Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce, and Science College, Ahmednagar (Autonomous)

(Affiliated to Savitribai Phule Pune University, Pune)

National Education Policy (NEP)
Choice Based Credit System (CBCS)

Programme Skeleton and Syllabus of

M.Sc. Biochemistry

Implemented from

Academic Year 2023-24

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

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9.2 Distribution of credits

Type of Courses	Total Credits	Credits/ Semester
Discipline-Specific Core Courses (DSC)	54	14 /12
Discipline Specific Elective Courses (DSE)	16	04
Research Methodology (RM)	04	Semester I only
On-Job Training/ Internship (OJT/I	04	Semester II only
Project (PR)	10	Semesters III and IV only
Total	88	22

9.3 Master of Science (M.Sc.) Course Distribution

Class	Semester	Subjects	Courses	DSC		DSE		RM/OJT/ Internship etc.		Project *	Total Credits
				T	P	T	P	T	P		
M. Sc. I	I	01	09	03	03	01	01	01*		00	22
M. Sc. I	II	01	09	03	03	01	01	00	01	00	22
M. Sc. II	III	01	07	02	02	01	01	00	00	01	22
M. Sc. II	IV	01	07	02	02	01	01	00	00	01	22

* RM: Theory and Practical credits in RM paper shall be decided by the Department. The final marks/grade point shall be calculated by considering theory and practical marks.

9.4 Master of Science (M. Sc.) Credit Distribution

Class	Semester	Subjects	Courses	DSC		DSE		RM/OJT/ Internship etc.		Project *	Total Credits
				T	P	T	P	T	P		
M. Sc. I	I	01	09	08	06	02	02	04*		00	22
M. Sc. I	II	01	09	08	06	02	02	00	04	00	22
Exit Option: PG Diploma											
M. Sc. II	III	01	07	08	06	02	02	00	00	04	22
M. Sc. II	IV	01	07	08	04	02	02	00	00	06	22
				32	**20**	**08**	**08**	**02**	**06**	**12**	**88**

9.5 Master of Science (M. Sc.) Distribution of Courses

Class	Semester	Course and their credits in the bracket			
		DSC	DSE	RM/OJT/ Internship etc.	Project *
M. Sc. I	I	DSC -01 (03)	DSE -01 (02)	RM-01(04)	NA
M. Sc. I	I	DSC -02 (03)	DSE -02 (02)		
M. Sc. I	I	DSC -03 (02)			
M. Sc. I	I	DSC -04 (02)			
M. Sc. I	I	DSC -05 (02)			
M. Sc. I	I	DSC -06 (02)			
M. Sc. I	II	DSC -07 (03)	DSE -03 (02)	OJT-01 (04)	NA
M. Sc. I	II	DSC -08 (03)	DSE -04 (02)		
M. Sc. I	II	DSC -09 (02)			
M. Sc. I	II	DSC -10 (02)			
M. Sc. I	II	DSC -11 (02)			
M. Sc. I	II	DSC -12 (02)			
M. Sc. II	III	DSC -13 (04)	DSE -05 (02)	NA	PR-01(04)
M. Sc. II	III	DSC -14 (04)	DSE -06 (02)		
M. Sc. II	III	DSC -15 (03)			
M. Sc. II	III	DSC -16 (03)			
M. Sc. II	IV	DSC -17 (04)	DSE -05 (02)	NA	PR-02(06)
M. Sc. II	IV	DSC -18(04)	DSE -06 (02)		
M. Sc. II	IV	DSC -19 (02)			
M. Sc. II	IV	DSC -20 (02)			

Programme Framework (Courses and Credits): M. Sc. Biochemistry

Sr. No.	Year	Semester	Level	Course Type	Course Code	Title	Credits
1.	I	I	6.0	DSC-01	MS-BC111T	Biomolecules	03
2.	I	I	6.0	DSC-02	MS- BC 112T	Cell Biochemistry	03
3.	I	I	6.0	DSC-03	MS- BC 113T	Enzymology	02
4.	I	I	6.0	DSC-04	MS- BC 114P	Analytical Biochemistry I	02
5.	I	I	6.0	DSC-05	MS- BC 115P	Analytical Biochemistry II	02
6.	I	I	6.0	DSC-06	MS- BC 116P	Practical Enzymology	02
7.	I	I	6.0	DSE-01	MS- BC 117T	Elective Option-A: Genetics OR Elective Option-B: Biostatistics	02
8.	I	I	6.0	DSE-02	MS- BC 118P	Elective Option-A: Practical in Genetics OR Elective Option-B: Practical Biostatistics	02
9.	I	I	6.0	RM-01	MS- BC 119T/P	Research Methodology	04
10.	I	II	6.0	DSC-07	MS- BC 121T	Metabolism	03
11.	I	II	6.0	DSC-08	MS- BC 122T	Physical Biochemistry	03
12.	I	II	6.0	DSC-09	MS- BC 123T	General Microbiology	02
13.	I	II	6.0	DSC-10	MS- BC 124P	Physical BiochemistryPractical I	02
14.	I	II	6.0	DSC-11	MS- BC 125P	Physical BiochemistryPractical II	02
15.	I	II	6.0	DSC-12	MS- BC 126P	Practical in Microbiology	02
16.	I	II	6.0	DSE-05	MS- BC 127T	Elective Option-A: Food Technology OR Elective Option-B: Bioinformatics	02
17.	I	II	6.0	DSE-06	MS- BC 128P	Elective Option-A: Practical	02

						in Food Technology OR Elective Option-B: Practical in Bioinformatics	
18.	I	II	6.0	OJT-01	MS- BC 129P	On Job Training	04
19.	II	III	6.5	DSC-13	MS- BC 131T	Molecular Biology	04
20.	II	III	6.5	DSC-14	MS- BC 132T	Medical Biochemistry and Immunology	04
21.	II	III	6.5	DSC-15	MS- BC 133P	Practical Molecular Biology	03
22.	II	III	6.5	DSC-16	MS- BC 134P	Practical Immunology	03
23.	II	III	6.5	DSE-05	MS- BC 135T	Elective option-A: Plant Biochemistry OR Elective option-B: Pharmacology	02
24.	II	III	6.5	DSE-06	MS- BC 136P	Elective option-A: Practical Plant Biochemistry OR Elective option-B: Practical in Pharmacology	02
25.	II	III	6.5	PR-01	MS- BC 137P	Project	04
26.	II	IV	6.5	DSC-17	MS- BC 141T	Genetic Engineering	04
27.	II	IV	6.5	DSC-18	MS- BC 142T	Endocrinology and Neurochemistry	04
28.	II	IV	6.5	DSC-19	MS- BC 143P	Practical Genetic engineering	02
29.	II	IV	6.5	DSC-20	MS- BC 144P	Practical Clinical Biochemistry	02
30.	II	IV	6.5	DSE-07	MS- BC 145T	Elective option-A: Fermentation Technology OR Elective Option-B: Advance Techniques in Biochemistry	02
31.	II	IV	6.5	DSE-08	MS- BC 146P	Elective option-A: Practical	02

						in FermentationTechnology OR Elective option-B: Practical in Advance Techniques in Biochemistry	
32.	II	IV	6.5	PR-02	MS-BC147P	Project	06

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar (Autonomous)

Board of Studies in Biochemistry

Sr. No.	Name	Designation
1.	Asso. Prof. P.S.Mutkule	Chairman
2.	Dr. A. E. Athare	Member
3.	Asst.Prof. S.P.Salve	Member
4.	Asso. Prof.S.B.Dare	Member
5.	Dr. S. J. Takate	Member
6.	Asst. Prof. G. A. Tikone	Member
7.	Dr. M. V. Padul	Academic Council Nominee
8.	Dr. M. S. Panchbhai	Academic Council Nominee
9.	Dr. P. S. Vaddadi	Vice-Chancellor Nominee
10.	Mr. S.G. Pawar	Alumni
11.	Mr. H. S. Joshi	Industry Expert
12.	Asst. Prof. A. S. Wani	Faculty(co-opt)

1. Prologue/ Introduction of the programme: At least one page

Through the present curriculum attempt has been made to generate enough interest among the students so that they can pursue education in Biochemistry to take up the career ofteaching, research or to serve the needs of medicine, agriculture related industrial establishments.

The discipline of Biochemistry involves the study of the structure and function of biomolecules and the vital processes that occur in living organisms. It is regarded as "Mother of all Biological Sciences" because it unveils the chemical basis of life in all living organisms including plants, animals and microorganisms. Biochemistry has contributed enormously to the growth of modern medical and health science and agriculture. Biochemistry has applications in clinical diagnosis, understanding pathology of diseases, treatment of diseases, designing of drugs, and understanding their metabolism and manufacture of various biological products like amino acids, proteins, antibiotics, hormones, enzymes, nutrients, etc. Understanding the biochemical basis of vital processes of plants such as photosynthesis, respiration, hormonal regulation, nutrient assimilation have helped in developing superior varieties of crop plants with better growth attributes and yield. For the estimation of pesticide residues in soil or food grain one has to rely on biochemical tests. The functions and the roles of various nutrients are described only by biochemistry. The composition of food materials including the quality-milk and possible adulterations can be checked by biochemical tests. This discipline has played valuable role in farming, fishery, poultry, sericulture, bee keeping and environment remediation.

Keeping in pace with the developmental trends in various subareas of Biochemistry it is expected that students undertaking Biochemistry course at post graduate level become conversant with the fundamentals of Biochemistry and at the same time at the end of the programme they exhibit certain levels of learning outcomes. Such learning outcomes like understanding of discipline, critical thinking, problem solving, analytical and scientific reasoning, research/ industry related skills, etc. will empower the students to develop their future career with a much better and meaningful orientation.

2. Programme Outcomes (POs)

A post graduate student shall be able to develop skill and acquire knowledge in fundamentals of chemistry, biology and will develop disciplinary theory and practical knowledge in the diversified areas of biochemistry. The students are given fundamentals in

each course and they are encouraged to become unique by allowing them to perform experiments in the areas of their interest. This will enable the students to equip themselves with the basic practical training in different areas of biochemistry ranging from metabolism, enzymology, clinical biochemistry, molecular biology to genetic engineering and biotechnology etc, to take up further research in these areas or to take up assignments/jobs inBiotech/ biochemical industries. The students should enjoy the academic freedom which willbring out the best from each student. These attributes are elaborated as under:

- **Disciplinary knowledge**:
    a) Ability to understand fundamental concepts of biology, chemistry and biochemistry.
    b) Ability to apply basic principles of chemistry to biological systems and molecular biology.
    c) Ability to relate various interrelated physiological and metabolic events.
    d) A general awareness of current developments at the forefront in biochemistry andallied subjects.
    e) Ability to critically evaluate a problem and resolve to challenge blindly acceptedconcepts.
    f) Zeal and ability to work safely and effectively in a laboratory.
    g) Good experimental and quantitative skills encompassing preparations of lab reagents, conducting experiments, satisfactory analyses of data and interpretationof results.
    h) Awareness of resources, and their conservation.
    i) Ability to think laterally and in an integrating manner and develop interdisciplinary approach.
    j) Overall knowledge of the avenues for research and higher academic achievements in the field of biochemistry and allied subjects.
- **Communication skills**:
    a) Ability to speak and write clearly in English.
    b) Ability to place scientific view points and engage with them.
- **Critical thinking**:
    a) Ability to substantial critical readings of scientific texts in order to persuade others.

b) Ability to place scientific statements and themes in contexts and also evaluatethem in terms of generic conventions.

- **Problem solving:**
  a) Ability to closely observe the situation, and apply lateral thinking and analyticalskills.
- **Analytical reasoning:**
  a) Ability to evaluate the strengths and weakness in scholarly texts spotting flaws intheir arguments.
  b) Ability to use critics and theorists to create a framework and to substantiate one'sargument in one's reading of scientific texts.
- **Research related skills:**
  a) Ability to problematize; to formulate hypothesis and research questions, and toidentify and consult relevant sources to find answers.
  b) Ability to plan and write research papers.
- **Teamwork and Time Management:**
  a) Ability to participate constructively in classroom discussions.
  b) Ability to contribute to group work.
  c) Ability to meet a deadline.
- **Scientific Reasoning:**
  a) Ability to analyze text, evaluating ideas and scientific strategies.
  b) Ability to formulate logical and convincing arguments.
- **Reflective Thinking:**
  a) Ability to locate oneself and see the influence of location – regional, national, global- on critical thinking.
- **Self- Directing Learning:**
  a) Ability to work independently in terms of organizing laboratory, and criticallyanalyzing research literature.
  b) Ability to postulate hypothesis, questions and search for answers.

- **Digital Literacy:**
    a) Ability to use digital resources, and apply various platforms to convey and explain concepts of biochemistry.
- **Multicultural Competence:**
    a) Ability to engage with and understand cultures of various nations and respect and transcend differences.
- **Moral and Ethical Values:**
    a) Ability to interrogate one's own ethical values, and to be aware of ethical andenvironmental issues.
    b) Ability to read values inherited in society and criticism vis a vis, the environment,religion and spirituality, as also structures of power.
- **Leadership Readiness:**
    a) Ability to lead group discussions, to formulate questions related to scientific and social issues.
- **Life-long Learning:**
    a) Ability to retain and build on critical thinking skills, and use them to update scientific knowledge and apply them in day to day business/life.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar

(Autonomous)

Syllabus

M.Sc. Biochemistry

Title of the Course: Biomolecules								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-1	MS-BC111T	03	00	03	45	30	70	100

Learning Objectives:

1. To understand the chemical unity due to biomolecules present in all living organisms.
2. To get the knowledge of proteins and amino acids responsible for living body formation.
3.To acquire the information about formation of derivatives of carbohydrates and amino acids.
4.To understand and learn to draw structures of all the biomolecules.
5. To become able to identify the biomolecules depending upon their physical and chemical properties.

Course Outcomes (Cos)

1. Students will study the properties of carbohydrates, proteins, lipids, nucleic acids.
2. Students will gain the knowledge of macromolecules and their importance in biological systems.
3. Students will be able to draw the structures of carbohydrates, proteins, lipids and nucleic acids.
4. Students will learn to identify the biomolecules by their properties.
5. Students will understand the biological significances of all the biomolecules.

Detailed Syllabus:

Unit I: The molecular logic of life (2)

The chemical unity of diverse living organisms. Composition of living matter. Macromolecules and their monomeric subunits.

Unit II: Amino acids (4)

Structure and classification of amino acids. Physicochemical properties amino acids. Rare amino acids.

Unit III: Proteins (14)

Classification based on composition, number of subunit, function. Primary Structure:

Peptide bond, importance of primary structure, End Group analysis.

Secondary structure: α-helix, β-pleated sheets, super secondary structure, Ramachandran plot. Tertiary Structure: Forces stabilizing tertiary structure. Fibrous proteins and Globular protein. Protein denaturation and folding. Quaternary structure – Hemoglobin

Unit IV: Carbohydrates (10)

Monosaccharides: Basic chemical structure, general reactions and properties. Diasaccharids: Formation of glycosidic linkage, reducing and non-reducing sugars. Trisaccharides and tetrasaccharides: Structure and function with example. Polysaccharide: Homo and heteropolysaccharides, structural and storage polysaccharide. Sugar derivatives, deoxy sugars, amino sugars, and sugar acids. Biological significance of carbohydrate.

Unit V: Lipids (10)

Building blocks of lipids- Fatty acids, glycerol, sphingosine. Classification: Structure and function of major lipid subclasses. Characteristics of lipids and rancidification. Lipoproteins- Chylomicrons, LDL, HDL and VLDL. Behavior of lipids in aqueous system.

Unit VI: Nucleotides and Nucleic Acids (5)

Structure and functions of nucleotides, Structure and forms of DNA. Structure and types of RNA (mRNA, rRNA, tRNA, snRNA, gRNA etc).

Suggested Readings/Material:

1. Principles of Biochemistry, Lehninger C Rs. Publ. 7th edition (2017).
2. Biochemistry, L. Stryer, W.H. Freeman, San Francisco (2008).
3. Schaum's Outline Series of Theory and Problems of Biochemistry
4. Problem Approaches in Biochemistry. Wood and Hood.
5. Biochemistry by Voet and Voet, 4th edition (2010).

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New Arts, Commerce and Science College, Ahmednagar

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Syllabus

M.Sc. Biochemistry

Title of the Course: Cell Biochemistry								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-2	MS-BC112T	03	00	03	45	30	70	100

Learning Objectives:

1. To differentiate the structure of prokaryotic and eukaryotic cells.
2. To give the detail knowledge of ultrastructure of cell organelles in eukaryotic cell.
3.To acquire the information about cell communication and their types.
4.To make students understand the membrane and its biochemistry.
5. To teach the various methods of transport through membrane.

Course Outcomes (Cos)

1. Students will study the properties of prokaryotic and eukaryotic cells.
2. Students will get the clear concepts of all the cellular organelles with their structures.
3. Students will able to understand different methods of cell communication through membrane.
4. Students will learn cell division and apoptosis mechanism of cell.
5. Students will study the membrane transport and various channels helping in transport.

Detailed Syllabus:

Unit I: Cell (3)

Structure and differences in prokaryotic cell and eukaryotic cell. Cell variability, size, shape and complexity, cell theory. Differences in plant cell and animal cell.

Unit II: Cellular Organization (12)

Structure and sub cellular components: Cell wall, plasma membrane, Nucleus, chromosomes, endoplasmic reticulum, Golgi apparatus, lysosomes, mitochondria, Chloroplast, Ribosomes, centriole, vacuoles, cell inclusions, cytoskeleton.

Unit III: Cell Communication (5)

Cell-cell adhesion and the extracellular matrix. Intercellular recognition. Cell junctions. Extracellular matrix and role of collagen, elastin and fibronectin.

Unit IV: Cell Division (5)

Cell cycle. Mitosis, meiosis. Apoptotic death in relation to cell cycle.

Unit V: Membrane transport (12)

Simple and facilitated diffusion. Role of proteins in the transport. Passive transport – Glucose transporter, anion transporter and porins. Primary active transport – ATPase, V type ATPase, F type ATPase. Secondary active transport – Lactose transport, Na^+ - glucose symport. ABC family of transporters – MDR, CFTR, Group translocation. Ion channels – Voltage gated ion channel (Na^+ and K^+ voltage gated ion chennels), Ligand gated ion chennels (acetyl cholin receptor). Ionophores.

Unit VI: Vesicular Transport and membrane fusion (8)

Types of vesicular transport and their function – Clathrin, COP I and COP II coated vesicles. Molecular mechanism of vesicular transport. Receptor mediated endocytosis of transferrin.

Suggested Readings/Material:

1. Molecular Biology of the cell– Bruce Alberts – J.D. Watson et al 4th edition (2002)
2. Cell and Molecular Biology – DeRobertis and Saunders, 8th edition (2017).
3. The cell – C.P. Swanson, Prentice Hall (1989)
4. Cell Biology – C.J. Avers, Addision Wesley Co. (1986).
5. Principles of Biochemistry, Lehninger C Rs. Publ. 7th edition (2017).
6. Biochemistry, L. Stryer, W.H. Freeman, San Francisco (2008).
7. Biochemistry by Voet and Voet, 4th edition (2010)

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New Arts, Commerce and Science College, Ahmednagar
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Syllabus
M.Sc. Biochemistry

Title of the Course: Enzymology								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-3	MS-BC113T	02	00	02	30	15	35	50

Learning Objectives:

1.To understand the enzyme related concepts and coenzyme, cofactor with example.

2. To understand the enzyme kinetics with their equations.

3.To learn optimum conditions of enzymes.

4.To understand the regulation mechanism of enzyme with inhibitors and activators.

5. To learn classification and study the enzyme catalysis.

Course Outcomes (Cos)

1. Students will study the cofactor, coenzyme, catalysis.

2. Students will gain the knowledge of enzyme kinetics, MM equation.

3. Students will study the optimum pH, temperature, etc.

4. Students will learn the inhibition mechanism by various inhibitors.

5. Students will understand the mechanism of enzyme action with example.

Detailed Syllabus:

Unit I: Basic aspects (4)

Nature of the enzymes (protein and non-protein). Remarkable properties of enzymes (Catalytic power and specificity of enzymes). Fischer's lock and key hypothesis and Koshland's induce fit hypothesis. Cofactors, prosthetic group, apoenzyme and holoenzyme, isoenzyme and multienzyme. Nomenclature and classification of enzymes.

Unit II: Enzymes kinetics (6)

Relation between initial velocity and substrate concentration, steady state kinetics, equilibrium constant- One substrate reactions. Michaelis-Menten equation and Lineweaver-Burk plot, Eadie-Hofstee and Hanesplot. Effect of pH, temperature and metal ions on enzyme activity. Two substrate reactions: theory, order analysis, pre-steady state kinetics, stoppedflow technique, relaxation methods.

Unit III: Mechanism of enzymes action (10)

Theoretical background. Factors leading to rate enhancement of enzyme catalyzed reactions: Proximity and orientation, strain and distortion, Acid-base and covalent catalysis (Chymotrypsin andlysozyme) and change in environment. Experimental approaches of determination of enzymes mechanism: Kinetics studies, detection of intermediates, chemical modification of amino acid side chain and affinity labeling.

Unit IV: Regulation of enzyme activity (10)

Control of activities of single enzyme: Inhibitor molecules, availability of substrate or cofactor and changes in covalent structure of enzymes. Zymogen activation and phosphorylation, dephosphorylation, ligand binding andinduced changes, allosteric enzymes, Hill equation, Adair equation, M.W.C. and K.N.F. Models, usefulness of the models. Significance of allosteric and cooperative behavior in enzymes.

Suggested Readings/Material:

1. Fundamentals of Enzymology by Price and Stevens, 3rd edition (1999).
2. Enzymology by Dixon and Webb, 2nd edition (1964).
3. Principles of Biochemistry, Lehninger C Rs. Publ. 7th edition (2017)
4. Enzymes by Palmer
5. Biochemistry, L. Stryer, W.H. Freeman, San Francisco (2008).

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Syllabus

M.Sc. Biochemistry

Title of the Course: Analytical Biochemistry I								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-4	MS-BC114P	00	02	02	60	15	35	50

Learning Objectives:

1. To understand about the various reactions of carbohydrates, lipids.

2. To acquire the knowledge of proteins and amino acids showing colour reactions.

3.To get familiar with the isolation methods for biomolecules.

4.To understand the properties of lipids practically.

5. To learn isolation nucleic acid from biological source.

Course Outcomes (Cos)

1. Students will study the isolation techniques for various carbohydrate, protein and lipids

2. Students will gain the knowledge of reagent preparation with given data of molarity and normality.

3. Students will perform various specific reactions for biomolecules.

4. Students will learn to isolate the DNA and RNA from various living tissue.

5. Students will determine the acid and saponification values of lipids.

Detailed Syllabus:

1. Calculation, preparation of normal, molar and percentage solutions.
2. Specific reactions for carbohydrate.
3. Specific reactions for amino acids.
4. Specific reactions for fatty acids.
5. Isolation of albumin and globulin from egg.
6. Isolation of cholesterol and lecithin from egg.
7. Isolation of casein by IpH precipitation from milk.
8. Isolation of starch from potato and its characterization.
9. Isolation of cellulose from grass and its characterization.
10. Isolation of DNA from bacterial/plant/animal source.

11. Isolation of RNA from yeast/plant.
12. Determination of saponification value.
13. Determination of acid value.

Suggested Readings/Material:

1. Biochemical Techniques Theory and Practice: J.R. Robyt and B.J. White
2. Practical Biochemistry: Principles and techniques: K. Wilson and J. Walker.
3. Practical Biochemistry by David Plummer
4. Introductory Practical Biochemistry by S.K. Sawhney and R.Singh.

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Syllabus

M.Sc. Biochemistry

Title of the Course: Analytical Biochemistry II								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-5	MS-BC115P	00	02	02	60	15	35	50

Learning Objectives:

1. To understand the various estimation techniques for amino acids, vitamins etc.
2. To learn the estimation of proteins by various methods and their comparison.
3. To learn finding the amount of carbohydrates in given samples.
4. To acquire knowledge of estimation techniques for nucleic acids.
5. To be able to identify the biomolecules based on their colour reactions.

Course Outcomes (Cos)

1. Students will study the estimation techniques for amino acids, vitamins etc.
2. Students will find the amount of protein in given samples by using various methods.
3. Students will be able to detect the presence of sugars, protein, amino acids both qualitatively and quantitatively.
4. Students will learn to identify the nucleic acid presence in samples by colour reactions.
5. Students will understand the estimation of sugar in any sample by using easy colorimetric method.

Detailed Syllabus:

1. Quantitative estimation of amino acid by Ninhydrin method.
2. Quantitative estimation of protein by Biuret method.
3. Quantitative estimation of protein by Lowry et.al method.
4. Quantitative estimation of protein by Bradford method.
5. Quantitative estimation of sugar by Folin-wu method.
6. Quantitative estimation of sugar by DNSA method.
7. Quantitative estimation of DNA by diphenylamine method.
8. Quantitative estimation of RNA by orcinol method.

9. Quantitative estimation of cholesterol by LB method.
10. Quantitative estimation of Vitamin C from lemon.
11. Quantitative estimation of phosphorus by Fiske-Subbarow method.
12. Quantitative estimation of α-amino nitrogen of amino acid.

Suggested Readings/Material:

1. Biochemical Techniques Theory and Practice: J.R. Robyt and B.J. White.
2. Practical Biochemistry: J. Jayaraman.
3. Practical Biochemistry by David Plummer
4. Introductory Practical Biochemistry by S.K. Sawhney and R.Singh.

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Syllabus

M.Sc. Biochemistry

Title of the Course: Practical Enzymology								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-6	MS-BC116P	00	02	02	60	15	35	50

Learning Objectives:

1. To learn isolation of the enzyme from any living sources by various methods.
2. To be able to determine the specific activity of enzymes.
3. To get trained to check the influence of factors like pH and temperature on enzyme activity.
4. To study the inhibition mechanism by some inorganic inhibitors.
5. To learn immobilization and reuse of the enzyme and determine its activity.

Course Outcomes (Cos)

1. Students will learn to isolate the various enzymes by using various sources.
2. Students will gain the knowledge about purification of the isolated enzyme.
3. Students will be able to find the optimum values for influencing factors.
4. Students will learn the inhibition and to determine the I50 value of given inhibitor.
5. Students will know how to find the specific activity of enzymes.

Detailed Syllabus:

1. Isolation and detection of enzyme invertase/amylase/peroxidase/catalase.
2. Partial purification of isolated enzyme.
3. Determination of activity and specific activity of enzyme.
4. Effect of substrate concentration on enzyme activity.
5. Effect of enzyme concentration on enzyme activity.
6. Effect of pH on enzyme activity.
7. Effect of temperature on enzyme activity.
8. Effect of activator on enzyme activity.
9. Effect of inhibitor on enzyme activity.
10. Determination of type of enzyme inhibition.

11. Determination of I_{50} value.
12. Enzyme immobilization.

Suggested Readings/Material:

1. Biochemical Techniques Theory and Practice: J.R. Robyt and B.J. White.
2. Practical Biochemistry: Principles and techniques: K. Wilson and J. Walker.
3. Practical Biochemistry by David Plummer
4. Introductory Practical Biochemistry by S.K. Sawhney and R.Singh.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
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Syllabus
M.Sc. Biochemistry

Title of the Course: Genetics								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSE-1	MS-BC117TA	02	00	02	30	15	35	50

Learning Objectives:

1. To understand the different types of gene interactions.
2. To learn linkage and crossing over.
3.To get trained in Pedigree analysis, microbial genetics.
4.To study population genetics.
5. To learn human genetics and genetic disorders.

Course Outcomes (Cos)

1. Students will learn linkage and crossing over.
2. Students will gain the knowledge of all types of alleles.
3. Students will be able to understand the extensions of Mendelian principles.
4. Students will learn the human genetics, microbial genetics.
5. Students will get the knowledge of genetic disorders and learn to solve pedigree analysis.

Detailed Syllabus:

Unit I: Mendelian principles and Extensions of Mendelism (7)

Dominance, segregation, independent assortment. Allelic variation and gene function – dominance relationships, multiple alleles, lethal allels and null alleles. Pleoiotropy gene interaction- epistatic and non-epistatic, interactions between gene(s) and environment.

Unit II: Linkage and Crossing over (4)

Morgans view on linkage, Chromosomal theory of linkage, kinds of linkage, significance of linkage. Types of crossing over, significance of crossing over.

Unit III: Microbial genetics (4)

Methods of genetic transfers-Transformation, conjugation and transduction.

Unit IV: Human Genetic disorders (6)

Variation in chromosome number- monosomy and trisomy od sex and autosomes. Variations in chromosome structure- inversions, deletions, duplications and translocations.

Unit V: Pedigree analysis (6)

Pedigree conventions, characteristics of dominant and recessive inheritance. Applications of pedigree analysis.

Unit VI: Population genetics (3)

Hardy-Weinberg law, predicting allele and genotype frequencies and exceptions to Hardy-Weinberg principle.

Suggested Readings/Material:

1. Genetics: Principles and Analysis. Sudbury, Hartl, D. L., & Jones, E. W. (1998).
2. Genetics: a Conceptual Approach. Pierce, B. A., W.H.Freeman and Co.(New York), ISBN: 13:978-1-4292-7606-1/ISBN: 10:1-4292-7606-1 (2012).
3. Principles of Genetics. Tamarin, R. H., & Leavitt, R. W. (1991).
4. Evolutionary Genetics. Smith, J. M. (1998). Oxford: Oxford University Press.
5. Genetics Author B. D. Singh Edition 2, reprint Publisher Kalyani Publishers.
6. Genetic Mapping and DNA Sequencing edited by Terry Speed, Michael Waterman.
7. An introduction to genetic analysis (2010), 10th ed., Griggiths, A.J.F, Wessler, S. R, Carrol, S. B.. and Doebley, J., W. H. Freeman and Company (New York), ISBN:10:1-4292-2943-8.

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New Arts, Commerce and Science College, Ahmednagar

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Syllabus

M.Sc. Biochemistry

Title of the Course: Biostatistics								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSE-1	MS-BC117TB	02	00	02	30	15	35	50

Learning Objectives:

1. To learn the management of biological data using statistical tools.
2. To understand sampling.
3.To get trained in data analysis.
4.To study and apply the hypothesis testing.
5. To learn regression and correlation.

Course Outcomes (Cos)

1. Students will learn to collect the data for sampling purpose.
2. Students will manage the given biological data using various statistical tools.
3. Students will acquire the knowledge of probability and probability distribution.
4. Students will learn the hypothesis testing
5. Students will know the regression and correlation.

Detailed Syllabus:

Unit I: Data collections (8)

Biological data management using statistical tools. Concepts of populations and sample, advantage of sampling, basic concepts in samplingand designing experiments. Estimation of sample size for biological experiments, sources of errors. Sample scheme-Simple random sampling, Systemic sapling, Stratified sampling, Cluster sampling, Non- Probability sampling. Estimation of mean proportion and standard error in cluster sampling, multistage and multiphase sampling, Types of numerical data- Nominal data, ordinal data, ranked data, discrete data, continuous data; Modes of presenting data: Frequency distributions, relative frequency.

Unit II: Analysis of variance (4)

Mean, median, mode; Coefficient of variation and standard deviation, range and interquartile range; Grouped mean and grouped variance;Frequency distributions.

Unit III: Probability (4)

Operations on events. Conditional probability, Probability distributions. Venn diagrams.

Unit IV: Hypothesis testing (6)

General concept- Null hypothesis, alternative hypothesis; Rejection of hypothesis. Type I and Type II errors. P value and sample size estimation.

Unit V: Regression and correlation (6)

Chi square test- Observed and expected frequencies, Calculating P values, Assumption of chi square goodness of fit; Correlation- Two-way scatter plot, Pearson's correlation coefficient; Regression- regression concepts, simple linear regression; Calculationof R^2 and ρ.

Unit VI: Introduction to ANOVA, AMOVA and SPSS. (2)

Suggested Readings/Material:

1. Principles of biostatistics, M. Pagano and K. Gauvreau (2000) Duxbury ThomasLearnings
2. Analysis of biological data, M. Whitlock and D. Schluter (2009) Roberts andcompany publisher.

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M.Sc. Biochemistry

Title of the Course: Practical in Genetics								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSE-2	MS-BC118PA	00	02	02	60	15	35	50

Learning Objectives:

1. To teach to solve the problems related to Mendelian inheritance.
2. To make students able to solve problems of chi square test.
3. To train the students to solve problems in epistasis.
4. To make them able to study the Drosophila melanogaster wild and mutant.
5. To teach them to solve pedigree analysis problems.

Course Outcomes (Cos)

1. Students will learn genetics problem solving in genetics.
2. Students will understand variation in population.
3. Students will understand Human genetic by karyotype analysis.
4. Students will learn Pedigree analysis.

Detailed Syllabus:

1. Problem set in Mendelian inheritance (Monohybrid cross and Dihybrid cross).
2. Deviation from in Mendelian inheritance (Incomplete dominance and Codominance).
3. Problem set in epistasis (Dominant, Recessive, Duplicate gene).
4. Problem set in Chi-Square test.
5. Problem set based on sex linked inheritance.
6. Pedigree analysis.
7. Problem set based on Hardy-Wenberg principle.
8. Problems based on inbreeding coefficient.
9. Study of *Drosophila melanogaster* (wild type).
10. Study of *Drosophila melanogaster* (mutant type).
11. Studies on Karyotype analysis.

Suggested Readings/Material:

1. Genetics: Principles and Analysis. Sudbury, Hartl, D. L., & Jones, E. W. (1998).
2. Genetics: a Conceptual Approach. Pierce, B. A. (2005).
3. Principles of Genetics. Tamarin, R. H., & Leavitt, R. W. (1991).
4. Evolutionary Genetics. Smith, J. M. (1998). Oxford: Oxford University Press.
5. Genetics Author B. D. Singh Edition 2, reprint Publisher Kalyani Publishers.
6. Genetic Mapping and DNA Sequencing edited by Terry Speed, Michael Waterman.

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Title of the Course: Practical Biostatistics								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSE-2	MS-BC118PB	00	02	02	60	15	35	50

Learning Objectives:

1. To learn random sampling.
2. To understand data representation.
3. To learn calculating mean, median and mode of given data.
4. To analyze the given data by variance.
5. To learn the SPSS software.

Course Outcomes (Cos)

1. Students will learn to collect the data for sampling purpose.
2. Students will learn to use various statistical tools to analyse data.
3. Students will acquire the knowledge of probability and probability distribution.
4. Students will learn the hypothesis testing, to use chi square test.
5. Students will learn to use the SPSS software.

Detailed Syllabus:

1. Estimation of population means and variance in simple random sampling.
2. Collection of data- random sampling method
3. Collection of data- cluster sampling method
4. Collection of data- stratified sampling method
5. Cluster sampling – equal and unequal cluster sizes. Double sampling using regressionand ratio estimates and double sampling for stratification.
6. Data representation- frequency and relative frequency distribution table. Plotting ofbiological data in graphical format.
7. Data analysis- calculating mean, median, mode, variance, standard deviation andstandard error for given data set.
8. Data analysis – Standard T- test for group analysis. Analysis of two-way variance.

9. Chi square goodness of fit test. Regression analysis and calculating regressioncoefficient.
10. Learning to analyze data using SPSS software.

Suggested Readings/Material:

1. Principles of biostatistics, M. Pagano and K.Gauvreau (2000)Duxbury ThomasLearnings
2. Analysis of biological data, M. Whitlock and D. Schluter (2009) Roberts and companypublisher.

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Title of the Course: Research Methodology								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
RM-1	MS-BC119T/P	02	02	04	90	30	70	100

Learning Objectives:

1. To understand the objectives of doing scientific research.

2.To learn how to identify area of research to be conducted.

3.To proceed for literature survey using variety of sources.

4.To learn writing research proposal with well laid hypothesis and objectives.

5.To learn the skills of research design, nature of sample size as well as collection and analysis of data.

Course Outcomes (Cos)

1.Student will acquire the knowledge of using excel for data analysis and interpretation

2.They will gain the knowledge of making power point presentations.

3.They will gain the knowledge of how to review a research paper.

4.They will know how to use media tools for research purpose.

5.Student will learn the skill of research designing.

6.They will learn writing a research proposal.

Detailed Syllabus:

Unit I: Research Methods (6)

Scientific research: Scientific methods and problem solving, Various phases of research. Major steps in the research process: Literature review, research proposal and aspects, Review of literature using appropriate sources – reviews, patents, research papers, books.

Unit II: Research Design (8)

Types of research design – exploratory, descriptive, experimental, survey and case study. Sampling techniques and sample size determination. Sample – Types, criteria,

characteristics and steps.

Unit III: Research reports (10)

Data preparation and preliminary analysis, Statistical analysis, Modelbuilding and decision making. Types of research documents, writing and formatting of reports, presentation,interpretation, art of oral presentation, format of publication in research journals. Journal Impact factor, citation index, h-index and i-10 index.

Unit IV: Bio-Ethics (6)

Bio-ethical concerns, Plagiarism, Citation and acknowledgement**.**

Practical content:

1. Use of Google Scholar, Scopus, Science Direct, PubMed, LibGen, Sci-Hub, etc. for research.
2. Use of Mendeley for citation and bibliography.
3. Introduction to MS-word for research writing and reference writing..
4. Use of Excel for measurement of Central Tendency (Mean, Median, Mode).
5. Use of Excel for Measurement of Dispersion/variability (Mean Deviation, Standard Deviation, Co efficient of variation).
6. Use of Excel for data representation by Line Graph, Bar graph, Pie chart, etc.
7. Introduction to MS- power point.
8. Use of MS- power point for preparing power point presentation.
9. Use of ChemDraw for chemical and biological structure drawing.
10. Writing of review article.
11. Preparation of research proposal for submitted to the funding agencies. (Submit it as report).
12. Presentation of prepared proposal.
13. Tools for plagiarism detection.

Suggested Readings/Material:

1. Research Methodology-methods and techniques By C. R. Kothari, New AgeInternational Publishers (2011) ISBN 978-81-224-1522-3.
2. Research Methodology by Dr. S. L. Gupta, Hitesh Gupta; International Book House Pvt Ltd (2013), ISBN-10: 8191064278, ISBN-13: 978-8191064278.
3. Writing Science: How to Write Papers That Get Cited and Proposals That Get Funded Joshua Schimel, Oxford University Press, (2011), ISBN: 9780199760.
4. Bhattacharya, ad. Ak. (2003): Research Methodology, Excel Books, New

Delhi.

5. Cenise F. Polit, J.B Bemadette, P. Hungler (1984) Essential of nursing research Methods Lippinott Company, UK.
6. Carol T. Bush (1985): Nursing Research, Reston Publishing C. Reston.

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Syllabus
M.Sc. Biochemistry

Title of the Course: Metabolism								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-7	MS-BC121T	03	00	03	45	30	70	100

Learning Objectives:

1. To understand the various types of metabolic reactions in human body.

2. To know the cause of energy formation by metabolism using various Biomolecules.

3.To understand the bioenergetics of carbohydrate metabolism through glycolysis, TCA cycle.

4.To understand the anabolic and catabolic pathways for lipids proteins.

5. To acquire the knowledge of nucleotide metabolism polyamines and porphyrins.

Course Outcomes (Cos)

1. Students will study the metabolic reactions in human body to liberate the energy.

2. Students will learn the bioenergetics concept with various pathways.

3. Students will able to draw the correct pathway or cycle with appropriate structures.

4. Students will understand the important mechanisms like non ribosomal protein synthesis.

5. Students will know the synthesis and degradation mechanism of nucleotides in human body.

Detailed Syllabus:

Unit I: Introduction of metabolism and Bioenergetics (3)

Metabolism, catabolism and anabolism, bioenergetics, role of ATP, biological oxidation-reduction reactions.

Unit II: Carbohydrate metabolism (9)

Reactions, energetics and regulation of glycolysis. Fates of pyruvate. Gluconeogenesis, Glyoxylate cycle, Glucuronic acid pathway, Pentose phosphate pathway. Synthesis of glycogen and starch. Citric acid cycle: Production of Acetyl-CoA, reactions, energetics and regulation.

Unit III: Lipid metabolism (5)

β-oxidation of fatty acid energetic with example. Formation of ketone bodies. Fatty acid synthase complex.

Unit IV: Amino acid metabolism (14)

Proteolysis, transamination, oxidative deamination, decarboxylation. Fates of carbon skeleton of amino acids. Urea cycle. Precursor functions of amino acids. One carbon atom transfer by folic acid. Amino acid biosynthesis.

Unit V: Protein Metabolism (5)

Polyamines, porphyrins, gamma glutamyl cycle, glutathione biosynthesis, nonribosomal protein biosynthesis.

Unit VI: Nucleotide metabolism: (5)

Biosynthesis, degradation and regulation of purine and pyrimidine nucleotides.

Unit VII: Electron transport system (4)

Oxidative phosphorylation, ATP synthase and its mechanism.

Suggested Readings/Material:

1. Principles of Biochemistry, Lehninger C Rs. Publ. 7th edition (2017).
2. Biochemistry, L. Stryer, W.H. Freeman, San Francisco (2008).
3. Biochemistry, G. L. Zuby,4th edition (1998).W.C.Brown Publishers,USA.
4. Biochemistry (2016) 6th edition, Garret R.H., Grisham C.M. Cengage Learning(Boston).
5. Biochemistry by Voet and Voet, 4th edition (2010)

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M.Sc. Biochemistry

Title of the Course: Physical Biochemistry								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-8	MS-BC122T	03	00	03	45	30	70	100

Learning Objectives:

1. To understand the sedimentation and the techniques based on it like centrifugation with their applications.
2. To get the knowledge about membrane filtration and the filters used like dialysis bags.
3.To acquire the knowledge to find the viscosity of given solutions.
4.To understand the mass spectrometry techniques and their applications.
5. To become able to separate and purify the given samples by using chromatography and electrophoresis.

Course Outcomes (Cos)

1. Students will study the sedimentation and centrifugation technique with their principles, instrumentation and applications.
2. Students will be familiar with all the chromatographic techniques based on different principles with their applications.
3. Students will able to understand the separation and purification mechanism by using electrophoresis.
4. Students will understand the advance techniques like mass spectrometry with its types.
5. Students will know the viscosity and its types with instrumentation.

Detailed Syllabus:

Unit I: Sedimentation (8)

Theory, Preparatory and Analytical ultracentrifuges, factors affecting sedimentation velocity, measurement of Sedimentation Coefficient, Zonal centrifugation, Specific examples of applications.

Unit II: Membrane filtration (4)

Nitrocellulose, Fibre glass, Polycarbonate filters, Dialysis and Reverse dialysis

Unit III: Chromatography (8)

Partition and Adsorption Chromatography- paper, TLC, GLC, GSC, gel filtration, ion exchange chromatography, affinity chromatography, hydrophobic interaction chromatography, metal chelate chromatography, covalent chromatography. DNA cellulose chromatography, MAK hydroxyl-apatite chromatography.

Unit IV: Electrophoresis (5)

Types of electrophoresis: moving boundary electrophoresis and zone electrophoresis. Paper Electrophoresis, Cellulose-acetate electrophoresis, Gel Electrophoresis,2D gel electrophoresis, Isoelectric focusing.

Unit V: Viscosity (4)

Theory, effect of macromolecules on the viscosity of a solution, Measurement of viscosity, molecular weight determination.

Unit VI: Spectroscopy (8)

Principle, instrumentation, methodology and biological applications of UV-Visible spectroscopy, Infra red (IR) spectroscopy, Nuclear Magnetic Resonance (NMR) spectroscopy, Optical Rotatory Dispersion (ORD) & Circular Dichroism (CD), Spectrofluorimeter and polarization of fluorescence

Unit VII: Mass Spectrometry (8)

Principle, component's, working and applications of mass spectrometer, Ionization methods used in mass spectrometer (CI,EI,ESI), Mass analysers used in mass spectrometer (magnetic sector, quadrapole), MALDI-MS, MALDI-TOF-MS.

Suggested Readings/Material:

1. Physical Biochemistry by D. Freifelder IInd Edition
2. Biochemical techniques by Wilson and Walker
3. Biophysical techniques by Upadhye and Upadhye.
4. Molecular cell biology 4th ed. Lodish B. Ball, 4th edition.

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Syllabus

M.Sc. Biochemistry

Title of the Course: General Microbiology								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-9	MS-BC123T	02	00	02	30	15	35	50

Learning Objectives:

1. To understand the microbial cell and cell components with structures.
2. To get the knowledge of microscope and learn to handle it.
3. To acquire the knowledge of fungal cells with ultrastructure.
4. To understand and to learn how to cultivate the bacteria by various methods.
5. To become able to know the viruses, their life cycle and the infections caused by viruses.

Course Outcomes (Cos)

1. Students will study the detail microbial structure with cell components.
2. Students will learn the microscopy and microscope with all the parts.
3. Students will able to understand the techniques for cultivation of bacteria in laboratory, their parameters.
4. Students will understand the host microbe interaction and symbiosis.
5. Students will know the structure and details of fungi and viruses.

Detailed Syllabus:

Unit I: Introduction (2)

Cell structure and components, characterization and classification of microorganisms.

Unit II: Microscopy: (4)

Principle and Application of phase contrast microscopy, fluorescence microscopyand electron microscopy. Specimen preparation, freeze etching, freeze fracture, shadow casting, electronmicroscopy of nucleic acids.

Unit III: Cultivation of Bacteria: (6)

Nutrition, physiology and growth of microbial cells, reproduction and growth,synchronous growth, continuous culture of microorganisms. Pure cultures and their characteristics.

Unit IV: Fundamentals of control of microbial growth: (6)

Use of physical agents for sterilization. Chemical and biochemical agents to control growth of microorganism.

Unit V: Host microbe interactions (5)

Endotoxins, exotoxins, capsular material. Tissue affinity, resistance and immunity.

Unit VI: Viruses (5)

Viruses of bacteria, plant and animal cells, (Structure, classification and life cycle), mycoplasma and viriods, diseases.

Unit VII: Fungi (2)

Cell structure. Classification. Biological importance.

Suggested Readings/Material:

1. Microbiology, M.S. Pelczar, R.D. Reid, E.C.S. Chan, Mc Graw Hill, New York,5th edition (2001).
2. General Microbiology (Vth Edition), R.Y. Stanier, Prentice Hall (1986)
3. Biology of Microorganisms by Brocks, 12th edition (2009)
4. Introductory Microbiology, F.C. Ross, Charles Merril Publication (1983).

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Syllabus
M.Sc. Biochemistry

Title of the Course: Physical BiochemistryPractical I								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-10	MS-BC124P	00	02	02	60	15	35	50

Learning Objectives:

1. To understand the technique for pH measurement by using indicators.
2. To get the knowledge of buffer preparation of desired pH and molarity.
3.To acquire the information about plotting the titration curves and to find the pI values.
4.To perform the separation and identification of components in given mixtures by column chromatography.
5. To become able to perform electrophoresis technique for nucleic acid separation.

Course Outcomes (Cos)

1. Students will train to prepare all types of acidic and basic buffers used in various practicals.
2. Students will learn to find the pI and pKa values for amino acids with the help of titration curves
3. Students will able to find the nature of given samples by using different types of pH indicators.
4. Students will learn to pack the column and to use it for separation purpose.
5. Students will perform the electrophoresis for separation and purification of nucleic acids.

Detailed Syllabus:

1. Preparation of acidic and basic buffer of desired molarity.
2. Determination of pH using pH meter and pH indicators.
3. Determination of pI and pKa of amino acid using pH meter.
4. Determination of nature and capacity of ion exchange column.
5. Separation of amino acids by ion exchange chromatography.
6. Separation and detection of amino acids by using paper chromatography/TLC.
7. Separation plant pigments by using paper chromatography.
8. Separation plant pigments by using column chromatography using silica gel-G.

9. Separation of lipids by TLC.
10. Separation of proteins by gel filtration chromatography.
11. Separation of proteins by polyacrylamide gel electrophoresis (Native-PAGE).
12. Separation of DNA by agarose gel electrophoresis.

Suggested Readings/Material:

1. An introduction to practical Biochemistry – David T. Plummer, Tata Mc Graw Hill Co.Ltd., Bombay. (2015) 3rd Edition.
2. Introductory Practical Biochemistry (2001). Ed. S.K. Sawhney and Randhir Singh.
3. Practical Biochemistry by Sadasivam and Manickam.
4. Practical Biochemistry, Principles and Techniques (1995). Ed. Keith Wilson and JohnWalker. . (2006) 5th Edition.
5. Practical Biochemistry by J. Jayaraman.
6. Practical Biochemistry by Shinde and Rao.

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Title of the Course: Physical BiochemistryPractical II								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-11	MS-BC125P	00	02	02	60	15	35	50

Learning Objectives:

1. To understand the technique to determine viscosity of given samples.

2. To get the knowledge of isolation of organelles from given living tissue.

3.To acquire the information about absorption spectrum analysis.

4.To perform the separation by using dialysis and reverse dialysis technique.

5. To become able to operate centrifuge based on sedimentation principle.

Course Outcomes (Cos)

1. Students will study the Lambert Beers law and learn to plot the absorption spectrum.

2. Students will learn to find the relative and specific viscosity of given solutions.

3. Students will able to isolate the cellular organelles by using fractionation technique.

4. Students will learn to separate the smaller molecules by using dialysis technique.

5. Students will learn to find absorption maxima of various biomolecules.

Detailed Syllabus:

1. Verification of Lamberts-Beer's Law using Colorimeter/Spectrophotometer.
2. Absorption spectrum of proteins and determination of its λmax.
3. Absorption spectrum of nucleic acids and determination of its λmax.
4. Determination of relative viscosity of hydrolyzed and unhydrolyzed starch.
5. Determination of specific viscosity of hydrolyzed and unhydrolyzed starch.
6. Sub- cellular fractionation by sedimentation.
7. Isolation of mitochondria from liver and assay of marker enzyme.
8. Separation/ Purification of biomolecules by using dialysis.
9. Concentrate the sample using Reverse dialysis.
10. Spectrofluoremetric estimation of riboflavin.
11. Demonstration and analysis of a sample components by HPLC.

12. Determination of angle of rotation of sugar molecule by using polarimeter.

Suggested Readings/Material:

1. An introduction to practical Biochemistry – David T. Plummer, Tata Mc Graw Hill Co.Ltd., Bombay. (2015) 3rd Edition
2. Introductory Practical Biochemistry (2001). Ed. S.K. Sawhney and Randhir Singh.
3. Practical Biochemistry by Sadasivam and Manickam.
4. Practical Biochemistry, Principles and Techniques (1995). Ed. Keith Wilson and JohnWalker. (2006) 5th Edition
5. Practical Biochemistry by J. Jayaraman
6. Practical Biochemistry by Shinde and Rao.

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Title of the Course: Practical in Microbiology								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSC-12	MS-BC126P	00	02	02	60	15	35	50

Learning Objectives:

1. To understand the proper media preparation method and tarin to prepare media.
2. To get the hand in isolation of bacteria from soil or sewage samples and their colony and biochemical characterization.
3. To learn to cultivate the bacterial cells by using streak, spread etc. methods.
4. To handle the microscope and to study the morphology of microorganisms.
5. To become able to determine the antimicrobial property of given samples.

Course Outcomes (Cos)

1. Students will train to prepare media according to microorganisms to isolate them from soil or sewage samples.
2. Students will learn all the types of aseptic culture transfer techniques.
3. Students will able to study the morphology of microorganisms by various staining techniques and by observation under microscope.
4. Students will learn to plot the growth curve of microorganisms
5. Students will find the antimicrobial assay of given samples for its inhibition activity.

Detailed Syllabus:

1. Culture media preparation and sterilization.
2. Isolation of bacteria from soil or sewage water.
3. Culture transfer techniques:
    a) Solid to solid (streaking).
    b) Liquid to solid (spreading)
    c) Solid to liquid
    d) Liquid to liquid
4. Microscopic examination:

a) Monochrome staining.

b) Gram's staining.

c) Negative staining.

d) Motility testing by hanging drop technique.

e) Capsular staining

5. Colony characterization and biochemical test in organism identification.
6. Cell counting by haemocytometer and determination of CFU/ml.
7. Methylene blue reduction test (MBRT) for quality of milk.
8. Growth curve of *E. coli*.
9. Total viable count determination (pour plate).
10. Microbial assay of antibiotic.
11. Plaque assay for phage
12. UV survival curve.

Suggested Readings/Material:

1. Microbiology, M.S. Pelczar, R.D. Reid, E.C.S. Chan, Mc Graw Hill, New York, 5th edition (2001).
2. General Microbiology (Vth Edition), R.Y. Stanier, Prentice Hall (1986)
3. Biology of Microorganisms by Brocks, 12th edition (2009)
4. Introductory Microbiology, F.C. Ross, Charles Merril Publication (1983).

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar
(Autonomous)
Syllabus
M.Sc. Biochemistry

Title of the Course: Food Technology								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSE-3	MS-BC127TA	02	00	02	30	15	35	50

Learning Objectives:

1. To understand the food microbiology and biochemistry of food spoilage.
2. To get the knowledge of foods and nutrition required by living bodies and concept of balanced diet.
3. To acquire the information about all the methods for food preservation with their principles.
4. To understand and to learn the best protein sources and their significance for body.
5. To become familiar with food related laws and food quality management as well as food engineering.

Course Outcomes (Cos)

1. Students will study the relationship between food, nutrition and health, balanced diet.
2. Students will learn the food microbiology and about the mechanism of food spoilage.
3. Students will able to understand the food preservation methods depends on different principles.
4. Students will understand the importance of proteins as a perfect food content.
5. Students will become aware of food laws and food quality management.

Detailed Syllabus:

Unit I: Introduction to Food and Nutrition (5)

Basic terms used in study of food and nutrition, BMI and Nutritional Status, understanding relationship between food, nutrition and health. Functions of food-physiological, psychological and social, Concept of Balanced Diet, Food Groups, Food Pyramid.

Unit II: Food Microbiology (3)

Definition and scope of food microbiology, SCP, Microbial food spoilage.

Unit III: Food processing and Preservation (6)

Enzymes in food analysis, alcohol, amino acids, glucose. Enzymes in food processing, meat tenderization and fruit juice technology. Low temperature (freezing and refrigeration) and High temperature (Thermal processing). Moisture control (Drying, Dehydration and Evaporation) Irradiation, Chemical Preservatives.

Unit IV: Food Safety (4)

Introduction, Food Hazards of Physical, Biological and Chemical Origin, Management of hazards. Food Laws: FSSAI, AGMARK, BIS, FPO, Weights and Measures Act ,CODEX.

Unit V: Food Quality (4)

Introduction to food quality management – Definition of quality, quality concepts, quality perception, quality attributes.

Unit VI: Food Additives (6)

Introduction, need of food additives in food processing and preservation. Characteristics and classification of food additives. Antimicrobial agents (Nitrites, sulphides, sulphur di oxide, sodium chloride, hydrogen peroxide). Antioxidants (natural and synthetic antioxidants, technological aspect of antioxidants). Sweeteners: Importance, classification (natural and artificial) and consideration for choosing sweetening agents. Colors: Importance, classification (natural, artificial, and natural identical), FD and C Dyes and Lakes.

Unit VII: Food Engineering (2)

Introduction, Psychometrics (use and application). Genetically modified foods.

Suggested Readings:

1. Introduction to food sciences and technology –GF Stewart and MA Amerine (1973) Academic Press .
2. Desrosier NW and Desrosier JN, The Technology of Food Preservation, CBS Publication, New Delhi, 1998
3. Enzymes and food processing- GG Birch, N Blackbrough (1981)
4. Biochemical Methods, By S Sadashivan, A.Manickam; Third Edition, New Age International Publishers
5. Essentials of food and nutrition M Swaminathan Vol. II, Applied aspects (1974), Ganesh Pub, Madras
6. Rao PG, Fundamentals of Food Engineering, PHI Learning Pvt Ltd, New Delhi, 2010
7. Food Safety and Standards Authority of India portal, Government of India
8. Pelczar MJ, Chan E.C.S and Krieg, Noel R. Microbiology, 5th Ed., TMH, New Delhi, 1993.

Ahmednagar Jilha Maratha Vidya Prasarak Samaj's

New Arts, Commerce and Science College, Ahmednagar

(Autonomous)

Syllabus

M.Sc. Biochemistry

Title of the Course: Bioinformatics								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSE-3	MS-BC127TB	02	00	02	30	15	35	50

Learning Objectives:

1. To understand the tools of bioinformatics.
2. To study in silico protein structure predictions.
3. To get trained in applications of program use for database searching protein.
4. To get trained in DNA sequence analysis.
5. To learn prediction of protein structures.

Course Outcomes (Cos)

1.Studying this course students will have an understanding of tools of bioinformatics andcomputational biology and will be we are in position to access biological databases and software which will be helpful in understanding sequential regiments and predictingthe structure of biomolecules such as protein.

2.Students will be exposed to available bioinformatics tools and databases.

3.They will be in a position to complete the fundamental aspects of *in silico* protein structure prediction.

4.They will understand application of theoretical approaches to biological systems.

5.Students will get trained in applications of program use for database searching proteinand DNA sequence analysis and prediction of protein structures.

Detailed Syllabus:

Unit I: Introduction to Bioinformatics: (1)

Definition, History and Applications of Bioinformatics

Unit II: Biological Databases: (8)

Concept of database and types of Biological databases, various databases (NCBI, SwissProt, PDB) and bioinformatics tools, Nucleic acid sequence databases (GenBank),

Protein sequence databases (UniProt), Genome Databases, 3D Structure Database (PDB), Literature Database (PubMed).

Unit III: Sequence Analysis: (10)

File formats, Basic concepts of sequence analysis. Scoring matrices. Pair wise sequence alignments, Multiple sequence alignment, Database Searches (BLAST, FASTA)

Unit IV: Structural bioinformatics: (6)

Overview and Introduction to Protein Structure. Visualization of structures using Rasmol or SPDBV. Structure prediction by Homology Modeling.

Unit V: Phylogenetic analysis: (5)

Introduction to Molecular Phylogeny. Choice of Molecular Marker. Overview of methods of Phylogeny.

Suggested Readings/Material:

1. Essential Bioinformatics – Jin Xiong Cambridge University Press; 1st edition,Cambridge.
2. A text book of bioinformatics (2008) Sharma, Munjal and Shankar. RastogiPublications, Meerut.
3. Introduction to Bioinformatics (2008) Arthur M. Lesk OUP, Oxford.

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Syllabus

M.Sc. Biochemistry

Title of the Course: Practical in Food Technology								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSE-4	MS-BC128PA	00	02	02	60	15	35	50

Learning Objectives:

1. To determine the various special contents in given foods.
2. To get the hand to isolate enzymes present in food and to find their activitiy.
3. To acquire the technique to analyze synthetic food additives like vinegar, artificial additives.
4. To understand and to learn to find the different types of adulterants in milk and milk products.
5. To become able to preserve the foods by various methods and again to study their characteristics for spoilage.

Course Outcomes (Cos)

1. Students will determine the special content amount present in food samples.
2. Students will learn to find adulterants added in milk or milk products.
3. Students will able to determine the important parameters of given food samples like beverages.
4. Students will train to preserve the food by low and high temperature and to recheck it.
5. Students will learn to prepare the caramel, fruit candy by standard procedure.

Detailed Syllabus:

1. Determination of gluten content of various flours.
2. Determination of starch content of various cereals.
3. Determination of amylase activity of various types of rice.
4. Determination of amylase activity of germinated pulses.
5. Estimation of reducing and non-reducing sugars.
6. Determination of pH and acidity of different beverages.
7. Estimation of acetic acid from vinegar.
8. Estimation of protein content of processed and unprocessed pulses.

9. Identification of molds by lactophenol blue staining.
10. Determination of *E.coli* in beverages.
11. Detection of adulterants in milk and milk products.
12. Determination of gelatinization temperature range (GTR) of different starches.
13. Preparation of fruit candy and study quality characteristics of it preserved by drying.
14. Preservation and study quality characteristics of foods preserved by high and low temperature.
15. Extraction of oil/ oleoresins from spices.
16. Preparation of caramel.

Suggested Readings:

1. Biochemical Methods, By S Sadashivan, A.Manickam; Third Edition, New Age International Publishers
2. ICMR (2010). Nutrient Requirements and Recommended Dietary Allowances for Indians.
3. Hand Book of Food Analytical Chemistry: Water, Proteins, Enzymes, Lipids, and Carbohydrates Edited, Ronald e. wrolstad et al ,Wiley Interscience, a John Wiley & Sons, Inc., Publication
4. Food Analysis, Edited by S. Suzanne Nielsen, Fourth Edition, Springer.
5. Fruit and vegetable processing, M.G. Danthy,FAO, Rome.

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Syllabus

M.Sc. Biochemistry

Title of the Course: Practicalin Bioinformatics								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
DSE-4	MS-BC128PB	00	02	02	60	15	35	50

Learning Objectives:

1.To understand the tools of bioinformatics.

2.To study in silico protein structure predictions.

3.To get trained in applications of program use for database searching protein.

4.To get trained in DNA sequence analysis.

5.To learn prediction of protein structures.

Course Outcomes (Cos)

1.Studying this course students will have an understanding of tools of bioinformatics and computational biology and will be we are in position to access biological databases and software which will be helpful in understanding sequential regiments and predictingthe structure of biomolecules such as protein.

2.Students will be exposed to available bioinformatics tools and databases.

3.They will be in a position to complete the fundamental aspects of *in silico* protein structure prediction.

4.They will understand application of theoretical approaches to biological systems.

5.Students will get trained in applications of program use for database searching proteinand DNA sequence analysis and prediction of protein structures.

Detailed Syllabus:

1. Referencing in Scientific literature and their practical usage- PubMed.
2. Study of biological databases GenBank, DDBJ.
3. Study of biological databases- EMBL, UniProt, PDB.
4. Sequence retrieval from biological databases.
5. Pair wise sequence alignment - Local and Global alignment

6. Multiple Sequence Alignment – Clustal Omega, Clustal X, T-Coffee, Muscle.
7. Databases search for homologous sequence using BLAST.
8. Databases search for homologous sequence using FASTA.
9. Protein structure visualization and prediction tools- RASMOL, SwissPDB Viewer, SwissModel.
10. Phylogenetic tree construction using MEGA.

Suggested Readings:

1. Bioinformatics: Sequence, Structure and Databanks: A Practical Approach (The Practical Approach Series, 236), Des Higgins (Editor), Willie Taylor. 1st edition, October 2000, Oxford University Press. ISBN: 978-0199637904.
2. Bioinformatics: Sequence and Genome Analysis, David W. Mount. 2nd edition, June 2004, Cold spring harbor laboratory press. ISBN: 978-0879697129
3. Introduction to Bioinformatics, Teresa Attwood, David Parry-Smith, 1st edition, May 2001, Pearson Education. ISBN: 978-8178085074
4. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Second Edition, Andreas D. Baxevanis, B. F. Francis Ouellette. 3nd edition, October 2004, A John Wiley & Sons, Inc., Publication. ISBN: 978-0471478782.

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Syllabus
M.Sc. Biochemistry

Title of the Course: On Job Training								
Year: I				**Semester: I**				
Course Type	Course Code	Credit Distribution		Credits	Allotted Hours	Allotted Marks		
		Theory	Practical			CIE	ESE	Total
OJT-1	MS-BC129P	00	04	04	120	30	70	100

Learning Objectives:

1. To acquire experiential learning.

2. To acquire the practical skills required for the workplace related to their subject. On Job Training/Internship report serves as an archival evidence of OJT/internship experience.

3. To grab opportunity to develop record keeping and report writing skills.

4. To understand subject more efficiently by relating the classroom theory with workplace practice.

Course Outcomes (Cos)

1. Students will learn about various sections of industries.

2. Students will gain hands on experience on industrial instruments.

3. Students will acquire ethical knowledge about industrial behavior.

4. Students will understand industrial SOPs.

Guidelines –

1. Job training should be of 120 Hrs.

2. Students should submit report and completion certificate.

Details of the Report

1. The organization of the final report should be in sequence and it should help the reader to obtain a clear understanding of the detailed points presented in the report.

2. Topics within the report should be coherent, clear and concise. Discussions should be work-oriented.

3. The report can be illustrated with appropriate tables, diagrams and graphs wherever necessary and should be properly labeled.

4. Any facts and figures about the company where the training was completed should be supported by references, internal company reports, etc.

5. The report should be a minimum of 20 pages and not more than 40 pages.

6. The report should describe the students' work in their own words.

7. The report should have a bibliography and references, if applicable.

Report Writing - Format and Contents:

The arrangement of Internship / On-the-job training report should be as follows:

· Covering page.

· Bonafide certificate page in the prescribed format.

· Declaration page.

· Certificate issued by the Industry/Organization/Company.

· Acknowledgement.

· Table of Contents

· Table of Abbreviations

· Introduction

· Technical report

· Conclusion

· Bibliography (if applicable)

1. Front pages: The title/ covering page should be in prescribed format. It should be followed by the Bonafide certificate page and the declaration page. The certificate issued by the Industry / Organisation / Company and the work diary should be placed after these pages.

2. Acknowledgements: In this section, student can acknowledge the help, assistance and advice given during the internship and in the preparation of the report.

3. Table of Content: The report must have a table of content which should show the principle divisions of the work and the page numbers on which they are found.

4. Table of Abbreviations: This section should list each abbreviation within the report and its meaning.

5. Introduction: The purpose of this section is to provide a brief introduction of the work. It should not exceed five pages and should comprise the following topics:

a) Organization / Company Background: A brief and clear presentation of the company and the functions of the department(s) in which the student completed her/his internship.

b) Training Objective: Description of the student's internship objective and work accomplishments.

c) Student's Work Assignment: A general presentation of the student's function within the company and work assignments.

6. Technical report / Areas Covered / Training Experience: This section constitutes the core (subject) of the report. It describes the work that a student has accomplished during the training,

the techniques he/she has learnt, the skills acquired, the contributions made, the responsibilities assumed, the equipment he/she has used (if any), the safety procedures followed and all other relevant information. It should contain all the crucial technical details including reactions, experimental work, illustrations, equations, programs, software versions, graphs, tables, charts, diagrams, etc. The technical part may be presented in the form of chapters, sections or any other arrangement suitable to the nature of the technical report. One or two pages of Geotagged photographs (taken along with the student) should be included.

7. Conclusion: A short description of training experience in own words, his/her opinion on the importance and merits of the internship/On Job training and how far it is supportive to his/her program can be included in this section. It should also include a student's technical preparation for launching a career / start-up.

8. Bibliography: A bibliography is a list of books and other references that a student used in preparing the report, which should be provided in an appropriate style.

Note:

Two copies of the report not less than 20 pages should be submitted by the students before the commencement of the first term test of the III Semester.

Formatting:

-Times New Roman

-Font size 12

-Double-Spacing

-Paper size A4.

Page Numbering: Page number should begin with 1 from the introduction page and should continue throughout the report including the reference pages.

The page numbers should be on the bottom middle or bottom right of each page throughout the text.

· Work diary should also be submitted with report which will have daily work details written in it.