SHIVAJI UNIVERSITY, KOLHAPUR.

Accredited By NAAC with 'A' Grade

Revised Syllabus For

Master of Science

Part- I

GENERAL MICROBIOLOGY

CBCS PATTERN

Syllabus to be implemented from

June, 2019 onwards.

M.Sc. General Microbiology CBCS Pattern (2019-20)

M.Sc. Part-I

	Sr. No.	Course code	Teaching Scheme			Examination Scheme					
			Theory and Practical			University Assessment (UA)			Internal Assessment (IA)		
			Lectures (per week)	Hours (per week)	Credit	Maximum Marks	Minimum Marks	Exam. Hours	Maximum Marks	Minimum Marks	Exam. Hours
SEMESTER-I (Duration- Six month)											
A	1	CC-101: Taxonomy and Microbial Diversity	4	4	4	80	32	3	20	8	1
	2	CC-102: Virology	4	4	4	80	32	3	20	8	1
	3	CC-103: Genetics and Molecular Biology	4	4	4	80	32	3	20	8	1
	4	CC-104A: Immunology	4	4	4	80	32	3	20	8	1
	5	CCPR-105: Laboratory Course	16	16	16	200*	80	-	-	-	-
(A)			**-**	**-**	**24**	**520**	**-**	**-**	**80**	**-**	**-**
CGPA	1	AEC-106	2	2	2	-	-	-	50	20	2
SEMESTER-II (Duration- Six month)											
A	1	CC-201: Techniques in Microbiology	4	4	4	80	32	3	20	8	1
	2	CC-202: Microbial physiology, biochemistry and metabolism	4	4	4	80	32	3	20	8	1
	3	CC-203: Medical Microbiology	4	4	4	80	32	3	20	8	1
	4	CC-204: Microbial Ecology	4	4	4	80	32	3	20	8	1
	5	CCPR-205: Laboratory Course	16	16	16	200*	80	-	-	-	-
(B)			**-**	**-**	**24**	**520**	**-**	**-**	**80**	**-**	**-**
CGPA	1	SEC-206	2	2	2	-	-	-	50	20	2
(A + B)			**-**	**-**	**48**	**1040**	**-**	**-**	**160**	**-**	**-**

* Practical examination Internal/External as per department choice.

- Question number 1 of question paper is subjective (long answer) instead of objective.

SHIVAJI UNIVERSITY, KOLHAPUR
M. Sc. GENERAL MICROBIOLOGY SYLLABUS
Revised to be implemented from June 2019
(Applicable to affiliated colleges only)

PROGRAM OUTCOMES

- This is a two year M. Sc. program covering all general aspects of Microbiology.
- It helps in developing competent Microbiologists who can progress to diverse fields of microbiological interests in various fields of industries, research, teaching, medical science and entrepreneurship.
- The course is aimed at adding to the knowledge base of Microbiology graduates through significant inputs of latest information on the subject.
- It also envisages that the students read original research publications and develop the ability of critical evaluation of the study.
- Development of communication skills as well as laboratory work and team work, creativity, planning and execution are also a major objective of this program.
- In the core courses, the students study the basics of Microbiology along with the basics of subjects allied to and useful in Microbiology (Techniques, Biostatistics, Computer handling and Bioinformatics, Scientific writing and Pharmaceutical).
- The specializations include topics on various fields of Industrial Microbiology, Waste Management Technology, Extremophiles, Recombinant DNA Technology and Pharmaceutical Microbiology.
- During this program students undertake a Research Project/ Industrial Training in Semester IV in which the student is expected to study research methodology through experimental work, literature survey and report writing following the IMRAD (Introduction, Aims and objectives, Materials and Methods, Results and Discussion) system.
- In Industrial Training, the student is to take training in the Industry for a period of at least three weeks which will help student to study Microbiological aspects in the Industry.
- Educational tour to various institutes and or industries provides actual microbiological applications in various fields of Microbiology.

SHIVAJI UNIVERSITY, KOLHAPUR
M. Sc. GENERAL MICROBIOLOGY REVISED SYLLABUS
To be implemented from June 2019
(Applicable to affiliated colleges only)

A. ORDINANCE AND REGULATIONS:

1. Ordinance:

O. M. Sc. 1 -

1.1 Any person who has taken the degree of B. Sc. of this University or the degree of any other statutory University recognized as equivalent and has kept four terms in the University as a post-graduate student be admitted to the examination for the degree of Master of Science (M. Sc.) in Microbiology

1.2 A student shall be held eligible for admission to the M. Sc. Microbiology Course provided s/he has passed the B. Sc. examination with Microbiology as a principal subject or with a subsidiary/interdisciplinary/applied/allied subjects and has passed the entrance examination in Microbiology conducted by the University.

1.3 The students with B. Sc. from other universities shall be eligible if they qualify through the entrance examination and theory score minimum 55 percent (B+) marks in the subject at the B. Sc. examination.

1.4 While preparing the merit list for M. Sc. admission, the performance at B. Sc. III (Microbiology) examination and the performance at the entrance examination (Microbiology) will be given equal weightage (50:50)

2. Regulation:

R. M. Sc. 2 –

The M. Sc. degree will be awarded only after successful completion of written and practical university examinations.

R. M. Sc. 4 –

4.1 The entire course of M. Sc. shall be of 2400 marks so that each semester shall have 600 marks i.e. 400 Theory + 200 Practical. There shall be internal evaluation of 20% for theory papers.

4.2 The examination shall be split up into four semesters

4.3 The commencement and conclusion of each semester shall be notified by the University from time to time

4.4 There shall be a University examination for theory and practicals at the end of each semester. The evaluation of theory and practical examinations be done by internal and external examiners (50:50).

4.5 In each semester there shall be four theory papers and two practical courses

4.6 A student who has passed in semester examination shall not be allowed to take the examination in the same semester again

4.7 Each theory paper in each semester as well as each practical course shall be treated as separate head of passing

4.8 The student is allowed to keep terms in semester- III even if s/he has failed in three papers

4.9 The result shall be declared at the end of each semester examination as per University rules

B. REVISED SYLLABUS FOR MASTER OF SCIENCE (M. Sc. Part-I):

1. Title: Subject: - MICROBIOLOGY

Compulsory under the Faculty of Science

2. Year of implementation:

New syllabus will be implemented from June 2019 onwards

3. Preamble: (Applicable to University affiliated college centers)

Total number of semesters	: 02 (Per year)
Total No. of papers	: 08
Total no. of practical courses	: 04
No. of theory papers per semester	: 04
No. of practical courses per semester	: 02
Maximum marks per paper (Theory/Practical)	: 100
Distribution of marks (Theory only) –	
Internal evaluation	: 20
External evaluation (Semester exam)	: 80
Total marks for M. Sc. Degree Course	
Theory papers	: 1600
Practical course	: 800
	2400

4. General Objectives of the Course:

This two year M. Sc. programme is designed to develop competent Microbiologists who can progress to diverse fields of microbiological interests that include industry, research, teaching, medical science and entrepreneurship. The course is aimed at adding to the knowledge base of Microbiology graduates through significant inputs of latest information on the subject. It also envisages that the students read original research publications and develop the ability of critical evaluation of the study. Development of communication skills as well as laboratory work and team work, creativity, planning and execution are also a major objective of this programme. In the core courses, the students study the basics of Microbiology along with the basics of subjects allied to and useful in Microbiology (Techniques, Biostatistics, Computer handling and Bioinformatics, Scientific writing and Pharmaceutical). The specializations include topics on various fields of Industrial Microbiology, Waste Management Technology, Extremophiles, Recombinant DNA Technology and Pharmaceutical Microbiology.

Students are required to undertake a Research Project/ Industrial Training in Semester IV as part of Practical Course – VIII (MIC – 406).

In the Research Project (undertaken at the Parent Department), the student is expected to study research methodology through experimental work, literature survey and report writing following the IMRAD (Introduction, Aims and objectives, Materials and Methods, Results and Discussion) system.

In Industrial Training, the student is to take training in the Industry for a period of at least three weeks in the vacation period after Semester – II. The student should study Microbiological aspects in the Industry and submit its report in the form of dissertation duly signed by the concerned authority (from the industry), concerned supervisor (in the department) and Head of the department.

Students are also required to compulsorily undertake an educational tour organized by the Department in each year (M. Sc. I and M. Sc. II) to various places of Microbiological interest and submit a `Tour Report' duly signed by the Head of the Department, at the time of the Sem. – II and Sem. – IV practical examinations respectively failing which they will not be allowed to attend the examination.

5. Duration:

- The course shall be a fulltime course
- The course shall be of two years, consisting of four semesters

6. Fee Structure:

- Entrance Examination fees : as prescribed by Shivaji University, Kolhapur
- Course Fee : as prescribed by Shivaji University, Kolhapur

7. Eligibility For Admission:

- As per O. M. Sc. 1.2 for graduates of this University
- As per O. M. Sc. 1.3 for graduates from other Universities
- Merit List of entrance examination result

8. Medium of instruction: English

9. Structure of the course:

Semester I

Theory Courses:

Paper-I (MIC –101) –Taxonomy and Microbial Diversity
Paper-II (MIC –102) – Virology
Paper-III (MIC –103) – Genetics and Molecular Biology
Paper-IV (MIC –104) – Immunology

Practical Courses:

Practical Course – I: (MIC –105)
Practical Course – II: (MIC –106)

600 marks

Semester II

Theory Courses:

Paper-V (MIC –201) –Techniques in Microbiology
Paper-VI (MIC –202) – Microbial physiology, biochemistry and metabolism
Paper-VII (MIC –203) – Medical Microbiology
Paper-VIII (MIC –204) – Microbial Ecology

Practical Courses:

Practical Course – III: (MIC –205)
Practical Course – IV: (MIC –206)

600 marks

10. System of Examination: applicable to University affiliated college centres

1. Scheme of examination:

- Semester examination (External evaluation) will be conducted for both theory and practical courses by the University at the end of each term (Semester)

- Theory paper of the external evaluation (Semester exam) will be of 80 marks
- The internal evaluation test (by the Department) will be for a total of 20 marks consisting of two tests of 10 marks each for each course paper in the middle of the semester
- The two practical course examinations will be external evaluation (Semester exam) only, of 100 marks each
- Question paper will be set in view of the entire syllabus and preferably covering each unit of the syllabus

2. Standard of passing:
As per the rules and regulations of the university for the M. Sc. course

3. 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 units 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

b) Internal Evaluation Theory paper: Maximum marks – 20

- Objective- multiple choice/True or false/ fill in the blanks/match the following
- Total number of questions will be 10 each carrying 01 mark

c) Practical Examination (External Evaluation 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

C. INTAKE CAPACITY:
1. 48* students (24 grant-in-aid + 24 Non-grant basis) every year on the basis of entrance examination

2. The above includes 10 % students from other Universities
*for Yashwantrao Chavan College of Science, Karad only

D. CREDIT SYSTEM:

1. Definition of CREDITS:

It is the workload of a student in College activities. This includes:
1. Lectures – time put in for attendance in theory class
2. Practicals – time put in performing experiments in the laboratory
3. Examinations – time put in for theory and practical examinations during and at the end of each semester
4. Other activities –
4.1 Seminars – time put in for delivering a seminar topic in class
4.2 Private study work in the Library/Home – book issue, reference work (books and journals), reading magazines and relevant literature, internet access, study, preparation of notes, computations, etc, writing reviews of referred literature
4.3 Taking subject related add on courses conducted by College, University or any authorized organizations.
4.4 Proficiency in state, national and international sports, social service – NSS, military service – NCC, colloquiums and debates, cultural programmes, participation in seminars, scientific symposia, workshops, conferences, etc.

1.1 Types of credits:

1.1.1 Credits by evaluation - examination (theory and practical)
1.1.2 Credits by non-evaluation – Other activities

2. Credits by lectures and practicals: 96

- Total instructional days as per norms of UGC = 180
- One (01) credit is equivalent to 12 contact hours
- There are four (04) theory papers with 04 hours teaching per week
- Each theory paper consists of 04 units
- There are two (02) practical courses of 09 hours duration per week
- Each practical course consists of 02 units
- As there are four (04) semesters to the M. Sc. course, the total credits from lectures and practicals will be - 04 × 24 = 96 credits
- The distribution of credits (per semester) is –

Course type	**Contact hours**	**Credits**
Theory paper		
Unit-I	**15**	**1**
Unit-II	**15**	**1**
Unit-III	**15**	**1**
Unit-IV	**15**	**1**
	Total	**4**
Practical Course		
Unit-I		**2**
Unit-II		**2**
	Total	**4**

Total credits per semester= 24		
Theory course	**04 X 04 =**	**16**
Practical course	**02 X 04 =**	**08**

3. M. Sc. Course Work (credit system) for a student:

. Total number of credits for the entire M. Sc. Course will be 100

Theory papers : 16 × 04 = 64 credits
Practical courses : 08 × 04 = 32 credits

- Other activities : = 04 credits

Total : = 100 credits

- The option of choosing credits from other departments/courses will be available only in semester – III and IV
- This choice will be restricted to 08 credits and only for theory papers i.e. two (02) papers
- Time course: 02 years minimum

4. Class capacity:

Theory : maximum 60 students per class
Practical courses : 12 students per batch

5. Examination:

Theory Examination:

External: 80 marks per theory paper (examination at the end of the Semester)

- This will be conducted by the University as specified in section B.10

Internal: 20 marks per theory paper (based on `objective type' question Paper)

- This will be conducted by the Department as per the norms specified in section B.10.3b above

Practical Examination:

- This will be conducted only by the University as specified in section B.10

<u>Project/ Industrial Training evaluation:</u>

External: 50 marks by the university examiners through observation of the oral presentation and assessment at the time of the Semester IV practical examination
Internal: 50 marks by the concerned project supervisor as the internal examiner during progress of the work.

6. Courses available in the Department:

Semester-I:

Theory courses : Paper-I (MIC-101), Paper-II (MIC-102), Paper-III (MIC-103), Paper-IV (MIC-104).
Practical courses : Practical course-I (MIC- 105) and Practical course-II (MIC-106)

Semester-II:

Theory courses : Paper-V (MIC-201), Paper-VI (MIC-202), Paper-VII (MIC-203), Paper-VIII (MIC-204).
Practical courses : Practical course-III (MIC-205) and Practical course-IV (MIC-206)

SEMESTER- I

Paper (Course)-I (MIC – 101): TAXONOMY AND MICROBIAL DIVERSITY

COURSE OUTCOMES

This course provides solid curriculum for students to explore the enormous biological diversity in the microbial world. The course also provides a practical guide to microbial diversity from phylogenetic perspective in which students learn evolutionary relationship. This course draws the student's attention to the Universe of Microbial diversity, with focused studies of the contributions that specific microorganism makes to the Universe. This course trains students by providing information on how bacteria are named and identified in the laboratory.

UNIT - I **(15)**

1. General characteristics and outline classification of Archaea
2. General characteristics of Methanogenic, Extremely Halophilic and Extremely thermophilic Archaeobacteria
3. Extremophiles: general characteristics of acidophilic, alkaliphilic, barophilic microorganisms
4. General characteristics and outline classification of Actinomycetes

UNIT - II **(15)**

1. Fungi: General characteristics and outline classification of fungi, Morphology of some common fungi - Mucor, Rhizopus, Aspergillus, Penicillium and Fusarium
2. Yeasts: General characteristics and outline classification of yeasts
3. General characteristics of Lichens and Mycorrhiza

UNIT - III **(15)**

1. Anoxygenic photosynthetic bacteria: general characteristics of purple bacteria and green bacteria
2. Oxygenic photosynthetic bacteria: General characteristics of Cyanobacteria – external and internal features, physiology and ecology
3. Magnetotactic bacteria- General characteristics, Magnetosomes, Enrichment and isolation of Magnetotactic bacteria.

UNIT - IV **(15)**

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

REFERENCE BOOKS

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

Paper (Course)-II (MIC – 102): VIROLOGY

COURSE OUTCOMES

Virology is a branch of science that is of immense relevance to mankind as viruses are the threats to human health, causing various diseases such as AIDS, hepatitis B, cancer, measles and influenza. This course helps students to become trained virologists. This course covers basic aspects of bacteriophages, plant viruses and animal viruses. Three entire units are devoted separately for three groups of viruses. Students learn number of virus replication cycles along with general principles of chemotherapy against viral diseases in this course.

UNIT - I **(15)**

1. Single burst and premature lysis experiment for phage host interaction
2. Productive cycle of T-odd phages
3. Productive cycle of lambda phage
4. Interaction of Bacillus phages with their hosts.
5. Properties of lambda lysogeny
6. Brief details of lysogenic interactions of P2, P22, P1 and Mu1 phages.

UNIT - II **(15)**

1. Transmission of plant viruses:

1.1 Vector transmission- insect, nematode and fungal vectors

1.2 Non vector transmission- Seed transmission, graft transmission, mechanical transmission

2. Effect of viruses on plants- roots, stem, leaves, flowers and fruits
3. Gene expression and replication strategies of-

3.1 Poty virus

3.2 TMV

3.3 Lettuce necrosis yellow virus

UNIT - III **(15)**

1. Productive cycle of animal viruses having DNA

1.1 Herpes viruses

1.2 Parvo viruses

2. Productive cycle of animal viruses having double stranded RNA- Reo virus

3. Productive cycle of animal viruses having single stranded RNA
3.1 Rhabdo
3.2 Picorna
3.3 Retro
3.4 Influenza

UNIT – IV **(15)**

1. Slow viruses – Discovery, General features and importance
2. DI particles – general features and interactions
3. Inhibition and inactivation of bacteriophages, animal viruses and plant viruses- photodynamic inhibition, inactivation by heat and radiations, inactivation by chemicals
4. 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

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

Paper (Course)-III (MIC – 103): GENETICS AND MOLECULAR BIOLOGY

COURSE OUTCOMES

This course focusses on the current state of knowledge on the genetics of microorganisms and higher living beings. The course provides knowledge about molecular basics of transcription, translation and replication process. First two units are devoted to classical genetics. The last two units contain latest information on molecular biology techniques and information regarding newer trends in genetics and molecular biology. This course induces students to appreciate the strength of microbial genetics and realize the contribution of these tiny organisms to the growth of life sciences as a whole and genetics in particular. This course helps to develop strong foundation in genetics which also helps in comprehending more modern concepts of molecular biology and recombinant technology.

UNIT – I **(15)**

1. Origin of life- aspects of prebiotic environment, evolution of the pre-cell.
2. Organic evolution: concepts and theories, mechanisms of speciation, genetic basis of evolution - Hardy-Weinberg genetic equilibrium, evolutionary clock.

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
4. Origin and evolution of economically important microbes, plants and animals.
5. Evidences for nucleic acids as genetic material.
6. Organization of eukaryotic genetic material: Operon, Unique and repetitive DNA, Interrupted genes, gene families, structure of chromatin and chromosomes, heterochromatin and euchromatin. Polytene and Lampbrush chromosomes.

UNIT – II **(15)**

1. Principles of Mendelian inheritance: linkage and gene mapping - Tetrad analysis, split and overlapping genes.
2. Law of DNA constancy and redundancy, C-value paradox, Cot curves and DNA re-association constant, dosage compensation, genetic load.
3. Molecular basis of mitosis and meiosis
4. Replication of DNA and duplication of chromosomes – modes and molecular mechanisms of DNA replication in prokaryotes (bacteria) and eukaryotes (nuclear and mitochondrial).
5. Co-transcriptional and post-transcriptional processing of RNA, structure and stability of mRNA

UNIT – III **(15)**

1. Translation in eukaryotes – machinery, initiation, elongation, termination and release, posttranslational processing.
2. Localization of proteins in cell - mechanisms of transport to nucleus, mitochondria, chloroplasts and outside the cell
3. Molecular mechanism of homologous recombination in bacteria and other organisms – RecBCD and Ruv systems, Holliday junction, interallelic, specialized and site specific recombination; Gene targeting.
4. Restriction and modification of DNA – enzymes, molecular mechanisms and significance.

UNIT – IV **(15)**

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 tumour suppressor (anti-cancer) genes, role of apoptosis and telomere shortening in cancer.

3. Techniques in molecular genetics:

3.1 Basic techniques - PCR, LCR, Nick translation, Blotting techniques – Southern, Northern and Southwestern blotting, colony hybridization

3.2 Applications - Chromosome walking, DNA foot printing and 16s rRNA sequence analysis

3.3 Transfection – Protoplast fusion, electroporation

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
17. Molecular Gebetics of Bacteria by L. Snyder and W. Champness, ASM Press, Washington

Paper (Course)-IV (MIC – 104): IMMUNOLOGY

COURSE OUTCOMES

This course ensures that students both master fundamental immunological concepts and internalize a vision of immunology as an active and ongoing process. Students get knowledge of many related pieces of information in immunology. Students are provided with the basic knowledge about use of immunological techniques in disease diagnosis. Chapters regarding transplantation rejection process and tumor immunology are also covered in this course.

UNIT - I **(15)**

1. MHC complex: structure, function, MHC polymorphism, assembly and presentation of peptide MHC complex.
2. Signal transduction: Ras dependant and Jak/Stat pathway, signal transduction by IL-1, IL- 2 and T-cell antigen receptors.
3. T-cell sensitization: TCR signaling by CD 45 and CD 28, Interaction of T-cells with APCs.

UNIT - II **(15)**

1. Complement System: Regulation of complement pathways, biological consequences of activation, complement polymorphism
2. Genetics of antibody synthesis: Types of genes, location and positions of genes, genes for constant region, genes for variable region of immunoglobulin
3. Antibody diversity: Introduction, Mechanisms.
4. Immunomodulation, potentiation, tolerance and suppression.
5. Vaccines:

5.1 rDNA

5.2 DNA vaccines

5.3 Edible vaccines, Carrier, Synthetic peptide, subunit vaccines, anti-idiotypic

UNIT - III **(15)**

1. Transplantation immunology: Immunological basis of graft rejection, clinical manifestation, immunosuppressive therapy, Kidney transplantation – ABO testing, pathology of graft rejection
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.

UNIT - IV **(15)**

1. Serodiagnosis of diseases: Approaches for serodiagnosis, detection of antigen or antibody, diagnostic titer, ASO, Cold hemagglutination test, Weil-Felix test, Tuberculin test, Paul-Bunnel test.
2. Immunochemical techniques and their applications: Immunohistochemical technique, ELISA, FAT, Western blot technique, Immunoelectrophoresis (IEP), Immunodiffusion, Fluorescence Activated Cell Sorters.
3. PCR based diagnostic tests

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. Immunobiotechnology 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.
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 K. Wilson and J. M. Walker
17. Text book of Microbiology by Vasanthakumari R.
18. The text book of Microbiology by Dubey R. C., Maheshwari D. K.

PRACTICAL COURSE – I: (MIC – 105)

UNIT - I

1. Isolation and morphological study of *Aspergillus*, *Penicillium*, *Rhizopus* and *Mucor* species by slide culture method
2. Isolation and morphological studies of yeast from sugar and starchy materials
3. Induction and observation of Ascospores of *Saccharomyces cerevisiae*
4. Isolation and morphological studies of Actinomycetes by coverslip technique
5. Enrichment and Isolation of Anoxygenic phototrophic bacteria
6. Isolation and Characterization of thermophilic bacteria
7. Isolation and Characterization of Acidophilic bacteria
8. Isolation and Characterization of Halophilic and halotolerant bacteria.

UNIT - II

9. Phage typing of *E. coli*
10. Titration of *E. coli* phages
11. Preparation of high titre stock of *E. coli* phages
12. Study of one step growth of T-4 phage
13. Isolation of plaque morphology mutants of phages by using UV radiations
14. Isolation of plaque morphology mutants of phages by using chemical mutagen
15. Demonstration of egg inoculation techniques

REFERENCE BOOKS

1. PracticalMicrobiology 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. MicrobiologicalMethods 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 5th Ed.

PRACTICAL COURSE – II: (MIC – 106)

UNIT - I

1. Isolation of RNA from yeasts.
2. Isolation of Plasmid DNA from bacteria
3. Thermal denaturation of DNA
4. Gene transfer in *E. coli* by – conjugation
5. Demonstration of protoplast fusion in bacteria
6. Estimation of mutation rate in *E. coli*
7. Synthesis of inducible enzyme β-galactosidase in E. coli
8. PCR (demonstration)

UNIT – II

9. Ouchterlony's double diffusion test
10. Radial immunodiffusion test
11. Immunoelectrophoresis test
12. ASO test
13. RA test
14. Weil-Felix test
15. Isolation of immunoglobulins from whole blood

REFERENCE BOOKS

1. PracticalMicrobiology 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. MicrobiologicalMethods 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

11. Environmental Science and Biotechnology- Theory and Techniques by A. G. Murugesan and C. Rajkumari, MJP Publisher Chennai.

SEMESTER-II

Paper (Course)-V (MIC – 201): TECHNIQUES IN MICROBIOLOGY
COURSE OUTCOMES

The course emphasizes on understanding the theory behind the techniques as well as analysis of the resulting data. The course covers both, traditional and modern techniques most commonly used in current life science research. This course integrates theory and practice and to ensure the students understand why and how each technique is used.

UNIT – I **(15)**

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 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 – principles and working of transmission and scanning microscopes.
5.1 Dark field, phase contrast, polarisation, differential interference contrast (DIC), fluorescence, confocal scanning, scanning tunnelling, atomic force microscopy.

UNIT – II **(15)**

1. Good laboratory practices:

1.1 Accuracy in preparation of solutions, media, etc.
1.2 Qualifications of equipment – design (DQ), installation (IQ), operational (OQ) and performance (PQ)
1.3 Validation and calibration
1.4 Documentation- Concepts, necessity and types

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 Ionising radiations
2.1.4 Infectious materials
2.1.5 Gas and fire
2.2 Safety measures –
2.2.1 In the use of equipments and gas facility
2.2.2 Personal protection
2.2.3 Waste disposal
2.2.4 First aid

3. Cell disruption methods – principles and methods of disruption of microbial, plant and animal cells and separation of cellular components

UNIT – III **(15)**

1. Chromatography – general principles and working of
1.1 Column chromatography – gel, ion exchange.
1.2 Gas chromatography
1.3 HPLC
2. Electrophoresis-
2.1 Polyacrylamide gel electrophoresis (PAGE) - native and gradient gels, DNA Sequencing gels, SDS-PAGE, isoelectric focusing, 2-D PAGE
2.2 Agarose gel electrophoresis- DNA gel, Pulsed field gel, RNA electrophoresis.
2.3 Capillary electrophoresis
3. Centrifugation – principles of differential and density gradient centrifugation, sedimentation coefficient determination

UNIT – IV **(15)**

1. Spectroscopy – Principles of IR and Raman spectrophotometry, turbidimetry and nephelometry, fluorimetry, luminometry, circular dichroism and optical rotational dichroism spectrophotometry, ESR, NMR
2. Mass spectrometry
3. X – ray crystallography
4. Radioisotopic techniques –
4.1 Nature of radioactivity and general principles of radioisotopic techniques
4.2 Methods of detection of radioactivity – gas ionization (GM counter), excitation (scintillation) and exposure of photographic emulsions (autoradiography).
4.3 Methods of using radioisotopes – radioisotope tracer technique, isotope dilution assay (RIA) and other methods
5. Electrochemical techniques – general principles of electrochemical cells and potentiometry, principles and applications of the pH, ion selective and oxygen electrodes

REFERENCE BOOKS

1. Methods in Microbiology (series) by Norris and Ribbons, Academic Press, NY.
2. Principles and techniques in Practical Biochemistry by K. Wilson and J. M. 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 R. V. Gadre, MACS, Agharkar Research Institute, Pune
7. Isolation Methods for Anaerobes by Shapton, Academic Press.
8. Tools in Biochemistry by D. Cooper
9. Protein Purification by R. Scopes, Springer Verlag Publications
10. Analytical Biochemistry (Biochemical Techniques) by P. Asokan, Chinnaa Publications

Paper (Course)-VI (MIC- 202): MICROBIAL PHYSIOLOGY, BIOCHEMISTRY AND METABOLISM

COURSE OUTCOMES

The course is flourished with knowledge regarding molecular mechanisms involved during growth with respect to biochemical approaches. The course helps stimulate students to dedicate part of their future research in understanding mechanisms and applications of biochemistry. This course deals with basic concepts and some recent developments in biochemistry.

UNIT - I **(15)**

1. Carbohydrate metabolism: Citric acid cycle- steps involved, amphibolic nature, anaplerotic reactions.
2. Oxidation of hydrocarbons:
2.1 Aliphatic hydrocarbons - alkanes and alkenes- alpha, beta and omega oxidation
2.2 Aromatic hydrocarbons - beta keto adipate pathway, valerate pathway and gentisate pathway
3. Oxidation of fatty acids and phospholipids: beta-oxidation of fatty acids, phospholipases and thioesterases
4. Catabolism of amino acids (General reactions)
5 Pasteur and Crabtree effect
6. Autotrophy - Concept, factors for, types of autotrophs, mechanisms

UNIT - II **(15)**

1. Respiratory metabolism:
1.1 Mitochondrial ETC- structure of mitochondrion, ETC and its components, Shuttle system across membrane, Atkinson's energy charge.
1.2 Oxygen toxicity- mechanism of oxygen toxicity, mechanism to overcome the toxicity - catalase, peroxidase and superoxide dismutase
2. Photo-phosphorylation in bacteria-
2.1 Photosynthetic and non-photosynthetic ETC
2.2 Cyclic and non-cyclic photophosphorylation
3. Drug metabolism in the body, mechanisms of detoxification of various substances
4. Fermentation of saccharolytic clostridia and propionic acid bacteria

UNIT - III **(15)**

1. Protein chemistry- Structure of peptide bond, stabilization of conformation,
1.1 Secondary structure, alpha helix, beta conformation, Ramachandran plot
1.2 Tertiary structure
1.3 Quaternary structure
2. Biosynthesis of aminoacids: a- ketoglutarate family, oxaloacetate family, Pyruvate family
3. Lipid metabolism in prokaryotes –
3.1 Biosynthesis of fatty acids
3.2 Phospholipid biosynthesis – phosphatidylethanolamine and phosphatidylglycerol
3.3 Regulation of lipid metabolism
5. Purine and pyridine biosynthesis- de novo pathway and salvage pathway

UNIT - IV **(15)**

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

REFERENCE BOOKS

1. Text book of Biochemistry 4th ed. by West, Todd, Mason and Burgen
2. Principles of Biochemistry 5th 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
11. Microbial Physiology by A. G. Moat and others Wiley India Edition

Paper (Course)-VII (MIC – 203): MEDICAL MICROBIOLOGY

COURSE OUTCOMES

The course helps students to get an information about basics of the disease causing process. The objective of this course is to instill a broad based knowledge of etiologic organisms and their pathogenic mechanism. Students are provided with the knowledge of necessary information for diagnosis, therapy and prevention of the infectious diseases. The course tries to provide in detail information on some aspects important aspects of medical microbiology.

UNIT - I **(15)**

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 (Diptheria, Cholera, Clostridial, Staphylococcal)
2.2 Endotoxins of gram negative bacteria
2.3 Extracellular enzymes (Coagulase, Lysozyme)
3. Pathogen survival mechanisms:
3.1 Capsulation, sporulation, cyst formation
3.2 Against Environmental factors-
3.2.1 Physical (Heat, radiations)
3.2.2 Chemical (antibiotics and disinfectants)
3.3 immune escape mechanisms
4. Collection and transport of clinical specimens (clinical samples from throat, alimentary tract, genito-urinary tract, conjuctiva, ear, blood), preliminary processing of specimens

UNIT - II **(15)**

1. Bacterial Diseases: causative agent - morphological, cultural, biochemical, antigenic characters; lab diagnosis, transmission, prevention and control of diseases caused by *Leptospira icterohemorrhagy*, *Streptococcus mutans Rickettsia burnetti, Mycobacterium tuberculosis*
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

UNIT - III **(15)**

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
4. Special microbial metabolites and their applications in health care– Lovastatin, Daunorubicin

UNIT IV **(15)**

1. B-cell immunodeficiency disorders:

1.1 X-linked agammaglobinaemia
1.2 Selective IgA and IgM deficiency

2. T-cell immunodeficiency disorders: Congenital thymic aplassia
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 9th ed. by D. P. Stites, I. T. Abba, T. G. Parslow

11. Immunology by I Kannan
12. Immunobiotechnology by M. Sharma and N. Tripathi
13. Biotechnology Application and Research by P. N. Cheremisinoff and R. P. Ouellette
14. Immunology 5th ed. by R. A. Goldsby, T. J. Kindt, B. A. Osborne and J. Kuby
15. Fundamentals of Immunology 2nd ed. by Q. N. Myrrik and R. S. Weiser
16. Essential Immunology by I. M. Roitt
17. Immunology 3rd ed. by I. M. Roitt, J. Brostoff and D. K. Male

Paper (Course)-VIII (MIC – 204): MICROBIAL ECOLOGY

COURSE OUTCOME

Microbial ecology emerged as an energetic and dynamic branch of science which helps students to understand global ecosystems. The course of Microbial ecology creates platform for students to investigate and explore microbial activities for welfare of human being. It also helps to understood practical implications and biotechnological applications of microbial ecology.

UNIT – I **(15)**

1. Concept and importance of microbial ecology.
2. Microbial communities and ecosystems - Development of microbial communities, Experimental Ecosystem models – Batch system, Flow-Through System, Microcosm, Germ free animal.
3. Physiological ecology of Microorganisms: abiotic limitations to microbial growth, starvation strategies, environmental determinants - temperature, radiation, pressure, salinity, water activity, pH, redox potential, magnetic force, organic and inorganic compounds

UNIT – II **(15)**

1. Culture dependant and culture independent analyses of microbial communities.
2. Quantitative ecology: Sample collection, processing and detection of microbial populations
3. Determination of microbial numbers, biomass, measurement of microbial metabolism.

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UNIT – III **(15)**

1. Biological interactions –
   1.1 Microbe – Microbe interactions – Interaction within single microbial population-positive and negative interactions, Interactions between diverse microbial populations-mutualism, commensalism, synergism, ammensalism, parasitism and predation.
   1.2 Microbe – Plant interactions – Interactions with aerial plant structures.
   1.3 Microbe – Animal interactions- Microbial contributions to animal nutrition, Commensal and mutualistic intestinal symbionts, Symbiotic light production.

UNIT – IV **(15)**

1. The animal as an environment – The indigenous microbial population of alimentary tract and skin, factors affecting composition of flora, sources of nutrients for organisms in the alimentary tract and on skin, energy metabolism in rumen
2. Ecological control of pests and disease causing populations- Modification of

- populations, reservoirs of pathogens and vector populations Microbial control of pests, genetic engineering in biological control.

REFERENCE BOOKS

1. Microbial Ecology by M. Lynch and others
2. Experimental Microbial Ecology by R. C. Burns and others
3. Environmental Microbiology by K. Vijaya Ramesh, MJP Publishers
4. Microbial Ecology by Larry L. Barton and Diana E. Northup Copyright © 2011 Wiley-Blackwell.
5. Soil Microbiology by N. S. Subba Rao Oxford and IBH Publishing Co. Pvt. Ltd
6. Introduction to Soil Microbiology by M. Alexander, John Wiley and Sons Inc. New York, London
7. Microbial Ecology by R. M. Atlas and R. Bartha
8. The Prokaryotes: A handbook on the Biology of Bacteria; M. Dworkin (Editor in Chief) and others.

PRACTICAL COURSE – III: (MIC – 205)

UNIT - I

1. Enrichment and isolation of chitin degrading bacteria
2. Enrichment of *Clostridium* species using potato, Thioglycollate broth and Candle jar
3. Spectroscopy -

3.1 Calibration of colorimeter/ spectrophotometer (Verification of Beer's law),

3.2 Determination of absorption maxima, molar extinction coefficient and difference spectra

4. Chromatography –

4.1 Separation of dyes and amino acids on silica gel column

4.2 Ion exchange chromatography of amino acids / proteins

5. Agarose gel electrophoresis
6. Density gradient centrifugation of budding yeast cells
7. Preservation of microbial cultures –

7.1 Slant cultures of aerobic and facultative organisms

7.2 Stab cultures of microaerophilc organisms

7.3 Soil culture technique for spore formers

UNIT - II

8. Determination of specific growth rate and generation time of E. coli
9. Determination of protein content of bacteria
10. Determination of carbohydrate content of bacteria
11. Determination of nucleic acid (DNA, RNA) content of bacteria
12. Effect of hypotonic and hypertonic solutions on cells
13. Determination of phenol coefficient of 'test disinfectant'

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

PRACTICAL COURSE – IV: (MIC – 206)

UNIT - I

1. Qualitative and Quantitative study of water microflora
2. Study of microflora in Winogradsky column
3. Qualitative and quantitative study of air microflora
4. Isolation and characterization of microflora from human skin.
5. Demonstration of bacterial synergism and antagonism
6. Detection of siderophores production by microorganisms
7. Isolation and characterization of ruminant bacteria from animal gut.

UNIT - II

8. Using Bergey's Mannual of Systematic Bacteriology for identification of Bacteria.
9. Isolation and characterization of respiratory pathogenic bacteria from throat.
10. Determination of susceptibility to dental caries by Snyder test
11. Isolation and characterization of etiological agent of dental caries
12. Isolation and characterization of enteric pathogens from clinical samples
13. Isolation and characterization of Urinary tract infection causing bacteria from urine.
14. Antibiotic sensitivity of Urinary tract infection causing bacteria.

REFERENCE BOOKS

1. PracticalMicrobiology 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. MedicalMicrobiology by Cruickshank and others. ELBS Publications
4. Experimental Microbiology by R. J. Patel. Aditya Publishers, Ahmedabad
5. Laboratory Methods in Food Microbiology by Harrigan, Academic Press
6. Identification Methods for Microbiologists by B. M. Gibbs and F. A. Skinner. Academic Press
7. Laboratory Microbiology by L. Jack Bradshaw. W. B. Saunders & Co.

8. Benson's Microbiological Applications: Laboratory Manual in GeneralMicrobiology by Alfred E. Brown
9. MicrobiologicalMethods by Michael Collins
10. Handbook of Microbiological Media by R. M. Atlas. CRC Publications
11. Laboratory Exercises in Microbiology by Robert A. Pollock and others
12. Applied Microbiology Laboratory Manual by F. Duncan.
13. Practical Handbook of Microbiology by Emanuel Golman and Lawrence H. Green, 2nd Ed
14. Procedures/Guidelines for the Microbiology Laboratory

15. Laboratory Excersises in Microbiology 5th edn. Harley Prescott

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EQUIVALENCE OF SYLLABUS FOR M. Sc. (MICROBIOLOGY)
Titles of Theory and Practical courses in the Semesters

M.Sc.-Part-I:

SEMESTER - I

Old Syllabus (From June 2013 to 2019)
Present Syllabus (Implemented from June 2019)

Paper-I (MIC – 101): Morphology, Cytology and Taxonomy of Microorganisms
Paper-I (MIC – 101): Taxonomy and Microbial Diversity

Paper-II (MIC – 102): Virology
Paper-II (MIC – 102): Virology

Paper-III (MIC – 103): Genetics and Molecular Biology
Paper-III (MIC – 103): Genetics and Molecular Biology

Paper-IV (MIC – 104): Immunology
Paper-IV (MIC – 104): Immunology

Practical Course – I: (MIC – 105)
Practical Course – I: (MIC – 105)

Practical Course – II: (MIC – 106)
Practical Course – II: (MIC – 106)

SEMESTER - II

Old Syllabus (From June 2013 to 2019)
Present Syllabus (Implemented from June 2019)

Paper-V (MIC – 201): Techniques in Microbiology
Paper-V (MIC – 201): Techniques in Microbiology

Paper-VI (MIC – 202): Microbial physiology, biochemistry and metabolism
Paper-VI (MIC – 202): Microbial physiology, biochemistry and metabolism

Paper-VII (MIC – 203): Medical Microbiology
Paper-VII (MIC – 203): Medical Microbiology

Paper-VIII (MIC – 204): Microbial Ecology
Paper-VIII (MIC – 204): Microbial Ecology

Practical Course – III: (MIC – 205)
Practical Course – III: (MIC – 205)

Practical Course – IV: (MIC – 206)
Practical Course – IV: (MIC – 206)

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