ST. MARY'S COLLEGE (Autonomous)

(Re-accredited with 'A$^+$' Grade by NAAC)

Thoothukudi-628001, Tamilnadu

(Affiliated to Manonmaniam Sundaranar University)

Syllabus

B.Sc. Microbiology

School of Biological Sciences

Outcome Based Curriculum

(W.e.f.2024)

Preamble

Microbiology is the branch of biology dealing with the structure, function, uses, and modes of existence of microscopic organisms. Microbiology is the study of microorganisms such as bac- teria, fungi, algae, protozoa and virus. Microbiology encompasses numerous sub- disciplines in- cluding virology, parasitology, mycology and bacteriology.

Vision

To make young women as an effective science personality through experimental scientific education.

Mission

To empower and enrich women with scientific knowledge so that they are skilled to compete in this global sphere of education as an eminent personalities.

Programme Outcome

PO No.	**After completion of the Undergraduate programme the students of St. Mary's College will be able to**
PO 1	acquire an in-depth domain knowledge and a comprehensive knowledge of various disciplines to become skilled professionals
PO 2	enrich their communicative skills, and enhance their creative, numerical, analytical and problem solving skills
PO 3	gain potential skills to excel in digital literacy, team management, scientific reasoning, research and self-directed life-long learning to emerge as entrepreneurs
PO 4	be aware of the environment with a social responsibility for the well-being of humanity and the planet at large
PO 5	be an empowered, economically independent woman with a global perspective to emerge holistically in the egalitarian society

Programme Specific Outcome

PSO No.	Students of B.Sc. Microbiology will be able to
PSO-1	Prepare the students in all disciplines like agriculture, industry, medical, dairy, food and sea food processing, immunology, vermitechnology and water treatment for effective and respectful placement.
PSO-2	Create effective entrepreneur by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations.
PSO-3	Design and implement microbiological systems that comply with good laboratory practices, following ethical values, leading the organization towards growth and development.
PSO-4	Contribute to the development of society and produce microbiological products, by collaborating with stake holders, related to the betterment of environment and mankind at the national and global level.
PSO-5	Enhancing the practical skill in various fields of microbiology and empowering women through microbiological techniques.

ST. MARY'S COLLEGE (AUTONOMOUS), THOOTHUKUDI

DEPARTMENT OF MICROBIOLOGY

UG COURSE STRUCTURE (w.e.f.2024)

SEMESTER I

Part	Components	Course Code	Course Title	Contact Hours / Week	Credits	Max. Marks		
						CIA	ESE	Total
I	Tamil / French	24ULTA11 24ULFA11	,f;fhy ,yf;fpak; : (nra;As;> ,yf;fzk;> ,yf;fpa tuyhW> rpWfij) Foundation Course French I	6	3	40	60	100
II	General English	24UGEN11	Poetry, Prose, Extensive Reading and Communicative English I	6	3	40	60	100
III	Core I	24UMIC11	Introduction to Microbiology and Microbial Diversity	6	5	40	60	100
	Core Practical I	24UMICR1	Practical in Introduction to Microbiology and Microbial Diversity	2	2	40	60	100
	Generic Elective I	24UMIE11	Biochemistry I	4	4	40	60	100
	Generic Elective Practical I	24UMIER1	Practical in Biochemistry I	2	1	40	60	100
IV	Skill Enhancement Course I	24UMISE1	Bioinstrumentation	2	2	20	30	50
	Ability Enhancement Course I	24UAVE11	Value Education	2	2	20	30	50
			Total	**30**	**22**			

Semester – II

Part	Course	Course Code	Course Title	Contact Hours / Week	Credits	Max Marks		
						CIA	ESE	Total
I	Tamil / French	24ULTA21 24ULFA21	rka ,yf;fpaq;fs;: nra;As;> ,yf;fzk;> ,yf;fpa tuyhW> ciueil> tho;f;if tuyhW Proficient French Course	6	3	40	60	100
II	General English	24UGEN21	English Poetry, Prose, Extensive Reading and Communicative English II	6	3	40	60	100
III	Core II	24UMIC21	Microbial Physiology	6	5	40	60	100
	Core Practical II	24UMICR2	Practical in Microbial Physiology	2	2	40	60	100
	Generic Elective II	24UMIE21	Biochemistry II	4	4	40	60	100
	Generic Elective Practical II	24UMIER2	Practical in Biochemistry II	2	1	40	60	100
IV	Skill Enhancement Course II	24UMISE2	Practical in Medical Laboratory Technology	2	2	20	30	50
	Ability Enhancement Course II	24UAEV21	Environmental Studies	2	2	20	30	50
			Total	**30**	**22**			

Semester - III

Part	Components	Course Code	Course Title	Hrs/ Week	Credit	Max.Marks		
						CIA	ESE	Total
I	Tamil / French	24ULTA31 24ULFA31	fhg;gpa ,yf;fpaq;fs; : ngUq;fhg;gpak;> rkaf; fhg;gpak;> ,yf;fzk;> ,yf;fpa tuyhW> Gjpdk; French Literature and Grammar I	6	3	40	60	100
II	General English	24UGEN31	English Poetry, Prose, Extensive Reading and Communicative English III	6	3	40	60	100
III	Core III	24UMIC31	Molecular Biology and Microbial genetics	5	5	40	60	100
	Core Practical III	24UMICR3	Practical in Molecular Biology and Microbial genetics	2	2	40	60	100
	Generic Elective III	24UMIE31	Biostatistics and Computers	4	3	40	60	100
	Generic Elective Practical III	24UMIER3	Practical in Biostatistics and Computers	2	1	40	60	100
	NME I	24UMIN31	Clinical Microbiology	2	2	20	30	50
IV	Skill Enhancement Course III	24UMISE3	Nanotechnology	2	2	20	30	50
	Ability Enhancement Course III	24UAYM31	Yoga and Meditation	1	1	20	30	50
	Self-Study I / MOOC / Internship (Compulsory)	24UMISS1	Probiotics		+2	--	50	50
Total				**30**	**22+2**			

Semester - IV

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max.Marks		
						CIA	ESE	Total
I	Tamil /	24ULTA41	rq;f ,yf;fpaq;fs; : vl;Lj;njhif> gj;Jg;ghl;L> ,yf;fzk;>,yf;fpa tuyhW> ehlfk;	6	3	40	60	100
	French	24ULFA41	French Literature and Grammar II					
II	General English	24UGEN41	English Poetry, Prose, Extensive Reading and Communicative English IV	6	3	40	60	100
III	Core IV	24UMIC41	Medical Microbiology	5	5	40	60	100
	Core Practical IV	24UMICR4	Practical in Medical Microbiology	2	2	40	60	100
	Generic Elective IV	24UMIE41	Dairy Technology	4	3	40	60	100
	Generic Elective Practical IV	24UMIER4	Practical in Dairy Technology	2	1	40	60	100
	NME II	24UMIN41	Food Microbiology	2	2	20	30	50
IV	Skill Enhancement Course IV	24UMISE4	Bio fertilizer Technology	2	2	20	30	50
	Ability Enhancement Course IV (Entrepreneurial Based)	24UAMI41	Mushroom Technology	1	1	--	50	50
V	NCC / NSS / Sports				1			
	CDP Extension activity				+1			
Total				**30**	**23+1**			

Semester - V

Part	Components	Course Code	Course Title	Hrs/ Week	Credits	Max.Marks		
						CIA	ESE	Total
III	Core V	24UMIC51	Immunology	5	5	40	60	100
	Core VI	24UMIC52	Environmental and Agricultural Microbiology	5	5	40	60	100
	Core VII	24UMIC53	Industrial Microbiology	5	5	40	60	100
	Core Practical V	24UMICR5	Practical in Immunology	3	2	40	60	100
	Core Practical VI	24UMICR6	Practical in Environmental, Agricultural and Industrial Microbiology	6	3	40	60	100
	Discipline Specific Elective I	24UMIE51/ 24UMIE52	**Microbial Biotechnology** / Biosafety and Bioethics	4	4	40	60	100
VI	Skill Enhancement Course V	24UMISE5	Vermitechnology	2	1	20	30	50
	Self-Study II Online Course / Internship (Optional)	24UMISS2	Food Packaging Technology		+2	--	50	50
				30	**25+2**			

Semester - VI

Part	Components	Course Code	Course Title	Hrs/ Week	Credit	Max.Marks		
						CIA	ESE	Total
III	Core VIII	24UMIC61	Genetic Engineering	5	5	40	60	100
	Core IX	24UMIC62	Pharmaceutical Microbiology	5	5	40	60	100
	Core X	24UMIC63	Food Microbiology	5	5	40	60	100
	Core Practical VII	24UMICR7	Practical in Genetic Engineering and Pharmaceutical Microbiology	4	2	40	60	100
	Core Practical VIII	24UMICR8	Practical in Food Microbiology	2	1	40	60	100
	Core XI	24UMIP61	Project and Viva Voce	5	4	40	60	100
	Discipline Specific Elective II	24UMIE61/ 24UMIE62	**Bioinformatics** / Cosmetic Microbiology	4	4	40	60	100
				30	**26**			

SEMESTER I			
Core I INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY			
Course Code: 24UMIC11	**Hrs/ Week: 6**	**Hrs/ Sem: 90**	**Credits: 5**

Objectives:

- Learn the historical events of Microbiology including recent developments in the area.
- Understand the basic laboratory techniques – culturing, sterilization and staining in Microbiology.
- Explain the ultra structure of bacteria and their functions.
- Describe the structure and characteristics of fungi and algae.
- Differentiate the properties of plant and animal viruses.

Course Outcome:

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Summarize the historical events and inventions and understand the classification of microorganisms and microscopy.	K1
CO-2	Analyse the various microbiological techniques, different types of media, and techniques involved in culturing microorganisms.	K3
CO-3	Demonstrate detailed structure and functions of bacteria and their types.	K2
CO-4	Recommend the properties and classification of fungi and algae.	K5
CO-5	Distinguish between plant and animal viruses and to learn about the parasites	K4

SEMESTER I			
Core I INTRODUCTION TO MICROBIOLOGY AND MICROBIAL DIVERSITY			
Course Code: 24UMIC11	**Hrs/ Week: 6**	**Hrs/ Sem: 90**	**Credits: 5**

Unit -I: (18 Hrs)

History and Scope of Microbiology. Binomial nomenclature - Classification of microorganisms – Three kingdom, five kingdom and six kingdom. Difference between prokaryotes and eukaryotes. Microscopy- terms in microscopy. Types – Simple, Compound, Dark field, Bright field, Phase contrast and Transmission Electron microscopy.

Unit -II: (18 Hrs)

Sterilization – physical-chemical-biological. Basic component of growth media – Types of growth media - General, selective, differential and transport media. Staining techniques - types of dyes and stains. Simple, Differential and Special staining (Capsule staining).

Unit –III (18 Hrs)

Bacteria- General characters, Ultra structure- cell wall, cell membrane, capsule, flagella, pili, mesosomes, chlorosomes, phycobilisomes, spores, and gas vesicles. Types- Gram positive bacteria (*Bacillus*) - Gram negative bacteria (*E.coli*) - Acid fast Bacteria (*Mycobacterium tuberculosis*)

Unit –IV (18 Hrs)

Fungi – General characters, morphology and classification. General features and Life cycle of *Aspergillus*, *Mucor* and *Agaricus*. Algae- General characters, Structure and classification. General features and life cycle of Blue green algae (*Nostoc*), Red algae (*Gracilaria*) and Green algae (*Chlorella*). Economic importance of algae.

Unit–V (18 Hrs)

Viruses - Properties and Classification. Structure and characteristics of Plant viruses (TMV and CaMV) Animal viruses (Adeno virus and Rhabdo virus) Virion and Prions. Protozoa – General introduction – morphology and classification. General features and Life cycle – *Sarcodina* and *Mastigophora*.

Text Books

1. Dubey. R.C., and Maheswari, S. (2000). A Text Book of Microbiology – Chand and Co, New Delhi.

2. Pelczar Jr. M.J., Chan E.C.S., and Kreig N.R. (2000). Microbiology – McGraw Hill, Inc., New York.
3. Jagadish Chandar (2001). A Text Book of Medical Mycology. Inter Print. New Delhi.
4. Powar C.B and Daginawala H.F (2005). General Microbiology, Volume I and II, 8th Edition, Himalaya Publishing House, Mumbai.
5. Salle, A.J. (1996). Fundamental Principles of Bacteriology. 7th edition. Tata McGrawHill Publishing Company Ltd., New Delhi.

Books for Reference:

1. Prescott L.M., Harley J.P., and Klein D.A (2008). Microbiology 7th Edition McGraw Hill, New York.

2. Madigan M.T., Martinko. J.M. Parker .J., and brock T.D. (2001). Biology of Microorganisms.8th Edition. Prentice Hall International Inc, London.

3. Alexopoulos, C.J.,and Mims,C.W.(2002). Introductory Mycology, Wiley,New York.

4. Stainer R.Y., In graham J.L., wheelis M.L., and Painter P.R. (2001). General Microbiology, Macmillan Education Lt., London.

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://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-nutrition/

SEMESTER I

Mapping of Course Outcomes with Pos and PSOs

Course Outcomes	Programme Outcomes(PO)					Programme Specific Outcomes(PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	3	2	2	2	1	2	2	2
CO-2	2	2	2	1	3	2	3	2	1	3
CO-3	3	2	2	2	3	1	2	2	3	2
CO-4	2	2	1	2	2	3	3	2	2	1
CO-5	2	1	2	2	2	1	2	2	1	2
Ave.	2.4	1.8	2.0	1.8	2.4	1.8	2.2	2.0	1.8	2.0

Mapping	<40%	≥ 40%and<70%	≥ 70%
Relation	Low Level	MediumLevel	High Level
Scale	1	2	3

Core Practical I Practical in Introduction to Microbiology and Microbial Diversity			
Course Code: 24UMICR1	**Hrs/Week:2**	**Hrs/Sem:30**	**Credits:2**

Objectives

- To instill students on laboratory techniques like microscopy, sterilization and culture of microbes
- To acquire skills and competency in microbiological laboratory practices
- To provide knowledge on diversity of microorganisms
- To provide hands on training in microbiology research

Course outcome

CO No	Upon completion of this course,students will be able to	Cognitive Level
CO-1	Demonstrate appropriate laboratory skill and techniques related to isolation, staining, identification and control of microorganisms	K3
CO-2	Explain working principle of microscopy and sterilization technique	K2
CO-3	Describe the methods of cultivation of bacteria	K1
CO-4	Distinguish various forms of microbes based on microscopic observation	K4
CO-5	Estimate microbial population in a given environment	K5

SEMESTER I			
Core Practical I Practical in Introduction to Microbiology and Microbial Diversity			
Course Code: 24UMICR1	**Hrs/Week:2**	**Hrs/Sem:30**	**Credits:2**

1. Microbiology Good Laboratory Practices and Biosafety
2. Sterilization of media and glassware using autoclave and hot air oven
3. Staining Techniques – Simple, Gram's staining and Negative staining
4. Preparation of culture media – Solid, Semi solid and liquid media
5. Isolation of bacteria and fungi from the soil sample
6. Enumeration of bacteria from the water sample
7. Pure culture techniques – dilution-plating, Streak-plate, Spread-plate, Pour-Plate
8. Preservation of microbial culture by deep tube and sterile oil
9. Motility test – Hanging drop method
10. Direct microscopic count – Colony counter
11. Diagrammatic identification of -. Yeast- *Saccharomyces cerevisiae, Candida albicans.* ii. Molds- *Mucor, Rhizopus, Penicillium, Aspergillus*
12. Study of symbiotic association between plant and microbe (Demonstration)
13. Study of microbial quality of air by open plate method
14. Growth characteristics of bacteria on solid and liquid media (Demonstration)

Books for Reference

1. Kannan, N. (2015). Laboratory Manual in General Microbiology. Palani Paramount
2. Publication, Palani.
3. Aneja. K.R, (2002). Experiments in Microbiology plant pathology tissue culture and mushroom production technology, III Ed. New Age International publishers (P) Ltd, New Delhi.
4. James. G. Cappucino. And Natabe Sherman, (2004). Microbiology – A Laboratory Manual, VI Ed., (I Indian Reprint). Pearson Education (Singapore) Pvt. Ltd., India.
5. Dubey, R.C and Maheswari, D.K. (2002). Practical Microbiology, I Ed., Chand and Company Ltd., India.

Web Resources

1.https://microbenotes.com/pour-plate-technique-procedure significance-advantages-limitations/

2.https://apsjournals.apsnet.org/doi/10.1094/PHYTO-11-20-0512-PER

3.https://www.sigmaaldrich.com/IN/en/applications/microbiological-testing/microbial-culture-media-preparation

Mapping of Course Outcomes with Pos and PSOs

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	1	3	2	2	2	2	3	2	2	2
CO-2	2	2	1	2	2	1	2	2	3	3
CO-3	1	3	2	3	1	2	2	3	3	1
CO-4	2	3	2	1	2	3	1	2	2	1
CO-5	2	1	3	2	1	2	3	2	2	3
Ave.	1.6	2.4	2..0	2.0	1.6	2.0	2.2	2.2	2.4	2.0

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER I

Generic Elective I Biochemistry I			
Course Code: 24UMIE11	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credits: 4**

Objectives

- understand the nature of various biological molecules and their importance
- highlight the salient feature on the classification and structural properties of carbohydrates
- create interest on the classification and properties of proteins
- impart knowledge on the structure and functions of lipids
- acquire overall knowledge on nucleic acids and vitamins

Course Outcome:

CO No	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Ability to remember chemical nature of biomolecules	K1
CO-2	Use biochemical tools for better understanding of structures of biomolecules and their functions	K3
CO-3	Develop comprehensive knowledge on classification and properties of carbohydrates, proteins, lipids and nucleic acid	K2
CO-4	Capacity to analyse the functions of carbohydrates, proteins, and lipids	K4
CO-5	Make new techniques to study Biochemical importance and regulation	K5

SEMESTER I			
Generic Elective I Biochemistry I			
Course Code - 24UMIE11	**Hrs/ Week: 4**	**Hrs/ Sem: 60**	**Credits: 4**

Unit I **(12 hrs)**

Introduction - Chemical elements – Structure of atoms, molecules and chemical bonds, chemical reactions. Water – structure, physical and chemical properties. Composition of living matter, biochemistry of bacterial, animal and plant cell. Structure and function of cellular constituents. Applications of biochemistry in medicine, nutrition and agriculture.

Unit II **(12 hrs)**

Carbohydrates-Sources, significance, structure, physical and chemical properties and classification of monosaccharides - glucose and fructose, disaccharides - sucrose and lactose and polysaccharides - starch and cellulose.

Unit III **(12 hrs)**

Proteins- Sources, significance, structure (primary, secondary and tertiary), physical and chemical properties and classification of proteins. Amino acids – Essential and non-Essential aminoacids and their roles.

Unit IV **(12 hrs)**

Lipids-Sources, significance, structure, physical and chemical properties (saponification, rancidity, definition of acid number, saponification number and iodine number) and classification of lipids-Fatty acids – Simple lipids: tertiary compound lipids (phospholipid), derived lipids: steroids (cholesterol), saturated fatty acids (butyric acid), unsaturated fatty acid (linoleic acid).

Unit V **(12 hrs)**

Nucleic acids-Sources, significance, structure and functions of DNA (Watson and Crick model)-Structure and functions of RNA (mRNA, tRNA and rRNA). Vitamins-Sources, significance-Water soluble vitamins (vitamin Riboflavin and vitamin Ascorbic acid), fat soluble vitamins (Vitamin A, D, E and K)-Functions and deficiency syndromes.

Text Books:

1. Satyanarayana, U. and Chakrapani, U (2014).Biochemistry,4th Edition, Made Simple Publisher.
2. Jain J L, Sunjay Jain and Nitin Jain (2016).Fundamentals of Biochemistry, 7th Edition, S Chand Company
3. AmbikaShanmugam's (2016). Fundamentals of Biochemistry for Medical Students, 8th 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, 8th edition. WH Freeman publisher.

Books for Reference:

1. Amit Kessel and Nir Ben-Tal (2018). Introduction to Proteins: structure, function and motion. 2ndEdition, Chapman and Hall.
2. David L. Nelson and Michael M. Cox (2017). Lehninger Principles of Biochemistry, 7thEdition W.H. Freeman and Co., NY.
3. LupertStyrer, Jeremy M. Berg, John L. Tymaczko, Gatto Jr., Gregory J (2019). Biochemistry. 9thEdition , W.H.Freemanand Co. New York.
4. Donald Voet, Judith Voet, Charlotte Pratt (2016). Fundamentals of Biochemistry: Life at the Molecular Level, 5th Edition, Wiley.
5. Joy PP, Surya S. and AswathyC (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 of Course Outcomes with Pos and PSOs

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO - 1	**PO -2**	**PO -3**	**PO -4**	**PO -5**	**PSO - 1**	**PSO - 2**	**PSO - 3**	**PSO - 4**	**PSO -5**
CO - 1	3	1	3	1	1	3	1	1	2	1
CO – 2	3	1	3	1	1	3	1	1	1	2
CO - 3	3	1	3	1	1	3	1	1	1	1
CO - 4	3	1	3	1	1	1	1	2	1	2
CO - 5	3	1	3	2	3	3	2	3	3	3
Ave.	**3**	**1**	**3**	**1.2**	**1.4**	**2.6**	**1.2**	**1.6**	**1.6**	**1.8**

Mapping	**<40%**	**≥40% and < 70%**	**≥70%**
Relation	**Low level**	**Medium level**	**High level**
Scale	**1**	**2**	**3**

SEMESTER I

Generic Elective Practical I Practical in Biochemistry I			
Course Code : 24UMIER1	**Hrs/ Week: 2**	**Hrs/ Sem: 30**	**Credit: 1**

Objectives:

• impart a practical knowledge on the estimation of Carbohydrates using various methods

• demonstrate the estimation of proteins

• identify unknown carbohydrates and proteins

• perform estimation of Amino acids

• estimate and quantify various biomolecules

Course Outcome:

CO No	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Ability to remember safety measures and rules to be followed in a microbiological laboratory.	K1
CO -2	Comprehensive knowledge on various biomolecules and their importance	K2
CO-3	Handling and use of Instruments used to analyse biomolecules	K3
CO-4	Capacity to analyse carbohydrates, proteins, lipids and nucleic acid.	K4
CO-5	Make use of techniques to identify the unknown biomolecules	K5

SEMESTER I			
Generic Elective Practical I Practical in Biochemistry I			
Course Code : 24UMIER1	**Hrs/ Week: 2**	**Hrs/ Sem: 30**	**Credit: 1**

1. Estimation of Carbohydrates - Anthrone method (total carbohydrates).
2. Estimation of Carbohydrates - Benedict's method (Glucose)
3. Qualitative analysis of unknown carbohydrates
4. Estimation of Proteins by Lowry's method
5. Qualitative analysis of unknown proteins
6. Precipitation reactions of proteins
7. Estimation of Lipids (Demonstration)
8. Estimation of Amino acids
9. Estimation of Nucleic acids (Demonstration)
10. Estimation of vitamin - Ascorbic acid (Demonstration)

Books for Reference :

1. Jayaraman, J.(2000). Laboratory Manual in Biochemistry. Wiley Eastern Ltd., New Delhi.
2. Plummer, D.T.(2001). An Introduction to Practical Biochemistry. Tata McGraw-Hill.NewDelhi.
4. Palanivelu. P. (2005) Analytical Biochemistry and Separation Techniques.21st Century Publications.
4. Keith Wilson.K and Walker.J (2003) Principles of Practical Biochemistry – CambridgeUniv Press.

Web Resources

1. https://www.slideshare.net/brunobasil/lipids-methodology
2. https://www.iitg.ac.in/biotech/BTechProtocols/Ascorbic.pdf
3. https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/3%20ESTIMATION%20OF%20SUGAR.pdf
4. https://www.zmchdahod.org/pdf/college/Reactions_of_Protein-01-11-2018.pdf

Mapping of Course Outcomes with POs and PSOs

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	2	2	3	2	3	1	2	1	2	2
CO-2	3	3	2	3	2	2	1	2	1	3
CO-3	3	2	3	2	1	2	3	2	2	1
CO-4	3	3	1	1	2	2	1	3	2	3
CO-5	2	3	2	2	3	3	1	2	2	3
Ave.	2.3	2.3	2.2	2.0	2.2	2.0	1.6	2.0	1.8	2.4

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER I
Skill Enhancement Course I Bioinstrumentation

Course Code: 24UMISE1	Hrs/ Week: 2	Hrs/ Sem: 30	Credits: 2

Objectives:

- Understand the basic analytical instruments and study the basic principles in the field of sciences.
- To gain knowledge about principles of spectroscopy
- Understand the analytical techniques of Chromatography
- To understand the principle of electrophoresis
- To gain information about the principles of Fluorescence and radiation based techniques

Course Outcome:

CO No	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Interpret knowledge about the basic instruments	K2
CO-2	Explain the structure of atoms and molecules by using the principles of spectroscopy	K1
CO-3	Evaluate by separating and purifying the components using Chromatography	K5
CO-4	demonstrate the need and applications of electrophoretic techniques	K3
CO-5	Analyse the working principle and applications of fluorescence and radiation based techniques	K4

SEMESTER I
Skill Enhancement Course I Bioinstrumentation

Course Code : 24UMISE1	Hrs/ Week: 2	Hrs/ Sem: 30	Credits: 2

Unit I: **(6 Hrs)**

Basic instruments: pH meter, Buffers- Buffer of biological importance (Phosphate, Acetate, TE, TAE), Centrifuge, Autoclave, Hot Air Oven and Incubator.

Unit II: **(6 Hrs)**

Spectroscopic Techniques: Colorimeter, Ultraviolet and visible, Infrared and Mass Spectroscopy.

Unit III: **(6 Hrs)**

Chromatographic Techniques: Paper, Thin Layer, Column, HPLC and GC.

Unit IV: **(6 Hrs)**

Electrophoresis Techniques: Starch gel, AGE, Native PAGE, SDS PAGE, Gradient gel

Unit V: **(6 Hrs)**

Fluorescence and radiation based techniques: Spectro fluorimeter, Flame photometer, Scintillation counter, Geiger Muller counter, Autoradiography.

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- 5th Edition - MJP publishers.

4. Upadhyay, Upadhyay and Nath (2002). Biophysical chemistry – Principles and techniques 3rd Edition.Himalaya publishing home.

5. Chatwal G and Anand (1989). Instrumental Methods of Chemical Analysis. S.Himalaya PublishingHouse, Mumbai.

Books for Reference:

1. Rodney.F. Boyer (2000). Modern Experimental Biochemistry, 3 rd Edition. Pearson Publication.

2. Skoog A.,West M (2014). Principles of Instrumental Analysis – 14th Edition W.B.SaundersCo.,Philadephia.

3. N.Gurumani. (2006). Research Methodology for biological sciences- 1st Edition – MJP Publishers.

Web Resources:

1. https://www.biologydiscussion.com/biochemistry/centrifugation/basic-principles-of-sedimentation-and-sedimentation-coefficient-centrifugation/12487#google_vignette
2. https://mvpsvktcollege.ac.in/wp-content/uploads/2022/11/3-TYGC.pdf
3. https://www.sigmaaldrich.com/IN/en/technical-documents/protocol/protein-biology/gel-electrophoresis/southern-and-northern-blotting?utm_source=googleandutm_medium=cpcandutm_campaign=15000381747andutm_content=129438265155andgclid=Cj0KCQjw-_mvBhDwARIsAA-Q0Q4h8geNWy6-Jdk3q9SJgUYvT-Slt_8t0KNe6rQhuxHhU_nO0GrY76MaAj8fEALw_wcB
4. https://www.vedantu.com/physics/spectroscopy

Mapping of Course Outcomes with Pos and PSOs

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	3	2	1	1	2	3	2	1	1	3
CO-2	3	2	2	1	1	3	1	2	2	3
CO-3	3	3	2	2	1	2	3	3	2	3
CO-4	2	3	2	1	1	2	3	3	2	3
CO-5	3	3	1	1	1	3	3	3	2	2
Ave.	2.8	2.6	1.6	1.2	1.2	2.6	2.6	2.4	1.8	2.8

Mapping	<40%	≥ 40% and <70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

Core II Microbial Physiology			
Course Code: 24UMIC21	**Hrs/Week:6**	**Hrs/Sem:90**	**Credits:5**

Objectives

- To understand the basic concepts of aerobic and anaerobic metabolic pathway
- To analyse the role of individual components in overall cell function
- To provide information on sources of energy and its utilization by microorganisms
- To know the concept of microbial growth and identify the factors affecting bacterial growth.

Course outcome

CO No	Upon completion of this course,students will be able to	Cognitive Level
CO-1	Sequence the order of metabolism in microbes	K1
CO-2	Distinguish the methods of nutrient uptake	K2
CO-3	Demonstrate the factors affecting and importance of microbial control and growth	K3
CO-4	Analyse overview of metabolic pathway	K4
CO-5	Simplify bacterial photosynthesis and reproduction	K4

SEMESTER II			
Core II Microbial Physiology			
Course Code: : 24UMIC21	**Hrs/Week:6**	**Hrs/Sem:90**	**Credits:5**

Unit I : (18Hrs)

Introduction to microbial physiology – Types of microbial growth: Batch – Fedbatch Continuous - synchronous cultures; Growth curve – Phases of microbial growth – Generation time – Microbial growth measurement methods (turbidity, biomass, and cell count). Control of microbial growth.

Unit II: (18Hrs)

Nutrition requirements – Micro and Macro elements – Classification of microorganism based on nutritional requirnements - Photoautotrophs, Photo organotrophs, Chemolithotrophs (Nitrite, Sulphur, Bacteria), Chemoorganotrophs. Nutrition transport mechanisms –Active transport – types – Passive transport – Group translocation -. Factors affecting microbial growth

Unit III (18Hrs)

An overview of Metabolism - Embden Meyerhof Pathway, Pentose Phosphate Pathway, Tricarboxylic Acid Cycle. Electron Transport Chain and Oxidative Phosphorylation. ATP synthesis. Fermentation- Fermentative pathways in specific group of microbes: Homolactic Fermentation, Heterolactic Fermentation, Mixed Acid Fermentation and Butanediol Fermentation

Unit IV (18Hrs)

Photosynthesis – Types of microbial photosynthesis - Photosynthetic Pigments in microbes – Difference between Phyto and bacterial photosynthesis - Light Reaction-Cyclic and non-cyclic and Photophosphorylation.

Unit V (18Hrs)

Bacterial reproduction - Binary fission, Budding, Reproduction through conidia, cyst formation, endospore formation. Fungi asexual and sexual reproduction, Asexual and sexual reproduction of protozoa.

Text Books

1. Schlegal, H.G. (1993). General Microbiology.,7th Edition, Press syndicate of the University of Cambridge.
2. MeenaKumari. S.(2006). Microbial Physiology, Chennai 1st Edition MJP Publishers
3. Dubey R.C. and Maheswari, S. (2003). A textbook of Microbiology, New Delhi: S. Chand and Co.

Books for Reference

1. Robert K. Poole (2004). Advances in Microbial Physiology, Elsevier Academic Press, New York, Volume 49.
2. Lansing M. Prescott John.P. Harley and Donald A, Klein. (2003). Microbiology. Newyork: (5thedition). McGraw –Hill Company.
3. Tortora, Funke Case Addison. (2001). Introduction to Microbiology, Newyork: (7thedition) Wesley Longman Inc.
4. Moat, A.G and J.W Foaster (2000). Microbial Physiology, 3rd edition. Wiley – LISS, A John Wiley and Sons. Inc. Publications.
5. Bhanu Shrivastava. (2011). Microbial Physiology and Metabolism: Study of Microbial Physiology and Metabolism. Lambert academic Publication.

Web Resources

1. https://microbenotes.com/classification-of-bacteria-on-the-basis-of-nutrition/
2. http://biocheminfo.com/2020/05/04/transport-in-cells-uptake-of-nutrients/
3. https://www.britannica.com/science/cellular-respiration
4. https://bio.libretexts.org/Bookshelves/Microbiology/Microbiology_(Kaiser)/Unit_7%3A_Microbial_Genetics_and_Microbial_Metabolism/18%3A_Microbial_Metabolism/18.7%3A_Photosynthesis/18.7A%3A_Introduction_to_Photosynthesis
5. https://www.britannica.com/science/bioluminescence

Mapping of Course Outcomes with Pos and PSOs

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	1	2	3	2	2	2	1	2	2	2
CO-2	2	2	1	1	3	2	3	2	1	3
CO-3	3	2	2	2	3	1	2	2	3	2
CO-4	2	2	1	2	2	3	3	2	2	1
CO-5	2	1	2	1	2	1	2	1	1	2
Ave.	2	1.8	1.8	1.6	2.4	1.8	2.2	2.0	1.8	2.0

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER II			
Core Practical II Practical in Microbial Physiology			
Course Code: 24UMICR2	**Hrs/Week:2**	**Hrs/Sem:30**	**Credits:2**

Objectives

- To study the biochemical identification of the bacteria.
- To discuss about different phases of microbial growth.
- To explain the basic concepts of microbial growth based on nutritional requirements
- To demonstrate the basic principle of microbial metabolism

Course outcome

CO No	**Upon completion of this course,students will be able to**	**Cognitive Level**
CO-1	Discuss IMViC test series to identify bacteria	K2
CO-2	Describe anaerobic and aerobic metabolic pathway and ATP production.	K1
CO-3	Demonstrate the growth curve of bacteria	K3
CO-4	Examine hydrolysis of starch, protein and Gelatin based on extracellular enzyme	K4
CO-5	Combine the adaptive features of bacteria in the growth media	K5

SEMESTER II			
Core Practical II Practical in Microbial Physiology			
Course Code: 24UMICR2	**Hrs/Week:2**	**Hrs/Sem:30**	**Credits:2**

1. IMViC test
2. Carbohydrate fermentation-Glucose.
3. TSI test
4. Urease test
5. Catalase test
6. Oxidase test
7. Nitrate reduction test
8. Starch hydrolysis test

9 Study of growth curve using turbidometric method

10. Lipid and Gelatin hydrolysis
11. Micrometry: Determination of the size of yeast (Demonstration)
12. Capsular staining
13. Study of anaerobic fermentation from yeast (Demonstration)
14. Effect of P^H and temperature on bacterial growth

Books for Reference

1. Kannan. N (2015).Laboratory manual in General Microbiology. Palani Publications.
2. Sundararaj T (2005). Microbiology Lab Manual (1st edition) publications.
3. Gunasekaran. P (2007). Laboratory manual in Microbiology. New age international publisher.
4. James G Cappucino and N. Sherman MB (2005). A lab manual Benjamin Cummins, New York
5. DavidWhite., James Drummond., Clay Fuqua (2012) Physiology and Biochemistry of Prokaryotes. 4th Ed. Oxford University Press, New York.
6. Moat, A.G and J.W Foaster, (2001). Microbial Physiology, 3rd edition. Wiley – LISS, A John Wiley and Sons. Inc. Publications.

Web Resources

1. https://www.frontiersin.org/journals/microbiology/articles/10.3389/fmicb.2020.589222/full
2. https://microbiologyinfo.com/starch-hydrolysis-test/
3. https://www.docsity.com/en/study-plot-the-growth-curve-of-e-coli-using-turbidimetric-method-and-calculate-the-growth-rate-specificity-generation-time/7139017/
4. https://ugcmoocs.inflibnet.ac.in/assets/uploads/1/78/2353/et/Module%2032-Academic%20script20022405050202525 2.pdf

Mapping of Course Outcomes with Pos and PSOs

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	PO-2	PO-3	PO-4	PO-5	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5
CO-1	1	2	3	2	2	2	1	2	2	2
CO-2	2	2	1	1	3	2	3	2	1	3
CO-3	3	2	2	2	3	1	2	2	3	2
CO-4	2	2	1	2	2	3	3	2	2	1
CO-5	2	1	2	1	2	1	2	1	1	2
Ave.	2	1.8	1.8	1.6	2.4	1.8	2.2	2.0	1.8	2.0

Mapping	<40%	≥ 40% and < 70%	≥ 70%
Relation	Low Level	Medium Level	High Level
Scale	1	2	3

SEMESTER II			
Generic Elective II Biochemistry II			
Course Code: 24UMIE21	**Hrs/ Week:4**	**Hrs/ Sem:60**	**Credits: 4**

Objectives:

- understand the classification, structure and functions-mechanism of enzyme action
- highlight the salient feature of metabolic pathways
- create interest on the blood and its functions
- impart knowledge on human endocrine hormones
- acquire overall knowledge on major plant secondary metabolites

Course Outcome

CO.No.	**Upon completion of this course, students will be able**	**Cognitive Level**
CO 1	Ability to remember the classification and functions of enzymes	K1
CO 2	Develop comprehensive knowledge on various metabolic pathways	K2
CO 3	Use biochemical tools for better understanding of blood and its function	K3
CO 4	Capacity to analyse the functions of human endocrine hormones	K4
CO 5	Make new techniques to study Biochemical importance and regulation	K5

SEMESTER II			
Generic Elective II Biochemistry II			
Course Code: 24UMIE21	**Hrs/ Week:4**	**Hrs/ Sem:60**	**Credits:4**

Unit I **(12 hours)**

Enzymes-Definition, classification, structure and functions-Mechanism of Enzyme action-Factors affecting Enzyme activity-pH, temperature and substrate concentration-Michaleis Menton equation-Enzyme inhibition Competitive and Non competitive inhibition.

Unit II **(12 hours)**

Introduction to metabolism – concepts and principles of metabolism – anabolism and catabolism. Hormone regulation of metabolism. Biosynthesis of macromolecules: synthesis of carbohydrates, nucleic acids (salvage and de novo pathway), protein and lipids (Triglyceride synthesis). Break down of carbohydrates - Glycolysis (EMP)-Kreb's cycle (TCA)- Pentose Phosphate Pathway HMP shunt. Electron Transport Chain (ETC). Test

Unit III **(12 hours)**

Blood-Introduction, composition, characterization, functions and coagulation of blood. Buffer system of blood. Blood group antigens. Structure and functions of myoglobin and haemoglobin.

Unit IV **(12 hours)**

Hormones-Definition, classification of hormones-Human Endocrine hormones pituitary, thyroid, parathyroid, pancreas, adrenal testis and ovary Diseases associates with deficiency of endocrine hormones.

Unit V **(12 hours)**

Secondary metabolites and major/accessory plant pigments, chlorophyll, carotenoids, phycobilin and anthocyanins. Phytohormones. Definition, classification, structure and functions of auxins, gibberellins, cytokinin and abscisic acid.

Text book:

1. Albert L Lehninger, David L Nelson and Michael M Cox. Lehninger. (2010). Principles of Biochemistry, 2nd edition, Wiley publisher.

2. Charlotte W Pratt and Kathleen Comely. (2013). Essential Biochemistry, 3rd edition, Wileypublisher.

3. Thomas M Devlin. (2010).Textbook of Biochemistry with Clinical Correlations, 7th edition, Wiley publisher.

4. Deb AC. (2011) Fundamentals of Biochemistry, 10th edition, New Central Book Agency (p) ltd, London.

5. Ambika Shanmugam. (2005)Fundamentals of Biochemistry for Medical students. Nagaraj and Company Pvt ltd, India.

Books for Reference:

1. Sathyanarayana U and Chakrapani U. (2013). Biochemistry, 4th edition, Elsevier publishers.

2. Rafi MD. (2014). Textbook of Biochemistry for medical students, 2nd edition, Universities Press, (India) Pvt. Ltd, Hyderabad, India..

3. Rajagopal G. (2010). Concise textbook of biochemistry, 2nd edition, Ahuja Publishing House.

4. Reginald H Garrett and Charles M Grisham. (2012). Biochemistry, 5th edition. Brooks Cole publishers.

5. Denise R Ferrier. (2013). Biochemistry, 6th edition, LWW publishers.

Web Resources

1. https://bio.libretexts.org/Bookshelves/Biochemistry/Book%3A_Biochemistry_Free_and_Easy_(Ahern_and_Rajagopal)/04%3A_Catalysis/4.11%3A_Enzyme_Inhibition#:~:text=In%20competitive%20inhibition%2C%20this%20doesn,from%20that%20of%20uninhibited%20reactions.
2. https://www.britannica.com/science/metabolism/The-synthesis-of-macromolecules
3. http://www.adichemistry.com/inorganic/bioinorganic/hemoglobin/hemoglobin.html
4. https://www.webmd.com/diabetes/endocrine-system-disorders
5. https://www.vedantu.com/neet/auxins

Mapping of Course Outcomes with Pos and PSOs

Course Outcomes	Programme Outcomes (PO)					Programme Specific Outcomes (PSO)				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	2	1	3	3	3	3	2	1	1	3
CO-2	1	3	1	2	1	3	1	2	2	3
CO-3	3	3	2	1	1	2	3	3	2	2
CO-4	2	2	2	2	1	2	2	3	2	2
CO-5	2	2	2	2	3	3	3	2	2	3
Ave.	**2**	**2.2**	**2**	**2**	**1.8**	**2.6**	**2.2**	**2.2**	**1.8**	**2.6**

Mapping	**<40%**	**≥ 40% and <70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER II			
Generic Elective Practical II Practical in Biochemistry II			
Course Code: 24UMIER2	**Hrs/ Week: 2**	**Hrs/ Sem: 30**	**Credit: 1**

Objectives:

- Impart a practical knowledge on the estimation of blood sugar
- demonstrate the estimation of serum cholesterol
- estimate blood urea, serum proteins, serum uric acids
- perform estimation of enzymes, amino acids and IAA
- estimate and quantify various chlorophyll in plant samples

Course Outcome:

CO.No.	**Upon completion of this course, students will be able to**	**Cognitive Level**
CO 1	Ability to remember quantitation techniques used in biochemistry	K1
CO 2	Comprehensive knowledge on various biomolecules and their properties	K2
CO 3	Handling and use of Instruments used to analyse biomolecules	K3
CO 4	Capacity to analyse albumin, uric acid and urea in blood	K4
CO 5	Make use of techniques to demonstrate plant pigments	K5

SEMESTER II			
Generic Elective Practical II Practical in Biochemistry II			
Course Code : 24UMIER2	**Hrs/ Week: 2**	**Hrs/ Sem: 30**	**Credit: 1**

1. Estimation of blood sugar by Folin-Wu method (Demonstration)
2. Estimation of blood glucose – COD-POD method
3. Estimation of serum cholesterol
4. Estimation of IAA (Indole-3-acetic acid) (Demonstration)
5. Separation and Estimation of Enzymes
6. Separation of amino acids by chromatographic techniques
7. Estimation of blood urea by diacetyl monoxime (DAM) method (Demonstration)
8. Estimation of serum proteins and albumin/globulin ratio by Biuret method
9. Estimation of serum uric acid by Caraway method (Demonstration)
10. Estimation of chlorophyll in plant leaf
11. Estimation of carotenoids and phycobiliproteins

Books for Reference:

1. Keith Wilson and John Walker. (2005) Principles and Techniques of Practical Biochemistry, 4th edition, Cambridge University press, Britain.

2. Shawn O' Farrell and Ryan T Ranallo. (2000). Experiments in Biochemistry: A Handson Approach-A manual for the undergraduate laboratory, Thomson Learning, Inc., Australia.

3. Strolv BA, Makavora VC. (2009). Laboratory manual in Biochemistry. MIR Publisher, Moscow.

4. Oser BL Hawks. (2005). Physiological Chemistry, TATA Mc Graw Hill.

Web Resources

1. https://mcconline.org.in/download/lab_manual/112.pdf
2. https://d-nb.info/1198921803/34
3. https://hbmahesh.weebly.com/uploads/3/4/2/2/3422804/estimation_of_urea_by_damo.pdf
4. https://laboratorytests.org/diacetyl-monoxime-dam-method-for-estimation-of-urea/
5. https://www.jaypeedigital.com/eReader/chapter/9788184482591/ch22#:~:text=Estimation%20of%20Serum%20Uric%20Acid%20by%20Caraway%20Method22andtext=The%20intensity%20of%20blue%20color,660%20nm%20(red%20filter).andtext=Pipette%200.6%20ml%20of%20serum,for%205%20minutes%20and%20filter.

Mapping of Course Outcomes with Pos and PSOs

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	3	1	2	3	3	3	3	1	1	2
CO-2	3	1	2	2	2	3	2	1	3	3
CO-3	3	1	3	2	3	3	2	1	1	2
CO-4	3	1	2	3	1	3	1	1	3	2
CO-5	3	2	3	2	3	3	2	2	2	3
Ave.	3	1.2	2.4	2.4	2.4	3	2	1.2	2	2.4

Mapping	**<40%**	**≥ 40% and <70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**

SEMESTER II			
Skill Enhancement Course II Practical in Medical Laboratory Technology			
Course Code: 24UMISE2	**Hrs /Week : 2**	**Hrs/Sem : 30**	**Credit: 2**

Objectives:

- The Medical Laboratory Technology graduates excel as innovative practitioners committed to excellence and a collaborative and healthy work environment.
- These graduates play a vital role in the provision of quality health care and in scholarship for the advancement of self, the profession and society.

Course Outcome:

CO NO.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	Recall the laboratory practices and know how to maintain the laboratory instruments	K1
CO-2	Interpret and distinguish various types of blood Groups	K2
CO-3	Produce culture tests and understand the pathological diseases of humans	K3
CO-4	Analyze the physical, chemical and microscopicanalysis of culture samples	K4
CO-5	Evaluate various techniques on isolation of micro-organisms for various sources	K5

SEMESTER II

Skill Enhancement Course II Practical in Medical Laboratory Technology			
Course Code: 24UMISE2	**Hrs/week : 2**	**Hrs/Sem : 30**	**Credit: 2**

1. Separation of blood.
2. Collection and preservation of blood sample.
3. Estimation of glucose from serum (Demonstration).
4. Estimation of cholesterol from serum (Demonstration).
5. Estimation of hemoglobin by Sahli's method
6. Qualitative test of carbohydrates from urine.
7. Qualitative test of proteins from urine.
8. Staining of blood smear
9. Examination of urine- physical, chemical, and microscopic
10. Urine analysis: urea, creatinine and bilirubin.
11. Culture tests- urine, nasal, throat swab, stool and pus
12. Pregnancy test from urine sample.
13. Erythrocyte Sedimentation Rate.
14. Testing of stool samples for parasite-ova and cysts- (Demonstration).
15. Visit to clinical laboratory.

Books for Reference:

1. Rajan S., Selvi Christy R.,(2010) *Experimental procedures in Life Sciences.* Chennai:Anjanaa Publishers,
2. Kanai Mukerjee L., (2005)*Medical Laboratory Technology – A procedure manual for routinediagnosis tests*- Vol III Tata mc Graw Hill Publishing Co. Ltd., New Delhi:.
3. Cappucino.J.G., and Sherman. N. (2000) *Microbiology – a laboratory manual.* BenjaminCummins. New York.
4. Kannan.N. (2002.) *A laboratory manual in general Microbiology*. Palani: Palani paramountpublication,
5. Gunasekaran. P. (2000) *Laboratory manual in Microbiology.* New Delhi: A new ageInternational Ltd.,publishers,

Web Resources:

1. https://oncquestlabs.com/blog/collection-preservation-and-transportation-of-blood-sample/
2. https://medlineplus.gov/lab-tests/bilirubin-in-urine/
3. https://www.pathlab.co.nz/news/2019-05-14-microscopic-examination-of-stools-for-ova-cysts-and-parasites/

Mapping of Course Outcomes with Pos and PSOs

Course Outcomes	**Programme Outcomes (PO)**					**Programme Specific Outcomes (PSO)**				
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**
CO-1	2	1	3	3	3	3	2	1	1	3
CO-2	1	3	1	2	1	3	1	2	2	3
CO-3	3	3	2	1	1	2	3	3	2	2
CO-4	2	2	2	2	1	2	2	3	2	2
CO-5	2	2	2	2	3	3	3	2	2	3
Ave.	2	2.2	2	2	1.8	2.6	2.2	2.2	1.8	2.6

Mapping	**<40%**	**≥ 40% and <70%**	**≥ 70%**
Relation	**Low Level**	**Medium Level**	**High Level**
Scale	**1**	**2**	**3**