

BIO TECH.

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M.Sc. Biotechnology Course Department of Microbiology, Gujarat University, Ahmedabad 380 009. Gujarat, India.

I : Eligibility Criteria

A candidate who has obtained a degree of Bachelor of Science in Biotechnology, Microbiology, Biochemistry, Botany, Zoology, Industrial Microbiology as vocational, Biochemistry with Biotechnology as vocational subject or allied Biological Sciences of this University or of any other University recognized as equivalent. The candidate should have obtained first class or higher second class at the 1st attempt at the B.Sc. examination.

II : Distribution of the seats

Out of 20 seats, 15 seats are reserved for Gujarat University students viz: 5 seats for Biotechnology + Vocational Biotechnology + Biochemistry, 5 seats for Microbiology + Vocational Industrial Microbiology and 5 seats for Botany + Zoology + Allied Biological Science. 5 seats are for students other than the Gujarat University with maximum 2 seats for NRI meeting the eligibility criteria. Admission is strictly by merit based on only theory external marks for students of Gujarat University, while interview and/or written test for students of other than Gujarat University.

III : Fees structure

M.Sc. Biotechnology self-financed course of Gujarat University is an annual pattern course of two years duration. Each academic year is divided in two terms. The fees structure for each term is as under:

Rs.15,000/- per term per student

Rs.50,000/- per term per student for NRI seat

Fees once paid will not be refundable under any circumstances

Examination fees : Rs. 500/- will be collected along with examination form. The examination form and mark sheet fees will be charged extra as per the University rules. The Gujarat University will award the Degree Certificate to the successful candidate at its convocation. The convocation fees will be charged as per University rules.

IV : Course detail

1. The medium of instruction/teaching will be in English.

2. Teaching Scheme

M.Sc. Part I : 4 Papers of 75 marks each = 300

Practicals of 150 marks = 150

450

There shall be four theory papers each of three hours duration and one practical of seven hours duration.

M.Sc. Part II : 3 Papers of 75 marks each = 225

1 Paper Dissertation = 75

Practicals of 150 marks = 150

450

Grand total of marks of M.Sc. I & II = 900

Internal examination and assessment will be as per Gujarat University rules. The Expert Committee suggest internal evaluation of the student in terms of seminars, quiz and internal examination and the obtained marks will be considered in the University annual examination in the proportion of internal and external 30% + 70% (S.P. University have 30% and M.S. University have 50% internal marks). Such internal evaluation forces the students to remain sincere and active through out the year.

3. Each theory paper is divided into five units. Each unit will have equal weightage while setting question paper.
4. Question or its sub question including the options will be set from the same unit.
5. Practical batch will be consisting of maximum 10 students.
6. There will be an annual examination at the end of each year.
7. Examination passing standard and award of the class as per the Gujarat University rules.

Course Coordinator : Prof. & Head, Department of Microbiology, School of Sciences, Gujarat University, Ahmedabad 380 009. India

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M.Sc. Biotechnology Course
Department of Microbiology, Gujarat University,
Ahmedabad 380 009. Gujarat, India.

BIOTECHNOLOGY SYLLABUS
M.Sc. PART I
From June 2005

There shall be four theory papers each of three hours duration and four practicals each of seven hours duration.

Each theory paper shall carry seventy-five marks and practical shall carry one hundred fifty marks.

Each theory paper is divided into five units. Each unit will have equal weightage while setting question paper.

Question or its sub question including the options will be set from the same unit.

Practical batch will be consisting of maximum 10 students.

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PAPER I : MICROBIAL DIVERSITY, PHYSIOLOGY AND BIOCHEMISTRY

UNIT I : INTRODUCTION TO MICROORGANISMS AND METHODS

- Evolution of life forms, species concept and microbial nomenclature
- Introduction to microbial classification and various methods of classification
- Basic microbiological techniques
- Introduction to microbial diversity - principles of microbial diversity. distribution, abundance, ecological niche, of eukaryotes, prokaryotes and viruses
- Culturable and unculturable organisms and methods of studying microbial diversity
- Economic value of microbial diversity and conservation strategies with respect to biotechnology

UNIT II : MICROBIAL GROWTH AND PHYSIOLOGICAL DIVERSITY

- Microbial growth and growth kinetics
- Continuous culture as a research tool
- Synchronous culture
- Physico-chemical factors influencing microbial growth
- Biochemical and nutritional diversity of phylogenetically diverse group of organisms, phototrophs, autotrophs and heterotrophs
- Mechanism of antibiosis and drug resistance
- Biochemistry and regulation of nitrogen fixation

UNIT III : REGULATION OF MACROMOLECULES

- Macromolecules and supra-molecular assemblies
- Protein
- Nucleic acid

UNIT IV : ENZYMOLOGY

- Enzyme activity - principles and techniques of extraction, purification and analysis, factors affecting enzyme activity
- Enzyme kinetic and Ping-Pong mechanisms
- Mechanism of enzyme actions and enzyme inhibitors

UNIT V : METABOLISM

- Principles of bioenergetics and thermodynamics
- Metabolism of carbohydrates and lipids
- Metabolism of protein and nucleic acids

PAPER II : BIOSTATISTICS, INSTRUMENTATION AND BIO INFORMATICS

UNIT I : INTRODUCTION TO BIOSTATISTICS

- Biostatistics: scope of biostatistics
- Population and sample
- Measures of central tendency
- Measures of dispersion
- Data representation
- Probability and distributions

UNIT II : BIOSTATISTICS TEST AND APPLICATIONS

- Test of significance
- Group comparison and pairing design tests
- F -Test and an introduction to ANOVA
- Linear regression and correlation
- The Chi-Square (χ^2) test
- Computer aided statistical calculations
- Factorial experiments and statistical designs
- Applications of biostatistics

UNIT III : ANALYTICAL TECHNIQUES

- Principles and application of pH meter, viscosity, UV-Vis spectroscopy, infrared spectroscopy, atomic absorption spectroscopy, NMR, tracer techniques and polarographic techniques

UNIT IV : SEPARATION AND RADIO ISOTOPES TECHNIQUES

- Basic principles and applications of
- Gel filtration, ion exchange and affinity chromatography, GLC, HPLC, HPTLC, SCMS, TLC, column chromatography, electrophoresis, ultra centrifugation
- Radio tracer, radio immuno assay, immuno-fluorescence

UNIT V : INTRODUCTION TO BIOINFORMATICS

- Introduction to bioinformatics
- Information networks
- Protein information resources
- Genome information resources

PAPER III : IMMUNOLOGY

UNIT I : IMMUNE SYSTEM AND IMMUNITY

- History of immunology; structures
- Composition and function of cells and organs involved in immune system
- Host parasite relationships
- Microbial infections
- Virulence and host resistance
- Immune responses-innate immunity, acquired immunity
- Immuno haematology-blood Groups
- Blood transfusion and Rh incompatibilities

UNIT II : ANTIGENS, ANTIBODIES AND COMPLEMENT

- Antigen - structure and properties, types-iso and allo-haptens, adjuvants-antigen specificity
- Vaccines and toxoids
- Immunoglobulins : structure, heterogeneity, types and subtypes, properties (physico-chemical and biological), Monoclonal Antibody
- Theory of antibody production
- Complement : structure, components, properties and functions of complement components; complement pathway and biological consequences of complement activation.

UNIT III : ANTIGEN-ANTIBODY REACTIONS

- *In vitro* methods - agglutination, precipitation, complement fixation, immunofluorescence, ELISA, Radio Immuno Assays
- *In vivo* method: skin test and immune complex tissue demonstration
- Applications of these methods in diagnosis of microbial diseases

UNIT IV : MAJOR HISTOCOMPATIBILITY COMPLEX AND TUMOUR IMMUNOLOGY

- Structure and function of MHC and HLA system
- Gene regulation and IR genes
- HLA and tissue transplantation-tissue typing methods for organ and tissue transplantation in humans; Graft vs Host reactions and rejection
- Auto-immunity- theory, mechanism and diseases with their diagnosis
- Tumour immunology- tumour specific antigens, immune response for tumours, immuno diagnosis of tumours-detection for tumour markers-alpha foetal proteins, carcinoembryonic antigens etc.

UNIT V : HYPER SENSITIVITY REACTIONS

- Antibody mediated type-1, Anaphylaxis type-2, antibody dependent cell cytotoxicity type-3, immune complex mediated reaction type-4, cell mediated hypersensitivity reaction, respective diseases
- Immunological method of diagnosis
- Lymphokines and cytokines-their assay methods

PAPER IV : CELL AND MOLECULAR BIOLOGY

UNIT I : CELL BIOLOGY

- Cell as an unit of living organisms – cellular organelles: structure and functions, organisation of cytoskeleton and nuclei
- Chromatin structure; organisation of nucleosome and chromosomes
- Biomembrane: structure, organisation and basic function
- Organelles of eukaryotic cells

UNIT II : MANIPULATIONS OF ANIMAL CELLS AND VIRUSES

- Molecular aspects of cell division and cell cycle, cell fusion
- Growth of plants and animal cells in culture
- Viruses and bacteriophages : T₄, T₇ phages, viroids, prions, animal virus, plant virus

UNIT III : MAINTENANCE OF GENOME

- Genome organisation
- DNA and chromosome structure, function and fine structure gene analysis
- Replication of DNA
- Molecular basis of mutation
- DNA damage and repair
- Extrachromosomal inheritance

UNIT IV : EXPRESSION OF GENOME

- Genetic code: properties, codon usage patterns and codon bias
- Gene expression in eukaryotes and prokaryotes
- Post transcriptional modification
- RNA splicing
- Translation in eukaryotes and prokaryotes
- Post translation modifications

UNIT V : MOLECULAR ASPECTS OF GENE TRANSFER AND REGULATION

- Molecular basis of recombination and gene transfer
- DNA replication, amplification and rearrangement
- Gene regulation in prokaryotes and eukaryotes
- Operon concept : lac, ara and trp operons
- Global factors of gene regulation

REFERENCES

| <u>No.</u> | <u>Name</u> | <u>Author</u> |
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| 2. | Bergey's Manual of Systematic Bacteriology Volume: I-IV | Krieg & Holt |
| 3. | The Prokaryotes Volume I and II | Ed. Starr & others |
| 4. | Smith's Introduction to Industrial Mycology | Onions et. al. |
| 5. | Moulds and filamentous fungi in technical microbiology | O. Fassatiova |
| 6. | Biology of the fungi | I.K. Ross |
| 7. | A guide to identifying and classifying yeast | Burnet et.al |
| 8. | Biology of the conidial fungi | Cole & Kendrick |
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| 11. | Brock's Biology of the microorganisms 8 th edition | M.T.Madigan,T.M. |
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Current references will be added whenever necessary. For each topic the current references will be given as and when needed.

PRACTICALS M.Sc. PART I

Paper I

1. Staining techniques of microorganisms and their structures.
2. Isolation, cultivation and preservation of microorganisms.
3. Study of cultural, biochemical and physiological characteristics of microorganisms
4. Identification of selected industrially useful organisms.
5. Bacterial growth - relationship between cell number and turbidity, growth curve, enumeration of bacterial by pour plate and spread plate technique
6. Bacterial growth kinetics
7. Effect of water activity on microbes of different environment.
8. Microbial control : physical chemical agents
9. Evaluation of disinfectant
10. Bacterial nutrition study
11. Assay and kinetic study of enzyme
12. Estimation of carbohydrate, proteins and lipids

Paper II

1. Demonstration of various equipments used in the study
2. Chromatography
3. Electrophoresis
4. Polarography
5. UV-Visible spectrophotometric examination
6. Atomic absorption spectrophotometry
7. Solvent extraction and purification of methods
8. Purification of protein/enzyme
9. Statistical analysis of data, S.D., significance test of the results obtained in each experiments

Paper III

1. Gel diffusion techniques
2. Agglutination and precipitation test/assay
3. ELISA
4. Western blot analysis.
5. Purification of antibodies
6. Antibiotic sensitivity test

Paper IV

1. Isolation of chromosomal DNA
2. Isolation and screening of mutants by physical and chemical mutagens : auxotrophic pigment, lac, antibiotic
3. Characterization of mutants : lac mutants, cross feeding
4. Induction of β -galactosidase
5. Gene transfer experiments - conjugation and transduction
6. One step growth curve of bacteriophage
7. Fluctuation test
8. G+C determination

Besides these practicals, other practicals of relevance shall be introduced as per the need.