marks	Credits
1.	PART I: Language	4	400	12
2.	PART II: Foundation English	4	400	12
3.	PART III :Major	17 (11t+6p)	1700	70
4.	PART III :Major (Elective)	2	200	8
5.	PART III : Allied	8 (4t+4p)	800	16
6.	PART III :Major (Internship)	1	100	4
7.	PART-IV: Value Education	2	200	4
8.	PART-IV: SBC	4	400	8
9.	PART-IV: NMEC	2	200	4
10.	PART-V: Extension Activity	1	-	2
	TOTAL	**45**	**4400**	**140**

FOR COURSE COMPLETION

Student shall complete:

- Language papers (Tamil/Hindi/French and English) in I, II, III andIV semesters.
- Value Education Yoga and Environmental Studies in I and II Semester
- Non Major Elective Course in III and IV semesters.
- Skill Based Course in III, IV, V and VI semesters.
- Extension activity in V semester.
- Project work in the VI semester.

Add-on Course: (Career Oriented Courses)

Keeping tempo with the demand for career-oriented courses at the undergraduate level, apart from the regular courses, various add-on courses are in the pipeline to be introduced. Candidates pursuing Under Graduation are eligible to take up one o f the Add -on courses simultaneously with their regular course of study. At the end o f three years, the students will be provided with a Certificate in an Add-on course. It is an opportunity to students to add Credentials to their regular Degrees without affecting their regular study. All these programmes are to be conducted during the evenings between 4.00 pm and 5.30 pm.

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 course is 50 hours for each subject.

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 every subject.

Advanced Learners Course (ALC)

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

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 be eligible for appearing ALC in the 5th semester.

Non-appearance of the candidate for ALC Exam shall disqualify him/her for next ALC.

18UTALA101	**TAMIL I: கவிதைகளும் கதைகளும்**	**பருவம் - I**

இப்பாடத்திட்டத்தின் நோக்கங்களாவன:

1.தற்காலத்தமிழ் இலக்கிய வகைகளை மாணவர்களுக்குக் கற்பித்தல்.

2.காலந்தோறும் தமிழ்க் கவிதை வளர்ச்சி நிலைகளை அறிமுகப்படுத்துதல்.

3.அடிப்படைத் தமிழ் இலக்கணத்தைக் கற்பித்து அரசுப் போட்டித் தேர்வுகளுக்கு ஆயத்தப்படுத்துதல்.

Credits: 3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**மரபுக் கவிதைகள்** அ.பாரதியார் - பாரததேசம் ஆ.பாரதிதாசன் - தமிழின் இனிமை இ. நாமக்கல் கவிஞர் - கவிதை என்றால் என்ன? ஈ. முடியரசன் - நல்ல உலகமடா!	**10**	**CO1**
II	**புதுக்கவிதைகள்** அ.வைரமுத்து - ரத்ததானம் - தண்ணீர் பிச்சை ஆ.வெ.இறையன்பு - பூபாளத்திற்கொருபுல்லாங்குழல் - பனித்துளியில் பாற்கடல் இ. தீபா - மழைக்கு ஒரு மடல் - பாரதியார், வறுமை ஈ. சிற்பி - ஒரு கிராமத்து நதி–ஒரு கிராமத்து நதி	**10**	**CO2**
III	**சிறுகதைகள்** அ.அறிஞர் அண்ணா - செவ்வாழை ஆ. கிருத்திகா - உழவுமாடுகள் இ.வள்ளி.வ. - தணல் துண்டாய்...சிலதருணங்கள்	**10**	**CO3**

	ஈ.தி.ஜானகிராமன் - முள்முடி		
IV	**இலக்கியவரலாறு** அ. மரபுக்கவிதையின் தோற்றமும் வளர்ச்சியும் ஆ. புதுக்கவிதையின் தோற்றமும் வளர்ச்சியும் இ. சிறுகதையின் தோற்றமும் வளர்ச்சியும் ஈ. நாடகத்தின் தோற்றமும் வளர்ச்சியும்	**10**	**CO4**
V	**அடிப்படை இலக்கணம்** அ.முதலெழுத்துகள் மற்றும் சார்பெழுத்துகள் (நன்னூல் விதிப்படிவிளக்கம்) ஆ.வல்லினம் மிகும் மிகா இடங்கள். இ. மரபுப் பெயர்கள் - இளமைப் பெயர்கள்	**10**	**CO5**
Text Book			
1	தமிழ்த்துறை வெளியீடு, கே.எஸ்.ரங்கசாமி கலை அறிவியல் கல்லூரி(தன்னாட்சி), திருச்செங்கோடு.		

COURSE OUTCOMES (CO)

இப்பாடத்தைக் கற்பதன் வாயிலாக மாணவர்கள் பெறும் பயன்களாவன

CO1	மரபுக்கவிதைகளின் வடிவங்களை அறிதல்.
CO2	புதுக்கவிதைகளின் வடிவங்கள் மற்றும் பாடுபொருள் தன்மையை அறிதல்.
CO3	சிறுகதைகளின் உருவம், உள்ளடக்கங்களை அறிதல்
CO4	காலந்தோறும் மாறும் இலக்கிய வளர்ச்சியை அறிதல்
CO5	எழுத்துகளின் வகைகளை அறிதல்.

18UENLA101	FOUNDATION ENGLISH I	SEMESTER – I

Course Objectives:

The Course aims

- To enable the students to develop their comprehensive skill.
- To introduce the students to know about English poetry.
- To introduce the students to know about English short stories.

Credits: 3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I & II	**POETRY** William Wordsworth - The Solitary Reaper Margaret Atwood - This Is a Photograph of Me **SHORT STORY** A. J. Cronin - Two Gentlemen of Verona **GRAMMAR** Parts Of Speech Articles **COMPOSITION** Letter Writing – Formal **COMMUNICATION SKILLS** Greeting and Introducing Inviting a Person	20	CO1 & CO2
III & IV	**POETRY** Robert Frost - The Road Not Taken **SHORT STORIES** Pearl S. Buck - The Refugees C. Rajagopalachary – Tree Speaks **GRAMMAR** Kinds of Sentences	20	CO3 & CO4

	COMPOSITION Dialogue Writing **COMMUNICATION SKILLS** Seeking Permission Offering a Suggestion and Giving an Advice		
V	**SHORT STORY** R. K. Narayan - The Axe **GRAMMAR** Question Tag **COMPOSITION** Reading Comprehension **COMMUNICATION SKILLS** Persuading	**10**	**CO5**

Text Books

1	*G.Damodar, D.Venkateshwarlu, M.Narendra, M.SaratBabu, G.M.Sundaravalli.* 2009. **English For Empowerment**. Published by Orient Blackswan Private Limited. Hyderabad.
2	*M.M.Lukose*. 2010. **Images, A hand book of Stories.** Macmillan Publishers Indian Limited. Chennai.
3	*Dr.A.Shanmugakani,* M.A., Ph.d, **Prose for Communication**. Manimekala Publishing House, Madurai.
4	*SasiKumar V and Syamala V*. 2006. **Form and Function A Communicative Grammar for Colleges.** Emerald Publishers. Chennai.
5	*T.M.Farhathullah.* 2006. **Communication Skills For Undergraduates**. Publishers-RBA Publications. Chennai.

Reference Book

1	*Thomas, A.J and Martinet, A.V.* 1994. **A Practical English Grammar.** Oxford University Press. Delhi.

COURSE OUTCOMES (CO)

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

CO1	Know the different parts of genres in English
CO2	Trace the famous authors of English
CO3	Enrich grammar knowledge
CO4	Stimulate their writing skills
CO5	Deserve appreciation for their communication

18UBTM101	CORE I: CONCEPTS OF CELL BIOLOGY	SEMESTER - I

Course Objectives:

The Course aims

- 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),	**12**	**CO5**

	Stem cells – definition and types.		

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

H-High; M-Medium; L-Low

18UBTMP101	CORE PRACTICAL I: LAB IN CELL BIOLOGY	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.

18UCSBTA101	ALLIED 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 Option-	10	CO3

	Printing your Document-Editing the Document-Editing Tools-AutoCorrect-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-CopyingFormula-Formulas that Make Decisions-Styles-Functions in Excel-Using Auto calculate-References-Sum Function-Average Function- Creating Charts in Excel-Auditing a Workbook-Comments Inserting-Outlines-Worksheet Fitting on a Page-Function Wizard-Goal Seeking-Scenarios Manager-Creating a Pivot Table Report-Typing with AutoFill-Formatting Numbers and Labels-Changing the Size of Rows and Columns-Adding and Deleting Rows and Columns-Inserting(and Removing) Page Breaks-Applying Themes-Add or Remove a Sheet Background-Convert Text to Columns-Protect Worksheet or Workbook Elements-Functions in Excel.	**10**	**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 Picture in a Photo Album-Overview of Creating a Photo Album-Add a	**10**	**CO5**

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

H-High; M-Medium; L-Low

18UCSBTAP101	**ALLIED 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.

18UVE101	VALUE EDUCATION I: YOGA	SEMESTER - I

Course Objectives:

The Course aims

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

Credits: 2 **Total Hours: 30**

UNIT	CONTENTS	Hrs	CO
I	**Yoga and Physical Health:** Health - Meaning and Definition - Physical Structure - Three bodies - Five limitations - Simplified Physical Exercises - Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana 1, 2 , Massage, Acu pressure, Relaxation exercises - Yogasanas – Surya namaskar - Padmasana - Vajrasana - Ardha katti Chakrasana - Viruchasana - Yogamudra - Patchimothasana - Ustrasana - Vakkarasana – Salabasana	06	CO1
II	**Greatness of Life Force and Mind :** Maintaining youthfulness - Postponing the ageing process - Sex and spirituality - Significance of sexual vital fluid - Married life - Chastity - Development of mind in stages - Mental Frequencies - Methods for Concentration - Meditation and its Benefits	06	CO2
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	06	CO3

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	**06**	**CO4**
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.	**06**	**CO5**
Text Book			
1	Value Education - World Community Service centre, Vethathiri Publications, Erode.		
Reference Books			
1	*Vethathiri Maharishi*, 2011, Journey of Consciousness, Erode, Vethathiri Publications.		
2	*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

18UTALA201	**Tamil II: சமய இலக்கியங்கள்**	**பருவம் - II**

இப்பாடத் திட்டத்தின் நோக்கங்களாவன:

1. சமய இலக்கியங்களை அறிமுகம் செய்தல்
2. சமயச் சான்றோர் நிலைப்பாட்டை உணர்த்துதல்
3. சமயங்கள் வளர்த்த தமிழை அறியச் செய்தல்

Credits: 3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**சைவ,வைணவ இலக்கியங்கள்** அ. சம்பந்தர் தேவாரம் - திருக்கொடிமாடச்செங்குன்றூர்- (**முதல் ஐந்துபாடல்கள்**) ஆ. மாணிக்கவாசகர் - திருவம்மானை - (**முதல் ஐந்துபாடல்கள்**) இ. பெரியாழ்வார் - திருப்பல்லாண்டு (**முதல் ஐந்துபாடல்கள்**) ஈ. ஆண்டாள் - திருமணக் கனவு (**முதல் ஐந்துபாடல்கள்**)	**10**	**CO1**
II	**கிறித்துவ, இசுலாமிய இலக்கியங்கள்** அ. இரட்சணியயாத்திரிகம் - சிலுவைப்பாடு **(முதல் பத்துப ் பாடல்கள்)** ஆ. நாயகம் ஒருகாவியம்–பாம்பின் நேசமும் தோழரின் பாசமும் **(முதல் பத்துப்பாடல்கள்)**	**10**	**CO2**
III	**சமயச் சான்றோர் வரலாறு** அ. **சைவசமயச் சான்றோர்கள்** 1. திருஞானசம்பந்தர், 2. திருநாவுக்கரசர், 3. சுந்தரர், 4. மாணிக்கவாசகர் 5. சேக்கிழார் ஆ. **வைணவசமயச் சான்றோர்கள்** 1. முதலாழ்வார்கள் 2. திருமங்கையாழ்வார் 3.ஆண்டாள் 4. நாதமுனிகள்	**12**	**CO3**

IV	**சமய இலக்கியவரலாறு** அ.பன்னிருதிருமுறைகள் ஆ. பதினெண்சித்தர்கள் இ. நாலாயிரதிவ்யபிரபந்தம் ஈ. சைவசித்தாந்தசாத்திரங்கள்	**08**	**CO4**
V	**இலக்கணமும் மொழித்திறனும்** அ. ஆகுபெயர் ஆ. தொகைச்சொற்கள் இ. மயங்கொலிச் சொற்கள் (ர,ற வேறுபாடுகள்) ஈ. நேர்காணல்	**10**	**CO5**
Text Book			
1	தமிழ்த்துறை. வெளியீடு : கே.எஸ். ரங்கசாமி கலை அறிவியல் கல்லூரி (தன்னாட்சி),திருச்செங்கோடு– 637 215.		

COURSE OUTCOMES (CO)

இப்பாடத்தைக் கற்பதன் வாயிலாக மாணவர்கள் பெறும் பயன்களாவன:

CO1	தேவார, திவ்யபிரபந்தச் சிறப்பினை உணர்தல்.
CO2	கிறித்துவ, இசுலாமிய காவியங்களின் சிறப்பினை உணர்தல்.
CO3	சைவசமய, வைணவ சமயச் சான்றோர் சிறப்புக்களை உணர்தல்.
CO4	சமயவளர்ச்சி, இலக்கியவளர்ச்சி ஆகியவற்றை உணர்தல்
CO5	ஆகுபெயர் வகைகளை உணர்தல், மொழித்திறன் பெறுதல்.

18UENLA201	**FOUNDATION ENGLISH II**	**SEMESTER – II**

Course Objectives:

The course aims

- To enable the students to develop their comprehensive skill.
- To introduce the students to know about English poetry and short stories.

Credits: 3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I & II	**POETRY** Langston Hughes - I, Too **SHORT STORIES** Vsevolod M. Garshin - The Signal W. Somerset Maugham - The Man with the Scar **GRAMMAR** Tenses (Present, Past & Future) **COMPOSITION** E-mail SMS **COMMUNICATION SKILLS** Asking Questions	**20**	**CO1 & CO2**
III & IV	**POETRY** Chinua Achebe - Refugee Mother and Child Nissim Ezekiel - Goodbye Party for Miss Pushpa T. S **SHORT STORY** H. G. Wells - The Stolen Bacillus **GRAMMAR** Voices (Active and Passive) **COMPOSITION** Note Making, Note Taking **COMMUNICATION SKILLS**	**20**	**CO3 & CO4**

	Praising and Complimenting Complaining and Apologizing		
V	**POETRY** Tripuraneni Srinivas - I Will Embrace only the Sun **SHORT STORY** O. Henry - One Thousand Dollars **COMPOSITION** Discourse Pattern **COMMUNICATION SKILLS** Expressing Sympathy Phoning	**10**	**CO5**
Text Books			
1	*G.Damodar, DVenkateshwarlu, M.Narendra, M.SaratBabu, G.M.Sundaravalli.* 2009. **English For Empowerment**. Published by Orient Blackswan Private Limited. Hyderabad –500 029.		
2	*M.M.Lukose*. 2010. **Images, A hand book of Stories.** Macmillan Publishers Indian Limited. Chennai–600 041.		
3	*SasiKumarV and SyamalaV*. 2006. **Form and Function A Communicative Grammar for Colleges.** Emerald Publishers. Chennai–600 008.		
4	*T.M.Farhathullah.* 2006. **Communication Skills For Undergraduates**. Publishers-RBA Publications. Chennai–600 015.		
Reference Books			
1	*Thomas, A.J and Martinet, A.V.* 1994. **A Practical English Grammar.** Oxford University Press. Delhi.		
2	*Martin Hewings.* 1999. **Advanced English Grammar.** Cambridge University Press. New Delhi.		

COURSE OUTCOMES (CO)

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

CO1	Know the different parts of genres in English.
CO2	Identify the famous authors of English.
CO3	Enrich their grammar knowledge.
CO4	Stimulate their writing skills.
CO5	Deserve appreciation for their communication.

18UBTM201	CORE 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

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.

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.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	M	L
CO2	H	M	M	M	L
CO3	H	H	M	H	H
CO4	M	L	M	M	M
CO5	H	H	M	M	M

H-High; M-Medium; L-Low

18UBTMP201	**CORE PRACTICAL II: LAB IN GENETICS**	**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.

18UCHBTA201	ALLIED 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 ofligands-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	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	L	L	H	H
CO2	L	M	L	H	M
CO3	H	M	M	H	M
CO4	H	H	L	M	L
CO5	L	M	M	M	H

H-High; M-Medium; L-Low

18UCHBTAP201	**ALLIED PRACTICAL II: VOLUMETRIC AND ORGANIC ANALYSIS**	**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.

18UVE201	VALUE EDUCATION 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	**06**	**CO4**

	summit.		
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

18UTALA301	TAMIL III : காப்பியம் - சிற்றிலக்கியம்	பருவம் - III

இப்பாடத் திட்டத்தின் நோக்கங்களாவன:

1. தமிழ்க் காப்பியங்கள் தோற்றத்தையும்,காப்பிய இலக்கணத்தையும் காப்பியவகைகளையும் அறிமுகம் செய்தல்.
2. சிற்றிலக்கியங்கள் தோற்றம்,வளர்ச்சிநிலைகளையும்,சிற்றிலக்கியங்களையும் அறிமுகம் செய்தல்.
3. பகுபதஉறுப்புக்களைக் கற்பித்தல்.

Credits: 3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	காப்பியங்கள் - சிலப்பதிகாரம் - வழக்குரைகாதை மணிமேகலை - மலர்வனம் புக்ககாதை.	10	CO1
II	பிறகாப்பியங்கள் - கம்பராமாயணம் - குகப் படலம் பெரியபுராணம் - இளையான்குடிமாறநாயனார் புராணம்.	10	CO2
III	சிற்றிலக்கியங்கள் - குற்றாலக் குறவஞ்சி– வசந்தவல்லியின் காதல் (1-10 பாடல்) கலிங்கத்துப் பரணி - பேய்களைப் பாடியது.	10	CO3
IV	இலக்கியவரலாறு - காப்பியங்கள் - ஐம்பெருங்காப்பியங்கள் - ஐஞ்சிறுகாப்பியங்கள் -புராணங்கள் - சிற்றிலக்கியங்கள்.	10	CO4
V	இலக்கணமும் மொழிப்பயிற்சியும் - பகுபதஉறுப்பிலக்கணம் - சீர் வகைகள் - வழூஉச் சொற்கள் - கடிதம் எழுதுதல்.	10	CO5

Text Book

1	தமிழ்த்துறை வெளியீடு, கே.எஸ்.ரங்கசாமி கலை அறிவியல் கல்லூரி (தன்னாட்சி), திருச்செங்கோடு-637 215.

COURSE OUTCOMES (CO)

இப்பாடத்தைக் கற்பதன் வாயிலாக மாணவர்கள் பெறும் பயன்களாவன

CO1	இரட்டைக் காப்பியங்களின் மேன்மை நிலையை உணர்தல்.
CO2	காப்பியக்காலகுடிகளின் நிலையை,உரிமையை உணர்தல்.
CO3	சிற்றிலக்கியங்களின் சிறப்பை உணர்தல்.
CO4	காப்பிய, சிற்றிலக்கியங்களின் வரலாறு குறித்த செய்திகளை அறிதல்.
CO5	இலக்கணம் மற்றும் மொழிப்பயிற்சியின் அமைப்பை உணர்தல்.

18UENLA301	FOUNDATION ENGLISH III	SEMESTER – III

Course Objectives:

The Course aims

- To enable the students to develop their comprehensive skill.
- To promote language skills through literature.

Credits: 3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I & II	**ONE ACT PLAY** A. Ball - The Seven Slaves **PROSE** Somerset Maugham - Mr. Know –All **GRAMMAR** Degrees of Comparison **COMPOSITION** Advertisement **COMMUNICATION SKILLS** Speaking About Oneself The Media	**20**	**CO1 & CO2**
III & IV	**ONE ACT PLAY** R.H. Wood - Post Early for Christmas **PROSE** Satyajit Ray - Film Making **GRAMMAR** Determiners **COMPOSITION**	**20**	**CO3 & CO4**

	Resume Writing **COMMUNICATION SKILLS** Imagining Context specific expression - Master of Ceremonies		
V	**PROSE** Isai Tobolsky - Not Just Oranges **GRAMMAR** Reported Speech **COMPOSITION** Precise Writing **COMMUNICATION SKILLS** Inviting Personalities.	**10**	**CO5**

Text Books

1. *G.Damodar, D.Venkateshwarlu, M.Narendra, M.SaratBabu, G.M.Sundaravalli.* 2009. **English For Empowerment**. Published by Orient Blackswan Private Limited. Hyderabad –500 029.
2. *Ramamurthy.K.S.* 1984. **Seven-Act Plays**. Published in India by Oxford University. New Delhi–110 001.
3. *Sasi Kumar V and Syamala V*. 2006. **Form and Function - A Communicative Grammar for Colleges.** Emerald Publishers. Chennai–600 008.
4. *T.M.Farhathullah.* 2006. **Communication Skills For Undergraduates**. Publishers-RBA Publications. Chennai–600 015.

Reference Books

1. *Raymond Murphy*. 1994. **Intermediate English Grammar.** Cambridge University India Pvt. Ltd, Delhi.

COURSE OUTCOMES (CO)

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

CO1	Know the different parts of genres in English
CO2	Trace the famous authors of English
CO3	Enrich their grammar knowledge
CO4	Stimulate their writing skills
CO5	Deserve appreciation for their communication

18UBTM301	CORE III: MICROBIOLOGY	SEMESTER- III

Course Objectives:

The Course aims

- To learn the basics of Microbiology.
- 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. Principles and types of stain –Simple stain, differential stain - Cell wall of Gram positive and Gram negative bacteria and principle of gram staining and special staining – Endospore & Capsular.	**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 filters. Disinfection and disinfective agents. Chemicals–Alcohol, Aldehydes, Phenol.	**10**	**CO4**

V	Bacterial Growth curve, bacteriostatic, bactericidal and fourth generation antibiotics, Antimicrobial chemotherapy-Antibiotics-mode of action of 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 Hill New Delhi.		
Reference Book			
1	*Christopher, J. Woolveerton, Joanne Wiley* and *Linda Sherwood*.2007. **Prescott's Microbiology.** [Fourth Edition].Tata McGraw Hill, New Delhi.		

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

H-High; M-Medium; L-Low

18UBTMP301	CORE PRACTICAL III: LAB IN MICROBIOLOGY	SEMESTER – III

Course Objectives:

The Course aims

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

Credits: 2 **Total Hours:39**

S.No	EXPERIMENT	Hrs	CO
1.	Handling microbes	**03**	**CO1**
2.	Molecular taxonomy	**03**	
3.	Media preparation–Liquid, Solid Media and Slant preparation	**03**	**CO2**
4.	Pure Culture Techniques: i. Spread plate method. ii. Pour plate method. iii. Streak Plate Method	**06**	**CO3**
5.	Simple staining	**03**	**CO4**
6.	Gram's staining	**03**	
7.	Spore staining	**03**	
8.	Motility test	**03**	**CO5**
9.	Biochemical tests – IMViC test	**03**	
10.	Triple Sugar Iron Test	**03**	
11.	Oxidase and Catalase test	**03**	
12.	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.

18UBCBTA301	ALLIED III : BIOCHEMISTRY (BIOMOLECULES)	SEMESTER - III

Course Objectives:

The Course aims

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

Credits: 2 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Carbohydrates:** Introduction, classification. Monosaccharide – Structure and importance of glucose and fructose. Isomers: stereo and structural isomers. Mutarotation and chemical reactions- reduction, oxidation and osazone formation. Oligosaccharides – Disaccharides - Structure and importance of sucrose, lactose. Polysaccharides - Structure and importance of homopolysaccharides – Starch and Glycogen. Heteropolysaccharides - Hyaluronic acid and Heparin.	08	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.	08	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	08	CO3

	Cholesterol.		
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).	**08**	**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.	**08**	**CO5**
Text Book			
1	*Jain, J. L.* 2002. **Fundamentals of Biochemistry.** [Fifth Edition]. S. Chand & Company Ltd., New Delhi.		
Reference Books			
1	*Deb, A. C.* 2000**. Fundamentals of Biochemistry.** Books and Allied (P) Ltd., Calcutta.		

COURSE OUTCOMES (CO)

After the completion of the course, the student 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	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	H	H
CO2	H	M	M	H	H
CO3	H	M	M	H	H
CO4	H	M	M	H	H
CO5	H	M	M	H	H

H-High; M-Medium; L-Low

18UBCBTAP301	**ALLIED 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.	**09**	**CO1**
2.	Amino acids: Tyrosine, tryptophan, histidine, methionine and cysteine.	**06**	**CO1**
3.	Proteins: Solubility test, coagulation test, ninhydrin test, biuret test, folin's phenol test, precipitation by metals.	**03**	**CO1**
4.	Lipids: Solubility, grease spot, Oil spot, emulsification, halogenations, colour reactions.	**03**	**CO1**
II. Quantitative Analysis			
5.	Estimation of Glycine by Formal titration method.	**03**	**CO2**
6.	Determination of Saponification Value	**03**	**CO2**

Reference Books

1 *Sadasivam, S.* and *Manickam, A*. 2010. **Biochemical Methods.** [Third Edition]. New Age International (P) Ltd., New Delhi.

2 *Jayaraman, J*. 2008. **Laboratory Manual in Biochemistry**. [First Edition Reprint]. New Age International (P) Ltd., New Delhi.

COURSE OUTCOMES (CO)

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

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

18UBTSB301	SBC I: CALCULATIONS FOR BIOLOGIST	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 from scientific notation to decimal notation. Adding, subtracting, multiplying and dividing numbers written in scientific noatation, 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 UV spectrometry –ds DNA, ss DNA, RNA. Quantitation of protein by measuring at 280 nm. Quantitating protein at A280 in nucleic acid contamination. PCR calculations – template and amplification, Calculating Tm, DNA Polymerase –Calculating Polymerase error rate.	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-**Academic press.		

COURSE OUTCOMES (CO)

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

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

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	L	H	M	H	M
CO2	L	H	M	H	M
CO3	L	M	M	M	H
CO4	H	M	L	H	M
CO5	L	L	H	H	M

H-High; M-Medium; L-Low

18ULS301	CAREER COMPETENCY SKILLS I	SEMESTER – III

Course Objectives:

The Course aims

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

Total Hours: 15

UNIT	CONTENTS	Hrs	CO
I	Basic Grammar – Usage of English – Listening and Speaking (Level-1) Tenses and Voices (Present, Past and Future)	**03**	**CO1**
II	Sentence Correction – Sentence Pattern - Reading Comprehension (Level -1)	**03**	**CO2**
III	Expansion of Proverbs – Closet Test (Level -1)	**03**	**CO3**
IV	Sentence Improvement (Essay Writing, Now- a –Days Vocabulary), Story Writing	**03**	**CO4**
V	E-Mail Building (Sending call letters), Letters (Formal and Informal)	**03**	**CO5**

Text Books

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

Reference Book

1	*Chand S, Agarwal R. S.* **Objective General English.** Arihant Publications (India) Limited.

COURSE OUTCOMES (CO)

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

CO1	Recall the basic grammar in English
CO2	Concentrate on Sentence Correction
CO3	Understand Paragraph Writing
CO4	Improve the ability of Sentence Construction and Story Writing
CO5	Format Web Writing and Formal Writing of letters.

18UTALA401	**TAMIL IV: சங்க இலக்கியம் - நீதி இலக்கியம்**	**பருவம் - IV**

இப்பாடத்திட்டத்தின் நோக்கங்களாவன :

1.சங்க இலக்கியம், அற இலக்கியங்களின் சிறப்பைஉணர்த்துதல்.

2.இலக்கண நூல்களைகாலவரிசைப்படிஅறியச் செய்தல்.

3.அணி இலக்கணத்தின் சிறப்பைஉணரச் செய்தல்.

Credits: 3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**எட்டுத்தொகை** அ.நற்றிணை–அன்னாய் வாழிப்பத்து (பாடல் எண். 208, 209, 210) ஆ. குறுந்தொகை–யாயும் ஞாயும் (பாடல் எண்.40) இ. கலித்தொகை–ஆற்றுதல் என்பதொன். (பாடல் எண்.103) ஈ. புறநானூறு –பல்சான்றீரேபல்சான்றீரே (பாடல் எண்.195)	10	CO1
II	**பத்துப் பாட்டு** அ. குறிஞ்சிப்பாட்டு (1 முதல் 106 அடிகள் வரை) -கபிலர்	12	CO2
III	**அற இலக்கியங்கள்** அ. நாலடியார் -பாடல் எண் (35,59,94,141,333) ஆ. நான்மணிக்கடிகை - பாடல் எண் (04,09,59,69,80) இ. பழமொழி-பாடல் எண் (05,21,120,149,361) ஈ. சிறுபஞ்சமூலம் - பாடல் எண் (05,17,48,83,99)	10	CO3
IV	**இலக்கியவரலாறு** அ. சங்க இலக்கிய நூல்கள் அறிமுகம் ஆ. முச்சங்கவரலாறு இ. தமிழ் இலக்கண நூல்கள் அறிமுகம் ஈ. அற இலக்கியங்கள் அறிமுகம்	10	CO4
V	**இலக்கணம்** அ. அணி இலக்கணம் 1. உவமைஅணி 2. உருவகஅணி 3. வேற்றுமைஅணி	08	CO5

	4. வஞ்சப்புகழ்ச்சிஅணி ஆ. அகத்திணைகள்,புறத்திணைகள் - விளக்கம்		
Text Book			
1	தமிழ்த்துறைவெளியீடு,கே.எஸ்.ரங்கசாமிகலைஅறிவியல் கல்லூரி(தன்னாட்சி), திருச்செங்கோடு– 637 215.		

COURSE OUTCOMES (CO)

இப்பாடத்தைக் கற்பதன் வாயிலாக மாணவர்கள் பெறும் பயன்களாவன

CO1	எட்டுத்தொகை நூல்களின் சிறப்பை அறிதல்
CO2	பத்துப்பாட்டு நூல்களின் சுவை அறிதல்
CO3	அற இலக்கியங்கள் பற்றிஅறிதல்
CO4	இலக்கியங்கள் தோற்றமுறையை அறிதல்
CO5	அணி இலக்கணத்தின் பயன் பற்றிஅறிதல்.

18UENLA401	**FOUNDATION ENGLISH IV**	**SEMESTER – IV**

Course Objectives:

The Course aims

- To promote communication skills through literature.
- To enhance the language learning through activities.

Credits: 3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I & II	**ONE ACT PLAY** Monica Thorne - The King Who Limped **PROSE** A.G.Gardiner - On Shaking Hands **GRAMMAR** Punctuation **COMPOSITION** Hints Development **COMMUNICATION SKILLS** Breaking the Law Honoring the Person	**20**	**CO1 & CO2**
III & IV	**ONE ACT PLAY** Ella Adkins – The Unexpected **PROSE** Minoo Masani - No Man is an Island **GRAMMAR** Conditional Clause **COMPOSITION** Report Writing **COMMUNICATION SKILLS** Brain Storming	**20**	**CO3 & CO4**

V	**PROSE** Arnold Toynbee - India's Contribution to World Unity **GRAMMAR** Simple, Compound and Complex Sentences **COMPOSITION** Jumbled Sentences **COMMUNICATION SKILLS** Role-Play	**10**	**CO5**

Text Books

1	*Ramamurthy*.K.S. 1984. **Seven-Act Plays**. Published in India by Oxford University. New Delhi–110 001.
2	*Damodar.G, D.Venkateshwarlu, M.Narendra, M.SaratBabu, G.M.Sundaravalli. 2009*. **English For Empowerment**. Published by Orient Blackswan Private Limited. Hyderabad –500 029.
3	*SasiKumarV and SyamalaV*. 2006. **Form and Function - A Communicative Grammar for Colleges.** Emerald Publishers. Chennai–600 008.
4	*Farhathullah.T.M.* 2006. **Communication Skills for Undergraduates**. RBA Publications. Chennai–600 015.

Reference Books

1	*Raymond Murphy.* 1994. **Intermediate English Grammar.** Cambridge University India Pvt. New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Understand the text on the basis of close reading analytically and critical views.
CO2	Ability to construct a sustained sophisticated and original argument on a specific topic.
CO3	Acquire language skills through composition.
CO4	Acquire both composition and communication skills.
CO5	Apply basic communication skills.

18UBTM401	CORE IV : BIOPHYSICS AND BIOINSTRUMENTATION	SEMESTER- IV

Course Objectives:

The Course aims

- To study the basic techniques and principles of instrumentation.

Credits:5 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	Nature of chemical bonds, intra and intermolecular interactions in biological systems. Proteins: Amino acids – Conformations. Phi and Psi angles. Ramachandran plot. Peptides – peptide bond isomerisation. Disulphide bonds, electrostatic forces, van der waals interaction. Hydrogen bonds, Determination structure of proteins: NMR, 3D structure by x- ray diffraction.	**10**	**CO1**
II	Care and general maintenance of laboratory instrumentation Weighing balance, pH meter, Laminar flow chambers, Hot air oven, Autoclave and Incubator. Introduction, principles and applications of spectroscopy:– Colorimeter, UV-visible spectrophotometer, pH meter and Henderson and Hasselbalch equation.	**08**	**CO2**
III	Chromatography – Paper Chromatography, Thin Layer Chromatography, column chromatography, Ion Exchange Chromatography, High Performance Liquid Chromatography, Gas Chromatography and LC-MS.	**10**	**CO3**
IV	Electrophoresis – Agarose Gel Electrophoresis, SDS-PAGE .Blotting techniques- Southern, Northern, Western & Immuno blotting. Separation techniques: Centrifugation – principles and 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, Liquid Scintillation Counter and Autoradiography.	**10**	**CO5**

Text Books

1. *Freifelder,. D.* 1976. Physical Biochemistry, Applications to Biochemistry and Molecular Biology General Biophysics, Vol. I & II – H.V. Volkones.
2. *Boyer,.R.F*. 1993. **Modern Experiments in Biochemistry.** [Second Edition]. The Benjamin/ Cummings Publishing Company, Red wood City, California.
3. *Ghatak, K.L.* 2003. Techniques and Methods in Biology. PHI Learning Private Ltd. New Delhi.

Reference Books

1. *Upadhyay*. 2005. **Biophysical Chemistry.** Himalaya Publications.
2. *Wilson,.K. and Walker*, 2003. **Practical Biochemistry.** [First Edition]. Cambridge University Press.

COURSE OUTCOMES (CO)

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

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

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	L
CO2	M	L	M	H	M
CO3	H	M	L	H	M
CO4	M	M	L	H	M
CO5	H	H	M	M	M

H-High; M-Medium; L-Low

18UBTMP401	CORE PRACTICAL IV: LAB IN BIOPHYSICS & BIOINSTRUMENTATION	SEMESTER – IV

Course Objectives:

The Course aims

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

Credits:3 **Total Hours:36**

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

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

COURSE OUTCOMES (CO)

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

CO1	Handle pH meter, colorimeter and spectrophotometer.
CO2	Determine km and Vmax and extend the knowledge on the principles of Diffusion and Osmosis.
CO3	Apply haemolysis and different types of Chromatographic techniques.
CO4	Isolate proteins using SDS-PAGE.
CO3	Demonstrate western blotting.

18UMABTA401	ALLIED 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 of hypothesis – 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. S and Manoharan. M,* 2001. **Statistical methods for Biologists.** [Third Edition]. Palani Paramount Publications, Palani.
Reference Books	
1	*Daniel W.W.* 1987. **Biostatistics.** John Wiley and Sons, Newyork.
2	*Arora, P.N. and Malhan, P.K.* 2006. **Biostatistics.** Himalaya Publishing House, Mumbai.

Course Outcomes (CO)

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

CO 1	Learn the importance of statistics
CO 2	Understand the concepts of measures of central tendency
CO 3	Know the concepts of measures of dispersion
CO 4	Gain knowledge on correlation and regression analyses
CO 5	Test the samples using testing of hypothesis

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	L	H	H
CO2	M	M	L	H	H
CO3	M	M	L	H	H
CO4	M	M	L	H	H
CO5	M	M	L	H	H

H-High; M-Medium; L-Low

18UMABTAP401	ALLIED PRACTICAL IV: STATISTICS (USING MS-EXCEL)	SEMESTER – IV

Course Objectives:

The Course aims

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

Credits:2 **Total Hours: 21**

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

Reference Books

1	*Bhattacharjee Dibyojyoti.* **Practical Statistics Using Microsoft Excel.** Asian Books Private Ltd.
2	*Apte D.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

CO 1	Demonstrate the data in diagrammatic and graphical representation
CO 2	Find the averages and measures of dispersion
CO 3	Calculate correlation and regression for huge amount of data
CO 4	Gain knowledge about test of significance

18UBTSB401	SBC II: BIOSAFETY AND BIOETHICS	SEMESTER- IV

Course Objectives:

The Course aims

- To develop the student skills to work in the laboratory and to learn the basic ethics.
- To acquire the basic knowledge on about the laboratory chemicals, containments and issues regarding the r-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, biosafety level, Basic laboratory, laboratory design, General guidelines 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**

Reference book

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

COURSE OUTCOMES (CO)

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

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

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	L	L
CO2	M	L	M	H	L
CO3	H	M	H	H	M
CO4	M	H	M	M	M
CO5	M	H	L	L	M

H-High; M-Medium; L-Low

18ULS401	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 – Alligation or Mixture - Permutation and Combination.	**03**	**CO3**
IV	Aptitude: Probability – Missing Number series – Wrong Number Series – Races & Games of Skill.	**03**	**CO4**
V	Aptitude: Time & Work – Pipes & Cistern – Time & Distance – Problems on Trains – Boats and Streams.	**03**	**CO5**

Text Book

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

Reference Book

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

COURSE OUTCOMES (CO)

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

CO1	Carry out mathematical calculations using shortcuts.
CO2	Calculate problems on age, surds and indices with shortcuts
CO3	Understand the core concepts of SI and CI, Permutation and Combination.
CO4	Obtain knowledge on shortcuts to calculate number series.
CO5	Perform new methods for aptitude calculations.

18UBTNM301	NMEC I: MEDICINAL HERBS	SEMESTER- III

Course Objectives:

The Course aims

- To apply the basic knowledge of common medicinal plants.

Credits:2 **Total Hours:30**

UNIT	CONTENTS	Hrs	CO
I	Introduction to Medicinal Plants; Traditional medicinal systems-AYUSH.	06	CO1
II	Herbs- *Aloe vera*, Green chirayta, Gulf leaf flower, Tridax daisy, *Vinca*, Great Basil, Tulsi, Mint &Ajwain.	06	CO2
III	**Climbing plants:** Petel, Ivy gourd, Butterfly pea, Veldt grape, Climbing Brinjal, Indravalli, pepper & Madras pea pumpkin.	06	CO3
IV	**Shrubs:** Indian mallow, Shikakai, Desert cotton, Rose mallow, Turkey berry & Copper leaf.	06	CO4
V	Cash crops - Sugarcane, Tobacco, Cotton, Jute, rice, wheat and corn.	06	CO5

Reference Book

1 *Arya Vaidya Sala.,* 1994. **Indian Medicinal Plants**. Vol II. Universities Press.

COURSE OUTCOMES (CO)

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

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

18UBTNM401	NMEC II: FUNDAMENTALS OF BIOTECHNOLOGY	SEMESTER- IV

Course Objectives:

The Course aims

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

Credits:2 **Total Hours: 30**

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

Reference book

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

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

COURSE OUTCOMES (CO)

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

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

18UBTAC301	ADD ON COURSE: 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.

Total Hours: 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	Emdat In Scribe software: Transcription Technology, Medical Reports, Medical Transcriptionist's Tool Box, E-mail and Security, Medical Transcription Report Editing,	**05**	**CO4**
V	International Classification of Diseases (ICD-10) and Surgical Procedures (ICD-9CM), CPT, HCPCS, Ethics and confidentiality /HIPAA laws.	**05**	**CO5**

Reference book

1 *Marcy Otis Diehl*. 2011. **Medical Transcription: Techniques and Procedures**, [Seventh Edition], Kindle Edition.

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

3 *Arnould Taylor W.E.* 1988. **A Textbook of Anatomy and Physiology** [second

4	edition] Nelson Thornes Ltd. *Frederic H. Martini, Judi L. Nath, Edwin F. Bartholomew*.2017. **Fundamentals of Anatomy & Physiology** [11th Edition].

COURSE OUTCOMES (CO)

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

CO1	Gain knowledge about the types and process of medical transcription.
CO2	Explain about anatomy and physiology.
CO3	Describe about medical terminology
CO4	Explain about Emdat In Scribe software.
CO5	Describe about various surgical procedures and ethics.

18UBTAC302	ADD ON COURSE : ELECTROPHORESIS	SEMESTER- III

Course Objectives:

The Course aims

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

Total Hours: 25

UNIT	CONTENTS	Hrs	CO
I	Electrophoresis: Origin, Introduction, Principle of electrophoresis, Requirement of Electrophoresis – Electrophoretic mobility, EEO, Electrical field strength, Friction, Net charge, convertion of AC to DC, Voltage, Ammeter, Electrode for electrophoresis, Cathode reaction, Anode reaction. Buffer- buffering action, Buffering capacity and isoelectric point.	**05**	**CO1**
II	Zone electrophoresis: Introduction, Principle, Advantage. Media for zone electrophoresis – Agar, Agarose, Starch, Cellulose acetate. Polyacrylamide - salient features, Cross-linking agent, Polymerization of acrylamide – chemical & photochemical polymerization, Optimum temperature for gelation, evacuation, Chaotropic agents, Pore size, Gel rods, Gel slabs.	**05**	**CO2**
III	Ferguson plot – Optimal gel concentration, PAGE, SDS. Gradient gels – Introduction, Advantages, Types – Linear & Concave gradient. Principle, Preparation of reagent, Experimental procedure for Disc electrophoresis, Slab gel electrophoresis, Agarose gel electrophoresis, Starch gel electrophoresis, Cellulose acetate electrophoresis, 2-D gel electrophoresis, SDS-PAGE, Common buffer system for separating native proteins, Pulse field Electrophoresis, Isoelectric focusing, Capillary electrophoresis.	**05**	**CO3**

IV	Apparatus for zone electrophoresis: Paper electrophoresis apparatus – Hanging strip inverted V type, Horizontal strip type, High voltage paper electrophoresis apparatus, Starch gel apparatus – Agar gel electrophoresis, Agarose gel electrophoresis, Submarine gel electrophoresis, Preparative electrophoresis, Pulse field gel electrophoresis, Field inversion gel electrophoresis, Types of slab gel apparatus, Sequencing apparatus – Manual method for DNA sequencing, Automated DNA sequencer.	**05**	**CO4**
V	Marker dye – Bromophenol Blue, Xylene cyanol FF, Analysis of Bands: Direct photometric scanning, staining methods, Radiolabelling & autoradiography, Enzyme assay, Immunological methods, Direct extraction, Blotting and Detection.	**05**	**CO5**
Reference book			
1	Anbalagan, K. 1999. *An introduction to Electrophoresis.* The Electrophoresis institute, Biotech- 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 apparatus used in electrophoresis.
CO5	Describe about the types of dyes used in electrophoresis and also can analyse the bands.

18UBTAC401	ADD ON COURSE : 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.

Total Hours:25

UNIT	CONTENTS	Hrs	CO
I	Corporate Biotechnology- Introduction, Applications. Intellectual property rights- Copy rights, 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, Bt cotton, Bt brinjal, golden rice, Flavr Savr ^{R}	**05**	**CO2**
III	Animal breeding - Care and maintenance of laboratory animals- mice, rabbit, monkey, guinea pig. Advantages of Transgenic animals. Laboratory animal's ethics – Anesthesia. Ethical guidelines for use of Animals in scientific Research – in-vitro systems to replace animals.	**05**	**CO3**
IV	Aquaculture- Transgenic fishes, Silvi culture- Principles and establishment of silvi culture system. Arboriculture- 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. Rangaswami and D.J. Bagyaraj,* 1998. **Agricultural Microbiology**. [Second Edition]. Prentice, Hall of India Pvt. Ltd., New Delhi.
Reference Books	
1	*Purohit, S.S.* 2009. **Biotechnology**: **Fundamentals and Applications**.[Fourth Edition].
2	*Keshav Trehan*, 1997. **Biotechnology.** New age International Pvt. Ltd., Publication.
3	*Freshney, R.I.* 2005. **Culture of Animal cells***:* A manual of basic technique. [Fifth Edition]. John wiley and Sons, New Jersey.

COURSE OUTCOMES (CO)

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

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

18UBTAC401	ADD ON COURSE IV: ANIMAL PHYSIOLOGY	SEMESTER – IV

Course Objectives:

The Course aims

- To acquire the knowledge on Animal physiology.

Total Hours: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: Peptic ulcers, Gastroenteritis.	**05**	**CO2**
III	Respiratory system: Organs of respiratory system – Gaseous exchange – Transport of O_2 and CO_2 - 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's disease, Parkinson's disease.	**05**	**CO4**
V	Integumentory system: Organs of integumentory system – Protection – Sensory function – Thermoregulation – Vit D synthesis. Disorders: Eczema, Psoriasis.	**05**	**CO5**

Reference Books

1 *Chandi charan chatterjee.* 1994. **Human Physiology**. Special reprint edition.

2 *Verma P.S.* and *Agarwal V.K.* 1979. **Animal Physiology.** Chand & company Ltd, New Delhi.

3 *Sarada subrahmanyam*. 1989. **A concise text book of Physiology.** Reprint, Orient longman Ltd, 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.

18UBTAL401	**ADVANCED LEARNER COURSE : DNA SCIENCE AND DRUG DISCOVERY**	**SEMESTER - IV**

Course Objectives:

The Course aims

- 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 into 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, structural elucidation.	**CO5**

Reference books

1 *Tarek K.* 2017. **The DNA molecule Structure and Features**. Cario University press.

2 *James D. Watson.* 1967. **The Double Helix- Personal Account of the Discovery of the Structure of DNA**. Harvard University press. Cambridge.

3	*Kokate C.K, Purohit A.P, Gokhale S.B.* 2008. **Pharmacognosy**. Nirali Prakashan publishers, Pune India.
4	*James Swarbrick.* 2003. **Drugs and the Pharmaceutical Sciences**, Marcel Dekker publishers, France.

COURSE OUTCOMES (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.

18UBTAL402	ADVANCED LEARNER COURSE : STEM CELL BIOLOGY	SEMESTER – IV

Course Objectives:

The Course aims

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

UNIT	CONTENTS	CO
I	Stem Cells – introduction, properties, Important sources of stem cells, Regulation of stem cells self-renewal and molecular markers, cellular and molecular basis of stem cell differentiation.	CO1
II	*In vitro* fertilization, Human embryonic stem cells (hES) - Isolation, culturing, identification and characterization of hES cells, Cloning and maintenance of hES; Applications of ES cells.	CO2
III	Adult stem cells-types-Hematopoietic stem cells, Bone marrow stromal stem cells, Liver stem cells, Skeletal muscle stem cells, Bone marrow derived stem cells and its applications, identification and differentiation of adult stem cells.	CO3
IV	Therapeutic need for stem cells, Stem cells and progenitors for drug testing, Genetically engineered stem cells for drug discovery & gene therapy, Common signaling pathways in cancer and Pathways involved in cancer & stem cell renewal, Pathways involved in stem cell differentiation.	CO4

Reference Book

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

COURSE OUTCOMES (CO)

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

CO1	Gain knowledge about properties and sources of stem cells.
CO2	Explain about isolation, culturing, identification and characterization of human embryonic stem cells.
CO3	Isolate and amplify the DNA.
CO4	Explain about adult stem cells.
CO5	Illustrate about stem cell therapy and preservation of stem cells.

GUIDELINES

1. SUBMISSION OF RECORD NOTE BOOKS:

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

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

(i) THEORY

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

***Internal Marks Distribution* [CA- Total Marks: 25]**

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

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

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

***Internal Marks Distribution* [CA- Total Marks: 100]**

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

(iii) PRACTICAL

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

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

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

3. CAREER COMPETENCY SKILLS

Viva voce– Semester III

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

On Line Objective Examination (Multiple Choice questions) – Semester IV

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

4. QUESTION PAPER PATTERN AND MARK DISTRIBUTION

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

Question Paper Pattern and Mark Distribution

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

2. **PART – B (5 x 5 = 25 Marks)**
   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

<u>External Marks Distribution</u> [CE- Total Marks: 60]

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

***<u>Question Paper Pattern and Mark Distribution</u>* (For 60 marks)**

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 (25 Marks)**
   Procedure : 15 Marks
   Performance : 05 Marks
   Result : 05Marks

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

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

4. Viva – Voce **:** 05 Marks

18UBTM501	CORE 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 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	Molecular basis of life – An introduction, Central dogma of molecular biology, DNA replication – Evidences for semiconservative model, DNA replication in prokaryotes and Eukaryotes – initiation, elongation and termination, Rolling circle model and theta model.	**10**	**CO1**
II	Mutation – Definition, mutagen, types of mutation – insertion and deletion, Point mutation – sense, mis-sense, and non-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 – proto oncogene and tumor suppressor genes. Molecular chaperones.	**08**	**CO5**

Text Book

1	*Rastogi S.C.*, 2006. **Molecular Biology.** CBS Publishers and Distributors, New Delhi.
2	*Ajoy paul*, 2007. **Text book of Cell and Molecular Biology**. Books and Allied Pvt. Ltd., Kolkatta.

Reference Books	
1	*Harvey Lodish*, 2004. **Molecular Cell Biology.** [Fifth Edition]. W.H. Freeman and Company. New York.
2	*Robert F.Weaver*, 1999. **Molecular Biology.** [First Edition]. Mc Graw Hill Publication Company, USA.

COURSE OUTCOMES (CO)

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

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

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	H	M	M	H
CO3	H	M	M	M	H
CO4	H	M	M	M	H
CO5	H	M	M	M	H

H-High; M-Medium; L-Low

18UBTM502	CORE VI: IMMUNOLOGY	SEMESTER - V

Course Objectives:

The Course aims

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

Credits: 5 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	Milestones in Immunology, Immunity: Types – innate and acquired immunity, Cells of immune system, Primary and secondary lymphoid organs.	**10**	**CO1**
II	Antigens - antigenicity and immunogenicity. Immunoglobulin – basic structure, function and classes, Hybridoma technology - Production of Monoclonal antibody, Complement systems.	**10**	**CO2**
III	Antigen – Antibody interaction, Precipitation – Mancini method and Ouchterlony method, Immunoelectrophoresis, Agglutination - Haemagglutination and Bacterial agglutination, Immunofluorescence, ELISA.	**10**	**CO3**
IV	MHC complex – structure and function of MHC, Antigen processing and presentation– Cytosolic pathway and Endocytic pathway, Cytokines – types and functions.	**10**	**CO4**
V	Hypersensitivity – definition and its types, Autoimmunity – Organ specific and systemic autoimmune disease, Transplantation immunology – immunologic basis of graft rejection, Vaccines – Live vaccine, killed vaccine, whole organism vaccine and purified macromolecule vaccine.	**10**	**CO5**

Text Book

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

Reference Books

1	*Ian R Tizard,*2006. **Immunology an introduction. [**Fourth Edition]. Advanced Immunology David male.
2	*Kalus D. Elgert*, 2004. **Immunology understanding the Immune system.** [Second Edition]. Wiley- Blackwell Publication.

3	*Tristram G. Parslow, Daniel P. Stites, Abba I.Terr and John B. Imboden,* 2007**.** **Medical Immunology.** [Tenth Edition].Tata Mc Graw Hill Publication.

COURSE OUTCOMES (CO)

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

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

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	M	M
CO2	H	M	M	M	H
CO3	H	H	H	H	H
CO4	H	M	M	H	M
CO5	H	H	H	H	M

H-High; M-Medium; L-Low

18UBTM503	CORE VII: INDUSTRIAL BIOTECHNOLOGY	SEMESTER - V

Course Objectives:

The Course aims

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

Credits: 5 **Total Hours: 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, fed batch, 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.**[Second Edition]. Science Tech Publishers, USA.

Reference Books

1 *Shuler,M.L. and Kargi.F*.2004. **Bioprocess Engineering: Basic Concepts.**[Second Edition].Prentice Hall. Pvt. Ltd., New Delhi.

2 *Aiba, S, Humphrey, A.E and Millis, N.F*, 1973, **Biochemical Engineering** [Second Edition], Academic Press, New York.

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

4	*El- MansiE.M.T., Bryce C.F.A., DemainA. L. Allman A.R.,* 2007. **Fermentation Microbiology and Biotechnology.**[Second Edition]. CRC Press.

COURSE OUTCOMES (CO)

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

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

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	M	M	L
CO2	M	M	M	L	L
CO3	M	M	M	M	M
CO4	M	H	L	M	M
CO5	M	M	M	M	M

H-High; M-Medium; L-Low

18UBTM504	CORE 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 **Total Hours: 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's medium, Gamborg's medium and Nitsch and Nitsch medium, Growth regulators and sterilization techniques.	**10**	**CO1**
II	Micropropagation-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- electroporation, microinjection, 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-Herbicide resistance, Insect resistance, Production of stress tolerant plants-Drought, temperature and salt	**10**	**CO3**
IV	Somatic embryogenesis-Developmental stages of embryogenesis, Germplasm preservation and synthetic seed technology, Genetic engineering for improvement of protein, lipids, carbohydrates, and vitamins, Plant genome organization, Role of RFLP in plant breeding. DNA barcoding in plants, Transposable elements in plant.	**10**	**CO4**
V	Protoplast culture-Introduction, Protoplast isolation, protoplast culture and Protoplast fusion, Production of virus free plants, Somaclonal variation, Secondary metabolites from plants- 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- Theory and Practice. Elsevier Publishers, New Delhi.
Reference Books	
1	*Chawla, H.S*. 1998. Biotechnology in crop improvement. International book distribution co., New Delhi.
2	*Jain, V.K.,* 2013. Fundamentals of plant physiology. (Fifth edition). S. Chand and company, New York.
3	*Trivedi, P.C.* 2004. Advances in plant physiology. (Third edition).I.K. International publications pvt Ltd, New Delhi.
4	*Slater, Scott and Fowler*. 2003. Plant Biotechnology (The genetic manipulation of plants), Oxford University, UK.

COURSE OUTCOMES (CO)

After completion of the course, 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 *in vitro* condition and transformation techniques
CO3	Describe the embryo culture, Production of haploid, resistant and stress tolerant plants
CO4	Explain about somatic embryogenesis, Germplasm preservation, plant genome organization, synthetic seed technology and Genetic engineering for improvement of protein, lipids, carbohydrates, and vitamins.
CO5	Explain about Protoplast culture, Production of virus free plants, Somaclonal variation and Plant secondary metabolites.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	H	M	M	H
CO3	H	M	M	M	H
CO4	H	M	M	M	H
CO5	H	M	M	M	H

H-High; M-Medium; L-Low

18UBTEL501	ELECTIVE I: NANOBIOTECHNOLOGY	SEMESTER - V

Course Objectives:

The Course aims

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

Credits: 4 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	Nanobiology – concepts, definitions, prospects; nanoparticles – size, shape, properties. Bionanoparticles – nanostarch, nano composites – dendrimers. Hot – Dot nanoparticles. Types of biomaterials. Biodegradable polymers.	08	CO1
II	Methods of nanobiotechnology – Analysis of bimolecular nanostructures by Atomic Force Microscopy, Scanning Probe Electron Microscopy. Nanofabrication - lithography. Drug nanoparticles - structure and preparation, Liposomes, Cubosomes and hexosomes. Lipid based nanoparticles-liquid nano dispersion, solid liquid nanoparticles	08	CO2
III	Nanotubes, Nanorods, Nanofibers and Fullerenes for nanoscaledrug. Bionanoelectronics. Applications of nanobiotechnology in medicine, drug designing and cancer treatment. Medical, social and ethical considerations of nanobiotechnology.	08	CO3
IV	Nanopores, Applications of NanoMolecules in Biosystems - Nanoscale Elements for Delivery of Materials into Cells. Peptides Coupled Nanoparticles. DNA Based Artificial Nanostructure. Proteins as Components in Nanodevices-Nanoparticle synthesis in plants, bacteria, and yeast.	08	CO4
V	Nanotechnology for Cancer Diagnostics and Treatment: Cancer Biology; Clinical Aspects, Current Approaches and Challenges. Nanotechnology for Cancer Research and Therapy. siRNA. Tumor-targeted Drug Delivery Systems. Nanotechnology for Imaging and Detection	08	CO5

Reference Books

1	*Christof M. Niemayer, Chad A. Mirkin,* 2004. **Nanobiotechnology: Concepts, applications and perspectives.** Wiley VCH publishers

2	*David S. Goodsell*., 2006. **Bionanotechnology: Lessons from Nature**. John Wiley & Sons, New Jersey.
3	*Jain K.K.,* 2005**. Nanobiotechnology in Molecular Diagnostics: Current Techniques and Applications.** Tailor L. Francis Group.
4	*Tuan Vo-Dinh,* 2007**. Nanotechnology in Biology and Medicine: Methods, Devices and Applications.** CRC Press, Taylor and Francis Inc., London.
5	*Torchilin Vladimir P.* 2006**. Nanoparticulates as Drug Carriers**. World Scientific. Imperial College Press, World Scientific Publishing Co. Pt. Ltd, London.

COURSE OUTCOMES (CO)

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

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

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H
CO2	H	H	H	M	H
CO3	H	H	M	M	H
CO4	H	H	M	M	H
CO5	H	H	M	M	H

H-High; M-Medium; L-Low

18UBTEL502	ELECTIVE I: BIOINFORMATICS	SEMESTER - V

Course Objectives:

The Course aims

- To understand and 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 amino acid, DNA and 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 depositing system, 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 Ab initio approaches. Predicting the protein secondary structure (Domain, blocks, motifs), Predicting protein tertiary	**08**	**CO5**

	structure (Homology, Ab-initio, threading and fold recognition) and visualization of predicted structure.		

Text Books

1	*Jin Xiong*, 2006. **Essential Bioinformatics**. Cambridge University Press. UK.
2	*Attwood, K.* and *Smith J. P.* 2003. **Introduction to Bioinformatics.** Pearson Education, Singapore.

Reference Books

1	*Rajaraman V*., 2003. **Introduction to information technology.** Prentice Hall of India Pvt. Ltd, New Delhi.
2	*Lesk, A. M.*, 2002. **Introduction to Bioinformatics**. Oxford University Press, London.
3	*Attwood T. K.* and *Parry-Smith D J.* 2005. **Introduction to Bioinformatics**. [First Edition]. Pearson Education, UK.
4	*Kothekar V.* and *Nandi T,* 2007. **An Introduction to Bioinformatics**. [Second Edition]. Duckworth press- Bioscience Publishers, New Delhi.
5	*David W Mount,* 2004. **Bioinformatics: Sequence and Genome Analysis**. CSHL Press, New York.

COURSE OUTCOMES (CO)

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

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

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	M	H
CO2	H	H	M	M	H
CO3	H	H	M	M	M
CO4	H	M	M	H	H
CO5	H	M	M	M	H

H-High; M-Medium; L-Low

18UBTMP501	CORE PRACTICAL- V	SEMESTER- V

Course Objectives:

The Course aims

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

Credits:3 **Total Hours:42**

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

Reference Books

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

COURSE OUTCOMES (CO)

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

CO1	Identify and count the blood cells and perform blood grouping
CO2	Perform ODD, RID, immunoelectrophoresis 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

18UBTSB501	**SBC III: IPR FOR LIFESCIENCE (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 –** IPR and its 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, multicellular organism, 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, trade mark.	**05**	**CO4**
V	**Copy rights –** coverage by copy rights, filing copyright in India, infringement. Plant breeder's rights. Open source Biotechnology, pros and cons of open source.	**05**	**CO5**

Reference Book

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

COURSE OUTCOMES (CO)

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

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

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	M	M
CO2	H	M	H	M	H
CO3	H	H	H	H	M
CO4	M	M	M	H	H
CO5	M	M	H	H	H

H-High; M-Medium; L-Low

18ULS501	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	CO 1
II	Non-Verbal Reasoning: Series Completion - Analogy and Classification - Completion of Incompletion Pattern.	3	CO 2
III	Non-Verbal Reasoning: Mirror Image and Water Image – Statement and Arguments - Cubes and Dices.	3	CO 3
IV	Reasoning: Puzzle Arrangement - Syllogism - Input and Output.	3	CO 4
V	Verbal Reasoning: Linear Arrangement - Circular Arrangement – Matrix Arrangement.	3	CO 5

Text Book

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

Reference Book

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

COURSE OUTCOMES (CO)

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

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

18UBTM601	CORE IX: RECOMBINANT DNA TECHNOLOGY	SEMESTER - VI

Course Objectives:

The Course aims

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

Credits: 5 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	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.

REFERENCE BOOKS

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

H-High; M-Medium; L-Low

18UBTM602	CORE X : ENVIRONMENTAL BIOTECHNOLOGY	SEMESTER - VI

Course Objectives:

The Course aims

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

Credits: 5 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	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**.** **(Self study)**	**10**	**CO5**

Text Book

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

Reference Books

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]. Pearson Education Ltd, England.
3	*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	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	M	H
CO2	H	H	H	M	M
CO3	H	H	M	L	M
CO4	M	H	M	M	H
CO5	M	H	M	M	H

H-High; M-Medium; L-Low

18UBTM603	CORE XI: BASICS OF ANIMAL CELL CULTURE	SEMESTER -VI

Course Objectives

The course aims

- To learn basic concepts about animal tissue culture.

Credits: 5 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	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. **Gene cloning and DNA analysis an Introduction.** [Sixth Edition]. Wiley Blackwell Publication, UK.

Reference Books	
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.

COURSE OUTCOMES (CO)

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

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

MAPPING

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

H-High; M-Medium; L-Low

18UBTEL601	ELECTIVE 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	08	CO5

	engineering for specific tissues and organ		

Text Book

1	*Lela Buckingham* and *Maribeth L. Flaws.* 2007. **Molecular diagnostics-Fundamentals, methods and clinical applications.** FA Davis Company. Philadelphia.

Reference Books

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.

COURSE OUTCOMES (CO)

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

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

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	L	M
CO2	H	M	L	M	M
CO3	M	M	L	M	M
CO4	H	M	M	L	M
CO5	H	H	M	M	M

H-High; M-Medium; L-Low

18UBTEL602	ELECTIVE II: FOOD BIOTECHNOLOGY	SEMESTER - VI

Course Objectives:

The Course aims

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

Credits: 4 **Total Hours: 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.

Reference Books

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.

COURSE OUTCOMES (CO)

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

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

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	M	M	L
CO2	L	M	H	M	M
CO3	M	H	M	L	M
CO4	M	H	M	M	L
CO5	H	M	L	M	H

H-High; M-Medium; L-Low

18UBTMP601	CORE PRACTICAL- VI	SEMESTER- VI

Course Objectives:

The Course aims

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

Credits:3 **Total Hours:42**

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

Reference Books

1. *Joseph Sambrook and David W. Russell*, 2001. **Molecular cloning – A laboratory manual Volume 1 to 3**. [Third Edition]. Cold Spring Harbor Laboratory Press, New York.
2. Aneja, K.R. 2003. **Experiments in Microbiology, Plant pathology and Biotechnology.** [Fourth Edition]. New age international.
3. *Cappucino, J.G and Sherman, N.* 2012. **Microbiology – A laboratory manual.**[Seventh Edition]. Pearson Education Inc.
4. *Freshney, R.I.,* 2005. **Culture of Animal Cells: A Manual of Basic Technique.**[Fifth Edition]. John Wiley and Sons , New Jersey.

COURSE OUTCOMES (CO)

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

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

18UBTSB601	SBC IV: BASICS OF RESEARCH (100% INTERNAL EVALUATION)	SEMESTER - VI

Course Objectives:

The Course aims

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

Credits: 2 **Total Hours: 25**

UNIT	CONTENTS	Hrs	CO
I	Research – 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, year systems.	**05**	**CO3**
IV	Journals – Standard of Research journals – impact factors – citation index, search scientific information – google, pubmed – Scientific information.	**05**	**CO4**
V	Component of Research report - Report, Table, Figures, Format of Thesis.	**05**	**CO5**

Reference Book

1 *Gurumani, N.* 2006. **Research Methodology**. MJP Publishers.

COURSE OUTCOMES (CO)

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

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

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	M	M
CO2	H	H	L	M	H
CO3	M	M	L	H	H
CO4	H	M	M	H	H
CO5	H	H	H	M	H

H-High; M-Medium; L-Low

18ULS601	CAREER COMPETENCY SKILLS-IV	SEMESTER – VI

Course Objectives:

The course aims

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

Total Hours: 15

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

Text Books

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

Reference Book

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

COURSE OUTCOMES (CO)

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

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

18UBTAL501	**ADVANCED LEARNERS COURSE II: GENES AND 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	Introduction to genes: History of genes – characteristics, formation and structure of genes. Genes and chromosomes. Role of genes in Human body and its functions.	**CO1**
II	Human cyto-genetics: Human karyotype, Banding techniques, classification, use of HCG in medical science. 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: Heart disease, Alzheimer's disease. Chromosomal abnormalities: Klinefelter syndrom. Mitochondrial inheritance: Leber's hereditary optic atrophy, MERRF.	**CO3**
IV	Genetic testing and Diagnosis: An introduction to genetic testing-gene tracking-clinical tests-personalized medicine- types and methods of diagnosis -prenatal diagnosis of genetic disorders.	**CO4**
V	Control of Human genetic diseases: Guidelines by WHO, Prevention and control of genetic diseases.Gene therapy: Somatic gene therapy, Germline gene therapy.Human Genome Project an Introduction-Goals of HGP.	**CO5**

Text Book

1	*Mahabal Ram,* 2010. **Fundamentals of cytogenetics and genetics**. PHI learning private limited, New Delhi.

Reference Book

1	*Tom Strachan* and *Andrew Read*, 2007. **Human molecular genetics** [Third edition]. BIOS scientific Publishers Ltd Oxford.

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 chromosomal abnormalities
CO4	Demonstrate genetic testing and diagnosis
CO5	Explain the control of human genetic disease

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	L	L	L
CO2	H	H	L	M	M
CO3	H	H	L	M	M
CO4	H	H	M	L	L
CO5	H	H	L	L	L

H-High; M-Medium; L-Low

18UBTAL502	ADVANCED LEARNERS COURSE II: OMICS - SCIENCE	SEMESTER - V

Course Objectives:

The Course aims

- To introduce genome architecture, 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	**Transcriptomics** Introduction to Transcriptomics, Types and function of Transcriptome – rRNA, tRNA, mRNA, siRNA, miRNA, RNAi, Catalytic RNA, RNA editing, RISC. Microarrays, Sequencing RNA, Transcriptomics and disorders, Impact of transcriptomics in pharmaceutical research.	**CO2**
III	**Proteomics** Organization of protein structure, Domains, Fold, Motif, PSSM, Classification of proteins, Ramachandran plot, Protein sequencing, Protein microarray, Mass Spectrometry 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, metal Ions. Phage display, Protein profiling, Molecular Docking.	**CO4**
V	**Metabolomics** Metabolic profiling and fingerprinting, Metabolic pathway analysis and metabolic networks, Single cell metabolomics.	**CO5**

REFERENCE BOOKS

1	*Brown.T.A.*2007. **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	Lehninger, **Principles of Biochemistry** [Fifth edition]. W.H. Freeman and Company, New York
4	David. E. Sadava. **Cell Biology: Organelle Structure and 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	Describe the protein function
CO5	Apply the skills in Metabolomics.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	L	M	L	H	M
CO2	H	M	M	M	H
CO3	L	M	M	H	H
CO4	M	M	M	M	H
CO5	M	M	M	M	H

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, otherwise the candidates will not be permitted to appear for the Practical Examinations.

2. PASSING MINIMUM AND INTERNAL MARK DISTRIBUTION

(Theory and Practical)

(i) THEORY

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

Internal Marks Distribution [CA- Total Marks: 25]

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

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

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

Internal Marks Distribution [CA- Total Marks: 100]

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

(iii) PRACTICAL

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

Internal Marks Distribution [CA- Total Marks: 40]

Experiment	: 10 Marks
Attendance	: 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 Internship and 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.
- Upon completion of the internship work the candidate shall be required to appear for a Viva-Voce conducted by an external examiner.
- The candidate shall be declared to have passed the Examination, if the candidate secure not less than 40 marks put together out of 100 in the Comprehensive Examination in 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	:	10 Marks
2.	Review (2)	:	20 Marks
3.	Presentation	:	10 Marks
	Total	**:**	**40 Marks**

External Mark Distribution **Comprehensive Examination (CE) Total Marks: 60**

1.	Internship work done	:	20 Marks
2.	Internship report	:	20 Marks
3.	Presentation	:	10 Marks
4.	Viva-Voce	:	10 Marks
	Total	**:**	**60 Marks**

4. CAREER COMPETENCY SKILLS

Semester III and VI - Viva voce

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

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

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

5. QUESTION PAPER PATTERN AND MARK DISTRIBUTION

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

Question Paper Pattern and Mark Distribution

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

2. **PART – B (5 x 5 = 25 Marks)**
   Answer ALL questions
   One question from each UNIT with Internal Choice

3. **PART – C (3 x 10 = 30 Marks)**
   Answer ANY THREE questions
   Open Choice – 3 out of 5 questions
   One question from each UNIT

ii) PRACTICAL

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

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

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

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 (25 Marks)**
   Procedure : 15 Marks
   Performance : 05 Marks
   Result : 05Marks

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

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

4. **Viva – Voce** **:** 05 Marks