

SHIVAJI UNIVERSITY, KOLHAPUR

The overall structure of the course to be implemented from the academic year 2009 – 2010 onwards is as given below,

- 1) The entire M.Sc. Course in Microbiology shall be covered in 16 (sixteen) theory papers, 7 (seven) practical courses (semester I, II, III, IV) and a project work (in lieu of one practical courses of semester IV) for each semester there shall be four theory papers each carrying 100 marks and for first three semester viz. semester I, II and III, there shall be two practical courses each. Each practical course shall carry 100 marks. However, for semester IV there shall be a research project work of 100 (one hundred) marks in lieu of one practical course in addition to four theory paper and one practical course.
- 2) Semester wise theory papers and practical courses shall be as shown below,
Semester I : Four theory papers and two practical courses compulsory to all students.
Semester II : Four theory papers and two practical courses compulsory to all students.
Semester III : Four theory papers and two practical courses compulsory to all students.
Semester IV : Four theory papers compulsory (from any one of the electives /specializations) and one research project work and one practical course for every student.
- 3) Each theory paper will be covered in four lectures per week. Each practical course shall be covered in three practical turns of three clock hours practical periods per week.
- 4) For university practical examination the duration should be as shown below
 For every semester there shall be three days practical examination per batch (at least six and half hours duration each day)
- 5) Each candidate must produce a certificate from the Head of the Department in his/her college, stating that he/she has completed, in a satisfactory manner, a practical course on the lines laid down from time to time by Academic Council on the recommendations of Board of studies and that the laboratory journal has been properly maintained. Every candidate must have recorded his/her observation in the laboratory journal and a written report on each exercise performed. Every journal is to be checked and signed periodically by a member of teaching staff and certified by the Head of the Department at the end of each semester. Candidates are to produce their journal at the time of practical examination. There shall be twenty marks for each journal for semesters I, II and III each.

There shall be one compulsory seminar delivery per year for each student and at the time of practical examination every student must submit the certificate from Head of the Department in his/her college stating the he/she has satisfactory completed the seminar work.

Students shall have to undertake an academic tour to visit at least two places of academic interests like industries/research institutions / R & D departments during semester II & semester IV each. The student should submit the report of their visit at the time of practical examination. The report should be duly certified by the Head of Department. There shall be twenty marks for tour report.

Student is to undertake a research project / industrial training (as part of the semester IV in lieu of Practical Course (MIC- 406)]which is to be started in the beginning of semester III so as to give enough time for duly completion of project. In the project student is to study research methodology (Introduction, Aims and objectives, material and methods, results and discussions, conclusion and bibliography). For the research project work out of one hundred marks, fifty marks shall be done by university examiners through the presentation and assessment of dissertation at the time of semester IV practical examination. The evaluation of remaining fifty marks done by concerned supervisor of the student as an internal evaluation during research project work in progress.

In industrial training –

- 1) The supervisor of student should locate the industry and depute the student in the industry for the period at least of three weeks.
- 2) Student should complete his/her industrial training cum industrial project in the vacation period after semester II.
- 3) Student should study microbiological aspects in industry and submit its report in the form of dissertation duly signed by the concerned authority, concerned supervisor and Head of the Department of Microbiology.
- 4) The method of evaluation of ‘industrial training’ should be as formulated for ‘project work’ being an option for project work the industrial training will carry 100 marks.

Syllabus for M.Sc.-I (Microbiology)

Titles of theory and practical courses in the Semesters

M.Sc. I , Semester I

MIC –101 – Morphology, Cytology & Taxonomy of Microorganisms

MIC –102 – Virology

MIC –103 – Genetics and Molecular Biology

MIC –104 – Medical Microbiology and Immunology - I

MIC –105 – Practical Course - I

MIC –106 – Practical Course – II

M.Sc. I , Semester II

MIC –201 –Techniques in Microbiology

MIC –202 – Microbial physiology, biochemistry and metabolism

MIC –203 – Medical Microbiology and Immunology - II

MIC –204 – Microbial Ecology

MIC –205 – Practical Course - III

MIC –206 – Practical Course – IV

MIC – 101. MORPHOLOGY, CYTOLOGY AND TAXONOMY OF MICROORGANISMS**Unit-I (6)**

1. Cell division, Cell cycle, and differentiation of *Bacillus*, *Azotobacter*, *Candida* and *Aureobasidium*.

Unit-II (6)

1. Surface properties of bacteria.
2. General characteristics and outline classification of Archaeobacteria.

Unit-III (6)

1. General characteristics & outline classification of Rickettsias.
2. General characteristics & outline classification of Chlamydia.
3. General characteristics & outline classification of Mycoplasma.

Unit IV (6)

1. Yeasts: Morphological & cultural characteristics of yeast cells. Cytology of yeast cells. Outline classification of yeasts.
2. Fungi : Outline classification of fungi, Fungal cell structure, Morphology of some common fungi - *Mucor*, *Rhizopus*, *Asergillus*, *Penicillium* and *Fusarium*.
General characteristics of lichens and Mycorrhiza.

Unit- V (6)

1. Algae: Outline classification of algae, algal cell structure and reproduction, microalgae.
2. Actinomycetes: General characteristics and outline classification .

Unit- VI (6)

1. The Chemoautotrophic bacteria: General characteristics and significance of - Nitrifying bacteria, Iron bacteria, Hydrogen bacteria,

Unit- VII (6)

1. Using the Bergey's Manual of Systematic Bacteriology.
2. Classification of prokaryotic organisms –An overview
3. Principles of bacterial nomenclature.

Unit- VIII (6)

1. Numerical taxonomy, Chemotaxonomy, Genetic & serological methods used in classification.

References

1. Alouopolus C.J., Introductory Mycology, 7th Ed., Willey Eastern Pvt. Ltd., New Delhi.
2. Bergey's Manual of Systemic Bacteriology 2nd Ed., Vol. 2, Springer, USA.
3. Lamanna C., Mallette F., Basic Bacteriology, 3rd Ed., the Willium and Wilkins company. Calcutta.
4. Salle A.J., Fundamental Principles of Bactetriology, 3rd Ed. TMH Publishing Company, New Delhi.
5. The Yeast- A.H. Rose
6. General Microbiology, 5th Ed. -R.Y. Stanier

MIC 102 VIROLOGY**UNIT- I (6)**

1. Single burst and premature lysis experiment for phage host interaction
2. Productive cycle of T-odd phages
3. Productive cycle of lambda phage

UNIT- II (6)

1. Interaction of *Bacillus* phages and host.
2. Properties of lambda lysogeny
3. Brief details of lysogenic interactions of P2, P22, P1 and Mu1 phages.
4. Isolation and cultivation of DNA phages and RNA phages

UNIT- III (6)

1. Transmission of plant viruses (vector and non-vector)
2. Effects of viruses on plants- roots, stem, leaves flowers and fruits
3. Cultivation of plant viruses using live plants.

UNIT- IV (6)

1. Gene expression and replication strategies of- a)Poty virus b) potex virus c) TMV
d) Lettuce necrosis yellow virus

UNIT- V (6)

1. Cultivation of viruses in experimental animals and purification
2. Productive cycle of animal viruses having DNA (a.Herpes viruses, b.Parvo viruses)

UNIT- VI (6)

1. Productive cycle of animal viruses having RNA (a.Reo, b.Rhabdo, c.Picornia and d.Retro)

UNIT- VII (6)

1. Inhibition and inactivation of bacteriophages, animal viruses and plant viruses- photodynamic inhibition, inactivation by heat and radiations, inactivation by chemicals
2. 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.

UNIT- VIII (6)

1. Slow viruses and DI particles- discovery and importance
2. Viroids and prions- General properties, significance
3. Viral vaccines (newer- r DNA, DNA, carrier, synthetic peptide, subunit vaccines, anti-idiotypic)

REFERENCES:

- 1.General Virology- by Luria
- 2.Bacterial and bacteriophage genetics- by Edward A. Birge
- 3.Principles of Bacteriology, virology and immunology 8th edn 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, Robbert P.Ouklette
- 7.Molecular biology and biotechnology – by Walker and Gingold
- 8.Medical microbiology 2nd edn- by Mims, Playfour and Roitt
- 9.Brock's biology of microorganisms by Modigam
- 10.Advances in general microbiology vol.I- by Shrivastava

MIC – 103 GENETICS AND MOLECULAR BIOLOGY**UNIT – I (6)**

1. Origin of life- aspects of prebiotic environment and molecular evolution.
2. Organic evolution: concepts and theories, evidences, mechanisms of speciation, genetic basis of evolution - Hardy-Weinberg genetic equilibrium, genetic polymorphism and selection, coincidental and concerted molecular basis, gene duplication, composite transposons, evolutionary clock and sequence divergence, gene conversion, recombination and crossover fixation, ribozymes and evolution, sigma (σ) factor conservation, pseudogenes as dead ends of evolution, origin and evolution of economically important microbes, plants and animals, Darwinism.

UNIT – II (6)

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, C_0t curves and DNA reassociation constant, dosage compensation, genetic load.
3. Molecular basis of mitosis and meiosis

UNIT – III (6)

1. Evidences for nucleic acids as genetic material
2. Organization of genetic material: viral, bacterial (prokaryotic), eukaryotic- nuclear, organelle (mitochondria and chloroplasts), polytene and lampbrush chromosomes.

UNIT – IV (6)

1. Replication of DNA and duplication of chromosomes – machinery and rules, models and molecular mechanisms of DNA replication in viruses, bacteria (prokaryotes) and organelles (mitochondria, chloroplasts) and eukaryotes.
2. Transcription in prokaryotes and eukaryotes – machinery, initiation, elongation, termination, posttranscriptional processing of RNA, structure and stability of mRNA

UNIT – V (6)

1. Translation in prokaryotes and eukaryotes – machinery, activation of amino acids, initiation, elongation, termination and release, posttranslational processing.
2. Localization of proteins in cell - mechanisms of transport to various locations in and outside the cell.

UNIT – VI (6)

1. Molecular mechanism of homologous recombination in bacteria and other organisms – RecBCD and Ruv systems, Holliday junction, interallelic, specialized and site specific recombination, role of topoisomerases and gyrase in recombination, MAT, HML, HMR loci, HO and switching control, Gene targeting.
2. Restriction and modification of DNA – enzymes, molecular mechanisms and significance, types of systems, anti-restriction system, modification systems encoded by P1, Mu and other bacteriophages.

UNIT – VII (6)

1. Teratogenesis, chromosome aberrations, genetic disorders and differential gene activity, genetic counseling
2. Cancer and oncogenesis:
 - a. Theories and genes, transforming viruses, environmental factors causing cancer-carcinogens
 - b. 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.

UNIT – VIII

(6)

1. Techniques in molecular genetics
 - a. Basic techniques - PCR, LCR, Nick translation, Blotting techniques – Southern, Northern and Southwestern blotting, colony hybridization.
 - b. Applications - Chromosome walking, DNA foot printing and 16s rRNA analysis.
 - c. Transfection – protoplast fusion, electroporation.

REFERENCES

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 & Co., New Delhi
3. Organic Evolution *by* N. Arumugam
4. Organic Evolution *by* R. S. Lull, 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

MIC 104 MEDICAL MICROBIOLOGY AND IMMUNOLOGY -I**UNIT I (6)**

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 – Toxins (Diphtheria, Cholera, Clostridial, Staphylococcal, endotoxins of gram negative bacteria), extracellular enzymes (Coagulase, Lysozyme), lactoferrin and transferrin.

UNIT II (6)

1. Attributes of the host that determines resistance to microorganisms.
 - a) Mechanisms of non-specific host resistance (Phagocytosis- phagocytic cells, mechanism of phagocytosis)
 - b) Specific host defense mechanism- mechanism of elimination of pathogens
2. Bacterial survival mechanisms.

UNIT III (6)

1. Collection and transport of clinical specimens (clinical samples from throat, alimentary tract, urinogenital tract, conjunctiva, ear, blood.), preliminary processing of specimens
2. Methods of identification of infectious Microorganisms: Immunohistochemical technique, ELISA, FAT, RIA, western blot techniques, Immunoelectrophoresis (IEP), Immunodiffusion, Fluorescence Activated Cell Sorters

UNIT IV (6)

1. Serodiagnosis of diseases: Approaches for serodiagnosis, detection of antigen or antibody, diagnostic titer, Widal test, ASO, cold hemagglutination test, Weil-Felix test, Tuberculin test, PCR based diagnostic tests, Test for brucellosis. Paul- Bunnell test.

UNIT- V (6)

1. Cells of Immune system – T & B cells, NK cells, mononuclear phagocytes, granulocytes, dendritic cells,
2. MHC complex : structure, function, MHC polymorphism, assembly & presentation of peptide MHC complex.
3. Antigen processing & presentation :- The endocytic and cytosolic pathway, immunological synapse (structure & function)

UNIT- VI (6)

1. Signal transduction : Ras dependant and Jak/Stat pathway, signal transduction by IL-1, IL- 2 & T-cell antigen receptors.
2. T-cells sensitization : TCR signaling by CD 45 & CD 28, Interaction of T-cells with APCs.
3. Complement System : Regulation of complement pathways, biological consequences of activation, complement polymorphism.

UNIT- VII (6)

1. Genetics of antibody synthesis: Types of genes, location and positions of genes, genes for constant region, genes for variable region of immunoglobulin
2. Antibody diversity: Introduction, Mechanisms.

UNIT- V III**(6)**

1. Immunomodulation, potentiation, tolerance & suppression.
2. Vaccines :
 - a) r DNA : Methods of preparation – Preparation of DNA, DNA cloning vectors, DNA restriction endonucleases, DNA ligation, cloning strategy, cosmid cloning, identification of r DNA
 - b) DNA vaccines
 - c) Edible vaccines

REFERENCES

1. Basic and clinical immunology :- by Stites Daniel P., Stobo John D., Frudener H.H., Wells J.V.
2. Biotechnology application & research – by Paul N. Cheremisinoff & Robert P. Ouellette
3. Essential Immunology – by Roitt Ivan M.
4. Fundamentals of Immunology 2nd edn – by Myrrik Quentin N. & Weiser Russell S.
5. Immunobiotechnology – by Mahadav Sharma & Nirmal Tripathi
6. Immunology – by I Kannan,
7. Immunology 3rd edn – by Roitt Ivan M. , Brostoff Jonathan, Male Devid K.
8. Immunology 5th edn – by Richard A. Goldsby, Thomas J. Kindt, Barbra A. Osborne, Janis Kuby.
9. Immunology II – by Bellanti Joseph A.
10. Medical Immunology 9th edn - 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, Boswell Tim, and AlaAldeen Dlawer
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 by:- S Rajan MJP Publishers.
16. Principles and techniques in Practical Biochemistry by Wilson and Walker
17. Text book of microbiology :- by Vasanthkumari R.
18. The text book of Microbiology :- by Dubey R.C., Maheshwari D.K.

MIC-105 PRACTICAL COURSE -I

- 1) Isolation of peptidoglycan component of gram positive bacteria and its detection by chromatography
- 2) Isolation of cell wall lipopolysaccharide component of gram negative bacteria and its detection by chromatography.
- 3) Observation of lipid granules in *Bacillus* spp. by Burdons method
- 4) Isolation of lipid granules from *Bacillus* spp.
- 5) Isolation and morphological studies of Algae – *Spirulina*
- 6) Isolation and identification of fungi- *Aspergillus* spp., *Penicillium* spp., *Rhizopus* spp. *Fusarium* spp. (slide culture)
- 7) Isolation of yeasts from different sources.
- 8) Study of cultural and morphological characteristics of yeasts.
- 9) Induction of ascospores in yeasts *Saccharomyces cerevisiae* and observation of ascospore.
- 10) Isolation and cultivation of Actinomycetes, (Cover slip and slide culture)
- 11) Isolation, titration and high titer stock preparation of *E. coli* phages from sewage.
- 12) Phage typing of *E. coli*.
- 13) Demonstration of egg inoculation techniques.
- 14) Study of one step growth of T-4 phage
- 15) Isolation of plaque morphology mutants of phages by using UV radiations
- 16) Isolation of plaque morphology mutants of phages by using chemical mutagen.

MIC-106 PRACTICAL COURSE -II

- 1 Staining and microscopic observation of nuclear material of bacteria and yeasts – Feulgen and Giemsa methods.
- 2 Isolation of DNA from bacteria and yeasts.
3. Isolation of RNA from microorganisms
4. Curing and isolation of bacterial plasmids
5. Thermal denaturation of DNA
6. Determination of base composition of DNA and RNA
7. Southern blotting (demonstration)
8. Detection of polytene chromosome and chromosome banding in chironomous larva salivary glands.
9. Detection of gene transfer by transformation in *E. coli*
10. Detection of gene transfer by conjugation in *E. coli*
11. Preparation of bacterial protoplast and detection of protoplast fusion in bacteria.
12. Performing fluctuation test
13. Estimation of mutation rates in *E. coli*
14. Testing of chemicals for mutagenicity by Ame's test.
15. Rosset test for detection of T and B lymphocytes.
16. CRP test, ASO test, RA test
17. Detection of phagocytosis and determination of phagocytic index.

MSc –I SEMESTER-II**MIC – 201 TECHNIQUES IN MICROBIOLOGY****UNIT – I (6)**

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

UNIT – II (6)

1. 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.
2. Isolation of human and animal pathogenic fungi
3. Microscopic techniques –
 - a. Electron microscopy – principles and working of transmission and scanning microscopes, preparation of specimens.
 - b. Dark field, phase contrast, polarisation, differential interference contrast (DIC), fluorescence, confocal scanning, stereo microscopes
 - c. Image analysis, video microscopy.

UNIT – III (6)

1. Spectroscopy –
 - a. Principles, instrumentation and applications of UV-visible spectrophotometry and colorimetry.
 - b. Principles of IR and Raman spectrophotometry, turbidimetry and nephelometry, fluorimetry, luminometry, circular dichroism and optical rotational dichroism spectrophotometry, ESR, NMR and Mass spectroscopy.
 - c. X – ray crystallography

UNIT – IV (6)

1. Chromatography – general principles and working of
 - a. Column chromatography – adsorption, partition, gel, ion exchange chromatography
 - b. Gas chromatography and HPLC

UNIT – V (6)

1. Electrophoresis – general principles of moving boundary and zonal electrophoresis, electroendosmosis.
 - a. Polyacrylamide gel electrophoresis (PAGE) - native and gradient gels, DNA Sequencing gels, SDS-PAGE, isoelectric focusing, 2-D PAGE
 - b. Cellulose acetate, continuous flow elutriation

UNIT – VI (6)

1. Radioisotopic techniques –
 - a. Nature of radioactivity and general principles of radioisotopic techniques
 - b. Methods of detection of radioactivity – gas ionization (GM counter), excitation (scintillation) and exposure of photographic emulsions (autoradiography).
 - c. Methods of using radioisotopes – radioisotope tracer technique, isotope dilution assay and other methods
2. Electrochemical techniques – general principles of electrochemical cells, potentiometry and voltametry, principles and applications of the pH, ion selective and oxygen electrodes

UNIT – VII**(6)**

1. Cell disruption methods – principles and methods of disruption of microbial, plant and animal cells and separation of cellular components
2. Centrifugation – basic principles, types of centrifuges and rotors, principles of differential and density gradient centrifugation, sedimentation coefficient determination.
3. Ultrafiltration – principles and application, materials used, nanofiltration, reverse osmosis

UNIT – VIII**(6)**

1. Accuracy and workmanship in laboratory quality control:
 - a. Units of measurement – metric system, conversions, units in preparation of solutions, laboratory calculations, ratios and dilutions
 - b. Accuracy in preparation of solutions, media, etc.
 - c. Qualifications of equipment – design (DQ), installation (IQ), operational (OQ), performance (PQ).
 - d. Validation and calibration
 - e. Documentation
2. Safety in the laboratory:
 - a. Common hazards in the laboratory –
 - i. Electrical equipment
 - ii. Chemicals – corrosive, irritant, toxic, flammable, explosive
 - iii. Ionising radiations
 - iv. Infectious materials
 - b. Safety measures –
 - i. In the use of electrical equipments
 - ii. Personal protection
 - iii. Waste disposal
 - iv. First aid

REFERENCES:

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 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. Methods of Protein and Nucleic acid Research
11. Analytical Biochemistry (Biochemical Techniques) by P. Asokan, Chinna Publications

MIC- 202 MICROBIAL PHYSIOLOGY, BIOCHEMISTRY AND METABOLISM**UNIT- I (6)**

1. Carbohydrate metabolism: Citric acid cycle- steps involved, amphibolic nature, anaplerotic reactions.
2. Autotrophy and heterotrophy- Concept, factors for, types of autotrophs, mechanisms
3. Pasteur and Crabtree effect

UNIT- II (6)

1. Respiratory metabolism-
 - a) Mitochondrial ETC- structure of mitochondrion, ETC, shuttle system across membrane, Atkinson's energy charge.
 - b). Aerobic respiration in chemolithotrophic bacteria- nitro and nitroso group
2. Photo-phosphorylation in bacteria- Photosynthetic and non-photosynthetic ETC, cyclic and non-cyclic photophosphorylation.

UNIT- III (6)

1. Protein chemistry- Structure of peptide bond, stabilization of conformation,
 - a) secondary structure, alpha helix, beta conformation, Ramachandran plot,
 - b) tertiary structure,
 - c) quaternary structure
2. Lipid chemistry- Types and nomenclature of fatty acids, Types of lipids, structural aspects of Steroids, terpenes and prostaglandins
3. Chemistry of vitamins – Types, structure and functions of vitamins.

UNIT- IV (6)

1. Biosynthesis of amino acids
2. Biosynthesis of saturated fatty acids
3. Purine and pyridine biosynthesis- denovo pathway and salvage pathway

UNIT- V (6)

1. Catabolism of amino acids. (General reactions)
2. Oxidation of aliphatic hydrocarbons- Alkanes and alkenes- alpha, beta and omega oxidation;
3. Oxidation of aromatic hydrocarbon- beta keto acetyl pathway, valerate pathway and gentisate pathway
4. Drug metabolism in body, mechanisms of detoxification of various substances

UNIT- VI (6)

1. Fermentation of saccharolytic clostridia
2. Fermentation of proteolytic clostridia
3. Fermentation of propionic acid bacteria

UNIT- VII (6)

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

UNIT- VIII**(6)**

1. Oxygen toxicity- mechanism of oxygen toxicity, mechanism to overcome the toxicity- catalase, peroxidase, and superoxide dismutase
2. Microbial hormones
3. Quorum sensing in microorganisms

REFERENCES

1. Text book of biochemistry 4th edn by West, Tood, Mason and Burgen
2. Principles of biochemistry 5th edn, by White, Handler, Smith
1. Lehninger's principles of biochemistry by Nelson kocs.
2. Biochemistry by Zubay
3. Elements pf Biochemistry by O.P. Agrawal
4. Bacterioal metabolism by Doelle
5. Bacterial metabolism by Gotschalk
6. Advances in general microbiology by Shrivastava
7. Biochemistry by Strior

MIC 203: MEDICAL MICROBIOLOGY AND IMMUNOLOGY -II**UNIT I (6)**

Bacterial Diseases- Causative agent- morphological, cultural, biochemical, antigenic characters; lab diagnosis, transmission, prevention and control of diseases caused by *Borrelia*, *Bordetella pertussis*, *Rickettsia burnetti*, *Legionella* and *Streptococcus mutans*

UNIT II (6)

Fungal Diseases: Etiology, clinical features, pathogenesis, laboratory diagnosis, prevention and control of a) Superficial Mycoses, b) Subcutaneous Mycoses. c) Systemic Mycoses.

UNIT III (6)

Etiology, clinical features, pathogenesis, Laboratory diagnosis, prevention & control of -
 1. Diseases caused by - Herpes virus, Yellow fever virus, Encephalitis virus, Rubella and Rubiolla virus, Cytomegalo virus, SARS virus,
 2. Diseases caused by Protozoa - Leishmaniasis & Giardiasis.

UNIT IV (6)

1. Pathology of AIDS and prevalence of Tuberculosis, Mycoplasma and *Cryptococcus* infection.
2. Special microbial metabolites and their applications in health care – Lovastatin, Daunorubicin

UNIT- V (6)

Tumor immunology: Development of tumors, Antigen of tumor cells, immunological mechanisms against tumor cells, escaping of tumor cells from immune response, immune surveillance, immunocompromise & cancer, congenital immunodeficiency & neoplasia, cancer in organ transplant recipient & auto immune disorders, HIV & cancer, Immunotherapy & immunoprophylaxis of human cancer.

UNIT- VI (6)

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

UNIT- VII (6)

1. B-cell immunodeficiency disorder : X-linked agammaglobunaemia, selective Ig – A & Ig – M deficiency
2. T-cell immunodeficiency disorder: Congenital thymic aplasia
3. Combined B-cell & T-cell immunodeficiency disorder: Ataxia telangiectasia, graft versus host disease.

UNIT- VIII (6)

1. Complement disorder : complement component deficiency
2. Rheumatic disease : Systemic lupus erythematosus.
3. Atopic diseases : Allergic rhinitis & asthma
4. Autoimmune diseases : Organ specific & systemic autoimmune diseases, mechanism of induction of autoimmunity, treatment

REFERENCES

1. Basic and clinical immunology :- by Stites Daniel P., Stobo John D., Frudenber H.H., Wells J.V.
2. Medical Microbiology :-13th Edition by Jawetz Ernest, Melnick Joseph L, Adelberg Edward A.
3. Medical Microbiology :-6th Edition by Gupte Satish Jaypee Brothers,
4. Medical Microbiology :- by Irving William, Boswell Tim, and AlaAldeen Dlawer
5. Medical Microbiology :- by Cruickshank Robert, Duguid J.P., Marmion B.P., Swain R.H.A.
6. The text book of Microbiology :- by Dubey R.C., Maheshwari D.K.
7. Text book of microbiology :- by Vasanthkumari R.
8. Medical Microbiology by:- S Rajan MJP Publishers.
9. Immunology II – by Bellanti Joseph A.
10. Medical Immunology 9th edn - by Daniel P. stites, Abba I Terr, Tristram G. Parslow.
11. Immunology – by I Kannan,
12. Immunobiotechnology – by Mahadav Sharma & Nirmal Tripathi
13. Biotechnology application & research – by Paul N. Cheremisinoff & Robart P. Ouellette
14. Immunology 5th edn – by Richard A. Goldsby, Thomas J. Kindt, Barbra A. Osborne, Janis Kuby.
15. Fundamentals of Immunology 2nd edn – by Myrrik Quentin N. & Weiser Russell S.
16. Essential Immunology – by Roitt Ivan M.
17. Immunology 3rd edn – by Roitt Ivan M. , Brostoff Jonathan, Male Devid K.

MIC – 204 MICROBIAL ECOLOGY**UNIT – I (6)**

1. Concept and importance of microbial ecology, energy flow, attachment properties of microbes.
2. Microbial communities and ecosystems - Development of microbial communities, structure , ecosystems .

UNIT – II (6)

1. The soil environment – General description of soil, texture, structure, chemical properties, soil types and their microflora.
2. Decomposition of Hemicelluloses, starch, pectic substances, inulin and chitin.

UNIT – III (6)

1. Transformations of–Sulphur, iron, potassium, manganese, hydrocarbons and pesticides.

UNIT – IV (6)

1. Rhizosphere – Microflora, rhizospheric effect, Nitrogen fixation in rhizosphere associative and antagonistic activities of rhizosphere, rhizobacteria
2. The aquatic environment - Properties of water, types of aquatic environments, physical, chemical factors affecting microbial population energy flow.

UNIT – V (6)

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 .

UNIT – VI (6)

1. 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 .

UNIT – VII (6)

1. Atmosphere - Atmoecosphere characteristics and stratification of atmosphere, microbial dispersal through air, microorganisms in atmosphere.
2. Microbiology of extreme environments – Hot springs,acid springs and lakes, sea and salt lakes, Antarctica, ocean bottom .

UNIT – VIII (6)

1. Biological interactions –
 - a. Microbe – Microbe interactions
 - b. Microbe – Plant interactions
 - c. Microbe – Animal interactions

REFERENCES

1. Microbial Ecology by Lynch et al.
2. Experimental microbial ecology by Burns et al.
3. Environmental Microbiology (2004) by K. Vijaya Ramesh, MJP Publishers
4. Soil Microbiology (2006) by N.S. Subba Rao Oxford & IBH Publishing Co. PVT. LTD.
5. Introduction to Soil Microbiology (1961) by Martin Alexander, John Wiley & sons , INC. New York , London
6. Microbial Ecology (1993) by Ronald M. Atlas and Richard Bartha

MIC – 205 PRACTICAL – III

- 1 Closed system enrichment of *Azotobacter*, *Salmonella*, *Shigella*, alkali tolerant urea decomposing bacilli.
- 2 *In situ* enrichment of chitin degrading bacteria in soil
- 3 Separation of chemo-organotrophic spirilla and spirochaetes in soft agar and capillaries.
- 4 Enrichment of *Clostridium* species in potato, Thioglycollate broth and Robertson's Cooked Meat medium
- 5 Verification of Beer's law, determination of absorption spectrum, molar extinction coefficient and difference spectra
- 6 Chromatography –
 - a. 2-D paper chromatography of amino acids / sugars
 - b. TLC of dyes / sugars / lipids
 - c. Ion exchange chromatography of aminoacids / proteins
7. Electrophoresis –
 - a. SDS – PAGE
 - b. Cellulose acetate electrophoresis of proteins
8. Centrifugation – Density gradient centrifugation of pollen grains and yeast cell sizing
9. Preservation of microbial cultures –
 - a. Slant cultures of aerobic and facultative organisms
 - b. Stab cultures of microaerophilic organisms
 - c. Soil culture technique for spore formers
 - d. High titre stock of coliphages
10. Yeast cell disruption and separation of its organelles by differential centrifugation
11. Study of galactose transport in yeasts
12. Obtaining synchronous culture in yeasts *Saccharomyces cerevesiae*
13. Obtaining continuous culture of bacteria
14. Determination of specific growth rate and generation time of *E. coli*
15. Estimation of protein content of bacteria
16. Estimation of carbohydrate content of bacteria
17. Determination of nucleic acid (DNA, RNA) content of bacteria
18. Study of effect of hypo- and hyper- tonic conditions on cells.

MIC – 206 : Practical Course - IV

1. Study of soil moisture content, PH, temperature & nitrogen content
2. Qualitative and Quantitative study of soil Microflora
3. Microbial degradation of cellulose
4. Microbial degradation of hydrocarbons and pesticides
5. Qualitative and quantitative study of air microbiology
6. Enumeration & study of rhizospheric microflora
7. Isolation of thermophilic bacteria from soil
8. Isolation of acidophilic and alkalophilic bacteria and detection of protease and amylase production.
9. Isolation of psychrophilic bacteria.
10. Isolation of psychrotrophic bacteria and detection of lipase production
11. Isolation of halophilic and halotolerant bacteria
12. Isolation of etiological agent of dental caries & its drug sensitivity studies
13. Detection of virulence in Staphylococcal infection by coagulase test.
14. Antibiotic sensitivity against Urinary tract infections (UTI)
15. Widal test
16. ELISA test
17. Haemagglutination test

EQUIVALENCE FOR THEORY PAPERS.
(From June-2009)
M.Sc. Part I Semester- I

Pre Revised Syllabus		Revised Syllabus	
Paper No.	Title of the Paper	Paper No.	Title of the Paper
	Mic-101 Morphology Cytology and Taxonomy of microorganisms		Mic-101 Morphology Cytology and Taxonomy of microorganisms
	Mic-102 Virology		Mic-102 Virology
	Mic-103 Microbial genetics		Mic-103 Genetics & Molecular biology
	Mic-104 Medical microbiology & Immunology-I		Mic-104 Medical microbiology & Immunology-I

EQUIVALENCE FOR THEORY PAPERS.
(From June-2009)
M. Sc. Part I Semester- II

Pre Revised Syllabus		Revised Syllabus	
Paper No.	Title of the Paper	Paper No.	Title of the Paper
	Mic-201 Bio-chemical, Biophysical, Microbiological techniques		Mic-201 Techniques in Microbiology
	Mic-203 Microbiological Physiology Biochemistry & metabolism		Mic-202 Microbiological Physiology Biochemistry & metabolism
	Mic-204 Medical microbiology & Immunology-		Mic-203 Medical microbiology & Immunology
	Mic-202 Molecular biology & genetics		No equivalence Paper