

Yadava College (Autonomous)

(Accredited with 'A' Grade by NAAC)

Govindarajan Campus, Thiruppalai.

Madurai –625014

Regulations and Syllabus for the Degree of

Bachelor of Science (Microbiology)

Under CBCS

(This will come into force from the **Academic Year 2022 – 2023**)

Qualification for Admission:

Candidates should have passed the Higher Secondary Examination, Government of TamilNadu or any other examination accepted by the syndicate of Madurai Kamaraj University as equivalent there to.

Duration of the Course:

The students shall undergo the prescribed course of study for a period of **Three Academic Years (Six Semesters)**

Medium of the instructions: English Medium

Duration: Three Hours

Blue Print of the Question Paper

Section	Type of Question	No. of Question	No. of Question to be answered	Marks to each Question	Total Marks
A	Short answer Question Type (Open choice)	15	10	2	20
B	Paragraph Type Question (Either or Choice)	5	5	5	25
C	Essay Type Question (Open choice)	5	3	10	30
					75

PROGRAMME EDUCATIONAL OUT COMES

The B.Sc. Microbiology programme aims to achieve the following objectives:

PEO1	Describe how microorganisms are used as model systems to study basic biology, genetics, metabolism and ecology
PEO2	Identify ways microorganisms play an integral role in disease, and microbial and immunological methodologies are used in disease treatment and prevention
PEO3	Explain why microorganisms are ubiquitous in nature; inhabiting a multitude of habitats and occupying a wide range of ecological habitats.
PEO4	Site examples of the vital role of microorganisms in biotechnology, fermentation, medicine, and other industries important to human well being
PEO5	Demonstrate that microorganisms have an indispensable role in the environment, including elemental cycles, biodegradation, etc

PROGRAMME SPECIFIC OUT COMES

After completing the B.Sc. Microbiology course the students can

PSO1	Understand the contributions of various scientist in microbiology and scope of various branches
PSO2	Understand various kinds of prokaryotic & eukaryotic microbes and their interactions
PSO3	Explain and describe importance of organic compounds and its chemistry found in living cells
PSO4	Understand and explain various processes of metabolism of carbohydrates amino acids and vitamins
PSO5	Explain DNA, RNA and protein structure and their synthesis
PSO6	Understand the concept of disease development, spread, control and eradication from society
PSO7	Understand the basic concepts of gene and their regulation of action
PSO8	Explain and write various industrial fermentations and bioinstrumentation

SYLLABUS UNDER CBCS PATTERN (2022-2023)
B.Sc., MICROBIOLOGY - PROGRAMME STRUCTURE

Sem	Subject Code	Title of the Papers	Teaching Hours	Credit	Duration Of Examination	Internal	External	Total
First		Tamil	5	3	3	25	75	100
		English	5	3	3	25	75	100
	Core subject	General Microbiology	4	4	3	25	75	100
	Core subject	Practical –I Lab in General Microbiology	2	1	3	40	60	100
	Allied 1	General Chemistry	5	2	3	25	75	100
	Allied2	General Biology	5	2	3	25	75	100
	Skill Based subjects	Environmental Studies	2	2	3	25	75	100
		Skill Based Elective (Communicative English)	2	2	3	25	75	100
		NSS/NCC/Physical Education	-	-	-	-	-	-

Second		Tamil	5	3	3	25	75	100
		English	5	3	3	25	75	100
	Core subject	Microbial Physiology and Metabolism	4	4	3	25	75	100
		Practical-II Lab in Microbial Physiology And Metabolism	2	1	3	40	60	100
	Allied 1	Organic Chemistry	3	2	3	25	75	100
		Practical-I Qualitative analysis of Organic compounds	2	1	3	40	60	100
	Allied 2	Cell Biology	3	2	3	25	75	100
		Biology Practical I(Lab in General Biology and Cell Biology)	2	1	3	40	60	100
	Skill Based subjects	Value Education	2	2	3	25	75	100
		Skilled Based Elective (Communicative English)	2	2	3	25	75	100
		NCC/NSS/Physical Education	-	-	-	-	-	-

Third		Tamil	5	3	3	25	75	100
		English	5	3	3	25	75	100
	Core subject	Molecular Biology and Microbial Genetics	4	5	3	25	75	100
	Core subject	Practical III(Lab in Molecular Biology and Microbial Genetics)	2	2	3	40	60	100
	Allied 1	Industrial Chemistry	5	2	3	25	75	100
	Allied 2	Genetics	5	2	3	25	75	100
		Non Major Elective (Mushroom Cultivation)	2	2	3	25	75	100
	Skill Based subjects	Skill Based Elective (Communicative English)	2	2	3	25	75	100
		NSS/NCC/Physical Education	-	-	-	-	-	-
		Self study papers-Plant tissue Culture		3		25	75	100

Fourth		Tamil	5	3	3	25	75	100
		English	5	3	3	25	75	100
	Core subject	Industrial Microbiology I	4	5	3	25	75	100
	Core subject	Practical -IV Lab in Industrial Microbiology	2	2	3	40	60	100
	Allied 1	Biophysical Chemistry	3	2	3	25	75	100
	Allied 1	Chemistry Practical-II	2	1	3	40	60	100
	Allied 2	Biostatistics	3	2	3	25	75	100
	Allied 2	Genetics and Biostatics (Biology practical - 2)	2	1	3	40	60	100
		Non Major Elective (Catering and Food Processing Technology)	2	2	3	25	75	100
	Skill Based subjects	Skill Based Elective (Communicative English-4)	2	2	3	25	75	100
		NSS/NCC/Physical Education	-	-	-	-	-	
		Self study paper-Proteomics and Genetic Engineering		3		25	75	100

Fifth	Core subject	Medical Microbiology	5	5	3	25	75	100
	Core subject	Bioinformatics	5	5	3	25	75	100
	Core subject	Principles of Immunology	5	5	3	25	75	100
	Core subject	Biochemistry	5	5	3	25	75	100
	Core subject	Practical-V Lab in Medical Microbiology and Immunology	4	2	3	40	60	100
	Core subject	Practical-VI Lab in Biochemistry and Bioinformatics	4	2	3	40	60	100
	Skill Based subject	Skill Based Elective (Soft skills)	2	2	3	25	75	100
		NCC/NSS/Physical education	-	-	-	-	-	-
		Self study paper-Genetic Engineering		3		25	75	100

	Subject code	Title of the paper	Teaching hours	Credit	Duration of Examination	Internal	External	Total
Sixth	Core subject	Microbial Biotechnology	5	5	3	25	75	100
	Core subject	Environmental and Agricultural Microbiology	4	5	3	25	75	100
	Core subject	Food and dairy Microbiology	4	5	3	25	75	100
	Core subject	Industrial Microbiology II	4	4	3	25	75	100
	Core subject	Medical Lab Techniques	5	4	3	25	75	100
	Core subject	Practical -VII Lab in food and dairy, agricultural& environmental microbiology	3	2	3	40	60	100
	Core subject	Practical –VIII Lab in Medical Lab Techniques, Microbial Biotechnology &Industrial Microbiology	3	2	3	40	60	100
	Skill Based subject	Skill Based Elective (General Knowledge)	2	2	3	25	75	100
		NSS/NCC/Physical Education	-	1	-	-	-	-
		Self study paper- Aquaculture		3		25	75	100
		TOTAL	180	140				

Curriculum Structure for B.Sc (Microbiology)

(For those joined B.Sc., on or after June 2022)

Part I	In Lieu of Tamil	4x3	= 12	Credits
Part II	English	4x3	=12	Credits
Part III	Core		= 75	Credits
	Allied		= 20	Credits
Part IV	SBE	8 x2	= 16	Credits
	NME	2 x2	= 04	Credits
Part V	P.Ed./NCC/NSS		= 01	Credit
Total			140	Credits

Non-Major Electives

Semester	Papers
III	Mushroom Cultivation
IV	Catering and Food Processing Technology

Skill Based Electives

Semester	Papers
I,II,III&IV	Communicative English
I	Environmental studies
II	Value Education
V	Soft Skills
VI	General Knowledge

YADAVA COLLEGE (Autonomous), MADURAI-14
B.Sc.,(Microbiology)

Semester :I	GENERAL MICROBIOLOGY	Hours/Week:4
Sub-Code :		Credit :4

Objectives:

- To understand the Contributions of Scientist in the Field of Microbiology
- To Explore the Microscopy Techniques in Basic and Advanced Levels
- To learn the Staining and Morphological Mechanism of Bacteria
- To Study the Basics of Physical and Chemical Methods of Microbiological Sterilization
- To Develop the Culture Skills and Techniques for Culturing Microorganisms.

Unit I

Definition and scope of Microbiology, History- Spontaneous generation – Biogenesis theory, Contribution of Louis Pasteur, Leeuwenhoek, Lazaro Spallanzani, John Tyndall, Joseph Lister, Robert Koch, Edward Jenner ,Selman Waksman, Alexander Fleming and Crisper

CO-1	Outline the pioneers of microbiological research
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Unit II

Microscopy- Principles & Applications: Resolving power, numerical aperture. Components, working principles and applications of simple, compound microscope, light & dark field microscope. Electron microscopy, phase contrast microscopy and fluorescent microscopy.

CO-1	To understand the basic working principles of various types of Microscopes
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Unit III

Microbial taxonomy –Binomial nomenclature -Hackel’s & Whittaker kingdom classification, systems and their utility. Aims and principles of classification -Classification of bacteria according to systemic Bergey’s manual.

Characteristic features of Prokaryotes and Eukaryotes- Prokaryotes –ultra structure of bacterial, bacterial cell membrane, Gram positive and Gram negative bacterial cell wall. Types of Staining

–Simple, Differential (Gram’s, AFB), Special – Capsular staining (negative), flagellar staining and Spore staining.

CO-1	To learn the classification and taxonomy of microbes, basic ultra-structure of bacteria, and to categorize it as per their staining mechanisms on basics to practical handling
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Unit IV

Culture and media preparation – solid and liquid. Types of media –Semi synthetic, Synthetic, Enriched, Enrichment, Selective and Differential media. Pure culture techniques – Pour, Spread, Streak plate. Anaerobic culture technique- Wright’s Tube, Roll tube method, Anaerobic Jar.

CO-1	To Learn about the purpose of using Chemical medias and their Significance in Microbiological culture works and to learn about various Culture techniques for Cultivating Aerobic and Anaerobic Microorganisms.
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Unit V

Sterilization and disinfection- principles – methods of sterilization- physical methods- Dry heat- Moist heat – Radiation. Filtration (Membrane and HEPA). Chemical agents- antiseptic and disinfectant – Classification of chemotherapeutic agents -mode of action –phenol coefficient test –sterility testing.

CO-1	To Study about the Control of Microorganisms by various Physical and Chemical Methods
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Text books:

1. Prescott L.M, Harley J. P and Klein D.A, (2006) Microbiology, 8th edn, McGraw Hill Book Co, New Delhi.
2. Dubey, R.C. and Maheswari, D.K. (2005) A Text book of Microbiology. S. Chand & Company Ltd. New Delhi
3. Jeeva. S (2009). Microbiology Scitech Publication (India) Pvt., Ltd.

Reference Books:

1. Pelczar, M.J.. Chan. E.C.S. and Kreig. N.R. 1993. Microbiology, Tata McGraw-Hill Publishing Co. Ltd., New Delhi
2. Schlegel. H.G. 1993. General Microbiology. Cambridge University Press, Cambridge.
3. Stainer. R.Y., Ingraham, Wheelis, M.G. and Paintor. P.R.1986, The Microbial World, Prentice Hall, New Jersey.

4. Tauro. P., Kapoor, K.K.and Yadav. K.S.1989, An Introduction to Microbiology, Wiley Publications. New Delhi.
5. Microbiology: A Laboratory manual, P. Gunasekaran, New Age international publishers, 1996.
6. Laboratory manual in general microbiology, N. Kannan, Panima publishers, 2002.
7. Microbiology: Alaboratory manual. J.G. Cappuccino and N. Sherman, Additon-Wesley, 2002.
8. Bergey's manual determinative bacteriology, J.G. Holt and N.R. Krieg. Lippincott Williams & Wilkin publishers, 2000.

Pedagogy:

Chalk&Talk, Power point presentations, OHP, Group Discussion, Quiz, Assignment

E-Resources:

- http://www.freebookcentre.net/medical_text_books_journals/microbiology_ebooks_online_texts_download.html
- <https://open.oregonstate.education/generalmicrobiology/>

Name of the course designer:

- 1 Dr.K.Sendesh Kannan
2. Mrs. J.Jabeen
3. Mr. R.Kannan
4. Mrs.G.Ananthi

YADAVA COLLEGE (Autonomous), MADURAI-14
B.Sc.,(Microbiology)

Semester :I	Practical I LAB IN GENERAL MICROBIOLOGY	Hours/Week:2
Sub-Code :		Credit :1

CO1	Apply the principle & application of microbiology laboratory instruments.
CO2	Develop skills for pure culture techniques.
CO3	Find the micro organism by using different staining techniques.
CO4	Demonstrate the fundamental techniques in microbiology.
CO5	Discuss the structural characteristic features of bacteria, algae, fungi & protozoan.
CO6	Apply the knowledge on preparation of media and sterilization techniques.
CO7	Examine the enumeration of bacteria & fungi
CO8	To Acquire Knowledge on basics of Staining Techniques
CO9	To Study Structural Characteristics of Bacteria Fungi and Algae using Permanent Slides

Course Content:

1. Microbiology laboratory practices and safety rules
2. Principles of applications of microbiology laboratory instruments.
3. Preparation of media and sterilization techniques.
4. Staining techniques – Simple, Gram’s, Negative, Capsule & Spore staining
5. Preparation of slant, stabs & plating techniques.
6. Pure culture techniques – streak plate, spread plate & pour plate techniques.
7. Enumeration of bacteria and fungi from environmental samples.
8. Observation of permanent slides to study the structural characteristics of bacteria, algae, fungi & protozoan.

Text books:

1. P. Gunasekaran (2007) .Laboratory manual in microbiology Newage International Publication.
2. K.R.Aneja., 2001 .Experiment in Microbiology Plant Pathology Tissue Culture and Mushroom Production Technology. (Third Edition) Newage International Publication.

Reference Books:

1. Holt J.G, N.R.Krieg, 2000, Bergey's manual of Determinative Bacteriology. Ninth edition, Lippincott Williams & Wilkin Publishers.
2. Kannan N, 2002, Laboratory Manual in General Microbiology, Panima Publishers.
3. Sundararaj T, 2003, Microbiology Laboratory Manual, 2nd Edition, A. Sundararaj No.5, I cross street, Thirumalai Nagar, Perungudi, Chennai 600 096.

Pedagogy:

Chalk&Talk, Power Point Presentation, OHP.

E- Resources:

- [https://bio.libretexts.org/learning:objectives/laboratory_Experiments/Microbiology/labs_books%3a_General_Microbiology_lab_Manual_\(Pakpour_and_Horgan\)](https://bio.libretexts.org/learning:objectives/laboratory_Experiments/Microbiology/labs_books%3a_General_Microbiology_lab_Manual_(Pakpour_and_Horgan))
- <https://www.amazon.in/microbiology-lab-manual-ilamathi-jayaraman-ebook/dp/B09ZT2MLQK>
- https://www.ronaldschulte.nl/files/Laboratory_manual_in_general_microbiology.pdf

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B.Sc.,(Microbiology)

Semester :I	MICROBIAL PHYSIOLOGY AND METABOLISM	Hours/Week:4
Sub-Code :		Credit :4

Objectives:

- To understand the Nutritional Requirements of Microorganisms and their Classification based on Nutrient ability
- To Explore the Growth curve patterns of microorganisms and effect of growth over intrinsic and extrinsic factors
- To familiarize with the metabolic pathways of Microorganisms
- To Study the Basics of Aerobic and Anaerobic Respiration
- To become familiarized on Bacterial Photosynthesis

Unit I

Microbial nutrition - Autotrophs, Heterotrophs, Chemotrophs, Organotrophs, Myxotrophs
 Physiology of Extremophiles Copiotrophs and Oligotrophs. Transport Mechanisms- Membrane transport mechanism. Diffusion – Facilitated Diffusion, Active transport, Group translocation.

CO-1	Classify the microorganisms based on nutritional requirements
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Unit II

Different phases of growth – Growth curve – Generation time – Factors influencing microbial growth – Temperature, pH, Pressure, Salt concentration, Nutrients- synchronous growth and continuous cultivation. Auxinic culture, Diauxic growth, Sporulation – Endospore formation in bacteria.

CO-1	Discuss the different phases of growth curve and Patterns of Growth
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Unit III

Metabolism – EMP, HMP, ED Pathway – TCA cycle – Electron transport chain, Phosphorylation, Oxidative Phosphorylation, Substrate level Phosphorylation.

CO-1	To learn the Metabolic path ways and understand the process of Energy Synthesis
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Unit IV

Anaerobic respiration – sulphur, nitrogenous compounds and CO₂ as a final electron acceptor
Fermentation: Acetic acid fermentation, Alcoholic fermentation, mixed acid fermentation, lactic acid fermentation

CO-1	To Understand Mechanism of Microbial Anaerobic respiration and Acid synthesis Mechanism by Fermentation Process.
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Unit V

Photosynthesis – Characteristics and types of photosynthetic Prokaryotes- CO₂ fixation
Oxygenic and Anoxygenic – Bio film mechanism.

CO-1	To Learn about Microbial Photosynthesis process
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Text books:

1. Prescott L M, J P Harley and D A Klein (2005). Microbiology. Sixth edition, International edition, McGraw Hill
2. Dubey RC and Maheswari DK (2012). A text of Microbiology (Revised edition). S. Chand and Company Ltd., New Delhi.
3. Nagamani.B (2017) General Microbiology and Microbial Physiology .Margham Publication.

Reference Books:

1. Geeta Sumbali and Mehrotra RS (2009). Principles of Microbiology. First edition, Tata McGraw Hill P.Ltd., New Delhi.
2. Pelczar TR M J Chan ECS and Kreig N R (2006). Microbiology. Fifth edition, Tata McGraw-Hill INC.New York.
3. Robert F Boyd(1984). General Microbiology. Times mmor I Mosby college publishers.
4. Moat G, John W. Foster and Michael P. Spector (2002). Microbial physiology. Fourth edition, A John Wiley sons, Inc. Publication. New Delhi.
5. David white. The Physiology and biochemistry of prokaryotes. Oxford university press. 4th edition (2011)

Pedagogy:

Chalk &Talk, Power point presentations, Group Discussion, Quiz, Assignment.

E- Resources:

- <http://www.pdfdrive.com/microbial-physiology-and -metabolism-e175238071.html>
- <https://www.elsevier.com/books/bacterial-physiology-and - metabolism/sokatch/978-1-4832-3137-2>

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B.Sc.,(Microbiology)

Semester: I	PRACTICAL II LAB IN MICROBIAL PHYSIOLOGY & METABOLISM	Hours/Week:2
Sub-Code:		Credit :1

CO – 1	Determine the microbial growth
CO – 2	Classify microorganisms based on factors affecting the growth
CO – 3	Identify the bacteria using biochemical characteristics
CO –4	Understanding the laboratory principle
CO – 5	Practices in a biochemical test

I .Measurement of growth

- 1) Determination of direct count and viable count.
- 2) Calculation of growth rate of E.Coli and Generation time

II. Effect of pH and Temperature on bacterial growth

III. Biochemical tests for bacterial identification

1. IMViC test
2. Catalase test
3. Oxidase test
4. Urease test
5. Coagulase test
6. Triple Sugar Iron test.
7. Carbohydrate fermentation: Acid-gas production
8. McConkey agar test for Lactose fermentation
9. Starch, protein, and lipid hydrolysis

Text books:

1. P. Gunasekaran (2007) .Laboratory manual in microbiology Newage International Publication.
2. K.R.Aneja., 2001 .Experiment in Microbiology Plant Pathology Tissue Culture and Mushroom Production Technology. (Third Edition) Newage International Publication.

Reference Books:

1. Atlas R.M., A.E .Brown and L.C. Parks, Mosby, St. Louis, 1995, Laboratory Manual of Experimental Microbiology.
2. Cappuccino J.G and N. Sherman 2002, Microbiology: A laboratory Manual Addison-Wesley.
3. Holt J.G, N.R. Krieg, 2000, Bergey's manual of Determinative Bacteriology. Ninth edition, Lippincott Williams & Wilkin Publishers.
4. Kannan N, 2002, Laboratory Manual in General Microbiology, Panima Publishers.
5. Sundararaj T, 2003, Microbiology Laboratory Manual, 2nd Edition, A. Sundararaj No.5, I cross street, Thirumalai Nagar, Perungudi, Chennai 600 096.
6. Aneja KR (2005). Experiments in Microbiology, Plant pathology and Biotechnology. 4th Edition, New Age International Publishers, Chennai.
7. Harold J Benson (1998). Microbiological Applications – Laboratory Manual in General Microbiology. Seventh International edition, Me Grew-Hill, Boston.

Pedagogy:

Chalk&Talk, Power point presentations,OHP.

E-Resources:

- http://www.resarchgate.net/publication/336242145_book_on_Microbiology_laboratory
- https://www.gettextbooks.com/author/K_R_Aneja
- https://www.ronaldschulte.nl/files/Laboratory_manual_in_general_microbiology.pdf

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