

# **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:

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

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

<b>Second</b>		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	-	-	-	-	-	-

<b>Third</b>		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

<b>Fourth</b>		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

<b>Fifth</b>	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

	<b>Subject code</b>	<b>Title of the paper</b>	<b>Teaching hours</b>	<b>Credit</b>	<b>Duration of Examination</b>	<b>Internal</b>	<b>External</b>	<b>Total</b>
<b>Sixth</b>	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
		<b>TOTAL</b>	<b>180</b>	<b>140</b>				



## Curriculum Structure for B.Sc (Microbiology)

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

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

### 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)**

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

**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

<b>CO-1</b>	<b>Outline the pioneers of microbiological research</b>
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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.

<b>CO-1</b>	<b>To understand the basic working principles of various types of Microscopes</b>
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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.

<b>CO-1</b>	<b>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</b>
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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.

<b>CO-1</b>	<b>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.</b>
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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.

<b>CO-1</b>	<b>To Study about the Control of Microorganisms by various Physical and Chemical Methods</b>
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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](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)**

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

<b>CO1</b>	Apply the principle & application of microbiology laboratory instruments.
<b>CO2</b>	Develop skills for pure culture techniques.
<b>CO3</b>	Find the micro organism by using different staining techniques.
<b>CO4</b>	Demonstrate the fundamental techniques in microbiology.
<b>CO5</b>	Discuss the structural characteristic features of bacteria, algae, fungi & protozoan.
<b>CO6</b>	Apply the knowledge on preparation of media and sterilization techniques.
<b>CO7</b>	Examine the enumeration of bacteria & fungi
<b>CO8</b>	To Acquire Knowledge on basics of Staining Techniques
<b>CO9</b>	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, 2<sup>nd</sup> 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](https://www.ronaldschulte.nl/files/Laboratory_manual_in_general_microbiology.pdf)

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**B.Sc.,(Microbiology)**

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

**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.

<b>CO-1</b>	<b>Classify the microorganisms based on nutritional requirements</b>
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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.

<b>CO-1</b>	<b>Discuss the different phases of growth curve and Patterns of Growth</b>
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**Unit III**

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

<b>CO-1</b>	<b>To learn the Metabolic path ways and understand the process of Energy Synthesis</b>
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#### Unit IV

Anaerobic respiration – sulphur, nitrogenous compounds and CO<sub>2</sub> as a final electron acceptor

Fermentation: Acetic acid fermentation, Alcoholic fermentation, mixed acid fermentation, lactic acid fermentation

<b>CO-1</b>	<b>To Understand Mechanism of Microbial Anaerobic respiration and Acid synthesis Mechanism by Fermentation Process.</b>
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#### Unit V

Photosynthesis – Characteristics and types of photosynthetic Prokaryotes- CO<sub>2</sub> fixation

Oxygenic and Anoxygenic – Bio film mechanism.

<b>CO-1</b>	<b>To Learn about Microbial Photosynthesis process</b>
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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. 4<sup>th</sup> 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)**

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

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. 4<sup>th</sup> 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](http://www.resarchgate.net/publication/336242145_book_on_Microbiology_laboratory)
- [https://www.gettextbooks.com/author/K\\_R\\_Aneja](https://www.gettextbooks.com/author/K_R_Aneja)
- [https://www.ronaldschulte.nl/files/Laboratory\\_manual\\_in\\_general\\_microbiology.pdf](https://www.ronaldschulte.nl/files/Laboratory_manual_in_general_microbiology.pdf)

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