School of Sciences

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M.Sc. Microbiology

Prog. Code: 0902MB

(Two year Full Time Post Graduate Course)

Semester Pattern

Syllabus M.Sc. Microbiology (Prog Code: 0902MB)

GENERAL INTRODUCTION OF THE DEPARTMENT

MATS School of Sciences (MSS) was established with a vision to create technocrats in the applied branches of Biological and Chemical Sciences to convey updated scientific knowledge. In the school the performances of the students are constantly monitored by continuous assessment. The School believes in supplementing academic input of students with the help of regular Seminar, Guest Lectures, Industrial/Research Institute visits and encouraging the students to participate in National & International Seminars, Conferences and Workshops.

DEPARTMENT HIGHLIGHTS

- Research focus on frontier of Life Sciences and affordable healthcare
- Highly acclaimed scientists as faculty
- State-of-the-art Lab facilities
- Hand-on training on sophisticated equipments
- Academia – Industry interface
- Multidisciplinary research in affordable healthcare, Agriculture and Food

COURSEDESIGN

The department follows a unique course-design which is contemporary and cutting-edge. It includes modern and advanced papers/ subjects including the papers from Management Science as given in the curriculum matrix

PEDAGOGY

- Chalk Board, LCD and Projector based teaching
- Research based teaching
- Project based learning
- Separate lab bench for each student

FACILITIES

State-of-the-art facilities include:

- Double beam UV- Visible Spectrophotometer, Cooling Centrifuge, Microfuge, Incubators, Microscopes, Laminar flow hoods, Colorimeter, Micro- and regular balance, Electronic Balance Autoclave, Glass distillation apparatus, Computers, Deep freeze, DNA/RNA & Protein Electrophoresis apparatus, Plant Tissue Culture racks with light arrangements, Shakers, BOD incubator & Orbital Shaking Incubator etc
- Microbial cell culture
- Plant tissue culture

FACULTIES

- Well experienced faculties from Academic Institutes and Industries
- Invited lectures by eminent scientists from different countries

M. Sc. MICROBIOLOGY: SCOPE AND CONTENT

Microbiology is the research-oriented science, dealing with the Microorganisms & microbial Technology. This study includes a large variety of subjects including General Microbiology, Biochemistry, Computer, Bioinformatics& Biostatistics, Instrumentation, Management in Practice, Cell & Molecular Biology, Microbial Physiology & Metabolism, Immunology, Microbial Genetics, Entrepreneurship, Environmental Microbiology Medical Microbiology, Industrial Microbiology, Food & Dairy Microbiology, IPR Bioethics & Research Methodology, Dissertation etc. Microbiology features the use of living cells and bacteria in the industrial process. Microbiology

can be applied in developing various vaccines, medicines and diagnostics, improving energy production and conservation and increasing productivity.

OBJECTIVES OF THE M.Sc. MICROBIOLOGY PROGRAM

1. To impart knowledge and skills of various aspects of microbiology.
2. To train the students for industrial need and to pursue further education.
3. To develop human resource and entrepreneurs in Microbiology with the ability to independently start their own ventures or small biotech units in the field of biotechnology.
4. Understand modern microbiology - practices and approaches with an emphasis in technology application in pharmaceutical, medical, industrial, environmental and agricultural areas.
5. Become familiar with public policy, bio-safety, and intellectual property rights issues related to microbiology applications nationally and globally
6. Gain experience with standard molecular tools and approaches utilized: manipulate genes, gene products and organisms.
7. Develop skills in international teamwork and research collaboration.

ELIGIBILITY FOR ADMISSION:

Interested aspirants for M.Sc. Microbiology degree need to fulfill the below mentioned minimum eligibility criteria.

- Completion of UG (10+2+3) level of education.
- Biology as one of the subjects at UG level

Instead of biology, one may even have had any subject related to biological sciences as one of the main subject of study.

PROGRAM OUTCOME:

1. Post graduates will be able to apply knowledge, concepts to solve issues related to their course.
2. Post graduates will have ability to identify problems related to their subjects.
3. Post graduates will have ability to analyze and derive valid conclusions with fundamental knowledge in their respective subjects.
4. Post graduates upon the needs of environment and society, will be able to fulfill the same in the form of solutions within the safety limit of prevalent rules and guidelines.
5. Post graduates will have ability to design, conduct experiments, analyze and interpret data for investigating problems in their respective fields.
6. Post graduates will have ability to select and apply appropriate tools and techniques.
7. Post graduates will have knowledge for assessing societal, health, safety and legal aspects and the duties as responsible citizen of country.
8. Post graduates will have the knowledge for the need of sustainable development.
9. Post graduates will have the knowledge of ethics and regulatory norms of their respective course.
10. Post graduates will have oral, written communications skill along with team spirit.

PROGRAM SPECIFIC OUTCOMES:

1. Application of knowledge and techniques of microbiological sciences.
2. Scale up of biochemical process after designing, optimization and analysis for developing products required for society.
3. Tabulation and interpretation of Biological data using computer software.

CAREER PROSPECTS:

The microbiology & bio-technology Industry is constantly growing and in the past 10 years, human resources in the field have grown drastically. Today, Indian biotech sector comprises of lot many companies and bio suppliers, generating ample amounts of revenues. Indian biotech industry comprises of clinical research, new drug discovery, bioinformatics, R&D, biopharmaceuticals etc. Bio-tech industry has rapid growth rate per annum. As there is increasing popularity and explosive growth, there are plenty of opportunities available in Biotechnology field. One can be a Research Scientist, Teacher, Marketing manager, Science Writer, Bioinformatician, Quality Control Officer or Production in-charge in the Food, Chemical and Pharmaceutical industry, Analyst, Environmental / Safety Specialist .

THE MAIN JOB SECTORS ARE AS FOLLOWS:

Biotechnology companies, Health service organizations, Pharmaceutical companies, Universities and Research institute, Horticultural industries, Conservation organizations, Food and drink manufacturers, Water industry, Agricultural industry, Law Enforcement.

ATTENDANCE:

A candidate shall be deemed to have undergone a regular course of study in the University, if he/she has attended at least 60% of the lectures in each subject will be at least 75% in the aggregate of lectures, tutorials and practical in order to be eligible to appear at the Final Examination.

SCHEME OF EXAMINATION, EVALUATION AND DISTRIBUTION OF MARKS

1 The overall weightage of a course in the Syllabi and Scheme of Teaching & Examination shall be determined in terms of Marks assigned to the course.

2 The evaluation of students in a course shall have two components unless specifically stated otherwise in the Scheme of Teaching & Examination and Syllabi:
(i) Evaluation through a semester-end examination (University Examination Marks)
(ii) Continuous evaluation by the teacher(s) of the course.

3 Continuous Evaluation (Internal Marks)

i) Theory courses

The division of internal marks will of 50% marks for mid semester examination and 50% of marks for the internal class tests. There shall be three class tests held during each semester. The three class tests shall ordinarily be held after 4 weeks, 8 weeks and 12 weeks of teaching in accordance with the University Academic Calendar.

(ii) Practical/Laboratory courses

The total internal marks in practical /Laboratory courses shall be based on performance in the laboratory, regularity, practical exercises /assignments, quizzes, etc. The assessment shall be given at three nearly equi-spaced intervals.

Evaluation through a semester-end examination

The distribution of weightage for various components of evaluation shall be as given below:

		Bachelor's degree/ Under-graduate diploma	Master's degree/ Post-graduate diploma
A.	THEORY COURSES		
	(i) Semester-end examination	70%	70%
	(ii) Continuous evaluation by the teachers	30%	30%
B.	PRACTICAL/LABORATORY COURSES		
	(i) Semester-end examination	70%	70%
	(ii) Continuous evaluation by the teachers	30%	30%
C.	DISSERTATION/THESIS		
	(i) Assessment by External Examiner	70%	70%
	(ii) Assessment by Internal Examiner	30%	30%

PASSING MARKS:

For postgraduate students, obtaining a minimum of 45% marks in aggregate in each course shall be essential for passing the course and earning its assigned credits. A candidate, who secures less than 45% of marks in a course, shall be deemed to have failed in that course.

GRADING SYSTEM:

For UG:

80% and above – "10 Grade Point" and Letter Grade "O" (Outstanding)

40% and above but below 45% - "Grade Point 4" and Letter Grade "P" (Pass)

For PG:

80% and above – "10 Grade Point" and Letter Grade "O" (Outstanding)

45% and above but below 50% - "Grade Point 4" and Letter Grade "P" (Pass)

PROGRAM DURATION:

The maximum permissible period for completing a program for which the prescribed program duration is **n semesters**, shall be **(n+4)** semesters. All the program requirements shall have to be completed in (n+4) semesters.

ATKT criteria:

ATKT Candidate means a candidate who failed in not more than forty percent of the total number of Core and Core bracket papers, excluding the Practical Examination/Project Work/Viva Voce Examination in the Semester Examination and is appearing in the Examination of same semester again which is organized with the next Semester Examination. Forty percent (of the total number of Core and Core bracket papers) will be rounded off to higher side in case it is not a whole number. In case a Students fails or was absent in Practical Examination/ Project Work / Viva Voce Examination, he/she may be allowed to have ATKT exam on his/her own expenses.

Curriculum Matrix M.Sc. Microbiology (Prog. Code: 0902MB)

Semester I					Marks Distribution		
	Code	**Subject**	**Hours/ week**	**Credit (L+T+P)**	**External**	**Internal**	**Total**
Core Course	0902MB1101	Cell and Molecular Biology	4	4 (4+0+0)	70	30	100
	0902MB1102	General Microbiology	4	4 (4+0+0)	70	30	100
	0902MB1103	Biochemistry	4	4 (4+0+0)	70	30	100
	0902MB1104	Instrumentation	4	4 (4+0+0)	70	30	100
Laboratory	0902MB1205	Lab Course I	4	2 (0+0+2)	35	15	50
	0902MB1206	Lab Course II	4	2 (0+0+2)	35	15	50
Open Elective	0902OE1307 OR 0902OE1308	Food and Nutrition (0902OE1307) **OR** Management in Practice(0902OE1308)	4	4 (4+0+0)	70	30	100
		Total	**28**	**24 (20+0+4)**	**420**	**180**	**600**
Semester II							
Core Course	0902MB2101	Immunology	4	4 (4+0+0)	70	30	100
	0902MB2102	Biostatistics & Research Methodology	4	4 (4+0+0)	70	30	100
	0902MB2103	Bacteriology, Mycology and Virology	4	4 (4+0+0)	70	30	100
	0902MB2104	Microbial Physiology and Metabolism	4	4 (4+0+0)	70	30	100
Laboratory	0902MB2205	Lab Course III	4	2 (0+0+2)	35	15	50
	0902MB2206	Lab Course IV	4	2 (0+0+2)	35	15	50
Open Elective	0902OE2307 OR 0902OE2308	Vaccines and Antibiotics (0902OE2307) **OR** Nanobiotechnology(0902OE2308)	4	4 (4+0+0)	70	30	100
		Total	**28**	**24 (20+0+4)**	**420**	**180**	**600**
Semester III							
Core Course	0902MB3101	Medial Microbiology	4	4 (4+0+0)	70	30	100
	0902MB3102	Microbial Genetics	4	4 (4+0+0)	70	30	100
Core/ Discipline Based Elective	0902MB3103 OR 0902MB3104	General Pathology (0902MB3103) **OR** General Parasitology (0902MB3104)	4	4 (4+0+0)	70	30	100

	0902MB3105 OR 0902MB3106	Environmental Microbiology (0902MB3105) **OR** Industrial Microbiology (0902MB3106)	4	4 (4+0+0)	70	30	100
Laboratory	0902MB3207	Lab Course V	4	2 (0+0+2)	35	15	50
	0902MB3208	Lab Course VI	4	2 (0+0+2)	35	15	50
Open Elective	902OE3309 OR 0902OE3310	Medicinal and Pharmaceutical Chemistry (0902OE3309) **OR** Entrepreneurship (0902OE3310)	4	4 (4+0+0)	70	30	100
		Total	**28**	**24 (20+0+4)**	**420**	**180**	**600**
Semester IV							
Core Course	0902MB4101	Dissertation		16	280	120	400
	0902MB4102	Dissertation Seminar		2	35	15	50
	0902MB4103	Viva Voce		2	35	15	50
		Total		**20**	**350**	**150**	**500**
	L = Lecture, T= Tutorial, P= Practical		**Grand Total**	**92**	**1610**	**690**	**2300**
1 credit = 1 hour of teaching/week or 2 hours of Lab/week							
SGPA and CGPA will be calculated by the Examination Cell							
Coding Pattern : 1st digit denote semester; 2nd digit for type of paper [1-Core/Discipline based Elective, 2-Lab/Practical, 3-For others such as Open Elective]; 3rd & 4th digit for Paper Number							

M.Sc. Microbiology
Semester I: Theory
Cell and Molecular Biology
Code: 0902MB1101

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:

1. To impart in-depth knowledge of Cell and Molecular Biology.
2. To train the students to pursue further education.
3. To be familiar with molecular biology tools.
4. To gain experience of standard molecular tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Cell and Molecular Biology and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.

Module I

Cell Theory. Cell organization and functions: Structure of prokaryotic cells (bacteria, fungi, virus, cyanobacteria, mycoplasma etc.). General organization of eukaryotic cells; The cell cycle and its regulation; Cell division: Mitosis and Meiosis.

Module II

DNA REPLICATION: Enzymes and accessory protein involved in DNA replication. DNA replication in prokaryotes and eukaryotes. Repair of DNA;
Recombination and Transposition of DNA.

Module III

TRANSCRIPTION: In Prokaryotes and Eukaryotes; Mechanism of transcription.

Enzymology of transcription. Post-transcriptional modifications; Transcription in eukaryotes, RNA editing.

Module IV

TRANSLATION: In Prokaryotes and Eukaryotes; t-RNA and its function; Ribosome: Types and composition. Protein biosynthesis.

Module V

GENETIC CODE: Salient features of genetic code.

REGULATION OF GENE EXPRESSION: Basic elements in the control of gene expression, structural and regulatory genes, mechanism of activation of gene expression, operon model.

Suggested Readings:

- Molecular Biology of Cell, Alberts, B et. al
- Molecular Cell Biology, Darnell, Lodish, Baltimore, Scientific American Books Inc.1994.

- Molecular Biology LabFax, I.A.Brown (Ed), Bios Scientific Publishers Ltd., Oxford, 1991.
- Cell & Molecular Biology : Gerald Karp
- Cell Biology : C.B. Powar
- Essential Cell Biology : An introduction: Bruce, Alberts, Dennis
- The Cell: A Molecular Approach: Geoffrey M. Cooper
- Cell & Molecular Biology: SC Rastogi
- Molecular Cell Biology: Lodish
- Benjamin Lewin (1999) Genes VII, Oxford University Press, Oxford.
- Weaver R. F. (1999) Molecular biology, WCB McGraw-Hill Companies, Inc, New York.
- Brown T A (1995) Essential molecular biology, Vol. I, A practical approach, IRL press, Oxford.

M.Sc. Microbiology
Semester I: Theory
General Microbiology
Code: 0902MB1102

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:

1. To impart in-depth knowledge of microbiology.
2. To train the students to pursue further education.
3. To be familiar with microbiological tools.
4. To increase expertise of the course.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Microbiology and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
4. Ability to dissect a problem in to its key features.

Module I

Introduction to Microbiology: Historical background, Major Landmarks and Scope, Difference between Prokaryotic and Eukaryotic organisms.

Methods of Microbiology: Sterilization techniques, Pure culture techniques, Preservation and Maintenance of Microbial cultures, Principle of Microbial Nutrition, Perpetration of culture media, Enrichment culture, Different techniques for Isolation of Microbes.

Module II

Classification of Bacteria: Basic principle and techniques used in bacterial classification, Phylogenetic and numerical taxonomy. Bergy's manual and its importance, A brief account of Bacterial Classification. Ultra structure of Bacteria, A brief account of Rickettsiae, Mycoplasma and Chlamydiae.

Microbial Growth: The definition of growth, bacterial generation time, specific growth rate and yield measurement, Monoauxic, Diauxic and synchronized growth curve. Factor affecting microbial growth. Culture collection and maintenance of culture. Sporulation in bacteria.

Module III

Viruses: General characteristics, Morphology, Reproduction, Classification and structure of plant, animal and bacterial viruses. Cultivation of viruses, A brief account of TMV, Adenoviruses, Herpes, Retrovirus, HIV, Viroids and Prions

Module IV

Actinomycete: Distribution of actinomycetes, General characteristics, Economic importance.

Algae: Distribution of algae, Biochemical classification, Thallus organization, Reproduction, Products of algae and their Importance.

Fungi: General Characteristics, Classification, Vegetative body, Reproduction, Nutritional groups and Habitat relationships, Economic importance of fungi.

Module V

Microbial Ecology: Microbial flora of soil, Interaction among soil microorganisms. Nitrogen fixation (a brief account), Symbiotic association-types, functions and establishment of symbiosis.

Control of Microorganism by physical and chemical agents: Antimicrobial agents, Sulfa drugs, Antibiotics (penicillin and cephalosporin), Broad Spectrum antibiotics, antibiotics from prokaryotes. Anti fungal antibiotics, Mode of action, resistance of antibiotics.

Suggested Readings:

- General Microbiology-Roger. Y. Stainer, et al. 1986; Macmillan Press Ltd., Hampshire.
- Microbiology-An introduction: Gerald. J. Tortora, Berdell R.Funke,
- Christine.L.Case,Vth edition, 1995: The Benjamin/Cummings Publishing Co.Inc., USA.
- Microbiology: Essentials and Applications: Larry McKane, Judy Kandel, 2nd edition;1996; McGraw Hill Inc.
- Microbiology- Prescott, Harley, Klein, 4th edition, 1999; McGraw Hill Inc.
- Microbiology: Brock and Madigan
- Microbiology: Pelczar, Chan and Krieg
- Microbiology: Powar and Daginawala
- General Microbiology: R. Y. Ingraham
- Microbiology: Katherine Black

M.Sc. Microbiology
Semester I: Theory
Biochemistry
Code:
0902MB1103 **Credit: 4**
Total Marks: 100 (70+30)

Course Objectives:

1. To impart in-depth knowledge of biochemistry.
2. To train the students to pursue further education.
3. Become familiar with biochemical tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals Biochemistry and key principles of Biochemistry.
2. Awareness of the major issue at the forefront of the discipline.
3. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
4. Ability to dissect a problem in to its key features.

Module I

Carbohydrates: Chemical Properties, Classification and Biological Importance**.**

Stereochemistry: Stereochemistry of Sugars, Ring Structure (Aldose & Ketose) and Anomeric forms, Mutarotation.

Mono and Oligosccharides: Structure and Biochemical Roles of Mono and Oligosccharides.

Polysaccharides: Structure and Biochemical Roles of Homo and Heteropolysaccharides, Proteoglycans, Peptidoglycan, Glycosaminoglycans, Glycoconjugates, Glycoproteins.

Module II

Lipids: Classification, Fatty acids, Properties of Fatty acids, Triglycerides, Phospholipids and Sphingolipids; Biological Significance of Lipids.

Membrane Lipid: Lipid Bilayers, Formation of Lipid Bilayers, Membrane Fluidity, Fluid Mosaic Model.

Module III

Amino acids: Physical and Chemical Properties, Titration of amino acids, Separation and Identification of amino acids,

Peptide bond: Primary structure, Determination of amino acid sequencing, Ramachandran plot, Secondary structure of α-helix, β-strand, β-sheet, turns and loops. Tertiary structure, Quaternary Structure, Globular and Fibrous Protein, Protein Sequencing.

Membrane Protein: Integral, Lipid-linked and Peripheral Membrane Proteins.

Module IV

Purine and Pyrimidine Bases: Structure and Types, Composition of DNA and RNA, Phosphodiester bond, Nucleosides and Nucleotides.

Nucleic Acid: Watson - Crick Model of Double helix, Chargaff's rule. Different forms of DNA structure (A, B & Z), RNA, Primary, Secondary and Tertiary of RNA, Denaturation and Annealing of DNA, Cot Value and Super coiling of DNA. Protein-Nucleic Acid Interaction

Nucleic Acid Sequencing: By Restriction Endonucleases, By Chain Terminator Method.

Module V

Enzymes: Classification and Nomenclature, Co-enzyme, Cofactor and Prosthetic group, Turnover of Enzymes, Enzyme-substrate Interaction. Activation energy, Catalytic mechanism of Enzymes.

Enzyme Kinetics: Michaelis-Menten equation, Double reciprocal plot, Activator, Inhibitors, Inhibition reactions (Competitive, Uncompetitive and Non-competitive) and their kinetics. Allosteric and Feedback Inhibition.

Suggested Readings:

1. Biochemistry: J M Berg, J L Tymoczko and L Stryer.
2. Principles of Biochemistry: David L. Nelson, Albert L. Lehninger, Michael M. Cox.
3. Biochemistry: D Voet, J Voet and C W Pratt.
4. Biochemistry: U Satyanarayana and U Chakrapani.
5. Textbook of Biochemistry: Edward S West.
6. Harper's Illustrated Biochemistry: Robert K Murray, Daryl K Garner and Peter A Mayes
7. The Enzyme: Dixon and Webb.
8. Text Book of Biochemistry with Clinical Correlations: Thomas M Devlin
9. Medical Biochemistry: N Mallikarjuna Rao
10. Introduction to Enzyme and Coenzyme Chemistry: Tim Bugg

M.Sc. Microbiology
Semester I: Theory
Instrumentation
Code:
0902MB1104 **Credit: 4**
Total Marks: 100 (70+30)

Course Objectives:

1. To impart in-depth knowledge of instrumentation.
2. Become familiar with working principle of different instruments.
3. To increase expertise of the course.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals instrumentation and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
4. Ability to dissect a problem in to its key features.

Module I

Centrifugation techniques: Basic Principles of Sedimentation.
Centrifuge and Rotor: Types, Instrumentation and Applications.
Microscopy: Principles of Microscopy;
Types: Bright field, Dark field, Phase contrast, Confocal and Fluorescent, Electron Microscopes (SEM and TEM).

Module II

Radioisotopes Techniques: Radioactive decay.
Detection and different methods of measurement of radioactivity.
Use of radioactive isotopes in biology; Safety aspects.
Mass Spectrometry: Principles, Techniques and Applications;
Mass spectrometer, MALDI-TOF.

Module III

Spectrophotometric Techniques: - Basic principles;
Lambert Beer's Law, Absorbance, Transmittance and Extinction Coefficient.
UV, Visible and Infrared Spectroscopy: Theory, Instrumentation and Applications;
Atomic Spectroscopy and Nuclear Magnetic Resonance (NMR) Spectroscopy: Theory, Instrumentation and Application

Module IV

Chromatography Techniques: Basic Principles, Instrumentation and Applications;
Plane Chromatography: Paper and Thin Layer Chromatography (TLC).
Column chromatography: Adsorption, Partition, Gel filtration, Ion exchange, Affinity chromatography, High Performance Liquid chromatography (HPLC).

Module V

Electrophoretic Techniques: Theory, Instrumentation and Applications;
Types: Paper, Gel electrophoresis, Isoelectric Focusing, Pulse Field Gel Electrophoresis, Immuno-electrophoresis, Electroblotting techniques.

Suggested Readings:

1. Biophysical Chemistry Principles and Techniques: Upadhyay, Upadhyay and Nath.
2. Biotechniques Theory and Practice: S V S Rana; Rastogi Publications.
3. Principles and Techniques of Biochemistry and Molecular Biology: K Wilson and J Walkar.
4. Physical Biochemistry Principles and Application: D Sheehan; Wiley
5. Physical Biochemistry and Molecular Biology: Freifelder D.
6. Principles of instrumental analysis: Skoog and West.
7. Biochemical Techniques: Theory and Practice-Robyt and White.
8. Principles and Techniques of Practical Biochemistry: Williams and Wilson.

M.Sc. Microbiology

Semester I: Practical

Lab Course I

Code:

0902MB1205

Credit: 2

Total Marks: 50 (35+15)

Course Objectives:

1. To impart practical knowledge hands-on experience
2. To train the students to pursue further education.
3. Become familiar with tools.
4. Gain experience with standard molecular tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
2. Ability to dissect a problem in to its key features.
3. Ability to design experiments and understand the limitations of the experimental approach

1. Introduction to microbiological techniques, washing of glasswares & sterilization.
2. Different media composition and preparation used in Microbiology
3. Preparation of Slants and Plate Culture.
4. Different inoculation techniques.
5. Isolation and enumeration of microbes from air, water, soil and sewage.
6. Maintenance of pure culture.
7. Staining of microbes: Gram staining, Acid-fast staining, Cotton blue staining.
8. Hanging drop technique for motility of bacteria.
9. Study of Mitosis and Meiosis.
10. Effect of pH, temperature, light and nutrient source on the growth of microorganisms.
11. Bacterial growth curve by measuring the turbidity.

M.Sc. Microbiology

Semester I: Practical

Lab Course II

Code:

0902MB1206

Credit: 2

Total Marks: 50 (35+15)

Course Objectives:

1. To impart practical knowledge hands-on experience
2. To train the students to pursue further education.
3. Become familiar with tools.
4. Gain experience with standard molecular tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
2. Ability to dissect a problem in to its key features.
3. Ability to design experiments and understand the limitations of the experimental approach

1. Estimation of sugar by Anthrone reagent.
2. Estimation of sugar by Folin-Wu method.
3. Estimation of Amino acids by Ninhydrin method.
4. Estimation of Total protein by Biuret and Lowry's method.
5. Quantitative estimation of Iodine number and Acid value of oil.
6. Estimation of DNA by DPA method.
7. Estimation of RNA by Orcinol method.
8. Determination of Optimum pH and Temperature of enzyme Peroxidase extracted from germinating seeds.
9. Paper chromatography of Amino acids.
10. Verification of Lambert Beer's Law.
11. Gel chromatography for separation of a mixture of molecules.

M.Sc. Microbiology
Semester I: Theory
Food and Nutrition
Code: 0902OE1307

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Food and Nutrition.
2. To train the students to pursue further education.
3. To be familiar with dietetics and nutritional requirements.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals Food and Nutrition and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.

Module I

Cereal: Types, Structure and composition, Nutritional value, Storage and Care.
Pulses: Types, Composition and Nutritional Value.
Nuts and Oil seeds: Classification, Nutritional value and Importance.

Module II

Milk and Milk Products: Composition of Milk, Properties, Effect of Heat and Nutritional value.
Fruits and Vegetables: Composition, Classifications, Nutritional value and Storage.
Flesh Foods: Meat, Fish and Poultry uses, Nutritional value and Storage.

Module III

Nutrition: Food as Nutrients, Types of Nutrients, Functions of Food.
Carbohydrates: Classification, Source and Functions.
Fats and Oils: Classification, Source and Functions.
Protein: Sources, Functions, Essential and Non-essential Amino acids.

Module IV

Vitamins: Definition, Types, Source, Functions and Deficiency.
Minerals: Source, Functions and Deficiency.
Balance Diet: Definition, Composition, Balance Diet for Adult Man, Woman and Young Children.
RDA: Definition, RDA for Average Indians,

Module V

Energy: Definition, Unit of Energy, Body's need for Energy, BMR
Malnutrition: Protein-Energy Malnutrition, Malnutrition and Infection, Malnutrition and Behaviour.
Nutrition and Fitness: Diet and Aerobic Fitness, Fitness Plan.
Nutrition and Disease: Obesity, Diabetes and Heart Disease.

Suggested Readings:

1. Food and Nutrition: Don Ross; Oxford Book Company.
2. Nutritional Biochemistry: Tom Brody; Academic Press.
3. Nutrition Now: Judith E Brown; Wadsworth Cengage Learning.
4. A Text Book of Foods, Nutrition & Dietetics: M R Begum; Sterling Publishers Pvt. Ltd.
5. Nutrition and Dietetics: Subhangini A Joshi; Tata McGraw Hill Education Pvt. Ltd.

M.Sc. Microbiology
Semester I: Theory
Management in Practice
Code: 0902OE1308

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:

1. To understand the basic functions of management.
2. To know the basic qualities of a manager so that they can be utilized in practical situation.
3. To develop understanding of basic know-how of industrial planning, market assessment, future projections, etc.

Course Outcome:

Skills that students obtain after completion of the course:

1. To prepare business plan and its execution according to market available.
2. Ability to dissect a problem in to its key features.
3. Apply the basic concepts of management to different situations.

Module I

Introduction to Management: - Meaning, nature and importance. Evolution of Management-Classical, Neo-classical, Scientific Theory, Administrative Theory; Functions of a Manager. Qualities of a manager. Social Responsibilities of a Manager, Management as a Process-Planning-Meaning and Importance. Organizing-Meaning and Importance. Staffing- Meaning and Importance. Directing – Meaning and Function.

Module II

Human Resource Management-Meaning. Importance of Human Resource management. Manpower Planning- Meaning and Importance. Difference between Human Resource Development and Human Resource Planning. Recruitment-Meaning and Importance. Selection- Meaning and Methods Training Meaning. and Types. Performance Appraisal- Meaning and Types.

Module III

Organization Behavior- Introduction to Organization Behavior- Meaning, Importance and scope. Motivation- Meaning, Process and Importance. Motivational Theories- Maslow, Herzberg and McClelland. Attitude- Meaning and Importance, Components of attitude in Organization Behavior. Perception- Meaning and Importance in the context of Organization Behavior.

Module IV

Marketing Management- Meaning, Importance and Implications. Marketing Mix- Product- Meaning, types and Importance. Place- Meaning and Importance. Price- Meaning. Methods and Importance; Promotion- meaning. Instruments and Importance to make a marketing decision.

Module V

Financial Management- Meaning and Importance. Relationship with other managerial functions. Financial Analysis- Meaning and Importance; Tools of financial management, Fund Flow – Meaning, Process; Fixed and Working Capital- Meaning and Importance.

Suggested Readings:

- Principles of Management: L. M. Prasad
- Management by Robbins.
- Marketing Management-Raja Gopal.
- Financial Management for Non-Finance Executives by Dr. Prasanna Chandra
- Human Resource Management by C. V. Mamoria
- Organizational Behavior by S. Robbins
- Management by Stoner
- Financial Management by Khan and Jain
- Financial Management by Dr. Prasanna Chandra
- Marketing Management by Philip. A. Kotler
- Human Resource Management by Edward Flipo

M.Sc. Microbiology
Semester II: Theory
Immunology
Code:
0902MB2101

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:

1. To impart through knowledge of Immunology.
2. To train the students to pursue further education.
3. To be familiar with Immunological tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Immunology and key principles of it.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.

Module I

Introduction; Cells of the Immune system; Innate and Acquired immunity; Organs and cells involved in immune system and Primary and Secondary immune response; Nature of antigens; Chemical and molecular basis of antigenecity; superantigen, Immunogenicity; Epitopes, Haptens, Adjuvant, Freund's adjuvants and its significance. Immune Responses; Theory of Clonal selection.

Module II

B-lymphocytes, their subpopulation and activation; Structure and function of Immunoglobulin; Antigenic determinants on immunoglobulin; Antigen-Antibody interactions; Antibody affinity, avidity; Agglutination; Precipitation; Idiotypic antibodies; Theories of antibody formation, hybridoma technology for monoclonal antibodies and designer monoclonal antibodies. Multiple mylomas and structural basis of antibody diversity; Antibody engineering; Generation of antibody diversity; Major Histocompatibility Complex.

Module III

Biology of T lymphocyte; Classification of T lymphocytes; Structure of T Cell Receptor (TCR); TCR diversity and genetics, Antigen processing and presentation; Cytokines; Cell mediated cytotoxicity: mechanism of T cell and NK cell mediated lysis; Hypersensitivity. Non-specific immune mechanism: Surface defenses, Tissue defenses, Opsonization, Inflamatory reaction, and Hormone balance. Tissue metabolites with bactericidal properties (lysozyme, nuclein, histone, protamine, basic peptides of tissues – leukins, phagocytins, lecterins, haemocompounds).

Module IV

Expressions and Regulation of Immune Response: Antigen processing and presentation, Generation of humoral and cell mediated immune response, Activation of B and T lymphocytes, Cytokines and their role in immune regulation, T cell regulation, MHC restriction, Immunological tolerance. Cell mediated cytotoxicity: Mechanism of T cells and NK mediated lysis, antibody dependent cell mediated cytotoxicity,

and macrophage mediated cytotoxicity. Complement system, Regulation of complement activation. Transplantation immunology: MHC, Types of grafts, Grafts rejection, GVH reactions, Mechanism of graft rejection and prevention of graft rejection.

Module V

Immunity and Immunoassays Defense against bacteria, viruses, fungi and parasites including Immunodiagnostics and immunotherapy. Immuno-assays: SRID, ELISA, ELISA-PCR, RIA, Western Blotting, FACS, Immunofluorescence, Flow cytometry, Immunodiffusion and Immunoelectrophoresis; Hemagglutination; Immunofluroscens and their application.

Suggested Readings:

- Immunology: Kubey
- Immunology: A short Course; Eli Benjamin, Richard Coico
- Fundamentals of Immunology: William Paul
- Essentials of Immunology (6th Edition): Ivan Riot- Blackwell Scientific Publications, Oxford, 1988.
- Antibodies- A laboratory Manual: Harlow and David Lane (1988), Old Spring harbor Laboratory.
- Immunology: Roitt, Brostoff and Male
- Immunology: C.A. Janeway and Paul Travers.
- Immunology: Weir, D.M. 1992.
- Immunological techniques: I. R. Tizard, Immunology, An Introduction, 1995, 4th edition – Saunder's.

M.Sc. Microbiology

Semester II: Theory

Biostatistics and Research Methodology

Code: 0902MB2102

Credit: 4

Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Statistics and Research Methodology
2. To be familiar with biostatistics and its application.
3. Become familiar with statistical tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of statistics & research methodology and key principles of it.
2. Awareness of its major application.
3. Ability to use Computer for biostatistics or related problems.

Module I

Introduction to biostatistics; Kinds of biological data, Frequency distribution, Cumulative frequency distributions. Descriptive Statistics – Measures of Central tendency, Arithmetic Mean, Median, and Mode. Measures of dispersion – Standard deviation and Coefficient of Variations. Random Variable: Expectation and variance. Probability distribution, Mean Variance, Binomial, Poisson, Mean, Variance.

Module II

Normal distribution and standard normal distribution: Area properties, mean, variance, Testing of Hypothesis, Types of Hypothesis, Types of errors; z-test, t-test, F-test; Testing goodness of fit, Chi Square (χ^2) test.

Module III

Technique for analyzing Variance and Covariance, Principle of ANOVA, One-way ANOVA, Two-way ANOVA; Non Parametric tests: Sign test, Wilcoxon matched pairs test, Wilcoxon-Mann-Whitney test, Kruskal –Wallis test, Runs test (Test for randomness). Spearman's Rank Correlation, Kendall's coefficient.

Module IV

Research Methodology: Introduction, Meaning, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Research Methodology, Research & Scientific Method, Significance of knowledge of Research Methodology, Process of Research, Criteria of Good Research, Limitations of Research, Research Problem, Selecting a Problem, Necessity of defining the Problem, Techniques involved in defining a Problem, Hypothesis-Meaning & Characteristics, Research Design – Meaning, Need for Research Design, Features of good design, Developing a Research Plan Information sources for Literature search.

Module V

Interpretation and Report writing: Meaning of Interpretation, Techniques of Interpretation, Precaution in Interpretation, Significance of Report writing, Different steps in writing report, Layout of the Research Report, Types of Reports, Mechanics of writing a Research report, Precautions for writing Research Reports, Conclusions, Oral presentation.

Suggested Readings:

- Biostatistical Analysis: Jerrold H Zar
- Principles of Biostatistics: Mercelo Pagano
- Fundamentals of Biostatistics: Khan and Khanum
- Fundamentals of Biostatistics- Practical Approach: Naren Kumar Dutta
- Fundamentals of Mathematical Statistics : S C Gupta and V K Kapoor
- Statistical Methods: Snedecor and Cochran
- Research Methodology- Methods and Techniques: C. R. Kothari
- Research Methodology- A Step-by-Step Guide for Beginners: Ranjit Kumar

M.Sc. Microbiology
Semester II: Theory
Bacteriology, Mycology and Virology
Code: 0902MB2103

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:
1. To impart in-depth knowledge of Bacteriology, Mycology and Virology
2. To train the students to pursue further education.
3. To be familiar with microbiological tools.
4. To increase expertise of the course.

Course Outcome:
Skills that students obtain after completion of the course:
1. Understanding of the fundamentals of Bacteriology, Mycology and Virology and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
4. Ability to dissect a problem in to its key features.

Module I

Systematic study of bacteria; morphological, physiological, biochemical and serological studies; Genetic characterization, identification & classification chart; Habitat, structure, reproduction & classification of bacteria; Enterobacteriaceae and related organisms, their morphological & physiological characters, genetic interrelationship, taxonomic sub-division & their importance in human health.

Module II

Myxobacteria, cytophage group, filamentous & gliding chaemoheterotrophs & filamentous sulphur oxidizing bacteria. Gram positive spore forming bacteria; unicelluar endospore formers- *Bacillus*, *Clostridia*. Miscellaneous bacteria; lactic acid bacteria, *Micrococci*, *Corynebacteria*, *Mycobacteria*.

Module III

Fungal diversity-major taxonomic group, structure, reproduction, life cycle and significance of the following representatives: Gymnomycota: general account – cellular slime moulds (Dictyostelium), plasmodial slime moulds (Myxomycetes). Mastigomycota - Coelomomyces, Phytophthora, Plasmodiophora. Amastigomycota, Zygomyocotina - *Mucor*, *Blakeclea*, *Entomophthora*. Ascomycotina - *Emericeilla*, *Chaetomium*, *Neurospora*, *Claviceps*. Basidiomycotina - *Puccinia*, *Melamspora*, *Ustilago*, *Polyporus*, *Lycoperdon*, *Ganoderma*. Deutromycotina - *Fusarium*, *Cercospora*, *Curvularia*, *Beauveria*, *Microsporum*, *Phoma*.

Module IV

Fungi and biotechnology: production of alcoholic beverages, antibiotics, organic acids, ergot alkaloids; the cultivation of fungi for food - mushrooms, myco protein and mycofoods; Role of fungi in agriculture and forestry - mycorrhizae and their application, mycopesticides, mycotoxins, conservation of fungal germplasm.

Module V

General virology: Methods for isolation, identification, characterization and cultivation of viruses: Methodology for isolation, adsorption, One-step growth and burst size of virus. Determination of titre value, isolation of phage resistant strain, cultivation and maintenance of plant, animal and bacterial/ cyanobacterial viruses. Identification of viruses by physical, chemical and serological techniques. Prevention, treatment and control of viral diseases. Viral vaccines including DNA vaccines and interferons. Plant viruses: Some common viral diseases of plants (TMV, CMV, leaf curl of papaya). Animal viruses: Brief account of Adeno, Herpes, Hepatitis and HIV. Prevention, treatment and control of viral diseases.

Suggested Readings:

- General Microbiology-Roger. Y. Stainer, et al. 1986; Macmillan Press Ltd., Hampshire.
- Microbiology-An introduction: Gerald. J. Tortora, Berdell R. Funke,
- Christine.L.Case, Vth edition, 1995: The Benjamin/Cummings Publishing Co. Inc., USA.
- Microbiology: Essentials and Applications: Larry McKane, Judy Kandel, 2nd edition; 1996; McGraw Hill Inc.
- Microbiology- Prescott, Harley, Klein, 4th edition, 1999; McGraw Hill Inc.
- Microbiology: Brock and Madigan
- Microbiology: Pelczar, Chan and Krieg
- Microbiology: Powar and Daginawala
- General Microbiology: R. Y. Ingraham
- Microbiology: Katherine Black
- Fundamental Principles of Bacteriology: A J Salle, Tata McGraw-Hill.
- Introductory Mycology: C J Alexopolus, C W Mins, M M Blackwell, 4th Edition.
- An Introduction to Fungi: H C Dubey, 4th Edition.
- Textbook of Virology: Vinod Singh.
- Introduction to Modern Virology: N J Dimmnock.

M.Sc. Microbiology
Semester II: Theory
Microbiology Physiology and Metabolism
Code: 0902MB2104

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:
1. To impart in-depth knowledge of Microbial Physiology and Metabolism.
2. To train the students to pursue further education.
3. To be familiar with microbiological tools.
4. To increase expertise of the course.

Course Outcome:
Skills that students obtain after completion of the course:
1. Understanding of the fundamentals of Microbial Physiology and Metabolism and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
4. Ability to dissect a problem in to its key features.

Module I

Microbial growth: mathematical expression of growth, growth measurement, efficient growth curve, synchronous growth and continuous culture, effect of environmental factors on microbial growth, nutrients diffusion, active transport, group translocation, solutes, temperature, oxygen relations.

Module II

Photosynthetic microorganisms, brief account of photosynthetic pigments, Oxygenic and anoxygenic photosynthesis, cyclic and non-cyclic photophosphorylation, fixation of CO_2 - Calvin cycle -C3 & C4 pathway. Chemolithotrophy: sulphur, iron, hydrogen, nitrogen oxidations; Methanogenesis - luminescence. Electron transport- photoautotrophic generation of ATP, reverse TCA, carbohydrate anabolism. Bioluminiscence, quorum sensing, signal transduction pathways.

Module III

Aerobic respiration, EMP, ED and HMP pathway. TCA cycle- amphibolic reactions. Glyoxalate cycle. Mechanisms of substrate – level and oxidative phosphorylation. Respiratory electron transport in mitochondria and bacteria. Anaerobic respirations: Introduction, sulphate, nitrate, carbonate respirations and their ecological significance. ETC in some anaerobic bacteria. Catalase, SOD, Pasteur Effect. Fermentation of carbohydrates- homo and heterolactic fermentations.

Module IV

Lipid metabolism – Biosynthesis of glycerols, phospholipids and glycolipids. Oxidation of saturated and unsaturated fatty acids. Microbial metabolism of aromatic and aliphatic hydrocarbons (camphor, 2,4–D and toulene), Nucleotide metabolism – Biosynthesis of purine and pyrimidine nucleotides-salvage and *de novo* pathways.

Module V

Protein metabolism – Assimilation of inorganic nitrogen and sulphur. Biosynthetic pathways of amino acids and their regulation with emphasis on tryptophane and histidine. Porphyrine biosynthesis; catabolism of aminoacids (transaminaton, deamination). Degradation of proteins- proteases, exo & endo peptidases.

Suggested Readings:

- Microbial Physiology and Metabolism: D.R. Caldwell.
- Microbiology: Lansing M. Prescott, John P. Harley and Donald A. Klein
- Microbiology-Essentials and applications: Larry McKane and Judy Kandel.
- Microbial Physiology: A.G. Moat and J.W. Foster.
- Microbiology: M.J. Pelczar (Jr), E.C.S. Chan and N.R. Kreig.
- Fundamental principles of Bacteriology: A. J. Salle.
- The Physiology and Biochemistry of Prokaryotes: D. White.
- Microbial Physiology: S. Ram Reddy and S. M. Reddy.
- Biochemistry: Donald Voet and Judith G. Voet.
- Biochemistry : Lubert Stryer.
- Biochemistry: G Zubay.
- Principles of Biochemistry: Lehninger, Nelson & Cox
- Harper's Review of Biochemistry: Martin, Mayer & Rodwell
- Outlines of Biochemistry: Conn, Stumpf, Bruening & Doi.

M.Sc. Microbiology

Semester II: Practical

Lab Course III

Code:

0902MB2205

Credit: 2

Total Marks: 50 (35+15)

Course Objectives:

1. To impart practical knowledge and hands-on experience
2. To train the students to pursue further education.
3. Become familiar with tools.
4. Gain experience with standard molecular tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
2. Ability to dissect a problem in to its key features.
3. Ability to design experiments and understand the limitations of the experimental approach

1. Precipitation reaction: antigen-antibody interaction.
2. Agglutination reaction.
3. Radial Immunodiffusion.
4. ELISA.
5. Purification of IgG from the serum by ammonium sulphate, acetone precipitation and dialysis.
6. SDS-PAGE of denatured protein samples and determination of molecular weight of unknown proteins.
7. Poly Acrylamide Gel Electrophoresis of native proteins.
8. Estimation of acid and alkaline phosphate from serum.
9. Western Blotting of proteins.
10. Analysis of urine sample.
11. Antibiotic sensitivity test of blood and urine culture.
12. VDRL test.
13. HBs-AG test.
14. Estimation of Hemoglobin.
15. Perform an experiment based on probability distribution function.
16. Perform an experiment to correlate median class and standard deviation.
17. Calculate regression and correlation use excel

M.Sc. Microbiology

Semester II: Practical

Lab Course IV

Code:

0902MB2206

Credit: 2

Total Marks: 50 (35+15)

Course Objectives:

1. To impart practical knowledge and hands-on experience
2. To train the students to pursue further education.
3. Become familiar with tools.
4. Gain experience with standard molecular tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
2. Ability to dissect a problem in to its key features.
3. Ability to design experiments and understand the limitations of the experimental approach

1. Determination of growth curve and generation time.
2. Estimation of microbial enzymes-amylase, invertase, protease, celllulase, lipase, catalase and phosphatase.
3. Iodine number of fatty acids.
4. Determination of K_m and V_{max}.
5. Polyacrylamide gel electrophoresis of proteins.
6. Estimation of protein by Lowry's method.
7. Effect of different concentrations of heavy metal on bacterial growth.
8. To isolate, identify and enumerate *E. coli* and other coliforms from sewage water by using specific agar media.
9. To determine the MPN of portable and drinking water.
10. To determine the standard growth curve of *E. coli* by spectrophotometric method.
11. To isolate and identify various phyto-pathogenic fungi from infected plants foliage.
12. To measure fungal growth on solid agar media by radial method.
13. To measure the fermentation efficiency of *Saccharomyces cerevisiae* in different carbon sources.
14. To isolate bacteriophages from different water sources and perform DALT.

M.Sc. Microbiology
Semester II: Theory
Vaccines and Antibiotics
(Open Elective)
Code:
0902OE2307

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Vaccines and Antibiotics.
2. To be familiar with different tools of Vaccines and Antibiotics
3. To train the students to pursue further education.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Vaccines and Antibiotics and key principles of it.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

Module I

Vaccines: History and Nature; Types of Vaccines with examples: Simple and Mixed Vaccines, Univalent and Polyvalent Vaccines, Inactivated vaccine, Attenuated Vaccine, Live Vector Vaccine, Recombinant Vaccines, Subunit Vaccines, Conjugate Vaccines, Peptide Vaccines, DNA Vaccines, Cell Culture Vaccine.

Module II

Preparation, Standardization and Storage of Vaccines; Multivaccine System; Principles of vaccination, passive and active immunization, immunization programs and role of WHO in immunization programs.

Module III

Hybridoma Technology: Theory; Monoclonal antibodies, Production and applications; Monoclonal Antibodies as Vaccines.

Module IV

Historical background of Antibiotics; Classification of antibiotics: On the basis of Source, Mode of Action and Chemical structure with examples; Antibiotic resistance; Toxicity of antibiotics.

Module V

Broad Spectrum antibiotics: General Structure and Mode of action of Streptomycin, Penicillin, Tetracycline, Chloramphenicol, Quinolone, Sulfonamide, Fusidic acids; Applications of antibiotics.

Suggested Readings:

1. An instruction to industrial Microbiology by Dr. P. K. Sivakumaar, Dr. M. M. Joe, Dr. K. Sukesh.
2. Biotechnology, by Mohan P. Arora.
3. Medical Microbiology and Immunology by Warren Levinson and Ernest Jawetz.
4. Biotechnology by Wufl Crueger and Anneliese Crueger.
5. Microbiology: Principles and Explorations by Jacquelyn G. Black.
6. Microbiology by Prescott, Harley and Klein.
7. Medicinal Chemistry by Ashutosh Kar.

M.Sc. Microbiology
Semester II: Theory
Nanobiotechnology
(Open Elective)
Code: 0902OE2308

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Nanobiotechnology.
2. To be familiar with different tools of Nanotechnology
3. To train the students to pursue further education.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Nanobiotechnology and key principles of it.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

Module-I

Introduction to Nanotechnology: The Nanoscale Dimension and Paradigm; Definition, History and Current practices; Types of Nanomaterials and their Classifications; Over view of Physical and Chemical Fundamentals of Nanomaterials.

Module-II

Properties and Characterizations: Optical (UV-Vis/Fluorescence); X-ray diffraction; Imaging and size (Electron microscopy, Light scattering, Zetapotential).

Methods of Preparation of Nanomaterials: Top down and bottom up approaches-emulsifiers, Homogenizers, Sonicator; Over view of Biological Synthesis of Nanoparticles.

Module-III

Nanomedicine: Nano carriers for Drug delivery, Nanoparticle mediated Drug delivery, Nanotechnology in Drug discovery, Nano-formulation of Herbal Medicine; Nanoscafolds and their use in Cell culture, Organ culture and Tissue Engineering, Regulatory aspects in the approval of Nano medicine, Nano-Cosmetics and other use.

Module-IV

Nanomaterials and Toxicity Evaluation: Cyto-toxicity, Geno-toxicity, in vivo tests/assays etc.; Toxicological considerations in Nano medicine and Nano-delivery system.

Module-V

Environmental Applications: Nano clays, Nano adsorbents, Zeolites, Release of Nutrients and Pesticides, Biosensors - Green Technologies - Molecular biomimetic; Nano remediation: Identification and characterization of Hazardous waste; Nano pollution: air - water - soil contaminants; Treatment waters using nano-particles.

Suggested Readings:

1. Nanoscience: Nanobiotechnology and Nanobiology: Boissaeu, Houdy & Lehmani.
2. A-Z Nanobiology: Albert Shawn.
3. Nanotechnology in Biology and Medicine: Methods, Devices and Application, 2007, Tuan Vo-Dinh. CRC press
4. Nanoscience : Nanobiotechnology and Nanobiology (2009) P. Boisseau, P. Houdy and M.Lahmani, (Eds.) Springer, Heidelberg

M.Sc. Microbiology
Semester III: Theory
Medical Microbiology
Code: 0902MB3101
Credit: 4
Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Medical Microbiology.
2. To train the students to pursue further education.
3. To be familiar with Medical Microbiology tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Medical Microbiology and key principles of it.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

Module I

Early discovery of pathogenic microorganisms; scopes and development of bacteriology as scientific discipline; contributions made by eminent scientists. Classification of medically important micro organisms; Normal microbial flora of human body; role of the resident flora; normal flora and the human host.

Module II

Establishment, spreading, tissue damage and anti-phagocytic factors; mechanisms of bacterial adhesion, colonization and invasion of mucous membranes of respiratory, enteric and urino-genital tracts. Role of aggressins, depolymerising enzymes, organotropisms, variation and virulence. Organs and cells involved in immune system and immune response.

Module III

Classification of pathogenic bacteria *Staphylococcus, Streptococcus, Pneumococcus, Neisseria, Corynebacterium, Bacillus, Clostridium*, Non sporing Anaerobes, Organisms belonging to Enterobacteriaceae, Vibrios, Non fermenting gram negative bacilli *Yersinia; Haemophilus; Bordetella, Brucella; Mycobacteria, Spirocheates, Actiomycetes; Rickettsiae, Chlamdiae*.

Module IV

General properties of Viruses; Viruses host interactions; Pox viruses; Herpes virus, Adeno viruses; Picarno viruses; Orthomyxo viruses; Paramyxo viruse; Arboviruses; Rhabdoviruses, Hepatitis viruses; Oncogenic viruses; Human Immuno deficiency viruses. Dermatophytes, dimorphic fungi, Opportunistic fungal pathogens. Description and classification of pathogenic fungi and their laboratory diagnosis.

Module V

Laboratory control of anti-microbial therapy; various methods of drug susceptibility testing, antibiotic assay in body fluids. Brief account on available vaccines and schedules; passive prophylactic measures; Nosocomial infection, common types of hospital infections and their diagnosis and control.

Suggested Readings:

- A text book of Medical Parasitology: Jayaram Panicker
- A text book of Microbiology: Chakraborty
- Medical Microbiology Vol. I and II: Mackie and Mc Carthy
- A text book of Microbiology: R. Ananthnarayanan
- Text book of immunology by Kubey

M.Sc. Microbiology
Semester III: Theory
Microbial Genetics
Code: 0902MB3102

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:
1. To impart basic knowledge of Microbial Genetics.
2. To train the students to pursue further education.
3. To be familiar with Genetics tools.

Course Outcome:
Skills that students obtain after completion of the course:
1. Understanding of the fundamentals of Microbial Genetics and key principles of it.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

Module I
Bacterial plasmids: structure and properties, types -Fertility factors, drug resistance plasmids, Col Plasmids Ti plasmids, and other types of plasmids, detection, purification and transfer of plasmid DNA, *In vitro* plasmid transfer, plasmid- replication, amplification and incompatibility.
Transposition: Discovery, structure and types of bacterial transposons, mechanism of transposition, spread of antibiotic resistance.

Module II
Bacterial Transformation: Discovery, Biology of transformation, Molecular mechanism of transformation, mapping by transformation, transformation in nature. Bacterial conjugation: F Factor, Hfr Transfer, Gene mapping, artificially induced competence, Transduction: Generalized and specialized transduction.

Module III
Phage Biology: General properties of phage, structure of phage, lytic and lysogenic cycle, Counting phage, properties of phage infected bacterial culture, specificity in phage infection, host restriction and modification.

Module IV
Mutation: Biochemical basis of mutation, Silent mutation, spontaneous mutations, Induced mutation, physical and chemical mutagens, base pair substitution and frame shift mutation; reversion, detection of mutagens and carcinogens (Ames test).
DNA damage and repair: Biological indications of DNA damage, UV radiation and thymine dimmer, photoreactivation, Dark repair, Excision repair, Recombinational repair and SOS repair.

Module V
Genetic Engineering: Introduction, vectors, restriction enzymes, cloning of restriction fragments, , DNA ligase, insertion of DNA in to vector, cDNA library and genomic library, detection of recombinant molecules, Applications of genetic engineering: Restriction mapping, site directed mutagenesis, production of proteins from cloned genes, and some other applications.

Suggested Readings:

- Text book of Microbiology: Pelczar, Creig and Chan
- Text book of Microbiology: Pawar and Daginwalla. Vol I & II
- General Microbiology: Stanier *et al*.,
- Microbial genetics: Maylor, Cronan and Freifelder
- Microbiology: Presscott *et al*.,
- Microbiology: Talaro & Talaro

M.Sc. Microbiology
Semester III: Theory
General Pathology
Code: 0902MB3103

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of General Pathology.
2. To train the students to pursue further education.
3. To be familiar with pathological tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of General Pathology and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.

Module I

Introduction, history and scope of pathology. Definitions. Etiology of the disease. Predisposing factors, intrinsic and extrinsic factors responsible for the disease. Physical agents, mechanical injuries. Heat, cold and decreased atmospheric pressure, light (photosensitization) UV light, microwaves, electricity, chemical agentsexogenous chemicals (toxin, poisons, drugs and food substances), endogenous chemicals (metabolites, cytolytic or inhibitory immune complexes, free radicles, oxidants)

Module II

Immunopathology Immunopathology – anibody and cells, immuno-competence of foetus and new-born. Immune mediated tissue injury, hypersensitivity reactions- anaphylaxis, Arthus reaction, cyototoxic antibody reaction, immune complex disease, delayed hypersensitivity to chemicals, immuno-deficiency diseases, defective immunocompetence, autoimmune diseases.

Module III

Inflammation – definitions associated with inflammatory phenomenon, etiology of inflammation, cardinal signs, pathogenesis of inflammation, chemical mediators released from injured tissues and inflammatory cells. Cellular reponse in inflammation, structure and functions of cells associated with inflammation. Role of humoral and cell mediated defenses. Various classifications of inflammation. Healing, cellular regeneration capability of different body cells.

Module IV

Cellular Adaptations of Growth and Differentiation: Hyperplasia, Hypertrophy, Atrophy, Metaplasia.
Cell Injury and Cell Death: Necrosis, Apoptosis, Acute and Chronic Inflammation. Tissue Regeneration and Repair, Role of cells (macrophages, fibroblasts, myofibroblasts, endothelial cells), extracellular matrix components and growth factors in healing.

Module V

Common Infectious Diseases Categories of Infectious Agents: Viruses, Bacteria, Fungi, Protozoa Helminths. Environmental and Nutritional Diseases. Industrial and Agricultural Exposures, Effects of Tobacco and Alcohol. Adverse Drug Reactions: Drug Abuse, Poisoning, Radiation Injury.
Nutritional Deficiencies: Vitamins, Minerals • Obesity

Suggested Readings:

- Histology for Pathologists. Stephen S. Sternberg (Ed), Raven Press, New York.
- General Pathology JB Walter, MS Israel. Churchill Livingstone, Edinburgh
- Robbin's Pathologic Basis of Disease Ramzi S.Cotran, Vinay Kumar, Stanley L Robbins WB Saunders Co., Philadelphia.
- Pathology Emanuel Rubin, John L Farber. JB Lippincott Co., Philadelphia
- Anderson's Pathology. John M Kissane (Ed). The CV Mosby Co., St. LouisMicrobiology: Katherine Black
- Fundamental Principles of Bacteriology: A J Salle, Tata McGraw-Hill.
- Textbook of Virology: Vinod Singh.
- Diagnostic Surgical Pathology. Stephen S Sternberg. Lippincott, William Wilkins. Philadelphia
- Systemic Pathology. W St. C Symmers (Series Ed) Churchill Livingstone, Edinburgh

M.Sc. Microbiology
Semester III: Theory
General Parasitology
Code: 0902MB3104

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of General Parasitology.
2. To train the students to pursue further education.
3. To be familiar with parasitological tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of General Parasitology and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.

Module I:

General introduction to parasitology, Definition of terminology, Taxonomy and classification, History and scope, major discoveries, Host and parasite interaction, mechanism of disease produce or cause by parasites, immunity in parasitic infections.

Module II:

Taxonomy of protozoa, classification of pathogenic protozoa, Amoebae, life cycle of *Entamoeba histolytica*, other *Entamoeba* species (comparative study), (*Naegleria fowleri* and *Acanthamoeba*), characteristic feature, laboratory diagnosis, serological investigation. Endolimax (*E. nana*).

Module III:

Mastigophora: *Giardia lamblia, Giardia intestinalis, Trichomonasvaginalis, Trichomonashominis, Enteromonas, Trypanosomabrucei*, *Trypanosomacruzi* and Other intestinal flagellates (comparative study) Leishmania I: Introduction and classification; coetaneous leishmaniasis, visceral leishmaniasis; Status of Leishmaniasis in India.

Module IV:

Sporozoa: Pasmodium (*P. vivax, P. falciparum, P. malariae, P. ovale*), Isospora, Cryptosporidium, Toxoplasma, Babesia. Ciliophora: *Balantidium coli*. Helminths: General features and classification. Intestinal Nematodes, Cestodes (Tapeworms): General features, Intestinal Cestodes. Introduction and classification of trematodes.

Module V:

Laboratory diagnosis of Parasitic Diseases: Examination of faeces, blood, tissue, other specimens, immunodiagnosis. Antiparasitic agents: Antiprotozoan agents, intestinal protozoa, Trypanosomes, Leshmania, Malaria Toxoplasma, Antibacterial antiparasitic agents

Suggested Readings:

1. Paniker's Book of Parasitology, 7th edition by C.K. Jayaram Paniker and Sougata Ghosh, Jaypee brothers Medical Publishers (P) Ltd. New Delhi, India.

2. Parasitology (Protozoology and Healminthology), 13th edition by K.D. Chatterjee, EKTA Publishing House, Kathmandu, Nepal.
3. Text Book of Medical Parasitology 6th edition by C.K. Jayaram Paniker, Jaypee brothers Medical Publishers (P) Ltd. New Delhi, India.
4. Parasitology for Medical and Clinical Laboratory Professionals by John W. Ridley.
5. Advance in Parasitology by Das Gupta
6. The Short Textbook of Medical Microbiology (Including Parasitology), 10th edition by Satish Gupte, Jaypee brothers Medical Publishers (P) Ltd. New Delhi, India
7. Veterinary Parasitology by Hany Elsheikha, Jon S Patterson, CRC Press, Taylor & Francis Group

M.Sc. Microbiology
Semester III: Theory
Environmental Microbiology
Code: 0902MB3105

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:

1. To impart in-depth knowledge related to environmental microbiology
2. Become familiar with the environment.
3. To train the students to pursue further education.
4. Gain experience with standard tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of environmental microbiology and key principles of its.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.

Module I

Definition and scope of environmental microbiology. Aero microbiology: Microorganisms in air, nature of bioaerosols, their fate and transport, extramural aerobiology: Agriculture, waste disposal, intramural aerobiology: buildings, spaceflight, hospitals and labs.

Module II

Microbes in soil and subsurface, surface and deep soil environments, microbes as the source of clean energy. Interaction among soil microorganisms: natural; positive; negative association, Biogeochemical cycling: carbon, nitrogen and sulfur cycle.

Module III

Microbes in aquatic and extreme environments. Techniques for the study of aquatic microorganisms. Fresh water, brackish water, marine water and subterranean, thermophiles, barophiles, acidophiles, alkalophiles, psychrophiles. Role and importance of aquatic microbial ecosystem.

Module IV

Microorganisms in removal of organic and metal pollutants, biodegradation, bioremediation, bioaugmentation. Treatment schemes for waste waters of dairy, distillery, tannery, sugar and antibiotic industry. Microbiology of degradation of xenobiotics in environment; decay behavior and degradative plasmids, hydrocarbons, substituted hydrocarbons, oil pollution, Surfactants and pesticides.

Module V

Microbiology of domestic water and waste water: Water purification; bacteriological techniques, Waste water treatment methods including oxidation ponds, treatment of solid wastes, concept of indicator organism, BOD, COD, activated sludge process, composting, Bioremedation of contaminated oil and waste land.

References

- Comprehensive Biotechnology (Vol. 1-4): M.Y. Young (Eds.), Pergamon Press, Oxford.
- Environmental Microbiology: W.D. Grant & P.E. Long, Blakie, Glassgow and London.
- Bio-treatment Systems, Vol. 22, D. L. Wise (Ed.), CRC Press, INC.
- Standard Methods for the Examination of Water and Waste Water (14th Education), 1985. American Public health Association
- Alan and Scragg, 1999, Environmental Biotechnology. Pearson Education Ltd.England.
- S. N. Jogdand, 1995, Environmental Biotechnology Himlaya Publishing House Bombay.
- Waste Water Engineering – Treatment, Disposal and reuse. Metcalf and Eddy, Inc.,
- TATA McGraw Hill, New Delhi.
- A. K. De, Environmental Chemistry Willey Eastern Ltd. New Delhi.

M.Sc. Microbiology
Semester III: Theory
Industrial Microbiology
Code: 0902MB3106

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:

1. To impart in-depth knowledge of Industrial Microbiology.
2. To train the students to pursue further education.
3. To be familiar with industrial microbiology tools.
4. To gain experience of standard molecular tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Industrial Microbiology and key principles of it.
2. Awareness of the major issues at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

Module I

Introduction to industrial microbiology. Definition, scope, history, microorganisms, properties and industrial products. Screening for microbes of industrial importance. Primary screening, screening for amylase, organic acid, antibiotic, amino acid and vitamin producing microorganisms. Secondary screening. Further evaluation of primary isolates.

Module II

Detection and assay of fermentation products. Physico-chemical methods and biological assays. Fermentation equipment and its use. Design of fermentor, types of fermentor, agitation, aeration, antifoam, pH and temperature control.

Module III

Inoculum media, inoculum preparation. Raw materials: Saccharides, starchy and cellulosic materials. Fermentation media and sterilization. Types of fermentations processes: Solid state, surface and submerged fermentations.

Module IV

Batch, fed batch and continuous fermentations. Direct, dual or multiple fermentations. Scale up of fermentations. Product recovery methods. Fermentation type reactions: alcoholic, lactic acid, mixed acid, propionic acid, butandiol and acetone-butanol types.

Module V

Strain development strategies. Environmental factors and genetic factors for improvement. Immobilization methods: Absorption, covalent linkage, entrapment and cross linkage, types of carriers, advantage and disadvantages.

Suggested Readings:

- Industrial Microbiology: Casida, L E.

- Industrial Microbiology: Patel, A. H.
- Industrial Microbiology: Miller, B. M. and Litsky.
- Industrial Microbiology: Prescott and Dunn.
- Microbial Technology: Peppler, J. H. and Perlman, D.
- Biochemistry of Industrial Microorganisms: Rainbow and Rose
- Economic Microbiology Vol. I-V: Rose.
- Microbial Enzymes and Biotechnology: Fogarty W. M. and Kelly, C. T.
- Comprehensive Biotechnology All volumes Ed. Murray Moo-Yong.
- Biotechnology (A text book of industrial Microbiology) Ed. Cruger & Cruger.
- Advances in Applied Microbiology Ed. Perlman Series of volumes.

M.Sc. Microbiology

Semester III: Practical

Lab Course V

Code:

0902MB3207

Credit: 2

Total Marks: 50 (35+15)

Course Objectives:

1. To impart practical knowledge.
2. To train the students to pursue further education.
3. Become familiar with microbiological tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
2. Ability to dissect a problem in to its key features.
3. Ability to design experiments and understand the limitations of the experimental approach.

1. Demonstration of Bacterial flora of skin.
2. Demonstration of catalase test by bacterial flora of skin.
3. Isolation and Gram staining of Microbial flora of mouth-teeth crevices.
4. Staining techniques – Acid Fast staining, Capsular staining
5. Microorganisms and examination of upper respiratory tract (throat).
6. Isolation and examination of dermatophytes from skin.
7. Primary isolation and examination of enteric pathogens.
8. Immuno diagnosis - ELISA tests
9. Widal test to determine the presence of *Salmonella* infection.
10. Slide agglutination reaction: Blood group determination.
11. Slide agglutination reaction: Rh factor determination.
12. VDRL test/ RPR serological test for syphilis.
13. HBs-Ag test.
14. Isolation of Genomic DNA from Bacteria species
15. Isolation of Plasmid DNA.
16. Molecular size determination of DNA.
17. Restriction digestion and ligation of DNA.

M.Sc. Microbiology
Semester III: Practical
Lab Course VI
Code:
0902MB3208

Credit: 2
Total Marks: 50 (35+15)

Course Objectives:

1. To impart practical knowledge.
2. To train the students to pursue further education.
3. Become familiar with microbiological tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Good quantitative skills such as the ability to accurately and reproducibly prepare reagents for experiments.
2. Ability to dissect a problem in to its key features.
3. Ability to design experiments and understand the limitations of the experimental approach.

Environmental microbiology OR Industrial microbiology

1. Bacterial examination of water by multiple tube fermentation test.
2. Counting of MPN number.
3. Isolation and screening of cellulose degrading organism.
4. Determination of biological oxygen demand of water.
5. Effect of cleaning and sweeping of floors on the microbial population of labs.
6. Isolation of air microorganism.
7. Screening for amylase producing organisms
8. Isolation of rhizobia from root nodule.
9. Analysis of water for pH, turbidity, color, total dissolved solids.
10. Identification and estimation of nitrate, arsenic, iron and alkanity in water.
11. Microscopic studies of fresh water algae and protozoan.
12. To check the pollution levels by collection of particulate settled on leaves at various places in the city.
13. Screening for amylase producing organisms
14. Screening for organic acid producing microorganisms
15. Isolation of antibiotic producing microorganisms by crowded plate technique
16. Isolation and culturing of yeasts
17. Separation of amino acids by chromatography
18. Estimation of glucose by DNS method
19. Estimation of ethanol by dichromate method
20. Estimation of maltose
21. Immobilization of microbial cells by entrapment method.
22. Determine the effect of chemical disinfectant on the growth of microorganism.

General Parasitology

1. Identification of Equipments used in parasitology laboratory - Principles, Uses , maintenance
2. demonstration & visual presentation of protozoan examples
3. Stool examination
4. Detection and identification of *Entamoeba histolytica*
5. Detection and identification of other *Entamoeba* species Microscopy and visual presentation (differential morphology)
6. Detection and identification of *Pasmodium* species
7. Detection and identification of *Giardia lamblia*
8. Detection and identification of *Trichomonas vaginalis*
9. Detection and identification of other intestinal flagellates Microscopy and visual presentation (differential morphology)
10. Detection and identification of *Leishmania* species I: Coetaneous
11. Detection and identification of *Leishmania* species II: Visceral
12. Leishmaniasis in India – visual presentation
13. Detection and identification of trypanosomes
14. Detection and identification of trypanosomes Microscopy and Visual presentation

General Pathology

1. Sterilization and disinfection
2. Examination of urine, body fluids and stool.
3. Collection of blood
4. Estimation of blood sugar, urea, creatinine, proteins, bilirubin, cholesterol and uric acid.
5. Hemoglobin estimation, blood counts.
6. Collection, handling, documentation and section of material for important procedures.
7. Use of various culture media and identification of bacteria by specific procedures.
8. Use of various microbiological stains.
9. Identification of fungi in specimen and culture.
10. Antibiotic sensitivity tests.
11. Diagnostic procedures in important viral infections.
12. Staining and reporting of smears
13. ABO grouping, Rh typing, special blood groups
14. Serological techniques Widal, VDRL, HIV, HBS-Ag, pregnancy tests.

M.Sc. Microbiology

Semester III: Theory

Medicinal and Pharmaceutical Chemistry

Code: 0902OE3309

Credit: 4

Total Marks: 100 (70+30)

Course Objectives:

1. To impart basic knowledge of Medicinal and Pharmaceuticals Chemistry.
2. To train the students to pursue further education.
3. To be familiar with Chemical tools.
4. To increase expertise of the course.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals Medicinal and Pharmaceuticals Chemistry and key principles of it.
2. Awareness of the major issue at the forefront of the discipline.
3. Ability to dissect a problem in to its key features.
4. Ability to design experiments and understand the limitations of the experimental approach.

Module I

Local Anti Infective Drugs: Introduction and general mode of action, synthesis of sulphonamides, furazolidone, nalidixic acid, ciprofloxacin, norfloxacin, dapsone, amino salicylic acid, isoniazid, ethionamide, ethambutal, fluconazole and griseofulvin.

Module II

Antimalarials: Synthesis and properties of the following Anti malarial, 8-amino quinoline derivatives-pamaquine, primaquine, pentaquine, isopentaquine, 4-amino quinoline, derivatives- santoquine, camaquine, acridine derivatives-mepacrine, azacrin, pyrimidine and biquanide, derivatives-paludrine, pyremethamine.

Module III

Cardiovascular Drugs: Introduction, cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular output. Direct acting arteriolar dilators synthesis of amylnitrate, quindine methylopa, sorbitrate and atenolol.

Antineoplastic Drugs: - Introduction, cancer chemotherapy, special problems, role of alkylating agents and anti metabolites in treatment of cancer. Mention of carcinolytic antibiotics and mitotic inhibitors. Synthesis of mechlorethamine, cyclophosphamide, melphalan, uracil, mustards and 6-mercaptopurine.

Module IV

Drug Design: Development of new drugs, procedure followed in drug design, concept of lead compound and lead modification, concept of prodrug and soft drug, Structure activity relationship (SAR), factors affecting bioactivity, Quantitative structure activity relationship (QSAR), Concept of drug receptors, Physico-chemical parameter, lipophylicity, partition coefficient, Free-Wilson analysis, Hansch analysis, relationship between Free-Wilson and Hansch analysis, LD-50, ED-50 (Mathematical derivation of equations. excluded).

Module V

Pharmacokinetics: Introduction to drug adsorption, disposition, elimination using pharmacokinetics, important pharmacokinetic, parameter in defining drug disposition and in therapeutics', Mention of uses of pharmacokinetics in drug development process.

Pharmacodynamics: Introduction, elementary, treatment of enzyme stimulation, enzyme inhibition, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry

Suggested Readings:

- Natural Products Chemistry and Biological Significance, J. Mann, R.S. Davidson, J.B. Hobbs.
- Organic Chemistry, D.V. Banthrope, Longman Essex, J. B. Harbrone.
- Streoselective Synthesis, M.Nogradi and CHV. Odds Chemistry of Carbon Compounds, ED.S. Coffey, Elsevier.
- Biological and Pharmacological Properties of Medicinal Plants from Americans, M. P. Gupta and A. Marston, Harwood Academic Publishers.
- Introduction to Flavonoids, B. A. Bohm. Harwood Academic Publishers.
- New Trends in Natural Products, Rahman and M.I. Choudhary.
- Insecticides of Natural Origin, Sukh Dev.
- Text Book of organic Medicinal and Pharmaceutical Chemistry, Robert F. Dorde.
- An Introduction to Drug Design, S.S. Pandeya and J.R. Dimmock.
- Berger's Medicinal Chemistry and Drug Discovery, Vol-I (Chapter-9 and Ch-14). Goodman and Gillman's Pharmacological Basis of Therapeutics, Mc Graw Hill.
- The Organic Chemistry of Drug Design and drug Action, R.B. Silverman. Strategies for Organic Synthesis and Design, D. Lednicer, John Wiley.
- Burger. Medicinal Chemistry and Drug Discovery, Vol-1, Ed. M. E. Wolff, John Wiley (1994).
- Goodman & Gilman. Pharmacological Basis of Therapeutics, McGraw-Hill (2005).
- S. S. Pandeya & J. R. Dimmock.Introduction to Drug Design, New Age International.(2000).
- D. Lednicer. Strategies for Organic Drug Synthesis and Design, John Wiley (1998).
- Graham & Patrick. Introduction to Medicinal Chemistry (3rd edn.), OUP (2005)

M.Sc. Microbiology
Semester III: Theory
Entrepreneurship
(Open Elective)
Code: 0902OE3310

Credit: 4
Total Marks: 100 (70+30)

Course Objectives:

1. To learn basics of Entrepreneurship.
2. To understand statutory requirements on Entrepreneurship.
3. To develop understanding of basic know-how of industrial planning, market assessment, future projections, etc.

Course Outcome:

Skills that students obtain after completion of the course:

1. Implementation of entrepreneurship values
2. Ability to dissect a problem in to its key features.
3. To prepare business plan and its execution according to market available.

Module I

Entrepreneur-entrepreneurship-and-enterprise: conceptual issues. Entrepreneurship versus Management. Entrepreneurship versus Intrapreneurship. Qualities of an entrepreneur. Role of entrepreneurship in economic development. Role and functions of entrepreneur in relation to new venture creation. especially in the developing country context. Small business as the seedbed of entrepreneurship-contemporary discourse on small and medium enterprises.

Module II

Economic, Sociological and Psychological Perspectives. Entrepreneurial competencies, motivations, performance and rewards: The concept, metrics and role in entrepreneurial manifestation and sustenance entrepreneurship as a creative and dynamic process. Innovation and entrepreneurial orientation in a developing economy.

Module III

Global Entrepreneurship Monitor (GEM) Project, Total Entrepreneurship Index (TEI), India's rank and the issues facing Indian Entrepreneurship: Prominent business families and communities; Issues involved in family business. Especially those pertaining to accessing support for one's business ideas, assuming and asserting one's role in family business, and, leadership succession. The contemporary role models in Indian business: their values, business philosophy and behavioural orientations.

Module IV

Entrepreneurial Development Programmes: role, relevance and achievements. Role of Government in organizing EDPs. Critical Evaluation; Problems and Constraints. Reach of the various promotional programmes, evaluation of their effectiveness and the ways and means of accessing the available help. Role of industries/entrepreneur's associations and self-help groups.

Module-V

The idea of business and sources of business ideas. Opportunity sensing via personal observation, vicarious experience, primary surveys and secondary data analysis. Role of business

consultants/mentors, entrepreneurship trainers, and, family-and community networks in identifying business opportunities. Compatibility of the business idea with the personal profile of the entrepreneur. Tools and techniques of Economy-Sector- Industry analysis and projections.

Suggested Readings:

1) Harell (1995), 'For Entrepreneurs Only', New Jersey Career pub.
2) Vikram Sarabhai, (1974), 'Management for development', Vikas publications.
3) Rajagopal, Entrepreneurship and Rural Markets
4) Dr. Varshini, Fundamentals of Entrepreneurship
5) Ovmerod A, (1992), 'Textile, Project Management', The Textile Institute.
6) Rerry and Franklin, (2002), 'Principals of Management'. AITBS.
7) Acharya B.K. and Gonekan P.B. (1985) 'Marketing and Sale Management', Bombay, Himalaya Publication House

M.Sc. Microbiology
Semester IV

Semester IV is entirely based on the dissertation work as per the details below

Total Credits-20

1. Dissertation (Code: 0902MB4101)
2. Dissertation Seminar (Code: 0902MB4102)
3. Viva Voce (Code: 0902MB4103)