



# Dr. N.G.P. ARTS AND SCIENCE COLLEGE

(An Autonomous Institution, Affiliated to Bharathiar University, Coimbatore)  
 Approved by Government of Tamil Nadu & Accredited by NAAC with A++ Grade (3<sup>rd</sup> Cycle - 3.64 CGPA)  
 Dr. N.G.P. -Kalapatti Road, Coimbatore - 641048, Tamil Nadu, India  
 Web: www.drngpasc.ac.in | Email: info@drngpasc.ac.in | Phone: +91-422-2369100

## Regulations 2023 - 24 for Undergraduate Programme

(Outcome Based Education model with Choice Based Credit System)

### M.Sc Microbiology Degree

(For the students admitted during the academic year 2023-24 and onwards)

#### Programme : Microbiology

#### ELIGIBILITY:

A pass in any one of the following Degree Course of B.Sc. Microbiology / Biotechnology / Biology / Botany / Zoology / Plant Science/ Animal Sciences / Biochemistry / Bioinformatics / Environmental Science / Food and Nutrition/ Clinical Lab Technology of any University in Tamil Nadu or an Examination accepted as equivalent thereto by the Academic Council, Course to such conditions as may be prescribed thereto are permitted to appear and qualify for the **M.Sc., Microbiology Examination** of this College after a course study of two academic years.

#### PROGRAMME OBJECTIVES:

The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation to:

1. Present intense knowledge in areas of organization and functioning of microorganisms.
2. Familiarize with the operations of bio instruments and related techniques.
3. Enable students to understand the applications of microbiology in healthcare, agriculture, food technology and environmental protection.
4. Provide opportunities to develop skills and participate in Research Projects.



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## Programme Outcomes

On the successful completion of the programme, the following are the expected outcomes.

PO Number	PO Statement
PO1	To impart knowledge of various branches of Microbiology and to understand the role of microorganisms in human welfare and sustainable development.
PO2	To acquire skills in the techniques used to observe and study the nature of microorganisms and the techniques, skills, and modern tools necessary for biological practice.
PO3	To appreciate the complexities of microbiological processes for industrial and other purposes, especially the genetic manipulation of microorganisms for the production of antibiotics, hormones, etc.
PO4	To inculcate broad education necessary to understand the impact of microbiological solutions in a global and societal context; an ability to function in multi-disciplinary teams; To develop the ability to identify, formulate, and solve biological problems and to design and conduct experiments, as well as to analyze and interpret data.
PO5	To create awareness of contemporary issue and to appreciate the applications of Microbiology to become an entrepreneur.







## CURRICULUM

### M.SC MICROBIOLOGY

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
<b>First Semester</b>										
233MB2A1CA	Core - I	Fundamentals of Microbiology	4	-	-	3	25	75	100	4
233MB2A1CB	Core - II	Microbial Physiology and Bacterial Diversity	4	-	-	3	25	75	100	4
233MB2A1CC	Core - III	Mycology, Phycology and Lichenology	4	-	-	3	25	75	100	4
233MB2A1CD	Core - IV	Comprehensive Biology	3	1	-	3	25	75	100	3
233MB2A1CE	Core - V	Bio Analytical Techniques	3	1	-	3	25	75	100	3
233MB2A1CP	Core Practical - I	Basic Techniques in Microbiology	-	-	6	9	40	60	100	3
233MB2A1DA	DSE - I	Microbial Technology	3	1	-	3	25	75	100	3
233BC2A1DA		Cancer Biology, Diagnosis and Therapy								
233BT2A1DA		Applied Biotechnology								
<b>Total</b>			<b>21</b>	<b>3</b>	<b>6</b>				<b>700</b>	<b>24</b>

  
 BoS Chairman/HOD  
 Department of Microbiology  
 Dr. N. G. P. Arts and Science College  
 Coimbatore - 641 048

 <b>Dr.N.G.P. Arts and Science College</b>		
<b>APPROVED</b>		
BoS- 15th 10/06/2023	AC- 15th 14/07/2023	GB- 20th 05/08/2023



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Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
<b>Second Semester</b>										
233MB2A2CA	Core - VI	Microbial Genetics	4	-	-	3	25	75	100	4
233MB2A2CB	Core - VII	Immunology and Immunotechniques	4	-	-	3	25	75	100	4
233MB2A2CC	Core - VIII	Virology	4	-	-	3	25	75	100	4
233MB2A2CD	Core - IX	Medical Bacteriology	3	1	-	3	25	75	100	3
233MB2A2CE	Core - X	Recombinant DNA Technology	3	1	-	3	25	75	100	3
233MB2A2CP	Core Practical -II	Immunology and Molecular Techniques	-	-	6	9	40	60	100	3
233MB2A2DA	DSE - II	Bionanotechnology	3	1	-	3	25	75	100	3
233BC2A2DA		Biochemistry of Toxicology								
233BT2A2DA		Forensic Biotechnology								
<b>Total</b>			<b>21</b>	<b>3</b>	<b>6</b>	<b>-</b>	<b>-</b>	<b>700</b>	<b>24</b>	





Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
<b>Third Semester</b>										
233MB2A3CA	Core - XI	Environmental and Agricultural Microbiology	4	-	-	3	25	75	100	4
233MB2A3CB	Core - XII	Medical Mycology and Parasitology	4	-	-	3	25	75	100	4
233MB2A3CC	Core - XIII	Pharmaceutical Microbiology and Quality Assurance	4	-	-	3	25	75	100	4
233MB2A3CD	Core - XIV	Food Microbiology and Food Quality Control	4	-	-	3	25	75	100	4
233MB2A3CE	Core - XV	Research Methodology and Biostatistics	3	1	-	3	25	75	100	3
233MB2A3CP	Core Practical - III	Applied Microbiological Techniques	-	-	6	9	40	60	100	3
233MB2A3CT	IT	Internship	-	-	-	-	40	60	100	2
233MB2A3DA	DSE - III	Medical Laboratory Techniques	3	1	-	3	25	75	100	3
233BC2A3DA		Free Radicals and Antioxidant System								
233BT2A3DA		Molecular Therapeutics								
<b>Total</b>			<b>22</b>	<b>2</b>	<b>6</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>800</b>	<b>27</b>



Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
<b>Fourth Semester</b>										
233MB2A4CV	Core - XVI	Project and Viva - voce	-	-	16	-	80	120	200	8
233MB2A4CA	Core - XVII	Fermentation Technology	4	1	-	3	25	75	100	3
233MB2A4CB	Core - XVIII	Bioethics, Biosafety and IPR	4	1	-	3	25	75	100	3
233MB2A4DA	DSE - IV	Molecular Diagnostics and Bioinformatics	3	1		3	25	75	100	3
233BC2A4DA		Neurobiology								
233BT2A4DA		Stem Cell Technology								
<b>Total</b>			<b>11</b>	<b>3</b>	<b>16</b>				<b>500</b>	<b>17</b>
<b>*Grand Total</b>									<b>2700</b>	<b>92</b>



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**Self study paper offered by the Department of Microbiology**

<b>S. No.</b>	<b>Semester</b>	<b>Course Code</b>	<b>Course Title</b>
1.	III	233MB2ASSA	Developmental Biology
2.		233MB2ASSB	Inheritance Biology



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**PG REGULATION (R5)**  
**(2023-24 and onwards)**  
**(OUTCOME BASED EDUCATION WITH CBCS)**

Effective from the academic year 2023-24 and applicable to the students admitted to the Degree of Master of Arts/Commerce/Management/Science.

**1. NOMENCLATURE**

**1.1 Faculty:** Refers to a group of programmes concerned with a major division of knowledge. Eg. Faculty of Computer Science consists of Programmes like Computer Science, Information Technology, Computer Technology, Computer Applications, Cognitive Systems, Artificial Intelligence and Machine Learning and Cyber Security and Data Analytics etc.

**1.2 Programme:** Refers to the Master of Arts/Management/Commerce/Science Stream that a student has chosen for study.

**1.3 Batch:** Refers to the starting and completion year of a programme of study. Eg. Batch of 2023-2025 refers to students belonging to a 2-year Degree programme admitted in 2023 and completing in 2025.

**1.4 Course:** Refers to component of a programme. A course may be designed to involve lectures / tutorials / laboratory work / seminar / project work/ practical training / report writing / Viva voce, etc or a combination of these, to effectively meet the teaching and learning needs and the credits may be assigned suitably.

**a) Core Courses** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

**b) Extra Departmental Course (EDC):** A course chosen generally from a related discipline/subject, with an intention to seek exposure in the discipline relating to the core domain of the student.





c) **Discipline Specific Elective Course (DSE):** Elective courses are offered under main discipline/ subject of study.

**d) Internship/Industrial Training (IT)**

Students must undertake industrial / institutional training for a minimum of 15 days during the II semester summer vacation. The students will submit the report for evaluation during III semester.

e) **Project Work:** It is considered as a special course involving application of knowledge in problem solving/analyzing/exploring a real-life situation. The Project work will be given in lieu of a Core paper.

f) **Extra credits** Extra credits will be awarded to a student for achievements in co-curricular activities carried out outside the regular class hours. The guidelines for the award of extra credits are given in section two, these credits are not mandatory for completing the programme.

g) **Advanced Learner Course (ALC):** ALC is doing work of a higher standard than usual for students at that stage in their education. Research work / internships carried out in University/ Research Institutions/ Industries of repute in India or abroad for a period of 15 to 30 days.

## 2. STRUCTURE OF PROGRAMME

- Core Course
- Extra Departmental Course (EDC)
- Discipline Specific Elective (DSE)
- Industrial Training (IT)
- Project

## 3. DURATION OF THE PROGRAMME

M.Sc. /M.Com. / M.A. Programme must be completed within 2 Years (4 semesters) and maximum of 4 Years (8 semesters) from the date of acceptance to the programme. If not, the candidate must enroll in the course determined to be an equivalent by BoS in the most recent curriculum recommended for the Programme.



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#### 4. REQUIREMENTS FOR COMPLETION OF A SEMESTER

Every student shall ordinarily be allowed to keep terms for the given semester in a program of his/ her enrolment, only if he/ she fulfills at least seventy five percent (75%) of the attendance taken as an average of the total number of lectures, practicals, tutorials, etc. wherein short and/or long excursions/field visits/study tours organised by the college and supervised by the faculty as envisaged in the syllabus shall be credited to his attendance. Every student shall have a minimum of 75% as an overall attendance.

#### 5. EXAMINATIONS

The end semester examinations shall normally be conducted after completing 90 working days for each semester. The maximum marks for each theory and practical course as follows,

##### Mark distribution for Theory Courses

Continuous Internal Assessment (CIA) :	40 Marks
End Semester Exams (ESE) :	60 Marks
Total :	100 Marks

##### i) Distribution of Internal Marks

S.No.	Particulars	Distribution of Marks
1	CIA I (2.5 Units) (On completion of 45 <sup>th</sup> working day)	5
2	Model ( All 5 Units) (On completion of 85 <sup>th</sup> working day)	5
3	Attendance	05
4	Library Usage	05
5	Skill Enhancement *	05
<b>Total</b>		<b>25</b>

##### Breakup for Attendance Marks:

S.No	Attendance Range	Marks Awarded
1	95% and Above	5
2	90% - 94%	4
3	85% - 89%	3
4	80% - 84%	2
5	75% - 79%	1





**Note:**

Special Cases such as NCC, NSS, Sports, Advanced Learner Course, Summer Fellowship and Medical Conditions etc. the attendance exemption may be given by principal and Mark may be awarded.

**Break up for Library Marks:**

S.No	Attendance Range	Marks Awarded
1	10h and above	5
2	9h- less than 10h	4
3	8h - less than 9h	3
4	7h - less than 8h	2
5	6h - less than 7h	1

**Note:**

In exception, the utilization of e-resources of library will be considered.

**\*Components for "Skill Enhancement" may include the following:**

Class Participation, Case Studies Presentation/Term paper, Field Study, Field Survey, Group Discussion, Term Paper, Presentation of Papers in Conferences, Industry Visit, Book Review, Journal Review, e-content Creation, Model Preparation, Seminar and Assignment.

**Components for Skill Enhancement**

Any one of the following should be selected by the course coordinator

S.No.	Skill Enhancement	Description
1	Class Participation	<ul style="list-style-type: none"> <li>• Engagement in class</li> <li>• Listening Skills</li> <li>• Behaviour</li> </ul>
2	Case Study Presentation/ Term Paper	<ul style="list-style-type: none"> <li>• Identification of the problem</li> <li>• Case Analysis</li> <li>• Effective Solution using creativity/imagination</li> </ul>
3	Field Study	<ul style="list-style-type: none"> <li>• Selection of Topic</li> <li>• Demonstration of Topic</li> <li>• Analysis &amp; Conclusion</li> </ul>
4	Field Survey	<ul style="list-style-type: none"> <li>• Chosen Problem</li> <li>• Design and quality of survey</li> <li>• Analysis of survey</li> </ul>



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5	Group Discussion	<ul style="list-style-type: none"> <li>• Communication skills</li> <li>• Subject knowledge</li> <li>• Attitude and way of presentation</li> <li>• Confidence</li> <li>• Listening Skill</li> </ul>
6	Presentation of Papers in Conferences	<ul style="list-style-type: none"> <li>• Sponsored</li> <li>• International/National</li> <li>• Presentation</li> <li>• Report Submission</li> </ul>
7	Industry Visit	<ul style="list-style-type: none"> <li>• Chosen Domain</li> <li>• Quality of the work</li> <li>• Analysis of the Report</li> <li>• Presentation</li> </ul>
8	Book Review	<ul style="list-style-type: none"> <li>• Content</li> <li>• Interpretation and Inferences of the text</li> <li>• Supporting Details</li> <li>• Presentation</li> </ul>
9	Journal Review	<ul style="list-style-type: none"> <li>• Analytical Thinking</li> <li>• Interpretation and Inferences</li> <li>• Exploring the perception if chosen genre</li> <li>• Presentation</li> </ul>
10	e-content Creation	<ul style="list-style-type: none"> <li>• Logo/ Tagline</li> <li>• Purpose</li> <li>• Content (Writing, designing and posting in Social Media)</li> <li>• Presentation</li> </ul>
11	Model Preparation	<ul style="list-style-type: none"> <li>• Theme/ Topic</li> <li>• Depth of background Knowledge</li> <li>• Creativity</li> <li>• Presentation</li> </ul>
12	Seminar	<ul style="list-style-type: none"> <li>• Knowledge and Content</li> <li>• Organization</li> <li>• Understanding</li> <li>• Presentation</li> </ul>
13	Assignment	<ul style="list-style-type: none"> <li>• Content and Style</li> <li>• Spelling and Grammar</li> <li>• References</li> </ul>





## ii) Distribution of External Marks

<b>Total</b>	:	<b>75</b>
<b>Written Exam</b>	:	<b>75</b>

## Marks Distribution for Practical course

<b>Total</b>	:	<b>100</b>
<b>Internal</b>	:	<b>40</b>
<b>External</b>	:	<b>60</b>

## i) Distribution of Internals Marks

S. No.	Particulars	Distribution of Marks
1	Experiments/Exercises	15
2	Test 1	10
3	Test 2	10
4	Observation Notebook	05
<b>Total</b>		<b>40</b>

## ii) Distribution of Externals Marks

S.No.	Particulars	External Marks
1	Practical	40
2	Record	10
3	Viva- voce	10
<b>Total</b>		<b>60</b>

Practical examination shall be evaluated jointly by Internal and External Examiners.

## A) Mark Distribution for Project

<b>Total</b>	:	<b>200</b>
<b>Internal</b>	:	<b>80</b>
<b>External</b>	:	<b>120</b>

## i) Distribution of Internal Marks

S.No.	Particulars	Internal Marks
1	Review I	30
2	Review II	40
3	Attendance	10
<b>Total</b>		<b>80</b>



## ii) Distribution of External Marks

S.No	Particulars	External Marks
1	Project Work & Presentation	100
2	Viva -voce	20
<b>Total</b>		<b>120</b>

Evaluation of Project Work shall be done jointly by Internal and External Examiners.

## 6 . Credit Transfer

a. Upon successful completion of 1 NPTEL Course (4 Credit Course) recommended by the department, during Semester I to II, a student shall be eligible to get exemption of one 4 credit course during the 3<sup>rd</sup> semester. The proposed NPTEL course should cover content/syllabus of exempted core paper in 3<sup>rd</sup> semester.

S. No.	Course Code	Course Name	Proposed NPTEL Course	Credit
1			Option - 1 Paper title	4
			Option - 2 Paper title	
			Option - 3 Paper title	

b. Upon successful completion of 2 NPTEL Courses (2 Credit each) recommended by the department, during Semester I to II, a student shall be eligible to get exemption of one 4 credit course during the 3<sup>rd</sup> semester. Out of 2 NPTEL proposed courses, at least 1 course should cover content/syllabus of exempted core paper in 3<sup>rd</sup> semester.

### Mandatory

The exempted core paper in the 3<sup>rd</sup> semester should be submitted by the students for approval before the end of 2<sup>nd</sup> semester

Credit transfer will be decided by equivalence committee



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S. No.	Course Code	Course Name	Proposed NPTEL Course	Credit
1			Option - 1 Paper title	2
			Option - 2 Paper title	
			Option - 3 Paper title	
2			Option - 1 Paper title	2
			Option - 2 Paper title	
			Option - 3 Paper title	

NPTEL Courses to be carried out during semester I - II.					
S. No.	Student Name	Class	Proposed NPTEL Course		Proposed Course for Exemption
			Course I	Option 1- Paper Title Option 2- Paper Title Option 3- Paper Title	Any one Core Paper in 3 <sup>rd</sup> Semester
			Course II	Option 1- Paper Title Option 2- Paper Title Option 3- Paper Title	
Class Advisor		HoD		Dean	

### 7. Internship/Industrial Training

#### Mark Distribution for Internship/ Industrial Training

Total	:	100
Internal	:	40
External	:	60

#### i) Distribution of Internal Marks

S.No.	Particulars	Internal Marks
1	Review I	15
2	Review II	20
3	Attendance	5
<b>Total</b>		<b>40</b>



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## ii) Distribution of External Marks

S.No	Particulars	External Marks
1	Internship /Industrial training Presentation	40
2	Viva -voce	20
<b>Total</b>		<b>60</b>

Internship/ Industrial training shall be evaluated jointly by Internal and External Examiners.

### 9. Extra Credits: 10

Earning extra credit is not essential for programme completion. Student is entitled to earn extra credit for achievement in Curricular/Co-Curricular/ Extracurricular activities carried out other than the regular class hours.

A student is permitted to earn a maximum of 10 extra Credits during the programme period. A maximum of 1 credit under each category is permissible.

Category	Credit
Self study Course	1
CA/ICSI/CMA (Foundations)	1
CA/ICSI/CMA (Inter)	1
Sports and Games	1
Publications / Conference Presentations (Oral/Poster)/ Awards	1
Innovation / Incubation / Patent / Sponsored Projects / Consultancy	1
Representation in State / National level celebrations	1
Awards/Recognitions/Fellowships	1
<b>Advanced Learner Course (ALC)*</b>	<b>2</b>

Credit shall be awarded for achievements of the student during the period of study only.

### GUIDELINES

#### Self study Course

A pass in the self study courses offered by the department.

The candidate should register the self study course offered by the department only in the III semester.



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**CA/ICSI/CMA(Foundations)**

Qualifying foundation in CA/ICSI/CMA / etc.

**CA/ICSI/CMA(Inter)**

Qualifying Inter in CA/ICSI/CMA / etc.

**Sports and Games**

The Student can earn extra credit based on their Achievement in sports in University/ State / National/ International.

**Publications / Conference Presentations (Oral/Poster)**

Research Publications in Journals

Oral/Poster presentation in Conference

**Innovation / Incubation / Patent / Sponsored Projects / Consultancy**

Development of model/ Products /Prototype /Process/App/Registration of Patents/ Copyrights/Trademarks/Sponsored Projects /Consultancy

**Representation in State/ National level celebrations**

State / National level celebrations such as Independence day, Republic day Parade, National Integration camp etc.

**Awards/Recognitions/Fellowships**

Regional/ State / National level awards/ Recognitions/Fellowships

**\*Advanced Learner Course (ALC):**

ALC is doing work of a higher standard than usual for students at that stage in their education.

Research work/internships carried out in University/ Research Institutions/ Industries of repute in India or abroad for a period of 15 to 30 days will be considered as Advanced Learners Course.



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### QUESTION PAPER PATTERN

#### CIA Test I : [1½ Hours-2.5 Units] - 25 Marks

SECTION	MARKS	DESCRIPTION	TOTAL	Remarks
Section - A	8 x 0.5 = 04 Marks	MCQ	25 Marks	Marks secured will be converted To 5 mark
Section - B	3 x 2 = 06 Marks	Answer ALL Questions Either or Type ALL Questions Carry Equal Marks		
Section - C	3 x 05 = 15 Marks			

#### CIA Test II/ Model [3 Hours-5 Units] - 75 Marks

SECTION	MARKS	DESCRIPTION	TOTAL	Remarks
Section - A	10 x 1 = 10 Marks	MCQ	75 Marks	Marks secured will be converted To 5 mark
Section - B	5 x 3 = 15 Marks	Answer ALL Questions (Either or Type Questions) Each Questions Carry Equal Marks		
Section - C	5 x 8 = 40 Marks			
Section - D	1 x 10 = 10 Marks	Compulsory Question		

#### End Semester Examination [3 Hours-5 Units] - 75 Marks

SECTION	MARKS	DESCRIPTION	TOTAL
Section - A	10 x 1 = 10 Marks	MCQ	75 Marks
Section - B	5 x 3 = 15 Marks	Answer ALL Questions (Either or Type Questions) Each Questions Carry Equal Marks	
Section - C	5 x 8 = 40 Marks		
Section - D	1 x 10 = 10 Marks	Compulsory Question	



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Course Code	Course Name	Category	L	T	P	Credit
233MB2A1CA	FUNDAMENTALS OF MICROBIOLOGY	CORE	4	-	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- History of Microorganisms
- Basic techniques in Microbiology
- Characteristics of algae, fungi, protozoa and viruses.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Explain the theories to understand the importance of microorganisms.	K2
CO2	Apply the principles of sterilization and disinfection. Make use of the types of Media.	K3
CO3	Compare and contrast the principles of Microscopy	K2
CO4	Compare and understand the characteristics of algae, fungi and protozoa.	K4
CO5	Compare and understand the characteristics of viruses.	K4

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓				
CO2	✓	✓	✓	✓	✓
CO3		✓		✓	✓
CO4	✓	✓			
CO5	✓	✓			

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



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233MB2A1CA	FUNDAMENTALS OF MICROBIOLOGY	SEMESTER I
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Total Credits: 4

Total Instruction Hours: 48 h

### Syllabus

#### Unit I History of Microbiology 10 h

The Historic foundations and development of Microbiology - Spontaneous generation- Germ theory of diseases - Cell theory - Contributions of Antony van Leuwenhoek - Joseph Lister - Robert Koch - Louis Pasteur - Edward Jenner - John Tyndall - Sergei N. Winogradsky - Salmon A. Waksman - Alexander Flemming - Paul Erlich - Fannie Hessie - Elie Metchnikoff, Lederberg and Zinder, Lwoff, Arber and Smith, Temin and Baltimore - Scope of microbiology.

#### Unit II Sterilization and culturing methods 10 h

Sterilization and disinfection - Physical and chemical methods. Culturing of Bacteria - Isolation, purification and Cultivation of different types of Microorganisms -Aerobes and Anaerobes - Culture maintenance and Preservation - Culture Collection centres -ATCC, MTCC and NFMCC.

#### Unit III Microscopy and Staining 10 h

Principles of Microscopy- Light microscope, Inverted microscope, Electron microscope - TEM and SEM, Polarization microscope, Confocal, Perfocal, Atomic force microscope. Stains and staining principles: Simple, Gram, Negative, Capsule, Spore, Flagellar and Acid fast staining.

#### Unit IV Prokaryotes 9 h

Characteristics of Prokaryotic cells - Basic cell types: Prokaryotic cells - Size, shape and Arrangement - Overview of structure - Cell membrane. Internal membrane structure - Cytoplasm- Nucleoid - Inclusions - chlorosomes - carboxysomes - magnetosomes - phycobilisomes -Endospores. External structure - Cell Wall - Flagella and its function - Glycocalyx - Slime layer.

#### Unit V Protozoa, Viruses, Fungi and Algae 9 h

General Characteristics of Protozoa. Structure and Reproduction of Paramecium sp. General Properties of Viruses. Cultivation of Plant and Animal Viruses. Characterization and Enumeration of Viruses-Plant Viruses- CaMV and RNA containing Plant Viruses- TMV. General characteristics of algae- Structure and reproduction of Chlamydomonas sp. General characteristics of fungi- Structure and reproduction of Aspergillus niger



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*M.Sc. Microbiology (Students admitted during the AY 2023-24)*



**Text Books**

- 1 *Black J G, 2015, Microbiology, 9<sup>th</sup> Edition, John Wiley and Sons, New Jersey, United States*
- 2 *Joanne Wiley, Linda Sherwood, Christopher J and Woolverton, 2020, Prescott's Microbiology, 11<sup>th</sup> Edition, McGraw Hill Company, New York, United States.*

**References**

- 1 *Micheal T Madigan, 2018, Brock Biology of Microorganisms, 14<sup>th</sup> Edition, Pearson Education, New Delhi*
- 2 *Jeffrey C Pommerville, 2010, Alcamo's Fundamentals of Microbiology, 9<sup>th</sup> Edition, Jones and Bartlett Publishers, Massachusetts, United States*
- 3 *Salle A J, 2014, Fundamental Principles of Bacteriology, 7<sup>th</sup> Edition, Tata Mc Hill Publishing Company Ltd., New Delhi*
- 4 *Michael Pelczar, 2021, Microbiology, 5<sup>th</sup> Edition, Tata Mc Hill Publishing Company Ltd., New Delh*



Course Code	Course Name	Category	L	T	P	Credit
233MB2A1CB	MICROBIAL PHYSIOLOGY AND BACTERIAL DIVERSITY	CORE	4	-	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- The physiological, biochemical and metabolic properties of Microorganisms.
- The respiratory and nutritional pathways of microorganisms.
- The significance of Bacterial diversity.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	To discuss the nutritional classification of microorganisms based on carbon, energy and electron sources.	K3
CO2	To comprehend nomenclature, classification, kinetics and types of enzymes with an emphasis on nature of enzyme Inhibitions.	K4
CO3	To confer the significance of different pathways of carbohydrate metabolism.	K3
CO4	To acquire the knowledge on the concepts of biosynthesis of amino acids, nucleotides, fatty acids and cell wall of Gram positive and Gram negative bacteria.	K2
CO5	To outline the diversified classes among bacteria.	K5

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓			✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



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233MB2A1CB	MICROBIAL PHYSIOLOGY AND BACTERIAL DIVERSITY	SEMESTER I
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Total Credits: 4

Total Instruction Hours: 48 h

### Syllabus

#### Unit I Nutrition and Growth 10 h

Nutritional types of microorganisms: Phototrophs, Autotrophs, Lithotrophs, Organotrophs. Nutritional requirements -Macro, Micro nutrients and trace elements. Membrane transport - passive, facilitated diffusion, active transport (Proton Motive force, PTS, role of permeases), group translocation and ion uptake. Factors affecting Microbial growth - Temperature, pH, Osmosis, Pressure, Oxygen and Radiation. Physiology of Growth - Growth curve. Growth measurements - batch, continuous and synchronous.

#### Unit II Enzymes and co enzymes 9 h

IUBMB classification and nomenclature of enzymes, active site, Lock and key Mechanism and induced fit hypothesis, Enzyme kinetics- negative and positive. Enzyme inhibition: Reversible - Competitive, Noncompetitive, uncompetitive and irreversible inhibition -Feedback inhibition. Regulatory and Allosteric enzymes.

#### Unit III Energy Production pathways 10 h

EMP pathway - Substrate level Phosphorylation - HMP Pathway -Entner Doudroff pathway - Glyoxalate pathway - Krebs cycle. Energy production: Electron transport chain and Oxidative phosphorylation, Pasteur Effect, Bioluminescence. Fermentations of Carbohydrates: Acidic: Homolactic, Mixed acid, Butanediol and Propionic acid fermentation. Alcoholic fermentation: Ethanol.  $\beta$  - Oxidation of Fatty acids.

#### Unit IV Biosynthesis of Biomolecules 9 h

Biosynthesis of Aspartate, pyruvate, histidine and serine amino acid families - Purine and pyrimidine nucleotides - Denovo and salvage pathway. Biosynthesis of fatty acids and lipids. Biosynthesis of gram positive and gram negative cell wall.

#### Unit V Bacterial Diversity 10 h

Introduction to Archaea - Ecology, Cell walls and membranes, Genetics and molecular biology, metabolism. Archaeal taxonomy - Outline characteristics - Crenarchaeota and Euryarchaeota. Methylophs - Methanogens. Eubacteria - Photosynthetic bacteria, Cyanobacteria - Spirochaetes - Bacteroidetes. Characteristics of Proteobacteria: Alpha (Rickettsia), Beta (Neisseria), Gamma (Pseudomonas), Delta (Desulfovibrio) and Epsilon (Helicobacter). Low G+C gram positive (Staphylococcus) and High G+C gram positive (Mycobacterium). Case study on Profiling of Microbial Community from different soil.



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*M.Sc. Microbiology (Students admitted during the AY 2023-24)*

**Text Books**

- 1 *David White and George D. Hageman, 2000, Microbial Physiology and Biochemistry Laboratory, Oxford University Press, India.*
- 2 *Joanne Wiley, Linda Sherwood, Christopher J and Woolverton, 2016, Prescott's Microbiology, 10<sup>th</sup> Edition, Mc Graw Hill Company.*

**References**

- 1 *Moat. A.G, J.W.Foster, 2002. Microbial physiology. 4<sup>th</sup> edition. John Wiley & sons. Australia.*
- 2 *Demain A.J. and Solomon INA, 1999. 2<sup>nd</sup> edition. Manual of Industrial Microbiology and Biotechnology , ASM press.USA.*
- 3 *Geoffrey Michael Gadd, 2008, Bacterial Physiology and Metabolism, Cambridge University Press, UK*
- 4 *Doelle. H.W, 1960, Bacterial Metabolism, 2<sup>nd</sup> edition. Academic, Press. USA.*
- 5 *Gerhard Gottschalk, 2006, Bacterial Metabolism, Springer-Verlag, New York.*





Course Code	Course Name	Category	L	T	P	Credit
233MB2A1CC	MYCOLOGY, PHYCOLOGY AND LICHENOLOGY	CORE	4	-	-	4

### PREAMBLE

This course has been designed for students to learn and understand

- To acquire knowledge of the diversity of Fungi, Algae, and Lichens
- To gain knowledge on the structural organization and reproduction
- To obtain knowledge on the importance of Fungi, Algae, and Lichens

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	To introduce diversity, classification, and characteristics and acquire knowledge on economic quality of fungi	K4
CO2	To understand the organization and reproduction process of fungi	K3
CO3	To introduce classification, characteristics, and economic quality of algae.	K4
CO4	To understand the organization, reproduction, cultivation and various roles of algae in the environment.	K4
CO5	To grasp the basic characteristics, classification and economic importance of lichens	K4

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓		
CO5	✓	✓	✓		✓

<input checked="" type="checkbox"/>	Skill Development	<input checked="" type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input checked="" type="checkbox"/>	Innovations
<input checked="" type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input checked="" type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



233MB2A1CC	MYCOLOGY, PHYCOLOGY AND LICHENOLOGY	SEMESTER I
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Total Credits: 4

Total Instruction Hours: 48 h

### Syllabus

**Unit I** Classification and Characteristics of Fungi 10 h

Classification of fungi (Alexopoulos and Mims, 1979). Recent trends in classification of fungi. General characters of major classes: Mastigomycotina, Schizomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina. Phylogeny and interrelationships of major groups of fungi. Economic importance of fungi.

**Unit II** Organization and Reproductions of Fungi 10 h

Thallus organization - reproduction, life cycle types, parasexual cycles, reduction in sexuality in fungi - physiological races in fungi - spore dispersal mechanisms and fungal genetics, study of fossil fungi.

**Unit III** Classification And Characteristics of Algae 8 h

Classification of algae (Fritsch, 1945). Salient features of major classes: Chlorophyta, Cyanophyta, Charophyta, Xanthophyta, Phaeophyta and Rhodophyta. Ultrastructure of prokaryotic and eukaryotic algal cells and their components. Economic importance of algae.

**Unit IV** Ecology, Cultivation and Life Cycle Patterns of Algae 10 h

Ecology of algae - algae as pollution indicators, algal blooms, algicides - culture and cultivation of fresh water and marine algae - Knop's solution and Chu-10 medium (1972). Origin and evolution of sex in algae, phylogeny and interrelationships of algae. Lifecycle patterns in algae. Study of fossil algae.

**Unit V** Classification and characteristics of Lichens 10 h

Classification of Lichens (Hale, 1969). Occurrence and interrelationship of phycobionts and mycobionts, structure and reproduction in Ascolichens, Basidiolichens, and Deuterolichens. Lichens as indicators of pollution. Economic importance of Lichens. Case Study- Algal diversity and algal bloom in water bodies of your native city or state.



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*M.Sc. Microbiology (Students admitted during the AY 2023-24)*



**Text Books**

- 1 *Michael Madigan, 2015, Brock Biology of Microorganisms, 14<sup>th</sup> Edition, Pearson Publishers, New Delhi*
- 2 *Vashishta BR, Sinha AK, Singh VP, 2010, Botany for Degree students Algae, 1<sup>st</sup> Edition, S Chand & Company Ltd. India*

**References**

- 1 *Alexopoulos CJ, Mims CW, Blackwell M, 2002, Introductory Mycology, 4<sup>th</sup> Edition, Wiley India Pvt. Ltd, India*
- 2 *Moore D, Robson GD, Anthony P, Trinci J, 2011, 21st Century Guidebook to Fungi, Cambridge University Press, United Kingdom*
- 3 *Thomas H. Nash, 2008, Lichen Biology, 2<sup>nd</sup> Edition Cambridge University Press, India*
- 4 *Ernst Athearn Bessey, 2020, Morphology and taxonomy of fungi, 1<sup>st</sup> Edition, Alpha Edition Publishers, India*
- 5 <http://archive.bio.ed.ac.uk/jdeacon/microbes/fungalwe.html>
- 6 <https://gclambathach.in/lms/Algae.pdf>
- 7 <http://www.mycolog.com/chapter11.html>



Course Code	Course Name	Category	L	T	P	Credit
233MB2A1CD	CORE IV: COMPREHENSIVE BIOLOGY	CORE	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- The structure and function of biomolecules
- The basic concepts of developmental biology and cell signaling
- The evolution of living cells.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the importance of biological molecules.	K3
CO2	Cognize the basic concepts of developmental biology.	K3
CO3	Critically understand the idea on how a cell responds to external stimulus.	K3
CO4	Understand the inheritance of chromosomes.	K3
CO5	Cognize the formation and evolution pattern exhibited till date by living organisms over different time frames.	K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	
CO2	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	
CO4	✓	✓	✓	✓	
CO5	✓	✓	✓	✓	

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input type="checkbox"/>	Employability	<input checked="" type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics





233MB2A1CD	CORE IV: COMPREHENSIVE BIOLOGY	SEMESTER I
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Total Credits: 3

Total Instruction Hours: 48 h

### Syllabus

**Unit I** Structure of atoms, molecules and chemical bonds 10 h

Composition, structure and function of bio-molecules (carbohydrates, lipids, proteins, nucleic acids and vitamins). Interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction etc.). Principles of biophysical chemistry (pH, buffer, thermodynamics, colligative properties). Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds).

**Unit II** Basic concepts of developmental biology 10 h

Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; fertilization and early development.

**Unit III** Cell Signaling 10 h

Cell signaling - Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two component systems, light signaling in plants, bacterial chemotaxis and quorum sensing.

**Unit IV** Inheritance biology 9 h

Gene mapping methods: Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants. Extra chromosomal inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance. Human genetics: Pedigree analysis, lod score for linkage testing, karyotypes, genetic disorders.

**Unit V** Evolution 9 h

Emergence of evolutionary thoughts Lamarck; Darwin-concepts of variation, adaptation, struggle, fitness and natural selection; Origin of cells and unicellular evolution: Origin of basic biological molecules; Abiotic synthesis of organic monomers and polymers; Concept of Oparin and Haldane; Experiment of Miller; The first cell; Evolution of prokaryotes; Origin of eukaryotic cells; Evolution of unicellular eukaryotes; Paleontology and Evolutionary History: The evolutionary time scale; Eras, periods and epoch.

Case Study 1: Is there a scenario, where, within the earth, there are locations mimicking the ancient timelines with regards to temperatures (when the globe was formed from the sun due to explosion). If so, are we still witnessing abiotic synthesis even today?



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*M.Sc. Microbiology (Students admitted during the AY 2023-24)*

**Text Books**

- 1 *Dr. A. P. Singh & Kumar Pushkar, 2021, Upkar CSIR-UGC NET/JRF/SET Life Sciences, 1<sup>st</sup> Edition, Upkar Prakashan publishers, India.*
- 2 *Quaisher J. Hossain, Prashant Kumar, Ashish Nagesh, 2018, UGC CSIR NET / SLET (JRF & LS) Life Sciences, 4<sup>th</sup> Edition, Arihang Publications*

**References**

- 1 *Pranav Kumar & Usha Mina, 2020, Pathfinder Academy: CSIR-JRF-NET Life Sciences Book Combo Set with Ecology, 1<sup>st</sup> Edition, Pathfinder Publication.*
- 2 *De Robertis, E. D. P, 2017, Cell and Molecular Biology, 8<sup>th</sup> Edition, Lea & Febiger, New York.*
- 3 *Van De Graaff, R. Ward Rhees, Sidney L. Palmer, 2013, Schaum's Outline of Human Anatomy and Physiology, 4<sup>th</sup> Edition, Mcgraw-Hill Companies, New York.*
- 4 <http://www.easybiologyclass.com/csir-jrf-net-life-sciences-previous-year-question-papers/>





Course Code	Course Name	Category	L	T	P	Credit
233MB2A1CE	BIO ANALYTICAL TECHNIQUES	CORE	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- To comprehend the principle and instrumentation of diverse instruments for Microbiology
- To procure knowledge on the working methods of different instruments
- To appreciate its application in diverse fields

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	To understand the principles, instrumentation with an emphasis on applications of Analytical centrifuge.	K3
CO2	To become equipped with the operational principle and working methods of spectral instruments	K2
CO3	To procure knowledge on the principles and techniques of various types of electrophoresis	K3
CO4	To acquaint the concept of radioactivity and its types of decay	K3
CO5	Application of knowledge for the characterization of Biomolecules	K3

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	
CO2		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓		✓	
CO5	✓	✓	✓	✓	✓

<input checked="" type="checkbox"/>	Skill Development	<input checked="" type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input checked="" type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



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233MB2A1CE	BIO ANALYTICAL TECHNIQUES	SEMESTER I
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Total Credits: 3

Total Instruction Hours: 48 h

### Syllabus

**Unit I** Centrifugation and Chromatography 10 h

Centrifugation - Principles and types - Low speed, High speed and Ultra centrifuge. Applications of Analytical Ultra Centrifugation - Determination of Molecular weight and purity of macromolecules. Chromatography: Instrumentation, detection methods and Applications of TLC, Column, Gas, Ion Exchange, HPLC, Gel Filtration, GCMS and LCMS.

**Unit II** Colorimetry and Spectrometry 10 h

Colorimetry: Principles, Instrumentation, Application and Analysis - Qualitative and Quantitative. Spectrophotometry: Principles, Instrumentation and Applications of UV, Visible, IR, NMR, FTIR, Atomic absorption, Mass Spectroscopy and MALDI - TOF, Spectrofluorometry and Flame Photometry

**Unit III** Electrophoresis 8 h

Electrophoresis: Principles and Instrumentation - Separation of Nucleic acids - Agarose Gel Electrophoresis, Electrophoresis of RNA, Capillary Electrophoresis and Microchip Electrophoresis. Separation of Proteins - SDS - PAGE, Native Gel, Gradient Gel, Iso Electric Focusing, 2D Page, Cellulose Acetate Electrophoresis, Western Blotting - Detection, Estimation and Recovery of Proteins in gel.

**Unit IV** Radiometry 10 h

Introduction - Detection and Measurement of Radioactivity - Detection based on gas ionization - Autoradiography and its applications - Scintillation Counting - Safety Aspects - Biosensors and its applications (DNA and Immunosensors).

**Unit V** Quantification Methods for Biomolecules 10 h

Quantitative determination of Macromolecules: Carbohydrates (DNSA and Anthrone method), Lipids (Gravimetric), Protein (Lowry and Bradford method). Determination of Molecular weight of protein (MS and SDS-PAGE) and DNA (Agarose gel). Estimation of Microbial pigments: Chlorophylls and Carotenoids. Case study - Collect the various plant leaves from our college campus and analyze their compounds using chromatography techniques



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**Text Books**

- 1 *L Veerakumari, 2011, Bioinstrumentation, 1<sup>st</sup> Edition, MJB Publishers.*
- 2 *Keith Wilson and John Walker, 2010, Principles and Techniques of. Biochemistry and Molecular Biology, 7<sup>th</sup> edition, Cambridge University Press*

**References**

- 1 *Plummer .T David, 2004, An Introduction to Practical Biochemistry, 3<sup>rd</sup> Edition, TMH Publishers*
- 2 *Terrance G Cooper, 2010, The tools of Biochemistry, 2<sup>nd</sup> Edition, John Wiley and sons.*
- 3 *Rodney Boyer, 2000, Modern Experimental Biochemistry, 3<sup>rd</sup> Edition, Pearson education Publishers*
- 4 *Swahney S K and Singh R, 2014, Introductory Practical Biochemistry, Narosa Publishing House*



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233MB2A1CP	CORE PRACTICAL: BASIC TECHNIQUES IN MICROBIOLOGY	SEMESTER I
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Total Credits: 3  
Total Instructions Hours: 72 h

S.No	Contents
1	Bacterial Staining techniques - Gram, Acid-fast, Spore, Capsule and Negative Staining.
2	Morphological observation of Fungi -LPCB Mount.
3	Micrometry - Measurement of Microorganisms.
4	Motility determination- Hanging drop and soft agar inoculation.
5	Enumeration of Microorganisms from soil: Bacteria, Fungi and Actinomycetes.
6	Determination of Bacterial generation time - Direct microscopic method and turbidity method
7	Effect of various intrinsic factors on the growth of bacterium - pH, Temperature
8	IMViC test, Hydrogen sulphide test, Oxidase test, Calalase test, Urease test
9	Preferential utilization of sugar - Carbohydrate fermentation & TSI; Polymer degradation - Starch, Casein
10	Quantitative determination of Sugar by DNSA method and Protein by Lowry et al method
11	Separation techniques: Chromatography- TLC and Column.
12	Microscopic observation of Algae and Lichen thallus

Note: Out of 12-10 Mandatory



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**References**

- 1 *James Cappuccino, Natalie Sherman, 2013, Microbiology: A Laboratory Manual, 10<sup>th</sup> Edition, Pearson Publishers*
- 2 *Aneja. K.R, 2012. Experiments in Microbiology, Plant Pathology and Biotechnology, 2<sup>nd</sup> edition. New age publisher*
- 3 *Rajan S. Selvi Christy.R, Experimental Procedures in Lifesciences, CBS Publishers & Distributors Pvt Ltd*
- 4 *Kannan, N, 1997, Laboratory Manual of General Microbiology, 1<sup>st</sup> Edition, Panima Publishing house*



Course Code	Course Name	Category	L	T	P	Credit
233MB2A1DA	MICROBIAL TECHNOLOGY	DSE	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- The production of Sustainable products using Microorganisms.
- The importance of Microorganisms in Pharmaceutical sector.
- How to explore the ideas in commercial level

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Inculcate about microbial products and its scale up production through establishing a small scale industry	K2
CO2	Exemplify the ideas about the production and uses of Biofuel and Biofertilizer.	K3
CO3	Demonstrate the commercial production of Biopolymers using Microorganisms.	K4
CO4	Understand the way of cells and enzymes were immobilized for industrial uses.	K3
CO5	Explore the pharmaceutical products and possibilities of converting it to a commercial product.	K4

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓	✓	✓
CO2	✓	✓		✓	✓
CO3	✓		✓	✓	✓
CO4	✓		✓		✓
CO5	✓	✓		✓	✓

<input checked="" type="checkbox"/>	Skill Development	<input checked="" type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input checked="" type="checkbox"/>	Innovations
<input checked="" type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



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233MB2A1DA	MICROBIAL TECHNOLOGY	SEMESTER I
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Total Credits: 3

Total Instruction Hours: 48 h

## Syllabus

**Unit I** Microbial products 10 h

Single Cell Protein and its Economic Aspects: Bacterial, Yeast, Fungal and Algal Proteins - Brewer's and Baker's yeast - Food and Fodder yeast - Mushroom (Agaricus, Oyster) and Products from Higher fungi (Ganoderma lucidum).

**Unit II** Production of Biofuel & Biofertilizer 10 h

Production, Methods and Uses of Bioethanol (*S cerevisiae*) - Biodiesel (*Chlorella*) - Biohydrogen (*Chlamydomonas*) - Biogas (*Methanobacteria*). Biofertilizer - N<sub>2</sub> fixing, Phosphate Solubilizing, Phosphate Mobilizing, Plant Growth Promoting Rhizobacteria - Mass production and Applications.

**Unit III** Biopolymer production 8 h

Production and Uses of Polyhydroxybutyrate (PHB) - Xanthan - Alginate - Cellulose - Cyanophycin - Levan - Melanin - Welan - Succinoglucon- Curdlan- Chitosan - Polyhydroxyalkanoates - Hyaluronic acid.

**Unit IV** Immobilization of Cells & Enzymes 10 h

Cells - Surface attachment of cells - Entrapment - Hydrogel method, Preformed support materials - Containment behind a barrier: Microencapsulation, Immobilization using membranes - Self aggregation of cells - Methods for Enzyme immobilization - Carrier binding method, Intermolecular cross linking - Applications of Immobilized cells and Enzymes

**Unit V** Microbial products with pharmaceutical importance 10 h

Vaccines - Steps of Manufacturing - Growing the microbes and separation - Preparation of Live and killed vaccine - Preparation of Toxoid and uses - BCG Vaccine - Cholera vaccine - Rabies vaccine - Diphtheria toxoid. Pharmaceutical industry - certification & accreditation required. Bioentrepreneurship opportunities and Funding sources - Government funds, Venture capital, NGOs, Crowd funding and Incubation centers. Antimicrobial compounds from soil microbes - Case study



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M.Sc. Microbiology (Students admitted during the AY 2023-24)

**Text Books**

- 1 *Patel A H, 2012, Industrial Microbiology, 2<sup>nd</sup> Edition, Trinity Press, New Delhi*
- 2 *El-Mansi E M T, Bryce C F A, Dahhou B, Sanchez S, Demain A L and Allman A R, 2012, Fermentation Microbiology and Biotechnology, 3<sup>rd</sup> Edition, CRC Press, USA*

**References**

- 1 *Bernard R Glick, Jack J Pasternek and Cheryl L Patten, 2010, Molecular Biotechnology - Principles and Applications of Recombinant DNA, 4<sup>th</sup> Edition, ASM Publishers, USA]*
- 2 *Nidhi Goel, 2013, Pharmaceutical Microbiology, 1<sup>st</sup> Edition, Narosa Publishing House, New Delhi*
- 3 *Puvanakrishnan R, Sivasubramanian S and Hemalatha T, 2012, Microbial Technology - Concepts and Applications, 1<sup>st</sup> Edition, MJP Publishers, New Delhi*
- 4 *[https://agritech.tnau.ac.in/org\\_farm/orgfarm\\_biofertilizertechnology.html](https://agritech.tnau.ac.in/org_farm/orgfarm_biofertilizertechnology.html)*





Course Code	Course Name	Category	L	T	P	Credit
233BC2A1DA	CANCER BIOLOGY,DIAGNOSIS AND THERAPY	DSE	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- Molecular basis of cancer, mutations causing cancer, and repair mechanisms.
- The basic principles of cancer development and available therapeutic options
- The different diagnostic and treatment methods for cancer.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Compare and contrast benign and malignant tumors and the morphological characteristics of cancer cells.	K4
CO2	Justify the molecular basis of cancer. Distinguish interdisciplinary areas in cancer biology.	K5
CO3	Evaluate the molecular mechanism of oncogenesis, tumor biology and the role of cell cycle in cancer.	K5
CO4	Validate the role of tumor suppressor genes and apoptosis. Explain about epigenetics.	K5
CO5	Summarize on the choice of diagnosis and therapy available for cancer patients.	K6

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



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233BC2A1DA	CANCER BIOLOGY, DIAGNOSIS AND THERAPY	SEMESTER I
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Total Credits: 3

Total Instruction Hours: 48 h

## Syllabus

**Unit I** Introduction 9 h

Introduction: Cancer cell-morphology and growth characteristics. Metastasis and cytoskeleton. Types of growth- hyperplasia, dysplasia, anaplasia and neoplasia. Types and prevalence of cancer. Nomenclature of neoplasms, classification based on origin/organ. Differences between benign and malignant tumors.

**Unit II** Carcinogenesis 9 h

Cancer epidemiology and endocrinology. Cancer causing agents-radiation, viruses, chemicals. Multistep carcinogenesis: Initiation, Promotion, Progression. Para-neoplastic syndromes. Mutation-definition, significance, rates and frequency. Mutagenic agents. Molecular basis of mutagenesis: induced and spontaneous mutations, crossing over and segregation. Mutation Types-addition, deletion, inversion, reciprocal, translocation, insertional translocation and frame-shift mutations. Chemical carcinogenesis- genetic and epigenetic carcinogens, pro- carcinogens and co-carcinogens, promoters and initiators, testing for carcinogenicity, Ames test. Aberrant metabolism during cancer development.

**Unit III** Tumor Markers and Signal Transduction 10 h

Oncogenes - RNA and DNA tumor viruses, retroviruses and viral oncogenes and abrupt activation. Src and Ras gene, mechanism and characteristic of cell transformation. Molecular mechanism of oncogenesis- protooncogenesis, oncoproteins, tumor suppressor genes involved in cancer. Radiation- effect of ionizing radiations on DNA, chromosomal aberrations. Cancer Markers: Genetic basis of cancer, use of tumor markers in detection and monitoring of cancer. Signal transduction in cancer: cell-cell interactions, cell adhesion, invasion and metastasis, VEGF signaling and angiogenesis; role of transcription factors. Growth factors-EGF, TNF- $\alpha$  and TGF- $\beta$  and growth factor receptors. Free radicals and antioxidants in cancer. Diet and cancer.

**Unit IV** Cell Cycle, Cell Death and Cancer 10 h

Cell Cycle Regulation cancer: control of the cell cycle - cyclins and CDKs, and tumor suppressor genes p53, p21Rb, BRAC1 and BRAC2. Telomeres, and Immortality; Epigenetics- role of DNA methylation in gene silencing- epigenetic silencing of tumor - suppressor genes. Death - signaling pathways - mitochondrial and death receptor pathways, (Intrinsic- extrinsic pathways). Mechanism and Impact of apoptosis.

**Unit V** Cancer Diagnosis and Cancer Therapy, Stem Cells and Cancer 10 h

Principles and methods of cancer diagnosis - biochemical, genetic, cytotoxic, cell growth and viability tests. Diagnosis of cancer by histopathology, MRI scans, PET scan, cytogenetics test, karyotype, FISH. Strategies of anticancer drug therapy-chemotherapy, gene therapy, immuno therapy, radiotherapy and surgical therapy. Principles of cancer biomarkers and their applications.



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**Text Books**

- 1 Mc Kinnell R.G et al, 2012, "The Biological Basis of Cancer", 2nd edition, Cambridge University Press, London.
- 2 Weinberg R.A, 2014, "The Biology of Cancer", 2nd edition, Garland Science, New York & London.

**References**

- 1 Vincent T. De Vita M. D et al, 2020, "Principles and Practice of Oncology: Primer of Molecular Biology in Cancer", 3rd edition, Lippincott Williams and Wilkins, Philadelphia.
- 2 Pelengaris S and Khan M, 2010, "The Molecular Biology of Cancer - A bridge from bench to bed side", 2nd edition; Wiley Black well, London.
- 3 Hesketh R, 2013, "Introduction to Cancer Biology", 1st edition, Cambridge University Press, London.
- 4 Pezzella F et al, 2019, "Oxford textbook of Cancer Biology", 1st edition, Oxford University Press, London



Course Code	Course Name	Category	L	T	P	Credit
233BT2A1DA	APPLIED BIOTECHNOLOGY	DSE	3	1	-	3

### PREAMBLE

This course has been designed for students to learn and understand

- the applications of biotechnology in plant , animal and Environmental field
- the applications of biotechnology in health care sector
- the products obtained from fermentation and its applications.

### COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the fundamental applications of Biotechnology	K1
CO2	Know the basics and fundamentals of biotechnology applications in environment.	K2
CO3	Discuss about the disease and disease prevention.	K3
CO4	Discuss the applications of Enzymes in various fields.	K4
CO5	Discuss the production and application of products obtained from fermentation technology.	K1

### MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓		✓	
CO2	✓		✓	✓	✓
CO3			✓	✓	✓
CO4	✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

<input type="checkbox"/>	Skill Development	<input checked="" type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



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233BT2A1DA	APPLIED BIOTECHNOLOGY	SEMESTER I
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Total Credits: 3

Total Instruction Hours: 48 h

### Syllabus

**Unit I** Agricultural, Plant Biotechnology and Animal Biotechnology 10 h

Applications of transgenic crop technology: Herbicide resistance (Glyphosate Resistance plants), Pest resistance (Bt Cotton) and Virus Resistance. Enhancement of micro-nutrients (Vitamin A & Vitamin E). Delayed Fruit Ripening. Molecular pharming in plants. Transgenic animals (Transgenic mice and Transgenic cattle). Production and recovery of products from animal tissue cultures (Blood clotting factors, Growth hormones, insulin).

**Unit II** Environmental Biotechnology 08 h

Bioremediation- (Bioaugmentation and Biostimulation). Biodegradation of Xenobiotic compounds . Bioleaching. Microbially Enhanced Oil Recovery. Biotechnological methods for hazardous waste management. Bioindicators –Biomarkers –Biosensors –Management for effluent toxicity, heavy metal pollution, thermal and radioactive pollution

**Unit III** Health Care Biotechnology 10 h

Disease prevention – vaccines: conventional vaccines, purified antigen vaccines, recombinant vaccines. DNA vaccines, synthetic vaccines. Disease Diagnosis – Probes, monoclonal antibodies and detection of genetic diseases. Disease treatment – interferons, monoclonal antibodies. gene therapy, enzyme therapy and replacement. Forensic medicine.

**Unit IV** Enzyme Biotechnology 10 h

Enzyme used for Diagnostic purpose- (acid phosphatase, alanine aminotransferase and alkaline phosphatase). Cardiac Biomarkers. Enzymes used for screening liver and kidney diseases. Enzymes used in food Industry, leather industry, wool industries, dairy industry and Textile industry.

**Unit V** Fermentation Biotechnology 10 h

Production, harvest, recovery and uses – enzymes, Antibiotics (Tetracycline), vitamins (B2), Aminoacids (glutamic acid), Organic solvents (ethanol); Organic acids (lactic acid). Single Cell Protein (algae), beverages (Wine). Formulation of Biofertilizer (Rhizobium), Biopesticides.



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## Text Books

- 1 Bernard R Glick and Jack J Pasternak, 2010, **Molecular Biotechnology: Principles and Applications of recombinant DNA**, 4<sup>th</sup> Edition. ASM Press
- 2 Slater, Scott, and Fowler, 2008, **Plant Biotechnology: The genetic manipulation of plants**. 2<sup>nd</sup> Edition. Oxford University Press, UK

## References

- 1 S. S. Marwaha & K. Arora, 2000, **Food processing Biotechnological application**, Asiatech Publishers INC, New Delhi
- 2 T. Palmer, Bonner PLR, 2014, **Enzymes: Biochemistry, Biotechnology and Clinical Chemistry**, 2<sup>nd</sup> Edition. Woodhead Publishing Limited, Oxford.
- 3 P.F. Stanbury and A. Whitaker, 2005, **Principles of Fermentation technology**, 2<sup>nd</sup> Edition. Pergamon press.
- 4 El-Mansi, C.F.A. Bryce, A.L. Demain, A.R. Allman, 2007, **Fermentation microbiology and Biotechnology**, 2<sup>nd</sup> edition, Taylor and Francis.

*[Signature]* 10/06/2023  
 BoS Chairman/HOD  
 Department of Microbiology  
 Dr. N. G. P. Arts and Science College  
 Coimbatore - 641 048

 Dr. N. G. P. Arts and Science College		
<b>APPROVED</b>		
BoS- 15th 10/06/2023	AC - 15th 14/07/2023	GB - 20th 05/08/2023



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