



***** B+
Accredited By NAAC
New Syllabus For
M.Sc.
APPLIED MICROBIOLOGY

Syllabus to be implemented from June 2012 onwards.

SHIVAJI UNIVERSITY, KOLHAPUR

Structure of M.Sc. Degree Course for Applied Microbiology

Syllabus to be implemented from June 2012 onward

A prime objective to maintain updated curriculum and providing therein inputs to take care of fast paced developments in knowledge of Applied Microbiology and in relation to international context, a two year programme is formulated for M.Sc. Applied Microbiology as per UGC guidelines and to develop competent microbiologists to achieve desirable placements in the country and abroad. The programme obliges students to read original publications and envisages significant inputs in the laboratory work, communication skill, creativity, planning, execution and critical evaluation of the studies undertaken. In addition to disciplines viz. Virology, Immunology, Genetics, Molecular Biology, Enzymology, Biostatistics, Bioinformatics, Scientific writing, Computer Science etc. The overall structure of the course to be implemented from the academic year 2012 – 2013 onwards is as given below,

1) The entire M.Sc. Course in Applied 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 and a compulsory 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 of 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 journals 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 of minimum half an hour 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 instruction / R & D Departments during semester II and 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 VIII) 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 given by university examiners through 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.

***Note :** The Standard of passing and other rules are applicable as per other M.Sc. Courses

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 microbial 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.

Structure Of Course

M. Sc. Part I

Semester I

MIC(A) 101 : Morphology and Taxonomy of Microorganisms

MIC(A) 102 : Virology

MIC(A) 103 : Biomolecules and Bioenergetics

MIC (A) 104 : Genetics I

Practical Course : I

Practical Course : II

Semester II

MIC (A) 201 : Bio-instrumentation

MIC (A) 202 : Genetics II

MIC (A) 203 : Microbial Biochemistry

MIC (A) 204 : Medical Microbiology

Practical Course : III

Practical Course : IV

M. Sc. Part II

Semester III

MIC (A) 301 : Microbial Ecology & Extremophiles

MIC (A) 302 : Biostatistics, Bioinformatics And Scientific Writing

MIC (A) 303 : Genetic Engineering.

MIC(A) 304 : Immunology.

Practical Course : V

Practical Course : VI

Semester IV

MIC(A) 401 : Industrial Microbiology

MIC (A) 402 : Bioprocesses

MIC (A) 403 : Industrial Waste Management Andmicrobial Bioremediation

MIC (A) 404 : Quality Control Management In Industry

Practical Course : VII

Practical Course : VIII

Equivalence

	Paper NO	New	Old
M. Sc. Part I Semester I	MIC(A) 101	Morphology and Taxonomy of Microorganisms	Morphology and Taxonomy of Microorganisms
	MIC(A) 102	Virology	Virology
	MIC(A) 103	Biomolecules and Bioenergetics	Biomolecules and Bioenergetics
	MIC (A) 104	Genetics I	Genetics
Semester II	MIC (A) 201	Bio-instrumentation	Bio-instrumentation
	MIC (A) 202	Genetics II	Molecular Biology and Genetics
	MIC (A) 203	Microbial Biochemistry	Microbial Biochemistry
	MIC (A) 204	Medical Microbiology	Medical Microbiology and Immunology
M. Sc. Part II Semester III	MIC (A) 301	Microbial Ecology & Extremophiles	Microbial Ecology & Extremophiles
	MIC (A) 302	Biostatistics, Bioinformatics And Scientific Writing	Biostatistics, Bioinformatics And Scientific Writing
	MIC (A) 303	Genetic Engineering	Genetic Engineering
	MIC (A) 304	Immunology	Medical Microbiology and Immunology
Semester IV	MIC(A) 401	Industrial Microbiology	Industrial Microbiology
	MIC(A) 402	Bioprocesses	Bioprocesses
	MIC(A) 403	Industrial Waste Management And microbial Bioremediation	Industrial Waste Management And microbial Bioremediation
	MIC(A) 404	Quality Control Management In Industry	Quality Control Management In Industry

M. Sc. Part I
Semester I
Applied Microbiology New Syllabus (2012-13)
MIC(A) 101 : Morphology and Taxonomy of Microorganisms

UNIT- I **6**

Bacterial Classification I:

- a) Classification of prokaryotic organisms an overview.
- b) Numerical taxonomy.
- c) Nucleic acids in bacterial Classification.

UNIT -II **6**

Bacterial Classification II :

- a) Genetic methods .
- b) Serology and chemotaxonomy.
- c) Bacterial Nomenclature.
- d) Identification of Bacteria.
- e) 16S r RNA technique.

UNIT -III **6**

Archaeobacteria :

- a) General characteristics,
- b) morphology and classification.
- c) Study of Methanogenic Archaeobacteria.

UNIT –IV **6**

Rickettsia :

- a) General characteristics
- b) Morphology,
- c) Classification.

Actinomycetes:

- a) General characteristics,
- b) Morphology,
- c) classification.

UNIT-V **6**

A) Yeast :

- a) General characteristics,
- b) Morphology,
- c) classification and study of *Sacchromyces spp.*

B) Molds :

- a) General characteristics,
- b) morphology,
- c) Recent scheme of classification.

UNIT-VI

6

A) Cyanobacteria :

- a) General characteristics,
- b) Morphology and Significance.

B) Algae :

- a) General characteristics,
- b) Morphology,
- c) Recent scheme of classification.

UNIT- VII

6

A) Mycoplasma and PPLO :

- a) General characteristics ,
- b) Morphology & Classification

B) Myxobacteria :-

- a) General characteristics,
- b) Morphology and classification .
- c) Enrichment and Isolation .

UNIT- VIII

6

The Chemoautotrophic bacteria:

- a) General characteristics and significance of –
- b) Nitrifying bacteria,
- c) Iron bacteria,
- d) Hydrogen bacteria,

Reference:-

- 1) Bergey's Manual of Determinative bacteriology.
- 2) Bergey's Manual of systemic bacteriology- Vol.I,II,III & IV
- 3) C.J.Alexopoulos
- 4) C.W.mims
- 5) R.J.Mehrotra & K.R.Aneja
- 6) Sharma
- 7) Vashista
- 8) S.K. Singh
- 9) Fungi – John Webster & Roland Weber.
- 10) The yeast –A.H. Rose
- 11) Alexopoulos C.J.Introductory Mycology, 7 th Edn Willy Estern Pvt Ltd . New Delhi.

MIC(A) 102 : VIROLOGY

UNIT -I

6

Bacterial Viruses :

- a) One step growth experiment - single burst experiment.
- b) Productive cycle of λ (lambda) O (phi) X 174.
- c) Lysogeny of μ phage comparative study of lysogeny of P1,P2,P22.
- d) RNA phages –Types and life cycle.
- e) Isolation & cultivation of DNA & RNA phages.

UNIT- II

6

Animal Viruses :

Productive cycles of -

- a) DNA viruses- Parvo,Adeno.
- b) RNA viruses – Reo,Rhabdo,Picorna,Influenza,Retroviruses.

UNIT –III

6

Cultivation and Enumeration of animal Viruses :-

- a) Cultivation of Viruses – in embryonated eggs, experimental animals,cell lines,
- b) Cultivation of insect viruses.
- c) Enumeration of viruses – Direct microscopic count ,plaque method, end point method.(LD 50)

UNIT-IV

6

Plant Viruses :

- a) Transmission of plant viruses.
- b) Effect of viral infection on plants , Symptom.
- c) Plant disease - TMV structure, host range, gene expression and replication of viral genome,,TMV life cycle, serological tests for diagnosis , control measures.

UNIT-V

6

Human viral diseases:

- a) Nature of virus reservoirs.
- b) Viral epidemiology in small & large population.
- c) Animal model to study viral pathogenesis- a mouse model for study of Pox infection and its spread.
- d) Common viral diseases – H₁N₁ , mumps, measles.

UNIT-VI

6

Laboratory diagnosis of viral diseases :

- a) Principles of viral diagnosis.
- b) Collection and transport of clinical samples.
- c) Diagnostic techniques – microscopic techniques , nucleic acid based techniques, immunodiagnostic techniques.
- d) Reporting of results.
- e) Safety measures during diagnosis -

Treatment of Viral diseases :

- a) Antiviral chemotherapy – general approach, principles involved , Chemicals of therapeutic use inhibition of viral entry, inhibition of Viral nucleic acid replication and inhibition of viral protein function .
- b) Viral vaccines –
 - i) Conventional vaccines –killed & attenuated
 - ii) Modern Vaccines –rDNA, DNA, carrier synthetic peptide, subunit vaccines, antidiotypic.

Recent concepts in Virology :

- a) General properties and significance of viroids and Prions.
- b) Slow viruses and DI particles.
- c) Viruses – Threat of bioterrorism,
- d) Viruses as therapeutic agent,
- e) Viruses for gene delivery,
- f) Viruses to destroy other viruses.

References :

- 1) Microbiology : Third edition
Bernard Davis, Renato dublecco, HN NEisen and Harold S Ginsberg.
- 2) Basic Virology : 3rd edition, Edward Wagner, Martinez J Hewlett, David Bloom, David Camerini,
Blockwell Publishing USA.
- 3) International students edition –
Mackie and McCartney - Practical Medical Microbiology, J. G. Collee, J. P. Duguid, A. G. Fraser, B. P. Marmion.
13th Edition – Churchill Livingstone.
- 4) Zinsser Microbiology : 15th Edition
W. K. Joklik David T. Smith.
Appleton – Century – Crofts / New York.
A Publishing Division of Prentice Hall Inc.
- 5) Virology by Luria – General virology
- 6) Genetics of bacteria and viruses – William Hays
- 7) Introduction to Plant Virology – Bos I. (1983) Longman, London & New York.
- 8) Animal Virology – Fenner F. & White D. O. (1976) Academic Press Inc. New York.
- 9) Chemistry of Viruses 2nd Edn. Knight C. A. (1975) Springer Vaerlag Inc. New York.
- 10) Virology by Delbecco & Ginsgergs (1980) Harper & Ravi Publishers, New York.
- 11) Principles of Bacteriology, Virology & Immunology -8th edition Vol.IV
Topley and Wilson.
- 12) Field's Virology – Vol.I & Vol.II – Lipinott.
- 13) Methods in Virology – Edited by Karl Maramorosch & Hillary Koprowrki ,Vol.

MIC(A) 103 : Biomolecules and Bioenergetics

UNIT -I

6

Biomolecules :

Amino acids,Peptides and Polypeptides.

- Structure and Classification of amino acids – Neutral, acidic, basic and aromatic .
- Properties of amino acids- acid base nature ,Titration curve of glycine,electric charge.
- Peptide bonds and its nature.
- Peptide and polypeptides-Introduction,Ionisation,Behavior,Size and composition
- Properties of biological active peptides and polypeptides ex.Insulin,RNA polymerase.
- Polypeptide diversity.

UNIT -II

6

Proteins :

- Structural levels of proteins.
 - Primary structure –(ex.Oxytocin)
 - Secondary structure – (ex. α –keratin)-alpha helix, beta pleated structure, B-turn,
 - Tertiary structure – (e.g. myoglobin)
 - Quaternary structure –(Hemoglobin)
- Folding pathways for protein structure.
- Role of chaperon in protein folding)
- Diseases caused by misfolding.
- Protein stability –forces that stabilize protein structure
- Denaturation and Renaturation of protein.
- Reverse turns and Ramchandran plot.

UNIT -III

6

Determination of protein structure:

- Importance of amino acid sequencing.
- Sanger method
- Dansyl chloride & Debsyl chloride method.
- Edman degradation method & Autoanalyser.
- Enzymatic cleavage of protein to determine the structure.
- Prediction of conformation of protein structure from amino acid sequence.
- Study of surface properties of proteins by using potein ligand interaction, Monoclonal antibodies and fluorescence techniques

UNIT- IV

6

Carbohydrates:

- Monosaccharides and related compounds. Classification,structure of aldoses andketoses.
Configuration and conformation of monosaccharides
- Disaccharides –Lactose ,Sucrose.
- Polysaccharides –
 - Homopolysaccharide . Steric forces and hydrogen bonding in homopolysaccharide folding.Structure and role of starch,glycogen,cellulose,heparin,hyaluronate.
 - Heteropolysaccharide in bacterial and algal cell wall. e.g.agar and agarose.
- Glycoconjugates-Proteoglycan,Glycoprotein Glycolipids.

UNIT-V

6

Lipids :

- a) Definition and classification
- b) Fatty acids – general formula, nomenclature and chemical properties,
- c) Structure, function and properties of simple lipids, complex lipids, acylglycerols, phosphoglycerides, sphingolipids, waxes, terpenes, steroids and prostaglandins.

UNIT- VI

6

Vitamins :

- a) Introduction, definition and properties.
- b) Structure and forms of Coenzymes.
- c) Classification, mode of action, Sources and daily requirement,
- d) Deficiency of Vitamins e.g. Thiamine, Pyridoxine, Niacin, Riboflavin and Vit C.

UNIT-VII

6

Bioenergetics :

- a) Thermodynamic principles- laws of thermodynamics, Oxidation, reduction reactions redox couples.
- b) Oxidative phosphorylation - Architecture of mitochondria. Electron transport reactions in mitochondria.
- c) Electron transport chain in prokaryotes & eukaryotes.
- d) Mechanism of ATP synthesis- Chemiosmotic model.
- e) Uncouplers and Inhibitors of ETC.

UNIT-VIII

6

Photosynthesis :

- a) General features of photophosphorylation, Evolution of oxygenic Photosynthesis
- b) General photochemical events-Light driven electron flow.
- c) Photochemical reaction centers in bacteria-
Pheophytin- Quinone center and Fe-S center, photosystem II of Cyanobacteria.
- d) Photosynthetic pigments in *Halobacterium*.
- e) Photochemical reaction centers in plant- Photosystem I & II.
- f) Electron flow in I & II photosystem –Z scheme
- g) ATP synthesis by photophosphorylation

References :

- 1) Biochemistry by Zubey vol I,II,III.
- 2) Lehninger's Biochemistry by Nelson & Cox 5th Edition.
- 3) Biochemistry by Lubert Stryer-2010
- 4) Principles of Biochemistry – White & Smith
- 5) Lehninger's Principles of Biochemistry – Nelson & Cox
- 6) Biochemistry by Voet & Voet.
- 7) Practical Biochemistry – David Plummer
- 8) Elements of Biochemistry – Shrivastava.
- 9) Practical Biochemistry for Students – Malhotra.
- 10) Biochemical methods – Sadasivam
- 11) The Cell-Cooper
- 12) Biochemistry and Molecular Biology of Plants-B.Buchanan, W.Cruissem R.Jones.
- 13) Biochemistry – Chemical reactions of living cell. Vol I and II by David Metzie

MIC (A) 104 : Genetics

UNIT- I

6

Mendelism :

- a) Monohybrid crosses and Mendels' Principle of segregation.
- b) Dihybrid crosses and Mendelian principle of independent assortment
- c) Epistasis
- d) Statistical analysis of Genetic data. The Chi-square test.
- e) Multiple alleles – ABO blood groups.
- f) Essential genes and lethal genes.
- g) The environment and gene expression

UNIT- II

6

Non Mendelian Inheritance :

- a) Determining Non Mendelian Inheritance
- b) Maternal effects.
- c) Cytoplasmic inheritance (Mitochondria, chloroplast, infective particles)

UNIT -III

6

Structure of chromosomes:

- a) Lampbrush chromosomes
- b) Polytene chromosomes
- c) Heterochromatin – defense against mobile DNA elements.
- d) Mitotic chromosomes – their patterns

UNIT- IV

6

Chromosomal DNA and its packaging :

- a) Prokaryotic and eukaryotic chromosome
- b) Nucleosome core particle – Histone, non-histone
- c) ATP driven chromatin remodeling machines.
- d) Covalent modification of Histone tails
- e) Split genes – Exon, Intron, detection of intervening sequences, β -chains of haemoglobin, ovalbumin.
- f) Splicing mechanism i) Autocatalytic RNA ii) Spliceosome

UNIT -V

6

DNA replication :

- a) Mechanism of replication
- b) Enzymes involved – DNA ligase, DNA gyrase, topoisomerase I, DNA polymerases, Helicase.
- c) Proof reading, strand directed Mismatch repair
- d) Replication in prokaryotes (*E. coli*).
- e) Replication in Eukaryotes and organelle (chloroplast and mitochondria).

UNIT- VI

6

Gene transfer -I :

- a) **Transformation** – Discovery, mechanism, mapping by transformation and uses of transformation.
- b) **Conjugation** – Conjugation in E.coli and other microorganisms

UNIT-VII

6

Gene transfer - II :

Transduction –

- i) Generalized co-transduction and linkage specific transfer of a lysogen.
- ii) Protoplast fusion, electro poration.
- iii) New modes of gene transfer in archibacteria and other organisms.

UNIT-VIII

6

Plasmids :

- a) Structure & properties of plasmid, plasmid DNA, Tra operons in conjugative plasmids
- b) Replication, compatibility & inhibition.
- c) Detection and purification
- d) Evidences for involvement for plasmid in microorganism.
- e) Applications

Refernces :

- 1) Principles of Genetics – Gardener
- 2) Genes by Lewin – V and IX
- 3) Microbial Genetics – Friefelder
- 4) Gene – Watson
- 5) Genetics – Klug & Commings.

Practical Course : I

- 1) Isolation and Morphological Studies of Algae – Spirogyra,Chorella
- 2) Cultivation and study of morphological characters of Blue Green Algae (BGA),
Spirulina, Oscillatoria, Nostoc.
- 3) Morphological Study of– *Aspergillus, Penicillium, Rhizopus, Fusarium, Pithium, Alternaria*.
- 4) Isolation cultivation and Morphological Studies of Actinomycetes.
- 5) Isolation of *E. coli* phages from sewage and determination of titre.
- 6) Preparation of high titre stock of *E. coli* phages and their preservation.
- 7) Study of One step growth curve of T4 phages.
- 8) Isolation of plaque morphology mutant of T4 phages by using U. V. Radiation.
- 9) Isolation of temperature sensitive mutant of T4 phages by using U. V. Radiation
- 10) Determination of multiplicity of infection in *E. coli* and *Salmonella* by various phages.
- 11) Mechanical transmission of plant virus – TMV local lesion method..
- 12) Demonstration of Egg inoculation technique .
- 13) Induction of ascospore in *Saccharomyces cerevisiae*.
- 14) Isolation of Yeast and molds from foods
- 15) Isolation of spores of VAM fungi from soil and their identification.
- 16) Study of cyanobacteria with the help of permanent slides

Practical Course : II

- 1) Estimation of bacterial protein by Biuret method.
- 2) Isolation of casein from milk based on isoelectric pH and determination of its yield.
- 3) Isolation and characterization of starch from potatoes.
- 4) Quantitative estimation of amino acids by using Ninhydrin reagent.
- 5) Detection of changes in the confirmation of BSA by viscosity measurement.
- 6) Identification of 'C' terminal amino acid of protein by using Carboxypeptidase.
- 7) Estimation of glucose from blood by Folin Wu method.
- 8) Isolation of chromosomal DNA from bacteria.
- 9) Estimation of DNA by Diphenyl amine.
- 10) Isolation of bacterial plasmids (amplification and purification).
- 11) Curing of bacterial plasmids using curing agent.
- 12) Isolation of RNA from yeast.
- 13) Estimation of RNA by Bial's orcinol method.
- 14) Study of bacterial conjugation.
- 15) Study of bacterial trasduction.
- 16) Isolation and characterization of photosynthetic pigment Chlorophyll 'a' and 'b' from plant.
- 17) Separation of photosynthetic pigment Chlorophyll and Caretonoid by TLC.
- 18) Estimation of Vit. C from biological source.

**M. Sc. Part I,
Semester II
MIC (A) 201 : Bio-instrumentation**

UNIT-I

6

Fundamentals of technology :

- a) General scheme for purification of bio-components.
- b) Methods for studying cells and organelles.
- c) Sub cellular fractionation and marker enzymes.
- d) Methods for lysis of plant, animal and microbial cell.
- e) Ultra filtration, freeze drying and fractional precipitation
- f) Use of detergents in isolation of membrane proteins.

UNIT- II

6

Chromatography :

Basic principles and applications of -

- a) Ion exchange chromatography,
- b) Gel filtration,
- c) Affinity chromatography,
- d) Gas Liquid Chromatography (GLC),
- e) High Performance Liquid Chromatography (HPLC).

UNIT –III

6

Centrifugation :

- a) Introduction, types of centrifuges – small bench, large capacity refrigerated, high speed refrigerated and ultra centrifuge.
- a) Types of centrifugation – 1) Analytical centrifugation, 2) Preparative centrifugation – differential. centrifugation, density gradient centrifugation,
- b) Molecular weight determination, centrifugal elution
- c) Safety aspects in the use of centrifuges.
- d) Ultracentrifugation - velocity and buoyant density determination.

UNIT- IV

6

Electrophoresis :

- a) Introduction and General principles.
- b) Types of electrophoresis – Moving boundary and zonal.
- c) Basic techniques- i) Polyacrylamide, Starch and Agarose gel electrophoresis
ii) Capillary electrophoresis and Pulse field gel electrophoresis.
- d) Use of SDS/urea,
- e) Iso electric focusing.

UNIT- V

6

Radioisotopic techniques :

- a) Introduction, Radioisotopes, Biochemical applications of radioisotopes, radiation dosimetry, measurement of α , β and γ radiations.
- b) Radioisotopic techniques – Radiodating, radio active tracer technique, radio immuno assay.
- c) Detection and measurement of radioactivity – Autoradiography, cerenkov counting, Geiger-Muller counter, Scintillation counter.
- d) Safety aspects.

UNIT -VI

6

Spectroscopy I:

- a) Introduction,
- b) General principles of electromagnetic radiations.
- c) Principles and applications of –
 - i) UV, ii) Visible, iii) X-ray diffraction,
 - iv) NMR, v) ESR,

UNIT- VII

6

Spectroscopy II:

- a) Atomic absorption spectroscopy,
- b) CD/ORD,
- c) Mass spectroscopy
- d) Plasma emission spectroscopy.

UNIT-VIII

6

Microbial techniques :

- a) PCR, LCR,
- b) DNAsequencing- Maxam Gilbert and Sanger's method.
- c) DNA finger printing and foot printing.
- d) Chromosomal walking.

References :

- 1) Bioinstrumentation – L. Veerakumari, MJP Publishers, Chennai.
- 2) Tools in Biochemistry – David Cooper.
- 3) Protein purification by Robert Scopes, Springer Vevlog Publicaiotn, 1982.
- 4) Centrifugation D. Rickwood.
- 5) Methods of Protein and Nucleic Acid Research.
- 6) Principles and techniques of biochemistry and molecular biology 6th edn. – Wilson & Walkar.
- 7) Enzymes – Biochemistry, Biotechnology, Clinical Chemistry – Trevor, Palmer. Affiliated East-West Press Pvt. Ltd.
- 8) Analytical Biochemistry (Biochemical Techniques) – Dr. P. Asokan, Chinnaa Publications.

MIC (A) 202 : Molecular Biology

UNIT -I

6

The Genetic Code :

- i) Overlapping versus nonoverlapping codes.
- ii) Deciphering genetic code and its importance.
- iii) Wobble hypothesis.
- iv) Neirenberg & Khorana contributions.
- v) Altered code in Mitochondria and induced vaccinations in genetic code.

UNIT- II

6

Transcription in Prokaryotes and Eukaryotes ;

- a) RNA Polymerase – Structure and function.
- b) Transcription – Initiation, elongation, termination.
- c) Post transcriptional modifications and structures of mRNA, rRNA, tRNA, antisense RNA

Unit –III

6

Translation in Prokaryotes and Eukaryotes:

- a) Translation - Activation of amino acids, Initiation, Elongation, Termination.
- b) Translational frame shifting, RNA editing, Ribozyme,
- c) Inhibition of transcription,
- d) reverse transcriptase. Fighting AIDS with inhibitors of HIV reverse transcriptase.

UNIT-IV

6

Regulation of gene expression in Bacteria and their Viruses :

- a) Gene Regulation :- Basics of prokaryotic transcriptional regulation-genetic switches-Lac regulatory circuit.
- b) Lac system- Positive and negative regulation.
- c) Dual Positive and negative control – Arabinose operon.
- d) Metabolic pathways and addition levels of regulations alternation.
- e) Bacteriophage life cycles- Regulators & operons.
- f) Alternative sigma factors to regulate large sets of genes.

UNIT -V

6

Transposable elements :

- a) Discovery.
- b) Transposable elements in Prokaryotes
 - Bacterial insertion sequences.
 - Prokaryote transposons.
 - Mechanism of transposition.
- c) Transposable elements in Eukaryotes.
 - Class 1 – retrotransposons.
 - Class 2 – DNA transposons
 - Class 3 – utility of DNA transposons for gene discovery.
- d) The dynamic Genome- Large genomes as largely transposable elements.
 - Transposable elements in human genome LTR retrotransposons.

UNIT-VI

6

Oncogenes;

- a) Characteristics of cancer cells, origin of cancer cells, genes and theories associated with cancer, tumor suppressors, cellular regulatory proteins, transforming viruses.
- b) Sequence of genetic changes in : i) Brain tumor, ii) Colon cancer.
- c) Environmental causes of cancer-carcinogens.
- d) Methods for study of cancer.
- e) Human genome data Tailor Diagnosis and treatment.

UNIT -VII

6

Sequencing Genes and Genomes :

- a) Methodology for DNA sequencing. Chain termination DNA sequencing.
- b) Pyro sequencing.
- c) Shot gun approach of genome sequencing.
- d) Clone contig approach.
- e) Use of maps to aid sequence assembly. Genetic maps, physical maps
- f) Importance of maps in sequence assembly.

UNIT-VIII

6

Human Genome Project:

- a) Concept and meaning of Genome Project .
- b) Applications of Genome Project
- c) Gene annotation

References :-

- 1) An introduction of Genetic Analysis 10th Edition. Freeman 2010. Anthony & J.F. Griffiths. Susan R. wessler.
- 2) Introduction to Genetic analysis- Lodish 6th Edition.
- 3) Lehninger – Biochemistry – 6th Edition.
- 4) Gene Lewin –X
- 5) Molecular Cell biology by Lodish -2010
- 6) Molecular Biology F. Weaver -2010
- 7) Molecular Biology of gene 4th Benjamin and Cummings 2010
- 8) An introduction of genetic analysis 5th edn Freeman 2010

MIC (A) 203 : Microbial Biochemistry

UNIT- I

6

pH and buffers :

- a) Ionisation of water, weak acid and weak bases.
- b) pH – pH scales, Bronsted Lowery concept of acids and bases.
- c) Buffer – Buffer solutions, Henderson Hasselhalch equation.
- d) Biological buffer system – Phosphate buffer system, bicarbonate buffer system, proteins, amino acids

UNIT- II

6

Enzymes :

- a) Structure and function of
 - i) Pyruvate dehydrogenase
 - ii) Fatty acid synthetase
 - iii) ATPase
- b) Allosteric enzymes
 - i) Concept of allosterism
 - ii) Positive and negative cooperativity.
 - iii) Structural aspects of allosteric enzymes and their significance in regulation.
- c) Mechanism of action of enzymes.
 - i) Single displace reaction.
 - ii) Double displace reaction.

UNIT -III

6

A) Enzyme kinetics:

- a) Historical aspects.
- b) Methods used for investigating the kinetics of enzyme catalysed reactions – initial velocity
- c) Michaelis Menten equation and its significance.
- d) Alternative plots – Line weaver Burk Plot, Eadie Hofstee plot.

B) Enzyme inhibition :

- a) Competitive,
- b) Noncompetitive and .
- c) Un Competitive,

UNIT- IV

6

Aerobic growth of E. coli on the substrate other than glucose :

- a) Overview of glucose metabolism
- b) Fructose and lactose as substrate
 - i) Enzyme status.
 - ii) Fructose metabolism.
 - iii) Transport and breakdown of lactose, utilization of galactose.
- c) Acetate, pyruvate, malate as a substrate
 - i) Enzyme status.
 - ii) Reactions
 - iii) Relation with TCA and glyoxylate bypass.
- d) Gluconeogenesis.

UNIT- V

6

Microbial response to stress :

- a) Microbial stress response,
- b) Stress proteins, and their roles,
- c) Cold and heat shocks
- d) Oxidative and starvation stress.

UNIT -VI

6

Signaling and Behaviour in Procaryotes :

- a) Two components signaling system.
- b) Adaptive responses by facultative anaerobes to anaerobiosis.
- c) Regulatory system, chemotaxis, nitrogen assimilation.
- d) Porin structure.

UNIT VII

6

Membrane biochemistry :

- a) Components of membrane,
- b) Membrane structural models,
- c) Eucaryotic and procaryotic protein transport systems,
- d) Membrane protein
- e) Ion channels K^+ , Na^+ , Cl^-
- f) Na^+ / K^+ pump

UNIT- VIII

6

Lipid Biochemistry :

- a) Beta oxidation – pathway and regulation.
- b) Role of acyl carnitine in fatty acyl transport.
- c) Synthesis of fatty acid
- d) Structure and composition of fatty acid synthetase complex, pathway and regulation.
- e) Synthesis of triacyl glycerides.
- f) Ketone bodies – formation and utilization.

Reference Books

- 1) Lehninger's Principles of Biochemistry 1st edition – Nelson & Cox.
- 2) Biochemistry – 2nd edition D. Voet, J. Voet.
- 3) Biochemistry – 4th edition Lubert Stryer.
- 4) Fundamental of Biochemistry by Jain.
- 5) The Nature of enzymology by Foster.
- 6) Enzymes by Palmer
- 7) Bacterial metabolism by G. Gottschalk.
- 8) Biochemistry by Zubay.
- 9) The Physiology and Biochemistry of Procaryotes by White (Oxford Uni. Press)
- 10) Introduction to bacterial metabolism – Doelle H. W. (1975) (Academic Press)
- 11) The microbial world – Stanies
- 12) Biochemical calculations – Segal
- 13) General Microbiology – Schlege.

MIC (A) 204 : Medical Microbiology

UNIT- I	6
Community Medicine:	
a) Introduction.	
b) Definition of health, dimensions of health.	
c) Determinants and indicators of health.	
d) Concept of well- being.	
UNIT- II	6
Concept of disease:	
a) Concept of causation : Germ theory, Epidemiological triad multifactorial causation, web of causation.	
b) Natural history of disease- prepathogenesis and pathogenesis phase.	
c) Changing pattern of disease.	
UNIT- III	6
Novel mechanisms for disease:	
a) Introduction.	
b) Multifactorial disorders.	
c) Mitochondrial DNA and Genetic disorders.	
d) Genomic imprinting.	
UNIT-IV	6
Non Communicable diseases:	
a) Introduction - definition and risk factors	
b) Hypertention.	
c) Diabetes mellitus.	
UNIT –V	6
Principles of Epidemiology:	
a) Introduction.	
b) Epidemiology and clinical medicine.	
c) Measurement in epidemiology – Mortality rates and ratios.	
d) Immunization and adverse events following immunization.	
e) Disposal of biomedical waste.	
UNIT- VI	6
DNA repair disorders:	
a) Introduction.	
b) Xeroderma pigmentosum.	
c) Louis Bar Syndrome	
d) Bloom Syndrome.	

UNIT-VII

6

Bioterrorism and Microbial forensics:

- a) Introduction.
- b) Biological agents ,Bacterial toxins
- c) System of Microbial Forensics from sample collection to interpretation of evidence.
- d) National research and Development strategy for microbial forensics.

UNIT –VIII

6

Drug metabolism and drug toxicity :

- a) Introduction.
- b) Biotransformation of drug .
- c) Factors affecting drug metabolism .
- d) Drug intolerance - quatitative and qualitative
- e) Factors modifying effect of drug .

References :

- 1) Park's text book of Preventive and Social Medicine – K. Park (12th edition).
- 2) Molecular medicine – 3rd edition –R.J.Trent.
- 3) DNA Repair and Mutagenesis- Friedberg, walker and Wood
- 4) Deposition of toxic drugs and chemicals in man -9h edition
- 5) Basic and clinical pharmacology and toxicology –K. M. Brosen (Wiley –Blackwell publication)
- 6) The pharmacological Basis of Therapeutics Goodman and Gilman (Mc-Graw Hill) (11th edition.)
- 7) Pharmacology and pharmacotherapeutics 15th Edition R.S.Satoskar ,S.D.Phandarkar S.S.Ainapure . (popular publication)
- 8) Principals of pharmacology –HL Sharma and KK Sharma (Paras medical publisher)
- 9) <http://www.actinobioscience.org>
- 10) <http://www.ncbi.nlm.nih.gov>

Practical Course : III

- 1) Separation and identification of amino acid mixture by 2D paper chromatography.
- 2) Separation and identification of sugar mixture by 2D TLC.
- 3) Separation and identification of amino acid mixture by TLC.
- 4) Separation of DNA by agarose gel electrophoresis.
- 5) Separation of proteins by using molecular sieve chromatography.
- 6) Preparation of immobilized cells of Yeast cells and determination of invertase activity.
- 7) Comparative study of enzymatic activity of free cells and immobilized cells.
- 8) Study of effect of gel concentration on immobilized enzyme activity.
- 9) Determination of capacity of ion exchange resin [Dowex – 50].
- 10) Determination of mutation rate in bacteria.
- 11) Fluctuation test.
- 12) Isolation of thymine requiring mutants of E. coli.
- 13) Testing of chemical for mutagenicity using Ames test.
- 14) Demonstration Blotting techniques – Western, Northern, Southern Blotting

Practical Course : IV

- 1) Preparation of buffers.e.g.Phosphate , Borate , Tris .
- 2) Titration curve of glycine.
- 3) Isolation of cellulase producers from soil.
- 4) Determination of specific activity of cellulase (Lowry's method)
- 5) Assay of cellulase activity by using DNSA method.
- 6) Determination of effect of activator on amylase activity.
- 7) Determination of effect of inhibitor on amylase activity.
- 8) Determination of substrate affinity (K_M) for enzyme amylase.
- 9) Determination of Molar extinction coefficient.
- 10) Study of organisms subjected to nutritional stress (Carbon)
- 11) Study of organisms subjected to chemical stress (Chlorine as a test system.)
- 12) Estimation of Siderophore produced by *Pseudomonas* spp.
- 13) Detection of types of siderophores produced by given organisms.
- 14) Determination of blood sugar by glucometer.
- 15) Determination of human development index.
- 16) Determination of standard error of difference.
- 17) Survey – Clinical survey of any common disease in community.
- 18) Rapid detection of pathogen using chromogenic media.
- 19) Detection of CRP.
- 20) Determination of MIC of Streptomycin.

THEORY EXAMINATION NATURE OF QUESTION PAPER

Part -I

Q.1 Objective type (Multiple choice) 20 Marks

Part –II

Attempt any four question from Part –II\

Q. 2 a) Long answer 20 Marks
or

b) Long answer 20 Marks

Q.3) a) Long answer 20 Marks
or

b) Long answer 20 Marks

Q.4) Attempt (Any two) 20 Marks

a)

b)

c)

Q.5) Attempt (Any two) 20 Marks

a)

b)

c)

Q.6 Answer in brief (any four) 20 Marks

a)

b)

c)

d)

e)

f)

Q.7 Answer in brief (any four) 20Marks

a)

b)

c)

d)

e)

f)

**M.Sc Applied Microbiology
practical Examination**

Semistr –I, Practical Course –I

Question No,1	-	25 marks
Question No,2	-	25 marks
Question No,3	-	15 marks
Question No,4	-	15 marks
Journal	-	10 marks
Viva	-	10 marks

Semistr –II, Practical Course – II

Question No,1	-	25 marks
Question No,2	-	15 marks
Question No,3	-	15 marks
Question No,4	-	15 marks
Journal	-	10 marks
Viva	-	10 marks
Tour report	-	10 marks