



**THANTHAI HANS ROEVER COLLEGE
(AUTONOMOUS)**



PERAMBALUR-621220

(For the Students admitted from the Academic year 2025 -2026 onwards)

B.Sc., MICROBIOLOGY

Course Structure and Syllabus

**CHOICE BASED CREDIT SYSTEM- LEARNING OUTCOMES
BASED CURRICULUM FRAME WORK (CBCS-LOCF)**



PG & RESEARCH DEPARTMENT OF MICROBIOLOGY

(Nationally Re-Accredited by NAAC with A)

(Affiliated to Bharathidasan University, Tiruchirappalli)

ELAMBALUR, PERAMBALUR-621220.



THANTHAI HANS ROEVER COLLEGE (AUTONOMOUS)



*(Nationally Re-
Accredited by NAAC with A)
(Affiliated to Bharathidasan University,
Tiruchirappalli) ELAMBALUR,
PERAMBALUR-621220*

PG & RESEARCH DEPARTMENT OF MICROBIOLOGY

Vision

- ❖ To develop high quality human resource required for both academics and industries as well as to pursue research in the frontier areas of Microbiology of international standard and to rise as center of excellence and information/knowledge in the all fields of microbiology.

Mission

- ❖ To train students in the field of Microbiology, provide value based education, with commitment to academic excellence and innovative research.
- ❖ To undertake research activities relevant to present day needs such as emerging infections, drug developments, biofertilizers in agricultural fields, safety waste disposal/ management and water/ food quality control etc.
- ❖ To develop knowledgeable, motivated and skilled entrepreneurs who can establish/ accompanies modern microbiological industries that could cater the need of the hour.
- ❖ To create a biologically ethical, safe environment for the society.

Programme Outcomes (POs)

Upon completion of the Programme, the undergraduate will be able to

1. Acquire knowledge, understand concepts and apply new ideas which enable them to be employable or self-employed.
2. Demonstrate motivation in advancing to higher learning programmes.
3. Engage in socially responsible behavior and have value added education.

4. Have exposure to technical proficiency, analytical capability, soft skills and life skills development.
5. Develop broad understanding in the basic concepts of Languages/Commerce/Management Studies/Physical Sciences/Computing Sciences/Biological Sciences/Life Science.

Programme Specific Outcome:

1. Acquire an in depth knowledge on the fundamental concepts and scope of Microbiology and its related fields.
2. Realize the application oriented aspects of Microbiology and assimilate the technical skills in basic, medical and applied microbiology.
3. Apply specialized microbiology knowledge from multiple fields to critically analyze and evaluate microbiological, environmental and health-related problems.
4. Understand and explain the diversity of microorganisms and its interaction with the environment for sustainable development.
5. Attain higher knowledge by developing competency in the field of Microbiology assuring and enhancing entrepreneurial skills for the betterment of the society



THANTHAI HANS ROEVER COLLEGE
(AUTONOMOUS)
ELAMBALUR, PERAMBALUR-621220.



B.Sc., MICROBIOLOGY

CHOICE BASED CREDITS SYSTEM-

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS-
LOCF)

(Applicable to the Students admitted from the academic year 2025-
2026)

Semester	Part	Course Code	Title of the Course	Int. Hrs / Week	Credits	End Sem. Exam Hrs	Max. Marks		
							CIA	ESE	Total
I	I	25UT1/H1/F1	Language-I	6	3	3	25	75	100
	II	25UE1	English-I	6	3	3	25	75	100
	III	25UMB1CC1	Basic in Microbiology	5	5	3	25	75	100
		25UMB1CP1	Basic in Microbiology-Practical	4	3	3	40	60	100
		25UMB1AC1	Basic and Clinical Biochemistry	5	4	3	25	75	100
		25UMB2AP1	Basic and Clinical Biochemistry and Bioinstrumentation- Practical	2	--	--	--	--	--
	IV	25UVE	Value Education	2	2	3	25	75	100
			Value Added Course*	--	2*	2	50	50	100*
Total				30	20	-	-	-	600
II	I	25UT2/H2/F2	Language - II	6	3	3	25	75	100
	II	25UE2	English-II	6	3	3	25	75	100
	III	25UMB2CC2	Microbial diversity and Physiology	4	4	3	25	75	100
		25UMB2CP2	Microbial diversity and Physiology-Practical	3	3	3	40	60	100
		25UMB2AC2	Bioinstrumentation	3	3	3	25	75	100
		25UMB2AP1	Basic and Clinical Biochemistry and Bioinstrumentation- Practical	2	2	3	40	60	100
	IV	25UMB2NME1	Skill Enhancement Course-1 Nutrition & Health Hygiene(NME-1)	2	2	3	25	75	100
		25UES	Environmental Studies	2	2	3	25	75	100
			Value Added Course*	--	2*	2	50	50	100*

				Total	30	24	-	-	-	800
Semester	Part	Course Code	Title of the Course	Int. Hrs / Week	Credits	End Sem. Exam Hrs	Max. Marks			
							CIA	ESE	Total	
III				CIA	ESE	Total	25	75	100	
	II	25UE3	English-III	6	3	3	25	75	100	
	III	25UMB3CC3	Molecular Biology and Microbial Genetics	4	4	3	25	75	100	
		25UMB3CP3	Molecular Biology and Microbial Genetics-Practical	3	3	3	40	60	100	
		25UMB3AC3	Microbial Genomics and Proteomics	4	3	3	25	75	100	
		25UMB4AP2	Microbial Genomics and Proteomics and Food Processing Technology-Practical	3	--	--	--	--	--	
	IV	25UMB3NME2	Organic Farming & Biofertilizer Technology -NME-2	2	2	3	25	75	100	
		25UMB3SE1	Environmental Microbiology	2	2	3	25	75	100	
			Value Added Course*	--	2*	3	50	50	100*	
				30	20	-	-	-	700	
IV	I	25UT4/H4/F4	Language -IV	6	3	3	25	75	100	
	II	25UE4	English-IV	6	3	3	25	75	100	
	III	25UMB4CC4	Immunology and Immunotechnology	5	4	3	25	75	100	
		25UMB4CP4	Immunology and Immunotechnology-Practical	3	3	3	40	60	100	
		25UMB4AC4	Food Processing Technology	4	3	3	25	75	100	
		25UMB4AP2	Microbial Genomics and Proteomics and Food Processing Technology-Practical	3	2	3	40	60	100	
	IV	25UMB2SE2	Mushroom Technology	2	2	3	25	75	100	
		25UHW	Health and Wellness	1	1	--	--	--	100	
		Value Added Course*	--	2*	3	50	50	100*		

				Total	30	21	-	-	-	800
Semester	Part	Course Code	Title of the Course	Int. Hrs / Week	Credits	End Sem. Exam Hrs	Max. Marks			
							CIA	ESE	Total	
				5	5	3	25	75	100	
		25UMB5CC6	Virology and Parasitology	5	5	3	25	75	100	
		25UMB5CC7	Probiotic Technology	5	5	3	25	75	100	
		25UMB5CP3	Bacteriology and Mycology and Virology and Parasitology-Practical	5	4	3	40	60	100	
		25UMB5DE1	Recombinant DNA Technology	4	4	3	25	75	100	
		25UMB5DE2	Biosafety and Bioethics	4	4	3	25	75	100	
	IV	25USS	Soft Skills	2	2	3	25	75	100	
		25UMB5SI	Summer Internship	--	2*	3	--	--	100	
			Value Added Course*	--	2*	3	50	50	100*	
				Total	30	28	-	-	-	700
VI	III	25UMB6CC8	Soil and Environmental Microbiology	5	5	3	25	75	100	
		25UMB6CC9	Food, Dairy and Probiotic Microbiology	5	5	3	25	75	100	
		25UMB6CC10	Bioprocess Technology	5	5	3	25	75	100	
		25UMB6DE3	Pharmaceutical Microbiology	5	4	3	25	75	100	
		25UMB6DE4	Entrepreneurship and Bio-Business	4	4	3	25	75	100	
		25UMB6PW	Project Work	2	3	3	20	80	100	
	V	25UGS	Gender Studies	1	1	3	25	75	100	
			Extension Activity	--	1	--	--	--	--	
			Value Added Course*	--	2*	3	50	50	100*	
				Total	30	28	-	-	-	700
				Total	180	140				4300

Credit Distribution for B.Sc., MICROBIOLOGY

S.No	Part	Course Details	Credit
1	I&II	Language & English (Lang - 4x3=12, Eng - 4x3=12)	24
2	III	Core, Allied & Elective Course	94
3	IV	NME(2x2)	4
4		EVS(1x2)	2
5		Value Education(1x2)	2
6		Extension Activity(1x1)	1
		Gender Studies	1
7		<ul style="list-style-type: none"> • Skill Enhancement (5x2=10) • Foundation course 	10 2
			Total

❖ **LIST OF CORE COURSES OFFERED**

- Core Course I : Basic in Microbiology
- Core Course II : Practical I Basic in Microbiology
- Core Course III : Microbial diversity and Physiology
- Core Course IV : Core Practical II- Microbial diversity and Physiology
- Core Course V : Molecular Biology and Microbial Genetics
- Core Course VI : Practical III Molecular Biology & Microbial Genetics
- Core Course VII : Immunology and Immunotechnology
- Core Course VIII : Practical IV Immunology and Immunotechnology
- Core Course IX : Bacteriology and Mycology
- Core Course X : Virology and Parasitology
- Core course XI : Probiotic Technology
- Core Course XII : Practical V CC IX & CC X, CCXI
- Core Course XIII : Project with Viva-Voce - Group Project
- Core Course XIII : Soil and Environmental Microbiology
- Core Course XIV : Food, Dairy and Probiotic Microbiology
- Core Course XV : Bioprocess Technology

❖ **LIST OF ALLIED COURSES OFFERED**

- Allied Course-I : Basic and Clinical Biochemistry
- Allied Course II : Bioinstrumentation
- Allied Course III : Microbial genomics and Proteomics
- Allied Course IV : Probiotic Technology
- Allied Practical-I : Basic and Clinical Biochemistry& Bioinstrumentation
- Allied Practical-II : Microbial genomics and Proteomics and Food Processing Technology

❖ **LIST OF SKILL ENHANCEMENT COURSES OFFERED**

- ❖ Skill enhancement Course SEC - 1 (NME): Cosmetics Microbiology
- ❖ Skill Enhancement Course SEC-2 (NME): Nutrition & Health Hygiene
- ❖ Skill Enhancement Course SEC-3: Mushroom technology
- ❖ Skill Enhancement Course SEC -4 (Entrepreneurial Skill): Organic Farming & Biofertiliser Technology
- ❖ Skill Enhancement Course -5: Environmental Microbiology
- ❖ Skill Enhancement Course SEC -6: Softskill Development

❖ **LIST OF ELECTIVE COURSES OFFERED**

- ❖ Discipline Specific Elective- I: Recombinant DNA Technology
- ❖ Discipline Specific Elective II: Biosafety and Bioethics
- ❖ Discipline Specific Elective III: Pharmaceutical Microbiology
- ❖ Discipline Specific Elective IV: Entrepreneurship and Bio-Business

❖ **NOTE:**

	Internal Marks	External Marks
1. Theory	25	75
2. Practical	40	60
3. Separate passing minimum is prescribed for Internal and External marks		

❖ **FOR THEORY**

The passing minimum for CIA shall be 40% out of 25 marks [i.e. 10 marks]

The passing minimum for Semester Examinations shall be 40% out of 75 marks [i.e. 30 marks]

❖ **FOR PRACTICAL**

The passing minimum for CIA shall be 40% out of 40 marks [i.e. 16 marks]

The passing minimum for Semester Examinations shall be 40% out of 60 marks [i.e. 24 marks]

- Project: 100 Marks (The Project will be evaluated by an Internal and an External Examiner)

List of Value Added Courses

Course Code	Course Title
23UMBVA1	Hematology
23UMBVA2	Forensic Microbiology
23UMBVA3	Cancer cell Biology
23UMBVA4	First Aid and Emergency Care
23UMBVA5	Herbal Cosmetics
23UMBVA6	Spirulina Cultivation

Question Paper Pattern

UG Programme		
Maximum Marks : 75		Duration: 3 Hours
Section - A	i) a- (5 Questions for Multiple Choice) One question from each unit	5 x 1 = 5 Marks
	b- (5 Questions for Fill in the Blanks) One question from each unit	5 x 1 = 5 Marks
	ii) (5 short answer questions) One question from each unit	5 x 2 = 10 Marks
Section - B	5 Questions (Internal Choice: Either or) One set of questions from each unit	5 x 5 = 25 Marks
Section - C	3 Questions (Answer any 3 out of 5 Questions) One question from each unit	3 x 10 = 30 Marks

Sem.	Course Code	Credits	Title of the Course	CC / AC / DE / SE / GS / EVS / VE / VAC	Category			Sem. Exam	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
I	25UMB1CC1	5	BASIC IN MICROBIOLOGY	CC	5	5	-	3 Hrs.	25	75	100
Pre-Requisite:											
Course Objectives: The purpose of learning this course is:											
1. Learn the fundamental principles about different aspects of Microbiology including recent developments in the area.											
2. Describe the structural organization, morphology and reproduction of microbes.											
3. Explain the methods of cultivation of microbes and measurement of growth.											
4. Understand the microscopy and other basic laboratory techniques – culturing, disinfection and sterilization in Microbiology.											
5. Compare and contrast the different methods of sterilization.											
Course Outcomes:											
CO1: Study the historical events that led to the discoveries and inventions and understand the Classification of Microorganisms.											
CO2: Gain Knowledge of detailed structure and functions of prokaryotic cell organelles.											
CO3: Understand the various microbiological techniques, different types of media, and techniques involved in culturing microorganisms											
CO4: Explain the principles and working mechanism of different microscopes/Microscope, their function and scope of application.											
CO5: Understand the concept of asepsis and modes of sterilization and disinfectants.											
Unit-I									00 Hrs.		
History and Scope and Evolution of Microbiology, Classification – Three kingdom, five kingdom, six kingdom and eight kingdom. Basic concepts of Eubacteria, Archaeobacteria and Eucarya.											
Unit-II									00 Hrs.		
General characteristics of cellular microorganisms (Bacteria, Algae, Fungi and Protozoa) and acellular microorganisms - (Viruses, Viroids, Prions), Differences between prokaryotic and eukaryotic microorganisms. Structure of Bacterial cell wall, cell membrane, capsule, flagella, pili, mesosomes, chlorosomes, phycobilisomes, spores, and gas vesicles. Structure of fungi (Mold and Yeast), Structure of microalgae.											
Unit-III									00 Hrs.		
Bacterial culture media and pure culture techniques. Mode of cell division, Quantitative measurement of growth. Anaerobic culture techniques.											
Unit-IV									00 Hrs.		
Microscopy – Simple, bright field, dark field, phase contrast, fluorescent, electron microscope – TEM & SEM, Confocal microscopy, and Atomic Force Microscopy. Stains and staining methods.											

Unit-V	00 Hrs.
Sterilization–moist heat - autoclaving, dry heat – Hot air oven, radiation – UV, Ionization, filtration – membrane filter and disinfection, antiseptic; Antimicrobial agents	

Text Book(s):

1. Pelczar.M. J., Chan E.C.S. and Noel. R.K. (2007). Microbiology. 7th Edition., McGraw –Hill, New York.
2. Willey J., Sherwood L., and Woolverton C. J., (2017). Prescott's Microbiology. 10th Edition., McGraw-Hill International edition.
3. Tortora, G.J., Funke, B.R., Case, C.L. (2013). Microbiology. An Introduction 11th Edition., A La Carte Pearson.
4. Salle. A.J (1992). Fundamental Principles of Bacteriology. 7th Edition., McGraw Hill Inc. New York
5. Boyd, R.F. (1998). General Microbiology, 2nd Edition., Times Mirror, Mosby College Publishing, St Louis.

Reference Book(s):

1. Jeffrey C. Pommerville., Alcamo's Fundamentals of Microbiology (9th Edition). Jones & Bartlett learning 2010
2. Stanier R.Y, Ingraham J. L., Wheelis M. L., and Painter R. R. (2010). General Microbiology, 5th Edition., MacMillan Press Ltd.
3. Tortora, G.J., Funke, B.R. and, Case, C.L (2013). Microbiology-An Introduction, 11th Edition., Benjamin Cummings.
4. Nester E., Anderson D., Roberts C. E., and Nester M. (2006). Microbiology-A Human Perspective, 5th Edition., McGraw Hill Publications
5. Madigan M.T., Martinko J.M., Stahl D.A, and Clark D. P. (2010). Brock - Biology of Microorganisms, 13th Edition Benjamin-Cummings Pub Co.

Web Resources:

1. <https://www.cliffsnotes.com/study-guides/biology/microbiology/introduction-to-Microbiology/a-brief-history-of-microbiology>
2. <https://www.keyence.com/ss/products/microscope/bz-x/study/principle/structure.jsp>
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6604941/#>
4. <https://bio.libretexts.org/@go/page/9188>
5. <https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-nutrition/>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UMB1CC 1	Fundamentals Of Microbiology And Microbial Diversity					6	6			
Course Outcome s (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓	✓	✓	✓		✓	✓		
CO2	✓	✓	✓	✓		✓		✓	✓		
CO3	✓	✓	✓		✓	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓		✓	✓		
Number of Matches(✓) = 43 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Course Designed by	HOD
	Dr. R. ANBURAJ

Sem.	Course Code	Credits	Title of the Course	CC / AC / DE / SE / GS / EVS / VE / VAC	Category			Exam	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		INT	ESE	Total
I	25UMB1CP1	3	BASIC IN MICROBIOLOGY - PRACTICAL	CC	-		3	3 Hrs.	40	60	100
Pre-Requisite:											
Course Objectives: The purpose of learning this course is:											
1. Learn the fundamental principles about different aspects of Microbiology including recent developments in the area											
2. Describe the structural organization, morphology and reproduction of microbes.											
3. Explain the methods of cultivation of microbes and measurement of growth.											
4. Understand the microscopy and other basic laboratory techniques – culturing, disinfection and sterilization in Microbiology.											
5. Compare and contrast the different methods of sterilization.											
Course Outcomes:											
CO1: Study the historical events that led to the discoveries and inventions and understand the Classification of Microorganisms.											
CO2: Gain Knowledge of detailed structure and functions of prokaryotic cell organelles.											
CO3: Understand the various microbiological techniques, different types of media, and techniques involved in culturing microorganisms.											
CO4: Explain the principles and working mechanism of different microscopes/Microscope, their function and scope of application.											
CO5: Understand the concept of asepsis and modes of sterilization and disinfectants.											
List of Practicals											
1. Microscopy: light microscopy and bright field microscopy.											
2. Cleaning of glass wares, Microbiological good laboratory practice and safety.											
3. Sterilization and assessment of sterility – Autoclave, hot air oven, and membrane filtration.											
4. Media preparation: liquid media, solid media, semi-solid media, agar slants, agar deeps, agar plates, Preparation of basal, differential, enriched, enrichment, transport, and selective media preparation- quality control of media.											
5. Growth supporting properties, sterility check of media.											
6. Pure culture techniques: streak plate, pour plate, decimal dilution.											
7. Culture characteristics of microorganisms: growth on different media, growth characteristics, and description. Demonstration of pigment production.											
8. Staining techniques: smear preparation, simple staining, Gram's staining, Acid fast staining, Endospore staining and Capsular staining											

Text Book(s):

1. James G Cappucino and N. Sherman MB(1996). A lab manual Benjamin Cummins, New York 1996
2. Kannan. N (1996). Laboratory manual in General Microbiology. Palani Publications.
3. TSundararaj T (2005). Microbiology Lab Manual (1st edition) publications.
4. Gunasekaran, P. (1996). Laboratory manual in Microbiology. New Age International Ld., Publishers, New Delhi
5. R C Dubey and D K Maheswari (2002). Practical Microbiology. S. Chand Publishing.

Reference Book(s):

1. Atlas.R (1997). Principles of Microbiology, 2nd Edition, Wm.C.Brown publishers
2. Amita J, Jyotsna A and Vimala V (2018). Microbiology Practical Manual. (1st Edition). Elsevier India.
3. Talib VH (2019). Handbook Medical Laboratory Technology. (2nd Edition). CBS.
4. Wheelis M, (2010). Principles of Modern Microbiology, 1st Edition. Jones and Bartlett Publication.
5. Lim D. (1998). Microbiology, 2nd Edition, WCB McGraw Hill Publications.

Web Resources:

1. <http://www.biologydiscussion.com/micro-biology/sterilisation-and-disinfection-methods-and-principles-microbiology/24403>
2. <https://www.ebooks.cambridge.org/ebook.jsf?bid=CBO9781139170635>
3. https://www.grsmu.by/files/file/university/cafedry//files/essential_microbiology.pdf
4. <https://microbiologyinfo.com/top-and-best-microbiology-books/>
5. <https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	23UMB1CC2 P	CORE COURSE-II Practical I					3	3			
Course Outcome s (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓	✓	✓		✓	✓	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓	✓		✓	✓	✓	
CO4	✓	✓		✓	✓	✓	✓	✓		✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) = 42 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Course Designed by	HOD
	Dr. R. ANBURAJ

m.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			m. Exam	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
I	25UMB1AC1	3	BASIC AND CLINICAL BIOCHEMISTRY	AC	4	4	-	3 Hrs.	25	75	100
Pre-Requisite:											
Course Objectives: The purpose of learning this course is:											
1 Attain thorough knowledge on carbohydrates and lipids, their characteristic properties and organization in carrying out all the living functions which constitute the life.											
2. Explain the biological activity of amino acids and proteins.											
3. Identify the metabolic errors in enzymes of carbohydrates and lipids.											
4. Describe the disorders in amino acid metabolism.											
5. Interpret the consequences, biochemical, clinical features, diagnosis and treatment of metabolic diseases of day today life.											
Course Outcomes:											
CO1: Explain the structure, classification, biochemical functions and significance of carbohydrates and lipids											
CO2: Differentiate essential and non-essential amino acids, biologically important modified amino acids and their functions, Illustrate the role, classification of Proteins and recognize the structural level organization of proteins, its functions and denaturation.											
CO3: Assess defective enzymes and Inborn errors. Recognize diseases related to carbohydrate and lipid metabolism.											
CO4: Discuss and evaluate the pathology of amino acid metabolic disorders.											
CO5: Appraise the imbalances of enzymes in organ function and relate the role of Clinical Biochemistry in screening and diagnosis.											
Unit-I									00 Hrs.		
Biomolecules -Carbohydrate – General properties, function, structure, classification– monosaccharides (Glucose, Fructose and Galactose), Oligoaccharides (Sucrose, Maltose and Lactose) and polysaccharides (Starch and Glycogen,) and biological significance.											
Unit-II									00 Hrs.		
Amino acids – General properties, functions, structure, classification and biological significance. Proteins– General structure, Properties, functions, classification and biological significance.											
Unit-III									00 Hrs.		
Lipids – General properties, functions, structure, classification (Simple, Derived and Complex), Cholesterol, LDL, HDL – biological significance.											
Unit-IV									00 Hrs.		
Disorders of carbohydrate metabolism: diabetes mellitus, ketoacidosis, hypoglycemia, glycogen storage diseases, galactosemia and lactose intolerance.											

Unit-V		00 Hrs.
<p>Disorders of amino acid metabolism: alkaptonuria, phenylketonuria, phenylalaninemia, homocystinuria, tyrosinemia, aminoacidurias.</p> <p>Disorder of lipid hyperlipidemia, hyperlipoproteinemia, hypercholesterolemia, hypertriglyceridemia, sphingolipidosis.</p>		
<p>Text Book(s):</p> <ol style="list-style-type: none"> 1. Satyanarayana, U. and Chakrapani, U (2014). Biochemistry, 4th Edition, Made Simple Publisher 2. Jain J L, Sunjay Jain and Nitin Jain (2016). Fundamentals of Biochemistry, 7th Edition, S Chand Company. 3. Ambika Shanmugam's (2016). Fundamentals of Biochemistry for Medical Students, 8th Edition. Wolters Kluwer India Pvt Ltd 		

<p>Reference Book(s):</p> <ol style="list-style-type: none"> 1. Amit Kessel & Nir Ben-Tal (2018). Introduction to Proteins: structure, function and motion. 2nd Edition, Chapman and Hall. 2. David L. Nelson and Michael M. Cox (2017). Lehninger Principles of Biochemistry, 7th Edition W.H. Freeman and Co., NY. 3. Lupert Styrer, Jeremy M. Berg, John L. Tymoczko, Gatto Jr., Gregory J (2019). Biochemistry. 9th Edition, W.H. Freeman & Co. New York. 4. Donald Voet, Judith Voet, Charlotte Pratt (2016). Fundamentals of Biochemistry: Life at the Molecular Level, 5th Edition, Wiley. 5. Joy PP, Surya S. and Aswathy C (2015). Laboratory Manual of Biochemistry, Edition 1., Publisher: Kerala agricultural university.

<p>Web Resources:</p> <ol style="list-style-type: none"> 1. https://www.abebooks.com › plp 2. https://kau.in/document/laboratory-manual-biochemistry 3. https://metacyc.org 4. https://www.medicalnewstoday.com 5. https://journals.indexcopernicus.com

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
I	23UMB1AC 1	Allied Course – I Basic and Clinical Biochemistry	5	4						
Course Outcome s (COs)	Programme Outcomes (Pos)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	✓	✓		✓	✓	✓		✓	✓	
CO2	✓	✓		✓	✓	✓	✓	✓	✓	✓
CO3	✓			✓	✓	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches(✓) = 44 Relationship: High										

1.

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Course Designed by	HOD
	Dr. R. ANBURAJ

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE / SE / GS / EVS/ VE / VAC	Category			m. Exam	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		INT	ESE	Total.
I	25UMB1CP1	2	BASIC AND CLINICAL BIOCHEMISTRY AND BIOINSTRUMENTATION - PRACTICAL	AC	-	-	-	3 Hrs.	40	60	100
Pre-Requisite:											
Course Objectives: The purpose of learning this course is:											
1. Able to analyse the given carbohydrate systematically											
2. Able to analyse amino acids systematically											
3. Able to characterize lipids											
Course Outcomes:											
CO1: Perform qualitative analysis of sugars											
CO2: Perform qualitative analysis of Amino acids.											
CO3: Demonstrate the amino acid quantitatively											
CO4: Predict the amount of proteins.											
CO5: Demonstrate on paper and Thin Layer Chromatography											
List of Experiments									00 Hrs.		
1. Qualitative Analysis of Carbohydrates 2. Qualitative Analysis of Protein 3. Qualitative Analysis of Lipids 4. Estimation of glucose. 5. Estimation of amino acid by Anthrone Method 6. Analysis of Uric acid in Blood 7. Separation of serum and Plasma 8. Analysis of Bile salt in Urine 9. Estimation of Protein by Lowry's method. 10. Thin Layer Chromatography 11. Agarose Gel Electrophoresis											

Reference Book(s):

1. Keith Wilson and John Walker. Principles and Techniques of Practical Biochemistry, 4th edition, Cambridge University press, Britain. 1995.
2. Oser BL Hawks. Physiological Chemistry, TATA Mc Graw Hill. 1965.
3. Strolv BA, Makavora VC. Laboratory manual in Biochemistry. MIR Publisher, Moscow. 1989

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	23UMB2AP 2	Allied Practical I					2	2			
Course Outcome s (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO1	✓	✓	✓	✓	✓	✓		✓	✓		
CO2	✓		✓	✓	✓	✓		✓	✓		
CO3	✓	✓	✓	✓	✓	✓		✓	✓		
CO4	✓	✓	✓	✓	✓	✓		✓	✓		
CO5	✓	✓	✓	✓		✓		✓	✓		
Number of Matches(✓) = 38 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Course Designed by	HOD
	Dr. R. ANBURAJ

Sem.	Course Code	Credits	Title of the Course	CC / AC / DE / SE / GS / EVS / VE / VAC	Category			Sem. Exam	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total
II	25UMB2CC2	4	MICROBIAL DIVERSITY AND PHYSIOLOGY	CC	4	4	-	3 Hrs.	25	75	100
Prerequisite:											
Course Objectives: The purpose of learning this course is:											
1 Study the basic principles of microbial growth.											
2. Understand the basic concepts of aerobic and anaerobic metabolic pathways.											
3. Analyze the role of individual components in overall cell function.											
4 Provide information on sources of energy and its utilization by microorganisms.											
5. Study the different types of metabolic strategies											
Course Outcomes:											
CO1: Describe microorganisms based on nutrition.											
CO2: Know the concept of microbial growth and identify the factors affecting bacterial growth											
CO3: Explain the methods of nutrient uptake.											
CO4: Describe anaerobic and aerobic energy production.											
CO5: Elaborate on the process of bacterial photosynthesis and reproduction											
Unit-I									00 Hrs.		
Physiology of microbial growth: Batch – continuous - synchronous cultures; Growth Curve and measurement method (turbidity, biomass, and cell count). Control of microbial growth. Microbial biodiversity: Introduction to microbial biodiversity- ecological niche. Conservation of Biodiversity.											
Unit-II									00 Hrs.		
Nutrition requirements - Photoautotrophs, Photoorganotrophs, Chemolithotrophs (Ammonia, Nitrite, Sulfur, Hydrogen and Iron oxidizing Bacteria), Chemoorganotrophs. Nutrition transport mechanisms – Passive diffusion , Active transport and Group translocation. Factors affecting microbial growth.											
Unit-III									00 Hrs.		
Bacterial Cell Division - Binary fission, Budding, Reproduction through conidia, cyst formation, endospore formation asexual and sexual reproduction of Fungi, Microalgae and Protozoa.											
Unit-IV									00 Hrs.		
Metabolism and Catabolism- Embden Meyerhof Pathway, Entner-Doudoroff Pathway, Pentose Phosphate Pathway, Tricarboxylic Acid Cycle. Electron Transport Chain and Oxidative Phosphorylation. ATP synthesis. Fermentation-Homolactic Fermentation, Heterolactic Fermentation, Mixed Acid Fermentation, Butanediol Fermentation.											
Unit-V									00 Hrs.		
Photosynthesis - An Overview of chloroplast structure. Photosynthetic Pigments, Light Reaction-Cyclic and non-cyclic Photophosphorylation. Dark Reaction - Calvin Cycle.											

Text Book(s):

1. Schlegel, H.G. (1993). General Microbiology.,7th Edition, Press syndicate of the University of Cambridge.
2. RajapandianK.(2010). Microbial Physiology, Chennai: PBS Book Enterprises India.
3. MeenaKumari. S. Microbial Physiology, Chennai 1st Edition MJP Publishers 2006.
4. Dubey R.C. and Maheswari, S. (2003). A textbook of Microbiology, New Delhi: S. Chand & Co.
5. S. Ram Reddy, S.M. Reddy (2008). Microbial Physiology. Anmol Publications Pvt Ltd

Reference Book(s):

1. Robert K. Poole (2004). Advances in Microbial Physiology, Elsevier Academic Press, New York, Volume 49
2. Kim B.H., Gadd G.M. (2008). Bacterial Physiology and Metabolism. Cambridge University Press, Cambridge
3. Daniel R. Caldwell. (1995). Microbial Physiology & Metabolism Wm.C. Brown Communications, Inc. USA
4. Moat, A.G and J.W Foaster (1995). Microbial Physiology, 3rd edition. Wiley – LISS, A John Wiley & Sons. Inc. Publications.
5. BhanuShrivastava. (2011). Microbial Physiology and Metabolism: Study of Microbial Physiology and Metabolism. Lambert academic Publication

Web Resources:

1. <https://sites.google.com/site/microbialphysiologyoddsem/teaching-contents>
2. <https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-Nutrition>
3. https://onlinecourses.swayam2.ac.in/cec20_bt14/preview
4. http://web.iitd.ac.in/~amittal/2007_Addy_Enzymes_Chapter.pdf
5. <https://www.frontiersin.org/microbial-physiology-and-metabolism>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	23UMB2CC 3	Microbial Physiology and Metabolism					5	5			
Course Outcome s (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓	✓	✓		✓	✓	✓	✓		✓	
CO3	✓	✓		✓	✓	✓	✓	✓	✓	✓	
CO4	✓		✓	✓	✓	✓	✓	✓	✓	✓	
CO5	✓			✓	✓	✓	✓	✓	✓		
Number of Matches (✓) = 43 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Course Designed by	HOD
	Dr. R. ANBURAJ

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE/ SE/ GS/ EVS/ VE/ VAC	Category			Sem. Exam	Max. Marks		
					Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
II	25UMB2CP2 P	3	Microbial Diversity and Physiology - Practical	CC	-	3	3	3 Hrs.	40	60	100
Pre-Requisite:											
Course Objectives: The purpose of learning this course is:											
1. Understand the principles of motility test.											
2. Understand the basic concepts of staining methods.											
3. Learn the bacterial count using different methods and anaerobic culture.											
4. Study the morphological demonstration of microorganisms and identification.											
5. Study the biochemical identification of the bacteria											
Course Outcomes:											
CO1: Describe hanging drop, wet mount preparation, semi-solid agar, Craigie's tube method.											
CO2: Demonstrate Smear preparation, permanent specimen preparation, Capsular, and Acid-fast staining											
CO3: Explain antibiotic sensitivity testing: Disc diffusion test- quality control with standard strains.											
CO4: Describe demonstration of the size of yeast, fungal filaments and protozoa.											
CO5: Elaborate on the bacterial identification- morphological, physiological, and biochemical methods											
List of Experiments										00 Hrs.	
<ol style="list-style-type: none"> 1. Microbial Growth Curve 2. Bacterial Growth Measurement Using Heamocytometer in direct method 3. Bacterial Growth Measurement Using Spectrophotometer in indirect method 4. Effect of Temperature, Ph Nutritional source on Bacterial growth 5. Biochemical methods - IMViC test, H2S, TSI, Oxidase, catalase, urease test 6. Carbohydrate fermentation test 7. Demonstration of the size of yeast, fungal filaments and protozoa. 8. Aerobic and Anaerobic culture methods 9. Antibiotic sensitivity testing: Disc diffusion test- quality control with standard strains. 10. Maintenance of pure culture, paraffin method, stab culture, maintenance of mold culture. 											

Text Book(s):

1. James G Cappucino and N. Sherman MB (1996). A lab manual Benjamin Cummins, New York.
2. Kannan. N (1996). Laboratory manual in General Microbiology. Palani Publications.
3. Sundararaj T (2005). Microbiology Lab Manual (1st edition) publications.
4. Gunasekaran. P (2007). Laboratory manual in Microbiology. New age international publisher.
5. Elsa Cooper (2018). Microbial Physiology: A Practical Approach. Callisto

Web Resources:

1. <https://sites.google.com/site/microbialphysiologyoddsem/teaching-contents>
2. <https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-nutrition>
3. https://onlinecourses.swayam2.ac.in/cec20_bt14/preview
4. <https://www.studocu.com/microbial-physiology-practicals>
5. <https://www.agr.hokudai.ac.jp/microbial-physiology>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	23UMB2CC4 P	Practical II- Microbial Physiology and Metabolism					3	3			
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓		✓	✓	✓	✓		✓		
CO2	✓	✓		✓	✓	✓	✓	✓		✓	
CO3	✓	✓		✓	✓	✓	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	✓	✓	✓	✓		✓	
CO5	✓	✓	✓	✓	✓	✓		✓	✓		
Number of Matches (✓) = 41 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Course Designed by	HOD
	Dr. R. ANBURAJ

Sem.	Course Code	Credits	Title of the Course	CC / AC / DE / SE / CS / EYS /	Category	m.	Max. Marks
------	-------------	---------	---------------------	--------------------------------	----------	----	------------

				Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.		CIA	ESE	Total.
II	25UMB2AC2	3	BIOINSTRUMENTATION	AC	3	3	3 Hrs.	25	75	100
Pre-Requisite:										
Course Objectives: The purpose of learning this course is:										
1. Understand the analytical instruments and study the basic principles in the field of sciences										
2. To gain knowledge about principles of spectroscopy										
3. Understand the analytical techniques of Chromatography and electrophoresis										
4. To understand the principle of different types of scans used in medical diagnosis										
5. To gain information about the principles of radioactivity and its measurements										
Course Outcomes:										
CO1: Able Gain knowledge about the basics of instrumentation.										
CO2: Exemplify the structure of atoms and molecules by using the principles of spectroscopy.										
CO3: Evaluate by separating and purifying the components.										
CO4: Understand the need and applications of imaging techniques.										
CO5: Categorize the working principle and applications of fluorescence and radiation										
Unit-I										00 Hrs.
Basic instruments: pH meter, Preparation of standard solution – Primary and Secondary standard graph. Biochemical calculations-preparations of Molar solutions - Buffers- Phosphate, Acetate, TE, TAE- calculation of Normality ,PPM- Ammonium sulphate precipitation. Buffer of biological importance, Laminar Air Flow, Autoclave, Hot Air Oven and Incubator.										
Unit-II										00 Hrs.
Centrifuge- Preparative, Analytical and Ultra, Spectroscopic Techniques: Spectroscopic Techniques: Colorimeter, Ultraviolet and visible, Infra red and Mass Spectroscopy.										
Unit-III										00 Hrs.
Chromatographic and Electrophoresis Techniques: Chromatographic Techniques: Paper, Thin Layer, Column, HPLC and GC. Electrophoresis Techniques: Starch Gel, AGE, PAGE										
Unit-IV										00 Hrs.
Imaging techniques: Principle, Instrumentation and application of ECG, EEG, EMG, MRI, CT and PET scan radioisotopes.										
Unit-V										00 Hrs.
Fluorescence and radiation based techniques: Spectrofluorimeter, Flame photometer, Scintillation counter, Geiger Muller counter, Autoradiography.										

Reference Book(s):

1. Rodney.F.Boyer (2000). Modern Experimental Biochemistry, 3rd Edition. Pearson Publication
2. SkoogA.,WestM (2014). Principles of Instrumental Analysis – 14th Edition W.B.SaundersCo.,Philadephia
3. N.Gurumani. (2006). Research Methodology for biological sciences- 1st Edition – MJP Publishers
4. Wilson K, and Walker J (2010). Principles and Techniques of Biochemistry and Molecular Biology.7th Edition. Cambridge University Press
5. Webster, J.G. (2004). Bioinstrumentation- 4th Edition - John Wiley & Sons (Asia) Pvt. Ltd, Singapore

Web Resources:

1. <http://www.biologydiscussion.com/biochemistry/centrifugation/centrifugeintroduction-types-uses-and-other-details-with-diagram/12489>
2. <https://www.watelectrical.com/biosensors-types-its-working-andapplications/>
3. <http://www.wikiscales.com/articles/electronic-analytical-balance/ Page 24 of 75>
4. <https://study.com/academy/lesson/what-is-chromatography-definition-typesuses.html>
5. <http://www.rsc.org/learn-chemistry/collections/spectroscopy/introduction>

Text Book(s):

1. Jayaraman J (2011). Laboratory Manual in Biochemistry, 2nd Edition. Wiley Eastern Ltd., New Delhi.
2. Ponnurugan. P and Gangathara PB (2012). Biotechniques.1st Edition. MJP publishers.
3. Veerakumari, L (2009).Bioinstrumentation- 5th Edition -.MJP publishers.
4. Upadhyay, Upadhyay and Nath (2002). Biophysical chemistry – Principles and techniques 3rd Edition. Himalaya publishing home.
5. Chatwal G and Anand (1989). Instrumental Methods of Chemical Analysis. S.Himalaya Publishing House, Mumbai

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	23UMB2AC 2	Allied Course II - Bioinstrumentation					4	3			
Course Outcome s (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO1	✓		✓	✓		✓	✓	✓	✓	✓	
CO2	✓	✓		✓	✓	✓		✓	✓		
CO3	✓	✓	✓		✓	✓	✓	✓		✓	
CO4	✓	✓	✓		✓	✓		✓	✓		
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) = 42 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Course Designed by	HOD
	Dr. R. ANBURAJ

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE /	Category	em.	Max. Marks
------	-------------	---------	---------------------	---------------	----------	-----	------------

				SE / GS / EVS / VE / VAC	Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.	Exam	CIA	ESE	Total.
II	25UMB2AP1	2	LAB IN BASIC AND CLINICAL BIOCHEMISTRY & BIOINSTRUMENTATION		-	2	2	3 Hrs.	40	60	100

Pre-Requisite:

Course Objectives: The purpose of learning this course is:

1. To introduce students to the fundamental biochemical instruments and their principles.
2. To provide hands-on training in the preparation of standard solutions and buffer systems.
3. To teach accurate biochemical calculations including molarity, normality, and PPM.
4. To familiarize students with sterilization equipment like autoclave, hot air oven, and laminar air flow.
5. To impart knowledge on different types of centrifuges and their biochemical applications.

Course Outcomes:

- CO1: Understand and explain the working principles of basic biochemical instruments.
 CO2: Prepare accurate standard solutions and buffers for experimental needs.
 CO3: Perform calculations involving molarity, normality, ppm, and buffer capacity.
 CO4: Demonstrate proficiency in using sterilization and incubation equipment in a laboratory setting.
 CO5: Use centrifugation techniques for the separation of cellular components.

List of Experiments

00 Hrs.

1. Demonstrate the working and precautions of a Laminar Air Flow chamber.
2. Perform sterilization using an autoclave and hot air oven; compare methods.
3. Determine the absorption maxima of a dye solution using a UV-Visible spectrophotometer.
4. Perform Thin Layer Chromatography (TLC) to separate plant pigments.
5. Run an AGE (Agarose Gel Electrophoresis) to separate DNA fragments and visualize the bands.
6. Use a colorimeter to construct a standard curve and determine unknown sample concentration.
7. Determine the pH of given solutions using a pH meter.
8. Demonstrate the use of an incubator for microbial growth at specific temperatures.

Text Book(s):

1. Biochemical Methods – SADASIVAM AND MANICKAM
2. Introductory Practical Biochemistry – DAVID T. PLUMMER
3. Practical Biochemistry: Principles and Techniques – KEITH WILSON AND JOHN WALKER
4. Laboratory Manual in Biochemistry – J. JAYARAMAN
5. A Laboratory Manual for Biochemistry – R. HARISHA

Web Resources:

1. <https://pubchem.ncbi.nlm.nih.gov>
2. <https://ocw.mit.edu>
3. <https://www.thermofisher.com>
4. <https://www.protocols.io>
5. <https://www.bio-rad.com/en-in/education>

Course Designed by	HOD
	Dr. R. ANBURAJ

Sem.	Course Code	Credits	Title of the Course	CC / AC / DE /	Category	em.	Max. Marks
-------------	--------------------	----------------	----------------------------	-----------------------	-----------------	------------	-------------------

				SE / GS / EVS / VE / VAC	Theo. Hrs.	Tutorial Hrs.	Lab. Hrs.	Exam	CIA	ESE	Total.
II	25UMB2NME1	2	SKILL ENHANCEMENT COURSE -SEC-II (NME) – NUTRITION & HEALTH HYGIENE	SE		2		3 Hrs.	25	75	100

e-Requisite:

Course Objectives: The purpose of learning this course is:

1. Learn about nutrition and their importance.

6. Make student understand the nutritional facts for a better life

3. Learn information to optimize our diet

4. Impart knowledge on different health care programs taken up by India

5. Learn knowledge on different health indicators and types of hygiene methods

Course Outcomes:

CO1: Learn the importance of nutrition for a healthy life

CO2: Study the nutrition for life cycle.

CO3: Know the health care programmes of India.

CO4: Learn the importance of community and personal health & hygiene measures

CO5: Create awareness on community health and hygiene

Unit-I 00 Hrs.

Nutrition – definition, importance, Good nutrition, and mal nutrition; Balanced Diet: Basics of Meal Planning. Carbohydrates, Lipids, Proteins and Vitamins – functions, dietary sources, effects of deficiency. Macro and micro minerals – Example and functions, effects of deficiency; Importance of water – functions, sources, requirements and effects of deficiency.

Unit-II 00 Hrs.

Nutrition for Life Cycle: Balanced diet - Normal, Pregnant, lactating women, Infancy, young children Adolescents, Adults, and the Elderly; Diet Chart; Nutritive value of Indian foods.

Unit-III 00 Hrs.

Improper diets: Definition, Identification, Signs and Symptoms - malnutrition, under-nutrition, over-nutrition, Protein Energy Malnutrition, obesity; Nutritional Disease and Disorder - hypertension, diabetes, anemia, osteomalacia, cardiovascular disease.

Unit-IV 00 Hrs.

Health - Determinants of health, Key Health Indicators, Environment health & Public health; Health-Education: Principles and Strategies. Health Policy & Health Organizations: Health Indicators and National Health Policy of Govt. of India; Functioning of various nutrition and health organizations in India.

Unit-V 00 Hrs.

Hygiene – Definition; Personal, Community, Medical and Culinary hygiene; WASH (Water, Sanitation and Hygiene) programme. Rural Community Health: Village health sanitation & Nutritional committee. Community & Personal Hygiene: Environmental Sanitation and Sanitation in Public places. Health Programme – Malaria, AIDS, Corona vaccination.

Text Book(s):

1. Bamji, M.S., K. Krishnaswamy & G.N.V. Brahmam (2009) Textbook of Human Nutrition (3rd edition) Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Swaminathan (1995) Food & Nutrition (Vol I, Second Edition) The Bangalore Printing
3. SK. Haldar (2022). Occupational Health and Hygiene in Industry. CBS Publishers
4. Acharya, Sankar Kr, Rama Das, Minati Sen (2021). Health Hygiene and Nutrition
6. Perception and Practices. Satish Serial Publishing House
5. Dass (2021). Public Health and Hygiene, Notion Press

Reference Book(s):

1. Vijaya Khader (2000) Food, nutrition & health, Kalyan Publishers, New Delhi
2. Srilakshmi, B., (2010) Food Science, (5th Edition) New Age International Ltd., New Delhi
3. Arvind Kumar Goel (2005). A College Textbook of Health & Hygiene, ABD Publishers
4. Sharma D. (2015). Textbook on Food Science and Human Nutrition. Daya Publishing House
5. Revilla M. K. F., Titchenal A. and Draper J. (2020). Human Nutrition. University of Hawaii, Mānoa

Web Resources:

1. [National Rural Health Scheme:](https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=969&lid=49)
[https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=969&lid=49.](https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=969&lid=49)
2. [National Urban Health Scheme:](https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=970&lid=137)
[https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=970&lid=137.](https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=970&lid=137)
3. [Village health sanitation & Nutritional committee:](https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=149&lid=225)
[https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=149&lid=225.](https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=149&lid=225)
4. [Health Impact Assessment -](https://www.who.int/hia/about/faq/en/) <https://www.who.int/hia/about/faq/en/>
5. [Healthy Living](https://www.nhp.gov.in/healthylivingViewall) <https://www.nhp.gov.in/healthylivingViewall>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
III	23UMB2SE 2	SEC-II (NME) Nutrition and health Hygiene					2	2			
Course Outcome s (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					
	PO1	PO2	PO 3	PO 4	PO 5	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓		
CO2	✓	✓	✓	✓	✓	✓		✓	✓		
CO3	✓	✓		✓		✓	✓	✓		✓	
CO4	✓		✓	✓	✓	✓	✓	✓		✓	
CO5	✓	✓	✓	✓		✓		✓	✓		
Number of Matches(✓) = 39 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Course Designed by	HOD
	Dr. R. ANBURAJ

Sem.	Course Code	Credits	Title of the Course	CC / AC/ DE/ SE/ GS / EVS/ VE / VAC	Category			Exam	Max. Marks		
					Theo.	Tutorial	Lab.		CIA	ESE	Total.

			MUSHROOM TECHNOLOGY	Hrs.	Hrs.	Hrs.				
II	25UMB2SE3	2			2		3 Hrs.	25	75	100
Pre-Requisite:										
Course Objectives: The purpose of learning this course is:										
1. Acquire knowledge on the concepts of origin, growth and study of Mushroom Technology										
2. Describe the morphology of Mushroom										
3. Discuss effective management of Mushroom Production										
4. Demonstrate field skills in Mushroom Cultivation and their Nutritional Benefits.										
5. Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises										
Course Outcomes:										
CO1: Discuss the overall aspects of Scope of Mushroom Cultivation.										
CO2: Creates awareness among students about the economic importance and suitability of Mushroom Cultivation.										
CO3: Explain the Procedure for Spawn Preparation and Production										
CO4: Attain thorough knowledge about the Nutritional benefits of Mushroom.										
CO5: Acquire knowledge on Mushroom diseases and Value added Products from Mushroom.										
Unit-I										00 Hrs.
Introduction to Mushroom History and Scope of Mushroom Cultivation; Taxonomical rank of Mushroom; Vegetative characters of edible and poisonous mushrooms.										
Unit-II										00 Hrs.
Common edible Mushrooms Button Mushroom (<i>Agaricus bisporous</i>), Oyster mushroom (<i>Pleurotus sajorajju</i>), paddy straw mushroom (<i>Volvariella volvacea</i>), Milky Mushroom (<i>Calocybe indica</i>); Other economically important and medicinal mushroom- Shiitake Mushroom (<i>Lentinula edodes</i>), Kabul Dhingri (<i>King Oyster</i>) Mushroom.										
Unit-III										00 Hrs.
Principle of Mushroom Cultivation -Structure and construction of mushroom house. Sterilization of substrates. Spawn production culture media preparation, Preparation of mother spawn, production of planting spawn, storage/transportation of spawn, Criteria for selection of good quality spawn. Cultivation of Button mushroom and paddy straw mushroom; Introduction to microbiology laboratory Laminar Air flow, Autoclave.										
Unit-IV										00 Hrs.
Nutritional and health benefits of Mushroom -Nutritional and health benefits of mushrooms. Therapeutic aspects- antitumor effects.										
Unit-V										00 Hrs.
Disease and Pest Management in cultivated mushrooms Dry Bubble and wet bubble- Major diseases of cultivated mushroom; Major insect pests Mushroom flies / nematodes / mites. Value addition of Mushroom Value added products / recipes, Quality assurance, Packing and packaging, Market opportunities.										

Reference Book(s):

1. Pandey, R.K. and Ghosh, S.K. (2018). A handbook of Mushroom Cultivation. Emkey Publication.
2. Pathak, V.N. and Yadav, N. (2008). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
3. Nita, B. (2000). Handbook of Mushrooms. Vol 1 & 2. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Tewari, P. and Kapoor S.C. (2008). Mushroom Cultivation, Mittal Publication, New Delhi.

Web Resources:

1. https://indiaagronet.com/indiaagronet/Mushroom_cultivation/Spawn.htm
2. <https://www.medicalnewstoday.com/articles/278858#:~:text=Mushrooms%20contain%20protein%2C%20vitamins%2C%20minerals,metabolism%20and%20other%20bodily%20processes.>
3. <https://www.everydayhealth.com/diet-nutrition/potential-health-benefits-of-mushrooms/>

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
III	23UMB2SE 3	SEC – III MUSHROOM TECHNOLOGY					2	2				
Course Outcome (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	✓	✓		✓	✓		✓	✓	✓			
CO2	✓	✓	✓	✓	✓	✓		✓	✓			
CO3	✓	✓		✓		✓	✓			✓		
CO4	✓		✓	✓	✓		✓	✓		✓		
CO5	✓	✓		✓		✓		✓	✓			
Number of Matches(✓) = 38 Relationship: High												

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Course Designed by	HOD
	Dr. R. ANBURAJ