

THIRUVALLUVARUNIVERSITY
SERKKADU,VELLORE –632115



B.SC., MICROBIOLOGY
SYLLABUS

FROM THE ACADEMIC YEAR
2023-2024

SECOND SEMESTER

Sl.N O	Course Category	Course	Credit distribution				Overall Credits	Total contact Hours/week	Marks		
			L	T	P	S			CIA	ESE	Total
1	Part –I	Language - Tamil	L				3	6	25	75	100
2	Part –II	English	L				3	6	25	75	100
3	Part -III	CC-3	L				5	5	25	75	100
4	Part -III	CC-4			P		5	5	25	75	100
5	Part -III	AL-2	L				3	4	25	75	100
6	Part –IV	SEC-2	L				2	2	25	75	100
7	Part –IV	SEC-3	L				2	2	25	75	100
		Total					23	30			

SEMESTER II

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CI A	Exter nal	Total
22MBU GCT2	MICROBIAL PHYSIOLOGY AND METABOLISM	Core Course III	Y	-	-	-	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,.								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.	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	RajapandianK.(2010). Microbial Physiology, Chennai: PBS Book Enterprises India.		
3	MeenaKumari. 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	BhanuShrivastava. (2011). Microbial Physiology and Metabolism: Study of Microbial Physiology and Metabolism. Lambert academic Publication.
Web Resources	
1	https://sites.google.com/site/microbialphysiologyoddsem/teaching-contents
2	https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-Nutrition
3	https://onlinecourses.swayam2.ac.in/cec20_bt14/preview
4	http://web.iitd.ac.in/~amittal/2007_Addy_Enzymes_Chapter.pdf
5	https://www.frontiersin.org/microbial-physiology-and-metabolism

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	Longer essay/ Evaluation essay, Critique or justify with pros and cons	

(K5)	
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations

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
22MBU GCP2	MICROBIAL PHYSIOLOGY AND METABOLISM	CCIV-CORE PRACTICAL II	-	-	Y	-	5	5	25	75	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. Staining techniques: Smear 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.								12	CO2	
III	Anaerobic culture methods – Candle jar method. Antibiotic sensitivity testing: Disc diffusion test.								12	CO3	
IV	Morphological variations in algae, fungi and protozoa. Micrometry.								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

Methods of Evaluation		
Internal Evaluation	Continuous Internal Assessment Test	40 Marks
	Assignments	
	Seminars	
	Attendance and Class Participation	
External Evaluation	End Semester Examination	60 Marks
	Total	100 Marks
Methods of Assessment		
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Evaluate (K5)	Longer essay/ Evaluation essay, Critique or justify with pros and cons	
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations.	

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	External	Total
22MBUGDE 2	BIO INSTRUMENTA TION	Elective Generic /Disciplin e Specific Elective II	Y	-	-	-	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	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 Molarity, molality and normality solutions.								12	CO1	
II	Spectroscopic Techniques: Spectroscopic Techniques: Colorimeter, Ultraviolet and visible, Infra red 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: Spectrofluorimeter, Flame photometer, Scintillation counter, Geiger Muller counter,								12	CO5	

	Autoradiography.		
	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	SkoogA.,WestM (2014). Principles of Instrumental Analysis – 14 th Edition W.B.SaundersCo.,Philadephia.		
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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CO1	L			M							S
CO2				L						M	S
CO3				L			M				S

