



**MOTHER TERESA WOMEN'S UNIVERSITY
KODAIKANAL-624 101**

DEPARTMENT OF BIOTECHNOLOGY

**B.Sc. MICROBIOLOGY
Curriculum Framework, Syllabus, and Regulations
(Based on TANSICHE Syllabus under choice Based Credit System – CBCS)**



(For the candidates to be admitted from the Academic Year 2023-2024)

M.Sc. MICROBIOLOGY

About the Programme

Our B.Sc. Microbiology is a 3 years undergraduate program and the syllabus is divided into six semesters offering a strong foundation of microbiological concepts. This program involves the study of microorganisms with particular emphasis on the biology of bacteria, viruses, fungi and protozoan parasites. It emphasises on understanding microorganisms and their inter relationships with other organisms in nature. Students in the microbiology degree program study the background and current findings in the field of microbiology and also acquire the critical thinking skills and the hands-on laboratory and field skills required to succeed in science.

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK GUIDELINES BASED REGULATIONS FOR UNDER GRADUATE PROGRAMME	
Programme:	B.Sc. MICROBIOLOGY
Programme Code:	U23MB
Duration:	3 Years (UG)
Programme Outcomes:	<p>PO1: Disciplinary knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study</p> <p>PO2: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups.</p> <p>PO3: Critical thinking: Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development.</p> <p>PO4: Problem solving: Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.</p> <p>PO5: Analytical reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.</p>

	<p>PO6: Research-related skills: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation.</p> <p>PO7: Cooperation/Team work: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.</p> <p>PO8: Scientific reasoning: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.</p> <p>PO9: Reflective thinking: Critical sensibility to lived experiences, with self awareness and reflexivity of both self and society.</p> <p>PO10 Information/digital literacy: Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.</p> <p>PO 11 Self-directed learning: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion.</p> <p>PO 12 Multicultural competence: Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.</p> <p>PO 13: Moral and ethical awareness/reasoning: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work.</p> <p>PO 14: Leadership readiness/qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision,</p>
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	<p>motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way.</p> <p>PO 15: Lifelong learning: Ability to acquire knowledge and skills, including „learning how to learn“, that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.</p>
Programme Specific Outcomes:	<p>PSO1 – Placement: To prepare the students who will demonstrate respectful engagement with others’ ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions.</p> <p>PSO 2 - Entrepreneur: To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.</p> <p>PSO3 – Research and Development: Identify and utilize the tools and techniques in the research and development</p> <p>PSO4 – Contribution to Business World: To produce employable, ethical and innovative professionals to sustain in the dynamic business world.</p> <p>PSO 5 – Contribution to the Society: To contribute to the development of the society by collaborating with stakeholders for mutual benefit</p>

Eligibility *:

Candidate for admission to the first year of B.Sc. Degree Course in Microbiology shall be required to have passed the Higher Secondary Examination +2 Pass with Science Subject

Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	75 Marks
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, Short summary or Overview	
Application (K3)	Suggest idea/concept with examples, Suggest formulae, Solve problems, Observe, Explain	
Analyze (K4)	Problem-solving questions, Finish a procedure in many steps, Differentiate between various ideas, Map knowledge	
Evaluate (K5)	Longer essay/Evaluation essay, Critique or justify with pros and cons	
Create (K6)	Check knowledge in specific or off-beat situations, Discussion, Debating or Presentations	

- **Question Paper Pattern for External examination for all course papers.**

Max. Marks: 75			Time: 3 Hrs.
S.No.	Part	Type	Marks
1	A	10*1 Marks=10 Multiple Choice Questions (MCQs): 2 questions from each Unit	10
2	B	5*4=20 Two questions from each Unit with Internal Choice (either / or)	20
3	C	3*15=45 Open Choice: Any three questions out of 5 : one question from each unit	45
Total Marks			75

* Minimum credits required to pass: 140

Project Report

A student should select a topic for the Project Work at the end of the fifth semester itself and submit the Project Report at the end of the sixth semester. The Project Report shall not exceed 75 typed pages in Times New Roman font with 1.5 line space.

Project Evaluation

There is a Viva Voce Examination for Project Work. The Guide and an External Examiner shall evaluate and conduct the Viva Voce Examination. The Project Work carries 100 marks (Internal: 25Marks; External (Viva):75 Marks).

Conversion of Marks to Grade Points and Letter Grade (Performance in a Course/Paper)

Range of Marks	Grade Points	Grade	Description
90 –100	9.0 –10.0	O	Outstanding
80-89	8.0 –8.9	D+	Excellent
75-79	7.5 –7.9	D	Distinction
70-74	7.0 –7.4	A+	VeryGood
60-69	6.0 –6.9	A	Good
50-59	5.0 –5.9	B	Average

Attendance

Students must have earned 75% of attendance in each course for appearing for the examination. Students with 71% to 74% of attendance must apply for condonation in the prescribed form with prescribed fee. Students with 65% to 70% of attendance must apply for condonation in the prescribed form with the prescribed fee along with the Medical Certificate. Students with attendance lesser than 65% are not eligible to appear for the examination and they shall re-do the course with the prior permission of the Head of the Department, Principal and the Registrar of the University.

Maternity Leave

The student who avails maternity leave may be considered to appear for the examination with the approval of Staff i/c, Head of the Department, Controller of Examination and the Registrar.

Any Other Information

In addition to the above mentioned regulations, any other common regulations pertaining to the UG Programmes are also applicable for this Programme.

MOTHER TERESA WOMEN'S UNIVERSITY, KODAIKANAL
B.Sc. MICROBIOLOGY SYLLABUS
2023-2024

SEMESTER-I								
Course Code	Course Title	Hours			Credits	CIA	ESE	Total
		L	T	P				
U23TAL11	Language 1-Tamil	3	3		3	25	75	100
U23ENL21	Language 2-English	3	3		3	25	75	100
U23MBT11	Core 1 - Fundamentals of Microbiology And Microbial Diversity	3	2		5	25	75	100
U23MBP11	Core 2 Practical I- Fundamentals of Microbiology and Microbial Diversity			5	5	40	60	100
U23MBE1A / U23MBE1B	Discipline Specific Elective-I - A- Basic and Clinical Biochemistry / B - Developmental Biology	2	2		3	25	75	100
U23MBS11	Skill Enhancement Course 1 - Social and Preventive Medicine		2		2	25	75	100
U23MBF11	Foundation Course - Extremophiles		2		2	25	75	100
Total		30			23	-	-	700
SEMESTER-II								
U23TAL12	Language 1-Tamil	3	3		3	25	75	100
U23ENL22	Language 2-English	3	3		3	25	75	100
U23MBT22	Core 3 - Microbial Physiology and Metabolism	3	2		5	25	75	100
U23MBP22	Core 4 Practical II – Microbial Physiology and Metabolism			5	5	40	60	100
U23MBE2A/ U23MBE2B / U23MBE2C	Elective II (Discipline Specific) A – Bio Instrumentation / B - Human Physiology / Nutrition & Health Hygiene	2	2		3	25	75	100
U23MBS22	Skill Enhancement Course II Soft Skills		2		2	25	75	100
U23MBS23	Skill Enhancement Course III - Sericulture		2		2	25	75	100
Total		30			23	-	-	700

SEMESTER I

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23MBT11	Fundamentals of Microbiology And Microbial Diversity	Core Course – 1	3	2	-	-	5	5	25	75	100
Course Objectives											
CO1	Learn the fundamental principles about different aspects of Microbiology including recent developments in the area.										
CO2	Describe the structural organization, morphology and reproduction of microbes.										
CO3	Explain the methods of cultivation of microbes and measurement of growth.										
CO4	Understand the microscopy and other basic laboratory techniques – culturing, disinfection and sterilization in Microbiology.										
CO5	Compare and contrast the different methods of sterilization.										
UNIT	Details								No.of Hours	Course Objectives	
I	History and Evolution of Microbiology, Classification – Three kingdom, five kingdom, six kingdom and eight kingdom. Microbial biodiversity: Introduction to microbial biodiversity-ecological niche. Basic concepts of Eubacteria, Archaeobacteria and Eucarya. Conservation of Biodiversity.								12	CO1	
II	General characteristics of cellular microorganisms (Bacteria, Algae, Fungi and Protozoa) and acellular microorganisms - (Viruses, Viroids, Prions), Differences between prokaryotic and eukaryotic microorganisms. Structure of Bacterial cell wall, cell membrane, capsule, flagella, pili, mesosomes, chlorosomes, phycobilisomes, spores, and gas vesicles. Structure of fungi (Mold and Yeast), Structure of microalgae.								12	CO2	
III	Bacterial culture media and pure culture techniques. Mode of cell division, Quantitative measurement of growth. Anaerobic culture techniques.								12	CO3	

IV	Microscopy – Simple, bright field, dark field, phase contrast, fluorescent, electron microscope – TEM & SEM, Confocal microscopy, and Atomic Force Microscopy. Stains and staining methods.	12	CO4
V	Sterilization–moist heat - autoclaving, dry heat – Hot air oven, radiation – UV, Ionization, filtration – membrane filter and disinfection, antiseptic; Antimicrobial agents.	12	CO5
	Total	60	
Course Outcomes			
Course Outcomes	On completion of this course, students will;		
CO1	Study the historical events that led to the discoveries and inventions and understand the Classification of Microorganisms.	PO5, PO6, PO10	
CO2	Gain Knowledge of detailed structure and functions of prokaryotic cell organelles.	PO10	
CO3	Understand the various microbiological techniques, different types of media, and techniques involved in culturing microorganisms.	PO11	
CO4	Explain the principles and working mechanism of different microscopes/Microscope, their function and scope of application.	PO4, PO11	
CO5	Understand the concept of asepsis and modes of sterilization and disinfectants.	PO4, PO11	
Text Books			
1	Pelczar.M. J., Chan E.C.S. and Noel. R.K. (2007). Microbiology. 7 th Edition.,McGraw – Hill, New York.		
2	Willey J., Sherwood L., and Woolverton C. J., (2017). Prescott’s Microbiology. 10 th Edition., McGraw-Hill International edition.		
3	Tortora, G.J., Funke, B.R., Case,C.L. (2013). Microbiology. An Introduction 11 th Edition., A La Carte Pearson.		
4	Salle. A.J (1992). Fundamental Principles of Bacteriology. 7 th Edition., McGraw Hill Inc.New York.		
5	Boyd, R.F. (1998). General Microbiology,2 nd Edition., Times Mirror, Mosby CollegePublishing, St Louis.		
References Books			
1	Jeffrey C. Pommerville., Alcamo’s Fundamentals of Microbiology (9 th Edition). Jones &Bartlett learning 2010.		
2	Stanier R.Y, Ingraham J. L., Wheelis M. L., and Painter R. R. (2010). General		

	Microbiology, 5 th Edition., MacMillan Press Ltd
3	Tortora, G.J., Funke, B.R. and, Case, C.L (2013). Microbiology-An Introduction, 11 th Edition., Benjamin Cummings.
4	Nester E., Anderson D., Roberts C. E., and Nester M. (2006). Microbiology-A Human Perspective, 5 th Edition., McGraw Hill Publications.
5	Madigan M.T., Martinko J.M., Stahl D.A, and Clark D. P. (2010). Brock - Biology of Microorganisms, 13 th Edition Benjamin-Cummings Pub Co.
Web Resources	
1	https://www.cliffsnotes.com/study-guides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology
2	https://www.keyence.com/ss/products/microscope/bz-x/study/principle/structure.jsp
3	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6604941/#
4	https://bio.libretexts.org/@go/page/9188
5	https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-nutrition/

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1					M	M				M	
CO2										M	M
CO3											S
CO4				M							S
CO5				M							S

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23MBP11	Fundamentals of Microbiology and Microbial Diversity	Core Course II- Practical - I	-	-	5	-	5	5	40	60	100
Course Objectives											
CO1	Acquire knowledge on Cleaning of glass wares, GLP and sterilization.										
CO2	Gain knowledge on media preparation and cultural characteristics.										
CO3	Learn the pure culture technique										
CO4	Learn the microscopic techniques and staining methods.										
CO5	Acquire knowledge on stain and staining methods										
UNIT	Details								No.of Hours	Course Objectives	
I	Cleaning of glass wares, Microbiological good laboratory practice and safety. Sterilization and assessment of sterility– Autoclave, hot air oven, and membrane filtration.								12	CO1	
II	Media preparation: liquid media, solid media, semi-solid media, agar slants, agar deeps, agar plates.								12	CO2	
III	Preparation of basal, differential, enriched, enrichment, transport, and selective media preparation- quality control of media, growth supporting properties, sterility check of media. Pure culture techniques: streak plate, pour plate, decimal dilution.								12	CO3	
IV	Culture characteristics of microorganisms: growth on different media, growth characteristics, and description. Demonstration of pigment production. Microscopy: light microscopy and bright field microscopy.								12	CO4	

V	Staining techniques: smear preparation, simple staining, Gram's staining and endospore staining. Study on Microbial Diversity using Hay Infusion Broth- Wet mount to show different types of microbes, hanging drop.	12	CO5
	Total	60	
Course Outcomes			
Course Outcomes	On completion of this course, students will;		
CO1	Practice sterilization methods; learn to prepare media and their quality control.	PO4, PO7, PO8, PO9, PO11	
CO2	Learn streak plate, pour plate and serial dilution and pigment production of microbes.	PO4, PO7, PO8, PO9	
CO3	Understand Microscopy methods, different Staining techniques and motility test.	PO4, PO7, PO8, PO9, PO11	
CO4	Observe culture characteristics of microorganisms.	PO4, PO7, PO8, PO9	
CO5	Study on Microbial Diversity using Hay Infusion Broth-Wet mount	PO4, PO7, PO8, PO9	
Text Books			
1	James G Cappucino and N. Sherman MB(1996). A lab manual Benjamin Cummins, New York 1996.		
2	Kannan. N (1996). Laboratory manual in General Microbiology. Palani Publications.		
3	Sundararaj T (2005). Microbiology Lab Manual (1 st edition) publications.		
4	Gunasekaran, P. (1996). Laboratory manual in Microbiology. New Age International Ld., Publishers, New Delhi.		
5	R C Dubey and D K Maheswari (2002). Practical Microbiology. S. Chand Publishing.		
References Books			
1	Atlas.R (1997). Principles of Microbiology, 2 nd Edition, Wm.C.Brown publishers.		
2	Amita J, Jyotsna A and Vimala V (2018). Microbiology Practical Manual. (1 st Edition). Elsevier India		
3	Talib VH (2019). Handbook Medical Laboratory Technology. (2 nd Edition). CBS		
4	Wheelis M, (2010). Principles of Modern Microbiology, 1st Edition. Jones and Bartlett Publication.		
5	Lim D. (1998). Microbiology, 2 nd Edition, WCB McGraw Hill Publications.		
Web Resources			
1	http://www.biologydiscussion.com/micro-biology/sterilisation-and-disinfection-methods-and-principles-microbiology/24403 .		

2	https://www.ebooks.cambridge.org/ebook.jsf?bid=CBO9781139170635
3	https://www.grsmu.by/files/file/university/cafedry//files/essential_microbiology.pdf
4	https://microbiologyinfo.com/top-and-best-microbiology-books/
5	https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1				M			L	M	L		M
CO2				S			L	L	L		
CO3				S			M	M	L		M
CO4				S			M	L	L		
CO5				S			M	L	L		

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CI A	External	Total
U23MBE1A	Basic and Clinical Biochemistry	Elective Generic / Discipline Specific Elective-I	2	2	-	-	3	4	25	75	100
Course Objectives											
CO1	Attain thorough knowledge on carbohydrates and lipids, their characteristic properties and organization in carrying out all the living functions which constitute the life.										
CO2	Explain the biological activity of amino acids and proteins.										
CO3	Identify the metabolic errors in enzymes of carbohydrates and lipids.										
CO4	Describe the disorders in amino acid metabolism.										
CO5	Interpret the consequences, biochemical, clinical features, diagnosis and treatment of metabolic diseases of day today life.										
UNIT	Details								No.of Hours	Course Objectives	
I	Biomolecules -Carbohydrate – General properties, function, structure, classification– monosaccharides (Glucose, Fructose, Galactose), Oligoaccharides (Sucrose, Maltose, Lactose) and polysaccharides (Starch, Glycogen,) and biological significance. Lipids – General properties, functions, structure, classification (Simple, Derived and Complex), Cholesterol, LDL, HDL – biological significance.								12	CO1	
II	Biomolecules - Amino acids – General properties, functions, structure, classification and biological significance. Proteins– General structure, Properties, functions, classification and biological significance.								12	CO2	
III	Disorders of Metabolism: Disorders of carbohydrate metabolism: diabetes mellitus, ketoacidosis, hypoglycemia, glycogen storage diseases, galactosemia and lactose intolerance. Disorders of lipid metabolism: hyperlipidemia, hyperlipoproteinemia, hypercholesterolemia, hyper triglyceridemia, sphingolipidosis.								12	CO3	
IV	Disorders of Metabolism: Disorders of amino acid metabolism:								12	CO4	

	alkaptonuria, phenylketonuria, phenylalaninemia, homocystineuria, tyrosinemia, aminoacidurias.		
V	Evaluation of organ function tests: Assessment and clinical manifestations of renal, hepatic, pancreatic, gastric and intestinal functions. Diagnostic enzymes: Principles of diagnostic enzymology. Clinical significance of aspartate aminotransferase, alanine aminotransferase, creatine kinase, aldolase and lactate dehydrogenase.	12	CO5
	Total	60	
Course Outcomes			
Course Outcomes	On completion of this course, students will;		
CO1	Explain the structure, classification, biochemical functions and significance of carbohydrates and lipids	PO1	
CO2	Differentiate essential and non-essential amino acids, biologically important modified amino acids and their functions, Illustrate the role, classification of Proteins and recognize the structural level organization of proteins, its functions and denaturation.	PO1	
CO3	Assess defective enzymes and Inborn errors. Recognize diseases related to carbohydrate and lipid metabolism.	PO4, PO5, PO6	
CO4	Discuss and evaluate the pathology of aminoacid metabolic disorders.	PO4, PO5, PO6	
CO5	Appraise the imbalances of enzymes in organ function and relate the role of Clinical Biochemistry in screening and diagnosis.	PO5, PO6, PO9	
Text Books			
1	Satyanarayana, U. and Chakrapani, U(2014).Biochemistry,4 th Edition, Made Simple Publisher.		
2	Jain J L, Sunjay Jain and Nitin Jain (2016).Fundamentals of Biochemistry, 7 th Edition, S Chand Company.		
3	AmbikaShanmugam's (2016). Fundamentals of Biochemistry for Medical Students, 8 th Edition. Wolters Kluwer India Pvt Ltd.		
4	Vasudevan. D.M.Sreekumari.S, Kannan Vaidyanathan (2019). Textbook Of Biochemistry For Medical Students. Kindle edition, Jaypee Brothers Medical Publishers		
5	Jeremy M. Berg,LubertStryer, John L. Tymoczko, Gregory J. Gatto (2015).		

	Biochemistry, 8 th edition. WH Freeman publisher.
References Books	
1	Amit Kessel & Nir Ben-Tal (2018). Introduction to Proteins: structure, function and motion. 2 nd Edition, Chapman and Hall.
2	David L. Nelson and Michael M. Cox (2017). Lehninger Principles of Biochemistry, 7 th Edition W.H. Freeman and Co., NY.
3	Lupert Styer, Jeremy M. Berg, John L. Tymoczko, Gatto Jr., Gregory J (2019). Biochemistry. 9 th Edition, W.H. Freeman & Co. New York.
4.	Donald Voet, Judith Voet, Charlotte Pratt (2016). Fundamentals of Biochemistry: Life at the Molecular Level, 5 th Edition, Wiley.
5.	Joy PP, Surya S. and Aswathy C (2015). Laboratory Manual of Biochemistry, Edition 1., Publisher: Kerala agricultural university.
Web Resources	
1	https://www.abebooks.com > plp
2	https://kau.in/document/laboratory-manual-biochemistry
3	https://metacyc.org
4	https://www.medicalnewstoday.com
5	https://journals.indexcopernicus.com

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M										
CO2	M										
CO3				S	S	S					
CO4				S	S	S					
CO5					S	S			S		

Course Code	U23MBE1B	Developmental Biology	L	T	P	C
Elective			2	2	-	3
Cognitive Level	K1: Recall K2: Understand					
Learning objective	<ul style="list-style-type: none"> To understand the mechanisms of development from genes to the formation of an organism. To understand how evolutionary processes have shaped life in its varied forms. To explore selected areas of developmental biology in depth. To apply concepts in developmental biology to your development as a biologist. 					
Unit I	Gametogenesis: Definition-primordial germ cells-origin-spermatogenesis-physiological ripening of sperm- oogenesis- previtellogenesis- vitellogenesis.					
Unit II	Embryo development –Egg size, shape, egg membranes, tertiary membranes, organization of the egg yolk, pigments, egg cortex, polarity, origin of polarity, types of eggs. Cleavage-Definition, morula, blastula, types of blastula, molecular changes, planes of cleavages, types of cleavage, factors affecting cleavage, cleavage laws, adhesion of blastomeres during cleavage, nuclei of cleaving cells, cytoplasm of cleaving cells.					
Unit III	Gastrulation: Definition, exogastrulation, metabolism and molecular changes during gastrulation, gene activities during gastrulation. Morphogenic movements- Definition, types epiboly, emboly mechanism of morphogenic movements					
Unit IV	Organogenesis: Definition, tabulation, neurogenesis, spermatogenesis, growth and differentiation derivatives of ectoderm and mesoderm.					
Unit V	Regeneration: Definition – Types, Human Reproduction puberty, Menstrual cycle. Menopause, Pregnancy and related problems parturition and lactation.					
Textbook	1. Scott Gilbert. Developmental Biology. 11 th ed. Sinauer Associates Inc; 2016. ISBN 13 978-1605356044.					
References	<ol style="list-style-type: none"> Verma.S and Agarwal V.K. Chordate Embryology.1st ed. S.Chand & Co. New Delhi; 2010.ISBN -13 978-8121902618. Berrill.N.J. Developmental Biology .Mc.Graw Hill, New Delhi;1971.ISBN -13 978-0070050204. Patten, B.M. Foundations of Embryology.6th ed. Mc.Graw Hill, New Delhi; 2014. ISBN -13 978-9339205348. Saunders.J.W. Developmental Biology – Pattern and Principles.Macmillan New York; 1982. ISBN -13 978-0024063700. Principles of Embryology Waddington. . Principles of Embryology. 2021.ISBN -13 9781138956995. 					

E-references	1. https://www.e-libraryme.com/2019/12/developmental-biology.html		
Course outcome	Upon completion of this course, the students will be able to		
	CO1	gather knowledge on gametogenesis.	K1
	CO2	acquire information on egg and cleavage.	K2
	CO3	recognise the importance of gastrulation.	K2
	CO4	understand the process of orogenesis.	K2
	CO5	empathize on regeneration and human reproduction.	K2

Mapping of COs with POs &PSOs:

CO	POs								PSOs				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	S	M	S	S	S	S	S	S	S	S	S	M	S
CO2	S	S	S	S	S	S	S	M	S	S	S	S	S
CO3	S	S	M	S	M	S	S	S	S	S	S	S	M
CO4	S	M	S	S	S	S	S	S	S	S	S	S	S
CO5	S	S	S	S	S	M	S	S	S	S	M	S	S

Strongly Correlating

Moderately Correlating

Weakly Correlating

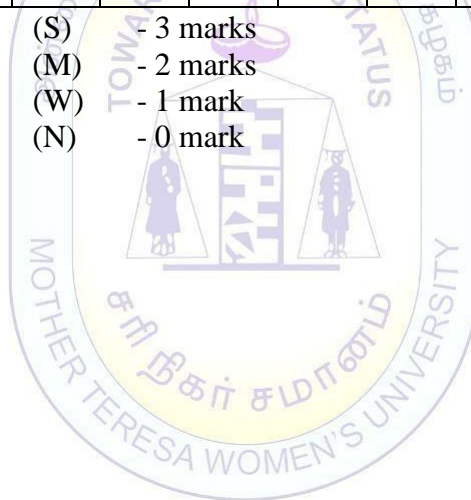
No Correlation

(S) - 3 marks

(M) - 2 marks

(W) - 1 mark

(N) - 0 mark



Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CI A	External	Total
U23MBS11	Social and Preventive medicine	Skill enhancement Course SEC - 1 (NME)	2	-	-	-	2	2	25	75	100
Course Objectives											
CO1	Describe the concepts of health and disease and their social determinants										
CO2	Summarize the health management system										
CO3	Know about the various health care services										
CO4	Outline the goals of preventive medicine										
CO5	Gain knowledge about alternate medicine										
UNIT	Details								No.of Hours	Course Objectives	
I	Introduction to social medicine: History of social medicine-concepts of health and disease-social determinants of health and disease-Health and quality of life-Health information system- measures of population health-health policies.								6	CO1	
II	Health management: Applications of behavioral sciences and psychology in health management- nutritional programs for health management-water and sanitation in human health-national programs for communicable and non-communicable diseases-environmental and occupational hazards and their control.								6	CO2	
III	Health care and services: Health care of the community-information, education, communication and training in health-maternal & child health-school health services- Geriatrics-care and welfare of the aged-mental health-health services through general practitioners.								6	CO3	
IV	Preventive medicine: Introduction- role of preventive medicine- levels of prevention-Risk assessment in communities and vulnerable population –surveillance, monitoring and reporting of disease outbreaks - forecasting and control measures in community								6	CO4	

	setting – early detection methods.		
V	Prevention through alternate medicine: Unani, Ayurveda, Homeopathy, Naturopathy systems in epidemic and pandemic outbreaks. International health regulations. Infectious disease outbreak case studies and precautionary response during SARS and MERS coronavirus, Ebola and novel SARS-COV2 outbreaks.	6	CO5
	Total	30	
Course Outcomes			
Course Outcomes	On completion of this course, students will;		
CO1	Identify the health information system	PO1,PO5, PO6	
CO2	Associate various factors with health management system	PO1,PO2, PO3,PO5, PO6, PO9	
CO3	Choose the appropriate health care services	PO1,PO5, PO6	
CO4	Appraise the role of preventive medicine in community setting	PO4,PO5, PO6	
CO5	Recommend the usage of alternate medicine during outbreaks	PO1,PO5, PO6	
Text Books			
1.	Park.K (2021). Textbook of preventive and social medicine, 26 th edition. BanarsidasBhanot publishers.		
2.	Mahajan& Gupta (2013). Text book of preventive and social medicine, 4 th edition. JaypeeBrothers medical publishers.		
3.	Chun-Su Yuan, Eric J. Bieber, Brent Bauer (2006). Textbook of Complementary and Alternative Medicine. Second Edition. Routledge publishers.		
4.	Vivek Jain (2020). Review of Preventive and Social Medicine: Including Biostatistics. 12 th edition, Jaypee Brothers Medical Publishers.		
5.	Lal Adarsh Pankaj Sunder (2011). Textbook of Community Medicine: Preventive and Social Medicine, CBS publisher.		
References Books			
1	Howard Waitzkin, Alina Pérez, Matt Anderson (2021). Social Medicine and the coming Transformation. First Edition. Routledge publishers.		
2	GN Prabhakara (2010). Short Textbook of Preventive and Social Medicine. Second Edition. Jaypee publishers.		
3	Jerry M. Suls, Karina W. Davidson, Robert M. Kaplan (2010).Handbook of Health		

	Psychology and Behavioral Medicine. Guilford Press.
4	Marie Eloise Muller, Marie Muller, Marthie Bezuidenhout, Karien Jooste (2006). Health Care Service Management. Juta and Company Ltd.
5	Geoffrey Rose (2008). Rose's Strategy of Preventive Medicine: The Complete. OUP Oxford.
Web Resources	
1	https://www.omicsonline.org/scholarly/social--preventive-medicine-journals-articles-ppts-list.php
2	https://www.teacheron.com/online-md_preventive_and_social_medicine-tutors
3	https://www.futurelearn.com
4	https://www.healthcare-management-degree.net
5	https://www.conestogac.on.health-care-administration-and-service-management

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	S				S	S					
CO2	S	S		M	S	S			M		
CO3				M	S	S					
CO4	S			S	S	M					
CO5	S				S	S					

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23MBF11	Extremophiles	Foundation course	2	-	-	-	2	2	25	75	100

Course Objectives

This course gives insights about the extreme habitats, extremophilic microorganisms, their adaptations and biotechnological potentials.

UNIT	Details
I	Definition- Bacterial extremophiles & Archea extremophiles – Factors influencing the growth of microorganisms – pH, Temperature, oxygen Requirements, Pressure and availability of water.
II	Thermophiles - classes, extremely thermophilic archaeobacteria, thermozyms, psychrophiles, psychrophilic archaeal extremozymes, Molecular adaptation of extremophiles. Protein stability in extremophilic microbes.
III	Acidophiles -Mechanism of adaptation- application- sulfur cycling and acid mine drainage. Thermoacidiphiles- physical characteristics- cell wall structure. Endolith –definition- environmental condition and survival condition.
IV	Halophiles-osmoregulation, cellular adaptation, structural adaptation, molecular adaptation. Xerophiles. Radiation resistant bacteria. Barophiles- Classification, high pressure habitat, life under pressure, barophily, death under pressure.
V	Psychrophiles - Conditions for microbial life at low temperature Climate of snow and ice, limits for life at subzero temperature. Molecular adaptations to cold habitats –Membrane components and cold sensing, cold adapted enzymes, cryoprotectants and ice binding proteins, role of exopolymers in microbial adaptations to sea ice

Course Outcomes

Apply the knowledge to study the extremophilic microorganisms and tap their unique properties for ecological and industrial applications.

Reference

1.	Ronald M. Atlas and Richard Bartha Microbial ecology. Fundamental and applications edition
2.	Thomas D.Brock Thermophiles. General, Molecular and applied Microbiology
3.	Pelczar M.J, Chan ECS, Kreig NR, Microbiology, McGraw Hill
4.	Stanier RY, Ingharam JL., Wheelis ML., General Microbiology

SEMESTER II

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CI A	External	Total
U23MBT22	Microbial Physiology and Metabolism	Core Course III	3	2	-	-	5	5	25	75	100
Course Objectives											
CO1	Study the basic principles of microbial growth.										
CO2	Understand the basic concepts of aerobic and anaerobic metabolic pathways.										
CO3	Analyze the role of individual components in overall cell function.										
CO4	Provide information on sources of energy and its utilization by microorganisms.										
CO5	Study the different types of metabolic strategies.										
Unit	Details								No.of Hours	Course Objectives	
I	Physiology of microbial growth: Batch – continuous - synchronous cultures; Growth Curve and measurement method (turbidity, biomass, and cell count). Control of microbial growth.								12	CO1	
II	Nutrition requirements - Photoautotrophs, Photoorganotrophs, Chemolithotrophs (Ammonia, Nitrite, Sulfur, Hydrogen, Iron oxidizing Bacteria), Chemoorganotrophs. Nutrition transport mechanisms – Passive diffusion and Active transport. Factors affecting microbial growth.								12	CO2	
III	An overview of Metabolism - Embden Meyerhof Pathway, Entner-Doudoroff Pathway, Pentose Phosphate Pathway, Tricarboxylic Acid Cycle. Electron Transport Chain and Oxidative Phosphorylation. ATP synthesis. Fermentation- Homolactic Fermentation, Heterolactic Fermentation, Mixed Acid Fermentation, Butanediol Fermentation.								12	CO3	
IV	Photosynthesis - An Overview of chloroplast structure. Photosynthetic Pigments, Light Reaction-Cyclic and non-cyclic Photophosphorylation. Dark Reaction - Calvin Cycle.								12	CO4	
V	Bacterial reproduction - Binary fission, Budding, Reproduction through conidia, cyst formation, endospore formation. Fungi asexual and sexual reproduction, Microalgae reproduction. Asexual and sexual reproduction of protozoa.								12	CO5	
	Total								60		

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Describe microorganisms based on nutrition.	PO6, PO9
CO2	Know the concept of microbial growth and identify the factors affecting bacterial growth.	PO6, PO7, PO9
CO3	Explain the methods of nutrient uptake.	PO6, PO9
CO4	Describe anaerobic and aerobic energy production.	PO6, PO9
CO5	Elaborate on the process of bacterial photosynthesis and reproduction.	PO6, PO9
Text Books		
1	Schlegel, H.G. (1993). General Microbiology., 7 th Edition, Press syndicate of the University of Cambridge.	
2	Rajapandian K. (2010). Microbial Physiology, Chennai: PBS Book Enterprises India.	
3	Meena Kumari. S. Microbial Physiology, Chennai 1 st Edition MJP Publishers 2006.	
4	Dubey R.C. and Maheswari, S. (2003). A textbook of Microbiology, New Delhi: S. Chand & Co.	
5	S. Ram Reddy, S.M. Reddy (2008). Microbial Physiology. Anmol Publications Pvt Ltd.	
References Books		
1	Robert K. Poole (2004). Advances in Microbial Physiology, Elsevier Academic Press, New York, Volume 49.	
2	Kim B.H., Gadd G.M. (2008). Bacterial Physiology and Metabolism. Cambridge University Press, Cambridge.	
3	Daniel R. Caldwell. (1995). Microbial Physiology & Metabolism Wm.C. Brown Communications, Inc. USA.	
4	Moat, A.G and J.W Foaster (1995). Microbial Physiology, 3 rd edition. Wiley – LISS, A John Wiley & Sons. Inc. Publications.	
5	Bhanu Shrivastava. (2011). Microbial Physiology and Metabolism: Study of Microbial Physiology and Metabolism. Lambert academic Publication.	
Web Resources		
1	https://sites.google.com/site/microbialphysiologyoddsem/teaching-contents	
2	https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-nutrition/	
3	https://onlinecourses.swayam2.ac.in/cec20_bt14/preview	
4	http://web.iitd.ac.in/~amittal/2007_Addy_Enzymes_Chapter.pdf	
5	https://www.frontiersin.org/microbial-physiology-and-metabolism	

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1						M			M		
CO2						M	L		M		
CO3						M			M		
CO4						M			M		
CO5						M			M		

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
U23MBP22	Microbial Physiology and Metabolism	CCIV-Core Practical II	-	-	5	-	5	5	40	60	100
Course Objectives											
CO1	Understand the principles of motility test.										
CO2	Understand the basic concepts of staining methods.										
CO3	Learn the bacterial count using different methods and anaerobic culture.										
CO4	Study the morphological demonstration of microorganisms and identification.										
CO5	Study the biochemical identification of the bacteria.										
UNIT	Details								No.of Hours	Course Objectives	
I	Motility demonstration: hanging drop, wet mount preparation, semi-solid agar, Craigie's tube method. Staining techniques: Smear preparation, permanent specimen preparation, Capsular, and Acid-fast staining								12	CO1	
II	Direct counts – Direct cell count (Petroff-Hausser counting chamber), Turbidometry. Viable count - pour plate, spread plate. Bacterial growth curve.								12	CO2	
III	Anaerobic culture methods. Antibiotic sensitivity testing: Disc diffusion test- quality control with standard strains.								12	CO3	
IV	Morphological variations in algae, fungi and protozoa. Micrometry: Demonstration of the size of yeast, fungal filaments and protozoa.								12	CO4	
V	Methods of bacterial identification- morphological, physiological, and biochemical methods - IMViC test, H ₂ S, TSI, Oxidase, catalase, urease test, and Carbohydrate fermentation test. Maintenance of pure culture, paraffin method, stab culture, maintenance of mold culture.								12	CO5	
	Total								60		

Course Outcomes		
Course Outcomes	On completion of this course, students will;	
CO1	Describe hanging drop, wet mount preparation, semi-solid agar, Craigie's tube method.	PO6, PO7, PO8, PO9, PO11
CO2	Demonstrate Smear preparation, permanent specimen preparation, Capsular, and Acid-fast staining.	PO6, PO7, PO8, PO9, PO11
CO3	Explain antibiotic sensitivity testing: Disc diffusion test- quality control with standard strains.	PO6, PO7, PO8, PO9, PO11
CO4	Describe demonstration of the size of yeast, fungal filaments and protozoa.	PO6, PO7, PO8, PO9, PO11
CO5	Elaborate on the bacterial identification- morphological, physiological, and biochemical methods.	PO6, PO7, PO8, PO9, PO11
Text Books		
1	James G Cappucino and N. Sherman MB (1996). A lab manual Benjamin Cummins, New York .	
2	Kannan. N (1996).Laboratory manual in General Microbiology. Palani Publications.	
3	Sundararaj T (2005). Microbiology Lab Manual (1 st edition) publications.	
4	Gunasekaran. P (2007). Laboratory manual in Microbiology. New age international publisher.	
5	Elsa Cooper (2018). Microbial Physiology: A Practical Approach. Callisto Reference publisher.	
References Books		
1	DavidWhite., James Drummond., Clay Fuqua (2012) Physiology and Biochemistry of Prokaryotes. 4th Ed. Oxford University Press, New York.	
2	Robert K. Poole (2004). Advances in Microbial Physiology, Elsevier Academic Press, New York, Volume 49.	
3	Kim B.H., Gadd G.M. (2008). Bacterial Physiology and Metabolism. Cambridge University Press, Cambridge.	
4	Dawes, I.W and Sutherland L.W (1992). Microbial Physiology (2 nd edition), Oxford	

	Blackwell Scientific Publications.
5	Moat, A.G and J.W Foaster, (1995). Microbial Physiology, 3 rd edition. Wiley – LISS, A John Wiley & Sons. Inc. Publications.
Web Resources	
1	https://sites.google.com/site/microbialphysiologyoddsem/teaching-contents
2	https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-Nutrition
3	https://onlinecourses.swayam2.ac.in/cec20_bt14/preview
4	https://www.studocu.com/microbial-physiology-practicals
5	https://www.agr.hokudai.ac.jp/microbial-physiology

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1						M	L	M	L		M
CO2						M	M	L	M		L
CO3						L	M	M	L		M
CO4						L	M	M	M		M
CO5						M	M	M	M		M

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CI A	Exter nal	Total
U23MBE2A	Bio - Instrumentation	Elective II - Discipline Specific	2	2	-	-	3	4	25	75	100
Course Objectives											
CO1	Understand the analytical instruments and study the basic principles in the field of sciences.										
CO2	To gain knowledge about principles of spectroscopy										
CO3	To understand the analytical techniques of Chromatography and electrophoresis										
CO4	To understand the principle of different types of scans used in medical diagnosis										
CO5	To gain information about the principles of radioactivity and its measurements										
Unit	Details								No.of Hours	Course Objectives	
I	Basic instruments: pH meter, Buffer of biological importance, Centrifuge- Preparative, Analytical and Ultra, Laminar Air Flow, Autoclave, Hot Air Oven and Incubator. Biochemical calculations- preparations of Molar solutions - Buffers- Phosphate, Acetate, TE, TAE- calculation of Normality ,PPM- Ammonium sulphate precipitation.								12	CO1	
II	Spectroscopic Techniques: Spectroscopic Techniques: Colorimeter, Ultraviolet and visible, Infrared and Mass Spectroscopy.								12	CO2	
III	Chromatographic and Electrophoresis Techniques: Chromatographic Techniques: Paper, Thin Layer, Column, HPLC and GC. Electrophoresis Techniques: Starch Gel, AGE, PAGE.								12	CO3	
IV	Imaging techniques: Principle, Instrumentation and application of ECG, EEG, EMG, MRI, CT and PET scan radioisotopes.								12	CO4	
V	Fluorescence and radiation-based techniques: Spectro fluorimeter, Flame photometer, Scintillation counter, Geiger Muller counter, Autoradiography.								12	CO5	
	Total								60		
Course Outcomes											
Course Outcomes	On completion of this course, students will;										
CO1	Gain knowledge about the basics of instrumentation.								PO1,PO4,PO11		

CO2	Exemplify the structure of atoms and molecules by using the principles of spectroscopy.	PO4,PO10,PO11
CO3	Evaluate by separating and purifying the components.	PO4,PO7,PO11
CO4	Understand the need and applications of imaging techniques.	PO7,PO8,PO11
CO5	Categorize the working principle and applications of fluorescence and radiation.	PO10,PO11
Text Books		
1.	Jayaraman J (2011). Laboratory Manual in Biochemistry, 2 nd Edition. Wiley Eastern Ltd., New Delhi.	
2.	Ponmurugan. P and Gangathara PB (2012). Biotechniques. 1 st Edition. MJP publishers.	
3	Veerakumari, L (2009). Bioinstrumentation- 5 th Edition -.MJP publishers.	
4	Upadhyay, Upadhyay and Nath (2002). Biophysical chemistry – Principles and techniques 3 rd Edition. Himalaya publishing home.	
5	Chatwal G and Anand (1989). Instrumental Methods of Chemical Analysis. S.Himalaya Publishing House, Mumbai.	
References Books		
1	Rodney.F.Boyer (2000). Modern Experimental Biochemistry, 3 rd Edition. Pearson Publication.	
2	Skoog A., West M (2014). Principles of Instrumental Analysis – 14 th Edition W.B.Saunders Co., Philadelphia.	
3	N.Gurumani. (2006). Research Methodology for biological sciences- 1 st Edition – MJP Publishers.	
4	Wilson K, and Walker J (2010). Principles and Techniques of Biochemistry and Molecular Biology. 7 th Edition. Cambridge University Press.	
5	Webster, J.G. (2004). Bioinstrumentation- 4 th Edition - John Wiley & Sons (Asia) Pvt.Ltd., Singapore.	
Web Resources		
1	http://www.biologydiscussion.com/biochemistry/centrifugation/centrifugeintroduction-types-uses-and-other-details-with-diagram/12489	
2	https://www.watelectrical.com/biosensors-types-its-working-andapplications/	
3	http://www.wikiscales.com/articles/electronic-analytical-balance/ Page 24 of 75	
4	https://study.com/academy/lesson/what-is-chromatography-definition-typesuses.html	

5	http://www.rsc.org/learn-chemistry/collections/spectroscopy/introduction
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Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L			M							S
CO2				L						M	S
CO3				L			M				S
CO4							S	S			S
CO5										M	S

Course Code	U23MBE2B	HUMAN PHYSIOLOGY	L	T	P	C
Elective				2	2	-
Cognitive Level	K1: Recall K2: Understand					
Learning objective	<ul style="list-style-type: none"> To learn fundamentals of anatomical structures and physiology of body organs. To describe the structure and functions of the blood & blood vessels To understand how the nervous system controls the body parts. To understand the structure and functions liver and pancreas, respiratory organs, urinary System, endocrine System 					
Unit I	General Anatomy; Digestion in the mouth, stomach and intestines. Movements of the intestine; Role of Liver and Pancreas – Structure and Functions.					
Unit II	Respiratory System: Structure of Respiratory organs; Sub – divisions of lung air; Chemistry of Respiration. Physiology of the Urinary System- Structure of kidney and nephron; Formation of urine, Skin – Structure and functions, Regulations of body temperature					
Unit III	Endocrine System – Structure and functions of thyroid, pituitary, parathyroid, adrenals, islets of langerhans of pancreas b) Reproductive System – anatomy of the male and female reproductive organs; menstrual cycle; mammary glands; Fertilisation; Development of Embryo; Pregnancy and parturition					
Unit IV	Nervous System: General classification of nervous system ; Structure of nerve cell and Spinal cord; Basic Knowledge of different parts of the brain – anatomy and functions of cerebrum, cerebellum and medulla oblongata. Structure and function of eye and ear; taste, smell and cutaneous sensations.					
Unit V	Blood: Composition and Functions of blood; White Blood Cells – Types and function; Red Blood Cells – Structure and functions; Haemoglobin –Structure and functions, Blood coagulation, Blood group – ABO, Rh.Structure of heart and blood vessels; Properties of cardiac muscle; cardiac cycle; origin and conduction of heart beat; measurement of arterial blood pressure.					
Textbook	1. Chatterjee C.C .Human Physiology Volume II.13 th ed.CBS publishers; 2020. ISBN 13 978-9388902717 .					
References	<ol style="list-style-type: none"> Sembulingam, K. Essentials of Medical Physiology. 8th ed. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi; 2019.ISBN -13 978- 9352706921. Best and Taylor. The Physiological Basis for Medical Practice. 13th ed. Wolters kluwer India Pvt Ltd; 2011.ISBN -13 978- 8184731927. 					

E-references	1. https://www.researchgate.net/publication/311934098_introduction_to_human_physiology
Course	Upon completion of this course, the students will be able to

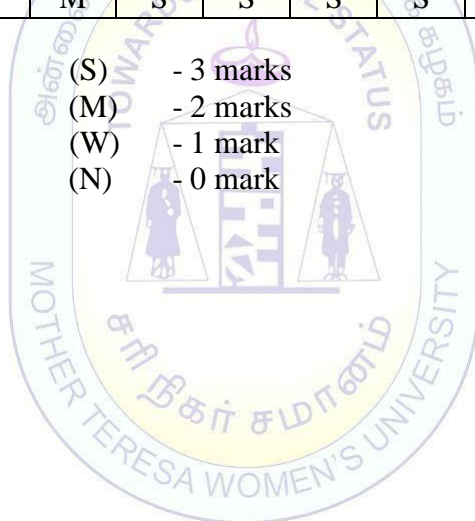
outcome		
CO1	realise and understand the function of digestive system and the role of liver and pancreas.	K1
CO2	acquire information on respiratory organs and its regulation.	K2
CO3	recognise the importance of endocrine system.	K2
CO4	understand the structure and function of nervous system.	K2
CO5	empathize on composition and functions of blood.	K2

Mapping of COs with POs &PSOs:

CO	POs								PSOs				
	1	2	3	4	5	6	7	8	1	2	3	4	5
CO1	S	M	S	S	S	S	S	S	S	S	S	M	S
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S
CO3	S	S	S	S	M	S	S	S	S	M	S	S	M
CO4	S	M	S	S	S	S	S	S	S	S	M	S	S
CO5	S	S	S	M	S	S	S	S	S	S	S	S	S

Strongly Correlating
Moderately Correlating
Weakly Correlating
No Correlation

(S) - 3 marks
(M) - 2 marks
(W) - 1 mark
(N) - 0 mark



Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CI A	External	Total
U23MBE2C	Nutrition & Health Hygiene	Skill Enhancement Course - SEC - 2 (NME)	2	-	-	-	2	2	25	75	100
Course Objectives											
CO1	Learn about nutrition and their importance										
CO2	Make student understand the nutritional facts for a better life.										
CO3	Learn information to optimize our diet										
CO4	Impart knowledge on different health care programs taken up by India										
CO5	Learn knowledge on different health indicators and types of hygiene methods										
Unit	Details								No. of Hours	Course Objectives	
I	Nutrition – definition, importance, Good nutrition, and mal nutrition; Balanced Diet: Basics of Meal Planning. Carbohydrates, Lipids, Proteins and Vitamins –functions, dietary sources, effects of deficiency. Macro and micro minerals –functions, effects of deficiency; food sources of Calcium, Potassium, and Sodium; food sources of Iron, Iodine, and Zinc. Importance of water– functions, sources, requirements and effects of deficiency								5	CO1	
II	Nutrition for Life Cycle: Balanced diet - Normal, Pregnant, lactating women, Infancy, young children Adolescents, Adults, and the Elderly; Diet Chart; Nutritive value of Indian foods.								5	CO2	
III	Improper diets: Definition, Identification, Signs and Symptoms - malnutrition, under-nutrition, over-nutrition, Protein Energy Malnutrition, obesity; Nutritional Disease and Disorder -								5	CO3	

	hypertension, diabetes, anemia, osteomalacia, cardiovascular disease.		
IV	Health - Determinants of health, Key Health Indicators, Environment health & Public health; Health-Education: Principles and Strategies. Health Policy & Health Organizations: Health Indicators and National Health Policy of Govt. of India; Functioning of various nutrition and health organizations in India.	5	CO4
V	Hygiene – Definition; Personal, Community, Medical and Culinary hygiene; WASH (Water, Sanitation and Hygiene) programme. Rural Community Health: Village health sanitation & Nutritional committee. Community & Personal Hygiene: Environmental Sanitation and Sanitation in Public places.	5	CO5
	Total	25	
Course Outcomes			
Course Outcomes	On completion of this course, students will;		
CO1	Learn the importance of nutrition for a healthy life	PO5, PO6, PO7, PO8, PO10	
CO2	Study the nutrition for life cycle	PO5, PO6, PO7, PO8, PO10	
CO3	Know the health care programmes of India	PO5, PO6, PO7, PO8, PO10	
CO4	Learn the importance of community and personal health & hygiene measures	PO5, PO6, PO7, PO10	
CO5	Create awareness on community health and hygiene	PO5, PO6, PO7, PO10	

Text Books	
1.	Bamji, M.S., K. Krishnaswamy & G.N.V. Brahmam (2009) Textbook of Human Nutrition (3rd edition) Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
2.	Swaminathan (1995) Food & Nutrition (Vol I, Second Edition) The Bangalore Printing & Publishing Co Ltd., Bangalore
3	SK. Haldar (2022). Occupational Health and Hygiene in Industry. CBS Publishers.
4	Acharya, Sankar Kr, Rama Das, Minati Sen (2021). Health Hygiene and Nutrition Perception and Practices. Satish Serial Publishing House
5	Dass (2021). Public Health and Hygiene, Notion Press
References Books	
1	Vijaya Khader (2000) Food, nutrition & health, Kalyan Publishers, New Delhi
2	Srilakshmi, B., (2010) Food Science, (5 th Edition) New Age International Ltd., New Delhi
3	Arvind Kumar Goel (2005). A College Textbook of Health & Hygiene, ABD Publishers
4	Sharma D. (2015). Textbook on Food Science and Human Nutrition. Daya Publishing House.
5	Revilla M. K. F., Titchenal A. and Draper J. (2020). Human Nutrition. University of Hawaii, Mānoa.
Web Resources	
1	National Rural Health Scheme: https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=969&lid=49
2	National Urban Health Scheme: https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=970&lid=137
3	Village health sanitation & Nutritional committee https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=149&lid=225
4	Health Impact Assessment - https://www.who.int/hia/about/faq/en/
5	Healthy Living https://www.nhp.gov.in/healthylivingViewall

Mapping with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1					S	M	M	M		S	
CO2					S	M	M	M		S	
CO3					S	M	M	M		S	
CO4					S	S	L			S	
CO5					S	S	M			S	

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CI A	External	Total
U23MBS23	Sericulture	Skill Enhancement Course - SEC-3	2	-	-	-	2	2	25	75	100
Course Objectives											
CO1	Acquire knowledge on the concepts of origin, growth and study of Sericulture as science and scientific approach of mulberry plant.										
CO2	Describe the morphology and physiology of silkworm.										
CO3	Discuss effective management of silkworm diseases.										
CO4	Demonstrate field skills in mulberry cultivation and silkworm rearing with an emphasis on technological aspects.										
CO5	Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises.										
Unit	Details								No. of Hours	Course Objectives	
I	General introduction to Sericulture, its distribution in India. Botanical distribution and taxonomical characters of mulberry varieties and species. Biology of Mulberry plant and Mulberry crop cultivation and protection.								5	CO1	
II	Silkworm- biology-morphology of silkworm. Life cycle of silkworm- egg, larva, pupa, and moth.								5	CO2	
III	Silkworm pathology: Introduction to Parasitism, Commensalism, Symbiosis and Parasite relationship - Mulberry Silkworm Diseases: Introduction, types, Pebrine, Grasserie, Muscardine, Flacherie, Symptoms and Pathogens, Mode of Infection, Prevention and Control -Non – mulberry silkworm diseases: Pebrine, Bacterial and viral diseases. Brief Account of Pests and Predators of Silkworms, Nature of damage and control measures.								5	CO3	
IV	Rearing of silkworm. Cocoon assessment and processing technologies. Value added products of mulberry and silkworms.								5	CO4	
V	Entrepreneurship and rural development in sericulture: Planning for EDP, Project formulation, Marketing, Insectary facilities and equipments: Location, building specification, air conditioning and environmental control, furnishings and equipment, sanitation and								5	CO5	

	equipment, subsidiary facilities.		
	Total	25	
Course Outcomes			
Course Outcomes	On completion of this course, students will;		
CO1	Discuss the overall aspects of Sericulture and the biology and varieties of mulberry plant. Creates awareness among students about the economic importance and suitability of Sericulture in Indian conditions.	PO1,PO5,PO7	
CO2	Familiarize with the lifecycle of silk worm.	PO1, PO2	
CO3	Explain common diseases of silkworm encountered during rearing, sources of infection, disease symptoms, pre-disposing factors and their management practices.	PO1, PO5	
CO4	Attain thorough knowledge about the cultivation of mulberry, maintenance of the farm, seed technology, silkworm rearing, post cocoon techniques like stifling, reeling, and utilization of by-products.	PO7, PO8, PO10	
CO5	Plan the facilities required for establishment of insectary. Competent to transfer the knowledge and technical skills to the Seri-farmers. Analyze the importance of sericulture in entrepreneurship development and emerge as potential entrepreneur.	PO5, PO7, PO8	
Text Books			
1	Ganga, G. and Sulochana Chetty (2010). Introduction to Sericulture, J., Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi.		
2	Dr. R. K. Rajan & Dr. M. T. Himantharaj (2005). Silkworm Rearing Technology, Central Silk Board, Bangalore.		
3	Dandin S B, Jayant Jayaswal and Giridhar K (2010). Handbook of Sericulture technologies, Central Silk Board, Bangalore.		
4	M. C. Devaiah, K. C. Narayanaswamy and V. G. Maribashetty (2010). Advances in Mulberry Sericulture, CVG Publications, Bangalore		
5	<i>T.V.Sathe and Jadhav.A.D.(2021). Sericulture and Pest Management, Daya Publishing House.</i>		
References Books			

1	S. Morohoshi (2001). Development Physiology of Silkworms 2 nd Edition, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi
2	Hamamura, Y (2001). Silkworm rearing on Artificial Diet. Oxford & IBH publishing Co., Pvt. Ltd. NewDelhi.
3	M.Johnson, M.Kesary (2019).Sericulture, 5 th .Edition.Saras Publications.
4	Manisha Bhattacharyya (2019). <u>Economics of Sericulture</u> , Rajesh Publications.
5	Muzafar Ahmad Bhat, Suraksha Chanotra, Zafar Iqbal Buhroo, Abdul Aziz and Mohd.Azam (2020). <u>A Textbook on Entrepreneurship Development Programme in Sericulture</u> , IP Innovative Publication.
Web Resources	
1	https://egyankosh.ac.in > bitstream
2	https://archive.org > details > SericultureHandbook
3	https://www.academic.oup.com
4	https://www.sericulture.karnataka.gov.in
5	https://www.silks.csb.gov.in

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	S				S		S				
CO2	M				S						
CO3	S				S						
CO4							S	S		S	
CO5					S		S	S			