FACULTY OF SCIENCE

SYLLABI

FOR

B.Sc. (HONOUR SCHOOL) BIOCHEMISTRY

1ST TO 6TH SEMESTER

&

M.Sc. (HONOUR SCHOOL) BIOCHEMISTRY

1ST TO 4TH SEMESTER

EXAMINATIONS 2013 - 2014

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Outlines of tests, syllabi and courses of reading for B.Sc. (Honours School) in Biochemistry, 1<sup>st</sup> year for the session 2013-14.

Courses for B.Sc. (HS) 1<sup>st</sup> year (Major)

1<sup>st</sup> Semester
1. BC-1101: Introductory Biochemistry 75 3+0+0
2. BC-1102: Cell Biology 75 3+0+0
3. BC-1151: Practical 50 0+1+1

2<sup>nd</sup> Semester
1. BC-1201: Lipids, proteins, nucleic acids and porphyrins 75 3+0+0
2. BC-1202: Various types of cells. Cell division and cell cycle 75 3+0+0
3. BC-1251: Practical 50 0+1+1

Courses for B.Sc. (HS) 1<sup>st</sup> year (Subsidiary)
(For the students of Botany and Anthropology Department)

1<sup>st</sup> Semester
1. BCS-1171: Biomolecules-I 75 3+0+0
2. BCS-1172: Practical 25 0+0+1

2<sup>nd</sup> Semester
1. BC-1271: Biomolecules-II 75 3+0+0
2. BC-1272: Practical 25 0+0+1

Courses for B.Sc.(H.S.) 2<sup>nd</sup> year (Semester System) (Major/Subsidiary)

**MAJOR (BIOCHEMISTRY)**

3<sup>rd</sup> Semester
1. BC-2101: Enzymes 75 3+0+0
2. BC-2102: Carbohydrate Metabolism 75 3+0+0
3. BC-2103: Metabolism of Nitrogenous Compounds 75 3+0+0
4. BC-2151: Practical 75 1+1+1

TOTAL 300 10+1+1

4<sup>th</sup> Semester
1. BC-2201: Bioenergetics & Enzymes Kinetics 75 3+0+0
2. BC-2202: Lipid Metabolism 75 3+0+0
3. BC-2203: Biochemical Techniques  
   Marks: 75  
   Credits: 3+0+0

4. BC-2251: Practical  
   Marks: 75  
   Credits: 1+1+1

**TOTAL 300**  
**Credits: 10+1+1**

**Biochemistry (SUBSIDIARY)**

**3rd Semester**

**Botany/Anthropology (2 years Course)**

1. BCS-2171: Intermediary Metabolism  
   Marks: 75  
   Credits: 3+0+0

2. BCS-2152: Practical  
   Marks: 25  
   Credits: 0+0+1

**TOTAL 100**  
**Credits: 3+0+1**

**4th Semester**

**Botany/Anthropology (2 years Course)**

1. BCS-2271: Molecular Biology  
   Marks: 75  
   Credits: 3+0+0

2. BCS-2252: Practical  
   Marks: 25  
   Credits: 0+0+1

**TOTAL 100**  
**Credits: 3+0+1**

**3rd Semester**

**Microbiology/Bio-Physics/Zoology (1 year Course)**

1. BCS-2172: Biomolecules and their metabolism  
   Marks: 75  
   Credits: 3+0+0

2. BCS-2153: Practical  
   Marks: 25  
   Credits: 0+0+1

**TOTAL 100**  
**Credits: 3+0+1**

**4th Semester**

**Microbiology/Bio-Physics/Zoology (1 year Course)**

1. BCS-2272: Enzymology and molecular biology  
   Marks: 75  
   Credits: 3+0+0

2. BCS-2253: Practical  
   Marks: 25  
   Credits: 0+0+1

**TOTAL 100**  
**Credits: 3+0+1**

**Courses for B.Sc.(H.S.) IIIrd year (Semester System)**

**5th Semester**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Marks</th>
<th>Credits</th>
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<tr>
<td>BC-3101</td>
<td>Fundamentals of Molecular Biology-I</td>
<td>75</td>
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<tr>
<td>BC-3102</td>
<td>Plant Biochemistry-I</td>
<td>50</td>
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<td>BC-3103</td>
<td>Endocrinology</td>
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<td>BC-3104</td>
<td>Immunology-I</td>
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<td>BC-3105</td>
<td>Nutritional Biochemistry: Basic Concepts</td>
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<td>BC-3106</td>
<td>Techniques in Biochemistry-I</td>
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<td>Practical-I</td>
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<td>BC-3202</td>
<td>Plant Biochemistry-II</td>
<td>75</td>
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<td>BC-3203</td>
<td>Neurobiology</td>
<td>50</td>
<td>2+0+0</td>
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<td>BC-3204</td>
<td>Immunology-II</td>
<td>75</td>
<td>3+0+0</td>
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<tr>
<td>BC-3205</td>
<td>Nutritional Biochemistry: Applied Aspects</td>
<td>50</td>
<td>2+0+0</td>
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<td>BC-3206</td>
<td>Techniques in Biochemistry-II</td>
<td>75</td>
<td>3+0+0</td>
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<td>BC-3207</td>
<td>Practical-I</td>
<td>50</td>
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<tr>
<td>BC-3208</td>
<td>Practical-II</td>
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**TOTAL** 500 15+3+2
ENVIRONMENT AND ROAD SAFETY EDUCATION

(25 hr. course)

UNIT I (ENVIRONMENT)

1. Environment Concept:
   Introduction, concept of biosphere—lithosphere, hydrosphere, atmosphere; Natural resources—
   their need and types; principles and scope of Ecology; concepts of ecosystem, population,
   community, biotic interactions, biomes, ecological succession.

2. Atmosphere:
   Parts of atmosphere, components of air; pollution, pollutants, their sources, permissible limits, risks
   and possible control measures.

3. Hydrosphere:
   Types of aquatic systems. Major sources (including ground water) and uses of water, problems of
   the hydrosphere, fresh water shortage; pollution and pollutants of water, permissible limits, risks
   and possible control measures.

4. Lithosphere:
   Earth crust, Soil—a life support system, its texture, types, components, pollution and pollutants,
   reasons of soil erosion and possible control measures.

5. Forests:
   Concept of forests and plantations, types of vegetation and forests, factors governing vegetation,
   role of trees and forests in environment, various forestry programmes of the Govt. of India, Urban
   forests, Chipko Andolan.

6. Conservation of Environment:
   The concepts of conservation and sustainable development, why to conserve, aims and objectives of
   conservation, policies of conservation; conservation of life support systems—soil, water, air,
   wildlife, forests.

7. Management of Solid Waste:
   Merits and demerits of different ways of solid waste management—open, dumping, landfill,
   incineration, resource reduction, recycling and reuse, vermicomposting and vermiculture, organic
   farming.

8. Indoor Environment:
   Pollutants and contaminants of the in-house environment; problems of the environment linked to
   urban and rural lifestyles; possible adulterants of the food; uses and harms of plastics and
   polythene; hazardous chemicals, solvents and cosmetics.

9. Global Environmental Issues:
   Global concern, creation of UNEP; Conventions on climate change, Convention on biodiversity;
   Stratospheric ozone depletion, dangers associated and possible solutions.

10. Indian Laws on Environment:
    Indian laws pertaining to Environmental protection: Environment (Protection) Act, 1986; General
    information about Laws relating to control of air, water and noise pollution. What to do to seek
    redressal.

11. Biodiversity:
    What is biodiversity, levels and types of biodiversity, importance of biodiversity, causes of its
    loss, how to check its loss; Hotspot zones of the world and India, Biodiversity Act, 2002.

12. Noise and Microbial Pollution:
    Pollution due to noise and microbes and their effects.

13. Human Population and Environment:

14. Social Issues:
    Environmental Ethics: Issues and possible solutions, problems related to lifestyle, sustainable
    development; Consumerisms and waste generation.
15. **Local Environmental Issues:**
Environmental problems in rural and urban areas, Problem of Congress grass & other weeds, problems arising from the use of pesticides and weedicides, smoking etc.

**Practicals:**
Depending on the available facility in the college, a visit to Vermicomposting units or any other such non-polluting eco-friendly site or planting/caring of vegetation/trees could be taken.

> Note: Above 15 topics to be covered in 25 hour lectures in total, with 2 lectures in each topics from 2 to 11 and one each for the topics 1 and 12 to 15.

**UNIT II (ROAD SAFETY)**

1. Concept and Significance of Road Safety.
2. Role of Traffic Police in Road Safety.
4. Traffic Signs.
5. How to obtain Driving License.
7. Common Driving mistakes.
8. Significance of First-aid in Road Safety.
9. Role of Civil Society in Road Safety.

**Examination Pattern:**
- Seventy multiple choice questions (with one correct and three incorrect alternatives and no deduction for wrong or un-attempted question).
- The paper shall have two units: Unit I (Environment) and Unit II (Road Safety).
- Unit I shall comprise of 50 questions with minimum of 2 questions from each topics 1, and 12 to 15 and minimum of 4 questions from topics 2 to 11.
- Unit II shall comprise of 20 questions with minimum of 1 question from each topics 1 to 10.
- The entire syllabus of Unit I is to be covered in 25 hours and that of Unit II is to be covered in 10 hours.
- All questions are to be attempted.
- Qualifying Marks 33 per cent i.e. 23 marks out of 70.
- Duration of examination : 90 minutes.
- The paper setters are requested to set the questions strictly according to the syllabus.

**Suggested Readings**
2. Road Safety Signage and Signs (2011), Ministry of Road Transport and Highways, Government of India.

**Websites:**
(a) [www.chandigarhpolicen.nic.in](http://www.chandigarhpolicen.nic.in)
(b) [www.punjabpolicen.gov.in](http://www.punjabpolicen.gov.in)
(c) [www.haryanapolicen.gov.in](http://www.haryanapolicen.gov.in)
(d) [www.hppolicen.nic.in](http://www.hppolicen.nic.in)
Syllabus and Courses of Reading for B.Sc. (Hons. School) (courses where English is taught as a subsidiary subject) for the session 2013-2014.

FIRST SEMESTER

Objectives:
The objective of teaching English to the science students is to create general awareness among them about literature and its impact on their lives. At the same time, it is expected that the students, on reading this course, shall develop proficiency in reading and writing skills, while acquiring a sensitive and analytical attitude towards literature in particular, and life in general. It is with this aim in mind that the new text has been selected and it is hoped that the objectives of the course will not only be reflected but also realized through necessary shift in the teaching practices, design of the question paper and mode of evaluation.

Note:
(i) There will be one paper of 80 marks, 10 marks are reserved for the Internal Assessment and 10 for the Practical Work. Total is 100.
(ii) The paper shall consist of Two Units. Unit I will be text specific and Unit II shall deal with different aspects of communications and language learning skills.
(iii) For Unit I, the prescribed text is Varieties of Expression, Ed. A. H. Tak, Foundation Books, which shall replace the existing text Patterns in Prose by Jagdish Chander, P.U., Chandigarh. It may be pointed out here that only certain sections of this text i.e. prose and drama are prescribed. Poetry has been deleted completely. Only five prose and five plays have been recommended for the study. The relevant sections, however, are as follows:

Prose:
I. The Judgement Seat of Vikramaditya, Sister Nivedita
II. Engine Trouble, R. K. Narayan
III. The Conjurer’s Revenge, Stephen Leacock

Drama:
I. The Rising of the Moon, Lady Gregory
II. Waterloo, Arthur Conan Doyle

(iv) No text book is recommended for Unit II, but a few books that may be used for this Unit are listed towards the end Unit II shall consist of the following:

Communication: It shall focus on different aspects of communication, types of communication, and significance of positive attitude in improving communication.

Writing Skills: This section shall focus on précis-writing, letters of all kinds; curriculum vitae, short, formal reports (no exceeding 200 words); public notices and advertisements relating to product promotion etc.,

Modern Forms of Communication: Here special emphasis shall be given to teaching the format of e-mails, fax messages, telegrams, audio-visual aids and power-point presentations. Apart from this, the students shall also be given basic lessons in effective listening, non-verbal communication, how to prepare for an interview and group discussion etc.,

Practical Work:-
Teacher should assign some project or practical work to the students. This should be in the nature of guided activity, which the students shall have to complete under the direct supervision of the teacher. The students may be given projects on a variety of subjects relating to their discipline i.e. science in general or a specific area of science they are specializing in. Preferably, they should be given minor projects (to be completed within less than two weeks, and length not exceeding 20 pages) in consultation with teachers of science. However, the evaluation of the projects should be done only by the Language Teachers, who must keep all the basic criteria of good writing in mind while doing so.
Note: In case of private candidates and students of School of Open Learning, the marks obtained by them out of 80 will be proportionately increased out of 100.

Testing Scheme:
The examination paper shall be divided into two sections, corresponding to two units already proposed in the syllabus. The distribution of questions and marks in Section I shall be as follows:

Section I (It is text-based and corresponds to unit I in the syllabus)
Q1. It shall consist of five short questions (not exceeding 100-120 words) out of which a student will be expected to attempt any three. This question shall be based upon the prescribed text Varieties of Expression and cover a wide range of issues, topics and problems. It shall consist of 12 marks.
Q2. It shall consist of two long questions (not exceeding 300-350 words) out of which a student will be expected to attempt only one. This question shall have internal choice, be based upon the prescribed text Varieties of Expression. This shall carry 10 marks.
Note: The question 1 & 2 should be so designed as to cover all the chapters prescribed, as well as the major issues and problems listed therein.
Q3. It shall consist of an Unseen Passage for Comprehension (not more than 800 words), with minimum six questions at the end. These questions should be designed in such a way that we are able to test a student’s comprehension ability, language/presentation skills and vocabulary etc. This question shall be of 12 marks.

Q.4. It shall exclusively be a test of vocabulary, but designed strictly on the lines of various exercises given at the end of each chapter in the prescribed text. The candidate shall be given six words in one column and asked to match them with words/meanings in the next column. This shall carry 6 marks.

Section II (Based upon Unit II)
Q.5 (a) The students shall be asked to write a short survey report on a situation, incident, problem of science or the possibility of starting a new scientific venture (in about 150-200 words). The students shall be given an internal choice in this question. This question shall carry 8 marks.
Q.5 (b) This question shall be on notices/advertisements of various types (as mentioned in the syllabus). It’ll carry 4 marks.
Q.6. This question shall test a student’s ability to write letters of various kinds (in nor more than 250 words). Again, there will be internal choice here and the question will be of 8 marks.
Q.7 There will test a student’s ability to write a Précis, A passage of about 200 words shall be given and the students shall have to write a précis of about 70 words (including the title). This question shall carry 10 marks.
Q.8 This question shall test a student’s understanding of various aspects of communication and modern forms of communication. It shall be divided into two parts:
   (a) Two short questions to be attempted (in not more than 100-120 words each) on different aspects of communication. It’ll carry 6 marks.
   (b) Definitions/format of modern forms of communication to be tested. This shall again carry 4 marks.

Suggested Reading:

SECOND SEMESTER

Objectives:
The objective of teaching English to the science students is to create general awareness among them about literature and its impact on their lives. At the same time, it is expected that the students, on reading this course, shall develop proficiency in reading and writing skills, while acquiring a sensitive and analytical attitude towards literature in particular, and life in general. It is with this aim
in mind that the new text has been selected and it is hoped that the objectives of the course will not only be reflected but also realized through necessary shift in the teaching practices, design of the question paper and mode of evaluation.

Note:

(i) There will be one paper of 80 marks, 10 marks are reserved for the Internal Assessment and 10 for the Practical Work. Total is 100.
(ii) The paper shall consist of Two Units. Unit I will be text specific and Unit II shall deal with different aspects of communications and language learning skills.
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**Prose:**

I  J. C. Bose, *Aldous Huxley*

II  The Position of Women in Ancient India, *Padmini Sen Gupta*

**Drama:**

I  *The Proposal*, Anton Chekhov

II  *Riders to the Sea*, J. M. Synge

III  *Lithuania*, Rupert Brooke

(iv) No text book is recommended for Unit II, but a few books that may be used for this Unit are listed towards the end Unit II shall consist of the following:

*Communication:* It shall focus on different aspects of communication, types of communication, and significance of positive attitude in improving communication.

*Writing Skills:* This section shall focus on précis-writing, letters of all kinds; curriculum vitae, short, formal reports (no exceeding 200 words); public notices and advertisements relating to product promotion etc.,

*Modern Forms of Communication:* Here special emphasis shall be given to teaching the format of e-mails, fax messages, telegrams, audio-visual aids and power-point presentations. Apart from this, the students shall also be given basic lessons in effective listening, non-verbal communication, how to prepare for an interview and group discussion etc.

*Practical work:*

Teacher should assign some project or practical work to the students. This should be in the nature of guided activity, which the students shall have to complete under the direct supervision of the teacher. The students may be given projects on a variety of subjects relating to their discipline i.e. science in general or a specific area of science they are specializing in. Preferably, they should be given minor projects (to be completed within less than two weeks, and length not exceeding 20 pages) in consultation with teachers of science. However, the evaluation of the projects should be done only by the Language Teachers, who must keep all the basic criteria of good writing in mind while doing so.

Note: In case of private candidates and students of School of Open Learning, the marks obtained by them out of 80 will be proportionately increased out of 100).

**Testing Scheme:**

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Q2. It shall consist of two long questions (not exceeding 300-350 words) out of which a student will be expected to attempt only one. This question shall have internal choice, be based upon the prescribed text Varieties of Expression. This shall carry 10 marks.

   Note: The question 1 & 2 should be so designed as to cover all the chapters prescribed, as well as the major issues and problems listed therein.

Q3. It shall consist of an Unseen Passage for Comprehension (not more than 800 words), with minimum six questions at the end. These questions should be designed in such a way that we are able to test a student’s comprehension ability, language/presentation skills and vocabulary etc. This question shall be of 12 marks.

Q4. It shall exclusively be a test of vocabulary, but designed strictly on the lines of various exercises given at the end of each chapter in the prescribed text. The candidate shall be given six words in one column and asked to match them with words/meanings in the next column, This shall carry 6 marks.

Section II (Based upon Unit II)

Q5 (a) The students shall be asked to write a short survey report on a situation, incident, problem of science or the possibility of starting a new scientific venture (in about 150-200 words). The students shall be given an internal choice in this question. This question shall carry 8 marks.

Q5 (b) This question shall be on notices/advertisements of various types (as mentioned in the syllabus). It'll carry 4 marks.

Q6. This question shall test a student’s ability to write letters of various kinds (in nor more than 250 words). Again, there will be internal choice here and the question will be of 8 marks.

Q7 There will test a student’s ability to write a Précis. A passage of about 200 words shall be given and the students shall have to write a précis of about 70 words (including the title). This question shall carry 10 marks.

Q8 This question shall test a student’s understanding of various aspects of communication and modern forms of communication. It shall be divided into two parts:

   (a) Two short questions to be attempted (in not more than 100-120 words each) on different aspects of communication. It’ll carry 6 marks.

   (b) Definitions/format of modern forms of communication to be tested. This shall again carry 4 marks.

Suggested Reading:


Instructions for paper-setter

Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

BC-1101: Introductory Biochemistry Credit: 3+0+0

Objective: To familiarize the students with properties of water, Bio-energetics and various techniques employed in biochemistry.

UNIT-I

Introduction: Scope of Biochemistry and Molecular Biology. Molecular logic of living systems.


UNIT-II


UNIT-III


UNIT-IV

Centrifugation; Electrophoresis; Radio-isotopic techniques, Spectrophotometry.

Books Suggested:
Objective: To learn cell biology and techniques employed in cell biology. Composition of blood and cell membranes. Idea of origin and evolution of life.

UNIT-I

UNIT-II
Structure and Function of cell Organelles: Detailed description of mitochondria, chloroplast, nucleus, smooth and rough endoplasmic reticulum, golgi apparatus, lysosomes, peroxisomes, cytoskeletal elements and extracellular matrix components.

UNIT-III

UNIT-IV

Books Suggested:

BC-1151: Practical
Instructions for paper-setter

Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

BC-1201: Lipids, proteins, nucleic acids and porphyrins. Credits: 3+0+0

Objective: To learn structures and functions of Lipids, proteins, nucleic acids and porphyrins.

UNIT-I


UNIT-II


UNIT-III


UNIT-IV


Books suggested:
BC-1202: Various types of cells. Cell division and cell cycle  
Objective: To learn various types of cells. Cell division and cell cycle

UNIT-I

UNIT-II

UNIT-III
Connective and bone tissue. Adipose and epithelial tissue. Kidney and Liver cells

UNIT-IV
Cell division, cell cycle, Mendeliam laws of inheritance, chromosomal changes, cytogenetics

Books Suggested

BC-1251: Practical  
Credit: 0+1+1
Qualitative tests for amino acids and proteins. Separation of amino acids by paper chromatography. Estimation of protein (Biuret), glucose (Folin-Wu, Anthrone), DNA. RNA. Saponification and Iodine value of fat/oil.
BIOCHEMISTRY (SUBSIDIARY) TWO YEAR COURSE
(For the students of Botany and Anthropology Departments)

B.Sc. (H.S.) 1st Year (1st Semester)

Instructions for paper-setter

Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

BCS-1171: Biomolecules-I Credit: 3+0+0
Objectives: To learn structure and properties of Water, Carbohydrates, Lipids and Nucleic Acids

UNIT-I
Water: Physical properties and hydrogen bonding of water, structure of liquid water, other properties of hydrogen bonding, solvent properties of water, ionization of water, ion product of water: The pH scale, Acids and Bases, Acid-Base indicators, Buffers.

UNIT-II
Carbohydrates: Definition and classification, Families of monosaccharides, Stereoisomerism of monosaccharides, Mutarotation and the anomic forms of D-glucose. Action of acids and bases on monosaccharides. Structure and functions of important derivatives of monosaccharides, disaccharides, polysaccharides (Glycans); storage polysaccharides, structural polysaccharides.

UNIT-III
Lipids: Definition and classification of lipids, fatty acids, triacylglycerols, phosphoglycerides, sphingolipids, waxes, prostaglandins, sterols, liposomes, their structure and functions.

UNIT-IV
Nucleic Acids: General structure of the pyrimidines and purines, nucleosides, nucleotides, nucleic acids, types of nucleic acids, hydrolysis of nucleic acids by acids and bases, enzymatic hydrolysis of nucleic acids, analysis of nucleotide sequence in nucleic acids, Nucleic acids – Protein supramolecular complexes. Structure and role of Cyclic nucleotides.

Books Suggested:

BCS: 1172: Practical: Based On Theory Credit: 0+0+1
B.Sc.(H.S.) 1st year (2nd Semester)

BCS-1271: Biomolecules - II  Credit: 3+0+0
Objectives: To learn structure of Amino Acids and Proteins. Techniques of Protein Purification and Properties of Enzymes

UNIT-I


UNIT-II


UNIT-III

Techniques in Protein Purification: Protein purification; Need for purification, Preliminary purification, precipitation techniques, Adsorption and ion-exchange chromatography, Gel filtration, affinity chromatography, Electrophoresis. Criteria of purity.

UNIT-IV


Books Suggested:

BCS-1272 : Practical  Credit: 0+0+1
Qualitative tests of amino acids and proteins, Paper chromatography of amino acid, Beer-Lambert’s law verification, Estimation of proteins by Biuret method, Preparation of milk casein, Achromatic point of salivary amylase, Alkaline phosphatase activity, Km determination.
B. Sc. (HS) 3rd Semester

BIOCHEMISTRY (MAJOR)

BC-2101: Enzymes 3+0+0

Instructions for paper-setter
Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

Objective: Introduction to enzymes, co-enzymes and mechanism of catalysis.

UNIT –I

UNIT–II
Role of coenzymes (NAD/NADP, FMN/FAD, coenzyme A, biocytin, lipoamide, TPP, pyridoxal phosphate, tetrahydrofolate, cobamide) and metal cofactors in enzyme catalysis.

UNIT–III
Mechanism of catalysis, transition state theory, covalent catalysis, acid-base catalysis, metal ion catalysis, proximity and orientation effects, strain and distortion theory.

UNIT–IV

SUGGESTED BOOKS
Instructions for paper-setter

Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

Objective: Study of major metabolic pathways of carbohydrates.

UNIT-I

UNIT-II
Metabolic pathways for the degradation of carbohydrates: glycolysis, fermentation, tricarboxylic acid cycle, phosphogluconate pathway, glycogenolysis, glucuronate pathway and glyoxylate cycle. Catabolism of fructose and galactose. Regulation of glycolysis, TCA cycle and HMP pathway.

UNIT-III
Major pathways for biosynthesis of carbohydrates: gluconeogenesis and glycogenesis. Biosynthesis of disaccharides, cell wall polymers and mucopolysaccharides. Regulation of glycogen metabolism.

UNIT-IV
Various mechanisms of metabolic regulations. Kinetic factors. Feed back inhibition and feed forward stimulation. Reversible and irreversible covalent modification of regulatory enzymes. Monocyclic cascade systems. Cyclic AMP (cAMP) and Ca$^{2+}$ ions as bioregulators.

SUGGESTED BOOKS
Instructions for paper-setter

*Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.*

**Objective:** Pathways of amino acid, nucleotide and heme catabolism.

**UNIT-I**

**UNIT-II**
Catabolism of carbon skeleton of amino acids. Glucogenic and ketogenic amino acids.

**UNIT-III**

**UNIT-IV**
Metabolism of purines and pyrimidine nucleotides, biosynthesis of deoxyribonucleotides, salvage pathways.

**BOOKS SUGGESTED**
**B.Sc.(HS) 4th Semester**  
**BC-2201: Bioenergetics and Enzyme Kinetics**  
3+0+0

**Instructions for paper-setter**  
*Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.*

**Objective:** To learn principles of thermodynamics & enzyme Kinetics.

**UNIT-I**  
Concepts of bioenergetics, principles of thermodynamics & their application in Biochemistry, concept of free energy, relation between equilibrium constant & standard free energy change, biological standard state and standard free energy change in coupled reactions, biological redox reactions, redox potential, its relation with the free energy change (including derivation & numericals). High energy phosphate compounds: introduction, phosphate group transfer potential.

**UNIT-II**  
Mitochondrial electron transport chain components and biochemical basis for their arrangement. Substrate level and mitochondrial oxidative phosphorylation. Inhibitors and uncouplers of mitochondrial oxidative phosphorylation. Critical evaluation of various hypotheses of mitochondrial oxidative phosphorylation.

**UNIT-III**  

**UNIT-IV**  
Enzyme inhibition. Reversible enzyme inhibition: competitive, non-competitive and uncompetitive enzyme inhibition, change in kinetic parameters by various types of inhibitors. Irreversible inhibition. Specific enzyme inhibitors and their mode of action: suicide inhibitors, side chain specific reagents, affinity reagents.

**SUGGESTED BOOKS**  
Instructions for paper-setter

Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

Objective: To learn pathways of lipid metabolism, electron transport chain and oxidative Phosphorylation.

UNIT-I

UNIT-II
Biosynthesis of saturated and unsaturated fatty acids. their elongation and regulation. Biosynthesis & functions of triglycerides, phospholipids and complex lipids. disorders in metabolism of complex lipids.

UNIT-III
Metabolism of eicosanoids (synthesis, inactivation and biological importance). biosynthesis of cholesterol, cholesterol transport, biosynthesis of bile acids and salts, steroid hormones synthesis of vitamin D from cholesterol, relationship between cholesterol and atherosclerosis.

UNIT-IV
Structure metabolism and functions of lipoproteins. Lipid transport, structure and applications of liposomes. biomedical consequences of lipid metabolism. Integration of metabolic pathways.

SUGGESTED BOOKS
Instructions for paper-setter

Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

Objective: The aim of the courses to provide knowledge of various experimental/Instrumentation techniques in biochemistry

UNIT-I

General Laboratory Techniques: Membrane/Ultra filtration, dialysis, diffusion, surface tension, viscosity and their applications to biological systems. Cell Biology techniques: Microbial, animal and plant cell/tissue culture, cell disruption/homogenization/sonication, cell sorting, cell counting, cryopreservation.

UNIT-II

Absorption spectroscopy: Principle, factors affecting absorption properties. UV-visible spectroscopy infrared spectroscopy.

UNIT-III

Chromatography: General principles, distribution coefficient, Partition chromatography-normal phase and reverse phase liquid chromatography. Modes of chromatography-column, thin layer and paper chromatography. Principles, matrices and applications of gel permeation, adsorption, ion exchange and affinity chromatography. TLC, GLC, HPLC.

UNIT-IV


SUGGESTED BOOKS

3. Fundamentals of analytical chemistry by skoog /west/Holter/Crouch Thompson/Brooks/Cole

BC-2251: Practical 1+1+1
Biochemistry (SUBSIDIARY) 3rd Semester

Botany/Anthropology (2 year course)
BCS-2171: Intermediary Metabolism 3+0+0

Instructions for paper-setter
Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

Objective:

UNIT-I

UNIT-II

UNIT-III

UNIT-IV

SUGGESTED BOOKS

BCS-2152 : Practical 0+0+1
Biochemistry (SUBSIDIARY) 4th Semester
Botany/Anthropology (2 year course)

BCS-2271: Molecular Biology 3+0+0

Instructions for paper-setter

Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

Objective:

UNIT-I

UNIT-II

UNIT-III

UNIT-IV

SUGGESTED BOOKS

BCS-2252: Practical 0+0+1
B.Sc.(HS) Biochemistry (Subsidiary)  3rd Semester
For Microbiology/Biophysics/Zoology (1 year course)

BCS-2174: Biomolecules and their Metabolism    3+0+0

Instructions for paper-setter

Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

Objective: To learn structure and function of various biomolecules, structure, function and their metabolism.

UNIT-I
Water and its properties, ionization of water, pH scale, buffer solutions, Henderson-Hasselbalch equation.
Carbohydrates: definition and classification, monosaccharides and their properties, isomerism in sugars, disaccharides of biological importance, oligosaccharides, storage and structural polysaccharides, mucopolysaccharides. Lipids: definition and classification, fatty acids and their properties, structure and properties of neutral fats, phospholipids and sterols, lipoproteins, fat soluble vitamins, gas liquid chromatography.

UNIT-II

UNIT-III
Introduction to metabolism, methods to study metabolism, bioenergetics, ATP-ADP cycle, electron transport chain and oxidative phosphorylation. Digestion and absorption of carbohydrates, glycolysis and alcoholic fermentation, gluconeogenesis, TCA cycle and glyoxylate pathway, glycogenolysis and glycogenesis, glycogen storage diseases, HMP pathway and its significance, metabolism of galactose and fructose, regulation of carbohydrate metabolism. Diabetes mellitus.

UNIT-IV

SUGGESTED BOOKS

**Instructions for paper-setter**

*Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.*

**Objective:** To learn elementary enzyme kinetics, Nature of genetic material and its expression.

**Unit-I**


**Unit-II**


**UNIT-III**


**UNIT-IV**

Regulation of gene expression (*lac* operon & *trp* operon). Recombinant DNA technology. Molecular components of membranes, models of membranes, membrane transport.

**SUGGESTED BOOKS**


BCS-2253: Practical 0+0+1
Semester V

Instructions for paper-setter

Question paper will have four sections. Examiner will set a total of nine questions comprising two questions from each unit, and one compulsory question of short answer type covering the whole syllabus. Students will attempt one question from each unit and the compulsory question. All questions will carry equal marks.

BC-3101: FUNDAMENTALS OF MOLECULAR BIOLOGY-1

Objective: Introduction to nature of genetic material, replication and transcription.

Unit-I
The History and Birth of Molecular Biology. Systems and analytical Approaches to Molecular Biology.

Unit-II

Unit-III

Unit-IV

Suggested Books

Objective: To study fundamental processes of life in plants, plant lipids and phytohormones.

Unit I

Unit II

Unit III

Unit IV
Signals regulating the growth and development of plant organs: phytohormones - auxins, gibberellins, cytokines, abscisic acid and ethylene. Steroid and peptide hormones in plants. Phytochromes, G-proteins and signal transduction chains in plants.

Suggested Books

BC-3103: ENDOCRINOLOGY

Objective: Introduction to hormones, their mechanism of action and role in physiology and pathophysiology.

Unit I
Functional organization and general characteristics of endocrine system, target gland concept, Negative and positive feedback control, Assay and measurement of hormones.

Unit II
Mechanism of hormone action: role of receptors, cyclic AMP, cyclic GMP, phosphoinositides, calcium, diacylglycerol and nitric oxide.
Unit III
Structure, biosynthesis and release of hormones, biochemical and physiological role, and pathophysiology of the following endocrine systems: Hypothalamus; Pituitary; Thyroid; Parathyroid, Calcitonin acid Vitamin D3; Adrenals; Pancreas; Gonads; G.I.T. tract; Heart (Endothelins).

Unit IV
Growth factors: Chemistry, Biological functions and mechanism of action of Epidermal growth factor; Hemopioetic cell growth factor; Fibroblast growth factor and Interleukins; Insulin like-growth factors, Nerve growth factors.

Suggested Books


BC-3104: Immunology –I

Objective: To understand general aspects of immune system like different components of the immune system, Generation and functions of these components, Knowledge of some techniques.

Unit-I
Historical background, overview of the immune system; Structures and functions of cells, tissues and organs of immune system: Innate and adaptive immunity, inflammation; Toll/NOD/RIG like receptors; cytokines and chemokines.

Unit-II
Antigens, hapten, epitopes; Antibody structure, function and properties, generation of diversity. Antigen-antibody interactions as tools for research: precipitation and agglutination reactions, immunodiffusion, immunoelectrophoresis, immunoassays.

Unit-III
Major Histocompatibility Complex: organization, structure of genes and proteins, polymorphism, antigen processing. T cell receptor: organization of genes and proteins, generation of diversity. Complement system- types, biological consequences of activation and deficiencies.

Unit-IV
Development, activation and differentiation of T and B cells
Cell mediated effector responses (T, NK, macrophage, etc.), regulation of immune responses, Evolution of the immune system

Suggested Books

**BC-3105: NUTRITIONAL BIOCHEMISTRY: BASIC CONCEPTS**

**Objective:** To provide comprehensive knowledge of different types of dietary components, their nutritional importance and biochemistry.

**Unit I**
Energy metabolism, Physiological forms of energy, Caloric value & energy content of various foods.
Measurement of energy expenditure: Direct and indirect Calorimetry. Respiratory quotient (RQ), Protein and non-protein RQ and its calculations.
Basal metabolic rate (BMR): Factors affecting BMR, calculation of BMR.
Specific dynamic of food, Energy requirement in various physiological and pathological conditions. Thermogenesis and the effect in various physiological process.

**Unit II**
Proteins:- Sources and chemical nature, Digestibility of proteins, protein as a source of energy, protein reserves.

**Unit III**
Carbohydrates: Dietary sources of carbohydrates, disposal of available carbohydrates. Dietary fibres, various types of dietary fibres, chemistry of fibres, physical properties, dietary source, physiological action. Role of Dietary Fibres in preventing cancer, diabetes, coronary heart disease. Possible adverse effects.

**Unit IV**
Fats:- Chemical composition and distribution. Essential fatty acids. Role of n-3 acids in various diseases; composition, dietary lipids and lipoproteins, n-3 PUFA and plasma lipids. Effects of n-3 PUFA on lipoproteins, thromboxane, prostaglandins and leukotrienes.
Vitamins: Sources, functions, and deficiency diseases of Vitamins A, D, E, K and vitamin B complex. Functions of choline, carnitine, inositol and taurine, carotenoids, glutamine and arginine.

**Suggested Books**

**Objective:** The aim of the courses to provide in depth knowledge of various experimental/Instrumentation techniques in biochemistry

**Unit I**
General Laboratory Techniques: Membrane/Ultra filtration, dialysis, diffusion, surface tension, viscosity and their applications to biological systems.
Cell Biology techniques: Microbial, animal and plant cell/tissue culture, cell disruption/homogenization/sonication, cell sorting, cell counting, cryopreservation.

**Unit-II**

**Unit III**
Radioisotopic techniques: Isotopes and nature of radioactivity, radioactivity units, types of radioactive decay, rate of radioactive decay, half-life, specific activity. Detection and measurement of radioactivity, counters, autoradiography, radiodating. Applications of radioactivity in biological sciences, safety aspects.

**Unit-IV**
Chromatography: General principles, distribution coefficient, Partition chromatography-normal phase and reverse phase liquid chromatography. Modes of chromatography-column, thin layer and paper chromatography. Principles, matrices and applications of gel permeation, adsorption, ion exchange and affinity chromatography. TLC, GLC,HPLC.

**Suggested Books**


**BC-3107: Practical-I**

**BC-3108: Practical-II**

**Semester VI**

**BC-3201: FUNDAMENTALS OF MOLECULAR BIOLOGY-II**
Objective: to familiarize the students with nature and discovery of Genetic code, protein biosynthesis and targeting, regulation of gene expression and gene cloning.

Unit-I


Unit-II

Regulation of Gene Expression in Prokaryotes: Control at initiation of transcription. Lac Operon (Genetical and Biochemical aspects.), trp and his Operons. Regulation of genes for ribosomes and bacterial viruses(Lytic and Lysogenic modes). Interactions between DNA and Proteins (Helix-turn-helix and β-Sheet Motifs). Locating the position of DNA binding sights in the genome. Co-crystal studies. Role of small molecules and RNA in gene control.

Unit-III


Unit-IV


Suggested Books


BC-3202: PLANT BIOCHEMISTRY-II

Objective: To study plant phenolics, plant cell wall and molecular biology of plants.

Unit I

Plant phenolics: General phenyl-propanoid metabolism. Introduction to alkaloids, lignins, flavonoids, tannins and quinones. Biosynthesis of some important alkaloids, lignins and flavonoids.

**Unit II**

Genome organization, protein synthesis and processing in plants: organization of nuclear genome, plastid genome and mitochondrial genome. Synthesis of nuclear encoded proteins; chloroplast and mitochondrial protein synthesis. Protein sorting.

**Unit III**


**Unit IV**

Applications of plant genetic engineering: Developing insect resistant, virus resistant, herbicide resistant plant strains by genetic engineering. Use of genetic engineering for improvement of yield and quality of crops, protection against environmental stress and to produce raw material for industry and pharmaceuticals. Genetic manipulation of flower pigmentation.

**Suggested Books**


**BC-3203: NEUROBIOLOGY**

**Objective:** Introduction to nervous system, biochemistry and molecular biology of neurological functions and dysfunctions

**Unit I**


**Unit II**

Synaptic transmission: Electrical and Chemical transmission, Electrical properties of neural membranes, Resting Potential and Action Potential: Origin and measurement of resting potential; Voltage clamp analyses, Patch-clamp analyses, generation and propagation of the action potential. Neurotransmitters and Neuromodulators: Types of neurotransmitters, synthesis, storage and release of neurotransmitters, neurotransmitter receptors, postsynaptic signaling, synaptic modulation and
mechanism of neural integration. Acetylcholine, glutamic acid, aspartic acid, glycine, GABA, Serotonin, Biogenic amines, Neuroactive peptides (Substance P and opioids).

**Unit III**
G-coupled Receptors: Messengers and receptors, B-adrenergic receptor (B-AR), muscarinic acetylcholine receptor (MACHR), substance K. receptor (SKR), rhodopsin, cone opsins. Ligand-gated channels: The nicotinic acetylcholine receptor, GABA receptor, Glycine receptor; receptors for excitatory amino acids (EAAs). Voltage gated channels: Potassium Channels (Delayed & Fast K+ channels, serotonin-dependent K+ Channel, Ca-dependent K+ channels, Potassium ‘leak’ Channels). Sodium Channels, Calcium Channels.

**Unit IV**
Sensory system: Taste, smell, hearing and vision. Learning & Memory: Types of Memory, Amnesia, correlation of behavioral and biochemical events, measurement of learning and memory, molecular basis of learning and memory. Neurodegenerative disorders: Amyotrophic lateral sclerosis (ALS), Alzheimer’s disease (AD); Huntington’s disease, Parkinson’s Disease (PD) and Multiple sclerosis

**Suggested Books:**
1. Smith CUM. Elements of molecular neurobiology. (3rd Ed.) John Wiley & Son’s, New York; 2003

**BC-3204: IMMUNOLOGY –II**

**Objective:** This course will provide information on mechanisms and regulation of immune mediators providing a background on various clinical immunology topics.

**Unit-I**
Dynamics of immune response; Immune response to various infectious agents - virus, bacteria, fungi, protozoa, worms; associated diagnostics, prevention and therapeutics.

**Unit-II**
Immunological tolerance, autoimmunity and related disorders, transplantation immunology, immunodeficiency – associated disorders

**Unit-III**
Tumor immunology, Hypersensitive reactions, Immunological memory

**Unit-IV**
Hybridoma technology, abzymes, Magnet/ Fluorescence Activated Cell Sorting and analysis, Experimental Animal models, Cloning of cells, evaluation of cell proliferation, apoptosis. Vaccine-types, merits and demerits, development.

**Suggested Books**

BC-3205: NUTRITIONAL BIOCHEMISTRY: APPLIED ASPECTS

Objective: To provide comprehensive knowledge of important nutritional components and their importance.

Unit I
Calcium:- Various forms of calcium present in food. physiological role of calcium in skeleton and non skeleton tissues. Calcium intake, absorption, role of calcium in lactation and pregnancy and in various other diseases. Hypocalcemia and hypercalcemia.
Copper:-Distribution in body. Cu deficiency, toxicity and treatment.
Physiological role of Iodine, Chlorine, Cobalt, Phosphorus, Manganese, Molybdenum.

Unit II

Unit III
Food Toxins: Types of toxins present in food. Lathyrus poisons, seawater fish, scombrototoxic poisoning; mussel poisoning. Argemone contamination, Ackee fruits, cycads, spices, oestrogens, carcinogens antivitamins hallucinogenic substance, toxins of fungal origin, pesticides and weed killers, antibiotics, hormones, fungicides, industrial wastes, chemical adulteration, radioactive fall out.

Unit IV
Food Additives:- Various types of additives, their chemical composition and physiological effects. Infective agents in food like bacteria, virus etc. Oxidative stress and oxidant defense Food processing: Nutrition, safety and quality balances.

Suggested Books:
2. Davidson S, Passmore R. Human nutrition and dietetics. Human nutrition and dietetics. (8th Ed.) Longman Group Ltd., Hong Kong; 1986

BC-3206: TECHNIQUES IN BIOCHEMISTRY-II

Objective: The aim of the course is to provide fundamental knowledge of various experimental/Instrumentation techniques in the applied biochemistry, molecular biology, Omics and system biology.
Unit I
Electrophoresis: General principle, support media, types of electrophoresis.
Electrophoresis of nucleic acid: Agarose-gel electrophoresis of DNA and RNA, pulsed-field gel electrophoresis, northern and southern transfer procedure.

Unit-II
Absorption spectroscopy: Principle, factors affecting absorption properties. UV-visible spectroscopy infrared spectroscopy.

Fluorescence spectroscopy: Principle, applications, Fluorescence activated cell sorting (FACS), fluorescence in situ hybridization (FISH), fluorescence immunoassay.

Unit III
Optical rotatory dispersion and Circular dichroism: Theory, techniques for measuring ORD and CD. Interpretation of curves, Applications.
Nuclear magnetic resonance (NMR) and Electron spin resonance (ESR): Theory, applications.

Unit IV
Atomic spectrometry, mass-spectrometry: Matrix assisted laser desorption ionization (MALDI).

Suggested Books

BC-3207: Practical-I

BC-3208: Practical-II
### M.Sc. (Hons School) Biochemistry 1st to 4th semester

#### M.Sc 1st Semester

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<td>BC-502</td>
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<td>BC-503</td>
<td>Biochemical Toxicology</td>
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**BC-501: APPLICATION OF BIOCHEMISTRY TO BIOTECHNOLOGY**

**Credits:** 4+0+0

**Objectives:** Learning of modern molecular techniques employed in Biotechnology

**Unit-I**

Micromethods in Protein Chemistry: Analytical Electrophoretic techniques of peptides and protein separation. Isolation of peptides for Sequence analysis. Peptide mapping, chemical and enzymatic hydrolysis of proteins, controlled and total hydrolysis, Western blot technique, Radioactive and nonradioactive procedures for the detection of protein blots, extraction and fractionation of RNA and DNA, Gel Electrophoresis of Nucleic acids. Pulse Field Electrophoresis of DNA, Isolation of plasmids, plasmid derived cloning Vectors, and genome library. Ti plasmid as tool for genetic engineering in plants, N-labelling Random labeling of nucleic acid probes, Nick translation,

**Unit-II**

Chromosomal walking, Hybridization and blotting techniques. DNA microarray chip technology, dot blot, Slot blot, Northern and Southern blot, South-Western blot analysis, use of restriction enzymes and T4 DNA ligase in molecular cloning, cDNA synthesis. Bacterial transformation screening of transformants, use of Minicells and Maxicells to detect the expression of DNA. Auto-radiography and fluorography, finger printing and related techniques to study DNA protein interactions. *In vitro* translation, biotin-avidin system applications in detection of bio-molecules. Enzymes involved in recombinant DNA technology.

**Unit-III**

Polymerase Chain Reaction (PCR), Basic principle, method, enzymes used, PCR thermo-cyler, Amplification of specific DNA fragments: Applications in medicine and forensic sciences. DNA based diagnosis of genetic disorders. Recombinant DNA technology in medicine and industry, *In situ* Hybridization with cDNA and with oligonucleotide probe. Generation of transgenic animals and plants, knockout animals.

**Unit-IV**

Monoclonal Antibodies and Vaccines: Definition and nature of monoclonal antibodies (MCA); Antigen preparation for MCA production; Methodology producing MCA; Immunization and generation of immune response; selection of animal-strain and immunization schedule. Myeloma cells for hybridization; cell fusion and selection of hybrids using HAT medium. Cloning and isolation of hybrid cell lines. Screening of specific MCA; Purificatin and labeling of MCA, uses and applications of MCA. T-cell hybridomas and their applications. Vaccines (subunit, live recombinant, attenuated and DNA Vaccines).

**Book Suggested:**

2. L.Davis et al, Basic Methods in Molecular Biology. Appleton & Lange
   Biochemical research Techniques McMilan Publishing Company, John Wiley & Sons
4. Winfried Hartmeier, Immobilized Biocatalysts, Spring-Verlager, Berlin,Germany
Objective: Learning of various diagnostic tests employed in clinical biochemistry

Unit-I

Diagnostic Enzymology-enzyme assay in serum/plasma, urine and cells. Clinically important enzymes, use of isoenzymes in diagnosis.
Function tests: Hepatic: Tests based upon the metabolism of carbohydrates, lipids, protein and detoxification. Differential diagnosis of jaundice
Renal: GFR and its clinical importance, clearance tests (urea and creatinine)
Intestinal: Malabsorption of fats, carbohydrates and proteins.
Pancreas: amylase, lipase and trypsin assays in serum

Unit-II

Disorders of Metabolism:
Carbohydrates- Glycogen Storage diseases, galactosemia
Amino Acids- Disorders of glycine, sulfur containing amino acids, aromatic amino acids, histidine, branched chain amino acids and proline, disorders of propionate and methylmalonate metabolism. Disorders in urea biosynthesis.

Unit-III

Lipids: Hyperlipoproteinemia, Hyperlipidemia, Tay-Sachs Disease (Gangliosidosis), Neimann Pick Disease, Gaucher’s Disease, Krab’s Disease, Metachromatic leukodystrophy and Fabry’s Disease, Wolman’s Disease.
Disorders of porphyrin and heme metabolism

Unit-IV

Myocardial infarction and atherosclerosis
Quality control in Clinical Biochemistry
Water & Electrolyte Balance, Acid-Base Balance

Books Suggested:

BC: 503: BIOCHEMICAL TOXICOLOGY  

Credits= 4+0+0  

Objectives: Toxins: metabolism and toxicity  

Unit-I  
Definition, scope and relationship of Toxicology to other sciences. Nature of toxic effects. Acute and chronic exposure.  
Dose: response relationship, Determination of LD-50, no observed effect level (NOEL), acceptable daily intake, bioavailability, volume of distribution, plasma half life, total body burden, total body clearane. Synergism and Antagonism  

Unit-II  

Unit-III  
Toxicity Testing- Decision-tree protocol, Ames test, Host mediated assay and dominant lethal test, Drosophillia sex linked recessive lethal test, micronucleus test.  

Unit-IV  
Toxicity of Pesticides-Classes of pesticides: Organochlorine, Organophosphates and carbamates. DDT: Metabolism, toxicity, persistence and bioaccumulation. Organophosphate-Metabolism and mechanism of insecticidal action.  
Metal Toxicity-Toxicity of Lead and its effect on heme synthesis. Toxicology of various forms of mercury.  
Drug Toxicity-Paracetamol, Metabolism and its Toxic effects.  

Books Recommended:  
1. Frenhe. LY, Lu’s Basic toxicology 4th Ed. (2002),  
2. A.Wallace Hayes, Principle & Methods of Toxicology 5th Ed. (2008)  
4. Curtis D. Klassen, Casarett & Poul’s Toxicology, the Basic science of Pusion 7th Ed.
Objectives: Introduction to Cell Cycle, Apoptosis and cell proliferation, signal molecules and Stem cells.

Unit-I

Cell Cycle: Cell cycle control system, cell cycle events in S. pombe, S. cerevisae, and mammalian system, M phase kinase, protein phosphorylation and dephosphorylation, p34 as key regulator in yeast, CDC 28, Cdk-cyclin complexes, function of Cdc2-cyclin and Cdk-cyclin dimers. Cdk inhibitors, reorganization of the cell at mitosis.

Unit-II

Apoptosis and cell proliferation: Extrinsic and intrinsic pathways of apoptosis, techniques to analyze apoptosis, molecular basis of cancer, multistep carcinogenesis, signal transduction and cancer, tumor suppressor genes and protooncogenes and oncogenes, tumor causing viruses, DNA viral genes, Retroviral-associated oncogenes in growth regulation, strategies for cancer prevention and cure.

Unit-III

Signaling molecule and cell surface receptors: Intracellular signal transduction, second messengers, protein functioning as signal transducers, localization of receptors and signal transducers, G-protein coupled receptors and downstream signaling, TGF receptors and activation of SMADS, cytokine receptors and JAK-STAT signaling, receptor tyrosine kinases and activation of Ras, Raf, MAP kinase signaling, phosphoinositide as signal transducer, pathways that involve signal induced protein cleavage (NF-KB and NOTCH), Hedge hog and wnt signaling pathways (classical and nonclassical) down regulation of receptor signaling.

Unit-IV

Specialized tissues and stem cells: Renewal of epidermis, sensory epithelia, airways and the gut, blood vessels, multipotent stem cells, connective tissue cell family, stem cell engineering

Books Recommended:

M.Sc. Biochemistry 2nd semester

BC: 505: Advanced Enzymology  
Credit= 4+0+0

Objectives: Kinetics of Multi substrate reactions, measurement of rate constants, study of active site and enzyme turn over

Unit-I

Enzyme diversity: concept of convergent and divergent evolution of enzymes, Kinetics of multi substrate enzyme catalyzed reactions: classification, kinetics of multisubstrate reactions, derivation of rate of expression for Ordered, ping-pong and Bi-Bi reaction mechanisms, investigation of reaction mechanism by using initial velocity, inhibition and isotope exchange studies.

Unit-II

Methods of measuring enzymatic rate constants and their magnitude: Rapid mixing and sampling techniques, relaxation methods, Absolute concentration of enzymes, Sigmoidal Kinetics: Cooperativity phenomenon for protein ligand binding, symmetric & sequential models for action of allosteric enzymes and their significance, Hill and Scatchard plots.

Unit-III

Identification of active site of enzymes: By trapping of enzyme-substrate complex, use of substrate analogues, enzyme modification by chemical procedures affecting amino acid side chains, treatment with proteases and site-directed mutagenesis, by studying the effect of changing pH. A brief account of investigation of three dimensional structure of active site, Structures & mechanisms of selected enzymes: Dehydrogenases, proteases, ribonuclease and lysozyme.

Unit-IV

Enzyme turnover: Kinetics of turnover, methods for measuring rates of enzymes turnover, Correlation between rates of turnover and the structure and functions of enzymes, Mechanism of enzyme degradation, significance of enzyme turnover.

Books Recommended:

BC-506: Medicinal Biochemistry

Objectives: Drug targets, drug discovery and development, antibiotic and herbal drugs

Unit-I

Introduction: Biochemistry in Health & Disease.
Molecular targets of drugs: Enzymes as targets: Medicinal uses of enzyme inhibitors, some examples of drug action at carrier and structural proteins.
Receptors as targets: Families of Receptors, Agonists/Antagonists and their design.
Nucleic acids and nucleic acid building blocks as targets.

Unit-II

Drug Discovery and drug development: Identifying drug targets, finding and developing a lead compound, Metabolism of Drugs, Designing Drugs to resist metabolism, Designing pro-drugs, Quantitative Structure-Activity Relationships (QSAR), A Rational Approach to Drug Design.

Unit-III

Antibacterial Agent: β-Lactam Antibiotics: Inhibitors of bacterial cell wall synthesis, Bacterial Agents which interfere with protein synthesis, Bacterial Agents which act on Nucleic Acid Transcription. Drug Resistance, Acting at nervous system: Cholinergics, Anticholinergics and Anticholinesterases

Unit-IV

Biochemistry of Herbal drugs: Risk/Benefits of Dietary supplements, Additives and Nutraceuticals, Ethanol – Drug Interactions

Books Suggested:

2. Lewke, T.L. Williams, D.A.; Roche, V.F. and Zito, S.W.Foyer’s, Principle of Medicinal Chemistry 6th Ed. Wallers Kluwer
3. Thomas, Medicinal Chemistry, latest Ed. Prentice Hall
5. King, F.D., Medicinal Chemistry principle and practical, Royal Society of Chemists

BC-507: Industrial Biochemistry

Objectives: Development of industrial fermentation, principles of fermentation process, enzyme biotechnology and biotreatment of effluents

Unit-I

Introduction: Definition and scope of Industrial Biochemistry, Biochemical Basis and Development of Industrial Fermentation process: screening and selection of the organisms for the
production of biologically important compounds, Strain improvements, Detection and production of fermentation products, Fermentation media, Scale up of fermentations, Biological reactors, Continuous and batch type reactors.

**Unit-II**

Biochemical principles of typical fermentation processes:
Amino Acid: Glutamic Acid, Lysine, Tryptophan,
Vitamins: B₁₂, Riboflavin, β-Carotene, Tocopherol
Industrial Products: Ethanol, Acetone, Glycerol
Organic Acids: Citric Acid, Gluconic Acid
Antibiotics: Beta lactam antibiotics, amino acid and peptide antibiotics, carbohydrate antibiotics, tetracyclines and anthracyclines, Nucleoside antibiotics, Aromatic antibiotics etc.

**Unit-III**

Enzyme biotechnology: Isolation, production and immobilization of enzyme and cells in biochemical reactions, support for immobilization, biofilms and biosensor development, Feature of enzymes in relation to biotechnology, Enzyme sources, release of enzymes from cells, Enzyme isolation and purification. Applications of biological catalysts, Immobilization techniques-enzymes adsorption, covalent coupling to a carrier surface, cross-linking and copolymerization, entrapment in matrix, Encapsulation, Conformational changes and stability, Steric restrictions and inactivation of enzymes molecules, Biotransformation by microbes, industrial and therapeutic uses of immobilized enzymes and their applications in agriculture, Food, Dairy, Textile, leather industry and in medicine.

**Unit-IV**

Biotreatment of Industrial effluents: Lipid technology: Natural resources of biologically important lipids, extraction, fractionation, esterification, and refining process, food emulsion and their storage, hydrogenation, Non-food uses of lipids.

**Books Suggested:**

1. Doble Mukesh and Kumar Anil, Biotreatment of industrial effluents
4. Rainbow C. and Rose A.H., A.P., Biochemistry of Industrial micro-organisms
5. P. F. Stanbury, A. Whitaker and S. Hall, Principles of Fermentation Technology

**BC-508: Molecular & Cellular Immunology**

**Credits= 4+0+0**

**Objectives:** This course will provide an insight of the immune response in relation to different disease etiologies, focussing on clinically applied and modern immunological concepts
Unit-I
Lymphocyte homing, migration and homeostasis in specific tissues- mucosal, renal, immune privilege sites, materno- fetal interface, dynamics; Immune senescence.
Variable lymphocyte receptors, Antigen receptor diversity, Chemokine receptors.

Unit-II
Host pathogen interaction, invasion & evasion strategies, pathogen selective autophagy.
Microbial infections: Bacterial (intracellular/ extracellular), Viral and Parasitic- pathogenesis, clinical manifestation, diagnosis.

Unit-III
Immune functions of cells, cytokines, chemokines, metalloproteinases, and prostaglandins with respect to Central Nervous System, leukocyte trafficking (blood brain barrier, etc); development, plasticity and pathology of tumors, viral/ bacterial/ parasitic infections in Brain.
Glycosylation- in health and disease, glycomics- identification of potential markers, therapeutics, vaccine strategies for diverse pathogens, cancer, etc.

Unit-IV
Epigenetics, genetics and micro RNA in immune responses.
Immune system engineering, Regenerative medicine, Human Hemato-Lymphoid System Mice

Books Suggested:
M.Sc. Biochemistry 3rd semester

BC-601 Genomics and Bioinformatics

Objectives: Introduction to genomics and bioinformatics

Unit-I

History of Genome sequencing project, The human Genome project- The human genome sequence annotation – Repeats, coding regions, non-coding regions. Genome Sequencing strategies: Hierarchical and Whole genome Sequencing strategies.

Unit-II
Nucleotide and Protein databases: Primary, secondary and composite database (genbank, EMBL, DDBJ, Uniprot, Swissprot, PIR, PDB, Genpepts). NCBI, EBI, DDBJ. nucleotide sequence flat files. Sequence formats: Genbank, FASTA, ASN.

Introduction to metabolic pathway databases on the web-KEGG, EcoCyc, Metacyc. Enzyme databases- BRENDA, LIGAND database.

Molecule visualization softwares: RasMol, Pymol, Cn3D, VMD etc.

Information retrieval from biological databases- NCBI resource, Entrez, Pubmed, Medline

Unit-III
Introduction to sequence alignment: Pairwise Sequence Alignment, Global alignment and Local alignment, general, gap and affine penalty. DotPlot, Scoring functions, Substitution Matrices- PAM and BLOSUM matrices.

Heuristic algorithms, Word methods or k-tuple methods, Dynamic Programming- implementation of the Needleman and Wunsch algorithm and Smith Waterman Algorithm for pairwise alignment and testing alignment score

Unit-IV
Multiple Sequence Alignment- consensus sequence, motifs and profiles. SP (Sum of Pairs) measure, Position specific scoring matrices, Hidden Markov Model, Clustal W, Clustal X

Blasta and Fasta, Blastp, Blastx, tBlastx, Blastn, PSI-BLAST

Significance of alignment: Scores, E value, p value

Comparative Genomics, Methods for predicting protein structure (secondary and tertiary)

Suggested Books:

BC-602 Computational Techniques & Biostatistics

Objectives: To introduce the basic concept of the C programming language and Biostatistics.

Unit-I

Overview of C: Brief history of C, general structure of a C program, stages in the development of a C program, Basic building blocks of C Language.

Data Types, Operators & Expressions: Constants and variables, data types, declaring variables, storage classes, different types of expressions and their evaluation, conditional expression, assignment statement, enumerated data type, type casting.

Console Input/Output: Standard input/output devices, unformatted input/output functions (character I/O functions and string I/O functions), formatted input/output functions (scanf() function and printf() function).

Unit-II

Control Statements: Decision making using if, if-else, elseif and switch statements, Looping using for, while and do-while statements, transferring program control using break and continue statements, programming examples to illustrate the use of these control statements.


Functions: Defining a function, local variables, return statement, invoking a function, specifying and passing arguments to a function, function prototyping, pointer to a function, recursion.

Unit-III

Arrays & Strings: Introduction to arrays, declaring arrays, initializing arrays, processing of arrays, pointers & Arrays, introduction to strings, programming examples to illustrate the use of arrays and strings. Discussion on arrays is to be limited up to 2-D arrays only.

Structures & Unions: Introduction to structures, declaring structures, initializing structures, accessing elements of structures, pointers to structures, passing structures as arguments to a function, introduction to unions.

Data Files: Introduction to data files, different ways of file processing (standard I/O & system I/O), description of various library functions for file handling, updating files, programming examples to illustrate the processing of files.

Unit-IV

Biostatistics: Expression and critical evaluation, interpretation and presentation of data, Statistical methods for analysis of data- Probability, Mean, median, frequency, t-test (paired and unpaired), ANOVA and correlations, statistical software

Books recommended:

M.Sc. Biochemistry 4th semester

BC-607 Current Topics in Biochemistry

Objectives: To introduce students to latest development in the field of Biochemistry

Note: Lectures and seminars on specialized topics in the areas indicated below. Topics would be announced at the beginning of the semester and each unit. There would be 7-8 lectures on each unit.

Unit-I

Recent developments in Biochemistry and Molecular Biology

Unit-II

Recent advances in understanding of molecular basis of disease

Unit-III

Recent Developments in Cell Signaling

Unit-IV

Recent Developments in applied aspects of biochemistry

Books Recommended:

1. Annual Reviews in Biochemistry
2. Journals in Biochemistry
3. Monographs on the suggested topics