KANNUR UNIVERSITY

(Abstract)

First to fourth Semester Scheme and Syllabus of the B.Sc. Microbiology Programme in tune with KU-FYUGP Regulations 2024 with effect from 2024 Admission onwards- Approved- Implemented- Orders Issued

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FYUGP Spl.cell

ACAD C/ACAD C3/21878/2024 Dated: 25.10.2024

Read:-1. U.O. No. FYUGPSC/FYSC-I/5074/2024, dated: 18/04/2024

2. The Minutes of the Meeting of the Scrutiny Committee held on 19.06.2024

3. E-mail of the Chairperson, Board of Studies in Microbiology (Cd), dated 24.06.2024

4. The Orders of the Vice Chancellor on 24.06.2024

5. The Minutes of the Meeting of the Academic Council, held on 25.06.2024

ORDER

1.The Regulations of the Kannur University Four Year UG Programmes (KU-FYUGP Regulations 2024) for affiliated Colleges was implemented with effect from 2024 admission onwards, vide paper read as(1) above.

2.Thereafter, the Scrutiny Committee, which included the Dean, Faculty of Science vide paper read as (2) above, scrutinized the Syllabus of the B.Sc.Microbiology programme for first to fourth semesters submitted by the Chairperson, Board of Studies in Microbiology(Cd) and recommended certain suggestions.

3.Subsequently, vide paper read as (3) above, the Chairperson, Board of Studies in Microbiology(Cd) forwarded the modified Syllabus of the B.Sc. Microbiology programme for first to fourth Semesters, prepared in tune with KUFYUGP Regulations 2024 with effect from 2024 Admission onwards.

4. Thereafter, the Vice Chancellor ordered to place the same before the Academic Council for consideration, as per the paper read (4) above.

5. Accordingly, the Syllabus of the B.Sc. Microbiology programme for first to fourth semesters in tune with KU-FYUGP Regulations 2024 was approved by the meeting of the Academic Council held on 25-06-2024 and granted permission to publish the same, as and when it is ready, after making the necessary modifications, as per paper read as (6) above.

6.The Vice Chancellor approved the Minutes of the aforesaid meeting of the Academic Council and the Syllabus of the B.Sc. Microbiology programme for first to fourth Semesters, prepared in tune with KU-FYUGP Regulations, 2024.

7.The approved Syllabus for the first to fourth semester of the B.Sc. Microbiology programme is appended with this U.O. and uploaded in the University website.

Orders are issued accordingly.

Sd/-

ANIL CHANDRAN R

DEPUTY REGISTRAR (ACADEMIC)

For REGISTRAR

To: The Principals of Arts and Science Colleges affiliated to Kannur University

Copy To: 1. The Examination Branch (through PA to CE)

2. The Chairperson, Board of Studies in Microbiology (Cd)
3. PS to VC/PA to R
4. DR/AR (Academic)
5. The IT Cell (For uploading in the website)
6. SF/DF/FC

Forwarded / By Order

SECTION OFFICER

KANNUR UNIVERSITY

FYUGP

MICROBIOLOGY SYLLABUS

(w.e.f. 2024 Admission)

Contents

Board of Studies in Microbiology (UG & PG Combined)

Chairperson

Dr. Soorej M Basheer (Associate Professor, Dept. of Molecular Biology, Dr. Janaki Ammal Campus, Palayad, Kannur University)

Members

1. Dr. Sabu Abdulhameed (Professor, Dept. of Biotechnology & Microbiology, Dr. Janaki Ammal Campus, Palayad, Kannur University)
2. Ramesan. C.K.V (Assistant Professor in Microbiology, Sree Narayana College, Kannur)
3. Dr. Sinosh Skariyachan (Assistant Professor in Microbiology, St. Pius X College, Rajapuram)
4. Dr. N.V. Vinod (Assistant Professor in Microbiology, St. Pius X College, Rajapuram)
5. Dr. Sarala Gopalakrishnan (Retd. Associate Professor, Dept. of Microbiology, St. Pius X College, Rajapuram)
6. Dr. Ayana N. (Assistant Professor, Dept. of Microbiology, Sree Narayana College, Kannur)
7. Dr. Suboj Babykutty (Assistant Professor, Dept. of Zoology, Mar Ivanios College, Thriuvananthapuram)
8. Dr. Sunish K.S. (Assistant Professor, Dept. of Zoology, Maharajas College, Ernakulam)
9. Dr. Krishnakumar B. (Senior Principal Scientist, NIIST-CSIR, Thiruvananthapuram)
10. Dr. Beena P.S. (Director, Omics Gen Life Sciences Pvt Ltd. Kalamassery)

KANNUR UNIVERSITY

FYUGP

Microbiology Syllabus

About the program:

Microbiology is the scientific study of microorganisms, a diverse group of microscopic entities that include bacteria, viruses, fungi, and protozoa. This field is fundamental to understanding the biological processes that govern life on Earth, as well as the roles microorganisms play in health, disease, agriculture, and industry.

The four-year Bachelor of Science (B.Sc.-Hons) program in Microbiology at Kannur University is designed to provide students with a comprehensive understanding of the theoretical and practical aspects of microbiology. The curriculum is structured to equip students with the necessary knowledge and skills to pursue careers in research, healthcare, pharmaceuticals, environmental science, and biotechnology, or to continue their studies at the postgraduate level or research.

Graduate Attributes

Kannur University is fundamentally dedicated to nurturing well-rounded individuals with a comprehensive set of graduate attributes. Graduates from Kannur University emerge equipped with a multidisciplinary approach, allowing them to integrate knowledge across various domains for a holistic understanding of complex issues. With a strong emphasis on critical thinking and effective problem-solving skills, Kannur University's graduates demonstrate intellectual curiosity and the ability to tackle challenges creatively. Proficient in communication and social interaction, they engage adeptly in diverse settings, fostering collaboration and effective interpersonal connections. Moreover, the graduates embody effective citizenship and leadership, showcasing a sense of responsibility, community engagement, and leadership qualities. With a global perspective, ethical grounding, and a commitment to environmental sustainability, our students are well-prepared for active participation in an interconnected world. Embracing self-directed and lifelong learning, they continually adapt to evolving challenges, embodying the university's commitment to producing resilient, knowledgeable, and socially responsible individuals.

Program Outcomes (POs):

Program Outcomes (POs) serve as a foundational framework defining the skills, knowledge, and attributes that students at Kannur University are expected to acquire upon completion of a specific academic program. Tailored to the unique goals of each program, POs articulate the overarching learning objectives that guide curriculum design and assessment. These outcomes encompass a diverse range of competencies, including critical thinking, problem-solving, effective communication, and discipline-specific expertise. POs play a crucial role in shaping educational experiences, ensuring alignment with academic standards and industry expectations. By articulating clear and measurable expectations, POs contribute to the continuous improvement of academic programs and provide a roadmap for students to develop into well-rounded, competent professionals within their chosen fields.

PO1: **Critical Thinking and Problem-Solving**-Apply critical thinking skills to analyze information and develop effective problem-solving strategies for tackling complex challenges.

PO2: **Effective Communication and Social Interaction**-Proficiently express ideas and engage in collaborative practices, fostering effective interpersonal connections.

PO3: **Holistic Understanding**-Demonstrate a multidisciplinary approach by integrating knowledge across various domains for a comprehensive understanding of complex issues.

PO4: **Citizenship and Leadership**-Exhibit a sense of responsibility, actively contribute to the community, and showcase leadership qualities to shape a just and inclusive society.

PO5: **Global Perspective**-Develop a broad awareness of global issues and an understanding of diverse perspectives, preparing for active participation in a globalized world.

PO6: **Ethics, Integrity and Environmental Sustainability**-Uphold high ethical standards in academic and professional endeavors, demonstrating integrity and ethical decision-making. Also acquire an understanding of environmental issues and sustainable practices, promoting responsibility towards ecological well-being.

PO7: **Lifelong Learning and Adaptability**-Cultivate a commitment to continuous self-directed learning, adapting to evolving challenges, and acquiring knowledge throughout life.

Program Specific Outcomes (PSOs)

The completion of Four Year UG program in Microbiology will equip students with a range of valuable skills and competencies. The program specific outcomes (PSOs) will be as follows:

PSO1: Develop a comprehensive understanding of the basic concepts and principles of microbiology in public health, food, industrial, agricultural, environmental and allied fields with data science.

PSO2: Acquire hands-on laboratory skills in microbiological techniques, including culturing staining, microscopy and molecular methods, along with addressing the ethical concerns.

PSO3: Develop professional efficiency and gain higher level knowledge in the field of microbiology.

PSO4: Build knowledge to solve issues like biological waste management, and also to contribute knowledge in sustainable development and environmental protection.

PSO5: Foster entrepreneurial skills and innovative thinking for those interested in starting their ventures in microbiology-related fields

PSO6: Promote the application of microbiological knowledge for the betterment of society and the environment.

PSO7: Develop effective communication skills to articulate scientific concepts, research findings and their implications to both scientific and non-scientific audiences.

PSO8: Cultivate a spirit of inquiry and lifelong learning to keep abreast of the latest advancement in microbiology and related fields

List of Courses (Category-wise)

Discipline Specific Core (DSC) courses (Major):

Sl. No	Semester	Course Code	Course Title	Credit				Hours/week				Marks		
				L*	T*	P*	Total	L	T	P	Total	CE	ESE	Total
1	I	KU1DSCMBG101	EXCITING WORLD OF MICROBES	3	0	1	4	3	0	2	5	35	65	100
2	II	KU2DSCMBG104	PERSPECTIVES OF MICROBIOLOGY	3	0	1	4	3	0	2	5	35	65	100
3	III	KU3DSCMBG201	MICROBIAL HETEROGENIETY	3	0	1	4	3	0	2	5	35	65	100
4		KU3DSCMBG202	ESSENTIALS OF BIOCHEMISTRY	4	0	0	4	4	0	0	4	30	70	100
5	IV	KU4DSCMBG206	DATA SCIENCE AND COMPUTATIONAL BIOLOGY	3	0	1	4	3	0	2	5	35	65	100
6		KU4DSCMBG207	ESSENTIAL MOLECULAR BIOLOGY	3	0	1	4	3	0	2	5	35	65	100
7.		KU4DSCMBG208	BASICS OF IMMUNOLOGY	3	0	1	4	3	0	2	5	35	65	100
8	V	KU5DSCMBG301	MEDICAL BACTERIOLOGY	3	0	1	4	3	0	2	5	35	65	100
9		KU5DSCMBG302	HUMAN VIRAL, FUNGAL & PARASITIC DISEASES	3	0	1	4	3	0	2	5	35	65	100
10		KU5DSCMBG303	MICROBES IN INDUSTRY	4	0	0	4	4	0	0	4	30	70	100
11	VI	KU6DSCMBG304	FOOD AND DAIRY MICROBIOLOGY	3	0	1	4	3	0	2	5	35	65	100
12		KU6DSCMBG305	ENVIRONMENTAL MICROBIOLOGY AND SANITATION	3	0	1	4	3	0	2	5	35	65	100
13		KU6DSCMBG306	MICROBES IN AGRICULTURE	4	0	0	4	4	0	0	5	30	70	100
14	VII	KU7DSCMBG401	MANAGEMNET OF PLANT DISEASES	3	0	1	4	3	0	2	5	35	65	100
15		KU7DSCMBG402	BIOPHYSICAL TECHNIQUES AND BIOINSTRUMENTATION	3	0	1	4	3	0	2	5	35	65	100
16		KU7DSCMBG403	CHEMO INFORMATICS AND COMPUTER AIDED DRUG DISCOVERY	3	0	1	4	3	0	2	5	35	65	100
17		KU7DSCMBG404	MICROBIAL OMICS AND METAGENOMICS	3	0	1	4	3	0	2	5	30	70	100
18		KU7DSCMBG405	ADVANCED BIOPROCESS TECHNOLOGY	3	0	1	4	3	0	2	5	35	65	100
19	VIII	KU8DSCMBG406	BIOBUSINESS AND ENTREUPRENURSHIP	3	0	1	4	3	0	2	5	35	65	100
20		KU8DSCMBG407	MICROBIAL NANOTECHNOLOGY	3	0	1	4	3	0	2	5	35	65	100
21		KU8DSCMBG408	RESEARCH METHODOLOGY & BIOSTATISTICS	3	0	1	4	3	0	2	5	30	70	100

Discipline Specific Core (DSC) courses (Minor):

Sl. No	Semester	Course Code	Course Title	Credit				Hours/week				Marks		
				L*	T*	P*	Total	L	T	P	Total	CE	ESE	Total
1	I	KU1DSCMBG102	MIGHTY WORLD OF MICROBES	3	0	1	4	3	0	2	5	35	65	100
2		KU1DSCMBG103	MICROBES AND MAN	3	0	1	4	3	0	2	5	35	65	100
3	II	KU2DSCMBG105	BASIC TECHNIQUES IN MICROBIOLOGY	3	0	1	4	3	0	2	5	35	65	100
4		KU2DSCMBG106	HANDLING OF MICROBES	3	0	1	4	3	0	2	5	35	65	100
5		KU2DSCMBG107	PHYSIOLOGY OF MICROORGANISMS	3	0	1	4	3	0	2	5	35	65	100
6	III	KU3DSCMBG203	MICROBES IN DAILY LIFE	3	0	1	4	3	0	2	5	35	65	100
7		KU3DSCMBG204	FLAVOURS OF MICROBES	3	0	1	4	3	0	2	5	35	65	100
8		KU3DSCMBG205	MICROBIAL GENETICS	3	0	1	4	3	0	2	5	35	65	100

Discipline Specific Elective (DSE) courses:

Sl. No	Semester	Course Code	Course Title	Credit				Hours/week				Marks		
				L*	T*	P*	Total	L	T	P	Total	CE	ESE	Total
1	V	KU5DSEMBG301	PHYSIOLOGY AND GENETICS OF MICROORGANISMS	4	0	0	4	4	0	0	4	30	70	100
2		KU5DSEMBG302	DIAGNOSTIC MICROBIOLOGY	4	0	0	4	4	0	0	4	30	70	100
3		KU5DSEMBG303	AQUATIC MICROBIOLOGY	4	0	0	4	4	0	0	4	30	70	100
		ANY TWO ELECTIVES SHOULD BE STUDIED IN V SEM												
5	VI	KU6DSEMBG304	GENETIC ENGINEERING AND RECOMBINANT DNA TECHNOLOGY	4	0	0	4	4	0	0	4	30	70	100
6		KU6DSEMBG305	PHARMACEUTICAL MICROBIOLOGY & ALGAL BIOTECHNOLOGY	4	0	0	4	4	0	0	4	30	70	100
7		KU6DSEMBG306	BIOSAFETY, BIOETHICS & IPR	4	0	0	4	4	0	0	4	30	70	100
8		KU6DSEMBG307	MICROBIAL ECOLOGY AND BIODIVERSITY	4	0	0	4	4	0	0	4	30	70	100
		ANY TWO ELECTIVES SHOULD BE STUDIED IN VI SEM												
9	VIII	KU7DSEMBG401	PHAGE THERAPY AND ADVANCED ANTIMICROBIAL AGENTS	4	0	0	4	4	0	0	4	30	70	100
11		KU8DSEMBG402	COMPUTATIONAL SYSTEMS BIOLOGY	4	0	0	4	4	0	0	4	30	70	100
12		KU8DSEMBG403	ANTIMICROBIAL STEWARDSHIP	4	0	0	4	4	0	0	4	30	70	100
13		KU8DSEMBG404	MEDICINAL CHEMISTRY AND	4	0	0	4	4	0	0	4	30	70	100

			MOLECULAR DYNAMIC SIMULATIONS											
14		KU8DSEMBG405	BIOCONTROL AGENTS IN AGRICULTURE	4	0	0	4	4	0	0	4	30	70	100
		ANY THREE ELECTIVES CAN BE STUDIED IN VIII SEM OR ANY THREE MOOC COURSES												

GENERAL FOUNDATION COURSES (MDC, VAC, SEC)

Multi-Disciplinary Courses (MDC):

Sl. No	Semester	Course Code	Course Title	Credit				Hours/week				Marks		
				L*	T*	P*	Total	L	T	P	Total	CE	ESE	Total
1	I	KU1MDCMBG101	ESSENCE OF MICROBIOLOGY	3	0	0	3	3	0	0	3	25	50	75
2	II	KU2MDCMBG102	FERMENTED FOODS AND BEVERAGES	3	0	0	3	3	0	0	3	25	50	75

Value Added Courses (VAC):

Sl. No	Semester	Course Code	Course Title	Credit				Hours/week				Marks		
				L*	T*	P*	Total	L	T	P	Total	CE	ESE	Total
1	III	KU3VACMBG201	MICROBES IN SOLID WASTE MANAGEMENT	2	0	1	3	2	0	2	4	25	50	75
2	IV	KU4VACMBG202	MICROBES FOR SUSTAINABLE LIFE	2	0	1	3	2	0	2	4	25	50	75
3		KU4VACMBG203	PUBLIC HEALTH AND HYGIENE	2	0	1	3	2	0	2	4	25	50	75

Skill Enhancement Courses (SEC):

Sl. No	Semester	Course Code	Course Title	Credit				Hours/week				Marks		
				L*	T*	P*	Total	L	T	P	Total	CE	ESE	Total
1	IV	KU4SECMBG201	MUSHROOM CULTIVATION	2	0	1	3	2	0	2	4	25	50	75
2	V	KU5SECMBG301	VALUE ADDED MICROBIAL PRODUCTS	2	0	1	3	2	0	2	4	25	50	75
3	VI	KU6SECMBG302	ADVANCED TECHNIQUES IN MICROBIOLOGY	2	0	1	3	2	0	2	4	25	50	75

Internship & Dissertation:

Sl. No	Semester	Course Code	Course Title	Credit				Hours/week				Marks		
				L*	T*	P*	Total	L	T	P	Total	CE	ESE	Total
1.	IV/V	KU4INTMBG201	INTERNSHIP	0	0	2	2	0	0	4	4	15	35	50
2.	VIII	KU8RPHMBG301	RESEARCH PROJECT	0	0	12	12	0	0	24	24	30	70	100

*L-Lecture, T-Tutorial, P-Practicals

Semester I

KU1DSCMBG101: EXCITING WORLD OF MICROBES

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC A1	100-199	KU1DSCMBG101	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

Course description:

This course provides a comprehensive outlook of the fundamentals of Microbiology such as the historical perspectives, developments and scope. The course emphasises on the working principles and applications of various types of microscopes for the visualisation of microorganisms. The course also illustrates the applications of various staining techniques for the study of the morphological features of microorganisms. Students will also study the structural features of bacteria and will gain hands-on experiments on handling and care of microscope and various staining techniques for the visualisation of microorganisms. In a nutshell, the course provides an overview of the fundamentals of microbiology and role in understanding the scope and applications of microorganisms.

Course prerequisite: Nil

Course outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the history, development, scope of microbiology and how microbiology has developed an important scientific discipline.	U
2	Familiarize the working principle, methodology and applications of various type of microscopes for the study of the morphological and structural features of microorganisms.	U
3	Apply various staining techniques for the visualization of microorganisms and study the structural components of bacterial cell.	A
4	Apply the fundamental concepts of microbiology and acquire the technical skills in basic protocols in Microbiology.	A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔		✔		✔	✔		✔
CO 2		✔	✔		✔			
CO 3		✔	✔			✔		
CO 4			✔			✔		

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1		**Historical perspectives and scope of Microbiology**	15
	1	History, development, and scope of Microbiology - Theories and concepts - Spontaneous generation versus biogenesis, Germ theory of disease.	
	2	Contributions of Anton Van Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Fleming, Edward Jenner, Paul Ehrlich, and Joseph Lister towards the development of Microbiology	
	3	Various branches of Microbiology, scope and applications of Microbiology	
	4	Scope of Microbiology principles in post-COVID era	
2		**Microscope and visualization of microorganisms**	15
	1	Microscopy – Basic principles of light microscopy – Structural components, working principles and applications of light microscopes- Bright field, Dark field, Phase contrast and Fluorescent Microscopes.	
	2	Specimen preparation, structure, working principles and applications of Scanning and Transmission electron microscopy. Cryo-electron Microscopy	
	3	Visualization of microorganisms -Morphological forms of bacteria, Staining –Basic principles, stains-components. Types of stains-acidic and basic- Staining techniques – Simple and Negative staining	

	4	Differential staining - Gram staining and acid-fast staining. Special staining for capsule, flagella and endospore. Fungal staining (LPCB), Wet mount for bacterial motility- Hanging drop technique	
3	**Ultra structure of bacterial cell**		**10**
	1	Ultra structure of bacterial cell - cell wall and its types- Gram positive and Gram negative	
	2	Cell membrane, Flagella, Pili, Capsule/glycocalyx/slime layer, Protoplasts and spheroplast.	
	3	Internal structures of bacteria- Ribosome, inclusion bodies, vacuoles, nuclear material (Nucleoid and plasmids) and mesosomes	
	4	Dormant resistant forms– endospore- structure and composition.	
4	**Practical applications of Basic Microbiology**		**30**
	1	General rules and regulations of Microbiology lab. Handling and care of Microscope, Demonstration of various types of microscopes and elucidation of the structural components of light microscope.	
	2	Simple staining and negative staining	
	3	Differential staining- Gram staining and acid-fast staining	
	4	Special staining- Capsule staining, endospore staining, fungal staining using LPCB	
	5	Bacterial motility using hanging drop technique	
5	**Teacher Specific Module**		**5**
	Directions/Suggestions		
	Activity		

Essential Readings:

1. Atlas RM (1997), Principles of Microbiology, Mosby Publishers.
2. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (2002) Microbiology. 5th Edition, Tata McGraw-Hill, New Delhi.
3. Tortora GJ, Funke BR and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.
4. Ananthanarayan and Paniker's (2020) Textbook of Microbiology 11th edition, Universities Press publishes
5. Prescott/Harley/Klein's Microbiology by Joanne Willey, Linda Sherwood and Chris Wolverton
6. Dubey R.C. and Maheswary A K., (2018) A textbook of Microbiology, S. Chand Publications
7. Aneja K.R. 2020 Experiments in Microbiology, Plant Pathology and Biotechnology sixth edition, New Age International Publications Private Limited

Suggested Readings:

1. Daniel Lim, (1997), Microbiology Brown (William C.) Co, U.S.; 2nd edition.
2. Topley & Wilson's Microbiology and Microbial Infections (1998), 8 volumes, sixth edition, Hodder Arnold, London.

Assessment Rubrics:

Theory

Evaluation Type		**Marks**
End Semester Evaluation L		**50**
Continuous Evaluation L		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation P		**15**
Continuous Evaluation P		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU1DSCMBG102: MIGHTY WORLD OF MICROBES

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC B1	100-199	KU1DSCMBG102	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

Course description:

This course offers a thorough introduction to the world of microbes, providing students with the fundamental knowledge and skills necessary to appreciate the complexities of microbial world. The course focuses the historical developments and scope of microbiology and the contributions of various pioneers in Microbiology. The course also emphases on the basics of staining techniques and their applications in studying the morphological features of bacteria with the aids of various types of microscopes. The course further illustrates the ultrastructure of bacterial cells and various cell components. The course also covers the technical skills required for understanding various concepts in microbiology.

Course prerequisite: Nil

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the history and scope of microbiology and their development as a major scientific discipline.	U
2	Familiarize the methodology and working principles of various microscopes and their utility in visualizing microorganisms using staining techniques.	U
3	Apply the concepts of microscopy and understand the morphological and structural characteristics of bacteria	A
4	Apply various techniques in microbiology and enrich the practical skills for various applications in biology.	A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔		✔		✔	✔		✔
CO 2		✔	✔		✔			
CO 3		✔	✔			✔		
CO 4			✔			✔		

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1		**History and scope of Microbiology**	**15**
	1	History and Development of Microbiology - Spontaneous generation versus biogenesis, Germ theory of disease	
	2	Contributions of Louis Pasteur, Robert Koch, Anton Van Leeuwenhoek and Alexander Fleming towards the development of Microbiology	
	3	Major branches of Microbiology	
	4	Scope and applications of Microbiology	
2		**Microscopy and staining techniques**	**10**
	1	Microscopy – Basic principles of light microscopy. Types of light Microscopy- Bright field, dark field, phase contrast and fluorescent	
	2	Electron microscopy-Scanning and Transmission electron microscopy	
	3	Morphological forms of bacteria. Visualization of microorganisms - Staining –stains-components of stains. Types of stains.	
	4	Staining techniques - Simple, Negative, Differential (Gram and Ziehl Neelsen), Hanging drop technique, Fungal staining	
3		**Structural features of bacterial cells**	**15**
	1	Ultra structure of bacterial cell – Gram positive and Gram negative	

	2	Cell membrane, mesosome, flagella, capsule, protoplasts and spheroplast	
	3	Internal structures of bacteria- ribosome, inclusion bodies, nuclear material - nucleoid and plasmids	
	4	Dormant forms– endospore structure. Process of sporogenesis.	
4	**Practical concepts of Basic Microbiology**		**30**
	1	General rules and regulations of Microbiology lab. Handling and care of Microscope- Structural parts and usage.	
	2	Simple and negative staining	
	3	Differential staining- Gram staining and acid-fast staining	
	4	Bacterial motility-Hanging drop techniques.	
5	**Teacher Specific Module**		**5**
	Directions/Suggestions		
	Activity		

Essential Readings:

1. Atlas RM (1997), Principles of Microbiology, Mosby Publishers.
2. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (2002) Microbiology. 5th Edition, Tata McGraw-Hill, New Delhi.
3. Tortora GJ, Funke BR and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.
4. Ananthanarayan and Paniker's (2020) Textbook of Microbiology 11th edition, Universities Press publishes
5. Prescott/Harley/Klein's Microbiology by Joanne Willey, Linda Sherwood and Chris Wolverton
6. Dubey R.C. and Maheswary A K., (2018) A textbook of Microbiology, S. Chand Publications
7. Aneja K.R. 2020 Experiments in Microbiology, Plant Pathology and Biotechnology sixth edition, New Age International Publications Private Limited

Suggested Readings:

1. Daniel Lim, (1997), Microbiology Brown (William C.) Co, U.S.; 2nd edition.
2. Topley & Wilson's Microbiology and Microbial Infections (1998), 8 volumes, sixth edition, Hodder Arnold, London.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation L		**50**
Continuous Evaluation L		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU1DSCMBG103: MICROBES AND MAN

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	DSC C1	100-199	KU1DSCMBG103	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

Course description:

This course provides an in-depth understanding of the intricate relationship between humans and microbes, highlighting both beneficial interactions and potential threats. This course delves into the fascinating beginnings of life and its evolutionary journey, understand the diverse microbes associated with the human body and their vital roles. This course provides an opportunity to learn about various infections and the virulence factors that contribute to microbial pathogenicity. Also examine the role of microbes in warfare and their potential use as bioweapons.

Course Prerequisite: NIL

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the history, origin of life and evolution	U
2	Understand various human microbiome and their significance	U
3	Understand various types of infection and virulence factors associated	U
4	Demonstrate various microflora of human body	A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔		✔		✔	✔		✔
CO 2		✔	✔		✔			
CO 3			✔			✔		
CO 4		✔	✔			✔		

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1		**Evolution of life on earth**	10
	1	Historical perspectives of Microbiology	
	2	Origin of life on earth	
	3	Evolution of eukaryotes	
	4	Prokaryotes and eukaryotes – comparison	
2		**Human microbiome and Microbes as vaccine**	15
	1	Human body as ecosystem	
	2	Human microbial flora – composition and functions, Gut microflora	
	3	Human vaccine - types of vaccines and importance	
	4	Challenges in vaccine development – novel vaccines	
3		**Microbes as threat to human**	15
	1	Infection and its types	
	2	Sources of infections to humans	

	3	Bacterial toxins and other virulence factors	
	4	Bioweapons and bioterrorism – Anthrax as example	
4	**Practicals**		**30**
	1	Demonstration of isolation of bacterial flora of mouth	
	2	Demonstration of isolation of skin flora	
	3	Microscopic observation of different bacterial flora of human	
	4	Observation of different fungi	
5	**Teacher Specific Module**		**5**
	Directions/Suggestions		
	Activity		

Essential readings:

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (2002) Microbiology. 5th Edition, Tata McGraw-Hill, New Delhi.
2. Tortora GJ, Funke BR and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.
3. Ananthanarayan and Paniker's (2020) Textbook of Microbiology 11th edition, Universities Press publishes
4. Prescott/Harley/Klein's Microbiology by Joanne Willey, Linda Sherwood and Chris Wolverton
5. Dubey R.C. and Maheswary A K., (2018) A textbook of Microbiology, S. Chand Publications
6. Aneja K.R. 2020 Experiments in Microbiology, Plant Pathology and Biotechnology sixth edition, New Age International Publications Private Limited

Suggested readings:

1. Daniel Lim, (1997), Microbiology Brown (William C.) Co, U.S.; 2nd edition.
2. Topley & Wilson's Microbiology and Microbial Infections (1998), 8 volumes, sixth edition, Hodder Arnold, London.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation L		**50**
Continuous Evaluation L		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU1MDCMBG101: ESSENCE OF MICROBIOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
I	MDC 1	100-199	KU1MDCMBG101	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0	0	25	50	75	1.5

Course description:

The course provides an overview of the essence of microorganisms in various filed of biological sciences. The course initially focuses on various groups of prokaryotes and eukaryotic microorganisms and their role in ecosystems, environment, and other allied fields. The course further illustrates the scope of microorganisms in various applications in food, agriculture, biopharma, and healthcare sectors. The course also outlines the recent emerging infectious diseases and scope of microbiology principles in tackling the pandemics. The course also narrates the role and applications of various microorganisms to produce sustainable energy products for better tomorrow. The course investigates various beneficial and detrimental impacts of microorganisms in various fields with relevant examples.

Course Prerequisite: Nil

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Comprehend various kinds of microorganisms and their role in environment, ecosystem and other applied fields	U
2	Familiarize the impact and relevance of microorganisms in various applications in food industry.	U
3	Understand the scope of microorganisms in agriculture and healthcare.	U
4	Familiarize the major emerging microbial infections and the role of microorganisms in sustainable energy production.	U

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔		✔		✔	✔		✔
CO 2		✔	✔		✔			
CO 3			✔			✔		
CO 4		✔	✔			✔		

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1		**Microorganisms, society and ecosystem**	10
	1	Introduction to microorganisms- Prokaryotes- Bacteria. Eukaryotic microorganisms- Fungi, algae, protozoa. Viruses-Bacterial viruses	
	2	Role of microorganisms in various fields- Food, pharma, agriculture, environment and public health	
	3	Distribution of microorganisms in air, soil and water-brief description	
	4	Role of microorganisms in food chain and food web	
2		**Applications of microorganisms in food industry**	10
	1	Major types of traditional fermented foods in South India	
	2	Role of microorganisms in baking industry (Bread, cake)	
	3	Role of microorganisms of brewing industry (Wine, beer)	
	4	Brief overview of food-borne pathogens and diseases	
3		**Role of microorganisms in agriculture and healthcare**	10
	1	Microorganisms in agriculture- Biofertilizers and bioinoculants	
	2	Microorganisms in environment- nutrient cycling and waste management -solid, sewage and plastic waste	
	3	Biopharmaceuticals – brief overview of antibiotics, antimicrobial resistance	
	4	Microorganisms as food- mushrooms, SCP, probiotics, nutraceuticals	

4	**Medical aspects of microorganisms and the role of microbes in sustainable energy**		**10**
	1	Detrimental impact of microorganisms- Infections and disease-causing microorganisms- bacteria and viruses (any four examples each)	
	2	Emerging viral infections of 21th century- COVID, Nipah	
	3	Importance of microbiology practices for tackling pandemics – Hygienic practices and vaccines	
	4	Microorganisms as a source of bioenergy- Biogas, biohydrogen, bioethanol (brief)	

5	**Teacher Specific Module**	**5**
	Directions/Suggestions	
	Activity	

Suggested readings:

1. Atlas, R. M. (1997). Principles of microbiology (2nd ed). Wm. C. Brown Publishers.
2. Black, J. G., & Black, L. J. (2018). Microbiology: Principles and explorations (10th edition). Wiley.
3. Frobisher, M. (Ed.). (1974). Fundamentals of microbiology (9th ed). W. B. Saunders Co.
4. Pommerville, J. (2014). Alcamo's fundamental of microbiology (Tenth edition). Jones and Bartlett India Pvt. Ltd
5. Michael J. Pelczar, Chan, E. C. S., Noel R. Krieg, & Merna Foss Pelczar. (2024). Microbiology (5th edition). Affiliated East-West Press Private Limited

Essential readings:

1. Madigan, M. T., Bender, K. S., Buckley, D. H., Sattley, W. M., Stahl, D. A., & Brock, T. D. (2022). Brock biology of microorganisms (Sixteenth edition, global edition). Pearson.
2. Tortora, G. J., Funke, B. R., & Case, C. L. (2019). Microbiology: An introduction (Thirteenth edition). Pearson.
3. Willey, J. M., Sandman, K., Wood, D. H., & Prescott, L. M. (2023). Prescott's Microbiology (Twelfth edition, international student edition). McGraw Hill.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total		**75**

Any components can be taken from the above table for CE not exceeding 25 marks

Semester II

KU2DSCMBG105- PERSPECTIVES OF MICROBIOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC A2	100-199	KU2DSCMBG105	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

Course Description:

This course offers a comprehensive exploration of the methods employed to manage microbial growth, cultivate diverse microorganisms & preserve their viability. From understanding different culture media and growth conditions to employing aseptic techniques, students will gain skills in isolating and propagating bacteria, viruses, fungi and algae. Students will also learn about culture preservation techniques ranging from routine periodic transfer techniques employed in the laboratory to more advanced preservation techniques like cryopreservation, lyophilization and other techniques used to maintain the stability of microbial strains ensuring their availability for future studies.

Course Prerequisite: Basic knowledge in Microbiology gained during +2 level and first semester of this programme

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the principle and methods for controlling microorganisms and apply this knowledge in controlling microbes in day today life.	U/A
2	Understand and familiarize various culture media and components for cultivation of different microorganisms	U
3	Utilize various culture methods for the isolation and cultivation pure cultures and for the enumeration of microbial cells.	A
4	Understand and apply the various methods for the short term and long-term preservation of microbial cultures.	U/A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔	✔		✔				
CO 2		✔			✔			✔
CO 3		✔	✔					
CO 4		✔	✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Control of microorganisms**		**15**
	1	Fundamentals of microbial control – Definition – sterilization, disinfection, Antisepsis, Sanitization, Microbistatic and microbicidal agents	
	2	Factors influencing the effectiveness of antimicrobial agents.	
	3	Physical agents of microbial control – Heat – TDP, TDT, D-value, Z-value, F-value, Moist heat and dry heat – Autoclave, Pasteurization, Tyndallisation, Inspissation, Incineration, Hot air oven. Filtration and Irradiation (Ionizing and non-ionizing).	
	4	Chemical antimicrobial agents – Phenolics, alcohols, halogens, heavy metals, quaternary ammonium compounds, aldehydes, sterilizing gases, characteristics of an ideal chemical agent, evaluation of antimicrobial potency of disinfectants- phenol coefficient – Rideal Walker and Chick	

		Martin tests. Antibiotics – classes with example and mode of action, antimicrobial resistance mechanisms in brief	

2	**Media and components**		**10**
	1	Culture media – major components- agar, peptone, beef extract, yeast extract.	
	2	Solid, semi solid and liquid cultures - Types of media – defined, basal, complex, enriched, enrichment, selective, indicator, differential, transport and anaerobic culture media	
	3	Media for the cultivation of bacteria, fungi, algae and protozoans – examples	
	4	Cultivation of viruses – brief account.	

3	**Culture methods**		**15**
	1	Pure culture- definition, culture methods – streak plate, spread plate, pour plate, lawn culture, stroke culture, stab culture, liquid cultures.	
	2	Anaerobic culture methods – anaerobic jar, roll tube, Rosenthal method.	
	3	Enumeration of microbial cells – CFU.	
	4	Fungal culture – Slide culture	

4	**Practicals in basic microbiology**		**30**
	1	Demonstration of the most common laboratory equipment used in microbiology practical- Autoclave, Hot air oven, Laminar airflow, Bacteriological incubator, Colony counter, etc. Sterilization by autoclave and hot air oven	
	2	Culture media preparation - Broth and agar- Nutrient broth, nutrient agar, Special media - Mac Conkey agar, Mannitol Salt agar, Blood agar and Mueller Hinton agar, Fungal media- SDA/PDA/MRBA	
	3	Culture methods – Streak plate, pour plate and spread plate methods	

		Isolation and enumeration of viable bacteria (CFU) from various samples (soil / water / fruits / vegetables)	
	4	Demonstration of fungal cultures - Slide culture technique	

5	**Teacher Specific Module**	**5**
	Directions	
	Activity	

Essential Readings:

1. Michael J Pelczar, JR., E C S Chan, Noel R Krieg; Microbiology; 5th edition.
2. Joanne Willey, Kathleen Sandman, Dorothy Wood; Prescott's Microbiology; Eleventh edition; Mc Graw Hill publishers.
3. Ananthanarayan, C K Jayaram Paniker; Textbook of Microbiology; 8th edition
4. Jacquelyn G Black, Laura J Black; Microbiology- Principle and Explorations; 9th edition; Wiley publishers.
5. Gerald J Tortora, Berdell R Funke, Christine L Case; Microbiology- An Introduction; Ninth edition; Pearson publishers.

Suggested Readings:

1. Michael J Pelczar, JR., E C S Chan, Noel R Krieg; Microbiology; 5th edition.
2. Joanne Willey, Kathleen Sandman, Dorothy Wood; Prescott's Microbiology; Eleventh edition; Mc Graw Hill publishers.
3. Ananthanarayan, C K Jayaram Paniker; Textbook of Microbiology; 8th edition
4. Jacquelyn G Black, Laura J Black; Microbiology- Principle and Explorations; 9th edition; Wiley publishers.
5. Gerald J Tortora, Berdell R Funke, Christine L Case; Microbiology- An Introduction; Ninth edition; Pearson publishers.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation L		**50**
Continuous Evaluation L		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU2DSCMBG106- BASIC TECHNIQUES IN MICROBIOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC B2	100-199	KU2DSCMBG106	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

Course Description

This course offers a comprehensive exploration of the methods employed to manage microbial growth, cultivate diverse microorganisms & preserve their viability. From understanding different culture media and growth conditions to employing aseptic techniques, students will gain skills in isolating and propagating bacteria, viruses, fungi and algae. Students will also learn about culture preservation techniques ranging from routine periodic transfer techniques employed in the laboratory to more advanced preservation techniques like cryopreservation, lyophilization and other techniques used to maintain the stability of microbial strains ensuring their availability for future studies.

Course Prerequisite: Basic knowledge on Microbiology gained during +2 level and first semester of this programme

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the physical and chemical methods for controlling microorganisms	U/A
2	Understand various culture media for the cultivation of bacteria, fungi, algae and viruses.	U
3	Understand methods for isolation and cultivation of pure cultures of microorganisms and also the enumeration of microbial cells.	A
4	Understand various preservation methods for short- and long-term preservation of microbial cultures under laboratory conditions	U/A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔	✔		✔				
CO 2		✔			✔			✔
CO 3		✔	✔					
CO 4		✔	✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Control of microorganisms**		**15**
	1	Fundamentals of microbial control – Definition – sterilization, disinfection, Microbistatic and microbicidal agents, antiseptics	
	2	Conditions influencing the effectiveness of antimicrobial agents.	
	3	Physical agents of microbial control – Heat –TDP, TDT, D-value, Z-value, F-value- Moist heat and dry heat – autoclave, pasteurization, tyndallisation, inspissation, incineration, hot air oven, Filtration, Irradiation (Ionizing and non-ionizing).	
	4	Chemical antimicrobial agents – Phenolics, alcohols, halogens, heavy metals, quaternary ammonium compounds, aldehydes, sterilizing gases, characteristics of an ideal chemical agent, evaluation of antimicrobial potency of disinfectants- phenol coefficient – Rideal Walker and Chick Martin tests. Antibiotics classes with examples	
2	**Culture media**		**10**
	1	Culture media – major components- agar, peptone, beef extract, yeast extract.	

	2	Solid, semisolid and liquid cultures - Types of media – defined, basal, complex, enriched, enrichment, selective, indicator, differential, transport and anaerobic culture media.	
	3	Media for the cultivation of bacteria, fungi, algae and protozoans– examples.	
	4	Cultivation of viruses – brief account	

3	**Culture methods**		**15**
	1	Pure culture- definition, culture methods – streak plate, spread plate, pour plate methods, lawn culture, stroke culture, stab culture, liquid cultures.	
	2	Anaerobic culture methods – anaerobic jar, roll tube, Rosenthal method	
	3	Enumeration of microbial cells – CFU	
	4	Fungal culture methods	

4	**Practicals in basic Microbiology**		**30**
	1	Sterilization techniques – autoclave and hot air oven	
	2	Culture media preparation – Liquid and solid -Nutrient agar, Mac Conkey agar and media for fungi (SDA/PDA)	
	3	Culture methods for bacteria – Streak plate, spread plate and pour plate method	
	4	Demonstration of culture method for fungi – Slide culture	

5	**Teacher Specific Module**	**5**
	Directions	
	Activity	

Essential Readings:

1. Michael J Pelczar, JR., E C S Chan, Noel R Krieg; Microbiology; 5th edition.

2. Joanne Willey, Kathleen Sandman, Dorothy Wood; Prescott's Microbiology; Eleventh edition; Mc Graw Hill publishers.

3. R Ananthanarayan, C K Jayaram Paniker; Textbook of Microbiology; 8th edition

Suggested Readings:

1. Jacquelyn G Black, Laura J Black; Microbiology- Principle and Explorations; 9th edition; Wiley publishers.

2. Gerald J Tortora, Berdell R Funke, Christine L Case; Microbiology- An Introduction; Ninth edition; Pearson publishers.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation L		**50**
Continuous Evaluation L		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU2DSCMBG107- HANDLING OF MICROBES

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC B2	100-199	KU2DSCMBG107	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

Course Description

This course offers a comprehensive exploration of the methods employed to manage microbial growth, cultivate diverse microorganisms & preserve their viability. From understanding different culture media and growth conditions to employing aseptic techniques, students will gain skills in isolating and propagating bacteria, viruses, fungi and algae. Students will also learn about culture preservation techniques ranging from routine periodic transfer techniques employed in the laboratory to more advanced preservation techniques like cryopreservation, lyophilization and other techniques used to maintain the stability of microbial strains ensuring their availability for future studies.

Course Prerequisite: knowledge obtained from previous semester of Microbiology

Course Outcomes

CO No.	Expected Outcome	Learning Domains
1	Understand the physical and chemical methods for controlling microorganisms	U/A
2	Understand various culture media for the cultivation of bacteria, fungi, algae and viruses.	U
3	Understand methods for isolation and cultivation of pure cultures of microorganisms and also the enumeration of microbial cells.	A
4	Understand various preservation methods for short- and long-term preservation of microbial cultures under laboratory conditions.	U/A

*Course outcomes based on revised blooms taxonomy

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔	✔		✔				
CO 2		✔			✔			✔
CO 3		✔	✔					
CO 4		✔	✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Microbial control**		**15**
	1	Fundamentals of microbial control – Definition – sterilization, disinfection, microbistatic and microbicidal agents	
	2	Conditions influencing the effectiveness of antimicrobial agents.	
	3	Physical agents of microbial control – Heat – TDP, TDT, Moist heat and dry heat – autoclave, pasteurization, tyndallisation, inspissation, hot air oven, filtration and irradiation (Ionizing and non-ionizing).	
	4	Chemical antimicrobial agents – Phenolics, alcohols, halogens, heavy metals, quaternary ammonium compounds, aldehydes, sterilizing gases, characteristics of an ideal chemical agent, evaluation of antimicrobial potency of disinfectants- phenol coefficient – Rideal Walker, Antibiotics (Brief account)	
2	**Culture media**		**10**
	1	Culture media – major components- agar, peptone, beef extract, yeast extract	
	2	Types of media - Solid, semisolid and liquid, simple and complex, defined and undefined, special - enriched, enrichment, selective, indicator, differential, transport and anaerobic culture media.	

		Media for Specific Applications- Clinical microbiology, Food microbiology, Environmental microbiology, Industrial applications	
	3	Media for the cultivation of bacteria and fungi – examples	
	4	Cultivation of viruses – brief account	

3	**Culture methods**		**15**
	1	Pure culture- definition, culture methods – streak plate, spread plate, pour plate methods	
	2	Lawn culture, stroke culture, stab culture, liquid cultures	
	3	Anaerobic culture methods	
	4	Enumeration of microbial cells	

4	**Practicals**		**30**
	1	Demonstration of sterilization	
	2	Demonstration of culture media, cultures of bacteria and fungi	
	3	Demonstration of culture methods	
	4	Demonstration of enumeration of bacteria	

5	**Teacher Specific Module**	**5**
	Directions	
	Activity	

Essential Readings

1. Michael J Pelczar, JR., E C S Chan, Noel R Krieg; Microbiology; 5th edition.
2. Joanne Willey, Kathleen Sandman, Dorothy Wood; Prescott's Microbiology; Eleventh edition; Mc Graw Hill publishers.
3. R Ananthanarayan, C K Jayaram Paniker; Textbook of Microbiology; 8th edition.
4. Jacquelyn G Black, Laura J Black; Microbiology- Principle and Explorations; 9th edition; Wiley publishers.
5. Gerald J Tortora, Berdell R Funke, Christine L Case; Microbiology- An Introduction; Ninth edition; Pearson publishers.
6. Joanne Willey, Kathleen Sandman, Dorothy Wood; Prescott's Microbiology; Eleventh edition; Mc Graw Hill publishers.
7. Michael J Pelczar, JR., E C S Chan, Noel R Krieg; Microbiology; 5th edition.

Suggested Readings

1. Jacquelyn G Black, Laura J Black; Microbiology- Principle and Explorations; 9th edition; Wiley publishers.
2. Gerald J Tortora, Berdell R Funke, Christine L Case; Microbiology- An Introduction; Ninth edition; Pearson publishers

Assessment Rubrics:

Theory

Evaluation Type		**Marks**
End Semester Evaluation **L**		**50**
Continuous Evaluation **L**		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		**Marks**
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU2DSCMBG108: PHYSIOLOGY & METABOLISM OF MICROORGANISMS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	DSC C2	100-199	KU2DSCMBG08	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

Course description:

This course provides an in-depth exploration of the physiological processes and mechanisms that underlie the life functions of microorganisms. Students will examine metabolic pathways, energy production, and regulatory systems. The course emphasizes the diversity of microbial life and how microorganisms adapt to various environmental conditions. Topics include microbial growth and reproduction, nutrient uptake and transport, stress responses, and the role of microorganisms in ecosystems. Laboratory sessions will complement lectures, providing hands-on experience in microbial physiology techniques and experimental approaches. This course is essential for students pursuing careers in microbiology, biotechnology, environmental science, and related fields.

Course Prerequisite: NIL

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand microbial nutrition	U
2	Understand microbial growth	U
3	Understand the metabolism of Microorganisms	U
4	Apply the knowledge in physiology and metabolism	A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔		✔		✔	✔		✔
CO 2		✔	✔		✔			
CO 3			✔			✔		
CO 4		✔	✔			✔		

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1		**Microbial Nutrition**	10
	1	Macroelements and microelements	
	2	Factors affecting microbial growth	
	3	Growth curve	
	4	Measurement of microbial growth - total count, viable count, turbidimetric techniques	
2		**Nutritional types**	15
	1	Based on carbon source – Autotrophs and Heterotrophs (with their subtypes)	
	2	Based on energy source – Phototrophs and chemotrophs (with their sub types)	
	3	Based on electron source – Lithotrophs and organotrophs	
	4	Classification based on oxygen requirement, temperature, pH and osmotic pressure	
3		**Microbial metabolism**	15
	1	Bacterial heterotrophism	
	2	Bacterial photosynthesis: light reaction- reaction centres, pigments.	

	3	Sulphur assimilation in microbes	
	4	Biochemical reactions – IMViC test and sugar fermentation	
4	**Practicals in physiology and metabolism**		**30**
	1	Effect of temperature on growth of bacteria	
	2	Effect of pH on bacterial growth	
	3	Sugar fermentation tests (GLSM)	
	4	IMViC Test	
5	**Teacher Specific Module**		**5**
	Directions/Suggestions		
	Activity		

Essential readings:

1. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. (2002) Microbiology. 5th Edition, Tata McGraw-Hill, New Delhi.
2. Tortora GJ, Funke BR and Case CL. (2008). Microbiology: An Introduction. 9th edition. Pearson Education.
3. Prescott/Harley/Klein's Microbiology by Joanne Willey, Linda Sherwood and Chris Wolverton
4. Dubey R.C. and Maheswary A K., (2018) A textbook of Microbiology, S. Chand Publications
5. Albert G. Moat, John W. Foster, Michael P. Spector (2002). Microbial Physiology 4th edition, Wiley.
6. Ann M. Stevens, Jayna L. Ditty, Rebecca E. Parales, Susan M. Merkel (2024). Microbial Physiology:Unity and Diversity. ASM Press Wiley

Suggested readings:

1. Daniel Lim, (1997), Microbiology Brown (William C.) Co, U.S.; 2nd edition.
2. Topley & Wilson's Microbiology and Microbial Infections (1998), 8 volumes, sixth edition, Hodder Arnold, London.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation L		**50**
Continuous Evaluation L		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU2MDCMBG102 - FERMENTED FOODS AND BEVERAGES

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
II	MDC 2	100-199	KU2MDCMBG102	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0	0	25	50	75	1.5

Course description:

Explore the fascinating world of fermentation in this comprehensive course designed for food enthusiasts, culinary professionals, and anyone interested in the science and art of fermenting foods and beverages. This course delves into the history, techniques, and health benefits of fermentation, providing both theoretical knowledge and practical skills.

Course Prerequisite: Nil

Course outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the Fundamentals of Fermentation.	U/A
2	Identify Microorganisms Involved in Fermentation	U
3	Produce Fermented Dairy, Vegetable, Fruit, Cereal,	A
4	Assess the Health Benefits and Safety of Fermented Products	U/A

*Course outcomes based on revised blooms taxonomy

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔			✔				
CO 2					✔			✔
CO 3			✔					
CO 4			✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Overview of fermentation**		**10**
	1	Introduction to fermentations- History and significance of fermented foods and beverages	
	2	Overview of microbial fermentation processes	
	3	Organisms involved in dairy microbiology (bacteria, yeast and mold)	
	4	Fermented foods - symbiotic cultures of bacteria and yeast (SCOBY)	

2	**Fermented foods – dairy and vegetables**		**10**
	1	Fermented Dairy Products- Cheese, Yoghurt & Curd	
	2	Introduction to Fermented vegetables- Sauerkraut, pickle	
	3	Steps involved in the production of fermented vegetables	
	4	Advantages of vegetable fermentation	

3	**Fermented foods – cereals and fruits**		**10**
	1	Fermented Cereal Products and fruits	
	2	Bread making (sourdough fermentation)	

	3	Production of Wine and its types	
	4	Beer brewing and types	

4	**Benefits of fermented foods**		**10**
	1	Probiotics and their health benefits	
	2	Nutritional changes during fermentation	
	3	Traditional fermentation methods from around the world	
	4	Case studies of regional fermented foods and beverages	

5	**Teacher Specific Module**	**5**
	Directions	
	Activities	

Essential Readings:

1. Food Microbiology. MO Adam, MO Moss. New Age International Publishers.
2. Food Microbiology. William C Frazier. Dennis C Westhoff. Mac Graw Hill Education.
3. Fermented foods in Health and Disease Prevention Juana Frías, Cristina Martinez-Villaluenga, Elena Peñas

Suggested Readings:

1. Microbiology- A laboratory Manual. James G Cappuccino & Chad Welsh. Pearson
2. Handbook of Food and Fermentation beverage Technology Y. H. Hui, Lisbeth Meunier-Goddik, Jytte Josephsen
3. Microbiology of Fermented foods BJ Wood

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	5
e)	Book/ Article Review	
f)	Viva-Voce	5
g)	Field Report	
Total		**75**

Any components can be taken from the above table not exceeding 25

Semester III

KU3DSCMBG201- MICROBIAL HETEROGENEITY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
III	DSC A3	200-299	KU3DSCMBG201	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

Course Description:

The course introduces the students to the enormous taxonomic, metabolic and ecological diversity of microorganisms on Earth. The course helps to inculcate the basic microbial structure and study the comparative characteristics of prokaryotes and eukaryotes. This makes aware about diversity of microorganism Impact of microbes on earth atmosphere, health and technology development and recognize the scope of microbiology in all spheres of life and industrial sector. The course explains the ways to classify the living system Understand the taxonomy and comprehend the various approaches of microbial taxonomy. The course also deals with the nutritional diversity among microorganisms, the different macro and micronutrients required for microbial growth and, the physical factors affecting microbial growth. And describes the pattern of growth, reproduction, death and growth kinetics of microbes and measure population growth by different methods. This also involves demonstration of theory and practical skills for identification of microorganisms.

Course Prerequisite: Basic knowledge in Microbiology gained during first semester of this programme

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Perceive the basics and tools in Microbial taxonomy	U/A
2	Understand the characters, classification and importance of Prokaryotic and Eukaryotic microbes, and acellular microbes	U
3	Understand the nutritional diversity among microorganisms and describe the pattern of growth, reproduction, death and growth kinetics of microbes	A
4	Comprehend the various methods for identification of microorganisms	U/A

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔			✔				
CO 2					✔			✔
CO 3			✔					
CO 4			✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Introduction of systematics**		**15**
	1	Introduction to microbial systematics. Concepts of systematics, taxonomy, taxa, species, strains. Taxonomic hierarchy. Scientific nomenclature	
	2	Conventional and modern approaches to classification: Numerical taxonomy, Phylogenetic analysis, Polyphasic approach. Major systems of classification: three-kingdom, five-kingdom classification and domain system	
	3	Major criteria used in bacterial classification - Morphological, staining, cultural and biochemical characteristics	
	4	Serological methods for identification of bacterial isolates, Molecular techniques for identification of bacteria - Nucleic acid hybridization & nucleic acid sequencing methods	

2	**Classification**		**10**
	1	General characteristics of different groups: Acellular microorganisms (Viruses, Viroids, Prions) and Cellular microorganisms (Bacteria, Algae, Fungi and Protozoa).	
	2	Taxonomy of bacteria- Bergey's manual of systematic bacteriology, Major volumes of Bergey's manual. Overview of Eubacteria and	

		Archaebacteria, Eubacteria- Major classifications with examples. Major groups of Gram positive and Gram-negative bacteria. Archaebacteria- Classification with examples.	
	3	Classification of Fungi - flagellated lower and higher fungi, Classification of microscopic algae - green algae, Diatoms and Golden-brown Algae, Dinoflagellates, euglenoids. Classification of Protozoa - Flagellates, Ciliates, Sarcodina and Sporozoa	
	4	Taxonomy of animal, plant and bacterial viruses with representing examples.	

3	**Nutrition and growth of microbes**		**15**
	1	Nutritional types of microorganisms. Nutritional requirements for microbial growth - Carbon, Nitrogen. Sulphur, Oxygen, Phosphorus, Hydrogen, microelements and energy sources; Vitamins and growth factors.	
	2	Factors influencing microbial growth - temperature, gaseous atmosphere, pH, osmotic pressure and hydrostatic pressure	
	3	Reproduction and growth of microorganisms: Binary fission, budding, cyst and spore formation	
	4	Kinetics of growth -multiplication, and death of microbial cell. Growth curve in a closed system, continuous culture and synchronous culture. Measurement of population growth.	

4	**Practical of microbial heterogeneity**		**30**
	1	Effect of temperature and pH on microbial growth	
	2	Determination of the size of microbial cells - bacteria/yeast- Micrometry	
	3	Demonstration of bacterial growth curve Measurement of turbidity/cell density- Calorimetry/ spectrophotometry	
	4	Biochemical tests for the identification of Bacteria- IMViC test, Catalase, Oxidase, Coagulase, Urease, Amylase, Sugar Fermentation (GLSM), TSI, Nitrate reduction, Gelatin liquefaction.	

5	**Teacher Specific Module**		**5**
	Directions		
		Activity	

Essential Readings:

1. Brock Biology of Microorganisms by M.T. Madigan. Iyer'd. Buckley, W. Sattley and D. Stahl.

2. Prescott's Microbiology by J. M. Willey, K. Sandman and D. Wood.
3. Microbiology by M. J. Pelczar, E. C. S. Chan and N. R. Krieg.
4. Practical Microbiology – Cappuccino
5. Practical Microbiology- R.C Dubey, D.K Maheshwari
6. Practical Microbiology – T.J. Mackie and J. E. Mc Cartney
7. Manual of Microbiology – Tools and Techniques – Kanika Sharma

Suggested Readings:

1. 1. Microbiology: Principles and Explorations by J.G. Black and L.J. Black.
2. Microbiology: An Introduction by G.J. Tortora, B.R. Funke, and C.L. Case.
https://www.microbiologyresearch.org/content/journal/ijsem

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation **L**		**50**
Continuous Evaluation **L**		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU3DSCMBG202- ESSENTIALS OF BIOCHEMISTRY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
III	DSC A4	200-299	KU3DSCMBG202	4	60

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	0	0	30	70	100	2

Course Description:

The course acts as one of the major discipline specific courses in the Third Semester for undergraduate program in Microbiology. The course aimed to provide essential knowledge about the four major biomolecules such as carbohydrates, lipids, nucleic acids and proteins in daily life with a special emphasis on the structural and functional relevance. The course also highlights the detailed classifications of each molecule with appropriate examples. The course deciphers the metabolisms of these biomolecules in microbial energy production and offers the knowledge on clinical implications of each biomolecule. The students undertake various teaching learning strategies and activity-based training during the completion of the course and acquire the essential knowledge of Biochemistry required for various applications in Microbiology.

Course Prerequisite: Basic knowledge on Microbiology gained during +2 level

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the biochemical functions and clinical relevance of carbohydrates and lipids	U/A
2	Analyze the need and importance of studying the structural aspects of proteins, enzymes and nucleic acids for functional elucidation.	U

3	Evaluate the biochemical and metabolic properties of various biomolecules.	A
4	Create an awareness on the relevance of various biomolecules in our daily life and their clinical implications.	U/A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔			✔				
CO 2					✔			✔
CO 3			✔					
CO 4			✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Biochemistry fundamentals and carbohydrates**		**10**
	1	Introductions to Biochemistry, Overview of biomolecules	
	2	Scope and applications of Biochemistry in Microbiology	
	3	Carbohydrates: Classification, properties, and structural characteristics, monosaccharides (Glucose, Lactose, Fructose, Galactose, Mannose)	
	4	Oligosaccharide - Disaccharides (Sucrose, Lactose, Maltose), Polysaccharides (Starch, Cellulose, Chitin, Pectin), Mucopolysaccharides: Peptidoglycan	
2	**Lipids and nucleic acids**		**10**
	1	Lipids: Classification, properties and structural characteristics of lipids- Simple lipids (Triglycerides & waxes)	

	2	Compound lipids (Phospholipids, glycolipids), Derived lipids (Steroids, Terpenoids, Carotenoids)	
	3	Nucleic acids: History, structure and properties of nucleic acids, Structural components of nucleic acids, types of DNA-A, B, Z forms.	
	4	Double helical structure of DNA and forces stabilizing the structure of DNA, Types of RNA- rRNA, tRNA and mRNA	

3	**Proteins and enzymes**		**15**
	1	Proteins: Amino acids and classification, Structural organization of proteins. Forces that stabilize structural organization.	
	2	Primary structure- Peptide bonds - structure, and properties, Secondary structure- Helices (right-handed, left-handed, 3_{10}, Pi helices), Beta sheet (Parallel & antiparallel), Ramachandran Plot. Super secondary structures, Tertiary structure- Motifs and domains- Structure of Myoglobin, Quaternary structure- Structure of Haemoglobin. Structural aspects of protein folding.	
	3	Enzymes: IUB classification of enzyme, Mechanism of enzyme action- Enzyme kinetics- Factors influencing enzyme action, Concentration of substrate- Michaelis Menten equation, Temperature and pH	
	4	Regulation of enzymatic activity – feed back inhibition, zymogen activation, covalent modification, competitive, non-competitive and uncompetitive inhibition	

4	**Metabolism of biomolecules**		**20**
	1	Metabolism of carbohydrates- Mechanism of aerobic respiration in bacteria - Glycolysis, Krebs cycle, Electron transport chain, Overview of sugar fermentation. Disorders in carbohydrate metabolism in brief	
	2	Metabolism of lipid- Beta oxidation pathway, disorders in lipid metabolism in brief	
	3	Metabolism of protein-deamination, transamination and decarboxylation, Disorders in protein metabolism in brief	
	4	Metabolism of nucleic acids- Metabolism of purines and pyrimidines – de novo and salvage pathways. Disorders in nucleic acid metabolism in brief	

5	**Teacher Specific Module**		**5**
	Directions		
		Activity	

Essential Readings:

1. Nelson D, Cox M. Lehninger Principles of Biochemistry. New York, 2005, 1216 pp., ISBN 0-7167-4339-6
2. Jain JL, Nitin Jain, Sunjay Jain. Fundamentals Of Biochemistry. S. Chand Publishing, ISBN-9352838300
3. Satyanarayana U, Chakrapani, U. Biochemistry. Elsevier. ISBN-8131264351
4. James G. Cappuccino, Natalie Sherman, Microbiology: A Laboratory Manual. Pearson Benjamin Cummings. ISBN-9780137546527

Suggested Readings:

1. Donald Voet, Judith G. Voet. Biochemistry. Wiley. ISBN: 0470917458
2. Jeremy M. Berg, Lubert Stryer, John L. Tymoczko, Gregory J. Gatto. Biochemistry. WH Freeman ISBN-1464126100
3. Eric E Conn, Paul K Stumpf, George Bruening and Roy H Doi. Outlines of biochemistry. Wiley. ISBN: 9788126509300
4. Deb AC. Fundamentals of Biochemistry. New Central Book Agency. ISBN: 817381144X
5. Amita Jain, Jyotsna Agarwal, Vimala Venkatesh. Microbiology Practical Manual. Elsevier India. ISBN-8131253538

Assessment Rubrics:

Theory

Evaluation Type		**Marks**
End Semester Evaluation		**70**
Continuous Evaluation		**30**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	5
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total		**100**

Any components from the above table can be taken for CE not exceeding 30 Marks

KU3DSCMBG203- MICROBES IN DAILY LIFE

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
III	DSC B3	200-299	KU3DSCMBG203	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

Course Description:

This course offers a thorough understanding on the various techniques used for the preservation of food while exploring the science behind spoilage. It also incorporates concepts of microbiology in learning the art and science behind fermented foods providing insights and experience into the diverse world of fermented foods. Emphasizing the applications of microbiology in diverse such as agriculture, industry & medicine. The aim is to learn basic concepts and practical applications of food preservation and spoilage and to provide a solid background to fermentation technology. It also aims to develop deep analytical skills to assess the use of microbes in agriculture, food, bioenergy production and their potential for innovation and sustainability.

Course Prerequisite: Basic knowledge on Microbiology gained during +2 level and first semester of this programme

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the importance of food preservation with a focus on food spoilage and sustainable food production.	U/A
2	Understand and harness the skill of microbes for developing functional foods and nutraceuticals	U/A
3	Apply the knowledge and skills needed to address challenges in food safety, shelf-life extension and sustainable food systems.	A
4	Gain practical skill in the respective field	U/A

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔	✔		✔				
CO 2		✔			✔			✔
CO 3		✔	✔					
CO 4		✔	✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Introduction**		**10**
	1	Overview of food spoilage. Factors influencing spoilage - Microbial, Enzymatic & Chemical	
	2	Preservation methods: Physical & Chemical methods	
	3	Dairy & Fermented Foods -Idly, Bread, Cheese, Yoghurt, Saukeraut, Soy sauce, Beer & Pickle	
	4	Introduction to Probiotics and SCP.	
2	**Food safety, GM foods and foodborne diseases**		**15**
	1	Definition & importance of food safety- Overview of international standards - ISO 22000, HACCP, GMP	
	2	Nutraceuticals - their sources and impact on human health.	
	3	GM foods – a basic overview- GM rice, Tomato, cauliflower, brinjal	
	4	Food and water-borne diseases (Brief)– Food infections and intoxications- Viral- Gastroenteritis – Rota, Adeno, Infectious hepatitis, Poliomyelitis. Bacterial - Cholera, Typhoid, Listeriosis, Shigellosis – symptoms and preventive measures	
3	**Applications of microbes in environment**		**15**

	1	Nitrogen fixation - Microbes as Biofertilizers: Rhizobium, Mycorrhiza - types, Azolla- Anabaena system and its benefits.	
	2	Microbiology of Municipal sewage: sewage treatment- primary – sedimentation, coagulation, secondary - septic tank, trickling filters, Imhoff tank, activated sludge, oxidation pond, rotating bio discs, anaerobic sludge digestion. Tertiary – Halogenation, radiation	
	3	Solid waste disposal: Sanitary landfills, composting – Vermicompost, Biogas, Microbiology of methane production, water quality analysis – MPN	
	4	Soil microorganisms and pesticide degradation - microbial decomposition of herbicides, insecticides and fungicides, Effect of pesticides on soil microorganisms.	

4	**Practicals**		**30**
	1	Production of pickles, Production of jams & jellies, Production of Yoghurt, Production of Sauerkraut	
	2	Production of Probiotic ice-cream, Production of Wine	
	3	Determination of Antibiotic sensitivity test	
	4	Water quality analysis – MPN, Mesophilic count of fish & milk sample, MBRT	

5	**Teacher Specific Module**	**5**
	Directions	
	Activity	

Essential Readings:

1. Soil Microbiology. Rao Subbha. Rao. CBS Publishers
2. Food Microbiology. MO Adam, MO Moss. New Age International Publishers.
3. Nutraceuticals and Functional Foods. Robert EC Wildman. CRC Press New York.
4. Food Microbiology. William C Frazier. Dennis C Westhoff. Mac Graw Hill Education.

Suggested Readings:

1. Microbial Ecology. Fundamentals and Applications. Ronald M Atlas. Pearson education.
2. Principles and Applications of Soil Microbiology, David M Sylvia, Pearson Prentice Hall.
3. Microbiology- A laboratory Manual. James G Cappuccino & Chad Welsh. Pearson

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation **L**		**50**
Continuous Evaluation **L**		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU3DSCMBG204- FLAVOURS OF MICROBES

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
III	DSC B3	200-299	KU3DSCMBG204	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

Course Description:

This course offers a flavourful journey into the world of microbes; it delves into the fascinating interplay between microorganisms and creation of Flavors in various foods and beverages. It also enables a better understanding of microbes involved in the production of these characteristic tastes and aromas, as well as their influence on food quality, safety and sensory experience. The aim is to feature a dynamic blend of tastings and laboratory experiments. Explore the cultural, economic and environmental impacts of fermentation processes on society. Consider the historical significance of fermented foods and beverages, their role in global cuisine and their potential contributions to sustainability and food security.

Course Prerequisite: Basic knowledge on Microbiology gained during +2 level and first semester of this programme

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the role of microbes in the production of fermented foods and their flavour development.	U/A
2	Understand the role of microbes in the production of fermented beverages and their flavour development.	U
3	Understand the role of microbes in preservatives and pigment production	A
4	Gain practical skill in various techniques in fermentation	U/A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔	✔		✔				
CO 2		✔			✔			✔
CO 3		✔	✔					
CO 4		✔	✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Introduction**		**10**
	1	Introduction to fermentation	
	2	Fermented indigenous foods- Idli, dosa, appam	
	3	Fermented dairy foods- Cheese, Yoghurt, Curd, Kefir, acidophilus milk, butter milk and paneer	
	4	Bread, Soy sauce & Pickles, vinegar	

2	**Fermented beverages**		**15**
	1	Introduction to Fermented beverages	
	2	Fermented beverage- Wine from different sources- Grape, Banana, Ginger	
	3	Fermented beverage - Production of Beer	
	4	Other fermented beverages – fermented tea – Kombucha, distilled beverages	

3	**Bio preservatives and biopigments**		**15**
	1	Biopreservatives – introduction and mode of action, advantages over chemical preservatives, FDA approval – GRAS	
	2	Microbes as preservatives - Lactobacillus, Pediococcus, Saccharomyces and Spirulina	
	3	Biopigments – introduction, mode of action and advantages	
	4	Biopigment producers – Serratia, Chromobacterium and Pseudomonas	

4	**Practicals**		**30**
	1	Production of wine and vinegar	
	2	Production of cheese and yoghurt	
	3	Production of probiotic ice creams and sauerkraut	
	4	Production of jams, jellies and pickles	

5	**Teacher Specific Module**	**5**
	Directions	
	Activity	5

Essential Readings:

1. Food Microbiology. MO Adam, MO Moss. New Age International Publishers.

2. Food Microbiology. William C Frazier. Dennis C Westhoff. Mac Graw Hill Education

Suggested Readings:

1. Microbiology- A laboratory Manual. James G Cappuccino & Chad Welsh. Pearson

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation **L**		**50**
Continuous Evaluation **L**		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU3DSCMBG205- MICROBIAL GENETICS

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
III	DSC C3	200-299	KU3DSCMBG205	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

Course Description:

This course provides an in-depth understanding of microbial genetics, focusing on the genetic mechanisms that drive the diversity and adaptability of microorganisms. Key topics include: the processes of transformation, transduction, and conjugation, and their impact on genetic diversity. This course equips students with a robust understanding of microbial genetics, preparing them for advanced studies and careers in microbiology, biotechnology, and related fields.

Course Prerequisite: Basic knowledge on Microbiology gained during +2 level and first semester of this programme

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the genetic make-up of microorganisms	U/A
2	Understand the conjugation	U
3	Understand the transformation and transduction	A
4	Gain practical skill in various techniques in microbial genetics	U/A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔	✔		✔				
CO 2		✔			✔			✔

CO 3		✔	✔					
CO 4		✔	✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Introduction to microbial genetics**		**10**
	1	The genetic elements in bacteria	
	2	Plasmids and its classification	
	3	Genetics elements in Viruses	
	4	Transposable elements	

2	**Conjugation**		**15**
	1	Conjugation in bacteria – the role of F plasmid	
	2	Conjugation mechanism and types	
	3	Applications of Conjugation	
	4	Role of conjugation in antibiotic resistance	

3	**Transformation and transduction**		**15**
	1	Mechanism of transformation	
	2	Applications of Transformation	
	3	Mechanism of Transduction and its types	
	4	Applications of transduction	

4	**Practicals**		**30**
	1	Demonstration of Conjugation	
	2	Demonstration of transduction	
	3	Demonstration of Transformation	
	4	Isolation of Plasmid DNA	

5	**Teacher Specific Module**	**5**
	Directions	
	Activity	5

Essential Readings:

1. Ananthanarayan and Paniker`s Textbook of Microbiology, 12th edition (2022). Universities Press (India) Pvt Ltd.

2. Microbial Genetics (1994) Maloy, Cronan and David Freifelder. Jones and Bartlett Publishers, Inc

3. Principles of Genetics, 8th edition (2006). Gardner, Simmons and Snustad. John Wiley & Sons

Suggested Readings:

1. Microbiology- A laboratory Manual. James G Cappuccino & Chad Welsh. Pearson

2. Snyder and Champness Molecular Genetics of Bacteria, 5th Edition. Joseph E. Peters, Tina M. Henkin (2020) Wiley.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation **L**		**50**
Continuous Evaluation **L**		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU3VACMBG201- MICROBES IN SOLID WASTE MANAGEMENT

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
III	VAC 1	200-299	KU3VACMBG201	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0	0	25	50	75	1.5

Course Description:

This course is provided as value addition course of microbiology aimed to provide knowledge in waste management and the role of microbes in managing waste. By completing this course, the student will gain knowledge in waste management. This syllabus explains different types of waste and their management strategies by using the power of microbes

Course Prerequisite: Nil

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Outline Solid Waste Management & Disposal Methods for Solid Waste	U/A
2	Explain the Bioprocessing of organic wastes	U
3	Understand the basics and application of microbes in bioremediation	A
4	Demonstrate various methods of composting	U/A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔	✔		✔				
CO 2		✔			✔			✔
CO 3		✔	✔					
CO 4		✔	✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Types of waste and its management**		**10**
	1	Introduction – Best practices in waste disposal, colour codes used for waste segregation, Waste management strategies - Refuse, Reduce, Reuse, Repurpose and Recycle	
	2	Solid waste – Sources, generation of solid waste	
	3	Types of solid waste, Need for solid and hazardous waste management	
	4	Role of microbes in waste management	
2	**Disposal methods**		**10**
	1	Incineration – methods, types and applications	
	2	Landfilling – methods and applications	
	3	Composting – types- aerobic, anaerobic, vermicomposting	
	4	Biogas – principles of methanogenesis, design of biogas plant	

3	**Bioremediation**		**10**
	1	Introduction, major approaches to bioremediation – *in situ* and *ex situ*	
	2	Other approaches – biosparging, bioaugmentation, biopiling, biodegradation and bioleaching	
	3	Myco and phytoremediation – brief account	
	4	Management of plastic waste – novel microbial techniques – application of co - cultures and microbial consortia	

4	**Best practices – demonstrations**		**10**
	1	Waste composting – vermi composting	
	2	Bin composting and pit composting, tube composting	
	3	Biogas production	
	4	Demonstration of plastic degradation	

5	**Teacher Specific Module**	**5**
	Directions	
	Activity	

Essential Readings:

1. Bhide A.D and Sundaresan B.B, "Solid waste management – collection, processing and Disposal", Mudrashilpa Offset Printers 2001.
2. Dubey, R.C. and Maheswari, D.K." A Textbook of microbiology". S. Chand & Company Ltd, New Delhi. 2005.
3. Hagerty, D. Joseph, Joseph L. Pavoni, and John E. Heer. "Solid waste management." Van Nostrand Reinhold, (1973).
4. Manual on Solid Waste Management, CPHEEO, Ministry of Urban Development, GOI, New Delhi, 2000.
5. Alexander M. "Introduction to soil microbiology", Wiley, New York; London. 2nd ed. 1977
6. Atlas, R. M., & Bartha, R. "Microbial ecology: Fundamentals and applications". 6th ed Menlo Park, Calif: Benjamin/Cummings 1998.

Suggested Readings:

1. Shukla S. K. & Srivastava P. R. In: Waste Management and Control. Commonwealth Publishers, New Delhi 1992.

2. R. E. Landrefh and P. A. Rebers, Municipal Solid Wastes-Problems & Solutions‖, Lewis, 1997.
3. Blide A.D.& Sundaresan, B. B, ‖Solid Waste Management in Developing Countries‖, INSDOC, 1993. 4. Georges E. Ekosse, Rogers W'O Okut-Uma, Pollution control & Waste management in Developing Countries, Commonwealth Publishers, New Delhi, 2000

Assessment Rubrics:

Theory

Evaluation Type		**Marks**
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	
Total		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Semester IV

KU4DSCMBG206 – DATA SCIENCE AND COMPUTATIONAL BIOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	DSC A5	200-299	KU4DSCMBG206	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
4	2	0	25L+10P	50L+15P	100	2

Course Description:

This an important discipline-specific course that enables the graduate to tackle various biological problems with the help of computational biology and data sciences-driven approaches. The course aims to provide essential knowledge on the applications of computational biology and data sciences in integration, management, and analysis of various data in biological sciences and other interdisciplinary applied sciences. The course covers the introduction to data science and computational biology, various databases, in silico tools and their applications, similarity searching and alignment techniques by various computational biology tools. The course also provides knowledge on the scope and applications of molecular phylogenetics, gene and structure prediction in various exercises in biological sciences. Further, the course covers the basics of molecular Modeling and interaction studies of protein-protein and protein-ligands and the applications of various computational tools for the prediction of various exercises in life sciences.

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Course Prerequisite: Basic knowledge in Microbiology gained during the previous semesters of this programme

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the fundaments concepts of data sciences, computational biology and their applications in modern biology.	U/A
2	Comprehend the scope and applications of various biological databases, sequence alignment and similarity searching tools biological science.	U
3	Predict the three-dimensional structure of protein and design molecular targets for drug development and validation	A
4	Evaluate and analyze the data for various sequence, structural and functional information useful for Life Sciences and R & D.	U/A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔	✔		✔				
CO 2		✔			✔			✔
CO 3		✔	✔					
CO 4		✔	✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Data science, computational biology and database**		**10**
	1	Fundamentals of data sciences- Major scope and applications. Major disciplines of computational biology.	
	2	Introduction to computational biology and Bioinformatics.	
	3	Classification of data bases- Primary, secondary, composite and specialized databases. File format - GenBank Flat File and PDB flat file	
	4	Similarity searching tools: BLAST and FASTA. Major algorithms available in BLAST.	

2	**Sequence alignment and molecular phylogenetics**		**15**
	1	Sequence alignment methods - Global and local alignment - Gap penalties, Substitution matrices - PAM and BLOSUM. Pairwise and multiple sequence alignment. Progressive alignment	
	2	Molecular phylogenetics: Structural component of phylogenetic tree, Types of phylogenetic trees, molecular clock hypothesis.	
	3	Phylogenetic data analysis - Multiple sequence alignment, substitution models, tree building- Distance based and character based, and tree evaluation methods	
	4	Major bioinformatics tools and software for phylogenetic data analysis.	

3	**Computational gene prediction and structure prediction**		**15**
	1	Computational gene prediction - Introduction, steps, Bioinformatics tools for gene prediction. Prediction of secondary structure of RNA.	
	2	Computational Prediction of protein structure - Secondary structure prediction, Tertiary structure prediction - Major Approaches - Homology modeling- Steps, principles, and associated bioinformatics tools.	
	3	Molecular visualization tools – Rasmol and Pymol	
	4	Study of protein-protein and protein - ligand interaction- Molecular docking, principle, methodology of molecular docking. Computational biology tools for molecular docking	

4	**Practicals**		**30**
	1	Retrieval of nucleic acid and protein sequences from GenBank and Uniport data bases. Retrieval of structure of PDB and molecular visualization of protein structures.	
	2	Pair wise alignment of sequences using any Bioinformatics tools. Multiple sequence alignment using Clustal Omega. Phylogenetic analysis and visualization of phylogenetic trees.	
	3	Prediction of the structure of gene using any Bioinformatics tools. Secondary structure prediction of protein by Bioinformatics tools.	
	4	Homology modeling of protein using amino acid sequences and computational validation of modelled structures. Demonstration of molecular docking - Protein-protein and protein-ligand docking	

5	**Teacher Specific Module**		**5**
	Directions		
		Activity	

Essential Readings:

1. Xinog J, Essentials of Bioinformatics, Texas A & M University, Cambridge University press. 2006. ISBN: 9780521600828
2. Baxevanis AD, Ouellettee BFF. Bioinformatics. A practical guide to the analysis of genes and Proteins. Third edition. John Wiley & Sons. 2006. ISBN: 978-0-471-47878-2

3. Tramontano A. Introduction to Bioinformatics. Chapman and Hall/CRC Press, 2006. ISBN 13: 9781584885696.
4. Cohen NC. Guidebook on Molecular Modeling in Drug Design. Academic Press, Elsevier. 1996. ISBN: 9780121782450

Suggested Readings:

1. David W. Mount. Bioinformatics: Sequence and Genome Analysis. Cold Spring Harbor Laboratory Press, U.S. ISBN: 0879697121
2. Arthur Lesk. Introduction to Bioinformatics. OUP Oxford. ISBN: 0198794142
3. Zhumur Ghosh, Bibekanand Mallick. Bioinformatics: Principles And Applications. OUP India ISBN: 0195692306
4. Rastogi S. C. Bioinformatics Concepts Skills And Applications, CBS Publishers. ISBN:8123914822
5. Sandhu SG. Bioinformatics and its Applications. Pragun Publications. ISBN: 9383101032

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation **L**		**50**
Continuous Evaluation **L**		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU4DSCMBG207 - ESSENTIAL MOLECULAR BIOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	DSC A6	200-299	KU4DSCMBG207	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

Course Description:

This course "Essential Molecular Biology" provides a comprehensive introduction to the fundamental principles of molecular biology, including the structure and function of nucleic acids, the mechanisms of DNA replication, transcription, and translation, and the regulation of gene expression. This course also provides hands -on expertise on basic molecular biology techniques.

Course Prerequisite: Nil

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand the structure and function of DNA, RNA, and proteins	U
2	Describe the molecular mechanisms underlying DNA replication, transcription, and translation	An
3	Explain the regulation of gene expression in prokaryotic and eukaryotic systems	U/A
4	Acquire hand-on experience in isolation, quantification and visualization of DNA and RNA	A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔						✔	
CO 2	✔		✔		✔			✔
CO 3			✔			✔	✔	
CO 4		✔	✔					✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Nucleic Acids and Replication**		**10**
	1	Structure of DNA and RNA, Chemical properties of nucleic acids.	
	2	DNA packaging in prokaryotes and eukaryotes, Chromatin structure and function.	
	3	Prokaryotic and eukaryotic replication - mechanism, enzymes and proteins in DNA replication, telomeres and telomerase	
	4	DNA damage and repair, DNA recombination	
2	**Transcription and RNA Processing**		**15**
	1	Mechanisms of transcription in prokaryotes and eukaryotes	
	2	RNA polymerase and transcription factors, inhibitors of transcription	
	3	Post-transcriptional modifications – capping, adenylation and splicing	
	4	Regulatory RNAs (siRNA, miRNA, RNAi)	
3	**Translation and Gene Regulation**		**15**
	1	Ribosomes - prokaryotic and eukaryotic, Genetic code, Wobble hypothesis	

	2	Mechanisms of translation in prokaryotes and eukaryotes, post translational modifications	
	3	Regulation of gene expression in prokaryotes and eukaryotes, Operon concept, structure of operon, Lac, Trp and Ara operons, catabolite repression	
	4	Epigenetics and chromatin remodeling	

4	**Practicals**		**30**
	1	Isolation and quantification of DNA (Chromosomal / plasmid DNA)	
	2	Isolation and quantification of RNA	
	3	Gel electrophoresis for nucleic acid analysis	
	4	PCR (Polymerase Chain Reaction)	

5	**Teacher Specific Module**	**5**
	Directions	
	Activity	

Essential Readings:

1. Sue Carson, Heather B. Miller, Melissa C. Srougi, D. Scott Witherow. Molecular Biology Techniques. A Classroom Laboratory Manual.4th Edition - March 5, 2019.
2. Molecular Biology of the Gene by Watson, JD, Hopkins NH, Roberts JW, Steitz JA, Weiner AAM. Pearson; 7th edition (2 April 2013).
3. Genes XII by Lewin B, Oxford University press. Jones and Bartlett Publishers, Inc; 12th edition (16 March 2017)
4. Molecular Cell Biology Lodish, Harvey F., Arnold Berk, Chris Kaiser, Monty Krieger, Anthony Bretscher, Hidde L. Ploegh, Kelsey C. Martin, Michael B. Yaffe, and Angelika Amon. *y*. New York: WH Freeman, 2021.
5. Molecular Biology by Freifelder D., 4th edition 2004 Narosa Publishing Home

Suggested Readings:

1. https://molbiomadeeasy.wordpress.com/wp-content/uploads/2013/09/ fundamental_molecular_biology.pdf
2. Michael R. Green, Joseph Sambrook, Sambrook Molecular cloning: a laboratory manual.4th ed. Publisher: Cold Spring Harbor Laboratory Press, Cold Spring Harbor, N.Y., 2014.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation **L**		**50**
Continuous Evaluation **L**		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU4DSCMBG208 - BASICS OF IMMUNOLOGY

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	DSC A7	200-299	KU4DSCMBG208	4	75

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	2	0	25L+10P	50L+15P	100	2

Course Description:

The course acts as one of the major discipline specific courses in the Fourth Semester for undergraduate program in Microbiology. Basics of Immunology for Undergraduates is an introductory course designed to provide students with a comprehensive understanding of the fundamental principles and mechanisms of the immune system. Through a combination of lectures, laboratory sessions, and interactive discussions, students will explore the structure, function, and regulation of the immune system in health and disease. The course begins by introducing the basic components of the immune system, including innate and adaptive immunity, and explores the cellular and molecular mechanisms underlying immune responses. Students will learn about the key cells involved in immunity, such as T cells, B cells, macrophages, and dendritic cells, and their roles in recognizing and eliminating pathogens. Throughout the course, students will also examine the processes of antigen recognition, antigen presentation, and immune activation, as well as the generation of immune memory and the development of immunological tolerance. In addition to theoretical knowledge, students will gain practical skills through laboratory sessions focused on techniques commonly used in immunological research. These hands-on experiences will complement the theoretical concepts covered in lectures and help students develop critical thinking and analytical skills essential for understanding and interpreting immunological data.

Course Prerequisite: Basic knowledge in Microbiology gained during +2 level and first, second and third semester of this programme

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand various immune mechanisms	U/A
2	Describe various immune cells and organs involved in immunity	U
3	Understand the basis of allergy reactions, auto immune mechanisms, transplantation and cancer immunity	A
4	Understand and practice different immunological techniques used and serological diagnosis of infectious diseases	U/A

****Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)***

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔	✔		✔				
CO 2		✔			✔			✔
CO 3		✔	✔					
CO 4		✔	✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Types of immunity, organs and immune response**		**10**
	1	Immunity – types – Innate and acquired, active and passive immune response	
	2	Organs and cells of immune system- central and peripheral lymphoid organs, leucocytes, lymphocytes, macrophages and plasma cells	
	3	Immune responses - primary and secondary. Mechanism of immunity, barriers and phagocytosis	
	4	Mechanism of inflammation	

2	**Antigens and antibodies**		**15**
	1	Antigens – types, antigenic determinants. Properties of antigen	
	2	Immunoglobulins - basic structure and classes (IgA, IgG, IgM, IgD and IgE) and their functions	
	3	Theories of antibody synthesis - instructive and selection theory, clonal selection theory. Monoclonal antibodies – hybridoma technology	
	4	Antigen - antibody reactions – principles, agglutination, precipitation, complement fixation, ELISA and its types, RIA, immunofluorescence	

3	**Hypersensitivity, autoimmunity, transplantation and cancer immunity**		**15**
	1	Hypersensitivity reactions – types and mechanisms Type 1 - Anaphylaxis, atopy, type 2, type 3 and type 4	
	2	Autoimmunity and autoimmune diseases (Pernicious anemia and Rheumatoid arthritis as example)	
	3	Transplantation and tumor immunity – types of transplants, allograft reactions – allograft rejection – primary and secondary rejection reactions, Graft versus Host (GVH) reactions.	
	4	Cancer immunology – introduction, Tumor antigens and mechanism of immune response to tumors	

4	**Practicals in Immunology**		**30**
	1	Precipitation – immuno diffusion, and agglutination reaction (Tube / slide)	
	2	Complement fixation test	
	3	Enzyme Linked immuno Sorbent Assay (ELISA) / Immuno Fluorescence	
	4	Widal, VDRL, ASO, RPR, CRP, ELISA – HIV / Western blot – HIV, HBsAg test	

5	**Teacher Specific Module**	**5**
	Directions	
	Activity	

Essential Readings:

1. Kuby Immunology by Thomas J. Kindt (2006) Publisher: W H Freeman & Co

2. Immunology: An Introduction by Ian R Tizard (2006) Publisher: Cengage Learning

3. Immunology and Immuno technology by Chakravarty (2006)

4. Elements of Immunology (2009) by Khan Publisher: Dorling Kindersley (India)

5. Immunology by K.R. Joshi (2007)

6. Ananthanarayan and Paniker, Text book of microbiology

Suggested Readings:

1. Basic Immunology, 3ed by: Abbas Publisher: Elsevier

2. Immunology by P.R. Yadav (2004) Publisher: Discovery Publishing House

3. Immunology by David A. Marcus, Richard A. Goldsby, Barbara A. Osborne (2003) Publisher: WH. Freeman & Company

Assessment Rubrics:

Theory

Evaluation Type		**Marks**
End Semester Evaluation **L**		**50**
Continuous Evaluation **L**		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	10
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total L		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

Practicals

Evaluation Type		Marks
End Semester Evaluation **P**		**15**
Continuous Evaluation **P**		**10**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Record	5
d)	Lab skill	10
e)	Regularity	5
f)	Viva-Voce	5
g)	Report writing	5
Total		**25**

Any components from the above table can be taken for CE not exceeding 10 Marks

KU4VACMBG202 - MICROBES FOR SUSTAINABLE LIFE

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	VAC 2	200-299	KU4VACMBG202	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0	0	25	50	75	1.5

Course Description:

The course named "Microbes for sustainable life" is a 3-credit lecture and interdisciplinary engaged learning experience for undergraduate students with no science background required. The course explores the science and culture of microbial agricultural products through readings, lectures, group projects. This course explores the diverse roles of microorganisms in promoting sustainability across different fields, including agriculture, environmental management, and biotechnology. Students will learn about the beneficial interactions between microbes and their environments and how these interactions can be harnessed to address global challenges.

Course Prerequisite: Nil

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Appreciate the importance of microbial diversity for sustainable practices.	U/A
2	Understand the role of soil microbiota in environment sustainability	U
3	Learn about microorganism's role in renewable energy production	A
4	Understand the role of microbes in medicine and biotechnology	U/A

**Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)*

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔	✔		✔				
CO 2		✔			✔			✔
CO 3		✔	✔					
CO 4		✔	✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Microbial Diversity and Bioprospecting**		**10**
	1	The role of various microorganisms and how they impact humans, agriculture and environment	
	2	Introduction to Agriculture and Sustainable Farming Practices - An overview of agriculture, its significance in food production, and the need for sustainable farming practices.	
	3	Bioprospecting for novel microbial strains	
	4	Potential applications in sustainable practices	

2	**Microbes in Environmental Sustainability**		**10**
	1	Microbes in environmental management: Biosensors – types and its structural components	
	2	Microbial remediation in oil spills – Construction of superbugs	
	3	Soil mineralization of cellulose, hemicelluloses, lignocelluloses and lignin	
	4	Microbial contributions to nutrient cycling – nitrogen, carbon, phosphorus and sulfur	

3	**Microbes in Renewable Energy Production**		**10**
	1	Role of microbes in renewable energy production – bacteria, fungi and algae	
	2	Microbes in bio - hydrometallurgy and fuel industry	
	3	Production of bioethanol, biodiesel, biohydrogen and bioelectricity	
	4	Bioplastics – production and applications	

4	**Microbes in Medicine and Biotechnology**		**10**
	1	Microbial production of pharmaceuticals.	
	2	Microbes in vaccine production	
	3	Microbial green synthesis of nano particles and its applications	
	4	GM crops Benefits, social and environmental aspects -Bt crops	

5	**Teacher Specific Module**	**5**
	Directions	
	Activity	

Essential Readings:

1. Madsen, Eugene L. (2015). Environmental Microbiology: From Genomes to Biogeochemistry. Wiley-Blackwell.
2. Jackson, R.B., Moore, L.A., Hoffmann, W.A., Pockman, W.T., & Linder, C.R. (2020). Microbial ecology in the age of genomics and metagenomics. Oxford University Press.
3. Ho, A., & Di Lonardo, D. P. (Eds.). (2018). Soil Microbiology, Ecology and Biochemistry. Academic Press.
4. Liu, Y., & Whitman, W. B. (2008). Microbial Biotechnology: Fundamentals of Applied Microbiology. Cambridge University Press.
5. Economic and Social Council (2021). The Role of Microorganisms in Sustainable Agriculture. United Nations Publications.

Suggested Readings:

1. National Research Council (US) Committee on Bioprocess Engineering. (1996). Bioprocess Engineering for a Green Environment: Bioremediation. National Academies Press.
2. Lichtfouse, E., Navarrete, M., Debaeke, P., Souchère, V., & Alberola, C. (Eds.). (2009). Sustainable Agriculture. Springer.
3. Society for Industrial Microbiology and Biotechnology. (2020). Industrial Microorganisms: Basic and Applied Molecular Genetics. ASM Press.
4. Walker, L. R., & del Moral, R. (2003). Primary Succession and Ecosystem Rehabilitation. Cambridge University Press.

5. United Nations Environment Programme. (2018). Climate Change and Microbial Ecology: Effects of Climate Change on Microbial Life. UNEP Publications.

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	5
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

KU4VACMBG203 - PUBLIC HEALTH AND HYGIENE

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
III	VAC 3	200-299	KU4VACMBG203	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0	0	25	50	75	1.5

Course Description:

This course aims to provide microbiology students with a comprehensive understanding of public health and hygiene. It will cover the fundamental concepts of epidemiology, disease prevention, health promotion, sanitation, and the role of microbiology in public health. The syllabus is designed to integrate theoretical knowledge with practical applications in public health practices

Course Prerequisite: Nil

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand public health	U/A
2	Understand various infectious diseases	U
3	Gain knowledge in environment health	A
4	Understand the role of microbiology in public health and apply the microbiological hygienic practices in day today life	U/A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔	✔		✔				
CO 2		✔			✔			✔
CO 3		✔	✔					
CO 4		✔	✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Introduction to public health**		**10**
	1	Definition and scope of public health	
	2	History and evolution of public health	
	3	Key public health functions and services	
	4	Overview of global health organizations (WHO, CDC, NIH etc.)	

2	**Infectious diseases**		**10**
	1	Epidemiology and overview of infectious agents: bacteria, viruses, fungi, parasites	
	2	Modes of transmission and infection	
	3	Common infectious diseases and their prevention	
	4	Vaccination and immunization programs Awareness on MDR, XDR and PDR of priority pathogens by WHO	

3	**Environment health**		**10**
	1	Impact of environmental factors on health	
	2	Water, air, and soil pollution and their health effects	
	3	Public health sanitation, water purification and vector control	

	4	Occupational health and safety, infection control protocol in hospitals	

4	**Public health Microbiology**		**10**
	1	Personal hygiene practices	
	2	Food hygiene, safety, standards – national and international	
	3	Microbiological practices in maintaining hygiene	
	4	Role of microbiologists in outbreak response	

5	**Teacher Specific Module**	**5**
	Directions	
	Activity	

Essential Readings:

1. Public Health: A Very Short Introduction" by Virginia Berridge
2. "Epidemiology: An Introduction" by Kenneth J. Rothman
3. "Control of Communicable Diseases Manual" by David L. Heymann
4. WHO and CDC websites for up-to-date information and guidelines
5. Research articles and case studies from scientific journals

Suggested Readings:

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. 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
4. Swaminathan (1995) Food & Nutrition (Vol I, Second Edition) The Bangalore Printing & Publishing Co Ltd., Bangalore

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	5
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks

KU4SECMBG201- MUSHROOM CULTIVATION

Semester	Course Type	Course Level	Course Code	Credits	Total Hours
IV	SEC1	200-299	KU4SECMBG201	3	45

Learning Approach (Hours/ Week)			Marks Distribution			Duration of ESE (Hours)
Lecture	Practical/ Internship	Tutorial	CE	ESE	Total	
3	0	0	25	50	75	1.5

Course Description:

Mushroom cultivation course enables the students to identify edible and poisonous mushrooms and also to understand the nutritive and medicinal values of mushrooms. The course provides the students to get complete understanding of the procedures in spawn production, cultivation methods. The course also provides the students to get enough knowledge in managing various diseases of mushroom and also to get an idea about the post-harvest processing. After completing this course, the students will understand various value-added products from mushroom. After successful completion of this course the students can start self-earning small-scale business in mushroom production.

Course Prerequisite: Nil

Course Outcomes:

CO No.	Expected Outcome	Learning Domains
1	Understand different types of mushrooms and its nutritional values	U/A
2	Understand spawn production and management	U
3	Gain knowledge in mushroom cultivation methods	A
4	Understand the management of diseases of mushrooms and its processing techniques	U/A

Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)

Mapping of Course Outcomes to PSOs

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PSO8
CO 1	✔	✔		✔				
CO 2		✔			✔			✔
CO 3		✔	✔					
CO 4		✔	✔			✔		✔

COURSE CONTENTS

Contents for Classroom Transaction:

MODULE	UNIT	DESCRIPTION	HOURS
1	**Types of mushrooms and health benefits**		**10**
	1	Introduction to mushroom cultivation. History and scope of mushroom cultivation.	
	2	Edible and poisonous mushrooms, common Indian mushrooms,	
	3	Nutritional and medicinal value of mushrooms.	
	4	Morphology and structure of Agaricus.	
2	**Spawn production and management**		**10**
	1	Pure culture preparation of mushroom, Media used, Maintenance of culture	
	2	Mushroom spawn and its types.	
	3	Substrates used for spawn production. Mother spawn production, Multiplication of bed spawn from mother spawn. Sterilization of substrate	
	4	Ideal characteristics of good spawn, spawn preservation methods.	
3	**Mushroom cultivation methods**		**10**

	1	Mushroom cultivation – oyster mushroom, paddy straw mushroom and white button mushroom.	
	2	Preparation of substrate. Construction of Mushroom houses, Sterilization of substrate and other materials	
	3	Method of cultivation and harvesting.	
	4	Factors influencing mushroom growth. Post harvest handling of mushrooms	

4	**Management of diseases and processing of mushrooms**		**10**
	1	Identification and management of different pests and diseases of mushrooms. Bacterial diseases – Bacterial blotch, Bacterial rot and Brown spot.	
	2	Fungal diseases – wet bubble, dry bubble, green molds and cobweb disease.	
	3	Insect pests – Phorid flies, Sciarid flies, Beetle. Damage by nematodes.	
	4	Post harvest processing and value-added products from mushrooms	

5	**Teacher Specific Module**	**5**
	Directions	
	Activity	

Essential Readings:

1. Nita Bhal. (2000). Handbook on Mushrooms. 2nd ed. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
2. Pandey R.K, S. K Ghosh, 1996. A Hand Book on Mushroom Cultivation. Emkey Publications.
3. Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
4. Tewari Pankaj Kapoor, S. C. (1988). Mushroom Cultivation. Mittal Publication, New Delhi.

Suggested Readings:

1. Tripathi, D.P. (2005) Mushroom Cultivation, Oxford & IBH Publishing Co. PVT.LTD, New Delhi.
2. V.N. Pathak, Nagendra Yadav and Maneesha Gaur, Mushroom Production and Processing Technology/ Vedams Ebooks Pvt Ltd., New Delhi (2000)

Assessment Rubrics:

Theory

Evaluation Type		Marks
End Semester Evaluation		**50**
Continuous Evaluation		**25**
a)	Test Paper- 1	5
b)	Test Paper-2	5
c)	Assignment	5
d)	Seminar	5
e)	Book/ Article Review	-
f)	Viva-Voce	5
g)	Field Report	-
Total		**75**

Any components from the above table can be taken for CE not exceeding 25 Marks