School of Biological and Chemical Sciences

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M.Sc. Biochemistry

Prog. Code: 0902BC

(Two year Full Time Post Graduate Course)

Semester Pattern

Syllabus M.Sc. Biochemistry (Prog Code: 0902BC)

GENERAL INTRODUCTION OF THE DEPARTMENT

MATS School of Biological and Chemical Sciences (MSBCS) 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

ABOUT THE COURSE M. SC. BIOCHEMISTRY

Biochemistry is the research-oriented science, dealing with Biochemistry and Biochemical Technology. This study includes a large variety of subjects including Biochemistry, General Microbiology, Computer, Bioinformatics & Biostatistics, Instrumentation, Management in Practice, Cell & Molecular biology, General Physiology & Nutritional Biochemistry, Immunology, Bioenergetics and Metabolism, Entrepreneurship, Plant Biochemistry, Enzymology and Clinical Biochemistry, Plant Biotechnology, Microbial biochemistry & Genetic Engineering, 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. BIOCHEMISTRY PROGRAM:

1. To impart knowledge and skills of various aspects of Biochemistry.
2. To train the students for industrial need and to pursue further education.
3. To develop human resource and entrepreneurs in Biochemistry with the ability to independently start their own ventures or small biotech units in the field of Life Sciences.
4. Understand Modern Biochemistry - 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.

ELIGIBILITY FOR ADMISSION:

Interested aspirants for M.Sc. Biochemistry 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 biochemistry.
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 Bioprocess 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:

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

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. For Diploma Courses the obtaining a minimum of 23% marks in aggregate in each course shall be essential for passing course and earning its assigned credits. A candidate, who secures less than 23% of marks in a course shall be deemed to have failed in that course. For PG Diploma courses the minimum pass marks for each paper will be 25% and in aggregate it should be 33%, remaining conditions being the same.

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. Biochemistry (Prog. Code: 0902BC)

Semester I					Marks Distribution		
	Code	**Subject**	**Hours/ week**	**Credit (L+T+P)**	**External**	**Internal**	**Total**
Core Course	02BC1101	Cell and Molecular Biology	4	4 (4+0+0)	70	30	100
	02BC1102	General Microbiology	4	4 (4+0+0)	70	30	100
	02BC1103	Biochemistry	4	4 (4+0+0)	70	30	100
	02BC1104	Instrumentation	4	4 (4+0+0)	70	30	100
Laboratory	02BC1205	Lab Course I	4	2 (0+0+2)	35	15	50
	02BC1206	Lab Course II	4	2 (0+0+2)	35	15	50
Open Elective	09OE1307 OR 09OE1308	Food and Nutrition (09OE1307) **OR** Management in Practice (09OE11308)	4	4 (4+0+0)	70	30	100
		Total	**28**	**24 (20+0+4)**	**420**	**180**	**600**
Semester II							
Core Courses	02BC2101	Immunology	4	4 (4+0+0)	70	30	100
	02BC2102	Biostatistics & Research Methodology	4	4 (4+0+0)	70	30	100
	02BC2103	Plant Biochemistry	4	4 (4+0+0)	70	30	100
	02BC2104	Bioenergetics and Metabolism	4	4 (4+0+0)	70	30	100
Laboratory	02BC2205	Lab Course III	4	2 (0+0+2)	35	15	50
	02BC2206	Lab Course IV	4	2 (0+0+2)	35	15	50
Open Elective	09OE2307 OR 09OE2308	Vaccines and Antibiotics (09OE2307) **OR** Nanobiotechnology (09OE2308)	4	4 (4+0+0)	70	30	100
		Total	**28**	**24 (20+0+4)**	**420**	**180**	**600**
Semester III							
Core Course	02BC3101	Physiological Biochemistry	4	4 (4+0+0)	70	30	100
	02BC3102	Enzymology	4	4 (4+0+0)	70	30	100
Core/ Discipline Based Elective	02BC3103 OR 02BC3104	Clinical Biochemistry (02BC3103) **OR** Microbial Biochemistry and Genetic Engineering (02BC3104)	4	4 (4+0+0)	70	30	100

	02BC3105 OR 02BC3106	Nutritional Biochemistry (02BC3105) **OR** Environmental and Agricultural Biochemistry (02BC3106)	4	4 (4+0+0)	70	30	100
Laboratory	02BC3207	Lab Course V	4	2 (0+0+2)	35	15	50
	02BC3208	Lab Course VI	4	2 (0+0+2)	35	15	50
Open Elective	09OE3309 OR 09OE3310	Medicinal and Pharmaceutical Chemistry (09OE3309) **OR** Entrepreneurship (09OE3310)	4	4 (4+0+0)	70	30	100
		Total	**28**	**24 (20+0+4)**	**420**	**180**	**600**
Semster IV							
Core Course	02BC4101	Dissertation		16	280	120	400
	02BC4102	Dissertation Seminar		2	35	15	50
	02BC4103	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. Biochemistry
Semester I: Theory
Cell and Molecular Biology
Code: 02BC1101

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. Biochemistry
Semester I: Theory
General Microbiology
Code: 02BC1102

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. Biochemistry
Semester I: Theory
Biochemistry
Code: 02BC1103

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. Biochemistry
Semester I: Theory
Instrumentation
Code: 02BC1104

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. Biochemistry
Semester I: Practical
Lab Course I
Code: 02BC1205

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 glassware & 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. Biotechnology
Semester I: Practical
Lab Course II
Code: 02BT1206

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. Biochemistry
Semester I: Theory
Food and Nutrition
Code: 09OE1307

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. Biochemistry
Semester I: Theory
Management in Practice
Code: 09OE1308

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. Biochemistry
Semester II: Theory
Immunology
Code: 02BC2101

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. Biochemistry
Semester II: Theory
Biostatistics and Research Methodology
Code: 02BC2102

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. Biochemistry
Semester II: Theory
Plant Biochemistry
Code: 02BC2013

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

Course Objectives:

1. To impart basic knowledge of Plant Biochemistry.
2. To train the students to pursue further education.
3. To be familiar with plant biology tools.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Plant Biotechnology 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

Structure and function of plant cell. Cell Wall-detailed study of the chemical composition and structure of the cell wall layer compounds. Organization of the wall, Properties of walls, formation of walls-initiation of wall during cell division and growth of walls.

Module II

Photosynthesis- Photosynthetic pigments. Structure of Chlorophyll molecules (a & b) and its biosynthesis. Photosystem I and II, their location, mechanism of quantum capture and energy transfer between photosystems. Light absorption by photosystem I P 700 and photosystem II P 680, cyclic and non cyclic photophosphorylation, Calvin cycle, Photorespiration. C4 pathway of CO_2 fixation

Module III

Plant hormone-Growth regulating substances and their mode of action, Molecular effects of auxin in regulation of cell extension and of gibberlic, abscisic acids and cytokinins in the regulation of seed dormancy, germination, growth and development and embryogenesis Photomorphogensis- structure, properties, functions and mechanism of action of phytochromes, senescence- biochemical changes and regulation.

Module IV

Secondary plant products – Structure and functions of tannins, terpenes, allkaloids, protocate chuic acid, digallic acid, catechin, quinoline, nicotine, morphine, flavanols coniferyl alcohol menthol, myrcene linalool, geraniol camphor borneol, abietic acid, Aboitoc, acid, Quercetin .

Module V

Nitrogen cycle, biological nitrogen fixation, assimilation of nitrate, ammonium ions and sulphate, plant microbe interaction- fungal, bacterial, and viral, symbiotic and non symbiotic plants. Defense system in plants.

Suggested Readings:

1. Plant Biochemistry - James Bonner & J. R Varner
2. Introduction to Plant Biochemistry - Goodwin
3. Plant physiology - Salisbery & Ross
4. Plant Biochemistry & Molecular Biology - P.J. Lea & R. G. Heagood

M.Sc. Biochemistry
Semester II: Theory
Bioenergetics and Metabolism
Code: 02BC2104

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

Course Objectives:
1. To impart knowledge of bioenergetics and metabolism.
2. To train the students to pursue further education.
3. Become familiar with different biochemical process.

Course Outcome:
Skills that students obtain after completion of the course:
1. Understanding of the fundamentals of bioenergetics and metabolism 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

Energy transformations in the living system, Bioenergetics: Laws of thermodynamics, Free energy concept.; Exergonic and endergonic reactions; High energy compounds; Biological oxidations; Redox reactions; Redox couplers; Reduction potential; Standard reduction potential of some biochemically important half reactions.

Module II

Ultra structure of Mitochondria; Electron Transport Chain; Oxidative phosphorylation; F0 F1-ATPase. Inhibitors of respiratory chain and oxidative phosphorylation, Uncouplers. Formation of reactive oxygen species and their disposal; Ultra structure of Chloroplast; Cyclic and Non-cyclic Photophosphorylation.

Module III

Concept of Anabolism and Catabolism. Glycolytic pathway, Regulation, Energy yield; Fate of Pyruvate (Aerobic and Anaerobic); Pasteur effect; Citric acid Cycle, Regulation, Energy yield; Anaplerotic reactions; Glycogenolysis and Glycogenesis; Pentose Phosphate Pathway; Gluconeogenesis; Cori's cycle,

Module IV

Catabolism of Fatty Acids (β- oxidation): Even and Odd number of Carbon atoms; Alpha and omega oxidations; Ketogenesis; de novo Synthesis of Fatty Acids; Elongation of fatty acids in Mitochondria and Microsomes; Biosynthesis and Degradation of Triacylglycerol; Metabolism of Cholesterol; Metabolism of Phospholipid.

Module V

Amino Acids Metabolism: General reactions, Transamination, Decarboxylation and Deamination; Urea cycle and Regulation; Catabolism of Amino Acids - Glycogenic and Ketogenic Amino acids; Biosynthesis of amino acids; Biosynthesis of Creatine. Inborn errors of amino acid metabolism.

Suggested Readings:

1. Principles of Biochemistry-Smith et al., McGraw-Hill International book Company, 8th Edition.
2. Principles of Biochemistry-Lehninger, Nelson, Cox, CBS publishers.
3. Fundamentals of Biochemistry-Voet et al., John Wiley and Sons, Inc.
4. Biochemistry-G. Zubay, WCB publishers.
5. Biochemistry - L. Stryer.
6. Textbook of Biochemistry – Edward S. West
7. Biochemistry & Microbiology – Elliott & Elliott
8. Biochemistry – Albert L. Lehninger

M.Sc. Biochemistry
Semester II: Practical
Lab Course III
Code: 02BC2205

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. 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. Biochemistry
Semester II: Practical
Lab Course IV
Code: 02BC2206

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. Spectrophotometric determination of chl-a, b & total & carotenoids in leaves.
2. Peroxidase activity in the green and senescent leaves.
3. Lechate conductivity in fresh and senescent leaves.
4. Lipid peroxidation in green and senescent leaves.
5. Polyphenol oxidase activity in green and senescent leaves.
6. Monophenol and total phenol content in green and senescent leaves.
7. SOD activity in the green and senescent leaves.
8. Hormones bioassay (Cytokinin, Auxin).
9. Estimation of serum protein
10. Estimation of blood sugar
11. Estimation of serum cholesterol.
12. Estimation of blood urea.

M.Sc. Biotechnology
Semester II: Theory
Vaccines and Antibiotics
(Open Elective)
Code: 09OE2307

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. Biotechnology
Semester II: Theory
Nanobiotechnology
(Open Elective)
Code: 09OE2308

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. Biochemistry
Semester III: Theory
Physiological Biochemistry
Code: 02BC3101

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

Course Objectives:

1. To impart knowledge of physiological biochemistry.
2. To train the students to pursue further education.
3. Become familiar with different biochemical process.

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of physiological biochemistry 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

Composition and function of blood plasma, blood corpuscles, plasma proteins; Hemoglobin: structure and function, abnormal hemoglobin, Blood coagulation mechanism and regulation. Blood groups.
Respiratory unit, exchange and transport of respiratory gases in the body, role of 2, 3- DPG, Bohr effect and chloride shift.

Module II

Structure of nephron, composition and mechanism of urine formation, glomerular filtration, tubular reabsorption of glucose, water and electrolytes, tubular secretion. Regulation of water and electrolyte balance, role of kidneys and hormones in their maintenance. Homeostasis, acid-base balance, acidosis and alkalosis.

Module III

Classification of muscles, Structure of skeletal, smooth and cardiac muscles. Actin, myosine, tropomyosine, troponine, Z disc and H line components. The sliding filament mechanism and subcellular ion movements during the contraction cycle in skeletal muscles.
Structure of neuron, nerve impulse, origin and transmission, neuromuscular junction, mechanism of nerve conduction. Reflex action and reflex arc.

Module IV

Hormones: General characteristics, Types, Mechanism of actions; Hormones of Pituitary gland, Adrenal gland, Thyroid gland, Pancreas, Sex hormones, Functions of Hormones.
Neurotransmitter: General characteristics, Types and Functions.

Module V

Liver function tests; Kidney function test; Lipid profile and cardiac function test.

Suggested Readings:

1. Principles of Anatomy and Physiology **by** Gerard J. Tortora
2. Human Physiology by K Sembulingam and Prema Sembulingam, Jaypee Publications

3. Text book of Medical Physiology by Arthyur C Guyton, John E. Hall
4. Review of Medical Physiology by William F Ganong
5. Human Physiology by C. C. Chatterjee
6. Fundamentals of Biochemistry: A C Deb
7. Harper's Illustrated Biochemistry: Murrey et al.

M.Sc. Biochemistry
Semester III: Theory
Enzymology
Code: 02BC3102

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

Course Objectives:
1. To impart knowledge of enzymology.
2. To train the students to pursue further education.
3. Become familiar with different enzymatic process.

Course Outcome:
Skills that students obtain after completion of the course:
1. Understanding of the fundamentals of enzymology 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

Historical background, General Properties, Nomenclature and Classification (I.U.B), Types of reaction catalyzed, Activation energy and Reaction coordinate, Mechanisms of Enzyme catalysis, Catalytic mechanisms of Lysozyme. Isoenzymes or Isozymes, Multienzyme Systems, Biological Roles of Enzymes.

Module II

Characteristics of Enzyme: Colloidal nature, Catalytic nature, Thermolability, Reversibility, pH sensitivity, Coenzymes and Cofactors, Water soluble vitamins and their coenzymes, Metallo enzymes, Three dimensional structure of Enzymes.

Module III

Enzyme Kinetics: Different rate equations, Michaelis-Menten equation (Derivation), Significance of K_m and V_{max}, Double reciprocal plot, Factors affecting enzyme activity, Bi-substrate reactions, Single and Double displacement reactions; Modifiers of enzyme activity; Enzyme Inhibition: Competitive, Non-competitive and Uncompetitive inhibitions.

Module IV

Regulation of enzyme activity: Covalent modulated regulation, Allosteric regulation, Enzyme assays, Methods for the determination of enzymes activity, Different isolation and purification procedure of enzymes. Criteria of purity of enzymes, Zymography, Isoenzymes, isoenzyme separation.

Module V

Industrial uses of enzymes – Food, Dairy and Pharmaceutical industries. Clinical enzymology – Serum enzymes in health and diseases. Immobilized enzymes and their industrial applications.

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. Biochemistry
Semester III: Theory
Clinical Biochemistry
Code: 02BC3104

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

Course Objectives:
1. To impart knowledge of clinical biochemistry.
2. To train the students to pursue further education.
3. Become familiar with different biochemical process.

Course Outcome:
Skills that students obtain after completion of the course:
1. Understanding of the fundamentals of clinical biochemistry 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:
Disorders of carbohydrate metabolism: Diabetes mellitus, glycohemoglobins, hypo-glycemias, galactosemia and ketone bodies. Various types of glucose tolerance tests. Glycogen storage diseases. Physiology of lipids/lipoproteins. Lipidosis. Clinical inter-relationships of lipids (sphingolipidosis and multiple sclerosis), lipoproteins and apolipoproteins.

Module II:
Disorders of amino acid metabolism- Phenylalanemia, homocystinuria, tyrosinemia, MSUD, phenylketonuria, alkaptonuria, albinism and animoacidurias.
Disorders of nucleic acid metabolism- Disorders in purine/ pyrimidine metabolism.

Module III:
Hormonal disturbances: Protein hormones (anterior pituitary hormones, posterior pituitary hormones), steroid hormones, adrenocorticosteroids, and reproductive endocrinology.
Disturbances in thyroid function.
Disorders of mineral metabolism: Hypercalcaemia, hypocalcaemia, normocalcaemia, hypophosphataemia and hyperphosphataemia.

Module IV:
Biochemical aspects of hematology: Disorders of erythrocyte metabolism, hemoglobinopathies, thalassemias thrombosis and anemias. Laboratory tests to measure coagulation and thrombolysis.
Detoxification in the body: enzymes of detoxification, polymorphism in drug metabolizing enzymes. Mechanism of drug action and channels of its excretion, Disorders of vitamins and trace elements.

Module V:
Homeostasis – disorders and regulation – Types of Anaemia deficiency of iron, B12 and folic acid, hemolytic, aplastic and genetic disorders), General inflammatory marks and specific therapeutic bioindicators. CRP (C reactive protein), RA (Rheumatoid Arthritis), ASO(Anti Streptolysin O), Acute inflammation, Vascular changes. Cellular vents, Chemical mediators, inflammation induced cell injury, Chronic inflammation, Lymphatics and lymph nodes in inflammation.

Suggested Readings:

1. A text book of medical physiology: Guyton A.C and J E Hall.
2. Textbook of Medical Biochemistry: MN Chatterjea and Rana Shinde.
3. Lehninger Principles of Biochemistry5th Ed: David L. Nelson and Michael M. Cox.
4. Davidson's Principles and Practice of Medicine: A Textbook for Students and Doctors
5. (Hardcover) 15th Ed: LSP Davidson, J MacLeod and CRW Edwards.
6. Medical Biochemistry (Paperback): John W. Baynes and Marek Dominiczak.
7. Clinical Biochemistry: An Illustrated Colour Text (Paperback) 3rd Ed: Allan Gaw, Michael Murphy, Robert Cowan, Denis O'Reilly, Michael Stewart and James.
8. Review of Medical Physiology (Lange Basic Science) (Paperback): William F. Ganong.
9. 7. Harper's Biochemistry (Lange Medical Books) (Paperback): Robert K. Murray, Daryl K. Granner, Peter A. Mayes and Victor W. Rodwell.

M.Sc. Biochemistry

Semester III: Theory

Microbial Biochemistry and Genetic Engineering

Code: 02BC3105

Credit: 4

Total Marks: 100 (70+30)

Course Objectives:

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

Course Outcome:

Skills that students obtain after completion of the course:

1. Understanding of the fundamentals of Medical biochemistry and genetic engineering 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

Cellular organisation of bacteria with special reference to molecular organisation of cell wall, flagella and pilli. Identification and classification of bacteria. Handling and sterility maintenance in microbiological work. Methods of isolation and pure culture techniques, culture media. Microbial nutrition, bacterial growth and its kinetics. Energy metabolism in bacteria - fermentation, aerobic and anaerobic respiration and bacterial photosynthesis.

Module II

Fermentation technology-Primary and secondary metabolites, Continuous and batch type culture techniques, Types and design of fermentors, fermentation processes, brewing manufacture of penicillin, production of other antibiotics and organic compounds, single cell proteins. Application of microbes in food industry, dairy products and food preservation. Microbial assay of vitamins and amino acids. Viruses-Structure, proteins classification and methods of assay. Replication of RNA and DNA viruses. Virus-host interaction, Vaccines and prevention.

Module III

Introduction to Genetic engineering, the tools of Genetic engineering, Enzymology of Recombinant DNA: RE, ligase, polymerase, phosphates, Exonuclease, DNAase, Methylase etc. Gene cloning vectors plasmids, bacteriophages, phagemids, cosmids, artificial chromosomes, yeast vectors

Module IV

Methods of DNA technology: obtaining a gene, selection of a vector, selection of the host cell, expression of the gene, collection of the gene products. Gene library: Construction and screenig of DNA library, Genome Maps: Genetics markers, DNA, RNA and Protein Markers. Linkage mapping: RFLP, RAPD, AFLP, STSs Physical mapping: Pulsed field gel electrophoresis,

Module V

Basic Techniques: Dot Blots, colony hybridization, Probes: prepration and labeling, southern, northern and western blotting.

PCR: Types and application, chemical synthesis of DNA, DNA sequencing, DNA finger printing

Suggested readings:

1. Fundamental principles of Bacteriology - A.J. Salle
2. Introduction to Environmental Microbiology - R. Mitchell
3. Molecular Biology & Biotechnology - J.M. Walker & Gingold E.B.
4. Food Microbiology - W.C. Frazier
5. Industrial Microbiology - Presscott & Dunn
6. Microbial Physiology - Albert G. Moat
7. Industrial Microbiology - Miller & Litsky
8. Microbiology - Michael J. Pelchar, E.C.S. Chan and Noel R. Krieg.
9. Molecular Cloning: a Laboratory Manual, J. Sambrook, E. F. Fritsch and T. Maniatis,
10. Applied Molecular genetics: Roge L Miesfeld
11. Recombinant DNA principles and Methodologies, James J. Greene, Venigalla B. Rao, Marcel Dekkar
12. DNA cloning a practical approach, D. M. Glover and B. D. Hames.
13. Molecular and Cellular methods in Biology and Medicine, P.B.Kaufman, W.Wu, D. Kim and L. J. Cseke.

M.Sc. Biochemistry
Semester III: Theory
Nutritional Biochemistry
Code: 02BC3105

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

Course Objectives:
1. To impart basic knowledge of nutritional biochemistry.
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 nutritional biochemistry 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:
Human Nutritional Requirements, methods determining human nutrient needs. Description of basic terms and concepts in relation to human nutritional requirements, guidelines and recommendation. National Nutritional Requirements. Significance of body composition and changes through the life cycle. Components of energy requirements: BMR, RMR, thermic effect of feeding, physical activity. Factors affecting energy requirements, methods of measuring energy expenditure.

Module II:
Carbohydrates, **Fats and Oils**, **Protein**: History, structure, sources, absorption, transport, utilization, storage, excretion, functions, bioavailability, requirements and RDA, deficiency, toxicity, assessment of status and alteration in requirements in various clinical and metabolic disorders.

Module III:
Vitamins, **Minerals:** : History, structure, sources, absorption, transport, utilization, storage, excretion, functions, bioavailability, requirements and RDA, deficiency, toxicity, assessment of status and alteration in requirements in various clinical and metabolic disorders
Dietary fibre Types, sources, role and mechanism of action.

Module IV:
Nutritional care process with socioeconomic status. Nutritional assessment and identification of nutritional problem. Nutritional Intervention and Diet Modification, Education and Counseling of Nutrition, Monitoring and Evaluation. Recommended dietary allowance (RDA), Food pyramid, Use of exchange list, Nutrition for weight management, etiology and disorders of energy Balance.

Module V:
Types of obesity, Assessment of obesity Health risks, causes of obesity: neural, hormonal, and psychological, Management of obesity, Dietary Modification: past and present approach. Maintenance of Reduced weight. Underweight/Excessive Leanness–Causes and assessment. Health risks and Dietary Management. Eating disorder, Anorexia Nervosa and Bulimia Nervosa. Nutritional management of eating disorders.

Suggested Readings:

1. Food & the Nutrition Care Process: Betsy B. Holli, Judith A. Beto,
2. Modern Nutrition in Health and Disease: Maurice Edward Shils, Moshe Shike,
3. Biochemical, Physiological, and Molecular Aspects of Human: Martha H. Stipanuk.
4. Dietetics: Srilakshmi, B.
5. Nutrition Science: Srilakshmi, B.
6. Principles of Nutritional Assessment: Rosalind S. Gibson.
7. Lippincott Modern Nutrition in Health and Disease: Williams & Wilkins.

M.Sc. Biochemistry
Semester III: Theory
Environmental and Agricultural Biochemistry
Code: 02BC3106

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

Course Objectives:
1. To impart basic knowledge of Environmental and Agricultural Biochemistry.
2. To train the students to pursue further education.
3. To be familiar with environmental and agricultural tools.

Course Outcome:
Skills that students obtain after completion of the course:
1. Understanding of the fundamentals Environmental and Agricultural Biochemistry 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
Microbiology of air: distribution and source of microorganisms, air as carrier of microorganisms, droplet, droplets nuclei, techniques for microbiological analysis of air, significance of air flora in human health. Hospitals, industries, Air sanitation – dust control, UV radiation, bacterial vapors, filtration, laminar air flow system (HEPA filters).

Module II
Aquatic microbiology: The aquatic environment, physical and chemical conditions and the aquatic microbial flora, distribution of microorganisms in the aquatic environment, water zonation – upwelling, eutrophication, techniques for the study of microorganisms, Aquatic microorganisms-lakes and ponds, streams, Estuaries, marine plankton. Productivity of aquatic ecosystem.

Module III
Microbiology of domestic water and waste water: Bacteriological evidence of water pollution, detection of coli form group in bacteria, Waste water-Chemical characteristics, Biological oxygen demand (BOD), microbiological characteristics: Municipal water treatment processes. Microorganisms and waste water treatment process.

Module IV
Microbiology of soil: Physical characteristics of soil, Microbial flora of soil, interaction among soil microorganisms, rhizosphere, phylloshere, interaction among soil microorganism, Nitrogen fixation (symbiotic and non-symbiotic). Biofertilisers, mycorrhizae: VAM.

Module V
Biogeochemical cycles: Nitrogen, carbon, phosphorus and sulphur cycle. Xenobiotics, Bioaccumulation, Biodegradation of herbicide and pesticides, Biopesticides.

Suggested Readings:

1. Microbiology by Pelczar et al.
2. Environmental Sciences by Purohit, Shammi and Agrawal.

3. Concepts of ecology by E.J. Karmondy
4. Biology of microorganisms by Brock et al.
5. General microbiology by Powar and Daginawala
6. Agriculture microbiology by Bagyaraj and Rangaswamy
7. Text book environmental microbiology by Pradipta. K. Mahapatra, IK International Pvt. Ltd.
8. Environmental microbiology by P.D Sharma.
9. Introduction to Soil and Agricultural Microbiology by G. Prabhakaran, Himalaya Publishing House.

M.Sc. Biochemistry
Semester III: Practical
Lab Course V
Code: 02BC3207

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 biochemical 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 blood group (ABO and Rh)
2. Estimation of hemoglobin
3. Counting of Red blood cell
4. Counting of White blood cell (Total leucocyte count)
5. Differential leucocyte count (DLC)
6. Study of polymorphism of leucocyte
7. Estimation of serum protein
8. Estimation of blood sugar
9. Kinetics of enzymatic reaction.
10. Determination of Km value for hydrolysis of sucrose by yeast β fructofuranocidase.
11. Assay of alkaline & acid phosphatase.
12. Assay of transaminases (SGOT & SGPT).
13. Assay of dehydrogenases.

M.Sc. Biochemistry
Semester III: Practical
Lab Course VI
Code: 02BC3208

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 biochemical 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.

Clinical Biochemistry and Microbial biochemistry and Genetic Engineering

1. Assay of alkaline & acid phosphatase.
2. Assay of transaminases (SGOT & SGPT).
3. Assay of dehydrogenases.
4. Lipid profiles- HDL Cholesterol & LDL cholesterol
5. Blood sugar estimation by Enzymatic method (GOD-POD).
6. Assay of bilirubin in blood.
7. Assay of amylase.
8. Assay of urease.
9. Determination of growth curve and generation time.
10. Estimation of microbial enzymes-amylase, invertase, protease, celllulase, lipase, catalase and phosphatase.
11. Isolation of Plasmid DNA.
12. Fungal Genomic DNA Extraction.
13. Polyacrylamide gel electrophoresis of microbial proteins.

Nutritional Biochemistry and Environmental and Agricultural Biochemistry

14. Estimation of serum protein
15. Estimation of blood sugar
16. Estimation of cholesterol
17. Estimation of blood urea.
18. Determination of Dissolved Oxygen from given water sample.
19. Determination of BOD of water.
20. Determination of COD of water.

21. Isolation of primary enteric pathogens from sewage water/fecal water.
22. Isolation of fungi from soil and air.
23. Study of rhizospheric and phylospheric microbes of some economically important plants.
24. Biodegradation of some organic pollutants
25. Microbial assessment of potable water.

M.Sc. Biochemistry
Semester III: Theory
Medicinal and Pharmaceutical Chemistry
Code: 09OE3105

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 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.

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. Biochemistry
Semester III: Theory
Entrepreneurship
(Open Elective)
Code: 09OE3310

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. Biochemistry
Semester IV

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

Total Credits-20

1. Dissertation (Code: 02BC4101)
2. Dissertation Seminar (Code: 02BC4102)
3. Viva Voce (Code: 02BC4103)