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 biotechniques 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			Credits Points
				CA	CE	Total	
FIRST SEMESTER							
Part I							
21UTALA101/ 21UHILA101/ 21UFRLA101	Tamil I /Hindi I/ French I	5	3	25	75	100	3
Part II							
21UENLA101	Communicative English I	5	3	25	75	100	3
Part III							
21UMBM101	DSC I: Basics in Microbiology	4	3	25	75	100	3
21UCHMBA101	GEC I: Chemistry	4	3	25	75	100	2
21UMBMP101	DSC Practical I	3	6	40	60	100	3
21UCHMBAP101	GEC Practical I: Volumetric and organic analysis	3	3	40	60	100	2
Part IV							
21UPEC101	AECC I : Professional English for Life Science	4	3	25	75	100	4
21UVE101	AECC II :Value Education I: Yoga	2	3	25	75	100	2
		30				**800**	**22**
SECOND SEMESTER							
Part I							
21UTALA201/ 21UHILA201/ 21UFRLA201	Tamil II /Hindi II/ French II	5	3	25	75	100	3
Part II							
21UENLA201	Communicative English II	5	3	25	75	100	3
Part III							
21UMBM201	DSC II: Microbial Taxonomy and Physiology	5	3	25	75	100	3
21UCSMBA201	GEC II: Computer for biology	4	3	25	75	100	2
21UMBMP201	DSC Practical II	3	6	40	60	100	3
21UCSMBAP201	GEC Practical II: Office package for biology	2	3	40	60	100	2
Part IV							
21UPEC201	AECC I :Professional English for Life Science	4	3	25	75	100	4

21UVE201	AECC II :Value Education II: Environmental Studies	2	3	25	75	100	2
		30				**800**	**22**
THIRD SEMESTER							
Part I							
21UTALA301/ 21UHILA301/ 21UFRLA301	Tamil III / Hindi III/ French III	4	3	25	75	100	3
Part II							
21UENLA301	Foundation English I	4	3	25	75	100	3
Part III							
21UMBM301	DSC III: Molecular Biology	4	3	25	75	100	4
21UMBM302	DSC IV : Mushroom Technology	4	3	25	75	100	3
21UMAMBA301	GEC III: Biostatistics	4	3	25	75	100	2
21UMBMP301	DSC Practical III	3	6	40	60	100	3
21UMAMBAP301	GEC Practical III Statistics (Using MS -Excel)	2	3	40	60	100	2
Part IV							
21UMBNM301	SEC I	2	3	25	75	100	2
21UMBSB301	SEC II : Bioinstrumentation (100% Internal)	2	3	100	-	100	2
Non credit							
21ULS301	NCC : Career Competency Skills I	1	-	-	-	-	-
		30				**900**	**24**
FOURTH SEMESTER							
Part I							
21UTALA401/ 21UHILA401/ 21UFRLA401	Tamil IV/ Hindi IV/ French IV	4	3	25	75	100	3
Part II							
21UENLA401	Foundation English II	4	3	25	75	100	3
Part III							
21UMBM401	DSC V: Immunology	4	3	25	75	100	4
21UMBM402	DSC VI : Corporate Microbiology	4	3	25	75	100	3
21UBCMBA401	GEC IV: Biochemistry	3	3	25	75	100	2
21UMBMP401	DSC Practical IV:	3	6	40	60	100	3
21UBCMBAP401	GEC Practical IV: Biochemistry	3	3	40	60	100	2
Part IV							

21UMBSB401	SEC II : Calculation for Biology(100% internal)	2	3	100	-	100	2
21UMBNM401	SEC I	2	3	25	75	100	2
Non credits							
21ULS401	NCC : Career Competency Skills II	1	-	-	-	-	-
		30				**900**	**24**
FIFTH SEMESTER							
Part III							
21UMBM501	DSC VII: Fundamentals of Virology	5	3	25	75	100	4
21UMBM502	DSC VIII: Environmental Microbiology	4	3	25	75	100	3
21UMBM503	DSC IX: Soil and Agricultural Microbiology	4	3	25	75	100	4
21UMBM504	DSC X: Medical Bacteriology	5	3	25	75	100	4
	DSE I	4	3	25	75	100	3
21UMBMP501	DSC Practical V	5	6	40	60	100	3
Part IV							
21UMBSB501	SEC II : Microbial Technology	2	3	100	-	100	2
Part V							
21UMBE501	Extension Activity	-	-	-	-	-	2
Non credit							
21ULS501	NCC : Career Competency Skills III	1	-	-	-	-	-
21UMBI501	Intership Training (100 % Internal evaluation)	-	-	-	-	-	-
		30				**700**	**25**
SIXTH SEMESTER							
Part III							
21UMBM601	DSC XI: Fermentation Technology	5	3	25	75	100	4
21UMBM602	DSC XII: Genetic Engineering	5	3	25	75	100	5
21UMBM603	DSC XIII : Food and Dairy Microbiology	4	3	25	75	100	4
	DSE II	4	3	25	75	100	4
21UMBMP601	DSC Practical VI	5	6	40	60	100	3
21UMBPR601	Project and Viva-Voce	4	-	40	60	100	4

Part IV							
21UMBSBP601	SEC II: Practical I: (External Evaluation)	2	3	40	60	100	2
Non credit							
21ULS601	NCC : Career Competency Skills IV	1	-	-	-	-	-
		30				**700**	**26**
					Grand Total	**4800**	**143**

DSC - Discipline Specific Course

GEC - Generic Elective Course

DSE - Discipline Specific Elective

AECC - Ability Enhancement Compulsory Courses

NCC - Non-Credit Courses

ACC - Additional Credit Courses

DSE SUBJECTS

The students shall choose any one of the following elective subjects in fifth and sixth semester.

S.No.	SUBJECT CODE	SUBJECT
1.	21UMBEL501	DSE I: Medical Mycology and Parasitology
	21UMBEL502	DSE I: Nano Microbiology
2.	21UMBEL601	DSE II: Pharmaceutical Microbiology
	21UMBEL602	DSE II: Microbiology for Social welfare

SKILL ENHANCEMENT COURSES (SEC)

Skill Enhancement Course is conducted for the Students of other Departments

Course Code	Subject	Semester
21UMBNM301	SEC I : Personal Hygiene	III
21UMBNM401	SEC I : Microbes in Human health	IV

***ADDITIONAL CREDIT COURSES (ACC):**

S.No	Semester IV &V	
1.	*Additional Credit Courses (ACC) – ALC, MOOC Courses offered in SWAYAM/ NPTEL/ CEC etc.,	Completed students can get extra credits

1. Advanced Learner Course:

Course Code	Subject	Semester
21UMBAL401	ACC I : Biofertilizer Technology	IV
21UMBAL501	ACC I : Marine Microbiology	V

2. MOOC Courses offered in SWAYAM / NPTEL / CEC etc.,

FOR COURSE COMPLETION

Students shall complete

- Language subjects (Tamil / Hindi / French, English) in I, II, III and IV semester.
- Ability Enhancement Compulsory Course : Yoga and Environmental Studies in I and II semester respectively.
- Generic Elective Course (GEC) in I, II, III and IV semester.
- Skill Enhancement Course I in III and IV semesters.
- Skill Enhancement Course II in III, IV, V and VI semesters.
- Extension activity and internship in the V semester.
- Discipline Specific Elective Courses in the V and VI semesters.
- Project and Viva voce in the VI semester.
- Non Credit Course in the semester III, IV, V and VI .

TOTAL MARKS AND CREDITS DISTRIBUTION

S.No.	PART	MARKS	No. OF CREDITS
1	PART I: Language I	400	12
2	PART II: Language II	400	12
3	PART III : DSC, GEC and DSE	3000	93
4	PART IV: AECC I, AECC II-, SEC I, SEC II	1000	24
5	PART V: Extension Activity	-	02
TOTAL		**4800**	**143**

21UTALA101	**தமிழ் I :இடைக்கால இலக்கியங்கள்**	பருவம் -I

இப்பாடத்திட்டத்தின் நோக்கங்களாவன

- பக்தி இலக்கியத்தின் சிறப்புகளை எடுத்துரைத்தல்
- சிற்றிலக்கியம் மற்றும் நாட்டுப்புற இலக்கியங்களின் வழி வாழ்க்கை கூறுகளை உணர்த்துதல்
- இலக்கியம்இஇலக்கணத்தின் சிறப்புகளை உணர்த்துதல்

Credits:3 **Total hours:50**

UNIT	CONTENTS	Hrs	CO
I	**சைவ,வைணவ இலக்கியம்:** சைவம் -இளையான் குடிமாற நாயனார் புராணம் வைணவம் -ஆண்டாள் -திருமணக்கனவு-5 பாடல்கள் பெரியாழ்வார் - பெரியாழ்வார் திருமொழி -10 பாடல்கள்	10	CO1
II	**சிற்றிலக்கியங்கள்:** திருக்குற்றால குறவஞ்சி- குறத்தி மலைவளம் கூறுதல் -3 பாடல்கள் முக்கூடற்பள்ளு - மூத்தப்பள்ளி, இளையப்பள்ளி -நாட்டு வளம் நந்திக்கலம்பகம் - வாடை நோக - பாணன் பெற்ற பரிசு - மயில் கண்டாள் (3 பாடல்கள் மட்டும்)	10	CO2
III	**நாட்டுப்புறப்பாடல்கள்:** காதல் பாடல் -கிளியம்மா-கன்னங்கருத்தப்புள்ளே... தாலாட்டுப் பாடல் -மகன் பெருமை –பட்ட மரம் பாலூறும் ஒப்பாரிப் பாடல் -சீட்டைப் பறித்தானோ? தொழில் பாடல் -நெல் களமடிக்கும் பாடல் விளையாட்டுப் பாடல்	10	CO3
IV	**இலக்கிய வரலாறு:** பக்தி இலக்கிய அறிமுகம் -சைவம், வைணவம் தோற்றம் வளர்ச்சி –சிற்றிலக்கிய அறிமுகம் - சிற்றிலக்கியங்கள் தோற்றம் வளர்ச்சி – நாட்டுப்புறவியல் அறிமுகம் - நாட்டுப்புறப் பாடல் வகைகள் -சைவ சமய மடங்கள்	10	CO4
V	**இலக்கணம்:** வல்லினம் மிகும் இடங்கள் -வல்லினம் மிகா இடங்கள் - சொற்றொடர் மாற்றங்கள்- கலைச்சொல்லாக்கம் -பிறமொழிச் சொற்களை தமிழ்ச் சொற்களாக மாற்றுதல்.	10	CO5

Text Books

1	செய்யுள்திரட்டு - தமிழ்த்துறை வெளியீடு கே.எஸ்.ரங்கசாமி கலை அறிவியல் கல்லூரி (தன்னாட்சி)

இடைக்கால இலக்கியங்கள்

COURSE OUTCOMES(CO)

இப்பாடத்தைக் கற்பதன் வாயிலாக மாணவர்கள் பெறும் பயன்களாவன

CO1	பக்தி இலக்கியத்தின் சிறப்புகளை கூறுதல்
CO2	சிற்றிலக்கியத்தின் சிறப்புகளை அறிதல்
CO3	நாட்டுப்புற இலக்கியங்களின் வழி வாழ்க்கை கூறுகளை அறிதல்
CO4	இலக்கிய வரலாற்றின் தோற்ற வளர்ச்சினை அறிதல்
CO5	அடிப்படை இலக்கணத்தை அறிதல்

21UENLA101	COMMUNICATIVE ENGLISH I	SEMESTER – I

Course Objectives:

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

Total Hours: 50

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

	3. Study Skills II: Using the Internet as a Resource a. Refine your search b. Guidelines for using the Resources c. e-learning resources of Government of India **4. Grammar in Context** Involving Action-I a. Verbs b. Concord		
III	**Unit III** 1. Listening and Speaking a. Giving and following instructions b. Asking for and giving directions c. Continuing discussions with connecting ideas 2. Reading and writing a. Reading feature articles(from newspapers and magazines) b. Reading to identify point of view and perspective (opinion pieces, editorials etc.) c. Descriptive writing – writing a short descriptive essay of two to three paragraphs. 3. Grammar in Context: **Involving Action – II** Verbals - Gerund, Participle, Infinitive Modals	**10**	**CO3**
	Unit IV 1. Listening and Speaking a. Giving and responding to opinions 2. Reading and writing a. Note taking b. Narrative writing – writing narrative essays of two to three paragraphs 3. Grammar in Context: **Tenses** Present Past Future	**10**	**CO 4**
	Unit V	**10**	**CO5**

	1. Listening and Speaking a. Participating in a Group Discussion 2. Reading andwriting a. Reading diagrammatic information – interpretation maps, graphs and pie charts b. Writing short essays usingthe language of comparison and contrast **Grammar in Context:** Voice (showing the relationship between Tenses and Voices)		

Text Book	
1.	Tamilnadu state council for higher Education (TANSCHE)

COURSE OUTCOMES (CO)

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

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

21UMBM101	DSC 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	10	CO5

	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.		

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										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	H	M	M	M	M	H	M	M
CO2	H	H	H	H	M	H	H	H	H	M
CO3	H	H	H	H	M	H	H	H	H	M
CO4	M	H	M	H	H	M	H	M	H	H
CO5	H	H	H	H	H	H	H	H	H	H
H – High; M- Medium; L - Low										

21UCHMBA101	**GEC 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										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	M	H	M	H	M	H	M	M
CO2	M	H	M	H	M	H	H	H	H	M
CO3	M	H	M	H	M	H	H	H	H	M
CO4	M	H	M	H	M	H	H	M	H	H
CO5	M	H	M	H	M	H	H	H	H	H
H – High; M- Medium; L – Low										

21UMBMP101	DSC 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: 42**

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

21UCHMBAP101	**GEC 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

21UPEC101	AECC – I: PROFESSIONAL ENGLISH FOR LIFE SCIENCE I	SEMESTER – I

Course Objectives:

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

Total Hours: 50

UNIT	CONTENTS	Hrs	CO
I	**COMMUNICATION** ***Listening****: Listening to audio text and answering questions – Listening to Instructions* ***Speaking****: Pair work and small group work.* ***Reading:*** *Comprehension passages –Differentiate between facts and opinion* **Writing:** Developing a story with pictures**.** **Vocabulary:** Register specific - Incorporated into the LSRW tasks	**10**	**CO1**
II	**DESCRIPTION** ***Listening:*** *Listening to process description.-Drawing a flow chart.* **Speaking:** Role play (formal context) **Reading:** Skimming/Scanning- Reading passages on products, equipment and gadgets. ***Writing:*** *Process Description –Compare and Contrast Paragraph-Sentence Definition and Extended definition-Free Writing.* ***Vocabulary:*** *Register specific -Incorporated into the LSRW tasks.*	**10**	**CO2**
III	**NEGOTIATION STRATEGIES** ***Listening:*** *Listening to interviews of specialists / Inventors in fields(Subject specific)* **Speaking:** Brainstorming. (Mind mapping). Small group discussions (Subject- Specific) **Reading:** Longer Reading text. **Writing**: Essay Writing (250 words) ***Vocabulary:*** *Register specific - Incorporated into the LSRW tasks*	**10**	**CO3**

IV	**PRESENTATION SKILLS** **Listening**: Listening to lectures. **Speaking:** Short talks. **Reading:** Reading Comprehension passages **Writing:** Writing Recommendations Interpreting Visuals inputs ***Vocabulary:*** *Register specific - Incorporated into the LSRW tasks*	**10**	**CO 4**
V	**CRITICAL THINKING SKILLS** ***Listening:*** *Listening comprehension- Listening for information.* ***Speaking****: Making presentations (with PPT- practice).* ***Reading*** *: Comprehension passages –Note making. Comprehension: Motivational article on Professional Competence,Professional Ethics and Life Skills)* ***Writing:*** *Problem and Solution essay– Creative writing –Summary writing* ***Vocabulary:*** *Register specific - Incorporated into the LSRW tasks*	**10**	**CO5**
Text Book			
1.	Tamilnadu state council for higher Education (TANSCHE)		

COURSE OUTCOMES (CO)

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

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

21UVE101	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.

21UTALA201	**தமிழ் II :காப்பியங்களும் தற்கால இலக்கியங்களும்**	gUtk; -II

இப்பாடத்திட்டத்தின் நோக்கங்களாவன

- ஐம்பெருங்காப்பிங்களின் மூலம் பழங்காப்பிய நிகழ்வுகள் மற்றும் அமைப்பு முறைகளை எடுத்துரைத்தல்
- உரைநடை,நாடக இலக்கியத்தின் வழி வாழ்வியல் முறையை உணர்த்துதல்
- பழந்தமிழ் இலக்கியத்தின் சிறப்பை உணரச் செய்தல்

Credits:3 **total hours:50**

UNIT	CONTENTS	Hrs	CO
I	**காப்பியங்கள்:** சிலப்பதிகாரம் -அடைக்கலக் காதை மணிமேகலை – சிறைக்கோட்டம் அறக்கோட்டமாக்கிய காதை சீவக சிந்தாமணி –விமலையார் இலம்பகம் அறிமுகம் மட்டும்	10	CO1
II	**நாடக இலக்கியம்:** நெல்லை க.சுப்பரமணியன் - ஆண்டாள் கவிதை நாடகம்	10	CO2
III	**உரைநடை இலக்கியம்:** மீராவின் ‘‘குக்கூ’’ கவிதைத் திறன் ‘‘தமிழ் மாமுனிவர்’’ குன்றக்குடி அடிகளார	10	CO3
IV	**இலக்கிய வரலாறு:** காப்பியம் தோற்றம் வளர்ச்சி –ஐம்பெருங் காப்பியங்கள் -ஐஞ்சிறுங்காப்பியங்கள் -பிற காப்பியங்கள் -நாடகம் தோற்றம் மற்றும் வளர்ச்சிப் படிநிலைகள் -உரைநடைத் தோற்றம் வளர்ச்சி.	10	CO4
V	**இலக்கணம்:** யாப்பிலக்கணம் -அணியிலக்கணம் -பாவகை –வெண்பா, ஆசிரியப்பா அணியிலக்கணம்: தன்மை –உவமை –பாவிக அணி –வாழ்த்துஅணி.	10	CO5

Text Books

1. நெல்லை க.சுப்பரமணியன் - ஆண்டாள் கவிதை நாடகம்

ssk publications and Distributors –முதல் பதிப்பு -2016

2.இலக்கியச் சிந்தனை -இரா.மோகன் -மீனாட்சி பதிப்பகம்- முதற் பதிப்பு

1	செய்யுள்திரட்டு - தமிழ்த்துறை வெளியீடு கே.எஸ்.ரங்கசாமி கலை அறிவியல் கல்லூரி (தன்னாட்சி)

COURSE OUTCOMES (CO)

இப்பாடத்தைக் கற்பதன் வாயிலாக மாணவர்கள் பெறும் பயன்களாவன:

CO1	இரட்டைக் காப்பியங்களின் மேன்மையை உணர்தல்.
CO2	நாடக இலக்கியத்தின் உரிமையை உணர்தல்.
CO3	ciueil இலக்கியத்தின் சிறப்பை உணர்தல்.
CO4	காப்பிய,சிற்றிலக்கியங்களின் வரலாறு குறித்த செய்திகளை அறிதல்.
CO5	இலக்கணம் மற்றும் மொழிப்பயிற்சியின் அமைப்பை உணர்தல்.

21UENLA201	COMMUNICATIVE ENGLISH II	SEMESTER – II

Course Objectives:

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

Total Hours: 50

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

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

Text Book	
1.	Tamilnadu state council for higher Education (TANSCHE)

COURSE OUTCOMES (CO)

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

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

21UMBM201	**DSC 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: 03 **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										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	H	H	M	M	M	H	H
CO2	H	H	H	H	H	H	H	H	H	H
CO3	H	M	H	M	M	H	M	H	M	M
CO4	H	H	H	H	H	H	H	H	H	H
CO5	M	H	M	H	H	M	H	M	H	H
H – High; M- Medium; L – Low										

21UCSMBA201	GEC 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 -	06	CO3

	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.		
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 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										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	H	H	M	M	M	H	H
CO2	H	H	H	H	H	H	H	H	H	H
CO3	M	M	H	H	M	H	H	H	M	M
CO4	H	H	H	H	H	H	H	H	M	H
CO5	M	H	M	H	H	M	H	M	H	H
H – High; M- Medium; L – Low										

21UMBMP201	**DSC 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: 48**

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

21UCSMBAP201	**GEC 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	**2**	**CO3**

	cells		
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.

21UPEC201	AECC – I: PROFESSIONAL ENGLISH FOR LIFE SCIENCE II	SEMESTER – II

Course Objectives:

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

Total Hours: 50

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

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

	Capitalization (use of upper case)		

Text Book	
1.	Tamilnadu state council for higher Education (TANSCHE)

COURSE OUTCOMES (CO)

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

CO1	Know the different skills in English
CO2	Develop theirs Communication skill
CO3	Attend interviews with boldness and confidence.
CO4	Adapt easily into the workplace context, having become communicativelycompetent.
CO5	Apply to the Research &Development organisations/ sections in companiesand offices with winning proposals.

21UVE201	**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.

21UTALA301	**தமிழ் III : சங்க இலக்கியங்களும் பக்தி இலக்கியங்களும்**	**பருவம் -III**

இப்பாடத்திட்டத்தின் நோக்கங்களாவன

- எட்டுத்தொகை மற்றும் பத்துப்பாட்டு மூலமாக சங்ககால மக்களின் வாழ்க்கையை அறியசெய்தல்
- பக்தி இலக்கியம் மூலம் சைவ-வைண வவழிப்பாட்டு முறைகளை அறியச் செய்தல்
- அகத்திணைகள் புறத்திணைகள் வாயிலாக மக்களின் ஒழுக்க நெறிமுறைகளை எடுத்துரைத்தல்.

Credits:3 **Total hrs: 50**

UNIT	CONTENTS	Hrs	CO
I	**எட்டுத்தொகை** அ) குறுந்தொகை - 02, 167 (2 -பாடல்கள்) ஆ) நற்றிணை - 01, 110 (2 -பாடல்கள்) இ) புறநானூறு - 74, 195 (2 -பாடல்கள்) ஈ) ஐங்குறுநூறு - 44, 277 (2 -பாடல்கள்)	10	CO1
II	**பத்துப்பாட்டு** அ) முல்லைப் பாட்டு - (முழுவதும்)	10	CO2
III	**பக்தி இலக்கியம்** அ) பெரியபுராணம் - சேக்கிழார் (மெய்ப்பொருள் நாயனார் புராணம்) ஆ) நாலாயிர திவ்யப் பிரபந்தம் - பூதத்தாழ்வார் (இரண்டாம் திருவந்தாதி – முதல் 5 பாடல்கள்) இ) இரட்சணிய யாத்திரிகம் - எச்.ஏ. கிருட்டிணப்பிள்ளை (சிலுவைப்பாடு -முதல் 7 பாடல்கள்)	10	CO3
IV	**இலக்கிய வரலாறு** அ)எட்டுத்தொகை ஆ)பத்துப்பாடல் இ)சைவம் தோற்றம் வளர்ச்சி ஈ)வைணவம் தோற்றம் வளர்ச்சி உ)கிறித்துவம் தோற்றம் வளர்ச்சி	10	CO4
V	**இலக்கணம்** அ)ஆகுபெயர்கள் ஆ)அகத்திணை இ)புறத்திணை	10	CO5
பாடநூல்	செய்யுள்திரட்டு - தமிழ்த்துறை வெளியீடு, கே.எஸ்.ரங்கசாமி கலை மற்றும் அறிவியல் கல்லூரி (தன்னாட்சி)		

சங்க இலக்கியங்களும் பக்தி இலக்கியங்களும்

COURSE OUTCOMES(CO)

இப்பாடத்தைக் கற்பதன் வாயிலாக மாணவர்கள் பெறும் பயன்களாவன:

CO1	சங்ககால மக்களின் அகப்புற வாழ்க்கை முறைகளை அறியச் செய்தல்
CO2	சங்ககால மக்களின் ஒழுக்க முறைகளை எடுத்துரைத்தல்.
CO3	பக்தி இலக்கியத்தின் சிறப்புகளை கூறுதல்
CO4	இலக்கிய வரலாறு மூலம் நூல்கள், ஆசிரியர்களைப் பற்றி அறிமுகம் செய்தல்.
CO5	இலக்கண அமைப்பு முறைகளை எடுத்துரைத்தல்.

21UENLA301	FOUNDATION ENGLISH-I	SEMESTER – III

Course Objectives:

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

Credit: 3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Unit I POETRY** 1. Shakespeare - Sonnet-130 2. Robert Burns - A Red ,Red Rose 3. P.B.Shelley - Ozymandias 4. Robert Frost - Stopping by woods on a Snowing Evening	**10**	**CO1**
II	**Unit II PROSE** 1. A.G.Gardiner - On Keyhole Morals 2. Martin Luther King - I have a dream- 3. A.P.J.Abdul Kalam - Dimensions of creativity	**10**	**CO2**
III	**Unit III ONE ACT PLAY** 1. J.M. Synge - Riders to the sea 2. Anton Chekov - The Proposal	**10**	**CO3**
IV	**Unit IV FUNCTIONAL SKILLS.** 1. Punctuation- Error Analysis. 2. Determiners. 3. Sentence Patterns 4. Voices (Active & Passive).	**10**	**CO 4**
V	**Unit V COMPOSITION & COMMUNICATION** **COMPOSITION:** 1. Jumbled Sentence. 2. Hints Development. 3. Precise Writing. **COMMUNICATION**:	**10**	**CO5**

	1. Describe a Picture. 2.Imagining (A Object or Product) 3.Meadia (Film Review proverb Expansion)		

Text Book

1.	H.H.Anniah Gowda and J.M.Synge *Two Irish Plays.* Published by Amitabh Nagpal for Macmillan Publishers India Lcd, Haryana.2013.
2.	Shakespeare, William, *Sonnet 130*, Project Gutenberg, 2007.
3.	King Martin Luther *I have a dream*. MPI Home Video, 1986.

Reference Book:

1.	Melvan Jacqueline. *English Grammar and Error correction (Guide and phrasal verb)* book 2016.print.
2.	Krishnaswamy.N *Modern English A Book of Grammar, Usage and Composition,* Macmillan Publishers India Lcd, Haryana.2011.

COURSE OUTCOMES (CO)

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

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

21UMBM301	DSC 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: 04 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Nucleic acids:** Central dogma of life - Different forms of DNA (A-DNA, B-DNA, Z-DNA) - DNA as genetic material- Griffith's, Avery and Hershey- Chase experiment. Prokaryotic DNA replication- Replication fork formation-Continuous and Discontinous strand synthesis -- Meselson and Stahl-. Enzymology of DNA replication - rolling circle replication.	**10**	**CO1**
II	**Gene expression in Prokaryotes:** Introduction to Transcription. Basic mechanism of transcription- RNA polymerase- I, II ,III, 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.-5'-3' UTR structure.	**10**	**CO2**
III	**Translation in Prokaryotes) :** Introduction to Translation. Genetic code-structure and properties. 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–. Positive and negative control of gene expression–attenuator control(trp	**10**	**CO4**

	operon)-Induced(lac operon) . Gene transfer methods-Discovery, mechanism and genetic importance. Transformation-Conjugation–transduction (generalized and specialized).		
V	**Techniques used in genome analysis-** DNA hybridization-Holmologous and Non Homologous recombination-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* 2020. **Microbiology.** [Eleventh Edition]. WMC. Brown Publishers		
2.	*Weaver, R.F.*1999. **Molecular Biology**, WCB Mc Graw-Hill.		
Reference Books:			
1.	Peter J. Russell. 2017. **Genetics**. 1998. [Fifth Edition]. Harpar Collins College Publishers.		
2. 3. 4.	*David Freifelder.* 1987. **Molecular Biology**. Jones and Bartlett, New Zealand**.** *Benjamin Lewin.*2014. **Genes XI.** Pearson Prentice Hall, USA *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										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H	H	H	H
CO3	H	H	H	H	H	H	H	H	H	H
CO4	H	H	H	H	H	H	H	H	H	H
CO5	H	M	H	M	M	H	M	H	M	M
H – High; M- Medium; L – Low										

21UMBM302	**DSC IV : 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.

Credits: 03 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Introduction:** Scope and economic importance of mushroom cultivation-Nutritive values of mushroom- key to differentiate edible from Poisonous mushrooms.	**10**	**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.	**10**	**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.	**10**	**CO3**
IV	**Storage of mushroom:** Long term and short term storage of mushrooms- Diseases and pest control of mushrooms.	**10**	**CO4**
V	**Value added products for mushrooms:** Mushroom research centers: National level and regional level, Marketing of mushrooms in India and world**.**	**10**	**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										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	H	M	M	H	H	H	M	H
CO2	H	H	M	H	H	H	H	M	H	H
CO3	H	H	H	H	H	H	H	H	H	H
CO4	M	M	M	M	M	H	M	H	H	H
CO5	H	H	H	H	H	M	M	M	M	H
H – High; M- Medium; L – Low										

21UMAMBA301	GEC III : BIOSTATISTICS	SEMESTER – III

Course Objective:

The Course aims

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

Credits: 2 **Total Hours: 40**

UNIT	CONTENTS	Hrs.	CO
I	**Introduction:** Definition – Function of Statistics – Limitations of Statistics – Collection of data – Classification and Tabulation. **(Chapter 1 Sections: 1.3, 1.7, 1.8) (Chapter 2 Sections: 2.1, 2.3)**	**08**	**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 Square). **(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)

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

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

MAPPING

PO & PSO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO 1	H	M	M	L	L	H	H	H	H	H
CO 2	H	H	H	L	M	H	H	H	L	H
CO 3	M	H	H	M	M	H	H	H	H	L
CO 4	L	L	M	H	H	H	H	H	L	H
CO 5	L	M	M	H	H	H	L	H	H	H

H- High; M-Medium; L-Low

21UMBMP301	**DSC 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: 36**

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

Reference Books:

1.	*Maniatis Sambrook and David W. Russel.* **Molecular Cloning: A Laboratory Manual. 2010.** [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.

21UMAMBAP301	GEC PRACTICAL III : STATISTICS (USING MS-EXCEL)	SEMESTER III

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.

21UMBSB301	**SEC 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. Buffer preparation– Phosphate buffer. Working principle, operation and maintenance of pH meter, Colorimeter and UV-Vis Spectrophotometer.	06	CO1
II	**Centrifugation:** Principles of centrifugation. Rotor types– Fixed angle, vertical tube and swinging bucket. Instrumentation and application of centrifugation –Preparative and analytical techniques. Ultracentrifuge.	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 , Gas chromatography and GCMS	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.* **2007. 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										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H	H	H	H	H	H
CO2	M	M	M	H	H	M	M	M	H	H
CO3	H	H	H	H	M	H	H	H	H	M
CO4	M	H	H	H	M	M	H	H	H	M
CO5	M	M	M	M	M	M	M	M	M	M
H – High; M- Medium; L – Low										

21ULS301	**NCC: 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 : Tenses, concord,sentence pattern	3	CO1
II	Coommunication effectiveness, personal skills, presentation & public speaking	3	CO2
III	Resume writing, formal letter (sending invitation/accepting invitation/declining invitation/permission letter)	3	CO3
IV	Professional skills(leadership skills, Emotional intelligence(EI & EQ), Negotiating, Delegation)	3	CO4
V	Group Discussion, Interview skills, Mock GD & Interview	3	CO5

Text Books:

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

Reference Book:

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

COURSE OUTCOMES (CO)

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

CO1	Able to recall the basic grammar in language
CO2	Easy to concentrate on sentence correction
CO3	Preparing for resume building & letter formatting.
CO4	Improving the ability of skill development
CO5	Improving the interview skills.

21UTALA401	**தமிழ் IV : காப்பியங்களும் அறஇலக்கியங்களும்**	பருவம் -IV

இப்பாடத்திட்டத்தின் நோக்கங்களாவன

- சிலப்பதிகாரத்தின் வழி பெண்ணுரிமையைப் பற்றி உணரச் செய்தல்.
- காப்பியங்களைப் பற்றி மாணவர்கள் அறியச் செய்தல்.
- அறஇலக்கியங்கள் வாயிலாக நீதிக்கருத்துக்களை அறிய உணர வைத்தல்.
- தமிழ் இலக்கணங்களை மாணவர்களுக்கு அறிய வைத்தல்.

Credits: 3 **Total Hours:50**

UNIT	CONTENTS	Hrs	CO
I	**காப்பியம்** அ. சிலப்பதிகாரம் - வழக்குரைக் காதை **ஆ.** மணிமேகலை – ஆதிரை பிச்சையிட்ட காதை	10	CO1
II	**அறஇலக்கியம்** அ. திருக்குறள் - செய்நன்றி அறிதல் ஆ. நாலடியார் - கல்வி (முதல் 5 பாடல்கள்) இ. இனியவை நாற்பது – முதல் 5 பாடல்கள் ஈ. ஆசாரக்கோவை – முதல் 5 பாடல்கள்	10	CO2
III	**பிற்கால நீதி இலக்கியம்** அ. மூதுரை - 2,9,10,12,28 (5பாடல்கள்) ஆ. கொன்றைவேந்தன் - முதல் 20 பாடல்கள் இ. ஆத்திசூடி - 21 முதல் 40 பாடல்கள் வரை ஈ. நல்வழி - முதல் 5 பாடல்கள்	10	CO3
IV	**இலக்கிய வரலாறு** அ.காப்பியங்கள்- அறிமுகம் (ஐம்பெருங்காப்பியங்கள், ஐஞ்சிறுகாப்பியங்கள்) ஆ. பதினெண்கீழ்க் கணக்கு நூல்கள் - அறிமுகம் இ. பிற்கால நீதிஇலக்கியங்கள் - அறிமுகம்	10	CO4
V	**இலக்கணம்** அ. தொகைநிலைத் தொடர், தொகா நிலைத்தொடர் ஆ. நேர்காணல் இ. கடிதம் எழுதுதல் (அலுவலகக் கடிதம், விண்ணப்பக் கடிதம்)	10	CO5

Text Books

1.	செய்யுள்திரட்டு - தமிழ்த்துறை வெளியீடு, கே.எஸ்.ரங்கசாமி கலை அறிவியல் கல்லூரி (தன்னாட்சி).

காப்பியங்களும் அறஇலக்கியங்களும்

COURSE OUTCOMES(CO)

இப்பாடத்தைக் கற்பதன் வாயிலாக மாணவர்கள் பெறும் பயன்களாவன:

CO1	காப்பியகால மக்களின் வாழ்க்கையை அறிய செய்தல்
CO2	வாழ்வில் பின்பற்ற வேண்டிய அறக்கருத்துக்களை உணரச் செய்தல்
CO3	நீதிஇலக்கியத்தின் வாயிலாக நற்பண்புகளை அறியச் செய்தல்
CO4	இலக்கியவரலாறு மூலம் பண்டைய நூல்கள் அறிதல்.
CO5	இலக்கண அமைப்பு மொழிப்பயிற்சியின் அமைப்பை உணர்தல்

21UENLA401	FOUNDATION ENGLISH-II	SEMESTER -IV

Course Objectives:

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

Credit:3 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**POEM** 1. A.E.Stalling - The Doll House. 2. John Keats - La Belle Dame Sans Merci 3. Sonnet 65 - William Shakespeare. 4.I Know why the caged Bird Sings - Maya Angelou 5. This is a Photograph of me - Margaret Atwood.	**10**	**CO1**
II	**PROSE** 1. Herman Wouk - A talk on Advertising 2. Ngugi wa Thiong'o - From Decolonising the Mind 3. A.G. Gardiner - On Habits	**10**	**CO2**
III	**ONE ACT PLAY** 1. Edward Alwee - The Zoo Story 2. Beth Henley - Am I Blue	**10**	**CO3**
IV	**Grammar (Functional Skills)** 1.Degrees of Comparison 2.Conditional Clauses 3.Simple, Compound and Complex	**10**	**CO 4**
V	**COMPOSITION &COMMUNICATION** 1.Resume Writing 2.Report Writing 3.MOC – (Specific Jorgen)	**10**	**CO5**

Text Book

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

COURSE OUTCOMES (CO)

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

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

21UMBM401	**DSC V: 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: 04 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Introduction and Immunity**: Basics in Immunology- Contributions- Early theories and clonal selection theory. Immunity types and response- Innate and Acquired immunity, Humoral and Cell mediated immunity.	**10**	**CO1**
II	**Cells and organs of immune system and antigen:** Hematopoiesis and its regulations. Cells, Organs and tissues of the immune system– Primary lymphoid organs– Secondary lymphoid tissues. Antigens: Types– Epitopes, hapten, adjuvants and properties. Super Antigens.	**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. Vaccinology – Immunization – Active and Passive- Attenuated vaccine-Recombinant vaccine – purified macromolecules as vaccines. COVID Vaccine	**10**	**CO4**
V	**Effector mechanisms:** Transplantation- HLA Typing-Types of grafting, graft acceptance and rejection. Hypersensitive	**10**	**CO5**

	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 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.* 2006. **Immunology. 7th Edition.** Blackwell Scientific Publishers, London.
3.	*Janeway, C. A., P. Travers, M. Walport and M. J. Shlomchik* (2008). **Immunobiology**: 7th Edition. The Immune System in Health and Disease. Garland Publishing, USA.
4.	*Richard Goldsby, Thomas.J. Kindt, Barbara. A. Osborne.* 2002. **Immunology**. [Fifth Edition]. W. H. Freemanand Co., NewYork.
5.	*Kuby.* 2007. **Immunology**. Sixth Edition. W.H.Freemna and Company, New York.

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										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	M	M	M	M	M	M
CO2	H	H	H	H	H	H	H	H	H	H
CO3	H	H	H	H	H	H	H	H	H	H
CO4	M	M	M	M	M	M	M	M	M	M
CO5	H	H	H	H	H	H	H	H	H	H
H – High; M- Medium; L – Low										

21UMBM402	DSC VI : CORPORATE MICROBIOLOGY	SEMESTER IV

Course Objectives:

The course aims

- To introduce, update and strengthen the entrepreneurship potential among students.
- To learn the basic rules and regulations for entrepreneurship.

Credits: 03 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Microbial Cell Protein :** Mushroom cultivation –substrate – Composting – spawn – Cropping –Harvesting. Diseases and control, - Nutritive value, single cell proteins substrate – production – uses.	10	CO1
II	**Cultivation techniques:** Isolation, purification, mass multiplication, formulation and crop response of inoculants - *Rhizobium, Azotobacter* and *Azospirillum* and phosphate solubilizer (*Pseudomonas striata*).	10	CO2
III	**Animal Care :** Maintenance and care of laboratory animals – mice, rabbit, guinea pig, chickens. Generation of Polyclonal and monoclonal antibodies and their applications.	10	CO3
IV	**Intellectual Property Rights (IPR):** Introduction to IPR,Patentable life science process and products, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design. Procedure for IPR registration, the effect of registration and term of protection. Govt of India's National IPR Policy and Career opportunities in IPR.	10	CO4
V	**Quality Accreditation and Standardization** : ISO 22000- HACCP – steps of the HACCP System – explanation and application of HACCP principles – standards. Certification procedures- FSSAI.	10	CO5

Text Books:

1. 2.	Keshav trehan 1997 biotechnology new Age international (P) Limited Publishers *Tilak,* Subba rao N.S. 1995, soil microorganisms and plant growth. Oxford and IBH Publishing Co Pvt. Ltd.

Reference Books:	
1.	P*urohit, S.S., P.R. Kothari and S.K. Mathur. 1993.* **Basic and Agricultural Biotechnology.** Agro Botanical Pub. India.
2.	Nithyananda, K V. (2019). **Intellectual Property Rights: Protection and Management**. India, IN: Cengage Learning India Private Limited.

COURSE OUTCOMES (CO)

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

CO1	Discuss the economic importance of mushroom and its cultivation.
CO2	Understand the nitrogen fixation process.
CO3	Apply the various formulation and production of antibiotics.
CO4	Demonstrate the importance of Intellectual Property Rights
CO5	Outline the standards and certification procedures.

MAPPING										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	M	H	H	H	H	M	H
CO2	H	H	M	H	H	H	H	H	H	H
CO3	H	M	M	H	H	H	M	H	H	H
CO4	H	M	M	H	H	H	M	H	H	H
CO5	H	H	M	H	H	H	H	H	H	H
H – High; M- Medium; L – Low										

21UBCMBA401	**GEC IV : BIOCHEMISTRY (BIOMOLECULES)**	**SEMESTER - IV**

Course Objectives:

The Course aims

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

Credits: 2 **Total Hours: 40**

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

	acids: - Structure. Sterol – Structure of Cholesterol.		
IV	**Enzymes –** Definition, IUB classification with examples. Active site - Definition, Mechanism of enzyme action - Lock & key model and induced fit hypothesis. Enzyme units - IU, katal. Factors affecting enzyme activity (pH, Temperature and substrate concentration).	**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 GEC (P) Ltd., Calcutta.		

COURSE OUTCOMES (CO)

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

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

CO5	Elucidate the classification and clinical significance of micronutrients

MAPPING										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	M	M	H	M	M	H	H
CO2	H	M	M	M	M	H	M	M	H	H
CO3	H	M	M	M	M	H	M	M	H	H
CO4	H	M	M	M	M	H	M	M	H	H
CO5	H	M	M	M	M	H	M	M	H	H
H – High; M- Medium; L - Low										

21UMBMP401	**DSC 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)	**3**	**CO5**
11.	COVID Test kit method	**3**	**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.

21UBCMBAP401	**GEC PRACTICAL IV: BIOCHEMISTRY (BIOMOLECULES)**	**SEMESTER – IV**

Course Objectives:

The Course aims

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

Credits: 2 **Total Hours: 30**

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

Reference Books

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

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

COURSE OUTCOMES (CO)

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

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

21UMBSB401	SEC II : CALCULATION FOR BIOLOGY	SEMESTER IV

Course Objectives:

The course aims

- To make the students to understand the basic calculations in Microbiology.
- To study various analytical techniques in the field of Microbiology.

Credits: 02 **Total Hours: 25**

UNIT	CONTENTS	Hrs	CO
I	**Unit of Measurement :** SI units. Sterngth of the solutions – Percentage solutions, part solutions, molar solutions and normal solutions.	05	CO1
II	**Buffers :** pH and pka calculations, preparartion of buffers – phosphate buffer , bicarbonate buffer, acetate buffer.	05	CO2
III	**Cell growth** : Bacterial growth curve – Manipulating cell concentration, linear graph, Calculating generation time, Measuring cell concentrations on hemocytometer.	05	CO3
IV	**Quantification of Nucleic acid and proteins:** Quantification of Nucleic acid by spectrmetry – ds DNA, ss DNA, RNA. Quantification of protein by measuring at 280 nm. Quantitating protein at A280 in nucleic acid contamination.	05	CO4
V	**Centrifugation :** Relative centrifugal force (g force), converting g force to RPM, calculating sediment times.	05	CO5

Text Book:

1. *Frank H. stephenson,* 2003. Calculations for Molecular Biology and Biotechnology – Academic press.

COURSE OUTCOMES (CO)

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

CO1	Prepare solutions and buffers for performing laboratory experiments.
CO2	Calculate the optimun concentrations of solutes to be mixed for preparing solutions.
CO3	Interpret the mechanism of bacterial cell growth.
CO4	Develop the skill to quantitate the biological macromolecules.
CO5	Apply the knowledge of centrifugation.

MAPPING										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H	H	H	H	H	H
CO2	M	M	M	H	H	M	M	M	H	H
CO3	H	H	H	H	M	H	H	H	H	M
CO4	M	H	H	H	M	M	H	H	H	M
CO5	M	M	M	M	M	M	M	M	M	M
H – High; M- Medium; L - Low										

21ULS401	NCC: 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	*Quantitative Aptitude – RS Aggarwal, S Chand and Company Limited, 2017Edition,New Delhi.*

Reference Book:

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

21UMBNM301	**SEC 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. COVID Care.	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*. 2020. **Microbiology**. [Eleventh 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.

21UMBNM401	**SEC 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 ,HIV and COVID-19.	**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*. 2020. **Microbiology**. [Eleventh Edition]. Mc Graw Hill, NewYork.
2.	*Michael J Pelczar, Chan, E. C. S. and Noel R Krieg.* 2012. **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.

21UMBAL401	**ACC 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										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	M	H	H	H	H	M	H
CO2	H	H	H	H	H	H	H	H	H	H
CO3	H	M	H	H	H	H	M	H	H	H
CO4	H	M	H	H	H	H	M	H	H	H
CO5	H	H	H	H	H	H	H	H	H	H
H – High; M- Medium; L – Low										

21UMBM501	DSC VII: FUNDAMENTALS OF VIROLOGY	SEMESTER V

Course Objectives:

The course aims

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

Credits: 04 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Virus:** History of virology, General properties of viruses – Structure of viruses– capsids, nucleocapsid, nucleicacids–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	**Plant viruses:** Structure, mode of transmission, Symptoms, Prevention and control of Tobacco Mosaic Virus, Cucumber Mosaic Virus, Potato Spindle Tuber Virus and Cauliflower Mosaic Virus.	10	CO3
IV	**Animal viruses:** Structure, replication. Pathogenesis and Laboratory diagnosis of Poxvirus, Herpes simplex virus, Poliovirus, Influenza virus, MMR, Rabies virus, HIV and Corona virus. Antiviral drugs and their mode of actions.	10	CO4

V	**Bacteriophages:** Classification, structure and life cycle of Single stranded DNA phages- Φx174 and M13; double stranded DNA phages– T4 and lambda. Viroids.	**10**	**CO5**
Text Books:			
1.	*Edward K. Wagner, Martinez J. Hewlett.* 1999. **Basic Virology.** Black well Science, Inc.		

Reference Books:	
1.	*Dimmock, K. J. and Primrose, S. B.* 1994. **Introduction to** M**odern Virology**. [Fourth Edition]. Black well Science Ltd., UK.
2.	*Lewy, J. A, Fraenled H. Cand 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 Long man.
4.	*Biswass, S. B. and Amita Biswass.* 1984. **An Introduction to Viruses**. [Third Edition]. Vikas Publishing House Pvt. Ltd., NewDelhi.

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

MAPPING										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	H	M	M	M	M	M
CO2	H	H	H	H	H	H	H	H	M	H
CO3	H	H	H	H	H	H	H	H	M	H
CO4	M	M	M	M	H	M	M	M	M	M
CO5	H	H	H	H	H	H	H	H	M	H
H – High; M- Medium; L – Low										

21UMBM502	DSC VIII: ENVIRONMENTAL MICROBIOLOGY	SEMESTERV

Course Objectives:

The course aims

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

Credits: 03 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Ecological Principles:** ecosystem- types of ecosystems- dynamics of ecosystem- Food chain, Food web. Microbial diversity - conventional and molecular methods of studying microbial diversity.	**08**	**CO1**
II	**Air and Aquatic Microbiology:** Aerosol- droplet and droplet nuclei. Enumeration of bacteria from air – Air sampling devices, Air borne diseases and their control measures and Air sanitation. Potability of water quality– Indicator organisms– MPN index. Eutrophication. Water borne 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 andmetals; biodegradation of paper, oil, pesticide and xenobiotic compound. Bio-deterioration of leather and textiles. Bioleaching of ores.	**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 LongmanInc.
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, NewJersey.
2. *Daniel J.C.* 1999**. Environment Aspects of Microbiology**. 1st Edition, Brightsun 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 disposa land recycling of waste water.
CO4	Develop remediation for control environmental pollution using Microorganisms.
CO5	Assess commercial application of microbial products.

MAPPING										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	M	M	M	M	M	M
CO2	H	H	H	H	H	H	H	H	M	H
CO3	H	H	H	H	H	H	H	H	M	H
CO4	M	M	M	M	M	H	H	H	M	H
CO5	H	H	H	H	H	H	H	H	M	H
H – High; M- Medium; L – Low										

21UMBM503	DSC IX : 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:** Introduction, Classification, types, Properties, structure, texture and formation of soil. Microbial grouping- Autochthonous, Allochthonous and Zymogenous microbes. Significance of soil microbes-Bacteria, Archaea, Eukaryotic algae, Cyanobacteria, Fungi and Actinobacteria.	08	CO1
II	**Biogeochemical cycle and Nitrogen fixers:** Carbon cycle, Phosphorous cycle, Sulphur cycle and Nitrogen cycle. Biochemistry of nitrogen fixation- Nitrogenase, hydrogenase, *nif* gene and *nod* gene. Nitrogen fixation- Symbiotic and Non symbiotic Nitrogen fixers.	08	CO2
III	**Interactions among soil microbes and plants:** Neutralism, Commensalism, Symbiosis, Synergism, Amensalism, Parasitism, Predation and Competition. 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. Mycoplasma disease- little leaf of brinjal. Fungal disease- Light blight of potato, Red rot of sugarcane, Wilt of cotton and Tikka leaf spot of groundnut.	**08**	**CO4**
V	**Biofertilizers, biopesticides and biocontrol agents:** Mass multiplication, field application and crop response to *Rhizobium,* and *Azospirillum* and Phosphobacterium. Mode of action, formulation and application methods of biopesticides *Bacillus thuringenesis* and *Breuvaria bassiana.*	**08**	**CO5**

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.
4. *SubbaRao, N.S.* 1982. **Advances in Agricultural Microbiology**. Oxfordand LBH publishing co.
5. *Alexander N. Glazer* and *Hiroshi Nikaido.* **Microbiol biotechnology-Fundamentals of Applied Microbiology.** W.H. Freemanand Co, Newyork.

Reference Books:

1. *Subbha Rao ,M.S.* 1995. **Soil Microorganisms and Plant Growth**. Oxfordand IBH. New Delhi.
2. *Paul, E.A* .2007. **Soil Microbiology and Biochemistry.** [Third Edition]. Academic Press- Anim print of Elsevier, Burlington, USA.
3. *Bawden. F.C.* 1999. **Plant Diseases**. Greenworld. First Edition in India. Efficient off set printers. New Delhi.
4. *Atlas, A.M. and R. Bartha.* 1998. **Microbial Ecology. Fundamentals and**

5.	**Applications**. Anim print of Addison Wesley longmann Inc. *MarkS. Coney*.,1999. **Soil Microbiology:** Anexploratory 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										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	M	M	M	M	M	M
CO2	H	H	H	H	H	H	H	H	M	H
CO3	H	H	H	H	H	H	H	H	M	H
CO4	M	M	M	M	M	H	H	H	M	H
CO5	H	H	H	H	H	H	H	H	M	H
H – High; M- Medium; L – Low										

21UMBM504	DSC X : 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 clinical laboratory.

Credits: 04 **Total Hours: 50**

UNIT	CONTENTS	Hrs	CO
I	**Bacterial disease:** Infection- Host interactions- adhesion, invasion, host damage, spread, multiplication and release of pathogen. Normal flora of human- skin, eye, respiratory tract and gastro intestinal 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* and *Clostridium tetani*.	10	CO3
IV	**Morphology, Cultural characteristic, pathogenesis, lab diagnosis and control of Gram negative Organisms**: *Escherichia coli, Klebsiella pneumoniae, Proteus vulgaris, Salmonella typhi, Salmonella paratyhi, Shigella flexneri, Pseudomonas aeruginosa* and *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. *Chakraborty, 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 Text book of Medical Microbiology**. Eighth edition, Jaypee Brothers, Medical publishers (P) Ltd.,NewDelhi.

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., NewDelhi.
4. *Sundararaj, T*. 2005. **Microbiology Laboratory Manual**, Perungudi, Chennai-96.
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										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	M	M	M	M	M	M
CO2	H	H	H	H	H	H	H	H	M	H
CO3	H	H	H	H	H	H	H	H	H	H
CO4	M	M	M	M	M	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	M	H
H – High; M- Medium; L – Low										

21UMBEL501	**DSE 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: 03 **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 samples. Mycotoxins. Antifungal agents- Testing methods and quality control. Virulence factors of fungi.	08	CO1
II	**Fungal Diseases:** Superficial mycosis- *Tinea*, *Piedra*- Dimorphic fungi causing Systemic mycosis- Histoplasmosis- Cutaneous mycosis- Dermatophytosis. Subcutaneous mycosis- Sporotrichosis and Mycetoma. Opportunistic mycosis- Candidiasis, and Aspergillosis.	08	CO2
III	**Medical Parasitology:** Morphology, classification, characteristics, pathogenesis, laboratory diagnosis, prevention and control; Intestinal amoebae – *Entamoeba histolytica, Giardia lamblia.* Free living *Amoebae–Naegleria fowleri.* Blood and tissue flagellates –*Trichomonas vaginalis, Trypanosoma brucei, Trypanosoma cruzi*. Malarial parasite– *Plasmodium falciparam, Plasmodium vivax.*	08	CO3

IV	**Helminths Infection of Helminthes:** *Taeniasolium, T.saginata, Fasciola hepatica, a*nd *Schistosomes, Ascaris lumbricoides, Ancyclostoma duodenale,* and *Wuchereria bancrofti.*	**08**	**CO4**
V	**Laboratory techniques in Parasitology**: Examination of faeces - Direct and concentration methods. Blood smear examination - Cultivation of protozoan parasites ,Serology and PCR techniques.	**08**	**CO5**

Text Books:

1. *Jagdish chander*. 2017. **Text book of Medical Mycology**. 4th edition, Taypee Publisher.
2. *Gopinath hait*. 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 Text book 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 Black well.
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- Black well.
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										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H	H	H	H	H	H
CO2	M	M	M	M	M	M	M	M	M	M
CO3	H	H	H	H	H	H	H	H	H	H
CO4	M	M	M	M	M	M	M	M	M	M
CO5	H	H	H	H	H	H	H	H	H	H
H – High; M- Medium; L – Low										

21UMBEL502	DSE I: NANOMICROBIOLOGY	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 nanoparticles.
- To know about the modern applications of nanobiology.

Credits: 03 **Total Hours: 40**

UNIT	CONTENTS	Hrs	CO
I	**Nanobiology:** Concepts, definitions, prospects. Nano scale systems. Biological Nano objects– proteins , lipids and DNA. Bionanoparticles- Nanostarch, Nanocomposites- Dendrimers.	08	CO1
II	**Methods of Nanobiology:** Analysis of bimolecular Nanostructures by Atomic Force Microscopy, Scanning Probe Electron Microcopy and FTIR. Nano fabrication- Lithography - Photolithography, Electron beam lithography.	08	CO2
III	**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	CO3
IV	**Antimicrobial properties of metal nanoparticles:** Ag, Cu, Au nanoparticles-antibiofilm properties of nanoparticles. Biogenesis of bacterial silver nanoparticles, platinum nanoparticles.	08	CO4

V	**Nano Applications:** Use of microbes in relation to Bimedical applications of nanoparticles. Application of Biogenic Silver Nanoparticles in Fabrics. Nano biosensors and their applications. Nano drug delivery systems.	**08**	**CO5**

Text Books:	
1.	*Balaji Subbaih.* 2010. **Nano biotechnology**. MJP Publishers, India.

Reference Books:	
1.	*Pradeep , T.* 2008. **Nano: The Essentials: Understanding Nano science and Nanotecnology.** Tata Mc Graw- Hill Publishing Company Limited, New Delhi.
2.	*Mahendra Roiand Nelson Dura.* 2011. **Metal nanoparticles in Microbiology**. Springer.
3.	*Christof M. Niemayer, Chad A. Mirkin*. 2004. **Nano biotechnology: 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 bio nanoparticles.
CO2	Compute the bimolecular nanostructures by AFM, Scanning Probe Electron Microcopy and FTIR.
CO3	Assess the various methods for susceptibility testing of nanoparticals.
CO4	Analyze antimicrobial properties of metal nanoparticles.
CO5	Prepare effective nano based drug delivery systems for infectious disease.

MAPPING										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	M	M	M	M	M	M
CO2	H	H	H	H	H	H	H	H	H	H
CO3	H	H	H	H	H	H	H	H	H	H
CO4	M	M	M	M	M	M	M	M	M	M
CO5	H	H	H	H	H	H	H	H	H	H
H – High; M- Medium; L – Low										

21UMBMP501	**DSC PRACTICAL V (Fundamentalsof 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.	Estimation of BOD.	05	CO1
3.	Estimation of COD.	05	CO1
4.	MPN Technique.	05	CO1
5.	Enumeration of bacteria from air by open plate method and air sampler method.	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.	05	CO2
9	Microscopic eaxmination of VAM fungi.	05	
10.	Isolation and Identification of clinical pathogens from sputum samples.	05	CO3
11.	Isolation and Identification of clinical pathogens from pus samples.	05	CO3
12.	Isolation and Identification of clinical pathogens from urine samples.	05	CO3

Reference Books

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

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

21UMBSB501	SEC II: MICROBIAL TECHNOLOGY	SEMESTER V

Course Objectives:

The course aims

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

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 and Lipase. Microbial production of organic acids - Butyric acid and Lactic acid.	05	CO1
II	**Plant Growth Promoting Rhizobacteria (PGPR):** Biofertilizers - Azotobacter, Gluconacetobacter, mycorrhizae, Blue Green Algae and Azolla.	05	CO2
III	**Microbial Production:** Biopolymers - Xanthan Gum. Adhesive biopolymer of yeast cell. Microbial synthesis of plant biopolymer. Human Interferon and Insulin.	05	CO3
IV	**Microbial Production:** Production of medicinal mushroom- *Ganodermalucidum* and *Cordycepsmilitaris*. Mold modified Foods - SoySauce, Miso, Hamanatto, Sufu, Tempeh. Probiotics.	05	CO4
V	**Energy Production:** Renewable bioenergy using microorganisms – Methanogenesis, Methane production by anaerobic digestion of waste organic materials.	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, MacMillan India Ltd, New Delhi.
Reference Books:	
1.	*Alexender, N. Glazer* and *Hiroshi Nikaido, W.H.* 1995. **Microbial Biotechnology.** Freeman and Company.
2.	*Pepple r,H,J.*, and *Perlman, D.* 2004. **Microbial Technology.** Volume I & II, 2nd Edition, Academic press.
3.	*Wulf, C* and *Anneliese, C.* 2000. **Biotechnology. 2nd** Edition, Panima Publications.
4.	*Ronald, M Atlas* and *Richard Bartha*. 2005. **Microbial Ecology .**4thEdition, Benjamin / Cummings Science Publishing.
5.	*Subbarao, N.S*. 1995. **Biofertilizers in Agriculture and forestry** ,3rdEdition, 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 wil lbe 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 biodegradation technology.

MAPPING										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H	H	H	H
CO3	M	M	M	M	M	M	M	M	M	M
CO4	M	M	M	M	M	M	M	M	M	M
CO5	H	H	H	H	H	H	H	H	H	H
H – High; M- Medium; L – Low										

21ULS501	NCC: CAREER COMPETENCY SKILLS - III	SEMESTER V

Course Objectives:

The course aims

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

Total Hours: 15

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

Text Book:

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

Reference Book:

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

COURSE OUTCOMES(CO)

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

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

21UMBAL501	ACC I: 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 microflora, 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 – Bacteria, Actinobacteria, Archaea, 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 in thermophilic, 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, seaweed fertilizers, Astaxanthin, βcarotene– enzyme– antibiotics– antitumor agents– biosurfactants- pigments. Preservation of sea foods.	**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.	*FordTE.* 1993. **Aquatic microbiology. Anecological approach.** Blackwell Scientific publications, London.
5.	*Austin. B* and *Austin, D. A*. 1999. **Bacterial Fish pathogens – Diseases of Farmed and 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.

ReferenceBooks:	
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 Hand book 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 about isolation, preservation and biogeochemical cycle of marine microbes.
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										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	M	M	M	M	M	M
CO2	H	H	H	H	H	H	H	H	H	H
CO3	M	M	M	M	M	M	M	M	M	M
CO4	H	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H	H
H – High; M- Medium; L – Low										

21UMBM601	DSC XI : FERMENTATION TECHNOLOGY	SEMESTER VI

Course Objectives:

The course aims

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

Credits: 04 **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:** Introduction, 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 intracellular and extracellular products.	10	CO3
IV	**Microbial products from industry:** Microbial production of α-amylase and Vitamin B_{12}. Preparation of substrate, fermentation and recovery of Wine and Beer. Production of organic acids – Citric acid and Acetic acid. Microbial	10	CO4

	production of antibiotics - Inoculum preparation, fermentation and recovery of Penicillin and Streptomycin.		
V	**Recombinant products :** Insulin , Interferon and Growth harmones.	**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., NewDelhi.
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]. Black well 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 antibiotics.
CO5	Create improved technology for recombinant products.

MAPPING										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	M	M	M	M	M	M
CO2	M	M	M	M	M	M	M	M	M	M
CO3	H	H	H	H	H	H	H	H	H	H
CO4	H	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H	H
H – High; M- Medium; L – Low										

21UMBM602	**DSC XII : 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 of genomic and cDNA Libraries.
- Tolearn 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:** Radio labelling 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**

TextBooks:	
1.	*Brown, T. A.* 1995. **Gene Cloning–An Introduction** .[Third Edition] .Chapmanand Hall,UK.

ReferenceBooks:	
1.	*Old ,R. W.and Primrose, S. B.* 1995. **Principles of Gene Manipulation– An Introduction to Genetic Engineering.** [Fifth Edition]. Black well 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 .NewDelhi.

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 increating the stable transformants.
CO5	Create novel transgenic plants and animals.

MAPPING										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H	H	H	H	H	H
CO2	M	M	M	M	M	M	M	M	M	M
CO3	H	H	H	H	H	H	H	H	H	H
CO4	M	M	M	M	M	M	M	M	M	M
CO5	H	H	H	H	H	H	H	H	H	H
H – High; M- Medium; L – Low										

21UMBM603	DSC XIII: 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 quality control and standards of food.

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	**Spoilage of foods :** Cereals and cereal products-Sugar and sugar products – Vegetables and fruits – Meat and meat products – Spoilage of canned food**.**	08	CO2
III	**Food borne diseases:** Food poisoning and food borne Infections - Bacterial and Mycotoxins. Investigation of food poisoning outbreaks.	08	CO3
IV	**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. Foodadditives.	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, NewDelhi.
Reference Books:	
1.	*Banwart, G. J.* 1989. **Basic Food Microbiology.** Chapmanand Hall NewYork.
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 microbes in food and 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										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	M	M	M	M	M	M	M	M
CO2	H	H	H	H	H	H	H	H	H	H
CO3	M	M	M	M	M	M	M	M	M	M
CO4	H	H	H	H	H	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H	H	H
H – High; M- Medium; L – Low										

21UMBMEL601	**DSE 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. Introduction , Classification of antibiotics and source of drugs. Routes of drug administration and pharmacological studies of microbes.	08	CO1
II	**Microbial contamination and spoilage of pharmaceutical products:** Microbial sources, contamination and spoilage of pharmaceuticals; Factors affecting microbial spoilage of pharmaceutical products.	08	CO2
III	**Preclinical Development:** Safety profile of drugs (Pyrogenecity, Toxicity, hepato, nephro, cardio and neurotoxicity), Toxicological evaluation of drug (LD 50, Acute, subacute and chronic toxicity), Mutagenecity (Ames test, micro nucleus test). And Carcinogenicity**:**	08	CO3
IV	**Clinical studies and Pharmaceutical Drug Analysis:** Phase I, Phase II, Phase III and Phase IV of clinical trials – Objectives, Conduct of trials, Out come of trials. Biosensors and applications in Pharmaceuticals; Macromolecular, cellular and synthetic drug carriers. Assay of steroids.	08	CO4

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. FDA, CDSCO, DCGI. Formulation of drugs and patenting of pharmaceutical products.	**08**	**CO5**

Text Books:

1. *Hugo and Russell.* 2004. **Pharmaceutical Microbiology.** [Seventh Edition]. Wiley-Black well 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, New York.
3. *Burn J. H.* **Principles of Therapeutics,** Black well 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	Develop the pharmaceutical products without contamination and spoilage.
CO3	Optimize the production of pharmaceutical products.
CO4	Apply the technology in drug delivery systems.
CO5	Follow the protocols and regulations to validate pharmaceutical products.

MAPPING										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H	H	H	H
CO3	H	H	H	H	H	H	H	H	H	H
CO4	M	M	M	M	M	M	M	M	M	M
CO5	H	H	H	H	H	H	H	H	H	H
H – High; M- Medium; L – Low										

21UMBEL602	**DSE II: MICROBIOLOGY FOR SOCIAL WELFARE**	**SEMESTER VI**

Course Objectives:

The course aims

- To learn the importance and applications of microbial products.
- To study the patenting methods for novel products.
- To understand the entrepreneur opportunities in relevance to Microbiology.

Credits: 04 **Total Hours: 40**

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.	08	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.	08	CO2
III	**Biofertilizers:** Algal fertilizers- *Azolla* as fertilizer. Composting– domestic waste, agricultural and industrial waste, vermi composting and organic farming.	08	CO3
IV	**Patenting in Microbial Biotechnology:** Patents– patenting strategies. Copyrights. Tradesecrets, Trademarks, WIPO, GATT & TRIPs. Patenting of Biological materials.	08	CO4
V	**SCP production**: Mushroom and Spirulina cultivation and its marketing. Probiotics and its use as animal feed.	08	CO5

TextBook:

1 *Dubey, R. C* (2009). **A text book of Biotechnology,** S. Chand & Company Ltd, New Delhi.

Reference Books:	
1.	*Subba Rao, N. S., 1995.* **Biofertilizer in agriculture and forestry.** *Oxfordand 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										
PO &PSO / CO	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H	H	H	H
CO3	M	M	M	M	M	M	M	M	M	M
CO4	M	M	M	M	M	M	M	M	M	M
CO5	H	H	H	H	H	H	H	H	H	H
H – High; M- Medium; L – Low										

21UMBMP601	**DSC 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	2	CO3
7.	Amylase production by Submerged fermentation	5	CO3
8.	Examination of fungi by slide culture technique.	5	CO1
9.	Giemsa stain	3	CO3
10.	Identification of blood parasites by Leishman Staining technique	5	CO3
11.	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.

21UMBSBP601	SEC II: PRACTICAL I: MICROBIAL TECHNOLOGY	SEMESTER VI

Course Objectives:

The course aims

- To give the knowledge about microbial products.
- To understand the immobilized cells

Credits: 02 **Total Hours: 24**

Experiment	CONTENTS	Hrs	CO
1.	Estimation of alcohol by colorimetric method.	4	CO1
2.	Enzyme Immobilization.	2	CO2
3.	Isolation, production and estimation of citric acid.	6	CO3
4.	Cultivation of Azolla.	2	CO3
5.	Isolation of cellulase producing microorganisms.	4	CO3
6.	Cultivation of mushroom.	6	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.

21ULS601	**NCC : CAREER COMPETENCY SKILLS - IV**	**SEMESTER VI**

Course Objectives:

The course aims

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

TotalHours:15

UNIT	CONTENTS	Hrs	CO
I	Basic Grammar- 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, AnneSeaton,Y.H.Mew, Saddle point 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 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 students in groups during the VI semester and has to complete the work at the end of the semester.
- The students has to attend 2 reviews before completing his / her Project and it will be evaluated by an internal examiner.
- The assessment of students performance in a semester is calculated by Continuous Internal Assessment (CA) for 40 Marks and External Assessment for 60 Marks.
- Upon completion of the project work the candidate shall be required to appear for a Viva Voce conducted by an external examiner.
- The candidate shall be declared to have passed the Examination, the candidate secure not less than 40 Marks put together out of 100 in the Comprehensive Examination in Project with a passing minimum of 24 marks in external out of 60.

Mark Distribution Pattern

Internal Mark Distribution **Continuous Assessment (CA) Total Marks: 40**

1.	Attendance	:	10 Marks
2.	Review (2)	:	20 Marks
3.	Presentation	:	10 Marks
Total		**:**	**40 Marks**

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

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

IV. NON CREDIT COURSE

Semester III and VI - Viva voce

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

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

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

3. QUESTION PAPER PATTERN AND MARK DISTRIBUTION

THEORY

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

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

DSC Practical Examinations (Maximum marks: 60) Time: 6 Hours

Question paper pattern

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

SEC 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**