

# **SADGURU GADAGE MAHARAJ COLLEGE, KARAD.**

(An Autonomous College - Affiliated to Shivaji University, Kolhapur)

Accredited A<sup>+</sup> with CGPA 3.63 by NAAC; RUSA Beneficiary and NAAC Designated Mentor College

Website: [www.sgm.edu.in](http://www.sgm.edu.in)

Estd.: 1954

SGM/SCIENCE/BOS/Industrial Microbiology

Date:

To,  
The Principal,  
Sadguru Gadage Maharaj College, Karad  
An Autonomous College- Affiliated to Shivaji University, Kolhapur

**Subject:** Regarding syllabi of B.Sc. and M.Sc. (NEP-2020) a degree program under the faculty of Science And Technology as per National Education Policy, 2020.

Respected Sir,

With reference to the subject mentioned above, I am directed to inform you that the Academic Council of Sadguru Gadage Maharaj College, Karad have accepted and granted approval to the **Syllabi and Nature of question paper of B.Sc. and M.Sc. (NEP-2020) System** under the faculty of Science And Technology as per National Education Policy, 2020.

Sr. No.	Faculty of Science and Technology	Programme/ Course
1.	Microbiology	B.Sc.- I Microbiology
		M.Sc.- I Industrial Microbiology

This Syllabi and Nature of question paper of B.Sc. and M.Sc. shall be implemented from the Academic Year 2023-24 onwards. A soft copy containing the syllabi is attached herewith and it is also available on college website [www.sgm.edu.in](http://www.sgm.edu.in).

You are, therefore, requested to bring this to the notice of all students and teachers concerned.

Thanking You,

Yours Faithfully,

Chairman,  
BOS in Microbiology

Rayat Shikshan Sanstha's  
**SADGURU GADAGE MAHARAJ COLLEGE, KARAD.**

(An Autonomous College - Affiliated to Shivaji University, Kolhapur)

**DEPARTMENT OF MICROBIOLOGY**

**M.Sc. Part- I (Industrial Microbiology)**

**Course Structure**

**NEP-2020**

**w.e.f. July 2023**

**Note:**

- The following in a nutshell gives the scope and extent of each course offered. Each core theory course has two levels of teaching: Lectures and Practical's. The elective course offered during the second year.

<b>M.Sc. Part- I (Industrial Microbiology): NEP-2020</b>					
Level	Semester –I				
<b>6.0</b>	Sr. No.	Course Code	Course Title	Credits	
	1	<b>IM23-101</b>	Taxonomy and Cell Biology	04	
	2	<b>IM23-102</b>	Genetics and Molecular Biology	04	
	3	<b>E-IM23-103A OR E-IM23-103B</b>	Immunology OR Virology	04	
	4	<b>P-IM23-104</b>	Ind. Microbiology Practical -I	04	
	5	<b>P-IM23-105</b>	Ind. Microbiology Practical -II	02	
	6	<b>RM-IM23-106</b>	Research Methodology	04	
				<b>Cum. Credit Total</b>	<b>22</b>
	Semester –II				
	1	<b>IM23-201</b>	Techniques in Microbiology	04	
	2	<b>IM23-202</b>	Microbial physiology, biochemistry and metabolism	04	
	3	<b>E-IM23-203</b>	Medical Microbiology	04	
	4	<b>P-IM23-204</b>	Ind. Microbiology Practical III	04	
	5	<b>P-IM23-205</b>	Ind. Microbiology Practical IV	02	
6	<b>FP-IM23-206</b>	Field Project	04		
			<b>Total</b>	<b>22</b>	
			<b>Cum. Credit for PG Diploma</b>	<b>44</b>	

# Structure of the Programme, Scheme of Teaching and Examination

M.Sc. Part – I (Level-8)

SEMESTER-I (Duration- Six Month)											
Course Type	Sr. No.	CourseCode	Teaching Scheme			Examination Scheme					
			Theory and Practical			Semester End Examination (SEE)			Continuous Comprehensive Evaluation (CCE)		
			Lectures (Per week)	Hours (Per week)	Credit	Max. Marks	Min. Marks	Exam. Hours	Max. Marks	Min. Marks	Exam. Hours
CGPA	1	IM23-101	4	4	4	80	32	3	20	8	1
	2	IM23-102	4	4	4	80	32	3	20	8	1
	3	E-IM23-103A <b>OR</b> E-IM23-103B	4	4	4	80	32	3	20	8	1
	4	P-IM23-104	4	16 (Per Batch)	4	100	40	4#	--	--	--
	5	P-IM23-105	2	08 (Per Batch)	2	50	20	2#	--	--	--
	6	RM-IM23-106	4	4	4	80	32	3	20	8	1
<b>Total (A)</b>			<b>22</b>	<b>40</b>	<b>22</b>	<b>470</b>	<b>--</b>	<b>--</b>	<b>80</b>	<b>--</b>	<b>--</b>
SEMESTER-II (Duration- Six Month)											
CGPA	1	IM23-201	4	4	4	80	32	3	20	8	1
	2	IM23-202	4	4	4	80	32	3	20	8	1
	3	E-IM23-203	4	4	4	80	32	3	20	8	1
	4	P-IM23-204	4	16 (Per Batch)	4	100	40	4#	--	8	1
	5	P-IM23-205	2	08 (Per Batch)	2	50	20	2#	--	8	--
	6	FP-IM23-206	-	-	4	100	--	--	--	--	--
<b>Total (B)</b>			<b>18</b>	<b>36</b>	<b>22</b>	<b>490</b>	<b>--</b>	<b>--</b>	<b>60</b>	<b>--</b>	<b>-</b>
<b>Total (A+B)</b>					<b>44</b>	<b>960</b>	<b>--</b>	<b>--</b>	<b>140</b>	<b>--</b>	<b>-</b>

Rayat Shikshan Santha's  
**SADGURU GADAGE MAHARAJ COLLEGE, KARAD**  
 (An Autonomous Institute)  
**Department of Microbiology**

**M.Sc.-I (Industrial Microbiology): Examination Patter**  
**Annual Total marks for Industrial Microbiology: 1100; Total credit: 44 = Sem I (22) + Sem II (22)**

Semester	Paper Code	Theory exam.			Practical Examination and Submission (SEE)							Grad Total	
		Theory exam. SEE	Internal exam CCE	Total	Pract. Paper Code	Pract. Exam	Internal submission				Total		
							Journal	Practical Viva	Day to Day perf.				
Sem- I	IM23-101	80	20	100	P-IM23-104 Pract. -I	70	-	10	10	10	100		
	IM23-102	80	20	100									
	E-IM23-103	80	20	100	P-IM23-105 Pract. -II	35	-	05	05	05	50		
	RM-IM23-106	80	20	100									
		-	-			-	-	-	-	-			
		<b>320</b>	<b>80</b>	<b>400</b>	<b>Practical Marks</b>	<b>105</b>		<b>20</b>	<b>20</b>	<b>20</b>	<b>150</b>	<b>550</b>	
Sem.- II	IM23-201	80	20	100	P-IM23-204 Pract. -III	70	-	10	10	10	100		
	IM23-202	80	20	100									
	E-IM23-203	80	20	100	P-IM23-205 Pract. -IV	35	-	05	05	05	50		
	FP-IM22-206	-	-	100									
		<b>240</b>	<b>60</b>	<b>400</b>	<b>Practical Marks</b>	<b>105</b>		<b>20</b>	<b>10</b>	<b>10</b>	<b>150</b>	<b>550</b>	
		<b>800</b>										<b>300</b>	<b>1100</b>

SEE- Semester End Examination, CCE- College Compressive Evaluation

➤ **Nature of question paper and evaluation scheme:**

❖ **Evaluation Scheme**

- **Separate passing for Theory, Practical and internal examination is mandatory.**
- In theory examination (SEE- Semester End Examination) passing for each paper is at **32** marks (40% of 80 marks).
- In internal of theory examination (CCE- Continuous compressive Evaluation) passing for each paper is at **08** marks (40% of 20 marks).
- In practical examination (SEE- Semester End Examination) passing is at 40/18 marks.

❖ **Scheme of Examination:**

- Semester examination (External evaluation) will be conducted for theory and practical by the college at the end of each semester for M.Sc. I and II respectively.
- Theory paper of the external evaluation (Semester exam) will be of 80 marks
- The internal evaluation test (by the Department) will be for 20 marks for each course paper.

- The two practical course examinations will be external evaluation of 100 and 50 marks.
- Question paper will be set in view of the entire syllabus and preferably covering each CREDIT of the syllabus
- ❖ **Standard of passing:** As per the rules and regulations of the college for the M. Sc. course
- ❖ **Nature of question paper and scheme of marking:** a) External Evaluation (Semester exam) Theory paper:  
Maximum marks – 80
  - Equal weightage shall be given to all CREDIT of the theory paper
  - Total number of questions – 07
  - All questions will carry equal marks.
  - Out of the seven questions, five are to be attempted of which Question 1 will be compulsory
  - Question No. 1 will be of an objective type
  - Total No. of bits – 16, Total marks – 16
  - Nature of questions - multiple choice, fill in the blanks, definitions, true or false, match the following
  - These questions will be answered along with the other questions in the same answer book
  - Remaining six questions will be divided into two sections, I and II.
  - Four questions are to be attempted from these sections in such a way that not more than two questions are answered from each section.
  - Both sections are to be written in the same answer book
- ❖ **CCE Theory paper: Maximum marks –20**
  - Class test: Theory/Objective-MCQ/True or false/ fill in the blanks/match the following  
OR
  - Oral test/Seminar on specific subject/ Book Review/ Study tour/Case study/Field survey
- ❖ **Practical Examination (SEE only) Maximum marks – 100**
  - Total number of questions – 06
  - All questions will be compulsory
  - Questions 1 to 4 will have at least two (02) internal options
  - Question 5 will be *viva voce* and question 6 will be for the journal, each carrying 10 marks
- ❖ **Field Project Evaluation (SEE only) Maximum marks – 100**
  - Project Report: 20 Marks
  - Project Presentation: 80 Marks

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**M.Sc.: Programme Outcome (POs): 2022-23**

PO's describe what students are expected to know or to be able to do by the time of graduation and post-graduation. The following Program outcomes of PG in Industrial Microbiology are:

At the end of the program, the students will be able to:

1. Apply knowledge of Industrial Microbiology, in all the fields of learning including higher research and its extensions.
2. Innovate, invent and solve complex microbiological problems in industries using the knowledge of pure and applied Industrial Microbiology.
3. Facilitate in the study of different Fermenters used in industries (pharmaceutical, etc.)
4. Demonstrate risk assessment in Industrial (pharmaceutical), disease spread in Environment.
5. Explain the knowledge of contemporary issues in the field of Industrial Microbiology and applied sciences.
6. Work effectively as an individual, and also as a member or leader in multi-linguistic and multi-disciplinary teams.
7. Adjust themselves completely to the demands of the growing field of Industrial Microbiology by lifelong learning.
8. Effectively communicate about their field of expertise on their activities, with their peer and society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations

**Program Specific Outcome (PSOs):**

**PS01:** Global level research opportunities to pursue Ph.D. programme targeted approach of CSIR-NET and MH-SET examination.

**PS02:** Enormous job opportunities at all level of pharmaceutical, food products, life-oriented material industries.

**PS03:** Specific placements in R&D pharmaceutical and allied division.

**PS04:** Developed problem-solving skill and apply them independently in pharmaceutical industry.

**PS05:** Assimilate complex microbiological ideas and arguments.

**PS06:** Improve own learning and performance.

**PS07:** Developed abstract microbiological thinking.

## SEMESTER - I

<b>Credits 04</b>	<b><u>IM23-101: TAXONOMY AND CELL BIOLOGY</u></b>	<b>No. of hours</b>
<b><u>UNIT - I</u></b>	<b>Taxonomy</b>	<b>(15)</b>
	1. Bergey's Manual System of bacterial classification 1.1 Brief history of the Bergey's Manual 1.2 Prokaryotic Domains 2. Classification of Prokaryotic organisms- Concept of bacterial speciation, Bacterial nomenclature 3. Modern trends in Prokaryote taxonomy: 3.1 Polyphasic taxonomy- Types of information used, polyphasic strategy, polyphasic taxonomy in practice 3.2 Phylogenetic basis- Reconstruction and interpretation of phylogenetic trees, limitations, presentation of trees, 16 S rRNA sequence analysis, FAME analysis 3.3 Numerical taxonomy	
<b><u>UNIT - II</u></b>	<b>General characteristics and outline of classification- I</b>	<b>(15)</b>
	1.1 Archaea 1.2 Mycoplasma 1.3 Rickettsia and Chlamydia 1.4 Actinomycetes 1.5 Algae	
<b><u>UNIT - III</u></b>	<b>General characteristics and outline of classification- II</b>	<b>(15)</b>
	1. Yeasts: Morphology, cytology and cultural characteristics of yeasts, outline classification of yeasts 2. Fungi: Outline classification of fungi, Fungal cell structure, Morphology of some common fungi - <i>Mucor</i> , <i>Rhizopus</i> , <i>Aspergillus</i> , <i>Penicillium</i> and <i>Fusarium</i> 3. General characteristics of Lichens and Mycorrhiza	
<b><u>UNIT - IV</u></b>	<b>Cell Cycle and Chemoautotrophic Microorganisms</b>	<b>(15)</b>
	1. Cell cycle in Prokaryotes 2. Cell cycle in Eukaryotes 3. The Chemoautotrophic bacteria: General characteristics and significance of – Sulfur oxidizing bacteria, Nitrifying bacteria, Iron bacteria, Hydrogen bacteria.	

**Course Outcome:**

- Gain adequate knowledge on comparative account of various Microbial divisions
- Study and IM19part knowledge about the occurrence, distribution, structure and life history of algae, fungi, lichens, yeast.
- Learn the phylogeny and evolutionary concepts in lower group of organisms
- Gain adequate knowledge about classification and modern trends in prokaryotic taxonomy.

**REFERENCE BOOKS**

1. Alexopoulos C. J., Introductory Mycology, 7<sup>th</sup> Ed., Wiley Eastern Pvt. Ltd., New Delhi.
2. Bergey's Manual of Systemic Bacteriology 2<sup>nd</sup> Ed. Springer, USA.
3. Lamanna C., Mallette F., Basic Bacteriology, 3<sup>rd</sup> Ed. The William and Wilkins Company. Calcutta.
4. Salle A. J. Fundamental Principles of Bacteriology, 3<sup>rd</sup> Ed. TMH Publishing Company, New Delhi.
5. The Yeasts- A.H. Rose
6. General Microbiology, 5<sup>th</sup> Ed. R. Y. Stanier and others
7. The Prokaryotes: A handbook on the Biology of Bacteria, Martin Dworkin (Editor- in- Chief) and others Springer



<b>Credits 04</b>	<b><u>IM23-102: GENETICS AND MOLECULAR BIOLOGY</u></b>	<b>No. of hours</b>
<b><u>UNIT - I</u></b>	<b>Evolutionary Biology</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. Origin of life- aspects of prebiotic environment, evolution of the pre-cell.</li> <li>2. Organic evolution: concepts and theories, mechanisms of speciation, genetic basis of evolution - Hardy-Weinberg genetic equilibrium, evolutionary clock.</li> <li>3. Molecular basis- genetic polymorphism and selection, coincidental and concerted molecular basis, gene duplication, sequence divergence, recombination and crossover fixation, pseudo-genes as dead ends of evolution</li> <li>4. Origin and evolution of economically important microbes, plants and animals.</li> <li>5. Evidences for nucleic acids as genetic material.</li> <li>6. Organization of eukaryotic genetic material:               <ol style="list-style-type: none"> <li>6.1 Nuclear and organelle (mitochondria and chloroplasts)</li> <li>6.2 Polytene and Lampbrush chromosomes</li> </ol> </li> </ol>	
<b><u>UNIT - II</u></b>	<b>Inheritance Biology and Cell division</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. Principles of Mendelian inheritance: linkage and gene mapping - Tetrad analysis.</li> <li>2. Law of DNA constancy and redundancy, C-value paradox, C<sub>ot</sub> curves and DNA re-association constant, dosage compensation, genetic load.</li> <li>3. Molecular basis of mitosis and meiosis</li> <li>4. Replication of DNA and duplication of chromosomes – modes and molecular mechanisms of DNA replication in prokaryotes (bacteria) and eukaryotes (nuclear and mitochondrial).</li> <li>5. Co-transcriptional and post-transcriptional processing of RNA, structure and stability of mRNA</li> </ol>	
<b><u>UNIT - III</u></b>	<b>Molecular Biology</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. Translation in eukaryotes – machinery, initiation, elongation, termination and release, posttranslational processing.</li> <li>2. Localization of proteins in cell - mechanisms of transport to nucleus, mitochondria, chloroplasts and outside the cell</li> <li>3. Molecular mechanism of homologous recombination in bacteria and other organisms – RecBCD and Ruv systems, Holiday junction, interallelic, specialized and site specific recombination; Gene targeting.</li> <li>4. Modification of DNA – enzymes, molecular mechanisms and significance.</li> </ol>	
<b><u>UNIT - IV</u></b>	<b>Oncogenesis and Techniques in molecular genetics</b>	<b>(15)</b>

	1. Teratogenesis- chromosome aberrations, genetic disorders; Genetic counseling. 2. Cancer and oncogenesis: 2.1 Transforming viruses, environmental factors causing cancer - carcinogens 2.2 Molecular mechanism and sequence of changes leading to oncogenesis - mutations, activation of proto-oncogenes, loss of function of tumor suppressor (anti-cancer) genes, role of apoptosis and telomere shortening in cancer. 3. Techniques in molecular genetics: 3.1 Basic techniques - PCR, Nick translation, Blotting techniques – Southern, Northern and Southwestern blotting, colony hybridization 3.2 Applications - Chromosome walking, DNA foot printing 3.3 Transfection – Protoplast fusion, electroporation	
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### Course Outcome

- Know the terms and terminologies related to molecular biology and microbial
- Understand the properties, structure and function of genes in living organisms at the molecular level
- Explain the significance of central dogma of gene action
- Have a conceptual knowledge about DNA as a genetic material, enzymology, and replication strategies
- Understand the molecular mechanisms involved in transcription and translation
- Describe the importance of split gene and overlapping gene.
- Discuss the molecular mechanisms of homologous recombination.
- Handle and independently work on lab protocols involving molecular techniques PCR, LCR.
- The terms Oncogenes and tumor suppressor genes, and how tumor viruses interact with these products and their intersecting pathways and cause oncogenesis.
- Know how viruses can be used as tools to study biological processes, as cloning vectors and for gene transfer.

### REFERENCE BOOKS

1. Molecular Biology of the Cell by Alberts and others, Garland Publishing, NY.
2. Concept of Evolution by P. S. Verma and V. K. Agarwal, S. Chand and Co., New Delhi
3. Organic Evolution by N. Arumugam
4. Organic Evolution by R. S. Lulla, Seema Publications
5. Genetics by Strickberger
6. Microbial Genetics by D. Freifelder, J. Wiley and Sons
7. Genes – VI, VII, VIII and IX by B. Lewin, Jones and Bartlett Publishers
8. Molecular Biology of the Gene by J. D. Watson and others, Benjamin Cummings Publishing Co.
9. Genetics by S. Mitra, Macmillan India
10. Genetic Engineering by S. Mitra, Macmillan India
11. Molecular Biology and Biotechnology by J. M. Walker and R. Rapley, Panima Publishing Corp. New Delhi
12. Molecular Biology by P. C. Turner and others, Bioscientific Publishers
13. Principles of Genetics and Genetic Engineering by E. John Jothi Prakash, JPR Publications
14. Principles and Techniques of Practical Biochemistry by K. Wilson and J. Walker, Cambridge University Press
15. Molecular Cloning- A Laboratory Manual, Vol. 1, 2, 3 by J.Sambrook, E.F. Fritsch and T. Maniatis
16. An Introduction to Genetic Analysis Freeman 1993

Credits 04	<b><u>E-IM23- 103A : IMMUNOLOGY</u></b>	No. of hours
<b><u>UNIT - I</u></b>	<b>MHC complex and T-cell</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. MHC complex: structure, function, MHC polymorphism, assembly and presentation of peptide MHC complex.</li> <li>2. Antigen processing and presentation: The endocytic and cytosolic pathway, immunological synapse (structure and function)</li> <li>3. Signal transduction: Ras dependant and Jak/Stat pathway, signal transduction by IL-1, IL-2 and T-cell antigen receptors.</li> <li>4. T-cell sensitization: TCR signaling by CD 45 and CD 28, Interaction of T-cells with APCs.</li> </ol>	
<b><u>UNIT - II</u></b>	<b>Complement System and Vaccines</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. Complement System: Regulation of complement pathways, biological consequences of activation,</li> <li>2. Genetics of antibody synthesis: Types of genes, location and positions of genes, genes for constant region, genes for variable region of immunoglobulin</li> <li>3. Antibody diversity: Introduction, Mechanisms.</li> <li>4. Immunomodulation, potentiation, tolerance and suppression.</li> <li>5. Vaccines:               <ol style="list-style-type: none"> <li>5.1 rDNA</li> <li>5.2 DNA vaccines</li> <li>5.3 Edible vaccines, Carrier, Synthetic peptide, subunit vaccines, anti-idiotypic</li> </ol> </li> </ol>	
<b><u>UNIT - III</u></b>	<b>Transplantation Immunology and Tumor Immunology</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. Transplantation Immunology: immunological basis of graft rejection, clinical manifestation, Immunosuppressive therapy, Kidney transplantation – ABO testing, pathology of graft rejection</li> <li>2. Tumor Immunology: Development of tumors, Antigen of tumor cells, immunological mechanisms against tumor cells, escaping of tumor cells from immune response, immune surveillance, Immunocompromise and cancer, congenital immunodeficiency and neoplasia, cancer in organ transplant recipients and auto immune disorders, HIV and cancer, immunotherapy and immunoprophylaxis of human cancer.</li> </ol>	
<b><u>UNIT - IV</u></b>	<b>Serodiagnosis and Immunochemical techniques</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. Serodiagnosis of diseases: Approaches for serodiagnosis, detection of antigen or antibody, diagnostic titer, ASO, Cold hemagglutination test, Weil-Felix test, Tuberculin test, Paul- Bunnell test.</li> <li>2. Immunochemical techniques and their applications: Immunohistochemical technique, ELISA, FAT, Western blot technique, immunoelectrophoresis (IEP), Immunodiffusion, Fluorescence Activated Cell Sorters.</li> <li>3. PCR based diagnostic tests</li> </ol>	

## Course Outcome:

- Demonstrate an understanding of key concepts in Immunology.
- Understand the overall organization of the immune system
- Conceptualize how the collection of individual clones of lymphocytes (termed the “Immune repertoire”) arises from rearrangement within two genetic loci: the Ig gene in B cells and the antigen receptor in T cells.
- Learn how “clonal selection” allows for the expansion of a limited number of antigen-recognizing lymphocytes in response to a specific antigenic stimulus
- Begin to appreciate the significance of maintaining a state of immune tolerance sufficient to prevent the emergence of autoimmunity.
- To understand about Tumor Immunology and help the students to understand its immune prophylaxis and immune therapy.
- To make them understand the salient features of antigen antibody reaction & its uses in diagnostics and various other studies.
- Learn about immunization and their preparation and its importance

## REFERENCE BOOKS

1. Basic and Clinical Immunology by Stites Daniel P., Stobo John D., Frudenberg H.H., Wells J.V.
2. Biotechnology Application and Research by P. N. Cheremisinoff and R. P. Ouellette
3. Essential Immunology by Roitt Ivan M.
4. Fundamentals of Immunology 2nd ed. by Myrrik Quentin N. and Weiser Russell S.
5. IM19munobiotechnology by Mahadev Sharma and Nirmal Tripathi
6. Immunology by I Kannan
7. Immunology 3rd ed. by Roitt I. M., Brostoff J., Male D. K.
8. Immunology 5th ed. by R. A. Goldsby, T. J. Kindt, B. A. Osborne, J. Kuby
9. Immunology II by Bellanti Joseph A.
10. Medical Immunology 9th ed. by Daniel P. Stites, Abba I Terr, Tristram G. Parslow.
11. Medical Microbiology by Cruickshank Robert, Duguid J. P., Marmion B. P., Swain R. H. A.
12. Medical Microbiology by Irving William and others
13. Medical Microbiology 13th Edition by Jawetz Ernest, Melnick Joseph L, Adelberg E. A.
14. Medical Microbiology 6th Edition by Gupte Satish, Jaypee Brothers,
15. Medical Microbiology S Rajan MJP Publishers.
16. Principles and techniques in Practical Biochemistry by Wilson and Walker
17. Text book of Microbiology by Vasanthakumari R.
18. The text book of Microbiology by Dubey R. C., Maheshwari D. K.

<b>Credits 04</b>	<b><u>E-IM23 –103B: VIROLOGY</u></b>	<b>No. of hours</b>
<b><u>UNIT - I</u></b>	<b>Life cycles of Bacteriophages</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. Single burst and premature lysis experiment for phage host interaction</li> <li>2. Productive cycle of T-odd phages</li> <li>3. Productive cycle of lambda phage</li> <li>4. Interaction of <i>Bacillus</i> phages with their hosts.</li> <li>5. Properties of lambda lysogeny/Lysogeny of lambda phage</li> <li>6. Lysogenic interactions of P2, P22, P1 and Mu1 phages.</li> </ol>	
<b><u>UNIT - II</u></b>	<b>Transmission and Effect of Plant Viruses</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. Transmission of plant viruses: <ol style="list-style-type: none"> <li>1.1 Vector transmission- insect, nematode and fungal vectors</li> <li>1.2 Non vector transmission- Seed transmission, graft transmission, mechanical transmission</li> </ol> </li> <li>2. Effect of viruses on plants- roots, stem, leaves, flowers and fruits</li> <li>3. Gene expression and replication strategies of- <ol style="list-style-type: none"> <li>3.1 Poty virus</li> <li>3.2 Potex virus</li> <li>3.3 TMV</li> <li>3.4 Lettuce necrosis yellow virus</li> <li>3.5 Viroids</li> </ol> </li> </ol>	
<b><u>UNIT - III</u></b>	<b>Life cycle of Animal Viruses</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. Productive cycle of animal viruses having DNA <ol style="list-style-type: none"> <li>1.1 Herpes viruses</li> <li>1.2 Parvo viruses</li> </ol> </li> <li>2. Productive cycle of animal viruses having double stranded RNA- Reo virus</li> <li>3. Productive cycle of animal viruses having single stranded RNA <ol style="list-style-type: none"> <li>3.1 Rhabdo</li> <li>3.2 Picorna</li> <li>3.3 Retro</li> <li>3.4 Influenza and its types</li> <li>3.5 Corona virus</li> <li>3.6 Prions</li> </ol> </li> </ol>	
<b><u>UNIT - IV</u></b>	<b>Antiviral chemotherapy</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. DI particles – general features and interactions</li> <li>2. Inhibition and inactivation of bacteriophages, animal viruses and plant viruses photodynamic inhibition, inactivation by heat and radiations, inactivation by chemicals</li> <li>3. Antiviral chemotherapy- general approach, principles involved (inhibition of viral entry, inhibition of viral nucleic acid function, inhibition of viral protein function), chemicals of therapeutic use</li> </ol>	

## **Course Outcome**

- Understand the architecture of viruses
- Know the methods used in studying viruses
- Discern the replication strategies of representative viruses from the seven Baltimore classes  
Comprehend the intricate interaction between viruses and host cells
- Understand the interactions between viruses and the host Immune system
- Explain vaccine strategies and mechanisms of antiviral drugs and interferons

## **REFERENCE BOOKS**

1. General Virology- by S. Luria
2. Bacterial and Bacteriophage genetics- by Edward A. Birge
3. Principles of Bacteriology, Virology and Immunology 8th ed. Vol. IV by Topley and Wilson
4. Introduction to Plant Virology – by Bos I.
5. Field's Virology Vol I and II – by Lipincott
6. Biotechnology: application and research– by Paul N. Cheremisinoff, Robert P. Ouellette
7. Molecular Biology and Biotechnology – by Walker and Gingold
8. Medical Microbiology 2nd ed.- by Mims, Playfour and Roitt
9. Brock's Biology of Microorganisms by Madigan
10. Advances in General Microbiology Vol.I- by Shrivastava
11. Plant Viruses as Molecular Pathogens by Jawed A Khan and Jeanne Dijkstra

<b>Credits: 04</b>	<b><u>P-IM23-104: Industrial Microbiology Practical - I</u></b>
<b>UNIT - I</b>	<p>1. Microbiological study of bacteria</p> <p>1.1 endospore development in <i>Bacillus</i></p> <p>1.2 cysts in <i>Azotobacter</i></p> <p>2. Isolation and morphological studies of Algae – <i>Spirulina</i></p> <p>3. Microbiological study of <i>Aspergillus</i>, <i>Penicillium</i>, <i>Rhizopus</i> and <i>Fusarium</i> species</p> <p>3.1 Isolation and characterization (growth and morphological)</p> <p>3.2 Slide culture study of developmental stages</p> <p>4. Microbiological study of yeasts</p> <p>4.1 Isolation and characterization (cultural and morphological)</p> <p>4.2 Induction and observation of Ascospores of <i>Saccharomyces cerevisiae</i></p> <p>5. Microbiological study of Actinomycetes</p> <p>5.1 Isolation and characterization</p> <p>5.2 Cover slip and slide culture study of morphological characters</p> <p>6. Staining and microscopic observation of nuclear material of bacteria and yeasts – Feulgen and Giemsa methods.</p>
<b>UNIT - II</b>	<p>7. Induction and observation of Ascospores of <i>Saccharomyces cerevisiae</i></p> <p>8. Isolation and characterization of chemoautotrophic nitrifying bacteria</p> <p>9. Isolation of <i>E. coli</i> phages</p> <p>10. Isolation of plaque morphology mutants of phages by using UV radiations</p> <p>11. Isolation of plaque morphology mutants of phages by using chemical mutagen</p> <p>12. Demonstration of egg inoculation techniques</p>

### REFERENCE BOOKS

1. Practical Microbiology by R. C. Dubey and D. K. Maheshwari. S. Chand & Co.
2. Environmental Science and Biotechnology: Theory and Techniques by A. G. Murugesan and C. Rajakumari. MJP Publishers
3. Experimental Microbiology by R. J. Patel. Aditya Publishers, Ahmedabad
4. Analysis of Plants, Irrigation water and Soils by R. B. Somawanshi and others. Mahatma Phule Agricultural University, Rahuri
5. Identification Methods for Microbiologists by B. M. Gibbs and F. A. Skinner. Academic Press
6. Laboratory Microbiology by L. Jack Bradshaw. W. B. Saunders & Co.
7. Benson's Microbiological Applications Laboratory Manual in General Microbiology by Alfred E. Brown
8. Methods in Microbiology (Vol. 5B and Vol. 3A) by Norris and Ribbons. Academic Press
9. Bergey's Manual of Systematic Bacteriology
10. Microbiological Methods by Michael Collins
11. Handbook of Microbiological Media by R. M. Atlas. CRC Publications
12. Laboratory Exercises in Microbiology by Robert A. Pollock and others
13. Laboratory Techniques in Microbiology and Biotechnology by R. P. Tiwari, G. S. Hoondal and R. Tewari, Abhishek Publications, Chandigarh
14. Handbook of Techniques in Microbiology by A. S. Karwa, M. K. Rai and H. B. Singh. Scientific Publishers, Jodhpur
15. Laboratory Exercises in Microbiology by J. P. Harley and L. M. Prescott 5<sup>th</sup> Ed.

<b>Credits: 02</b>	<b><u>P-IM23-105: Industrial Microbiology Practical - II</u></b>
<b>UNIT - I</b>	1. Isolation of DNA and RNA from bacteria and yeasts. 2. Thermal denaturation of DNA 3. Gene transfer in <i>E. coli</i> by – transformation 4. Gene transfer in <i>E. coli</i> by – conjugation 5. Demonstration of protoplast fusion in bacteria 6. Southern blotting (demonstration) 7. PCR technique
<b>UNIT - II</b>	8. Ouchterlony's double diffusion test 9. Radial Immunodiffusion test 10. Immunoelectrophoresis test 11. ASO test 12. RA test 13. Weil-Felix test 14. Ames test for carcinogenicity/mutagenicity of chemicals 15. ELISA test

### REFERENCE BOOKS

1. Practical Microbiology by R. C. Dubey and D. K. Maheshwari. S. Chand & Co.
2. Environmental Science and Biotechnology: Theory and Techniques by A. G. Murugesan and C. Rajakumari. MJP Publishers
3. Laboratory Manual in Biochemistry by J. Jayaraman. New Age International Publishers
4. Experimental Microbiology by R. J. Patel. Aditya Publishers, Ahmedabad
5. Methods in Microbiology (Vol. 5B and Vol. 3A) by Norris and Ribbons. Academic Press
6. Microbiological Methods by Michael Collins
7. Handbook of Practical Immunology (Vols. 1, 2, 3) by D. M. Weir
8. Molecular Cloning – A Laboratory Manual, Vol. 1,2,3 by J. Sambrook, E. F. Fritsch and T. Maniatis
9. Advanced Techniques in Diagnostic Microbiology by Yi-Wie-Tang and Charles W. Stratton, Springer
10. Molecular Biology Laboratory Manual by Denny R. Randall



<b>Credits 04</b>	<b><u>RM-IM23- 106: RESEARCH METHODOLOGY, BIostatISTICS AND BIOinformatics</u></b>	<b>No. of hours</b>
<b><u>UNIT - I</u></b>	<b>Introduction to Research Methodology-I</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. Research Methods vs. Methodology               <ol style="list-style-type: none"> <li>i) Introduction.</li> <li>ii) Types: Library research, field research, laboratory research.</li> </ol> </li> <li>2. Defining a Research Problem               <ol style="list-style-type: none"> <li>i) Concept.</li> <li>ii) Selecting the research problem.</li> <li>iii) Techniques involved in defining problem.</li> <li>iv) Conclusion of the problem.</li> </ol> </li> <li>3. Research Design               <ol style="list-style-type: none"> <li>i) Need for research design.</li> <li>ii) Concept in research design.</li> <li>iii) Types of research design.</li> </ol> </li> <li>4. Developing a Research Plan               <ol style="list-style-type: none"> <li>i) Need.</li> <li>ii) Essential characteristics of research plan.</li> </ol> </li> </ol>	
<b><u>UNIT - II</u></b>	<b>Practices in Research</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. Reporting Practical and Project Work               <ol style="list-style-type: none"> <li>i) Structure of report</li> <li>ii) Title, authors and their institution, abstract, keywords, abbreviations.</li> <li>iii) IMRAD technique                   <ol style="list-style-type: none"> <li>a) Introduction</li> <li>b) Material and methods</li> <li>c) Result discussion and conclusion</li> <li>d) Acknowledgements.</li> </ol> </li> </ol> </li> <li>2. Preparing a Grant Proposal for Research Project</li> <li>3. Manuscript Submission to Research Journals               <ol style="list-style-type: none"> <li>i) Statement of proposal.</li> <li>ii) Ethical considerations.</li> <li>iii) Publishing editorial issues.</li> <li>iv) Preparation and submission.</li> </ol> </li> </ol>	
<b><u>UNIT - III</u></b>	<b>Biostatistics</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. Importance of statistics in Biology               <ol style="list-style-type: none"> <li>i) Samples and Population</li> <li>ii) Types of data, random sampling methods and sampling errors, scales and variables, accuracy and precision.</li> </ol> </li> <li>2. Measures of Central Tendency               <ol style="list-style-type: none"> <li>i) Mean (arithmetic, geometric, harmonic), median, percentile and mode.</li> <li>ii) Measures of dispersion: mean deviation, standard deviation and variance.</li> <li>iii) Significance level, type I and type II errors, p-value</li> </ol> </li> <li>3. Chi square test, F test and ANOVA</li> </ol>	
<b><u>UNIT - IV</u></b>	<b>Bioinformatics</b>	<b>(15)</b>

	<ol style="list-style-type: none"> <li>1. Biological databases: Nucleic acid databases (GenBank, EMBL, DDBJ).</li> <li>2. Protein sequence data base (UniProt, PDB)</li> <li>3. Scoring matrices, local. global and multiple sequence alignment</li> <li>4. Database search for homologous sequences, BLAST</li> <li>5. Phylogenetic analysis: Overview and tree construction method</li> </ol>	
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### Course Outcome:

- Design a research plan.
- Present research in scientific language.
- Analyze research data employing biostatistical tools.
- Statistically signify the importance of research data.
- Get thorough knowledge about fundamental aspects on bioinformatics

### REFERENCE BOOKS

1. N. Gurumani (2010) Scientific thesis writing and paper presentation, MJP Publishers, Chennai.
2. C. R. Kothari (2004) Research Methodology; Methods and Techniques, 2<sup>nd</sup> Ed, New Age International Publishers, NewDelhi.
3. Irfan Ali Khan and Atiya Khanum, Fundamentals of Biostatistics.3rd Ed. Ukaaz, Publications, Hyderabad
4. Robert R. Sokal and F. James Rohlf (1969) Introduction to Biostatistics, 2<sup>nd</sup> Ed, Dover Publications, INC. Mineola, New York
5. P. N. Arora, P. K. Malhan (2006) Biostatistics, Himalaya Publishing House, Mumbai.
6. Lesk, AM (2002) Introduction to Bioinformatics, Oxford University Press, UK (ISBN:0-19-925196- 7)
7. Korf, I, Yandell, M and Bedell, J (2003) An Essential Guide to the Basic Local Alignment Search Tool-BLAST, O'Reilly Network Publishers, Tokyo
8. Baxevanis, A. D. and Ouellette, B. F. F. (2001) Bioinformatics: A practical guide to the analysis of genes and proteins. Second Edition. John Wiley & Sons, New York.
9. Mount, D. W. (2001) Bioinformatics: sequence and genome analysis. Cold Spring Harbor Laboratory Press, New York.
10. Zoe L. and Terence C. (2004) Bioinformatics: Managing Scientific Data, Morgan Kaufmann Publishers, New Delhi

## SEMESTER-II

<b>Credits 04</b>	<b><u>IM23-201: TECHNIQUES IN MICROBIOLOGY</u></b>	<b>No. of hours</b>
<b><u>UNIT - I</u></b>	<b>Microbial and Microscopic techniques</b>	<b>(15)</b>
	1. Enrichment culture techniques – principles and selective factors employed, enrichment systems – closed and open, single cell isolation methods 2. Principles and methods of preservation of microorganisms (bacteria, viruses, yeasts and molds). 3. Isolation and cultivation of anaerobes – principles, reducing agents, indicators, anaerobic jar methods and anaerobic glove box, Hungate’s roll tube technique and its serum bottle modification. 4. Isolation of human and animal pathogenic fungi 5. Microscopic techniques – 5.1 Electron microscopy – Working principles and application 5.2 Dark field, phase contrast, polarization, differential interference contrast (DIC), fluorescence, confocal scanning, scanning tunneling, atomic force microscopy.	
<b><u>UNIT - II</u></b>	<b>Good Laboratory Practices</b>	<b>(15)</b>
	1. Good laboratory practices: 1.1 Accuracy in preparation of solutions, media, Growth Promotion test (GPT). 1.2 Qualifications of equipment – design (DQ), installation (IQ), operational (OQ) and performance (PQ) 1.3 Validation and Calibration – Autoclave, pH meter, Electronic Balance, Pipettes and HVLC 1.4 Good Documentation Concepts- SOP 2. Safety in the laboratory: 2.1 Common hazards in the laboratory – 2.1.1 Electrical equipment 2.1.2 Chemicals – corrosive, irritant, toxic, flammable, explosive 2.1.3 Ionizing radiations 2.1.4 Infectious materials 2.1.5 Gas and fire 2.2 Safety measures – 2.2.1 In the use of equipment’s and gas facility 2.2.2 Personal protection 2.2.3 Waste disposal 2.2.4 First aid	
<b><u>UNIT - III</u></b>	<b>Chromatography, Electrophoretic and Centrifugation techniques</b>	<b>(15)</b>

	1. Chromatography – general principles and application 2. Electrophoresis- 2.1 Polyacrylamide gel electrophoresis (PAGE) - native and gradient gels, SDS-PAGE, isoelectric focusing, 2.2 Agarose gel electrophoresis- DNA gel, Pulsed field gel, RNA electrophoresis. 3. Centrifugation – principles of differential and density gradient centrifugation, sedimentation coefficient determination 4. Cell disruption methods – principles and methods of disruption of microbial, plant and animal cells and separation of cellular components	
<b>UNIT - IV</b>	<b>Spectroscopic and Radio-isotopic techniques</b>	<b>(15)</b>
	1. Spectroscopy – 1.1 IR, 1.2 Turbidometry 1.3 UV 1.4 NMR 2. Mass spectrometry 3. X – Ray crystallography 4. Radio isotopic techniques – 4.1 Nature of radioactivity and general principles of radio isotopic techniques 4.2 Methods of detection of radioactivity – gas ionization (GM counter), excitation (scintillation) and exposure of photographic emulsions (autoradiography). 5. Electrochemical techniques – general principles of electrochemical cells and potentiometry, principles and applications of the pH and Conductometry	

### Course Outcome:

- Students will gain a deep understanding of chemical principles, especially those relevant to the microbiology.
- Students will gain theoretical and practical knowledge of experimental methods and analytical instrumentation.
- Students will be able to safely and efficiently select and apply appropriate analytical methods to the analysis of real problems; able to interpret data from analytical methods, and will understand approaches for the validation of these analytical methods used in microbiology.
- Students will gain good laboratory practices and safety measures in microbiology laboratory

### REFERENCE BOOKS

1. Methods in Microbiology (series) by Norris and Ribbons, Academic Press, NY.
2. Principles and techniques in Practical Biochemistry by Wilson and Walker
3. Research Methodology for Biological Sciences by N. Gurumani, MJP Publishers, Chennai
4. Bioinstrumentation by L. Veerakumari, MJP Publishers, Chennai
5. A manual of Laboratory Techniques by N. Raghuramulu and others, NIN, Hyderabad
6. Microbiological aspects of Anaerobic Digestion – Laboratory Manual by D. R. Ranade and
7. R. V. Gadre, MACS, Agharkar Research Institute, Pune
8. Isolation Methods for Anaerobes by Shapton, Academic Press.
9. Tools in Biochemistry by D. Cooper
10. Protein Purification by R. Scopes, Springer Verlag Publications
11. Analytical Biochemistry (Biochemical Techniques) by P. Asokan, Chinnaa Publications

<b>Credits 04</b>	<b><u>IM23-202: MICROBIAL PHYSIOLOGY, BIOCHEMISTRY AND METABOLISM</u></b>	<b>No. of hours</b>
<b><u>UNIT - I</u></b>	<b>Biomolecules</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. Carbohydrate metabolism: Citric acid cycle- steps involved, amphibolic nature, anaplerotic reactions.</li> <li>2. Pasteur and Crabtree effect</li> <li>3. Oxidation of hydrocarbons:               <ol style="list-style-type: none"> <li>3.1 Aliphatic hydrocarbons - alkanes and alkenes- alpha, beta and omega oxidation</li> <li>3.2 Aromatic hydrocarbons - beta keto adipate pathway, valerate pathway and gentisate pathway</li> </ol> </li> <li>4. Oxidation of fatty acids and phospholipids: beta-oxidation of fatty acids, phospholipases and thioesterases</li> <li>5. Catabolism of amino acids (General reactions)</li> <li>6. Autotrophy - Concept, factors for, types of autotrophs, mechanisms</li> </ol>	
<b><u>UNIT - II</u></b>	<b>Respiratory Pathways</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. Respiratory metabolism:               <ol style="list-style-type: none"> <li>1.1 Mitochondrial ETC- structure of mitochondrion, ETC and its components, Shuttle system across membrane, Atkinson's energy charge.</li> <li>1.2 Oxygen toxicity- mechanism of oxygen toxicity, mechanism to overcome the toxicity - catalase, peroxidase and superoxide dismutase</li> </ol> </li> <li>2. Photo-phosphorylation in bacteria-               <ol style="list-style-type: none"> <li>2.1 Photosynthetic and non-photosynthetic ETC</li> <li>2.2 Cyclic and non-cyclic photophosphorylation</li> </ol> </li> <li>3. Drug metabolism in the body, mechanisms of detoxification of various substances</li> </ol>	
<b><u>UNIT - III</u></b>	<b>Protein Biochemistry and Biochemical pathways</b>	<b>(15)</b>
	<ol style="list-style-type: none"> <li>1. Protein chemistry- Structure of peptide bond, stabilization of conformation,               <ol style="list-style-type: none"> <li>1.1 Secondary structure, alpha helix, beta conformation, Ramachandran plot</li> <li>1.2 Tertiary structure</li> <li>1.3 Quaternary structure</li> </ol> </li> <li>2. Biosynthesis of amino acids: <math>\alpha</math>- ketoglutarate family, oxaloacetate family, Pyruvate family</li> <li>3. Lipid metabolism in prokaryotes –               <ol style="list-style-type: none"> <li>3.1 Biosynthesis of fatty acids</li> <li>3.2 Phospholipid biosynthesis – phosphatidylethanolamine and phosphatidylglycerol</li> <li>3.3 Regulation of lipid metabolism</li> </ol> </li> <li>5. Purine and pyridine biosynthesis- <i>de novo</i> pathway and salvage pathway</li> </ol>	
<b><u>UNIT - IV</u></b>	<b>Transport of Solutes and Microbial Communication</b>	<b>(15)</b>

	1. Osmosis- Effect of osmotic stress on microorganisms, plasmolysis and plasmoptysis, Microbial response to osmotic stress 2. Permeation- Primary active transport, secondary active transport, co-transport, Transport of ions across the membrane V-type, F-type and P-type ATPases 3. Bio-signaling- Molecular mechanisms, signaling in bacteria- The two-component signaling mechanism in bacterial chemotaxis 4. Microbial hormones and quorum sensing in microorganisms	
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### Course Outcome:

- Describe the concepts of electrolytes and electrolytic dissociation, pH and its biological significance, buffers, Henderson-Hasselbalch equation, biological buffer systems and their importance.
- Understanding the laws of thermodynamics , concepts of entropy, enthalpy and free energy changes and their application to biological systems and various biochemical studies and reactions.
- Conceptual knowledge of aerobic and anaerobic respiration and various intermediary mechanisms involved, oxidative phosphorylation
- Overview of major biomolecules –carbohydrates, lipids, proteins, amino acids, nucleic acids, classification, structure, function of the above-mentioned biomolecules
- Discuss the biosynthesis and the degradation pathways involved.
- Specify the biological significance of biomolecules in metabolism
- Conceptual knowledge of properties, structure, function of enzymes, enzyme kinetics and their regulation, enzyme engineering, Application of enzymes in large scale industrial processes.

### REFERENCE BOOKS

1. Text book of Biochemistry 4<sup>th</sup> ed. by West, Todd, Mason and Burgen
2. Principles of Biochemistry 5<sup>th</sup> ed. by White, Handler, Smith
3. Lehninger Principles of Biochemistry by Nelson and Cox
4. Biochemistry by Zubay
5. Elements of Biochemistry by O. P. Agrawal
6. Bacterial Metabolism by H. W. Doelle
7. Bacterial Metabolism by Gottschalk
8. Advances in General Microbiology by Shrivastava
9. Biochemistry by Stryer
10. Biochemistry of Lipids, Lipoproteins and membranes by D. E. Vance and J. E. Vance Elsevier Science

<b>Credits 04</b>	<b><u>E-IM23 - 203: MEDICAL MICROBIOLOGY</u></b>	<b>No. of hours</b>
<b><u>UNIT - I</u></b>	<b>Virulence Factors</b>	<b>(15)</b>
	1. Virulence: Establishment, spreading, Bacterial adhesion to host cells, Bacterial invasion of host cells and its mechanisms. 2. Attributes of microorganisms that enable them to cause disease: 2.1 Exotoxins (Diphtheria, Cholera, Clostridial, Staphylococcal) 2.2 Endotoxins of gram negative bacteria 2.3 Extracellular enzymes (Coagulase, Lysozyme) 3. Pathogen survival mechanisms: 4. Immune escape mechanisms	
<b><u>UNIT - II</u></b>	<b>Bacterial and Fungal Diseases</b>	<b>(15)</b>
	1. Bacterial Diseases: causative agent - morphological, cultural, biochemical, antigenic characters; lab diagnosis, transmission, prevention and control of diseases caused by <i>Leptospirosis</i> , <i>Bordetella pertussis</i> , <i>Rickettsia burnetti</i> , <i>Mycobacterium tuberculosis</i> 2. Fungal Diseases: Etiology, clinical features, pathogenesis, laboratory diagnosis, prevention and control of 2.1 Superficial Mycoses - Pityriasis 2.2 Subcutaneous Mycoses - Mycetoma 2.3 Systemic Mycoses - Histoplasmosis	
<b><u>UNIT - III</u></b>	<b>Viral and Protozoal Diseases</b>	<b>(15)</b>
	1. Etiology, clinical features, pathogenesis, Laboratory diagnosis, prevention and control of diseases caused by – 1.1 Herpes virus 1.2 Encephalitis virus 1.3 Influenza - H1N1 2. Diseases caused by Protozoa – Leishmaniasis, Filariasis 3. Pathology of AIDS and prevalence of Tuberculosis, Mycoplasma and Cryptococcus infections	
<b><u>UNIT - IV</u></b>	<b>Immunodeficiency disorders and Autoimmunity</b>	<b>(15)</b>
	1. B-cell immunodeficiency disorders: 1.1 X-linked agammaglobinaemia 1.2 Selective IgA and IgM deficiency 2. T-cell Immunodeficiency disorders: Congenital thymic aplasia 3. Combined B-cell and T-cell Immunodeficiency disorders: 3.1 Ataxia telangiectasia 3.2 Graft versus host disease. 4. Complement disorders: complement component deficiency 5. Rheumatic disease: Systemic lupus erythematosus 6. Atopic diseases: Allergic rhinitis and asthma 7. Autoimmune diseases: Organ specific and systemic autoimmune diseases, mechanism of induction of autoimmunity, treatment	

## REFERENCE BOOKS

1. Basic and clinical Immunology by D. P. Stites, J. D. Stobo, H. H. Frudenber, J. V. Wells
2. Medical Microbiology, 13th Edition by E. Jawetz, J. L. Melnick, E. A. Adelberg
3. Medical Microbiology, 6th Edition by S. Gupte, Jaypee Brothers Publications
4. Medical Microbiology, by W. Irving, T. Boswell and D. Aladeen
5. Medical Microbiology, by R. Cruickshank, J. P. Duguid, B. P. Marmion, R. H. A. Swain
6. The Textbook of Microbiology, by R. C. Dubey and D. K. Maheshwari
7. Text book of Microbiology by R. Vasanthkumari
8. Medical Microbiology by S. Rajan MJP Publishers
9. Immunology II by J. A. Bellanti
10. Medical Immunology 9<sup>th</sup> ed. by D. P. Stites, I. T. Abba, T. G. Parslow
11. Immunology by I Kannan
12. Immuno biotechnology by M. Sharma and N. Tripathi
13. Biotechnology Application and Research by P. N. Cheremisinoff and R. P. Ouellette
14. Immunology 5<sup>th</sup> ed. by R. A. Goldsby, T. J. Kindt, B. A. Osborne and J. Kuby
15. Fundamentals of Immunology 2<sup>nd</sup> ed. by Q. N. Myrrik and R. S. Weiser
16. Essential Immunology by I. M. Roitt
17. Immunology 3<sup>rd</sup> ed. by I. M. Roitt, J. Brostoff and D. K. Male



<b>Credits 04</b>	<b><u>P-IM23 –204: Industrial Microbiology Practical - III</u></b>
<b>UNIT - I</b>	1. Closed system enrichment of <i>Azotobacter</i> 2. Enrichment and isolation of chitin degrading bacteria 3. Enrichment of <i>Clostridium</i> species using potato, Thioglycollate broth and Candle jar 4. Spectroscopy - 4.1 Calibration of colorimeter/ spectrophotometer (Verification of Beer's law), 4.2 Determination of absorption maxima, molar extinction coefficient and difference spectra 5. Chromatography – 5.1 Thin Layer Chromatography 5.2 Separation of dyes and amino acids on silica gel column 6. Electrophoresis – 6.1 SDS – PAGE 6.2 Agarose gel electrophoresis 7. Differential centrifugation of disrupted yeast cells 8. Preservation of microbial cultures – 8.1 Slant cultures of aerobic and facultative organisms 8.2 Stab cultures of microaerophilic organisms 8.3 Soil culture technique for spore formers
<b>UNIT - II</b>	9. Study of galactose transport in yeasts 10. Determination of specific growth rate and generation time of <i>E. coli</i> 11. Determination of protein content of bacteria 12. Determination of carbohydrate content of bacteria 13. Determination of nucleic acid (DNA, RNA) content of bacteria 14. Determination of phenol coefficient of test disinfectant 15. Effect of hypotonic and hypertonic solutions on cells

### REFERENCE BOOKS

1. Laboratory Manual in Biochemistry by J. Jayaraman. New Age International Publishers
2. Experimental Microbiology by R. J. Patel. Aditya Publishers, Ahmedabad
3. Laboratory Methods in Food Microbiology by Harrigan, Academic Press
4. Identification Methods for Microbiologists by B. M. Gibbs and F. A. Skinner. Academic Press
5. Laboratory Microbiology by L. Jack Bradshaw. W. B. Saunders & Co.
6. Benson's Microbiological Applications Laboratory Manual in General Microbiology by Alfred E. Brown
7. Methods in Microbiology (Vol. 1, 3A and 5B) by Norris and Ribbons. Academic Press
8. Microbiological Methods by Michael Collins
9. Handbook of Microbiological Media by R. M. Atlas. CRC Publications
10. Laboratory Exercises in Microbiology by Robert A. Pollock and others

<b>Credits 02</b>	<b><u>P-IM23-205: Industrial Microbiology Practical - IV</u></b>
<b>UNIT - I</b>	<ol style="list-style-type: none"> <li>1. Qualitative and Quantitative study of water microflora</li> <li>2. Qualitative and quantitative study of air microflora <ol style="list-style-type: none"> <li>2.1 Settle plate</li> <li>2.2 Air sampling</li> <li>2.3 Liquid impingement</li> </ol> </li> <li>3. Isolation and characterization of microflora from human skin and throat</li> <li>4. Demonstration of bacterial synergism and antagonism</li> <li>5. Detection of siderophores production by microorganisms</li> <li>6. Study of Microflora from surfaces <ol style="list-style-type: none"> <li>6.1 Contact plate technique</li> <li>6.2 Swab technique</li> </ol> </li> </ol>
<b>UNIT - II</b>	<ol style="list-style-type: none"> <li>7. Determination of susceptibility to dental caries by Snyder test</li> <li>8. Isolation and characterization of etiological agent of dental caries</li> <li>9. Isolation and characterization of enteric pathogens from clinical samples</li> <li>10. Isolation and characterization of Urinary tract infection (UTI) causing bacteria from urine sample</li> <li>11. Antibiotic sensitivity of UTI causing bacteria.</li> </ol>

#### REFERENCE BOOKS

1. Practical Microbiology by R. C. Dubey and D. K. Maheshwari. S. Chand & Co.
2. Environmental Science and Biotechnology: Theory and Techniques by A. G. Murugesan  
1. and C. Rajakumari. MJP Publishers
2. Medical Microbiology by Cruickshank and others. ELBS Publications
3. Experimental Microbiology by R. J. Patel. Aditya Publishers, Ahmedabad
4. Laboratory Methods in Food Microbiology by Harrigan, Academic Press
5. Identification Methods for Microbiologists by B. M. Gibbs and F. A. Skinner. Academic Press
6. Laboratory Microbiology by L. Jack Bradshaw. W. B. Saunders & Co.
7. Benson's Microbiological Applications: Laboratory Manual in General Microbiology by Alfred E. Brown
8. Microbiological Methods by Michael Collins
9. Handbook of Microbiological Media by R. M. Atlas. CRC Publications
10. Laboratory Exercises in Microbiology by Robert A. Pollock and others
11. Applied Microbiology Laboratory Manual by F. Duncan.
12. Practical Handbook of Microbiology by Emanuel Golman and Lawrence H. Green, 2<sup>n</sup> Ed  
Procedures/Guidelines for the Microbiology Laboratory CRC Press

<b>Credits 04</b>	<b><u>FP-IM23-206: Field Project</u></b>
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