BACHELOR OF SCIENCE (MICROBIOLOGY)

VISION

To produce intellectual mind and qualified professionals through innovative research and inventions for the enhancement of society.

MISSION

- To establish overall competence among the students by inculcating energetic thinking and positive spirit.
- To cultivate knowledge, skills, values and confidence for the student's excellence through research in their area of expertise or interest.

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO 1: To build graduates professionally competent in Microbiology to solve problems in society.

PEO2: To demonstrate proficiency and practice bio techniques through lifelong learning.

PEO3: To perform as an individual or team with professional and ethical behavior.

PROGRAMME OUTCOMES (PO)

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

PO1: Apply the knowledge of domain and fundamental science to solve problems relevant to the needs of the society.

PO2: Identify, formulate and review research literature for providing substantial conclusion for complex problems.

PO3: Function effectively as an individual and as a member or leader in diverse team and in multidisciplinary settings.

PO4: Demonstrate knowledge and understand the principles and apply these to once own work as a member in a team to manage projects and come with solutions for multidisciplinary environment.

PO5: Apply the ethical principles and commit to professional ethics and responsibilities in multidisciplinary practices.

PROGRAMME SPECIFIC OUTCOMES (PSO)

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

PSO1: Design and execute industry oriented experiments in microbiology using standard techniques.

PSO2: Apply the domain knowledge and technology to develop research skill for commercialization of microbial products.

PSO3: Evaluate the need and impact of scientific solutions for sustainable development of society.

PSO4: Analyze the conceptual domain knowledge for innovative research and lifelong learning.

PSO5: Create and develop the employable, entrepreneur and socially responsible citizens.

BACHELOR OF SCIENCE (MICROBIOLOGY)

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 examination, Tamil Nadu or as per norms set by the Government of Tamil Nadu or an examination accepted as Equivalent there to by the Syndicate subject to such conditions as may be prescribed there to are permitted to appear and qualify for the **B.Sc., Microbiology** 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 twelve semesters.

SCHEME OF EXAMINATION

Subject Code	Subject	Hrs of Instruction	Exam Duration (Hrs)	Max 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	English I	5	3	25	75	100	3
Part III							
18UMBM101	Core I: Basics in Microbiology	5	3	25	75	100	5
18UCHMBA101	Allied I: Chemistry	4	3	25	75	100	2
18UMBMP101	Core Practical I	6	6	40	60	100	3
18UCHMBAP101	Allied Practical I: Volumetric and organic analysis	3	3	40	60	100	2
Part IV							
18UVE101	Value Education I: Yoga	2	3	25	75	100	2
		30				**700**	**20**
SECOND SEMESTER							
Part I							
18UTALA201/ 18UHILA201/ 18UFRLA201	Tamil II /Hindi II/ French II	5	3	25	75	100	3
Part II							
18UENLA201	English II	5	3	25	75	100	3
Part III							
18UMBM201	Core II: Microbial Taxonomy and Physiology	6	3	25	75	100	5
18UBCMBA201	Allied II: Computer for biology	4	3	25	75	100	2
18UMBMP201	Core Practical II	6	6	40	60	100	3
18UBCMBAP201	Allied Practical II: Office package for biology	2	3	40	60	100	2
Part IV							
18UVE201	Value Education II: Environmental Studies	2	3	25	75	100	2
		30				**700**	**20**

THIRD SEMESTER							
Part I							
18UTALA301/ 18UHILA301/ 18UFRLA301	Tamil III / Hindi III/ French III	5	3	25	75	100	3
Part II							
18UENLA301	English III	5	3	25	75	100	3
Part III							
18UMBM301	Core III: Molecular Biology	5	3	25	75	100	5
18UBCMBA301	Allied III: Biochemistry	3	3	25	75	100	2
18UMBMP301	Core Practical III	3	6	40	60	100	3
18UBCMBAP301	Allied Practical III: Biochemistry	3	3	40	60	100	2
Part IV							
18UMBSB301	SBC I : Bioinstrumentation (100% Internal)	2	3	25	75	100	2
	NMEC I	2	3	25	75	100	2
Part V (Non credit)							
18ULS301	Career Competency Skills I	1					-
	Add on course	1	3		100	100	
		30				**800**	**22**
FOURTH SEMESTER							
Part I							
18UTALA401/ 18UHILA401/ 18UFRLA401	Tamil IV/ Hindi IV/ French IV	5	3	25	75	100	3
Part II							
18UENLA401	English IV	5	3	25	75	100	3
Part III							
18UMBM401	Core IV: Immunology	5	3	25	75	100	5
18UMAMBA401	Allied V: Biostatistics	4	3	25	75	100	2
18UMBMP401	Core Practical IV	3	6	40	60	100	3
18UCSMBAP401	Allied Practical IV: Statistical Software	2	3	40	60	100	2
Part IV							
18UMBSBP401	SBC II : Practical I (External Evaluation)	2	3	40	60	100	2
	NMEC II	2	3	25	75	100	2
Part V (Non credit)							
18ULS401	Career Competency Skills II	1					
	Add on course	1	3		100	100	
		30				**800**	**22**

FIFTH SEMESTER							
Part III							
18UMBM501	Core V: Fundamentals of Virology	5	3	25	75	100	5
18UMBM502	Core VI: Environmental Microbiology	4	3	25	75	100	4
18UMBM503	Core VII: Soil and Agricultural Microbiology	4	3	25	75	100	4
18UMBM504	Core VIII: Medical Bacteriology	5	3	25	75	100	5
	Elective I	4	3	25	75	100	4
18UMBMP501	Core Practical V	5	6	40	60	100	3
Part IV							
18UMBSB501	SBC III : Microbial Technology	2	3	100	-	100	2
Part V							
18UMBE501	Extension Activity	-	-	-	-	-	2
18ULS501	Career Competency Skills III	1					
		30				**700**	**29**
SIXTH SEMESTER							
Part III							
18UMBM601	Core IX: Fermentation Technology	5	3	25	75	100	5
18UMBM602	Core X: Genetic Engineering	5	3	25	75	100	5
18UMBM603	Core XI : Food and Dairy Microbiology	4	3	25	75	100	4
	Elective II	4	3	25	75	100	4
18UMBMP601	Core Practical VI	5	6	40	60	100	3
18UMBIP601	Internship and Viva-Voce	4	-	40	60	100	4
Part IV							
18UMBSBP601	SBC IV: Practical II: (External Evaluation)	2	3	40	60	100	2
Part V							
18ULS601	Career Competency Skills IV	1					
		30				**700**	**27**
					Grand Total	**4400**	**140**

Non Major Elective Course (NMEC)

Course Code	Subject	Semester
18UMBNM301	Personal Hygiene	III
18UMBNM401	Microbes and Human health	IV

Add-on Course

Course Code	Subject	Semester
18UMBAC301	Mushroom Technology	III
18UMBAC401	Microbiology for social welfare	IV

Advanced Learners Course

Course Code	Subject	Semester
18UMBAL401	Biofertilizer Technology	IV
18UMBAL501	Marine Microbiology	V

ELECTIVE

The students shall opt one of the following subjects as Elective in fifth & sixth semester

Elective	Subject code	Subject
Elective I	18UMBEL501	Medical Mycology and Parasitology
	18UMBEL502	Nano Microbiology
Elective II	18UMBEL601	Pharmaceutical Microbiology
	18UMBEL602	Basic and Applied Botany

TOTAL MARKS AND CREDIT DISTRIBUTION

S.No.	PART	MARKS	NO. CREDITS
1.	PART I: Language	400	12
2.	PART II: Foundation English	400	12
3.	PART III : Core, Allied and Elective	2800	98
4.	PART IV: Value Education (Yoga) Environmental Studies NMEC and SBC	800	16
5.	PART V: Extension Activity	000	02
TOTAL		**(4400)**	**(140)**

18UTALA101	TAMIL – I: கவிதைகளும் கதைகளும்	பருவம் I

இப்பாடத்திட்டத்தின் நோக்கங்களாவன:

- தற்காலத்தமிழ் இலக்கியவகைகளைமாணவர்களுக்குக் கற்பித்தல்.
- காலந்தோறும் தமிழ்க் கவிதைவளர்ச்சிநிலைகளைஅறிமுகப்படுத்துதல்.
- அடிப்படைத் தமிழ் இலக்கணத்தைக் கற்பித்துஅரசுப்போட்டித் தேர்வுகளுக்கு ஆயத்தப்படுத்துதல்.

Credits: 03 **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 - பூபாளத்திற்கொரு புல்லாங்குழல் - பனித்துளியில் பாற்கடல் இ. தீபா - மழைக்குஒருமடல் - பாரதியார்,வறுமை ஈ. சிற்பி - ஒரு கிராமத்து நதி	10	**CO2**
III	**சிறுகதைகள்** அ. அறிஞர் அண்ணா - செவ்வாழை ஆ. கிருத்திகா - உழவு மாடுகள் இ. வள்ளி.வ. - தணல் துண்டாய்...சிலதருணங்கள் ஈ.தி.ஜானகிராமன் - முள்முடி	10	**CO3**
IV	**இலக்கிய வரலாறு** 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 வடிவங்களைஅறிதல்.
CO2	புதுக்கவிதைகளின் வடிவங்கள் மற்றும் பாடுபொருள் தன்மையையஅறிதல்.
CO3	சிறுகதைகளின் உருவம்,உள்ளடக்கங்களைஅறிதல்
CO4	காலந்தோறும் மாறும் இலக்கியவளர்ச்சியைஅறிதல்
CO5	எழுத்துகளின் வகைகளைஅறிதல்.

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: 03 **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 **COMPOSITION** Dialogue Writing **COMMUNICATION SKILLS** Seeking Permission Offering a Suggestion and Giving an Advice	20	CO3 & CO4
V	**SHORT STORY** R. K. Narayan - The Axe **GRAMMAR**	10	CO5

	Question Tag **COMPOSITION** Reading Comprehension **COMMUNICATION SKILLS** Persuading		

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.

18UMBM101	CORE I: BASICS IN MICROBIOLOGY	SEMESTER I

COURSE OBJECTIVES

The course aims

- To learn about the early developments of Microbiology.
- To understand the basic concepts of microscopy, staining, sterilization and chemotherapeutic techniques.

Credits: 05 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Introduction to Microbiology:** Scope of Microbiology– Historical developments- Spontaneous generation– Germ theory of diseases. Contributions of Leeuwenhoek- Louis Pasteur- Joseph Lister- Edward Jenner– Robert Koch– Alexander Fleming. General properties of microorganisms (Bacteria, Fungi, Algae, Virus and Protozoan)	10	CO1
II	**Microscopy:** Principles, components and applications - Light microscopy, Dark field, Phase Contrast and Fluorescent microscopy. Electron microscopy - Scanning and Transmission electron microscopy. Confocal microscopy. **Staining techniques:** Staining types - Simple, Differential (Gram staining and Acid fast staining) and Special staining (Spore and Capsule staining).	10	CO2
III	**Culture techniques:** Media preparation– culture media- types of media. Pure culture techniques – preservation of culture. **Microbial cell:** Ultra structure of bacteria, sub- cellular structures and cell envelope–capsule, cell wall, pili and flagella.	10	CO3
IV	**Sterilization Principles:** Physical agents- dry heat, moist heat, radiation and filtration. Chemical agents – alcohols, phenol, aldehydes and gaseous agents.	10	CO4
V	**Antimicrobial chemotherapy:** Antibiotics– classification and mode of action- cell wall synthesis inhibitors, protein synthesis	10	CO5

	inhibitors and nucleic acid synthesis inhibitors. Mechanism of drug resistance. Tests for antimicrobial susceptibility– Kirby Bauer method and Stokes method.		

TEXT BOOK

1. *Lansing M Prescott, John P Harleyand Donald A Klein*. 2010. **Microbiology**. [Eighth Edition]. Mc GrawHill, NewYork.

REFERENCE BOOKS

1. *Atlas,R .M.* 1997. **Principles of Microbiology.** [Second Edition]. WCK. McGraw–Hill.
2. *Black,J. G.* 1999. **Microbiology- Principles and Exploration.** [Fourth Edition]. Prentice Hall International Inc.
3. *Madigan, M.T., Martinko, J.M.* and *Parker, J.* 2000. **Brock Biology of Microorganisms.** [Ninth Edition]. Prentice Hall International, Inc.

COURSE OUTCOMES (CO)

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

CO1	Recall the origin of Microbiology.
CO2	Understand the principles of Microscopy and staining techniques.
CO3	Assess growth parameters for the cultivation and preservation of microbes in the laboratory.
CO4	Apply aseptic condition for maintenance of pure culture and control of contaminants.
CO5	Assess the use of antibiotics to control pathogens and treatment of microbial diseases.

MAPPING

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

H-High; M-Medium; L-Low

18UCHMBA101	ALLIED I: CHEMISTRY	SEMESTER I

COURSE OBJECTIVES

The course aims

- To understand the bonding in organic molecules and the factors affecting it
- To study the mechanism of substitution reactions
- To recall the basic ideas in Co-ordination compounds
- To evaluate the chemistry behind polymers
- To recognize the elementary ideas in Electrochemistry

Credits: 02 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Chemical Bonding:** Covalent bonds-Orbital overlap – Hybridisation-SP, SP^2, SP^3 -Electron displacement effect-Inductive effect – Resonance – Hyperconjugation-Steric effect-Their effects on the properties of compounds – Stereoisomerism-Optical isomerism-Elements of symmetry-Causes of optical activity-Tartaric acid-Geometrical isomerism of Maleic acid and Fumaric acid.	08	CO1
II	**Reaction and Mechanism:** Aliphatic Nucleophilic substitution reaction-Mechanism of SN^1 and SN^2 reaction-Aromatic compounds – Aromaticity- Huckel's rule-Electrophilic substitution reaction in Benzene-Mechanism of nitration, halogenation, sulphonation, Friedel-craft alkylation and Friedel-craft acylation	08	CO2
III	**Co-ordination Chemistry:** Definition-classification of ligands-Werner's theory-Sidgwick's theory-Effective atomic number-Pauling's theory (VB theory) – Chelation-Chelate effect – Haemoglobin-definition and biological role – Chlorophyll-definition and biological role – EDTA-its applications.	08	CO3
IV	**Polymer Chemistry:** Natural Polymer – Types of polymer –	08	CO4

	Homopolymer–Heteropolymer–Additional and Condensation polymers – polymerization reactions - Manufacture of film sheets – Rayon and Polyacrylicfibers – PVC – Uses of polymers.		
V	**Electrochemistry:** Kohlrausch's law-measurement of conductance-determination of P^H-Conductometric titration-Hydrolysis of salts-Elementary ideas – Examples-Galvanic cell-**Galvanic cell-**EMF-Standard electrode potential-Electrochemical series-its applications-Principal of electroplating – Corrosion-Corrosion prevention.	**08**	**CO5**
TEXT BOOK			
1.	*Madan.R.L. and Tuli G. D.* 2005. **Simplified course in Physical chemistry.** [Sixth Edition]. S.Chand and company Ltd., 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	M	H	M	H	M
CO2	M	H	H	H	M
CO3	H	H	H	H	M
CO4	H	H	H	H	H
CO5	M	M	H	H	H

H-High; M-Medium; L-Low

18UMBMP101	**CORE PRACTICAL I: BASICS IN MICROBIOLOGY**	**SEMESTER I**

COURSE OBJECTIVES

The course aims

- To learn the basic techniques of Microbiology.
- To understand the morphological structures of bacteria.
- To cultivate and maintain the microorganisms.

Credits: 03 **Total Hours: 60**

Experiment	CONTENTS	Hrs	CO
1.	Handling, maintenance and care of bright field Microscope	**3**	**CO1**
2.	Cleaning of glassware	**2**	**CO1**
3.	Staining techniques– Simple staining	**5**	**CO1**
4.	Gram's staining.	**5**	**CO1**
5.	Acid Fast (Ziehl- Neelson) staining	**5**	**CO1**
6.	Spore staining	**5**	**CO1**
7.	Capsular staining	**5**	**CO1**
8.	Media preparation- Liquid media– Nutrient broth, Solid media– Nutrient agar	**5**	**CO2**
9.	Preparation of agar slants and agar deeps.	**5**	**CO2**
10.	Pure culture techniques– Serial dilution method and pour plate method	**2**	**CO3**
11.	Streak plate method	**3**	**CO3**
12.	Spread plate method	**5**	**CO3**
13.	Stab culture method	**5**	**CO4**
14.	Antibiotic sensitivity test– Kirby-Bauer disc diffusion method	**5**	**CO5**

REFERENCE BOOKS	
1.	*Cappucino, J. Gand Sherman, N.* 2012. **Microbiology – A laboratory manual.** [Seventh Edition]. Pearson Education Inc.
2.	Harley and Presscott. 2002. **Laboratory Exercises in Microbiology,** [Fifth Edition]. Mc Graw Hill Companies.
3.	*Kannan, N.* **Laboratory manual in General Microbiology.** [Second Edition]. Panima publishing corporation, New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Identify microbes through staining with microscopy.
CO2	Design different media for cultivation of microorganisms.
CO3	Evaluate the isolation and purification of microorganisms.
CO4	Demonstrate the maintenance of bacterial cultures.
CO5	Evaluate control measures of microorganisms using chemotherapy.

18UCHMBAP101	ALLIED PRACTICAL I: VOLUMETRIC AND ORGANIC ANALYSIS	SEMESTER I

COURSE OBJECTIVES

The course aims

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

Credits: 02 **Total Hours: 30**

Experiment	CONTENTS	Hrs	CO
	Titrimetric Quantitative Analysis		
1.	Estimation of HCl using standard oxalic acid.	**3**	**CO1**
2.	Estimation of Ferrous sulphate using Mohr's salt.	**2**	**CO1**
	Organic Qualitative Analysis		
1.	Monocarboxylic acid	**5**	**CO2**
2.	Monoamide	**5**	**CO2**
3.	Diamide	**5**	**CO2**
4.	Carbohydrate	**5**	**CO2**

REFERENCE 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 OUTCOMES (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

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: 02 **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.	6	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.	6	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.	6	CO3
IV	**Human Resources Development:** Eradication of Worries -	6	CO4

	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.		
V	**Law of Nature:** Unified force - Cause and effect system - Purity of thought deed and Genetic Centre – Love and Compassion - Gratitude - Cultural Education - Fivefold culture.	**6**	**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**

இப்பாடத்திட்டத்தின் நோக்கங்களாவன:

- சமய இலக்கியங்களைஅறிமுகம் செய்தல்
- சமயச் சான்றோர் நிலைப்பாட்டைஉணர்த்துதல
- சமயங்கள் வளர்த்ததமிழைஅறியச் செய்தல்

Credits: 03 **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 பத்துப்பாடல்கள்)** 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	**08**	**CO4**

	ஈ. சைவசித்தாந்தசாத்திரங்கள்		
V	**இலக்கணமும் மொழித்திறனும்** அ. ஆகுபெயர் ஆ. தொகைச்சொற்கள் இ. மயங்கொலிச்சொற்கள் (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, வைணவசமயச் 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: 03 **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** Praising and Complimenting Complaining and Apologizing	**20**	**CO3 & CO4**
V	**POETRY** Tripuraneni Srinivas - I Will Embrace only the Sun **SHORT STORY**	**10**	**CO5**

	O. Henry - One Thousand Dollars **COMPOSITION** Discourse Pattern **COMMUNICATION SKILLS** Expressing Sympathy Phoning		

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

18UMBM201	CORE II: MICROBIAL TAXONOMY AND PHYSIOLOGY	SEMESTER II

COURSE OBJECTIVES

The course aims

- To learn the classification and taxonomic groups of microbes.
- To understand the basic nutritional requirements of microorganism.
- To learn the general metabolic activities of bacteria.

Credits: 05 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Microbial evolution**: Classification–Haeckel's three kingdom concepts– Whittaker's five kingdom concepts. Taxonomy hierarchy. Binomial Nomenclature. Classical systems of classification– Chemotaxonomy, Numerical taxonomy.	10	CO1
II	**Molecular based classification:** DNA- DNA Hybridization - Protein sequencing – rRNA sequencing. Classification and Salient features of bacteria according to the Bergey's manual of determinative bacteriology.	10	CO2
III	**Microbial Growth:** Growth and mode of cell division in bacteria– growth curve– measurement of growth- batch, continuous and synchronous culture. Factors affecting microbial growth- Physical and Chemical - temperature, pH, osmotic pressure, moisture, radiations and salinity. Endospore formation.	10	CO3
IV	**Microbial Nutrition:** Nutritional requirements and types of bacteria. Transport of nutrients by bacteria– active transport, passive diffusion, facilitated diffusion and group translocation.	10	CO4
V	**Metabolic Pathways:** Glycolysis, Entner Duodroff pathway, Citric acid cycle, Electron transport chain – ATP generation, Photosynthesis –oxygenic and anoxygenic and Fermentation.	10	CO5

TEXT BOOKS	
1.	*Atlas, R. M.* 1997. **Principles of Microbiology.** [SecondEdition]. WCK. Mc Graw–Hill.
2.	*LansingM Prescott, John P Harley and Donald A Klein.* 2010. **Microbiology**. [Eighth Edition]. Mc GrawHill, NewYork.

REFERENCE BOOKS	
1.	*Madigan, M.T., Martinko, J.M. and Parker, J.* 2000. **Brock Biology of Microorganisms.** [Ninth Edition]. Prentice Hall International, Inc.
2.	*Balows, A. Truper,H.G. Devorkin,M. Harder and Schleife, K.H.* 1992. **The Prokaryotes.** Springerlink. NewYork.
3.	*Black,J.G.* 1999. **Microbiology-Principles and Exploration.** [FourthEdition]. Prentice Hall International Inc.

COURSE OUTCOMES (CO)

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

CO1	Identify the group of microorganisms based on taxonomical character.
CO2	Analyze microorganisms based on their molecular features.
CO3	Assess the growth factors for cultivation of microorganisms in the laboratory.
CO4	Formulate suitable media for microbial growth.
CO5	Outline metabolic pathways and standardize culture conditions for industrially important microorganisms.

MAPPING

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

H-High; M-Medium; L-Low

18UCSMBA201	ALLIED II: COMPUTER FOR BIOLOGY	SEMESTER II

COURSE OBJECTIVES

The course aims

- Enable students to get familiar with fundamental knowledge of computers.
- Acquire knowledge and essential skills for using the office packages.

Credits: 02 **Total Hours: 30**

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. **The Input - Output Media:** Inputs and Outputs:CRT Monitors - Flat Panel Monitors - Keyboards - Graphics and Graphical Terminals - Printers.	06	CO1
II	**Introduction to Microsoft Office Word 2007:** Working with Documents in Microsoft Word2007 - Saving the File - Formatting the Text - Alignment of Text - Applying Fonts - Spell Checking - Consulting Thesaurus - Assign a Character Style - Borders and Shading - Closing of the File - Save as Option - Printing your Document - Editing the Document - Editing Tools - AutoCorrect - AutoFormat- Find and Replace - Find - Replace Text - Page Numbering - Header and Footer - Foot Notes and End Notes.	06	CO2
III	**Introduction to Microsoft Office Word 2007:** Splitting Panes - Tiling of the Document - Using Mail Merge in Word 2007 - Opening Screen of Microsoft Word screen. **Introduction to Microsoft Office Excel 2007:** Understanding Spreadsheets - Creating a Work sheet in Excel2007 - Copying Formula - Formulas that Make Decisions - Styles - Functions in Excel - Using Auto calculate - References - Sum Function - Average Function - Creating Charts in Excel - Auditing a Workbook - Comments Inserting - Outlines -Worksheet Fitting on aPage.	06	CO3
IV	**Introduction to Microsoft Office Excel 2007:** Function Wizard - Goal Seeking - Scenarios Manager - Creating a Pivot Table Report - Typing with AutoFill - Formatting Numbers	06	CO4

	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.		
V	Working with Microsoft Office PowerPoint 2007:Creating Presentation from Template - Creating a New Presentation - PowerPoint 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 Picture to a Photo Album - Change the Appearance of a Picture in a Photo Album.	**06**	**CO5**

TEXT BOOKS

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

REFERENCE BOOKS

1. *Anita Goel.* 2010. **Computer Fundamentals. [First Edition]. Pearson Publications**
2. *Pradeep K. Sinha, Priti Sinha.* 2016. [Fourth Edition]. **Computer Fundamentals**. BPB Publications
3. *J.B Dixit*. 2011[Kindle Edition]. **Fundamentals of Computer Program and Information Technology. Laxmi Publishers**
4. *Lisa A.Bucki, John Walkenbach, Faithe Wempen, Micheael Alexender, Dick Kusleika.* 2013. Reprint. **Microsoft Office 2013 Bible.** Wiley Publications
5. *John Walkenbach*. 2010. Reprint. **Microsoft Excel 2010 Bible**. Wiley India Pvt. Limited
6. *Tracy Syrstad*. 2015.[First Edition]. **Excel 2013 Absolute Beginners Guide**. Pearson Publications

WEB REFERENCE	
1.	*https://www.tutorialspoint.com*
2.	*https://www.free - computer - tutorials.net*
3.	*https://www.edu.getglobal.org*
4.	*https://www.w3schools.com*

COURSE OUTCOMES (CO)

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

CO1	Explore the fundamental components of computer devices.
CO2	Create well defined documents with various tools in MS Word.
CO3	Interpret the various formulas, functions and chart preparations in MS Excel.
CO4	Generate various kinds ofreports.
CO5	Create slides, overhead transparencies, Handouts and Speaker Notes.

MAPPING

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

H-High; M-Medium; L-Low

18UMBMP201	**CORE PRACTICAL II : MICROBIAL TAXONOMY AND PHYSIOLOGY**	**SEMESTER II**

COURSE OBJECTIVES

The course aims

- To learn about the morphological diversity of microorganisms.
- To understand the biochemical characterization of microorganisms.

Credits: 05 **Total Hours: 60**

Experiment	**CONTENTS**	**Hrs**	**CO**
1.	Measurement of cell size and motility of bacteria – Micrometry and Hanging drop method.	**5**	**CO1**
2.	Microscopic examination of cyanobacteria – *Oscillatoria* sp., *Spirulina* sp., *Nostoc* sp. and *Anabaena* sp.	**2**	**CO2**
3.	Microscopic examination of fungi – *Mucor* sp., *Aspergillus* sp., *Penicillium* sp. and *Alternaria* sp.	**2**	**CO2**
4.	Growth curve –Turbidity method	**5**	**CO3**
5.	IMViC tests	**5**	**CO4**
6.	Sugar fermentation tests	**5**	**CO4**
7.	Triple sugar iron agar (TSI) test	**5**	**CO4**
8.	Nitrate reduction test	**3**	**CO4**
9.	Starch hydrolysis	**3**	**CO4**
10.	Catalase and Oxidase tests	**5**	**CO4**
11.	Urease test	**5**	**CO4**
12.	Gelatin hydrolysis test	**5**	**CO4**
13.	Effect of various factors on growth of bacteria i. Temperature ii. pH iii. Nutrients – carbon source	**5**	**CO5**
14.	Thermal Death Point and Thermal Death Time	**5**	**CO5**

REFERENCE BOOKS	
1.	*Harley Prescott.* **Laboratory Exercises in Microbiology.** [Fifth Edition]. The McGraw-Hill companies.
2.	*Kannan, N.* **Laboratory Manual in General Microbiology.** [Second Edition]. Panima publishing corporation, New Delhi.
3.	*Benson.* 2001. **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	Identify the motility of bacteria and determine the size of bacteria.
CO2	Discriminate the structures of Algae and Fungi.
CO3	Analyze the different phases of bacterial growth.
CO4	Outline the characterization of bacteria based on biochemical activities.
CO5	Assess the bacterial growth based on environmental factors.

18UCSMBAP201	**ALLIED PRACTICAL II : OFFICE PACKAGE FOR BIOLOGY**	**SEMESTER II**

COURSE OBJECTIVES

The course aims

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

Credits: 02 **Total Hours: 24**

Experiment	**PROGRAMS**	**Hrs**	**CO**
MS-Word			
1.	Creating a Personal Profile.	**2**	**CO1**
2.	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).	**2**	**CO2**
3.	Creating a Document for topic presentation with following options • Single and Double Column. • Page numbers. • Headers and Footers. • Date and time, Pictures and Shapes.	**2**	**CO1**
4.	Mail Merge—Invitation to Multiple Recipients for Conducting Seminar in the Department.	**2**	**CO2**
MS-Excel			
5.	Entering Data for Stock Analysis and Formatting the cells	**2**	**CO3**

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

COURSE OUTCOMES (CO)

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

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

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: 02 **Total Hours: 30**

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

V	Population and environment – Population explosion – Environment and human health – HIV/AIDS – Women and Child welfare – Disaster Management - Resettlement and Rehabilitation of people, Role of information technology in environmental health – Environmental awareness.	**06**	**CO5**

TEXT BOOK	
1.	Department of Biochemistry. Environmental Studies (Study Material). Published by K.S.Rangasamy College of Arts & Science (Autonomous). Tiruchengode.
REFERENCE BOOK	
1.	*Erach Bharucha*. 2005. **Textbook of Environmental studies**. Universities press. PVT. Ltd.

COURSE OUTCOMES (CO)

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

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

18UTALA301	**TAMIL – III: காப்பியம் - சிற்றிலக்கியம்**	**பருவம் III**

இப்பாடத்திட்டத்தின் நோக்கங்களாவன:

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

Credits: 03 **Total Hours: 50**

UNIT	**CONTENTS**	**Hrs**	**CO**
I	காப்பியங்கள் - சிலப்பதிகாரம் - வழக்குரைகாதைமணிமேகலை - 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 - வழுஉச் 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 மேன்மைநிலையை உணர்தல்.
CO2	காப்பியக்காலகுடிகளின் நிலையை,உரிமையையுணர்தல்.
CO3	சிற்றிலக்கியங்களின் சிறப்பை உணர்தல்.
CO4	காப்பிய,சிற்றிலக்கியங்களின் வரலாறு குறித்த செய்திகளைஅறிதல்.
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: 03 **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** Resume Writing **COMMUNICATION SKILLS** Imagining Context specific expression - Master of Ceremonies	**20**	**CO3 & CO4**
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

18UMBM301	CORE III: MOLECULAR BIOLOGY	SEMESTER III

COURSE OBJECTIVES

The course aims

- To understand the basic knowledge about the central dogma of the organism.
- To know about basic mechanism of transcription and translation.
- To learn the gene transfer and gene analysis techniques.

Credits: 05 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Nucleic acids:** Central dogma - Different forms of DNA (ADNA, BDNA, ZDNA)- DNA as genetic material- Griffith's, Avery and Hershey-Chase experiment. Prokaryotic DNA replication- Semi-conservative mode of DNA replication. Enzymology of DNA replication- Meselson and Stahl experiment- rolling circle replication.	10	CO1
II	**Gene expression (Prokaryotes):** Transcription (Prokaryotes)- the basic mechanism of transcription- RNA polymerase- structure and function process of transcription-initiation (promoters), elongation and termination (Rho-dependant and Rho-independent process)- Inhibitors of transcription- Post transcriptional modification of m-RNA.	10	CO2
III	**Translation (Prokaryotes):** Translation in prokaryotes– structure of ribosomes– amino acid activation, charging of t–RNA–Initiation of protein synthesis. Elongation and termination– inhibitors of translation. Post translational modifications.	10	CO3
IV	**Prokaryotic gene regulation:** Operon concept– *trp*, *lac* operon. Positive and negative control of gene expression–attenuator control. Gene transfer methods- Transformation-Conjugation–transduction (generalized and specialized).	10	CO4

V	**Techniques used in genome analysis-** DNA hybridization-PCR-chromosome walking–Chromosome Jumping-RFLP-RAPD- AFLP-DNA microarray (DNA chips)-site directed mutagenesis.	**10**	**CO5**

TEXT BOOKS

1. *Prescott, L.M. Harley, J.P. and Klein, D.A* 2012. **Microbiology.** [Eighth Edition]. WMC. Brown Publishers
2. *Weaver, R.F.*1999. **Molecular Biology**, WCB Mc Graw-Hill.

REFERENCE BOOKS

1. Peter J. Russell. 1998. **Genetics**. 1998. [FifthEdition]. Harpar Collins College Publishers.
2. *David Freifelder.* 1987. **Molecular Biology**. Jones and Bartlett, New Zealand**.**
3. *Benjamin Lewin.*2007. **Genes IX.** Pearson Prentice Hall, USA
4. *Waston,J. D., Baker,T. A., Bell,S. P., Alexander G., Michael L. And Richard L.* 2004. **Molecular Biology of the Gene.** [Fifth Edition]. Pearson Education Pvt. Ltd., New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Recall the basics of molecular mechanisms.
CO2	Assess gene expression in prokaryotes.
CO3	Analyze the desired protein products.
CO4	Apply the knowledge of gene regulation into product launching.
CO5	Apply the molecular techniques for disease diagnosis.

MAPPING

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

H-High; M-Medium; L-Low

18UBCMBA301	**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 this is the basic requirement of all life sciences.

Credits: 02 **Total Hours: 40**

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

IV	**Enzymes –** Definition, IUB classification with examples. Active site - Definition, Mechanism of enzyme action - Lock & key model and induced fit hypothesis. Enzyme units - IU, katal. Factors affecting enzyme activity (pH, Temperature and substrate concentration).	**8**	**CO4**
V	**Vitamins** - Classification, Sources, daily requirements, physiological functions and deficiency of fat and water soluble vitamins. **Minerals and Trace elements**: Macro and micro minerals. Sources, daily requirements, physiological functions and deficiency diseases of calcium, phosphorous, sodium, potassium, iron.	**8**	**CO5**
TEXT BOOK			
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	M	M	H	H	L
CO2	M	M	H	H	L
CO3	M	M	H	H	L
CO4	M	M	H	H	L
CO5	M	M	H	H	L

H-High; M-Medium; L-Low

18UMBMP301	CORE PRACTICAL III : MOLECULAR BIOLOGY	SEMESTER III

Course Objectives:

The course aims

- To understand and apply the basic principles and techniques of molecular biology for further research.
- To know about isolation, estimation and purification of nucleic acids.

Credits: 05 **Total Hours: 50**

Experiment	CONTENTS	Hrs	CO
1.	Isolation of genomic DNA from bacteria.	**06**	**CO1**
2.	Isolation of plasmid DNA.	**06**	**CO1**
3.	Estimation of DNA by Diphenylamine method.	**05**	**CO2**
4.	Estimation of RNA by Orcinol method.	**05**	**CO2**
5.	Protein estimation by Lowry's method.	**06**	**CO2**
6.	Determination of UV killing effect for bacteria.	**06**	**CO3**
7.	Isolation of auxotrophic mutants by gradient plate technique (Spontaneous mutation).	**08**	**CO4**
8.	Isolation of auxotrophic mutants by replica plating technique (induced mutation).	**08**	**CO4**

Reference Books:

1. *Maniatis Sambrook and David W. Russel.* **Molecular Cloning: A Laboratory Manual.** [Third Edition]. Cold Spring Harbor laboratory press.
2. *Janarthanan, S. and Vincent, S.* 2009. **Practical Biotechnology: Methods and Protocols.** [Second Edition]. Universities press, (India) Pvt Ltd, Hyderabad.

COURSE OUTCOMES (CO)

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

CO1	Analyze the bacterial genomic DNA and RNA.
CO2	Assess the quantification of nucleic acids and proteins.
CO3	Determine the killing effect of UVC on microorganisms.
CO4	Demonstrate rDNA technology through gene transfer in prokaryotes.

18UBCMBAP301	**ALLIED PRACTICAL III: BIOMOLECULES**	**SEMESTER III**

Course objectives:

The course aims

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

Credits:02 **Total Hours: 27**

S.No.	**EXPERIMENT**	**Hrs**	**CO**
I. Qualitative Analysis			
1.	Carbohydrates: Glucose, fructose, xylose, sucrose, lactose, and starch.	9	CO1
2.	Amino acids: Tyrosine, tryptophan, histidine, methionine and cysteine.	6	CO1
3.	Proteins: Solubility test, coagulation test, ninhydrin test, biuret test, folin's phenol test, precipitation by metals.	3	CO1
4.	Lipids: Solubility, grease spot, Oil spot, emulsification, halogenations, colour reactions.	3	CO1
II. Quantitative Analysis			
5.	Estimation of Glycine by Formal titration method.	3	CO2
6.	Determination of Saponification Value	3	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

18UMBSB301	**SBC I: BIOINSTRUMENTATION**	**SEMESTER III**

Course Objectives:

The course aims

- To learn the working mechanism and applications of biological instruments.
- To study various analytical techniques in the field of Microbiology.

Credits: 02 **Total Hours: 30**

UNIT	**CONTENTS**	**Hrs**	**CO**
I	**Buffer, pH and Spectrometry:** Good Laboratory practices, pH meter and electrodes working principle with maintenance. Buffer preparation– Phosphate buffer- colorimeter and Spectrophotometer – (UV-Vis).	**06**	**CO1**
II	**Centrifugation:** Principles of centrifugation. Rotor types– Fixed angle, vertical tube and swinging bucket. Instrumentation for centrifugation. Application of Centrifugation –preparative and analytical techniques. Care of rotors and centrifuge.	**06**	**CO2**
III	**Electrophoresis:** Principles and applications–Paper electrophoresis, Agarose Gel Electrophoresis. SDS-PAGE, Two-dimensional electrophoresis and isoelectric focusing.	**06**	**CO3**
IV	**Chromatography:** Principle and applications- Paper, TLC, Column, Ion exchange, Affinity chromatography, HPLC and Gas chromatography.	**06**	**CO4**
V	**Radioactivity:** Half-life, Radioactive decay, Excitation, Ionization. Isotopes used in biological studies. Measurement of Radioactivity-Geiger- Muller counter, Scintillation counter.	**06**	**CO5**

Text Book:

1. *Rodney F. Boyer.* **Modern Experimental Biochemistry**. 3rd Edition. Pearson Education ltd.

Reference Books:	
1.	*Wilson, K., and Walker, J.* 2003. **Practical Biochemistry, Principles and Techniques**. Cambridge University Press, Cambridge.
2.	*Skoog, D. A*. 2006. **Principles of Instrumental Analysis**. [Sixth Edition]. Thompson Brooks/Cole: Belmont, CAs.

COURSE OUTCOMES (CO)

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

CO1	Discuss the importance of bioinstruments in research and industry.
CO2	Analyze microbial by products and end products by analytical and preparative methods.
CO3	Evaluate molecular characterization and profiling of proteins.
CO4	Assess the separation and characterization of biomolecules.
CO5	Evaluate the respective biomolecules through radio isotopes.

MAPPING

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

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)	3	CO1
II	Sentence Correction – Sentence Pattern - Reading	3	CO2

	Comprehension (Level -1)		
III	Expansion of Proverbs – Closet Test (Level -1)	3	CO3
IV	Sentence Improvement (Essay Writing, Now- a –Days Vocabulary), Story Writing	3	CO4
V	E-Mail Building (Sending call letters), Letters (Formal and Informal)	3	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 :

- சங்க இலக்கியம், அற இலக்கியங்களின் சிறப்பைஉணர்த்துதல்.
- இலக்கண நூல்களைகாலவரிசைப்படிஅறியச் செய்தல்.
- அணி இலக்கணத்தின் சிறப்பை உணரச் செய்தல்.

Credits: 03 **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	**இலக்கிய வரலாறு** 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 4. வஞ்சப்புகழ்ச்சிஅணி ஆ. அகத்திணைகள்,புறத்திணைகள் - விளக்கம்	**08**	**CO5**

TEXT BOOK

1	தமிழ்த்துறைவெளியீடு,கே.எஸ்.ரங்கசாமி கலை அறிவியல் 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: 03 **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	*SasiKumar V and Syamala V*. 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	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.

18UMBM401	**CORE IV: IMMUNOLOGY**	**SEMESTER IV**

COURSE OBJECTIVES

The course aims

- To understand the working of immune system and immune molecules.
- To know the mechanism of immune response and immunodiagnosis.

Credits: 05 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Immunity**: Early theories and clonal selection theory. Hematopoiesis and its regulations. Immunity types and response- Innate and Acquired immunity, Humoral and Cell mediated immunity.	**10**	**CO1**
II	**Cells and organs of immune system and antigen:** Cells, Organs and tissues of the immune system– Primary lymphoid organs– Secondary lymphoid tissues. Antigens: Types– Epitopes, hapten, adjuvants and properties.	**10**	**CO2**
III	**Antigen– Antibody reactions:** Antibody: Structure, types and properties. Monoclonal antibody production. Primary and secondary reactions, Chemical interactions, Agglutination, Agglutination inhibition, Precipitation, Immunofluorescence, ELISA, RIA, Complement fixation test, Immunohaematology– ABO and Rh incompatibility.	**10**	**CO3**
IV	**Complement system**: Properties, Classical and alternative pathway, Cytokines structure and functions, MHC and its role. Autoimmunity–Grave's disease, Myasthenia Gravis. Vaccines – immunization – active and passive- attenuated vaccine- recombinant vaccine – purified macromolecules as vaccines.	**10**	**CO4**
V	**Effector mechanisms:** Transplantation- types of grafting, graft acceptance and rejection. Hypersensitive reactions– Classification– IgE mediated (type–I) – Antibody mediated	**10**	**CO5**

	cytotoxic (Type–II)– Immune complex mediated (Type-III)- TDTH-Mediated (Type-IV). Cancer immunology– Origin and terminology, Immune responses to tumour, Cancer Immunotherapy.		

TEXT BOOK

1. *Nandhini Shetty.* 2007. **Immunology: Introductory Text Book**. New Age International Pvt. Ltd., New Delhi.

REFERENCE BOOKS

1. *Tizard, K.* 1983. **Immunology.** Saunders College Publishing, Philadelphia.
2. *Roitt.* 1988. **Essentials of Immunology.** Blackwell Scientific Publishers, London.
3. *Janeway, C. A., P. Travers, M. Walport and M. J. Shlomchik* (2001). **Immunobiology**: The Immune System in Health and Disease. Garland Publishing, USA.
4. *Richard Goldsby, Thomas.J. Kindt, Barbara. A. Osborne.* 2004. **Immunology**. [Fourth Edition]. W. H. Freemanand Co., NewYork.

COURSE OUTCOMES (CO)

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

CO1	Understand the importance of immunity.
CO2	Discuss the cells and organs of immune system.
CO3	Analyze the importance of immunity and to develop new monoclonal antibodies.
CO4	Demonstrate the nature of antigens and antibodies and to develop vaccines.
CO5	Analyze merits and demerits of transplantation.

MAPPING

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

H-High; M-Medium; L-Low

18UMAMBA401	**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: 02 **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	CO 1
II	**Measures of Central Tendency:** Arithmetic Mean – Median – Mode – Geometric mean – Harmonic mean. **(Chapter 3 Sections: 3.1.1, 3.2 - 3.5)**	08	CO 2
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	CO 3
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	CO 4
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	CO 5

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)

On completion of this 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	H	H	M	M
CO2	M	M	M	M	M
CO3	M	L	M	L	L
CO4	M	M	M	M	M
CO5	M	M	M	H	M

H-High; M-Medium; L-Low

18UMBMP401	**CORE PRACTICAL IV: IMMUNOLOGY**	**SEMESTER IV**

COURSE OBJECTIVES

The course aims

- To study the serological diagnostic techniques.
- To study the qualitative analysis of various antigen against antibody.

Credits: 03 **Total Hours: 36**

Experiment	**CONTENTS**	**Hrs**	**CO**
1.	ABO blood grouping and cross matching	**3**	**CO1**
2.	CRP	**3**	**CO2**
3.	RA	**3**	**CO2**
4.	ASO	**3**	**CO3**
5.	RPR	**3**	**CO2**
6.	WIDAL test (Slide and tube methods)	**6**	**CO3**
7.	Haemagglutination	**3**	**CO4**
8.	ELISA	**3**	**CO4**
9.	Counter Immunoelectrophoresis	**3**	**CO5**
10.	Double Immunodiffusion (Ouchterlony)	**6**	**CO5**

REFERENCE BOOKS

1. *Rajan, Sand Selva Christy, R.*2010. **Experimental Procedures in Life Sciences.** [First Edition]. Anjanaa Book House, Chennai.
2. *Kannan, N.* **Laboratory Manual in General Microbiology.** [Second Edition]. Panima publishing corporation, New Delhi.
3. *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	Identify viral infections by serological method diagnosis.
CO2	Analyze the blood group of individuals and also analyze the enteric fever and their causative agent.
CO3	Utilize immunotechniques for qualitative analysis of antigens.
CO4	Evaluate Streptococcal infections by serological methods and determine the infection status based on CRP level.
CO5	Identify the presence of rheumatoid factor among suspected patients and diagnose HIV, hepatitis viral infection among risky populations.

18UMAMBAP401	**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: 02 **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 the 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.

18UMBSBP401	**SBC PRACTICAL I: BIOINSTRUMENTATION**	**SEMESTER IV**

COURSE OBJECTIVES

The course aims

- To train the students to handle the basic instruments.
- To understand the basic techniques in characterization of biomolecules.

Credits: 02 **Total Hours: 25**

Experiment	**CONTENTS**	**Hrs**	**CO**
1.	Calibration and Maintenance of pH meter.	**2**	**CO1**
2.	Preparation of buffers- Phosphate, Acetate, Citrate	**3**	**CO2**
3.	Estimation of chlorophyll pigment by solvent extraction method	**5**	**CO2**
4.	Separation of amino acids by Paper chromatography	**5**	**CO3**
5.	Separation of bacterial pigment by Column chromatography	**5**	**CO4**
6.	Separation of amino acids by Thin Layer Chromatography	**5**	**CO4**

REFERENCE BOOKS

1.	*Thimmaiah, S.K.* **Standard Methods of Biochemical Analysis**. Kalyani Publishers

COURSE OUTCOMES (CO)

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

CO1	Discuss the calibration of basic microbiological instrument.
CO2	Apply the technique for the separation of biomolecules.
CO3	Evaluate the characteristic features of biopigments.

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.	3	CO1
II	Aptitude: Problems on Numbers – Problems on Ages – Surds & Indices – Percentage – Profit & Loss – Ratio & Proportion – Partnership – Chain Rule.	3	CO2
III	Aptitude: Simple & Compound Interest – Alligation or Mixture - Permutation and Combination.	3	CO3
IV	Aptitude: Probability – Missing Number series – Wrong Number Series – Races & Games of Skill.	3	CO4
V	Aptitude: Time & Work – Pipes & Cistern – Time & Distance – Problems on Trains – Boats and Streams.	3	CO5

TEXT BOOK

1	*R.S. Aggarwal.* 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.

18UMBNM301	NMEC I : PERSONAL HYGIENE (Course offered to other department students)	SEMESTER III

COURSE OBJECTIVES

The course aims

- To equip the student with procedures of good basic hygiene and sanitation requirements.
- To learn the prevention of health hazard situation through unhygienic handling of food, equipment used in food production and food production work areas.

Credits: 02 **Total Hours: 25**

UNIT	CONTENTS	Hrs	CO
I	**Hygiene and Health:** Introduction to hygiene and healthful living concepts of health and disease- Factors influencing health and healthful living. Scientific principles related to maintenance of normal circulation- normal respiration- normal digestion and elimination- normal sensory functions- normal skeletal alignment.	05	CO1
II	**Physical Health:** Skin care, cleanliness, clothing; care of the hair, prevention of pediculosis. Dental care and oral hygiene. Care of hands, hand washing, care of nails. Hygiene of elimination, menstrual hygiene.	05	CO2
III	**Health habits and practices**: Recognizing positive and negative practices in the community. Care of the face, foot wear, eyes, nose and throat, Food values- nutritious diet, selection, preparation and handling of food.	05	CO3
IV	**Periodic health examination**: The health examination; health record; infection- types; immunization; detection and correction of defects; prevention and early treatment of common ailments - common colds, indigestion, headache.	05	CO4
V	**Health in the home:** The home as a center for healthful living. Household measures for disposal of refuse, waste; latrines and		CO5

	sanitation; ventilation. Safety in the home; common home hazards. Sanitation in animal sheds; insects and pests.	**05**	

TEXT BOOK	
1.	*Nicholas Johns*. 2000. **Managing Food Hygiene.** Macmillan Publishers. Hong kong.
REFERENCE BOOKS	
1.	*Lansing M Prescott, John P Harley and Donald A Klein*. 2010. **Microbiology**. [Eighth Edition]. Mc Graw Hill, NewYork.

COURSE OUTCOMES (CO)

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

CO1	Create awareness of personal hygiene and healthy living.
CO2	Practice hygienic methods to protect the skin, hair, oral and nail.
CO3	Follow positive hygienic practice for healthy life.
CO4	Plan for periodic examination of body against common infection.
CO5	Explain proper disposal of waste and maintain hygiene at home.

18UMBNM401	NMEC II : MICROBES IN HUMAN HEALTH (Course offered to other department students)	SEMESTER IV

COURSE OBJECTIVES

The course aims

- To learn the basics of microbiology and microorganisms
- To know about the common microbial diseases

Credits: 02 **Total Hours: 25**

UNIT	CONTENTS	Hrs	CO
I	**Microbiology:** Introduction and Scope, Microorganisms – Types – Viruses – Bacteria – Algae – Fungi – Protozoans – General Characteristics.	05	CO1
II	**Normal micro flora:** Distribution and occurrence of the normal micro flora of skin – eye - respiratory tract - mouth- intestinal tract - genitourinary tract.	05	CO2
III	**Bacterial diseases:** Causative agent, Transmission, symptoms and prevention - Tuberculosis, Typhoid and Cholera.	05	CO3
IV	**Viral diseases:** Causative agent, Transmission, symptoms and prevention - Rabies, Hepatitis and HIV.	05	CO4
V	**Microbial diseases:** Causative agent, Transmission, symptoms and prevention of Fungal Diseases – Candidiasis and Aspergillosis. Protozoan disease – Amoebiosis and Malaria.	05	CO5

TEXT BOOK

1. *Chakraborthy, P.* 1995. **A Textbook of Microbiology.** New central Book Agency Pvt. Ltd., Calcutta.

REFERENCE BOOKS	
1.	*Lansing M Prescott, John P Harley and Donald A Klein*. 2010. **Microbiology**. [Eighth Edition]. Mc Graw Hill, NewYork.
2.	*Michael J Pelczar, Chan, E. C. S. and Noel R Krieg.* 2005. **Microbiology**. [Fifth Edition]. Tata Mc Graw – Hill Publications Ltd., New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Discuss aware of harmful disease causing microorganisms.
CO2	Evaluate the beneficial role of normal microflora in human body.
CO3	Assess the protection, prevention of spread of bacterial and viral disease.
CO4	Discuss prevention of fungal and protozoan diseases.
CO5	Critique proper use of antimicrobial drugs.

18UMBAC301	**ADD ON COURSE I: MUSHROOM TECHNOLOGY**	**SEMESTER III**

COURSE OBJECTIVES

The course aims

- To learn the scope and importance of mushrooms.
- To study cultivation methods of various edible mushrooms.

Total Hours: 25

UNIT	CONTENTS	Hrs	CO
I	**Introduction:** Scope and economic importance of mushroom cultivation-Nutritive values of mushroom- key to differentiate edible from Poisonous mushrooms.	05	CO1
II	**Equipments and substrates in mushroom cultivation:** Polythene bags, vessels, inoculation hook, inoculation loop, low cost stove, sieves, culture racks, mushroom unit or mushroom house, water sprayer, tray, boilers, driers.	05	CO2
III	**Cultivation techniques:** Spawn- tissue culture- types of spawn, substrate, mycelia isolation, spawn running- Cultivation of common edible mushrooms: *Agaricus bisporus*, *Pleurotus ostreatus* and *Volvariella volvaceae* and Harvesting. Medicinal properties of Magic mushroom.	05	CO3
IV	**Storage of mushroom:** Long term and short term storage of mushrooms- Diseases and pest control of mushrooms.	05	CO4
V	**Value added products from mushrooms:** Mushroom research centers: National level and regional level, Marketing of mushrooms in India and world**.**	05	CO5

TEXT BOOK

1. *Tripathi, D.P.* 2005. **Mushroom Cultivation**. Oxford & IBH Publishing Co. Pvt.Ltd, New Delhi.

REFERENCE BOOKS	
1.	*Pathak Y.G.* 2010. Mushroom production and Processing Technology. Agrobios (India).
2.	*Kannaiyan. S, Ramasamy. K*. 1980. **A hand book of edible mushroom**. Today & Tomorrows printers & publishers, New Delhi.
3.	*Nita. B.* **Handbook on Mushrooms** .Oxford & IBH Publishing Co.

COURSE OUTCOMES (CO)

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

CO1	Discuss the economic importance of mushrooms.
CO2	Understand instrumental part of mushroom cultivation.
CO3	Apply various cultivation techniques for mushrooms.
CO4	Demonstrate disease and pest management for mushroom cultivation.
CO5	Outline marketing and value added product preparation of mushrooms.

MAPPING

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

H-High; M-Medium; L-Low

18UMBAC401	ADD ON COURSE II: MICROBIOLOGY FOR SOCIAL WELFARE	SEMESTER IV

COURSE OBJECTIVES

The course aims

- To learn the importance and applications of microbial products.
- To understand the entrepreneur opportunities in relevance to Microbiology.

Total Hours: 25

UNIT	CONTENTS	Hrs	CO
I	**Microbial technology:** Bioactive compounds from microorganisms -Antibiotics – Production of Streptomycin. Novel Microbial products- Production of human insulin. Biopolymers – Engineering of *Xanthomonas campestris*. Biosequestration of heavy metal pollutants.	**05**	**CO1**
II	**Institutions and schemes of government of India:** Schemes and programmes, Department of science and technology schemes, Nationalized banks – other financial institutions etc – SIDBI – NSIC – NABARD – IDBI – IFCI – ICICI etc. Opportunities in & as NGO sectors.	**05**	**CO2**
III	**Biofertilizers: A**lgal fertilizers- *Azolla* as fertilizer. Composting – domestic waste, agricultural and industrial waste, vermi composting and organic farming.	**05**	**CO3**
IV	**Patenting in Microbial Biotechnology:** Patents – patenting strategies. Copy rights. Trade secrets, Trademarks, WIPO, GATT & TRIPs. Patenting of Biological materials.	**05**	**CO4**
V	**SCP production**: Mushroom and Spirulina cultivation and its marketing. Probiotics and its use as animal feed- .	**05**	**CO5**

TEXT BOOK

1	*Dubey, R.C* (2009). A text book of Biootechnonoly, S.Chand & CompanyLtd, New Delhi.

REFERENCE BOOKS

1	*Subba Rao, N.S., 1995.* **Biofertilizer in agriculture and forestry.** *Oxford and IBH, New york.*
2	*Bernard, R., Glick and Jack J Pasternik*. 1996. **Molecular Biotechnology Principles and Application of Recombinant DNA**. Panima Publishing Corporation, New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Discuss the valuable products of microbes.
CO2	Understand the various government schemes and banking systems
CO2	Apply the microbes and its products as bio fertilizers
CO3	Demonstrate the patenting methods for novel products
CO4	Outline the production of SCP and its marketing strategies

MAPPING

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

H-High; M-Medium; L-Low

18UMBAL401	**ADVANCED LEARNERS COURSE I: BIOFERTILIZER TECHNOLOGY**	**SEMESTER IV**

COURSE OBJECTIVES

The course aims

- To learn the scope and importance of biofertilizers.
- To study mass cultivation methods of various biofertilizers.

Total Hours: 25

UNIT	CONTENTS	Hrs	CO
I	**Introduction to biofertilizers:** Structure and characteristic features of the following biofertilizer organisms - *Azospirillum, Azotobacter, Rhizobium* and *Frankia.*	**05**	**CO1**
II	**Biofertilization processes:** Decomposition of organic matter and soil fertility and vermicomposting. Mechanism of phosphate solubilization and phosphate mobilization. Free living and symbiotic nitrogen fixation.	**05**	**CO2**
III	**Cultivation techniques:** Isolation, purification, mass multiplication, formulation and crop response of inoculants - *Rhizobium, Azotobacter* and *Azospirillum* and phosphate solubilizer (*Pseudomonas striata*).	**05**	**CO3**
IV	**Cyanobacteria:** Isolation, purification, mass multiplication and application of cyanobacterial bioinoculants. Azolla - mass cultivation and its application.	**05**	**CO4**
V	**Mycorrhizae**: Ecto and endomycorrhizae. Isolation of AM fungi - Wet sieving method and sucrose gradient method. Mass production of AM inoculants and field applications.	**05**	**CO5**

TEXT BOOKS

1. *Somani, L.L., S.C. Bhandari, K.K. Vyas and S.N. Saxena.* 1990**. Biofertilizers.** Scientific Publishers - Jodhpur.
2. *Tilak, K.V.B.* 1991. **Bacterial Biofertilizers.** ICAR Pub., New Delhi.

REFERENCE BOOKS	
1.	P*urohit, S.S., P.R. Kothari and S.K. Mathur. 1993.* **Basic and Agricultural Biotechnology.** Agro Botanical Pub. India.
2.	*Subba Rao, N. S.* 1988. **Biological Nitrogen Fixation: Recent Developments.** Oxford and IBH Pub. Co. Pvt. Ltd., India.
3.	*Subba Rao, N.S., G.S. Venkataraman and Kannaiyan. S*. 1993. **Biological Nitrogen Fixation.** ICAR Pub., New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Discuss the economic importance of biofertilizers.
CO2	Understand the nitrogen fixation process.
CO3	Apply the various formulation and cultivation methods for biofertilizer production.
CO4	Demonstrate the cyanobacterial biofertilizer production.
CO5	Outline the field application of mycorrhizal bioinoculants.

MAPPING

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

H-High; M-Medium; L-Low

ALLIED COURSE OFFERED BY THE DEPARTMENT

S. NO.	SUBJECT CODE	SUBJECT	SEMESTER	OFFERED TO THE STUDENTS OF
1.	18UMBBCA201	Allied II: Microbiology	II	Biochemistry
2.	18UMBBCAP201	Allied Practical II: Microbiology	II	Biochemistry

18UMBBCA201	ALLIED II: MICROBIOLOGY	SEMESTER II

COURSE OBJECTIVES

The course aims

- To learn the early developments and basics of Microbiology.
- To acquire the basic knowledge on microscopy, staining, sterilization and chemotherapeutic techniques.

Credits: 02 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Definition of Microbiology:** Scope and branches of microbiology– contributions–Leeuwenhoek, Edward Jenner, Louis Pasteur, Robert Koch and Alexander Fleming.	08	CO1
II	**Microscopy:** Simple and compound microscope, Darkfield microscope, Phase contrast microscope, Fluorescent microscope. Electron microscope. Principles and types of stain –Simple, differential and special staining (spore and capsule staining).	08	CO2
III	**Media preparation:** liquid media, solid media, selective media, enriched, enrichment and differential media. Isolation of pure culture– pour plate, spread plate and streak plate methods.	08	CO3
IV	**Sterilization:** Principle– dry heat, moist heat, radiation, UV rays and gamma rays. Filtration– depth, membrane and HEPA filters. Disinfection and disinfective agents. Chemical agents–alcohols, aldehydes and phenol.	08	CO4
V	**Antimicrobial chemotherapy:** Antibiotics– mode of action of cell wall, protein and nucleic acid synthesis inhibitors– antibiotic susceptibility test– Kirby Bauer and Stokes method.	08	CO5

TEXT BOOK

1.	*Pelczar Jr. M., Chan, E.C.S.* and *N.R. Kreig*. 1995. **Microbiology**. Tata Mc Graw Hill, New Delhi
REFERENCE BOOKS	
1.	*Lansing M Prescott, John P. Harley* and *Donald A. Klein*. 2005. **Microbiology**. [Sixth Edition]. Mc Graw Hill. New York.
2.	*Sale, A.J.* 1992. **Fundamental Principles of Bacteriology.** [Seventh Edition]. Mc Graw Hill Inc., New York.

COURSE OUTCOMES (CO)

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

CO1	Understand the scope and applications of microbiology the importance of bioinstruments in research and industry.
CO2	Apply microscopic techniques and perform staining in the laboratory for visualization of bacteria.
CO3	Analyse necessary parameters for the cultivation and preservation of microorganisms in the laboratory.
CO4	Apply aseptic condition for control of contamination.
CO5	Discuss proper usage of antibiotics to control pathogens and treatment for microbial diseases.

MAPPING

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

H-High; M-Medium; L-Low

18UMBBCAP201	ALLIED PRACTICAL II: MICROBIOLOGY	SEMESTER II

COURSE OBJECTIVES

The course aims

- To learn the basic techniques of Microbiology.
- To understand the morphological structures of bacteria.
- To cultivate and maintain the microorganisms.

Credits: 02 **Total Hours: 30**

Experiment	CONTENTS	Hrs	CO
1.	Handling and maintenance of bright field microscope	**3**	**CO1**
2.	Staining techniques– Simple staining	**3**	**CO1**
3.	Gram's staining	**3**	**CO1**
4.	Acid fast staining	**3**	**CO1**
5.	Spore staining	**3**	**CO1**
6.	Media preparation–Liquid and solid media	**3**	**CO2**
7.	Pure culture techniques– Streak plate method	**3**	**CO2**
8.	Pour plate method.	**3**	**CO2**
9.	Spread plate method.	**3**	**CO2**
10.	Antibiotic susceptibility test–Kirby Bauer method.	**3**	**CO3**

REFERENCE BOOKS

1.	*Thimmaiah, S.K.* **Standard Methods of Biochemical Analysis**. Kalyani Publishers.

COURSE OUTCOMES (CO)

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

CO1	Recall the handling of microscope and morphological identification of microbes.
CO2	Formulate the media for isolation and purification of microbial colonies.
CO3	Evaluate the antimicrobial drug potency.

GUIDELINES

1. SUBMISSION OF RECORD NOTE BOOKS AND PROJECT DISSERTATION:

Candidates appearing for Practical Examinations and Project Viva-voce shall submit Bonafide Record Note Books/ Dissertation prescribed for Practical/ Project Viva-voce Examinations, otherwise the candidates will not be permitted to appear for the Practical/ Project Viva-voce Examinations.

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

A.

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**

B. (i) 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

(ii) 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 (10-12 Experiments)
Attendance : 5 Marks
Record : 5 Marks
Internal Examinations : 20 Marks

Total : 40 Marks

(iii) PROJECT WORK

- The project work shall be carried out by group of students in VI Semester.
- Upon completion of the project work/dissertation the candidate will be required to appear for a Viva Voce conducted by an external examiner.
- The Student has to attend 3 reviews before completing his/her Project.
- All 3 reviews will be reviewed by Internal Resource Persons.
- A candidate failing to secure the prescribed passing minimum in the dissertation shall be required to resubmit the dissertation with the necessary modifications.
- The assessment of students performance in a semester is calculated by Continuous Internal Assessment (CA.) for 40 marks and External Assessment for 60 marks.

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

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

1. Research work done	: 10 Marks
2. Attendance	: 5 Marks
3. Record	: 5 Marks
4. Review	: 20 Marks (Three reviews)
Total	**: 40 Marks**

(iv) 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.

3. QUESTION PAPER PATTERN AND MARK DISTRIBUTION

THEORY

Question Paper Pattern and Mark Distribution **(For 75 marks)**

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

Question Paper Pattern and Mark Distribution **(For 100 marks)**

1. PART – A (10 x 2 = 20 Marks)

Answer ALL questions

Two questions from each UNIT

2. PART – B (5 x 7 = 35 Marks)

Answer ALL questions

One question from each UNIT with Internal Choice

3. PART – C (3 x 15 = 45 Marks)

Answer ANY THREE questions

One question from each UNIT

Open Choice – 3 out of 5

questions

One question from each UNIT

Question paper pattern for Core Practical Examinations (Maximum marks: 60) Time: 6 Hours

Experiment – I (Major)	- 30 Marks
Experiment – II (Minor)	- 15 Marks
Spotters (5 x 3)	- 15 Marks
Total	**- 60 Marks**

ALLIED MICROBIOLOGY PRACTICAL

Question paper pattern for Allied practical (Maximum marks: 60) Time: 3 Hours

Experiment – I	- 40 Marks
Spotters (5 x 4)	- 20 Marks
Total	**- 60 Marks**

Computer Practical Distribution

Internal marks distribution

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

External marks distribution

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

i) Aim	- 5 Marks
ii) Algorithm/Flow chart	- 10 Marks
iii) Writing the source code	- 15 Marks
iv) Test and debug the source code	- 15 Marks
v) Displaying the Output	- 10 Marks
vi) Result Declaration	- 5 Marks
Total	**- 60 Marks**

18UTALA101	**TAMIL – I: ftpijfSk; fijfSk;**	**gUtk; I**

,g;ghlj;jpl;lj;jpd; Nehf;fq;fshtd:

- jw;fhyj;jkpo; ,yf;fpatiffiskhztHfSf;Ff; fw;gpj;jy;.
- fhye;NjhWk; jkpo;f; ftpijtsh;r;rpepiyfismwpKfg;gLj;Jjy;.
- mbg;gilj; jkpo; ,yf;fzj;ijf; fw;gpj;JmuRg;Nghl;bj; Njh;TfSf;F Maj;jg;gLj;Jjy;.

Credits: 03 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**kuGf; ftpijfs;** m. ghujpahh; - ghujNjrk; M. ghujpjhrd; - jkpopd; ,dpik ,. ehkf;fy; ftpQh; - ftpij vd;why; vd;d? <. Kbaurd; - ey;y cyfklh!	10	**CO1**
II	**GJf;ftpijfs;** m. ituKj;J - uj;jjhdk;; - jz;zPh; gpr;ir M. nt.,iwad;G - G+ghsj;jpw;nfhU Gy;yhq;Foy; - gdpj;Jspapy; ghw;fly; ,. jPgh - kiof;FxUkly; - ghujpahh;>tWik <. rpw;gp - xU fpuhkj;J ejp	10	**CO2**
III	**rpWfijfs;** m. mwpQh; mz;zh - nrt;thio M. fpUj;jpfh - coT khLfs; ,. ts;sp.t. - jzy; Jz;lha;…rpyjUzq;fs; <.jp.[hdfpuhkd; - Ks;Kb	10	**CO3**
IV	**,yf;fpa tuyhW** m. kuGf;ftpijapd; Njhw;wKk; tsh;r;rpAk; M. GJf;ftpijapd; Njhw;wKk; tsh;r;rpAk; ,. rpWfijapd; Njhw;wKk; tsh;r;rpAk; <. ehlfj;jpd; Njhw;wKk; tsh;r;rpAk;	10	**CO4**
V	**mbg;gil ,yf;fzk;** m. KjnyOj;Jfs; kw;Wk; rhh;ngOj;Jfs; (ed;D}y; tpjpg;gbtpsf;fk;)	10	**CO5**

	M. ty;ypdk; kpFk; kpfh ,lq;fs;. ,. kuGg; ngah;fs; - ,sikg; ngah;fs;		

Text Book:	
1.	jkpo;j;Jiw ntspaPL¸ Nf.v];.uq;frhkp fiy mwptpay; fy;Y}hp (jd;dhl;rp)> jpUr;nrq;NfhL.

COURSE OUTCOMES (CO)
,g;ghlj;ijf; fw;gjd; thapyhf khzth;fs; ngWk; gad;fshtd:

CO1	kuGf;ftpijfspd; tbtq;fismwpjy;.
CO2	GJf;ftpijfspd; tbtq;fs; kw;Wk; ghLnghUs; jd;ikiamwpjy;.
CO3	rpWfijfspd; cUtk;>cs;slf;fq;fismwpjy;;
CO4	fhye;NjhWk; khWk; ,yf;fpatsh;;r;rpiamwpjy;;
CO5	vOj;Jfspd; tiffismwpjy;.

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: 03 **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 **COMPOSITION** Dialogue Writing	**20**	**CO3 & CO4**

	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.		

18UMBM101	CORE I: BASICS IN MICROBIOLOGY	SEMESTER I

Course Objectives:

The course aims

- To learn about the early developments of Microbiology.
- To understand the basic concepts of microscopy, staining, sterilization and chemotherapeutic techniques.

Credits: 05 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Introduction to Microbiology:** Scope of Microbiology–Historical developments- Spontaneous generation– Germ theory of diseases. Contributions of Leeuwenhoek- Louis Pasteur- Joseph Lister- Edward Jenner– Robert Koch– Alexander Fleming. General properties of microorganisms (Bacteria, Fungi, Algae, Virus and Protozoan).	10	CO1
II	**Microscopy:** Principles, components and applications - Light microscopy, Dark field, Phase Contrast and Fluorescent microscopy. Electron microscopy - Scanning and Transmission electron microscopy. Confocal microscopy. **Staining techniques:** Staining types - Simple, Differential (Gram staining and Acid fast staining) and Special staining (Spore and Capsule staining).	10	CO2
III	**Culture techniques:** Media preparation– culture media- types of media. Pure culture techniques – preservation of culture. **Microbial cell:** Ultra structure of bacteria, sub- cellular structures and cell envelope–capsule, cell wall, pili and flagella.	10	CO3
IV	**Sterilization Principles:** Physical agents- dry heat, moist heat, radiation and filtration. Chemical agents – alcohols, phenol, aldehydes and gaseous agents.	10	CO4
V	**Antimicrobial chemotherapy:** Antibiotics– classification and mode of action- cell wall synthesis inhibitors, protein synthesis inhibitors and nucleic acid synthesis inhibitors. Mechanism of drug resistance. Tests for antimicrobial susceptibility– Kirby Bauer method and Stokes method.	10	CO5

Text Book:	
1.	*Lansing M Prescott, John P Harleyand Donald A Klein*. 2010. **Microbiology**. [Eighth Edition]. Mc GrawHill, NewYork.
Reference Books:	
1.	*Atlas,R .M*. 1997. **Principles of Microbiology.** [Second Edition]. WCK. McGraw–Hill.
2.	*Black,J. G.* 1999. **Microbiology- Principles and Exploration.** [Fourth Edition]. Prentice Hall International Inc.
3.	*Madigan, M.T., Martinko, J.M.* and *Parker, J.* 2000. **Brock Biology of Microorganisms.** [Ninth Edition]. Prentice Hall International, Inc.

COURSE OUTCOMES (CO)

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

CO1	Recall the origin of Microbiology.
CO2	Understand the principles of Microscopy and staining techniques.
CO3	Assess growth parameters for the cultivation and preservation of microbes in the laboratory.
CO4	Apply aseptic condition for maintenance of pure culture and control of contaminants.
CO5	Assess the use of antibiotics to control pathogens and treatment of microbial diseases.

MAPPING

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

H-High; M-Medium; L-Low

18UCHMBA101	**ALLIED I: CHEMISTRY**	**SEMESTER I**

Course Objectives:

The course aims

- To understand the bonding in organic molecules and the factors affecting it
- To study the mechanism of substitution reactions
- To recall the basic ideas in Co-ordination compounds
- To evaluate the chemistry behind polymers
- To recognize the elementary ideas in Electrochemistry

Credits: 02 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Chemical Bonding:** Covalent bonds-Orbital overlap –Hybridisation-SP, SP^2, SP^3 -Electron displacement effect-Inductive effect – Resonance – Hyperconjugation-Steric effect-Their effects on the properties of compounds – Stereoisomerism-Optical isomerism-Elements of symmetry-Causes of optical activity-Tartaric acid-Geometrical isomerism of Maleic acid and Fumaric acid.	**08**	**CO1**
II	**Reaction and Mechanism:** Aliphatic Nucleophilic substitution reaction-Mechanism of SN^1 and SN^2 reaction-Aromatic compounds – Aromaticity- Huckel's rule-Electrophilic substitution reaction in Benzene-Mechanism of nitration, halogenation, sulphonation, Friedel-craft alkylation and Friedel-craft acylation	**08**	**CO2**
III	**Co-ordination Chemistry:** Definition-classification of ligands-Werner's theory-Sidgwick's theory- Effective atomic number-Pauling's theory (VB theory) – Chelation-Chelate effect – Haemoglobin-definition and biological role – Chlorophyll-definition and biological role – EDTA-its applications.	**08**	**CO3**
IV	**Polymer Chemistry:** Natural Polymer – Types of polymer – Homopolymer–Heteropolymer– Additional and Condensation polymers – polymerization reactions - Manufacture of film sheets – Rayon and Polyacrylicfibers – PVC – Uses of polymers.	**08**	**CO4**

V	**Electrochemistry:** Kohlrausch's law-measurement of conductance-determination of P^H-Conductometric titration-Hydrolysis of salts-Elementary ideas – Examples-Galvanic cell-**Galvanic cell-**EMF-Standard electrode potential-Electrochemical series-its applications-Principal of electroplating – Corrosion-Corrosion prevention.	**08**	**CO5**
Text Book:			
1.	*Madan.R.L. and Tuli G. D.* 2005. **Simplified course in Physical chemistry.** [Sixth Edition]. S.Chand and company Ltd., 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	M	H	M	H	M
CO2	M	H	H	H	M
CO3	H	H	H	H	M
CO4	H	H	H	H	H
CO5	M	M	H	H	H

H-High; M-Medium; L-Low

18UMBMP101	**CORE PRACTICAL I: BASICS IN MICROBIOLOGY**	**SEMESTER I**

Course Objectives:

The course aims

- To learn the basic techniques of Microbiology.
- To understand the morphological structures of bacteria.
- To cultivate and maintain the microorganisms.

Credits: 03 **Total Hours: 60**

Experiment	CONTENTS	Hrs	CO
1.	Handling, maintenance and care of bright field Microscope	**3**	**CO1**
2.	Cleaning of glassware	**2**	**CO1**
3.	Staining techniques– Simple staining	**5**	**CO1**
4.	Gram's staining.	**5**	**CO1**
5.	Acid Fast (Ziehl- Neelson) staining	**5**	**CO1**
6.	Spore staining	**5**	**CO1**
7.	Capsular staining	**5**	**CO1**
8.	Media preparation- Liquid media– Nutrient broth, Solid media– Nutrient agar	**5**	**CO2**
9.	Preparation of agar slants and agar deeps.	**5**	**CO2**
10.	Pure culture techniques– Serial dilution method and pour plate method	**2**	**CO3**
11.	Streak plate method	**3**	**CO3**
12.	Spread plate method	**5**	**CO3**
13.	Stab culture method	**5**	**CO4**
14.	Antibiotic sensitivity test– Kirby-Bauer disc diffusion method	**5**	**CO5**

Reference Books:

1. *Cappucino, J. Gand Sherman, N.* 2012. **Microbiology – A laboratory manual.** [Seventh Edition]. Pearson Education Inc.
2. *Harley and Presscott*. 2002. **Laboratory Exercises in Microbiology,** [Fifth Edition]. Mc Graw Hill Companies.
3. *Kannan, N.* **Laboratory manual in General Microbiology.** [Second Edition]. Panima publishing corporation, New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Identify microbes through staining with microscopy.
CO2	Design different media for cultivation of microorganisms.
CO3	Evaluate the isolation and purification of microorganisms.
CO4	Demonstrate the maintenance of bacterial cultures.
CO5	Evaluate control measures of microorganisms using chemotherapy.

18UCHMBAP101	ALLIED PRACTICAL I: VOLUMETRIC AND ORGANIC ANALYSIS	SEMESTER I

Course Objectives:

The course aims

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

Credits: 02 **Total Hours: 30**

Experiment	CONTENTS	Hrs	CO
	Titrimetric Quantitative Analysis		
1.	Estimation of HCl using standard oxalic acid.	**3**	**CO1**
2.	Estimation of Ferrous sulphate using Mohr's salt.	**2**	**CO1**
	Organic Qualitative Analysis		
1.	Monocarboxylic acid	**5**	**CO2**
2.	Monoamide	**5**	**CO2**
3.	Diamide	**5**	**CO2**
4.	Carbohydrate	**5**	**CO2**

Reference 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 OUTCOMES (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

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: 02 **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.	6	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.	6	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.	6	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.	6	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.	**6**	**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.

<table>
<tr><td colspan="2">18UTALA201</td><td colspan="2">Tamil – II: rka ,yf;fpaq;fs;</td><td>gUtk; II</td></tr>
<tr><td colspan="5">,g;ghlj;jpl;lj;jpd; Nehf;fq;fshtd:
• rka ,yf;fpaq;fismwpKfk; nra;jy;
• rkar; rhd;Nwhh; epiyg;ghl;ilczh;j;Jjy
• rkaq;fs; tsh;j;jjkpiomwpar; nra;jy;</td></tr>
<tr><td colspan="3">Credits: 03</td><td colspan="2">Total Hours: 50</td></tr>
<tr><td>UNIT</td><td colspan="2">CONTENTS</td><td>Hrs</td><td>CO</td></tr>
<tr><td>I</td><td colspan="2">irt> itzt ,yf;fpaq;fs;
m. rk;ge;jh; Njthuk; - jpUf;nfhbkhlr;nrq;Fd;W}h;- (Kjy; Ie;Jghly;fs;) M. khzpf;fthrfh; - jpUtk;khid - (Kjy; Ie;Jghly;fs;)
,. nghpaho;thh; - jpUg;gy;yhz;L (Kjy; Ie;Jghly;fs;)
<. Mz;lhs; - jpUkzf; fdT(Kjy; Ie;Jghly;fs;)</td><td>10</td><td>CO1</td></tr>
<tr><td>II</td><td colspan="2">fpwpj;Jt> ,Ryhkpa ,yf;fpaq;fs;
m. ,ul;rzpaahj;jphpfk; - rpYitg;ghL (Kjy; gj;Jg;ghly;fs;)
M. ehafk; xUfhtpak;–ghk;gpd; NerKk; Njhohpd; ghrKk; (Kjy; gj;Jg;ghly;fs;)</td><td>10</td><td>CO2</td></tr>
<tr><td>III</td><td colspan="2">rkar; rhd;Nwhh; tuyhW
m. irtrkar; rhd;Nwhh;fs;
1. jpUQhdrk;ge;jh;> 2. jpUehTf;furh;> 3. Re;juu;> 4. khzpf;fthrfu; 5. Nrf;fpohh;
M. itztrkar; rhd;Nwhh;fs;
1. Kjyho;thh;fs; 2. jpUkq;ifaho;thh; 3.Mz;lhs; 4. ehjKdpfs;</td><td>12</td><td>CO3</td></tr>
<tr><td>IV</td><td colspan="2">rka ,yf;fpatuyhW
m. gd;dpUjpUKiwfs;
M. gjpndz;rpj;jh;fs;
,. ehyhapujpt;agpuge;jk;
<. irtrpj;jhe;jrhj;jpuq;fs;</td><td>08</td><td>CO4</td></tr>
</table>

V	**,yf;fzKk; nkhopj;jpwDk;** m. MFngah; M. njhifr;nrhw;fs; ,. kaq;nfhypr;nrhw;fs; (u>w NtWghLfs;) <. Neh;fhzy;	**10**	**CO5**
Text Book:			
1	jkpo;j;Jiw. ntspaPL : Nf.v];.uq;frhkp fiy mwptpay; fy;Y}hp(jd;dhl;rp)> pUr;nrq;NfhL– 637 215.		

COURSE OUTCOMES (CO)

,g;ghlj;ijf; fw;gjd; thapyhf khzth;fs; ngWk; gad;fshtd:

CO1	Njthu> jpt;agpuge;jr; rpwg;gpid czh;jy;.
CO2	fpwpj;Jt> ,Ryhkpa fhtpaq;fspd; rpwg;gpid czh;jy;.
CO3	irtrka> itztrkar; rhd;Nwhh; rpwg;Gf;fis czh;jy;.
CO4	rkatsh;r;rp> ,yf;fpatsh;r;rp Mfpatw;iw czh;jy;
CO5	MFngah; tiffis czu;;jy;> nkhopj;jpwd; ngWjy;.

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: 03 **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** Praising and Complimenting Complaining and Apologizing	20	CO3 & CO4

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

18UMBM201	**CORE II: MICROBIAL TAXONOMY AND PHYSIOLOGY**	**SEMESTER II**

Course Objectives:

The course aims

- To learn the classification and taxonomic groups of microbes.
- To understand the basic nutritional requirements of microorganism.
- To learn the general metabolic activities of bacteria.

Credits: 05 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Microbial evolution**: Classification–Haeckel's three kingdom concepts– Whittaker's five kingdom concepts. Taxonomy hierarchy. Binomial Nomenclature. Classical systems of classification– Chemotaxonomy, Numerical taxonomy.	**10**	**CO1**
II	**Molecular based classification:** DNA- DNA Hybridization - Protein sequencing – rRNA sequencing. Classification and Salient features of bacteria according to the Bergey's manual of determinative bacteriology.	**10**	**CO2**
III	**Microbial Growth:** Growth and mode of cell division in bacteria– growth curve– measurement of growth- batch, continuous and synchronous culture. Factors affecting microbial growth- Physical and Chemical - temperature, pH, osmotic pressure, moisture, radiations and salinity. Endospore formation.	**10**	**CO3**
IV	**Microbial Nutrition:** Nutritional requirements and types of bacteria. Transport of nutrients by bacteria– active transport, passive diffusion, facilitated diffusion and group translocation.	**10**	**CO4**
V	**Metabolic Pathways:** Glycolysis, Entner Duodroff pathway, Citric acid cycle, Electron transport chain – ATP generation, Photosynthesis –oxygenic and anoxygenic and Fermentation.	**10**	**CO5**

Text Books:	
1.	*Atlas, R. M.* 1997. **Principles of Microbiology.** [SecondEdition]. WCK. Mc Graw–Hill.
2.	*Lansing M Prescott, John P Harley and Donald A Klein.* 2010. **Microbiology**. [Eighth Edition]. Mc GrawHill, NewYork.

Reference Books:	
1.	*Madigan, M.T., Martinko, J.M.* and *Parker, J.* 2000. **Brock Biology of Microorganisms.** [Ninth Edition]. Prentice Hall International, Inc.
2.	*Balows, A. Truper, H.G. Devorkin,M. Harder* and *Schleife, K.H.* 1992. **The Prokaryotes.** Springerlink. NewYork.
3.	*Black, J.G.* 1999. **Microbiology-Principles and Exploration.** [FourthEdition]. Prentice Hall International Inc.

COURSE OUTCOMES (CO)

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

CO1	Identify the group of microorganisms based on taxonomical character.
CO2	Analyze microorganisms based on their molecular features.
CO3	Assess the growth factors for cultivation of microorganisms in the laboratory.
CO4	Formulate suitable media for microbial growth.
CO5	Outline metabolic pathways and standardize culture conditions for industrially important microorganisms.

MAPPING

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

H-High; M-Medium; L-Low

18UCSMBA201	ALLIED II: COMPUTER FOR BIOLOGY	SEMESTER II

Course Objectives:

The course aims

- Enable students to get familiar with fundamental knowledge of computers.
- Acquire knowledge and essential skills for using the office packages.

Credits: 02 **Total Hours: 30**

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. **The Input - Output Media:** Inputs and Outputs: CRT Monitors - Flat Panel Monitors - Keyboards -Graphics and Graphical Terminals - Printers.	06	CO1
II	**Introduction to Microsoft Office Word 2007:** Working with Documents in Microsoft Word2007 - Saving the File - Formatting the Text - Alignment of Text - Applying Fonts - Spell Checking - Consulting Thesaurus - Assign a Character Style - Borders and Shading - Closing of the File - Save as Option - Printing your Document - Editing the Document - Editing Tools - AutoCorrect - AutoFormat- Find and Replace - Find - Replace Text - Page Numbering - Header and Footer - Foot Notes and End Notes.	06	CO2
III	**Introduction to Microsoft Office Word 2007:** Splitting Panes - Tiling of the Document - Using Mail Merge in Word 2007 - Opening Screen of Microsoft Word screen. **Introduction to Microsoft Office Excel 2007:** Understanding Spreadsheets - Creating a Work sheet in Excel2007 - Copying Formula - Formulas that Make Decisions - Styles - Functions in Excel - Using Auto calculate - References - Sum Function - Average Function - Creating Charts in Excel - Auditing a Workbook - Comments Inserting - Outlines -Worksheet Fitting on a Page.	06	CO3

IV	**Introduction to Microsoft Office Excel 2007:** 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.	**06**	**CO4**
V	Working with Microsoft Office PowerPoint 2007: Creating Presentation from Template - Creating a New Presentation - PowerPoint 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 Picture to a Photo Album - Change the Appearance of a Picture in a Photo Album.	**06**	**CO5**
Text Books:			
1.	*Atul Kahate*. 2008**. Information Technology. [**Third Edition]. Tata McGraw - Hill		
2.	*LawPoint*. 2008. **Microsoft Office 2007**. [First Edition]. Ashok Lodha Publication, Kolkata. (UNIT II, III, IV and V)		

Reference Books:	
1.	*Anita Goel.* 2010. **Computer Fundamentals. [First Edition]. Pearson Publications**
2.	*Pradeep K. Sinha, Priti Sinha.* 2016. [Fourth Edition]. **Computer Fundamentals**. BPB Publications
3.	*J.B Dixit*. 2011[Kindle Edition]. **Fundamentals of Computer Program and Information Technology. Laxmi Publishers**
4.	*Lisa A.Bucki, John Walkenbach, Faithe Wempen, Micheael Alexender, Dick*
5.	*Kusleika.* 2013. Reprint. **Microsoft Office 2013 Bible.** Wiley Publications
	John Walkenbach. 2010. Reprint. **Microsoft Excel 2010 Bible**. Wiley India Pvt. Limited
6.	*Tracy Syrstad*. 2015. [First Edition]. **Excel 2013 Absolute Beginners Guide**. Pearson Publications
Web Reference	
1.	*https://www.tutorialspoint.com*
2.	*https://www.free - computer - tutorials.net*
3.	*https://www.edu.getglobal.org*
4.	*https://www.w3schools.com*

COURSE OUTCOMES (CO)	
After completion of the course, the students' will be able to	
CO1	Explore the fundamental components of computer devices.
CO2	Create well defined documents with various tools in MS Word.
CO3	Interpret the various formulas, functions and chart preparations in MS Excel.
CO4	Generate various kinds ofreports.
CO5	Create slides, overhead transparencies, Handouts and Speaker Notes.

MAPPING

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

H-High; M-Medium; L-Low

18UMBMP201	**CORE PRACTICAL II : MICROBIAL TAXONOMY AND PHYSIOLOGY**	**SEMESTER II**

Course Objectives:

The course aims

- To learn about the morphological diversity of microorganisms.
- To understand the biochemical characterization of microorganisms.

Credits: 03 **Total Hours: 60**

Experiment	**CONTENTS**	**Hrs**	**CO**
1.	Measurement of cell size and motility of bacteria – Micrometry and Hanging drop method.	**5**	**CO1**
2.	Microscopic examination of cyanobacteria – *Oscillatoria* sp., *Spirulina* sp., *Nostoc* sp. and *Anabaena* sp.	**2**	**CO2**
3.	Microscopic examination of fungi – *Mucor* sp., *Aspergillus* sp., *Penicillium* sp. and *Alternaria* sp.	**2**	**CO2**
4.	Growth curve –Turbidity method	**5**	**CO3**
5.	IMViC tests	**5**	**CO4**
6.	Sugar fermentation tests	**5**	**CO4**
7.	Triple sugar iron agar (TSI) test	**5**	**CO4**
8.	Nitrate reduction test	**3**	**CO4**
9.	Starch hydrolysis	**3**	**CO4**
10.	Catalase and Oxidase tests	**5**	**CO4**
11.	Urease test	**5**	**CO4**
12.	Gelatin hydrolysis test	**5**	**CO4**
13.	Effect of various factors on growth of bacteria i. Temperature ii. pH iii. Nutrients – carbon source	**5**	**CO5**
14.	Thermal Death Point and Thermal Death Time	**5**	**CO5**

Reference Books	
1.	*Harley Prescott.* **Laboratory Exercises in Microbiology.** [Fifth Edition]. The McGraw-Hill companies.
2.	*Kannan, N.* **Laboratory Manual in General Microbiology.** [Second Edition]. Panima publishing corporation, New Delhi.
3.	*Benson.* 2001. **Microbiological Applications Laboratory Manual in General Microbiology.** [Eighth Edition]. The McGraw-Hill Companies.

EXPERIMENT OUTCOMES (CO)

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

CO1	Identify the motility of bacteria and determine the size of bacteria.
CO2	Discriminate the structures of Algae and Fungi.
CO3	Analyze the different phases of bacterial growth.
CO4	Outline the characterization of bacteria based on biochemical activities.
CO5	Assess the bacterial growth based on environmental factors.

18UCSMBAP201	**ALLIED PRACTICAL II : OFFICE PACKAGE FOR BIOLOGY**	**SEMESTER II**

Course Objectives:

The course aims

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

Credits: 02 **Total Hours: 24**

Experiment	**PROGRAMS**	**Hrs**	**CO**
MS-Word			
1.	Creating a Personal Profile.	**2**	**CO1**
2.	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).	**2**	**CO2**
3.	Creating a Document for topic presentation with following options • Single and Double Column. • Page numbers. • Headers and Footers. • Date and time, Pictures and Shapes.	**2**	**CO1**
4.	Mail Merge—Invitation to Multiple Recipients for Conducting Seminar in the Department.	**2**	**CO2**
MS-Excel			
5.	Entering Data for Stock Analysis and Formatting the cells	**2**	**CO3**
6.	Working with Sorting and Filtering.	**2**	**CO3**

7.	Creating a Chart for an Experiment with sample data.	**2**	**CO3**
8.	Stock Maintenance for LabEquipment.	**2**	**CO3**
MS-Powerpoint			
9.	Creating a Presentation for the given topic.	**2**	**CO4**
10.	Creating a Presentation for the Department Profile.	**2**	**CO4**
11.	Creating a Presentation with Animation effects.	**2**	**CO4**
12.	Creating a photo album for the Department event.	**2**	**CO5**
Web Reference			
1.	*https://www.tutorialspoint.com*		
2.	*https://www.free - computer - tutorials.net*		
3.	*https://www.edu.getglobal.org*		
4.	*https://www.w3schools.com*		

COURSE OUTCOMES (CO)

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

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

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: 02 **Total Hours: 30**

UNIT	CONTENTS	Hrs	CO
I	Environment– Definition– Scope– Structure and function of ecosystems- producers, consumers and decomposers- Energy flow in the ecosystem- Ecological succession– food chain, food webs and ecological pyramids– Concept of sustainabledevelopment.	**06**	**CO1**
II	Natural resources: Renewable- air, water, soil, land and wildlife resources. Non–renewable – Mineral coal, oil and gas. Environmental problems related to the extraction and use of natural resources.	**06**	**CO2**
III	Biodiversity– Definition– Values– Consumption use, productive social, ethical, aesthetic and option values threats to bio diversity – hotspots of bio diversity– conservation of bio- diversity: in– situ Ex– situ. Bio– wealth - National and Global level.	**06**	**CO3**
IV	Environmental Pollution : Definition– causes, effects and mitigation measures– Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution– Nuclear hazards – Solid wastes acid rain–Climate change and global warming environmental laws and regulations in India– Earth summit.	**06**	**CO4**
V	Population and environment – Population explosion – Environment and human health – HIV/AIDS – Women and Child welfare – Disaster Management - Resettlement and Rehabilitation of people, Role of information technology in environmental health – Environmental awareness.	**06**	**CO5**

Text Book:	
1.	Department of Biochemistry. Environmental Studies (Study Material). Published by K.S.Rangasamy College of Arts & Science (Autonomous). Tiruchengode.
Reference Book:	
1.	*Erach Bharucha*. 2005. **Textbook of Environmental studies**. Universities press. PVT. Ltd.

COURSE OUTCOMES (CO)

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

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

18UTALA301	**TAMIL – III: fhg;gpak; - rpw;wpyf;fpak;**	**gUtk; III**

,g;ghlj;jpl;lj;jpd; Nehf;fq;fshtd:

- jkpo;f;; fhg;gpaq;fs; Njhw;wj;ijAk;>fhg;gpa ,yf;fzj;ijAk; fhg;gpatiffisAk; mwpKfk; nra;jy;.
- rpw;wpyf;fpaq;fs; Njhw;wk;>tsh;r;rpepiyfisAk;>rpw;wpyf;fpaq;fisAk; mwpKfk; nra;jy;.
- gFgjcWg;Gf;fisf; fw;gpj;jy;.

Credits: 03 **Total Hours: 50**

UNIT	**CONTENTS**	**Hrs**	**CO**
I	fhg;gpaq;fs; - rpyg;gjpfhuk; - tof;FiufhijkzpNkfiy - kyh;tdk; Gf;ffhij.	**10**	**CO1**
II	gpwfhg;gpaq;fs; - fk;guhkhazk; - Ffg; glyk; nghpaGuhzk; - ,isahd;Fbkhwehadhh; Guhzk;.	**10**	**CO2**
III	rpw;wpyf;fpaq;fs; - Fw;whyf; FwtQ;rp– tre;jty;ypapd; fhjy; **(1-10 ghly;)** fypq;fj;Jg; guzp - Nga;fisg; ghbaJ.	**10**	**CO3**
IV	,yf;fpatuyhW - fhg;gpaq;fs; - Ik;ngUq;fhg;gpaq;fs; - IQ;rpWfhg;gpaq;fs; -Guhzq;fs; - rpw;wpyf;fpaq;fs;.	**10**	**CO4**
V	,yf;fzKk; nkhopg;gapw;rpAk; - gFgjcWg;gpyf;fzk; - rPh; tiffs; - t*cr; nrhw;fs; - fbjk; vOJjy;.	**10**	**CO5**

Text Book:

1	jkpo;j;Jiw ntspaPL> Nf.v];.uq;frhkp fiy mwptpay; fy;Y}up (jd;dhl;rp)> jpUr;nrq;NfhL-637 215.

COURSE OUTCOMES (CO)

,g;ghlj;ijf; fw;gjd; thapyhf khzth;fs; ngWk; gad;fshtd:

CO1	,ul;ilf; fhg;gpaq;fspd; Nkd;ikepiyia czh;jy;.
CO2	fhg;gpaf;fhyFbfspd; epiyia>chpikiaczh;jy;.
CO3	rpw;wpyf;fpaq;fspd; rpwg;ig czh;jy;.
CO4	fhg;gpa>rpw;wpyf;fpaq;fspd; tuyhW Fwpj;j nra;jpfismwpjy;.
CO5	,yf;fzk; kw;Wk; nkhopg;gapw;rpapd; mikg;ig czh;jy;.

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: 03 **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** Resume Writing **COMMUNICATION SKILLS** Imagining Context specific expression - Master of Ceremonies	**20**	**CO3 & CO4**

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

18UMBM301	CORE III: MOLECULAR BIOLOGY	SEMESTER III

Course Objectives:

The course aims

- To understand the basic knowledge about the central dogma of the organism.
- To know about basic mechanism of transcription and translation.
- To learn the gene transfer and gene analysis techniques.

Credits: 05 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Nucleic acids:** Central dogma - Different forms of DNA (ADNA, BDNA, ZDNA) - DNA as genetic material- Griffith's, Avery and Hershey-Chase experiment. Prokaryotic DNA replication- Semi-conservative mode of DNA replication. Enzymology of DNA replication- Meselson and Stahl experiment- rolling circle replication.	**10**	**CO1**
II	**Gene expression (Prokaryotes):** Transcription (Prokaryotes)- the basic mechanism of transcription- RNA polymerase- structure and function process of transcription-initiation (promoters), elongation and termination (Rho-dependant and Rho-independent process)- Inhibitors of transcription- Post transcriptional modification of m-RNA.	**10**	**CO2**
III	**Translation (Prokaryotes):** Translation in prokaryotes– structure of ribosomes– amino acid activation, charging of t–RNA–Initiation of protein synthesis. Elongation and termination– inhibitors of translation. Post translational modifications.	**10**	**CO3**
IV	**Prokaryotic gene regulation:** Operon concept– *trp*, *lac* operon. Positive and negative control of gene expression–attenuator control. Gene transfer methods- Transformation-Conjugation–transduction (generalized and specialized).	**10**	**CO4**
V	**Techniques used in genome analysis-** DNA hybridization-PCR-chromosome walking–Chromosome Jumping-RFLP- RAPD- AFLP-DNA microarray (DNA chips)-site directed mutagenesis.	**10**	**CO5**

Text Books:	
1.	*Prescott, L.M. Harley, J.P.* and *Klein, D.A* 2012. **Microbiology.** [Eighth Edition]. WMC. Brown Publishers
2.	*Weaver, R.F.*1999. **Molecular Biology**, WCB Mc Graw-Hill.
Reference Books:	
1.	Peter J. Russell. 1998. **Genetics**. 1998. [FifthEdition]. Harpar Collins College Publishers.
2.	*David Freifelder.* 1987. **Molecular Biology**. Jones and Bartlett, New Zealand**.**
3.	*Benjamin Lewin.*2007. **Genes IX.** Pearson Prentice Hall, USA
4.	*Waston,J. D., Baker,T. A., Bell,S. P., Alexander G., Michael L. And Richard L.* 2004. **Molecular Biology of the Gene.** [Fifth Edition]. Pearson Education Pvt. Ltd., New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Recall the basics of molecular mechanisms.
CO2	Assess gene expression in prokaryotes.
CO3	Analyze the desired protein products.
CO4	Apply the knowledge of gene regulation into product launching.
CO5	Apply the molecular techniques for disease diagnosis.

MAPPING

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

H-High; M-Medium; L-Low

18UBCMBA301	**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 this is the basic requirement of all life sciences.

Credits: 02 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Carbohydrates:** Introduction, classification. Monosaccharide – Structure and importance of glucose and fructose. Isomers: stereo and structural isomers. Mutarotation and chemical reactions- reduction, oxidation and osazone formation. Oligosaccharides – Disaccharides - Structure and importance of sucrose, lactose. Polysaccharides - Structure and importance of homopolysaccharides – Starch and Glycogen. Heteropolysaccharides - Hyaluronic acid and Heparin.	**8**	**CO1**
II	**Amino acids:** Classification, Structure and properties. Essential, Non-essential and Non-protein amino acids. **Protein:** Classifications and Functions: Structural organization of Proteins - Primary, secondary, tertiary and quaternary structure. Forces involved in stabilization of tertiary structure of proteins.	**8**	**CO2**
III	**Lipids:** Classification. Triacylglycerol – Structure, physical & chemical properties. Phospholipids - Structure of lecithin. Phospholipids in cell membrane – Fluid Mosaic model. Derived lipids. Essential fatty acids, Saturated and unsaturated fatty acids: - Structure. Sterol – Structure of Cholesterol.	**8**	**CO3**
IV	**Enzymes** – Definition, IUB classification with examples. Active site - Definition, Mechanism of enzyme action - Lock & key model and induced fit hypothesis. Enzyme units - IU, katal. Factors affecting enzyme activity (pH, Temperature and substrate concentration).	**8**	**CO4**
V	**Vitamins** - Classification, Sources, daily requirements, physiological	**8**	**CO5**

	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.		
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	M	M	H	H	L
CO2	M	M	H	H	L
CO3	M	M	H	H	L
CO4	M	M	H	H	L
CO5	M	M	H	H	L

H-High; M-Medium; L-Low

18UMBMP301	**CORE PRACTICAL III : MOLECULAR BIOLOGY**	**SEMESTER III**

Course Objectives:

The course aims

- To understand and apply the basic principles and techniques of molecular biology for further research.
- To know about isolation, estimation and purification of nucleic acids.

Credits: 03 **Total Hours: 50**

Experiment	**CONTENTS**	**Hrs**	**CO**
1.	Isolation of genomic DNA from bacteria.	**06**	**CO1**
2.	Isolation of plasmid DNA.	**06**	**CO1**
3.	Estimation of DNA by Diphenylamine method.	**05**	**CO2**
4.	Estimation of RNA by Orcinol method.	**05**	**CO2**
5.	Protein estimation by Lowry's method.	**06**	**CO2**
6.	Determination of UV killing effect for bacteria.	**06**	**CO3**
7.	Isolation of auxotrophic mutants by gradient plate technique (Spontaneous mutation).	**08**	**CO4**
8.	Isolation of auxotrophic mutants by replica plating technique (induced mutation).	**08**	**CO4**

Reference Books:

1. *Maniatis Sambrook and David W. Russel.* **Molecular Cloning: A Laboratory Manual.** [Third Edition]. Cold Spring Harbor laboratory press.
2. *Janarthanan, S. and Vincent, S.* 2009. **Practical Biotechnology: Methods and Protocols.** [Second Edition]. Universities press, (India) Pvt Ltd, Hyderabad.

COURSE OUTCOMES (CO)

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

CO1	Analyze the bacterial genomic DNA and RNA.
CO2	Assess the quantification of nucleic acids and proteins.
CO3	Determine the killing effect of UVC on microorganisms.
CO4	Demonstrate rDNA technology through gene transfer in prokaryotes.

18UBCMBAP301	**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:02 **Total Hours: 27**

S.No.	**EXPERIMENT**	**Hrs**	**CO**
I. Qualitative Analysis			
1.	Carbohydrates: Glucose, fructose, xylose, sucrose, lactose, and starch.	9	CO1
2.	Amino acids: Tyrosine, tryptophan, histidine, methionine and cysteine.	6	CO1
3.	Proteins: Solubility test, coagulation test, ninhydrin test, biuret test, folin's phenol test, precipitation by metals.	3	CO1
4.	Lipids: Solubility, grease spot, Oil spot, emulsification, halogenations, colour reactions.	3	CO1
II. Quantitative Analysis			
5.	Estimation of Glycine by Formal titration method.	3	CO2
6.	Determination of Saponification Value	3	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

18UMBSB301	**SBC I: BIOINSTRUMENTATION**	**SEMESTER III**

Course Objectives:

The course aims

- To learn the working mechanism and applications of biological instruments.
- To study various analytical techniques in the field of Microbiology.

Credits: 02 **Total Hours: 30**

UNIT	CONTENTS	Hrs	CO
I	**Buffer, pH and Spectrometry:** Good Laboratory practices, pH meter and electrodes working principle with maintenance. Buffer preparation– Phosphate buffer- colorimeter and Spectrophotometer – (UV-Vis).	**06**	**CO1**
II	**Centrifugation:** Principles of centrifugation. Rotor types– Fixed angle, vertical tube and swinging bucket. Instrumentation for centrifugation. Application of Centrifugation –preparative and analytical techniques. Care of rotors and centrifuge.	**06**	**CO2**
III	**Electrophoresis:** Principles and applications–Paper electrophoresis, Agarose Gel Electrophoresis. SDS-PAGE, Two-dimensional electrophoresis and Isoelectric focusing.	**06**	**CO3**
IV	**Chromatography:** Principle and applications- Paper, TLC, Column, Ion exchange, Affinity chromatography, HPLC and Gas chromatography.	**06**	**CO4**
V	**Radioactivity:** Half-life, Radioactive decay, Excitation, Ionization. Isotopes used in biological studies. Measurement of Radioactivity- Geiger- Muller counter, Scintillation counter.	**06**	**CO5**

Text Book:

1. *Rodney F. Boyer*. **Modern Experimental Biochemistry**. 3rd Edition. Pearson Education ltd.

Reference Books:	
1.	*Wilson, K., and Walker, J.* 2003. **Practical Biochemistry, Principles and Techniques**. Cambridge University Press, Cambridge.
2.	*Skoog, D. A.* 2006. **Principles of Instrumental Analysis**. [Sixth Edition]. Thompson Brooks/Cole: Belmont, CAs.

COURSE OUTCOMES (CO)

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

CO1	Discuss the importance of bioinstruments in research and industry.
CO2	Analyze microbial by products and end products by analytical and preparative methods.
CO3	Evaluate molecular characterization and profiling of proteins.
CO4	Assess the separation and characterization of biomolecules.
CO5	Evaluate the respective biomolecules through radio isotopes.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H
CO2	M	M	M	H	H
CO3	H	H	H	H	M
CO4	M	H	H	H	M
CO5	M	M	M	M	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)	3	CO1
II	Sentence Correction – Sentence Pattern - Reading Comprehension (Level -1)	3	CO2
III	Expansion of Proverbs – Closet Test (Level -1)	3	CO3
IV	Sentence Improvement (Essay Writing, Now- a –Days Vocabulary), Story Writing	3	CO4
V	E-Mail Building (Sending call letters), Letters (Formal and Informal)	3	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.

18UMBAC301	ADD ON COURSE I: MUSHROOM TECHNOLOGY	SEMESTER III

Course Objectives:

The course aims

- To learn the scope and importance of mushrooms.
- To study cultivation methods of various edible mushrooms.

Total Hours: 25

UNIT	CONTENTS	Hrs	CO
I	**Introduction:** Scope and economic importance of mushroom cultivation-Nutritive values of mushroom- key to differentiate edible from Poisonous mushrooms.	05	CO1
II	**Equipments and substrates in mushroom cultivation:** Polythene bags, vessels, inoculation hook, inoculation loop, low cost stove, sieves, culture racks, mushroom unit or mushroom house, water sprayer, tray, boilers, driers.	05	CO2
III	**Cultivation techniques:** Spawn- tissue culture- types of spawn, substrate, mycelia isolation, spawn running- Cultivation of common edible mushrooms: *Agaricus bisporus*, *Pleurotus ostreatus* and *Volvariella volvaceae* and Harvesting. Medicinal properties of Magic mushroom.	05	CO3
IV	**Storage of mushroom:** Long term and short term storage of mushrooms- Diseases and pest control of mushrooms.	05	CO4
V	**Value added products from mushrooms:** Mushroom research centers: National level and regional level, Marketing of mushrooms in India and world**.**	05	CO5

Text Book:

1. *Tripathi, D.P.* 2005. **Mushroom Cultivation**. Oxford & IBH Publishing Co. Pvt.Ltd, New Delhi.

Reference Books:	
1.	*Pathak Y.G.* 2010. **Mushroom production and Processing Technology**. Agrobios (India).
2.	*Kannaiyan. S, Ramasamy. K*. 1980. **A hand book of edible mushroom**. Today & Tomorrows printers & publishers, New Delhi.
3.	*Nita. B.* **Handbook on Mushrooms** .Oxford & IBH Publishing Co.

COURSE OUTCOMES (CO)

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

CO1	Discuss the economic importance of mushrooms.
CO2	Understand instrumental part of mushroom cultivation.
CO3	Apply various cultivation techniques for mushrooms.
CO4	Demonstrate disease and pest management for mushroom cultivation.
CO5	Outline marketing and value added product preparation of mushrooms.

MAPPING

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

H-High; M-Medium; L-Low

18UTALA401	**TAMIL – IV: rq;f ,yf;fpak; - ePjp ,yf;fpak;**	**gUtk; IV**

,g;ghlj;jpl;lj;jpd; Nehf;fq;fshtd :

- rq;f ,yf;fpak;> mw ,yf;fpaq;fspd; rpwg;igczh;j;Jjy;.
- ,yf;fz E}y;fisfhythpirg;gbmwpar; nra;jy;.
- mzp ,yf;fzj;jpd; rpwg;ig czur; nra;jy;.

Credits: 03 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**vl;Lj;njhif** m.ew;wpiz–md;dha; thopg;gj;J (ghly; vz;. 208> 209> 210) M. FWe;;njhif–ahAk; QhAk; (ghly; vz;.40) ,. fypj;njhif–Mw;Wjy; vd;gnjhd;. (ghly; vz;.103) <. GwehD}W –gy;rhd;wPNugy;rhd;wPNu (ghly; vz;.195)	**10**	**CO1**
II	**gj;Jg; ghl;L** m. FwpQ;rpg;ghl;L; (1 Kjy; 106 mbfs; tiu) -fgpyu;	**12**	**CO2**
III	**mw ,yf;fpaq;fs;** m. ehybahh; -ghly; vz; (35>59>94>141>333) M. ehd;kzpf;fbif - ghly; vz; (04>09>59>69>80) ,. gonkhop-ghly; vz; (05>21>120>149>361) <. rpWgQ;r%yk; - ghly; vz; (05>17>48>83>99)	**10**	**CO3**
IV	**,yf;fpa tuyhW** m. rq;f ,yf;fpa E}y;fs; mwpKfk; M. Kr;rq;ftuyhW ,. jkpo; ,yf;fz E}y;fs; mwpKfk; <. mw ,yf;fpaq;fs; mwpKfk;	**10**	**CO4**
V	**,yf;fzk;** m. mzp ,yf;fzk; 1. ctikmzp 2. cUtfmzp 3. Ntw;Wikmzp 4. tQ;rg;Gfo;r;rpmzp M. mfj;jpizfs;>Gwj;jpizfs; - tpsf;fk;	**08**	**CO5**

Text Book:

1	jkpo;j;JiwntspaPL>Nf.v];.uq;frhkp fiy mwptpay; fy;Y}hp (jd;dhl;rp)> jpUr;nrq;NfhL– 637 215.

COURSE OUTCOMES (CO)

,g;ghlj;ijf; fw;gjd; thapyhf khzth;fs; ngWk; gad;fshtd:

CO1	vl;Lj;njhif E}y;fspd; rpwg;ig mwpjy;
CO2	gj;Jg;ghl;L E}y;fspd; Rit mwpjy;
CO3	mw ,yf;fpaq;fs; gw;wpmwpjy;
CO4	,yf;fpaq;fs; Njhw;wKiwia mwpjy;
CO5	mzp ,yf;fzj;jpd; gad; gw;wpmwpjy;.

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: 03 **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**	**10**	**CO5**

	Simple, Compound and Complex Sentences **COMPOSITION** Jumbled Sentences **COMMUNICATION SKILLS** Role-Play		

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	*SasiKumar V and Syamala V*. 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	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.

18UMBM401	**CORE VI: IMMUNOLOGY**	**SEMESTER IV**

Course Objectives:

The course aims

- To understand the working of immune system and immune molecules.
- To know the mechanism of immune response and immunodiagnosis.

Credits: 05 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Immunity**: Early theories and clonal selection theory. Hematopoiesis and its regulations. Immunity types and response- Innate and Acquired immunity, Humoral and Cell mediated immunity.	**10**	**CO1**
II	**Cells and organs of immune system and antigen:** Cells, Organs and tissues of the immune system– Primary lymphoid organs– Secondary lymphoid tissues. Antigens: Types– Epitopes, hapten, adjuvants and properties.	**10**	**CO2**
III	**Antigen– Antibody reactions:** Antibody: Structure, types and properties. Monoclonal antibody production. Primary and secondary reactions, Chemical interactions, Agglutination, Agglutination inhibition, Precipitation, Immunofluorescence, ELISA, RIA, Complement fixation test, Immunohaematology– ABO and Rh incompatibility.	**10**	**CO3**
IV	**Complement system**: Properties, Classical and alternative pathway, Cytokines structure and functions, MHC and its role. Autoimmunity– Grave's disease, Myasthenia Gravis. Vaccines – immunization – active and passive- attenuated vaccine-recombinant vaccine – purified macromolecules as vaccines.	**10**	**CO4**
V	**Effector mechanisms:** Transplantation- types of grafting, graft acceptance and rejection. Hypersensitive reactions– Classification– IgE mediated (type–I) – Antibody mediated cytotoxic (Type–II)– Immune complex mediated (Type-III)- TDTH-Mediated (Type-IV). Cancer immunology– Origin and terminology, Immune responses to	**10**	**CO5**

	tumour, Cancer Immunotherapy.		
Text Book:			
1.	*Nandhini Shetty*. 2007. **Immunology: Introductory Text Book**. New Age International Pvt. Ltd., New Delhi.		
Reference Books:			
1.	*Tizard, K*. 1983. **Immunology.** Saunders College Publishing, Philadelphia.		
2.	*Roitt.* 1988. **Essentials of Immunology.** Blackwell Scientific Publishers, London.		
3.	*Janeway, C. A., P. Travers, M. Walport and M. J. Shlomchik* (2001). **Immunobiology**: The Immune System in Health and Disease. Garland Publishing, USA.		
4.	*Richard Goldsby, Thomas.J. Kindt, Barbara. A. Osborne.* 2004. **Immunology**. [Fourth Edition]. W. H. Freemanand Co., NewYork.		

COURSE OUTCOMES (CO)

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

CO1	Understand the importance of immunity.
CO2	Discuss the cells and organs of immune system.
CO3	Analyze the importance of immunity and to develop new monoclonal antibodies.
CO4	Demonstrate the nature of antigens and antibodies and to develop vaccines.
CO5	Analyze merits and demerits of transplantation.

MAPPING

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

H-High; M-Medium; L-Low

18UMAMBA401	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: 02 **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	CO 1
II	**Measures of Central Tendency:** Arithmetic Mean – Median – Mode – Geometric mean – Harmonic mean. (Chapter 3 Sections: 3.1.1, 3.2 - 3.5)	08	CO 2
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	CO 3
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	CO 4
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	CO 5

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)

On completion of this 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	H	H	M	M
CO2	M	M	M	M	M
CO3	M	L	M	L	L
CO4	M	M	M	M	M
CO5	M	M	M	H	M

H-High; M-Medium; L-Low

18UMBMP401	**CORE PRACTICAL IV: IMMUNOLOGY**	**SEMESTER IV**

Course Objectives:

The course aims

- To study the serological diagnostic techniques.
- To study the qualitative analysis of various antigen against antibody.

Credits: 03 **Total Hours: 36**

Experiment	**CONTENTS**	**Hrs**	**CO**
1.	ABO blood grouping and cross matching	**3**	**CO1**
2.	CRP	**3**	**CO2**
3.	RA	**3**	**CO2**
4.	ASO	**3**	**CO3**
5.	RPR	**3**	**CO2**
6.	WIDAL test (Slide and tube methods)	**6**	**CO3**
7.	Haemagglutination	**3**	**CO4**
8.	ELISA	**3**	**CO4**
9.	Counter Immunoelectrophoresis	**3**	**CO5**
10.	Double Immunodiffusion (Ouchterlony)	**6**	**CO5**

Reference Books:

1. *Rajan, Sand Selva Christy, R.*2010. **Experimental Procedures in Life Sciences.** [First Edition]. Anjanaa Book House, Chennai.
2. *Kannan, N.* **Laboratory Manual in General Microbiology.** [Second Edition]. Panima publishing corporation, New Delhi.
3. *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	Identify viral infections by serological method diagnosis.
CO2	Analyze the blood group of individuals and also analyze the enteric fever and their causative agent.
CO3	Utilize immunotechniques for qualitative analysis of antigens.
CO4	Evaluate Streptococcal infections by serological methods and determine the infection status based on CRP level.
CO5	Identify the presence of rheumatoid factor among suspected patients and diagnose HIV, hepatitis viral infection among risky populations.

18UMAMBAP401	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: 02 **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)

On 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.

18UMBSBP401	**SBC II: PRACTICAL I**	**SEMESTER IV**

Course Objectives:

The course aims

- To train the students to handle the basic instruments.
- To understand the basic techniques in characterization of biomolecules.

Credits: 02 **Total Hours: 25**

Experiment	**CONTENTS**	**Hrs**	**CO**
1.	Calibration and Maintenance of pH meter.	**2**	**CO1**
2.	Preparation of buffers- Phosphate, Acetate, Citrate	**3**	**CO2**
3.	Estimation of chlorophyll pigment by solvent extraction method	**5**	**CO2**
4.	Separation of amino acids by Paper chromatography	**5**	**CO3**
5.	Separation of bacterial pigment by Column chromatography	**5**	**CO4**
6.	Separation of amino acids by Thin Layer Chromatography	**5**	**CO4**

Reference Books:

1.	*Thimmaiah, S.K.* **Standard Methods of Biochemical Analysis**. Kalyani Publishers

COURSE OUTCOMES (CO)

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

CO1	Discuss the calibration of basic microbiological instrument.
CO2	Apply the technique for the separation of biomolecules.
CO3	Evaluate the characteristic features of biopigments.

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.	3	CO1
II	Aptitude: Problems on Numbers – Problems on Ages – Surds & Indices – Percentage – Profit & Loss – Ratio & Proportion – Partnership – Chain Rule.	3	CO2
III	Aptitude: Simple & Compound Interest – Alligation or Mixture - Permutation and Combination.	3	CO3
IV	Aptitude: Probability – Missing Number series – Wrong Number Series – Races & Games of Skill.	3	CO4
V	Aptitude: Time & Work – Pipes & Cistern – Time & Distance – Problems on Trains – Boats and Streams.	3	CO5

Text Book:

1	*R.S. Aggarwal.* 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.

18UMBAC401	**ADD ON COURSE II: MICROBIOLOGY FOR SOCIAL WELFARE**	**SEMESTER IV**

Course Objectives:

The course aims

- To learn the importance and applications of microbial products.
- To understand the entrepreneur opportunities in relevance to Microbiology.

Total Hours: 25

UNIT	CONTENTS	Hrs	CO
I	**Microbial technology:** Bioactive compounds from microorganisms -Antibiotics – Production of Streptomycin. Novel Microbial products- Production of human insulin. Biopolymers – Engineering of *Xanthomonas campestris*. Biosequestration of heavy metal pollutants.	**05**	**CO1**
II	**Institutions and schemes of government of India:** Schemes and programmes, Department of science and technology schemes, Nationalized banks – other financial institutions etc – SIDBI – NSIC – NABARD – IDBI – IFCI – ICICI etc. Opportunities in & as NGO sectors.	**05**	**CO2**
III	**Biofertilizers:** Algal fertilizers- *Azolla* as fertilizer. Composting – domestic waste, agricultural and industrial waste, vermi composting and organic farming.	**05**	**CO3**
IV	**Patenting in Microbial Biotechnology:** Patents – patenting strategies. Copy rights. Trade secrets, Trademarks, WIPO, GATT & TRIPs. Patenting of Biological materials.	**05**	**CO4**
V	**SCP production**: Mushroom and Spirulina cultivation and its marketing. Probiotics and its use as animal feed.	**05**	**CO5**

Text Book:

1	*Dubey, R.C* (2009). A text book of Biootechnonoly, S.Chand & CompanyLtd, New Delhi.

Reference Books:

1	*Subba Rao, N.S., 1995.* **Biofertilizer in agriculture and forestry.** *Oxford and IBH, New york.*

2	*Bernard, R., Glick and Jack J Pasternik*. 1996. **Molecular Biotechnology Principles and Application of Recombinant DNA**. Panima Publishing Corporation, New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Discuss the valuable products of microbes
CO2	Understand the various government schemes and banking systems
CO2	Apply the microbes and its products as biofertilizers
CO3	Demonstrate the patenting methods for novel products
CO4	Outline the production of SCP and its marketing strategies

MAPPING

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

H-High; M-Medium; L-Low

18UMBNM301	NMEC I : PERSONAL HYGIENE (Course offered to other department students)	SEMESTER III

Course Objectives:

The course aims

- To equip the student with procedures of good basic hygiene and sanitation requirements.
- To learn the prevention of health hazard situation through unhygienic handling of food, equipment used in food production and food production work areas.

Credits: 02 **Total Hours: 25**

UNIT	CONTENTS	Hrs	CO
I	**Hygiene and Health:** Introduction to hygiene and healthful living concepts of health and disease- Factors influencing health and healthful living. Scientific principles related to maintenance of normal circulation- normal respiration- normal digestion and elimination- normal sensory functions- normal skeletal alignment.	05	CO1
II	**Physical Health:** Skin care, cleanliness, clothing; care of the hair, prevention of pediculosis. Dental care and oral hygiene. Care of hands, hand washing, care of nails. Hygiene of elimination, menstrual hygiene.	05	CO2
III	**Health habits and practices**: Recognizing positive and negative practices in the community. Care of the face, foot wear, eyes, nose and throat, Food values- nutritious diet, selection, preparation and handling of food.	05	CO3
IV	**Periodic health examination**: The health examination; health record; infection- types; immunization; detection and correction of defects; prevention and early treatment of common ailments - common colds, indigestion, headache.	05	CO4
V	**Health in the home:** The home as a center for healthful living. Household measures for disposal of refuse, waste; latrines and sanitation; ventilation. Safety in the home; common home hazards. Sanitation in animal sheds; insects and pests.	05	CO5

Text Book:	
1.	*Nicholas Johns.* 2000. **Managing Food Hygiene.** Macmillan Publishers. Hong kong.
Reference Books:	
1.	*Lansing M Prescott, John P Harley and Donald A Klein*. 2010. **Microbiology**. [Eighth Edition]. Mc Graw Hill, NewYork.

COURSE OUTCOMES (CO)

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

CO1	Create awareness of personal hygiene and healthy living.
CO2	Practice hygienic methods to protect the skin, hair, oral and nail.
CO3	Follow positive hygienic practice for healthy life.
CO4	Plan for periodic examination of body against common infection.
CO5	Explain proper disposal of waste and maintain hygiene at home.

18UMBNM401	**NMEC II : MICROBES IN HUMAN HEALTH (Course offered to other department students)**	**SEMESTER IV**

Course Objectives:

The course aims

- To learn the basics of microbiology and microorganisms
- To know about the common microbial diseases

Credits: 02 **Total Hours: 25**

UNIT	CONTENTS	Hrs	CO
I	**Microbiology:** Introduction and Scope, Microorganisms – Types – Viruses – Bacteria – Algae – Fungi – Protozoans – General Characteristics.	**05**	**CO1**
II	**Normal micro flora:** Distribution and occurrence of the normal micro flora of skin – eye - respiratory tract - mouth- intestinal tract - genitourinary tract.	**05**	**CO2**
III	**Bacterial diseases:** Causative agent, Transmission, symptoms and prevention - Tuberculosis, Typhoid and Cholera.	**05**	**CO3**
IV	**Viral diseases:** Causative agent, Transmission, symptoms and prevention - Rabies, Hepatitis and HIV.	**05**	**CO4**
V	**Microbial diseases:** Causative agent, Transmission, symptoms and prevention of Fungal Diseases – Candidiasis and Aspergillosis. Protozoan disease – Amoebiosis and Malaria.	**05**	**CO5**

Text Book:

1. *Chakraborthy, P.* 1995. **A Textbook of Microbiology.** New central Book Agency Pvt. Ltd., Calcutta.

Reference Books:	
1.	*Lansing M Prescott, John P Harley and Donald A Klein*. 2010. **Microbiology**. [Eighth Edition]. Mc Graw Hill, NewYork.
2.	*Michael J Pelczar, Chan, E. C. S. and Noel R Krieg.* 2005. **Microbiology**. [Fifth Edition]. Tata Mc Graw – Hill Publications Ltd., New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Discuss aware of harmful disease causing microorganisms.
CO2	Evaluate the beneficial role of normal microflora in human body.
CO3	Assess the protection, prevention of spread of bacterial and viral disease.
CO4	Discuss prevention of fungal and protozoan diseases.
CO5	Critique proper use of antimicrobial drugs.

18UMBAL401	ADVANCED LEARNERS COURSE I: BIOFERTILIZER TECHNOLOGY	SEMESTER IV

Course Objectives:

The course aims

- To learn the scope and importance of biofertilizers.
- To study mass cultivation methods of various biofertilizers.

UNIT	CONTENTS	CO
I	**Introduction to biofertilizers:** Structure and characteristic features of the following biofertilizer organisms - *Azospirillum, Azotobacter, Rhizobium* and *Frankia*.	**CO1**
II	**Biofertilization processes:** Decomposition of organic matter and soil fertility and vermicomposting. Mechanism of phosphate solubilization and phosphate mobilization. Free living and symbiotic nitrogen fixation.	**CO2**
III	**Cultivation techniques:** Isolation, purification, mass multiplication, formulation and crop response of inoculants - *Rhizobium, Azotobacter* and *Azospirillum* and phosphate solubilizer (*Pseudomonas striata*).	**CO3**
IV	**Cyanobacteria:** Isolation, purification, mass multiplication and application of cyanobacterial bioinoculants. Azolla - mass cultivation and its application.	**CO4**
V	**Mycorrhizae**: Ecto and endomycorrhizae. Isolation of AM fungi - Wet sieving method and sucrose gradient method. Mass production of AM inoculants and field applications.	**CO5**

Text Books:

1. *Somani, L.L., S.C. Bhandari, K.K. Vyas and S.N. Saxena.* 1990**. Biofertilizers.** Scientific Publishers - Jodhpur.

2. *Tilak, K.V.B.* 1991. **Bacterial Biofertilizers.** ICAR Pub., New Delhi.

Reference Books:	
1.	P*urohit, S.S., P.R. Kothari and S.K. Mathur. 1993.* **Basic and Agricultural Biotechnology.** Agro Botanical Pub. India.
2.	*Subba Rao, N. S.* 1988. **Biological Nitrogen Fixation: Recent Developments.** Oxford and IBH Pub. Co. Pvt. Ltd., India.
3.	*Subba Rao, N.S., G.S. Venkataraman and Kannaiyan. S*. 1993. **Biological Nitrogen Fixation.** ICAR Pub., New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Discuss the economic importance of biofertilizers.
CO2	Understand the nitrogen fixation process.
CO3	Apply the various formulation and cultivation methods for biofertilizer production.
CO4	Demonstrate the cyanobacterial biofertilizer production.
CO5	Outline the field application of mycorrhizal bioinoculants.

MAPPING

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

H-High; M-Medium; L-Low

18UMBM501	CORE V: FUNDAMENTALS OF VIROLOGY	SEMESTER V

Course Objectives:

The course aims

- To gain knowledge about properties of viruses and life cycle in host cells.
- To understand role of pathogenesis and their diagnostic methods.
- To ascertain the importance and application of antiviral drugs and their mode of actions.
- To learn about advanced techniques in viral cultivation methods.

Credits: 05 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Virus:** History of virology, General properties of Viruses – Structure of viruses – capsids, nucleocapsid, nucleic acids – Viral envelopes and enzymes. Baltimore classification of viruses- DNA and RNA viruses.	10	CO1
II	**Cultivation of viruses:** Embryonated eggs, Animals Cell cultures - Primary and Continuous cell cultures. Viral purification, Viral Assays- Haemagglutination assay- Plaque assay.	10	CO2
III	**Bacteriophages:** Classification, structure and life cycle of Single stranded DNA phages- Φx174 and M13; double stranded DNA phages – T4 and lambda. Viroids.	10	CO3
IV	**Animal viruses:** Structure, replication. Pathogenesis and Laboratory diagnosis of Pox virus, Herpes simplex virus, Polio virus, Influenza virus, MMR, Rabies virus and HIV. Anti viral drugs and their mode of actions.	10	CO4
V	**Plant viruses:** Structure, mode of transmission, Symptoms, Prevention and control of Tobacco Mosaic Virus, Cucumber Mosaic Virus, Potato Spindle Tuber Virus and Cauli flower Mosaic Virus.	10	CO5

Text Books:	
1.	*Edward K. Wagner, Martinez J. Hewlett.* 1999. **Basic Virology.** Blackwell Science, Inc.

Reference Books:	
1.	*Dimmock, K.J. and Primrose, S.B.* 1994. **Introduction to Modern Virology**. [Fourth Edition]. Blackwell Science Ltd., UK.
2.	*Lewy, J. A, Fraenled H.C and Owens. R.A.* 1994. **Virology.** [Third Edition]. Prentice Hall, New Jersey, USA.
3.	*Ananthanarayanan, R* and *Jayaram Panicker, C.K.* 1994. **Text Book of Microbiology**. Orient Longman.
4.	*Biswass, S.B. and Amita Biswass.* 1984. **An Introduction to Viruses**. [Third Edition]. Vikas Publishing House Pvt. Ltd., New Delhi.

COURSE OUTCOMES (CO)	
CO1	Recall the general properties of viruses.
CO2	Understand the mode of expansion of viruses.
CO3	Compute the life cycles of phages.
CO4	Apply Anti viral drugs for controlling the viral infections.
CO5	Assess the importance of prevention and control of plant viruses.

MAPPING

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

H-High; M-Medium; L-Low

18UMBM502	**CORE VI: ENVIRONMENTAL MICROBIOLOGY**	**SEMESTER V**

Course Objectives:

The course aims

- To impart the significant processes involving in environmental microbiology.
- To understand bioremediation process and biofuel production**.**

Credits: 04 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Ecological Principles:** ecosystem-types of ecosystems-dynamics of ecosystem- culturable and non-culturable bacteria- conventional and molecular methods of studying microbial diversity.	**08**	**CO1**
II	**Air and Aquatic -Microbiology:** Aerosol- droplet nuclei. Enumeration of bacteria from air – Air sampling devices, Air sanitation- Air borne diseases and their control measures. Potability of water quality – Indicator organisms – MPN index. Eutrophication. Waterborne diseases and their control measures.	**08**	**CO2**
III	**Sewage Microbiology:** Chemical and Biochemical characteristics of sewage – Biological oxygen demand; Chemical oxygen demand. Sewage treatment – Physical, chemical and biological (trickling filter, activated sludge and oxidation pond) – Solid waste treatment-Saccarification and Pyrolysis.	**08**	**CO3**
IV	**Role of microbes in environment:** Bioremediation- types and its applications; bioremediation of hazardous waste and metals; biodegradation of paper, oil, pesticide and xenobiotic compound. Bio-deterioration of leather and textiles. Bioleaching of ores. Phytoremediation.	**08**	**CO4**
V	**Microbial conversion of solid waste to food:** Mushroom, SCP. Biofuel production– bioethanol, biogas, hydrogen and algal fuel. Applications of GIS and RS in environmental monitoring. Microbial composting and Vermicomposting.	**08**	**CO5**

Text Books:

1. *Atlas, R.M* and *Bartha R*. 1980. **Microbial Ecology: Fundamentals and applications**.

	Fourth Edition, An imprint of Adiision Wesley Longman Inc.
2.	*Vijaya Ramesh, K*. 2004. **Environmental Microbiology**. 1st Edition, MJ1P Publishers (A unit of Tamil Nadu Book house), Chennai.

Reference Books:	
1.	*Mithell R*. 1974. **Introduction to Environmental Microbiology**. Prantice Hall. Inc., Englewood Cliffs, New Jersey.
2.	*Daniel J. C.* 1999**. Environment Aspects of Microbiology**. 1stEdition, Bright sun Publications, Chennai.
3.	*Raina, M. M, Ian, L. P* and *Charles, P G*. 2000. **Environmental Microbiology.** Academic Press, USA.

COURSE OUTCOMES (CO)	
CO1	Recall the existence of living organisms and communities.
CO2	Evaluate air quality, air sanitation and control air borne diseases.
CO3	Create awareness about proper disposal and recycling of waste water.
CO4	Develop remediation for control environmental pollution using microorganisms.
CO5	Assess commercial application of microbial products.

MAPPING

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

H-High; M-Medium; L-Low

18UMBM503	CORE VII: SOIL AND AGRICULTURAL MICROBIOLOGY	SEMESTER V

Course Objectives:

The course aims

- To gain knowledge about basics of soil profile.
- To understand role of soil microorganisms and its interactions.
- To ascertain the importance and application of bio-fertilizers and biocontrol agents.

Credits: 04 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Soil Profile:** Properties of soil, structure, texture and formation of soil. Soil profile types. Classification of soil. Microbial grouping- Autochthonous, Allochthonous and zymogenous microbes. Significance of soil microbes- Bacteria, Archaea, eukaryotic algae, cyanobacteria, fungi, Actinomycetes, protozoa, Nematode and viruses.	08	CO1
II	**Biogeochemical cycle:** Carbon cycle, Phosphorous cycle and Nitrogen cycle. Nitrogen fixation- Symbiotic Nitrogen fixers, Root nodule formation. Non symbiotic bacteria – cyanobacteria. Biochemistry of nitrogen fixation- Nitrogenase, hydrogenase, nif gene and nod gene. Associative nitrogen fixation-*Azospirillum* sp.	08	CO2
III	**Interactions among soil microbes and plants:** Neutralism, Commensalism, Symbiosis, Synergism, Amensalism, Parasitism, Predation and Competetion. Rhizosphere concept, R:S ratio, rhizoplane; spermosphere; phyllosphere, Mycorrhizae.	08	CO3
IV	**Phytopathology:** Introduction, Symptoms, disease cycle and control measures. Bacterial diseases- Blight of rice, Citrus canker. Mycoplasama disease- little leaf of brinjal. Fungal disease- Light blight of potato, Red rot of sugarcane, Wilt of cotton Tikka leaf spot of groundnut.	08	CO4
V	**Biofertilizers, biopesticides and biocontrol agents:** Mass	08	CO5

	multiplication, field application and crop response *to Rhizobium,* and *Azospirullum.* Mode of action, formulation and application methods of biopesticides *Bacillus thuringenesis* and *Breuvaria bassiana.*		

Text Books:

1. *Atlas, R.M.* and *Bartha, R*. 1992. **Microbial Ecology – Fundamentals and Applications.** [Fourth Edition]. Red Wood City C.A Benjamin/Cummings. Menlo Park, California, USA.
2. *Martin Alexander*. 1997. **Introduction to Soil Microbiology**. John Wiley & Sons, New York, USA.
3. *Rangaswam, G.* and *A. Mahadvan.* 1999. **Diseases of crop plants in India.** Fourth edition. Prentice Hall of India Pvt Ltd., New Delhi.

   Subba Rao, N.S. 1982. **Advances in Agricultural Microbiology**. Oxford and LBH publishing co.
4. *Alexander N. Glazer* and *Hiroshi Nikaido.* **Microbiol biotechnology- Fundamentals of Applied Microbiology.** W.H. Freeman and Co, New york.

Reference Books:

1. *Subbha Rao, M.S.* 1995. **Soil Microorganisms and Plant Growth**. Oxford and IBH. New Delhi.
2. *Paul, E.A.* 2007. **Soil Microbiology and Biochemistry.** [Third Edition]. Academic Press - An imprint of Elsevier, Burlington, USA.
3. *Bawden. F.C.* 1999. **Plant Diseases**. Greenworld. First Edition in India. Efficient offset printers. New Delhi.
4. *Atlas, A.M. and R. Bartha*. 1998. **Microbial Ecology. Fundamentals and Applications**. An imprint of Addison Wesley longmann Inc.
5. *Mark S. Coney.*, 1999. **Soil Microbiology:** An exploratory approach., Delmar publishers, Singapore.

COURSE OUTCOMES (CO)

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

CO1	Analyze the soil profile and its properties.
CO2	Understand biogeochemical cycles and biological nitrogen fixation mechanism.
CO3	Compute interactions with soil microbes and plants.
CO4	Assess the disease established by phytopathogens.
CO5	Prepare effective biofertilizers for improving soil health.

MAPPING

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

H-High; M-Medium; L-Low

18UMBM504	**CORE VIII: MEDICAL BACTERIOLOGY**	**SEMESTER V**

Course Objectives:

The course aims

- To gain knowledge about the pathogenesis.
- To understand the importance of collection, transport, storage and processing of clinical samples
- To ascertain the antigenic properties of pathogens.
- To enhance employability skills in agriculture.

Credits: 05 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Microbial disease:** Infection- Host parasite interactions- adhesion, invasion, host damage, spread, multiplication and release of pathogen. Normal flora of human- skin, eye, respiratory tract and gastrointestinal tract.	**10**	**CO1**
II	**Collection, transport, storage and processing of clinical samples**: Blood, Urine, Sputum and Body fluids. Hospital acquired infection and their control.	**10**	**CO2**
III	**Morphology, Cultural characteristic, pathogenesis, lab diagnosis and control of Gram positive organisms**: *Staphylococcus aureus, Streptococcus pyogenes, Bacillus anthracis, Mycobacterium tuberculosis, Corynebacterium diptheriae, Clostridium botulinum, Clostridium tetani*.	**10**	**CO3**
IV	**Morphology, Cultural characteristic, pathogenesis, lab diagnosis and control of Gram negative Organisms**: *Escherichia coli, Klebsiella, Proteus, Salmonella, Shigella, Pseudomonas aeruginosa, Vibrio cholerae*.	**10**	**CO4**
V	**Morphology, Cultural characteristic, pathogenesis, lab diagnosis and control of sexually transmitted organisms**: *Treponema pallidum, Neisseria gonorrhoeae, Chlamydia trachomatis, Mycoplasma genitalium, Haemophilus ducreyi*.	**10**	**CO5**

Text Books:	
1.	*Chakrabort, P.* 2003. **A Text book of Microbiology**. Second edition, Published by New Central Agency (P) Ltd., Kolkata.
2.	*Ananthanarayan, R* and *Jayaram Paniker, C. K.* 2005. **Text Book of Microbiology**. Seventh edition, Orient Longman Limited, Hyderabad.
3.	*Satish, G.* 2005. **The Short Textbook of Medical Microbiology**. Eighth edition, Jaypee Brothers, Medical publishers (P) Ltd., New Delhi.

Reference Books:	
1.	*Baron, E.J, Peterson, L.R.,* and *Finegold, S. M* . 1994. **Bailey and Scotts diagnostic microbiology**. 9th edition, Mosby publications
2.	*Rajan, S.* 2009. **Medical Microbiology**. First edition, MJP Publishers, Chennai.6.
3.	*Rajesh Bhatia* and *Ratan Lallchhpujani*. 2004. **Essentials of Medical Microbiology.** Third edition, Jaypee Brothers, Medical Publishers (P) Ltd., New Delhi.
4.	*Sundararaj, T.* 2005. **Microbiology Laboratory Manual**, Perungudi, Chennai-96.8.
5.	*Jawetz, Melnick*, and *Adelberg's*. 2013. **Medical Microbiology**. 26th Edition. McGraw-Hill.

COURSE OUTCOMES (CO)

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

CO1	Analyze microbial diseases and normal flora.
CO2	Understand the proper processing of clinical samples.
CO3	Analyze and diagnose the infections caused by Gram positive pathogens
CO4	Analyze and diagnose the infections caused by Gram negative pathogens
CO5	Create awareness for parasitical infestation

MAPPING

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

H-High; M-Medium; L-Low

18UMBEL501	**ELECTIVE I: MEDICAL MYCOLOGY AND PARASITOLOGY**	**SEMESTER V**

Course Objectives:

The course aims

- To acquire knowledge of fungal and parasitic diseases, etiology, diagnosis and treatment.
- To understand the taxonomy, morphology, and pathogenesis of human parasites and fungi

Credits: 04 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Mycology:** Historical introduction to Mycology - Morphology – Taxonomy – Nomenclature and Classification of fungi - Isolation and identification of fungi from clinical specimens. Mycotoxins and Mycetism. Antifungal agents - Testing methods and quality control. Virulence factors of fungi.	**10**	**CO1**
II	**Fungal Diseases:** Superficial mycosis- *Tinea*, *Piedra*- Dimorphic fungi causing systemic mycosis- Blastomycosis and Histoplasmosis- Cutaneous mycosis- Dermatophytosis. Subcutaneous mycosis- Sporotrichosis, Mycetoma, Rhinosporidiosis. Opportunistic mycosis- Candidiasis, Cryptococcosis and Aspergillosis.	**10**	**CO2**
III	**Medical Parasitology:** Morphology, classification, characteristics, pathogenesis, laboratory diagnosis, prevention and control; Intestinal amoebae – *Entamoeba histolytica*, *Giardia lamblia.* Free living *Amoebae – Naegleria fowleri, Acanthamoeba* sp. Blood and tissue flagellates – *Trichomonas vaginalis, Trypanosoma brucei, Trypanosoma cruzi*. Malarial parasite – *Plasmodium falciparam, Plasmodium vivax.*	**10**	**CO3**
IV	**Helminths Infection of Helminthes:** *Taeniasolium, T. saginata, Echinococcus granulosus, Fasciola hepatica, Paragonimus westermani* and *Schistosomes, Ascaris lumbricoides, Ancyclostoma duodenale, Trichuris, Enterobius* and *Wuchereria bancrofti.*	**10**	**CO4**

V	**Laboratory techniques in Parasitology**: Examination of faeces - Direct and concentration methods. Blood smear examination - Cultivation of protozoan parasites, Serology and PCR techniques. *(Self-Study)*	-	**CO5**

Text Books:

1. *Jagdishchander*. 2017. **Text book of Medical Mycology**. 4th edition, Taypee Publisher.
2. *Gopinathhait.* 2017. **A Text book of Mycology**. New central book agency (NCBA).
3. *Chander, J*. 2009. **Text Book of Medical Mycology.** 3rd Edn. Mehta Publishers.
4. *Jayaram Paniker, C.K*. 2013. **Paniker's Textbook of Medical Parasitology**. 7th edition, Jaypee Brothers Medical Publishers (P) Ltd, 2013.
5. *Parija, S. C.* 2013. **Text Book of Medical Parasitology – Protozoology and Helminthology.** 4th Edn. All India Publishers and Distributors, New Delhi.

Reference Books:

1. *Errolraiss, H. Jeanshadorry, G. Mashallyon*. 2014. **Fundamental Medical Mycology.** Weiley Blackwell.
2. *Russel, F. Cheadle* and *Ruth Leventhal*. 2011. **Medical Parasitology**.
3. *Reiss, E. Shadomy, H.J.* and Lyon, G.M. 2011. **Fundamental Medical Mycology.** Wiley-Blackwell.
4. *Brooks, G, Carrol, K.C, Butel J.* and *Morse, S*. 2012. **Jawetz Melnick and Adelberg Medical Microbiology**. 26th Edn. Lange Medical Publications.
5. *Chatterjee, K.D*. 2009. **Parasitology: Protozoology and Helminthology**. 13th Edn. CBS Publishers & Distributors Pvt. Limited.

COURSE OUTCOMES (CO)

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

CO1	Analyze proper processing of fungal infected clinical samples.
CO2	Understand the superficial, cutaneous, subcutaneous and opportunistic fungal pathogens.
CO3	Analyze and diagnose the infections caused by intestinal and free living *Amoeba.*
CO4	Analyze and diagnose Helminths Infection of Helminthes.
CO5	Develop laboratory techniques in Parasitology.

MAPPING

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

H-High; M-Medium; L-Low

18UMBEL502	**ELECTIVE I: NANO MICROBIOLOGY**	**SEMESTER V**

Course Objectives:

The course aims

- To enable the learners to construct a good foundation in nanotechnology.
- To understand the role of microbes in the synthesis of nano particles.
- To know about the modern applications of nanobiology.

Credits: 04 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Nanobiology:** Concepts, definitions, prospects. Nanoscale systems. Biological Nanoobjects –DNA, protein, lipids. Bionanoparticles- Nanostarch, Nano composites- Dendrimers.	**08**	**CO1**
II	**Antimicrobial properties of metal nanoparticles:** Ag, Cu, Au nanoparticles- antibiofilm properties of nanoparticles. Biogenesis of bacterial silver nanoparticles, platinum nanoparticles.	**08**	**CO2**
III	**Methods of Nanobiology:** Analysis of bimolecular Nanostructures by Atomic Force Microscopy, Scanning Probe Electron Microcopy and FTIR. Nanofabrication- Lithography- Photolithography , Electron beam lithography.	**08**	**CO3**
IV	**Methods for Susceptibility Testing of Nanoparticles:** Growth inhibition assay by spectrophotometer, Broth dilution method, standard agar well diffusion method, Estimation of colony forming units (CFU).	**08**	**CO4**
V	**Nano Applications:** Use of microbes in relation to Bimedical applications of nanoparticles. Application of Biogenic Silver Nanoparticles in Fabrics. Nanobiosensors and their applications. Nano drug delivery systems.	**08**	**CO5**

Text Books:

1. *Balaji Subbaih.* 2010. **Nanobiotechnology**. MJP Publishers, India.

Reference Books:	
1.	*Pradeep, T.* 2008. **Nano: The Essentials: Understanding Nanoscience and Nanotecnology.** Tata McGraw-Hill Publishing Company Limited, New Delhi.
2.	*Mahendra Roi and Nelson Dura.* 2011. **Metal nanoparticles in Microbiology**. Springer.
3.	*Christof M. Niemayer, Chad A. Mirkin*. 2004. **Nanobiotechnology: Concepts, applications and perspectives.** Wiley VCH publishers.

COURSE OUTCOMES (CO)

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

CO1	Understand the basic concepts of bionanoparticles.
CO2	Analyze antimicrobial properties of metal nanoparticles.
CO3	Compute the bimolecular nanostructures by AFM, Scanning Probe Electron Microcopy and FTIR.
CO4	Assess the various methods for susceptibility testing of nanoparticals.
CO5	Prepare effective nano based drug delivery systems for infectious disease.

MAPPING

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

H-High; M-Medium; L-Low

18UMBMP501	**CORE PRACTICAL V (Fundamentals of Virology, Environmental Microbiology, Soil and Agricultural Microbiology and Medical Bacteriology)**	**SEMESTER V**

Course Objectives:

- To understand and apply the basic principles and techniques of molecular biology for further research.
- To know about isolation, estimation and purification of nucleic acids.

Credits: 03 **Total Hours: 60**

Experiment	CONTENTS	Hrs	CO
1.	Isolation of phages from sewage water sample	**05**	**CO1**
2.	Cultivation of virus by egg inoculation	**03**	**CO1**
3.	Estimation of BOD	**05**	**CO1**
4.	Estimation of COD	**05**	**CO1**
5.	MPN Technique	**05**	**CO1**
6.	Isolation of phosphate solubilizing bacteria	**05**	**CO2**
7.	Isolation of *Rhizobium* from root nodules	**05**	**CO2**
8.	Isolation of *Azospirillum* from damp soil	**02**	**CO2**
9.	Isolation and Identification of clinical pathogens from sputum samples	**05**	**CO3**
10.	Isolation and Identification of clinical pathogens from pus samples	**05**	**CO3**
11.	Isolation and Identification of clinical pathogens from urine samples	**05**	**CO3**
12.	Isolation and Identification of clinical pathogens from diarrhoeal samples	**05**	**CO3**
13.	Isolation and Identification of clinical pathogens from blood samples	**05**	**CO3**

Reference Books

1. *James G. Cappucino and Sherman Natalie*. 2005. **Microbiology – A Laboratory Manual**. [Seventh edition]. Pearson education India, New Delhi.

EXPERIMENTOUTCOMES (EO)	
CO1	Evaluate the purity of the water and analyze the pollutants present in water bodies.
CO2	Develop sustainable agriculture through study of agriculturally important microorganisms.
CO3	Apply the diagnosis knowledge to detect the unknown pathogens from clinical samples.

18UMBSB501	SBC III: MICROBIAL TECHNOLOGY	SEMESTER V

Course Objectives:

The course aims

- To gain knowledge about vaccines production.
- To understand the role of biofertilizers and biocontrol agents for improved plant growth.
- To ascertain the importance and application of microbial products.
- To learn about enhanced waste water treatment methods.

Credits: 02 **Total Hours: 25**

UNIT	CONTENTS	Hrs	CO
I	**Microbial Technology and Fermentation Economics:** Scope, General concept and application of Microbial technology. Microbial production of antibiotics: Cephalosporin and Tetracyclines. Microbial production of Enzymes: Protease, Lipase. Microbial production of organic acids: Butyric acid and Lactic acid. Biotransformation of steroids.	05	CO1
II	**Plant Growth Promoting Rhizobacteria (PGPR):** Biofertilizers-Azotobacter, Gluconacetobacter, Azorhizobium, phosphobacteria - mycorrhizae -Blue Green Algae and Azolla. Biopesticides - *Verticillium lecanii*, NPV, *Beauveria bassiana*.	05	CO2
III	**Microbial Production:** Biopolymers: Xanthan Gum. Adhesive biopolymer of yeast cell. Microbial synthesis of plant biopolymer. Human Interferon, Engineered human growth hormone and Insulin. Bioplastics.	05	CO3
IV	**Microbial Production:** Production of medicinal mushroom- *Ganoderma lucidum, Cordyceps militaris* . Mold modified Foods- Soy Sauce, Miso, Hamanatto, Sufu, Tempeh. Probiotics.	05	CO4
V	**Energy Production:** Renewable bioenergy using microorganisms – Methanogenesis, Methane production by anaerobic digestion of waste organic materials. Bioethanol and Biobutanol production by using microorganisms. Biohydrogen Generation, Microbial Fuel. Biodiesel from algae.	05	CO5

Text Books:	
1.	*Dubay, R.C.* 2008. A text book of Biotechnology, *S.Chand* & Company, New Delhi.
2.	*Sathyanarayana, U.* 2005. Biotechnology, 1st Edition, Books and allied (P) Ltd, Kolkata.
3.	*Patel, A.H.* 2005. Industrial Microbiology, Mac Millan India Ltd, New Delhi.
Reference Books:	
1.	*Alexender, N. Glazer* and *Hiroshi Nikaido, W.H.* 1995. **Microbial Biotechnology.** Freeman and Company.
2.	*Peppler, H, J.,* and *Perlman, D.* 2004. **Microbial Technology.** Volume I & II, 2nd Edition, Academic press.
3.	*Wulf, C* and *Anneliese, C.* 2000. **Biotechnology. 2**nd Edition, Panima Publications.
4.	*Ronald, M Atlas* and *Richard Bartha*. 2005. **Microbial Ecology.** 4th Edition, Benjamin/Cummings Science Publishing.
5.	*Subbarao, N.S*. 1995. **Biofertilizers in Agriculture and forestry**, 3rd Edition, Oxford and IBH Pub.Co.Pvt.Ltd, New Delhi.
6.	*Bernard R. Glick* and *Jack J.* Pasternak. **Molecular Biotechnology**, Panima Publishing corporation New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Analyze the advancements in microbial technology
CO2	Prepare effective biofertilizers for improving soil health.
CO3	Assess the microbial production of Enzymes.
CO4	Demonstrate the microbial production of fermented foods.
CO5	Develop methods for sewage treatment and biodegratation technology.

MAPPING

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	M	M
CO2	M	H	H	H	H
CO3	H	M	H	H	M
CO4	H	H	H	M	H
CO5	M	H	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	CO1
II	Non-Verbal Reasoning: Series Completion - Analogy and Classification - Completion of Incompletion Pattern.	10	CO2
III	Non-Verbal Reasoning: Mirror Image and Water Image –Statement and Arguments - Cubes and Dices.	10	CO3
IV	Reasoning : Puzzle Arrangement - Syllogism - Input and Output.	10	CO4
V	Verbal Reasoning : Linear Arrangement - Circular Arrangement – Matrix Arrangement.	10	CO5

Text Book:

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

18UMBAL501	ADVANCED LEARNERS COURSE II: MARINE MICROBIOLOGY	SEMESTER V

Course Objectives:

The course aims

- This subject aims to introduce the students to understand microbial diversity, significance, and dynamics of marine environment, Marine food borne pathogens, and marine products.

UNIT	CONTENTS	CO
I	**Marine Environment:** Properties of sea water, chemical and physical factors of marine environment-Ecology of coastal, shallow and deep sea microorganism - significance of marine microflora. Diversity of microorganism - Archaea, bacteria, actinobacteria, cyanobacteria, algae, fungi, viruses and protozoa in the mangroves and coral environments.	**CO1**
II	**Cultivation of Marine Microbes:** Methods of studying marine microorganisms- sample collection- isolation and identification: Cultural, Morphological, physiological, biochemical and Molecular characteristics- Preservation methods of marine microbes.	**CO2**
III	**Marine Extremophiles:** Survival at extreme environments – starvation – adaptive mechanisms inthermophilic, alkalophilic, osmophilic and barophilic, psychrophilic microorganisms – hyperthermophiles, halophiles and their importance.	**CO3**
IV	**Microbial Biodegradation:** Natural and synthetic material in the marine environment pesticide, cellulose degradation, hydrocarbon production. Bioremediation of pollutants in marine environment.	**CO4**
V	**Marine microbial products:** Carrageenan, agar-agar, sea weed fertilizers, Astaxanthin, β carotene – enzyme – antibiotics – antitumor agents – bio surfactants - pigments. Preservation of seafoods.	**CO5**

Text Book	
1.	*Belkin, S* and *Colwell, R, R*. 2005. **Ocean and health: Pathogens in the Marine Environment.** Springer.
2.	*Bhakuni, D.S* and *Rawat, D.S*. **Bioactive marine natural products.** Anamaya Publishers, New Delhi. 2005.
3.	*Elay, A.R*. 1992. **Microbial food poisoning.** Chapman and Hall, London.
4.	*Ford TE*. 1993. **Aquatic microbiology. An ecological approach.** Blackwell scientificpublications, London.
5.	*Austin. B* and *Austin, D.A.* 1999. **Bacterial Fish pathogens- Diseases of Farmedand Wild Fish.** Springer Publisher.
6.	*Munn* and *Munn.* 1996. **Marine Microbiology: Ecology and Applications.** BIOS Scientific publisher.
7.	*Atlas, R.M*. 1988. **Microbiology, Fundamentals and applications**. Maxwell McMillan International Editions.

Reference Books:	
1.	*Hunter-Cevera, J., Karl, D* and *Buckley, M*. 2005. **Marine Microbial Diversity: the key to Earth's habitability.** American Academy of Microbiology.
2.	*Jamesh W. Nybakker* . 2001. **Marine Biology**. Benjamin Cummings.
3.	*Krichman D.L*. **Microbial ecology of the oceans.** Wiley liss, New York.
4.	*Rheinheimer, G*. 1980. **Aquatic Microbiology-an Ecological Approach.** Blackwell Scientific Publications.
5.	*Kirchman, L*. 1991. **Microbial Ecology of the Oceans**. 2000 John Wiley and Sons.
6.	*The Prokaryotes*: 1992. **A Handbook on the biology of Bacteria.** Vol. 1-4. Springer &Verlag New York 2000.

COURSE OUTCOMES (CO)

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

CO1	Discuss Marine Environment and its diversity
CO2	Be aware of marine microbes isolation, preservation and biogeochemical cycle
CO3	Demonstrate marine extremophiles and their importance
CO4	Apply the marine microbes for biodegradations of various pollutant
CO5	Create and develop the employable and entrepreneur opportunity in marine microbiology.

MAPPING

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

H-High; M-Medium; L-Low

18UMBM601	CORE IX: FERMENTATION TECHNOLOGY	SEMESTER VI

Course Objectives:

The course aims

- To learn about the isolation of industrially important organism, industrial medium formulation and sterilization.
- To know the various component parts of the fermentor and its function.
- To get an idea about the sterility testing of pharma products.

Credits: 05 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Screening techniques:** Primary and secondary screening techniques. Preservation of culture. Strain improvement by rDNA techniques and mutation. Development of inoculum for various fermentation processes– Bacteria, fungi and yeast.	**10**	**CO1**
II	**Fermentor:** Components and types of fermentor. Control systems in fermentation - pH, Temperature, Oxygen and foam. Computer applications in fermentation technology.	**10**	**CO2**
III	**Upstream and downstream processing:** Medium formulation – Water, carbon, nitrogen, minerals and antifoams. Medium sterilization - Batch & continuous sterilization. Recovery and purification of intra cellular and extracellular products.	**10**	**CO3**
IV	**Industrial production of alcoholic beverages:** Preparation of substrate, fermentation and recovery of Wine and Beer. Production of organic acids - citric acid and acetic acid. Microbial production of Lysine and recovery. Microbial production of α-amylase and vitamin B_{12}.	**10**	**CO4**
V	**Industrial production of antibiotics:** Inoculum preparation, fermentation and recovery of Penicillin and Streptomycin. Citric acid – Surface culture and submerged process using *Aspergillus niger*.	**10**	**CO5**

Text Books:	
1.	*Stanbury, P.F., Whittaker, A. and Hall, S.J.* 1997. **Principles of Fermentation Technology**. [Second Edition]. Aditya Books Pvt. Ltd., New Delhi.
2.	*Patel, A.H., 2005*. **An Introduction to Industrial Microbiology**. Macmillan India Ltd., Chennai.

Reference Books:	
1.	*Hugo, W.B.* and *Russell, A.D.* 1998. **Pharmaceutical Microbiology.** [Sixth Edition]. Blackwell scientific company Ltd., USA.
2.	*Agarwal, A.K.*, and *Pradeep, P.* 2005. **Industrial Microbiology**: Fundamentals and Applications. [First Edition]. Published by Agrobios (India).
3.	*Hugo, W.B* and *Russel, A.D.* 1998. **Pharmaceutical Microbiology**. Sixth edition, Black Well Scientific Company Ltd.

COURSE OUTCOMES (CO)

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

CO1	Analyze the strain improvement techniques for potent strain preparation.
CO2	Prepare basic techniques for fermentor design.
CO3	Demonstrate the upstream and downstream techniques.
CO4	Assess the techniques used in Industrial production of Alcoholic beverages and enzymes.
CO5	Create improved technology for antibiotics production.

MAPPING

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

H-High; M-Medium; L-Low

18UMBM602	CORE X: GENETIC ENGINEERING	SEMESTER - VI

Course Objectives:

The course aims

- To gain knowledge about basics of gene cloning.
- To understand role of modifying enzymes in gene manipulation.
- To ascertain the importance and application genomic and cDNA Libraries.
- To learn about advanced techniques in creating transgenic animals and plants.

Credits: 05 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Tools of genetic engineering:** Introduction, scope and applications of genetic engineering. Restriction enzymes: types, nomenclature, classification and uses. DNA modifying enzymes: Nuclease, polymerases, methylases and DNA ligases. DNA manipulative enzymes.	**10**	**CO1**
II	**Cloning vectors:** Plasmid vectors- pBR322, pBR 327, pUC8, pGEM32. Bacteriophages, λ, M13 vectors, Hybrid vectors- Cosmids and Phagemids. Yeast vectors: YEp, YIp, YRp and YAC. Bacterial Artificial Chromosome.	**10**	**CO2**
III	**Gene cloning:** Basic steps in gene cloning– construction of cDNA and genomic DNA libraries. DNA delivery systems- Electroporation, Biolistics, Microinjection and Lipofection. Screening of recombinants.	**10**	**CO3**
IV	**Techniques in genetic Engineering:** Radiolabelling and non radiolabelling of nucleic acids - End labeling - Nick translation. Blotting techniques: Southern, Northern and Western blotting. DNA sequencing: Chemical and enzymatic methods. Polymerase Chain Reaction and its applications.	**10**	**CO4**
V	**Genetic Manipulation:** Plant transformation with Ti plasmid of *Agrobacterium tumefaciens* –Ti plasmid- derived vector systems (Binnay vector, Co- integrated vector). Development and use of Transgenic animals – Transgenic mice Transgenic cattle and their applications.	**10**	**CO5**

Text Books:	
1.	*Brown, T.A.* 1995. **Gene Cloning – An Introduction**. [Third Edition]. Chapman and Hall, UK.

Reference Books:	
1.	*Old, R.W. and Primrose, S.B.* 1995. **Principles of Gene Manipulation – An Introduction to Genetic Engineering.** [Fifth Edition]. Blackwell Scientific Publications, London.
2.	*Winnacker, E.C.* 1987. **From Genes to Clones - Introduction to Gene Technology**.VCH, Weinheim.
3.	*Bernard R. Glick* and *Jack J. Pasternak*. **Molecular Biotechnology –Principles and Applications of Recombinant DNA**. Panima Publishing Corporation. New Delhi.

COURSE OUTCOMES (CO)

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

CO1	Analyze the preparation of gene of interest for cloning.
CO2	Prepare effective technique for achieving transformants.
CO3	Demonstrate the techniques for screening the recombinants.
CO4	Assess the techniques used in creating the stable transformants.
CO5	Create novel transgenic animals and plants.

MAPPING

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

H-High; M-Medium; L-Low

18UMBM603	CORE XI: FOOD AND DAIRY MICROBIOLOGY	SEMESTER -VI

Course Objectives:

The course aims

- To understand the basic concepts of contamination, spoilage and preservation of food.
- To acquire an overview about food borne infections and intoxications.
- To learn about the fermented food products.

Credits: 04 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Food and microorganisms:** Important microorganisms in food (Bacteria, Mold and Yeasts). Factors affecting the growth of microorganisms in food- pH, moisture, oxidation - Reduction potential, nutrient content and inhibitory substances and biological structure.	08	CO1
II	**Principles of food preservation:** General principles and application. Asepsis - techniques of removal of microorganisms - Use of temperature (Pasteurization-low and high). Drying, Radiation Chemical preservatives. Food additives.	08	CO2
III	**Spoilage and preservation:** Cereals and cereal products - Sugar and sugar products -Vegetables and fruits- Meat and meat products- Spoilage of canned food	08	CO3
IV	**Food borne diseases:** Food poisoning and food borne infections - Bacterial and Mycotoxins. Investigation of food poisoning outbreaks.	08	CO4
V	**Quality control of milk:** MBRT, Litmus milk and Phosphatase tests. Quality assurance: Microbiological quality standards of food. Government regulatory practices and policies- HACCP and ISO.	08	CO5

Text Book:

1. *Frazier, W.C* and *Westhoff, D.C.* 2001. **Food Microbiology.** [Fourth Edition]. Tata Mc Graw-Hill Publishing Company Limited, New Delhi.

Reference Books:	
1.	*Banwart, G.J.*1989. **Basic Food Microbiology.** Chapman and Hall New York.
2.	*Jay,J. M.* 1987. **Modern Food Microbiology.** CBS Publishers and distributors, New Delhi
3.	*Adams, M.R.* and *Moss, M.O.* 1995. **Food Microbiology.** The Royal Society of Chemistry, Cambridge.

COURSE OUTCOMES (CO)

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

CO1	Discuss importance of food in dairy microbiology.
CO2	Understand the spoilage of food products for product development.
CO3	Analyze food borne infections and intoxications for product preservation.
CO4	Evaluate different kinds of food preservation methods for product safety.
CO5	Demonstrate various fermented food products.

MAPPING

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

H-High; M-Medium; L-Low

18UMBMEL601	**ELECTIVE II: PHARMACEUTICAL MICROBIOLOGY**	**SEMESTER- VI**

Course Objectives:

- To learn about the synthetic antimicrobial agents and its mechanism of action.
- To understand microbial contamination and spoilage of various pharmaceutical products.
- To study the quality assurance and validation of pharmaceutical Industry

Credits: 04 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Antibiotics:** Definition, scope and recent developments of pharmaceutical microbiology. Classification of antibiotics - Mechanism of action of antibiotics (Inhibitors of cell wall synthesis, nucleic acid and protein synthesis)- Antimicrobial resistance- MDR and XDR.	10	CO1
II	**Microbial contamination and spoilage of pharmaceutical products:** Microbial sources, contamination and spoilage of pharmaceuticals; Factors affecting microbial spoilage of pharmaceutical products; sterile injectables – Intravenous infusions and total parenteral nutrition (TPN), non injectables–non injectable water and haemodialysis solutions, ophthalmic preparations and implants and their sterilization. Methods of preservation of pharmaceutical products.	10	CO2
III	**Pharmaceutical Drug Analysis:** Biosensors and applications in Pharmaceuticals; Macromolecular, cellular and synthetic drug carriers. Assay of steroids.	10	CO3
IV	**Preclinical Development:** Safety profile of drugs (Pyrogenecity, Toxicity– hepato, - nephro, - cardio and neurotoxicity), Toxicological evaluation of drug (LD50, Acute, subacute and chronic toxicity), Mutagenecity (Ames test, micronucleus test) and Carcinogenicity. **Clinical studies:** Phase I, phase II, phase III and phase IV of clinical trials –Objectives, Conduct of trials, Outcome	10	CO4

	of trials.		
V	**Quality Assurance and Validation:** Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP) in Pharmaceutical Industry. Government regulatory practices and policies for pharmaceutical industry: Food and Drug Administration (FDA), The Central Drugs Standard Control Organisation (CDSCO), the Drug Controller General of India (DCGI); patenting of pharmaceutical products. *(Self-Study)*	**-**	**CO5**
Text Books:			
1.	*Hugoand Russell.* 2004. **Pharmaceutical Microbiology.** [Seventh Edition]. Wiley-Blackwell Publishers, UK.		
Reference Books:			
1.	*Purohit, S. S., Saluja,A. K.* and *Kakrani,H. N.* 2003. **Pharmaceutical Microbiology**. Agrobios, New Delhi.		
2.	*Lansing M Prescott, John P Harley* and *Donald A Klein*. 2010. **Microbiology**. [Eighth Edition]. Mc Graw Hill, NewYork		
3.	*Burn J. H.* **Principles of Therapeutics,** Blackwell Scientific Pub. O. Ltd. Oxford.		
4.	*Goldstein A., Aronow L., and Kalman S. M.* **Principles of Drug Action, The Basis of Pharmacology**, Harper international edition New York		
5.	*Mannfred A. Holliger.* 2008. Introduction to pharmacology, 3rd Ed., CRC Press		

COURSE OUTCOMES (CO)	
After completion of the course, the students' will be able to	
CO1	Recall the basics and working mechanism of antibiotics against infectious diseases
CO2	Optimize the production of pharmaceutical products
CO3	Develop the pharmaceutical products without contamination and spoilage
CO4	Apply the technology in drug delivery systems
CO5	Follow the protocols and regulations to validate pharmaceutical products.

MAPPING

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

H-High; M-Medium; L-Low

18UMBEL602	ELECTIVE II: BASIC AND APPLIED BOTANY	SEMESTER VI

Course Objectives:

The course aims

- To gain knowledge about morphology, occurrence and properties of major groups of plants.
- To understand the economic importance of algae, fungi, lichens and other groups of plants
- To learn about advanced techniques plant cultivation.

Credits: 04 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Algae:** Distribution, Morphology – Thallus structure – Classification. Sexual reproduction. Asexual Reproduction - algal nutrition. Algal importance - Algae as food. Commercial products derived from algae- Agar Agar, Carrageenin, SCP, Chlorellin	08	CO1
II	**Fungi:** Distribution – Fungal divisions: Characteristics of Ascomycetes, Basidiomycetes, Deuteromycetes, Zygomycetes – Cell structure – reproduction- sexual and asexual modes. Fungi – economic and agricultural importance.	08	CO2
III	**Plant:** General characteristics, occurrence, classification, structure, reproduction and economic importance of Lichens. General characteristics, occurrence, classification, structure, reproduction and economic importance Bryophyta, Pterdophyta, Gymnospermns and Angiosperms	08	CO3
IV	**Advanced Botany:** Plant Tissue Culture and its applications- - Organic farming. Vertical farming- Hydroponics for potato cultivation- Aeroponics- Bonzai technique. Medicinal plants and their applications -Herbarium preparation and its importance.	08	CO4
V	**Entrepreneurial Botany:** Production of biodiesel from Jatropha, Biocontrol agent production from Neem. Oyester Mushroom cultivation. Bee Keeping – Sericulture- Oriliculture. Plant breeding: Conventional plant breeding methods and its applications.	08	CO5

Text Books:	
1.	*Vashishta B.R.* 2012. **Botany for Degree Students – Algae**. S. Chand & Co.,
2.	*Sharma, O.P.* 2006. **Text Book of Fungi.** Tata McGraw Hill Publishing Co., New Delhi.
3.	*Misra, A.* and *Agarwal, R.P.* 1970. **Lichens, A Preliminary Text**, Oxford & IBH Publishing Co.
4.	*Pandey. B.P.* 1977. **A Text Book of Bryophyta, Pteridophyta and Gymnosperms.** *K.Nath* and Co., Meerut.
5.	*Pandey, B.P.* 1980. **Economic Botany**. S. Chand & Co.

Reference Books:	
1.	*Vashista, B.R.* 1969. **Botany for Degree students.** *S. Chand* and Co.

COURSE OUTCOMES (CO)

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

CO1	Discuss the valuable products of algae.
CO2	Understand the various classes of fungi and its applications.
CO3	Assess the lichens and various plant groups for plant identification and better classification.
CO4	Apply the advanced botany techniques in agriculture system.
CO5	Create and develop the employable and entrepreneur opportunity in botany.

MAPPING

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

H-High; M-Medium; L-Low

18UMBMP601	**CORE PRACTICAL VI (Fermentation Technology, Genetic Engineering and Food and Dairy Microbiology)**	**SEMESTER VI**

Course Objectives:

- To give keen knowledge about protein profiling.
- To develop skills to manipulate DNA for cloning.
- To study the quality of the milk by standard protocols.

Credits: 03 **Total Hours: 50**

Experiment	**CONTENTS**	**Hrs**	**CO**
1.	Protein profiling by SDS-PAGE.	**5**	**CO1**
2.	Polymerase Chain Reaction.	**5**	**CO1**
3.	Restriction digestion and ligation.	**5**	**CO2**
4.	Methylene Blue Reduction Test (MBRT)	**5**	**CO1**
5.	Assessment of milk quality by Phosphatase test	**5**	**CO3**
6.	Examination of milk by Breeds count method	**5**	**CO3**
7.	Solid state fermentation of citric acid from *Aspergillus niger*	**5**	**CO3**
8.	Amylase production by Submerged fermentation	**5**	**CO3**
9.	Examination of fungi by slide culture technique.	**5**	**CO1**
10.	Giemsa stain	**5**	**CO3**
11.	Identification of blood parasites by Leishman staining technique	**5**	**CO3**
12.	Identification of intestinal parasites by Iodine Mount method.	**5**	**CO3**

Reference Books

1. *Gakhar, S.K. and Monica Miglani* 2013. **Molecular Biology: A Laboratory manual**. I.K. International house, Mumbai.

COURSE OUTCOMES (CO)	
CO1	Apply the molecular techniques for protein analysis
CO2	Evaluate and analyze the purity of milk.
CO3	Demonstration of clinically important pathogens

18UMBSBP601	**SBC IV: PRACTICAL II : MICROBIAL TECHNOLOGY**	**SEMESTER VI**

Course Objectives:

The course aims

- To train the students to handle the.
- To understand the basic techniques in.

Credits: 02 **Total Hours: 25**

Experiment	**CONTENTS**	**Hrs**	**CO**
1.	Alcohol estimation by colorimetric method	**2**	**CO1**
2.	Enzyme Immobilization	**3**	**CO2**
3.	Production lactic acid	**5**	**CO3**
4.	Protease production	**5**	**CO3**
5.	PHB production	**5**	**CO3**
6.	Cellulase production	**5**	**CO3**

Reference Books:

1. *Thimmaiah, S.K.* **Standard Methods of Biochemical Analysis**. Kalyani Publishers

COURSE OUTCOMES (CO)

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

CO1	Discuss the estimation and quantification of ethanol.
CO2	Apply the immobilization method for biomedical benefits.
CO3	Evaluate the production of industrial important enzymes for industrial application.

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*

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

COURSE OUTCOMES (CO)	
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

GUIDELINES

1. SUBMISSION OF RECORD NOTE BOOKS AND INTERNSHIP:

Candidates appearing for Practical Examinations and Internship Viva-voce shall submit Bonafide Record Note Books/ Dissertation prescribed for Practical/ Internship Viva-voce Examinations, otherwise the candidates will not be permitted to appear for the Practical/ Internship Viva-voce Examinations.

2. PASSING MINIMUM AND INTERNAL MARK DISTRIBUTION

(Theory, Practical and Internship)

A. 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**

B. (I) 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**

ASSESSMENT OF SBC II: AND SBC III: (Internal Evaluation Only)

(II) 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 (10-12 Experiments)
Attendance	: 5 Marks
Record	: 5 Marks
Internal Examinations	: 20 Marks
Total	**: 40 Marks**

III. INTERNSHIP

The Internship shall be carried out by students individually during the VI semester by attending a minimum of 15 days training at any institution.

- 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

IV. CAREER COMPETENCY SKILLS

Semester III and VI- Viva voce

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

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

- 100 questions- 100 minutes.
- Twenty questions from each unit.
- Online examination will be conducted at the end of the IV and V semester.
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3. QUESTION PAPER PATTERN AND MARK DISTRIBUTION

THEORY

Question Paper Pattern and Mark Distribution **(For 75 marks)**

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

Question Paper Pattern and Mark Distribution **(For 100 marks)**

1. PART – A (10 x 2 = 20 Marks)

Answer ALL questions

Two questions from each UNIT

2. PART – B (5 x 7 = 35 Marks)

Answer ALL questions

One question from each UNIT with Internal Choice

3. PART – C (3 x 15 = 45 Marks)

Answer ANY THREE questions

One question from each UNIT

Open choice – 3 out of 5 questions

Question Paper Pattern for Core Practical Examinations

(Maximum Marks: 60) Time; 6 Hours

Experiment – I (Major)	- 30 Marks
Experiment – II (Minor)	- 15 Marks
Spotters (5 x 3)	- 15 Marks
Total	**- 60 Marks**

ALLIED MICROBIOLOGY PRACTICAL

Question paper pattern for Allied practical (Maximum marks: 60) Time: 3 Hours

Experiment – I	- 40 Marks
Spotters (5 x 4)	- 20 Marks
Total	**- 60 Marks**

Computer Practical Distribution

Internal marks distribution

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

External marks distribution

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

i) Aim	- 5 Marks
ii) Algorithm/Flow chart	- 10 Marks
iii) Writing the source code	- 15 Marks
iv) Test and debug the source code	- 15 Marks
v) Displaying the Output	- 10 Marks
vi) Result Declaration	- 5 Marks
Total	**- 60 Marks**

ALLIED COURSE OFFERED BY THE DEPARTMENT

S. NO.	SUBJECT CODE	SUBJECT	SEMESTER	OFFERED TO THE STUDENTS OF
1.	18UMBBCA201	Allied II: Microbiology	II	Biochemistry
2.	18UMBBCAP201	Allied Practical II: Microbiology	II	Biochemistry