FACULTY OF SCIENCE

SYLLABI

FOR

B.Sc.(HONOUR SCHOOL) BIOCHEMISTRY

1ST TO 6TH SEMESTER

EXAMINATIONS 2014 - 2015

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Outlines of tests, syllabi and courses of reading for B.Sc. (Honours School) in Biochemistry, 1st year for the session 2014-2015

Courses for B.Sc. (HS) 1st year (Major)

1st Semester

<table>
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<tr>
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2nd Semester

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<td>Biochemical Techniques-I</td>
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Courses for B.Sc. (HS) 1st year (Subsidiary)
(For the students of Botany and Anthropology Department)

1st Semester

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<tr>
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2nd Semester

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IMPORTANT NOTE

The Environment & Road Safety Education is a compulsory qualifying paper, which the students have to study in the B.Sc. 1st year (2nd Semester). If the student/s failed to qualify the paper during the 2nd Semester, he/she/they be allowed to appear/qualify the same in the 4th or 6th Semester/s.
UNIT I (ENVIRONMENT)

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

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, vermiculture and 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.

**Examination Pattern:**
A qualifying paper of 50 marks comprising of fifty multiple choice questions (with one correct and three incorrect alternatives and no deduction for wrong answer or unattempted question), and of 1 hour duration.

The students have to obtain 33% marks to qualify the paper. The marks are not added/included in the final mark sheet.

**UNIT II (ROAD SAFETY)**

1. Concept and Significance of Road Safety.
2. Role of Traffic Police in Road Safety.
3. Traffic Engineering – Concept & Significance.
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.

**Note:** Examination Pattern:
- The Environment and Road Safety paper is 70 marks.
- Seventy multiple choice questions (with one correct and three incorrect alternatives and no deduction for wrong or un-attempted questions).
- The paper shall have two units: **Unit I (Environment) and Unit II (Road Safety).**
- Unit II shall comprise of 20 questions with minimum of 1 question from each topics 1 to 10.
- The entire syllabus of Unit II is to be covered in 10 hours.
- All the questions are to be attempted.
- Qualifying Marks 33 per cent i.e. 23 marks out of 70.
• Duration of examination: 90 minutes.
• The paper setter is 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.chandigarhpolice.nic.in](http://www.chandigarhpolice.nic.in)

(b) [www.punjabpolice.gov.in](http://www.punjabpolice.gov.in)

(c) [www.haryanapolice.gov.in](http://www.haryanapolice.gov.in)

(d) [www.hppolice.nic.in](http://www.hppolice.nic.in)
Syllabus and Courses of Reading for B.Sc. (Hons. School) (courses where English is taught as a subsidiary subject) for the session 2014-2015.

**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 (not 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.

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/advertise ments 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 not 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:
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.
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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 (not 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.

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*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.

(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 not 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:


BC-1101: BIOMOLECULES -I Credit: 3+0+0

Objective: To familiarize the students with properties of water, structure & function of carbohydrates and lipids.

UNIT-I

UNIT-II

UNIT-III

UNIT-IV

Books Suggested:
BC-1102: Cell Biology

Objective: To get an idea of origin and evolution of life. Knowledge about various types of cells & tissues.

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. Cell fractionation, marker enzymes

UNIT-III

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

Books Suggested:


BC-1151: Practical

Instruction 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: BIOMOLECULES-II

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

UNIT-I

UNIT-II

UNIT-III

UNIT-IV

Books Suggested:

BC-1202: Biochemical Techniques-I Credit: 3+0+0

Objective: To learn various biochemical techniques

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

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. TLC, Column chromatography, Electrophoresis
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
Objective: 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 anemic 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

**Objective:** 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.
### Courses for B.Sc.(H.S.) 2nd year (Semester System) (Major/Subsidiary)

#### MAJOR (BIOCHEMISTRY)

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<td>1. BC-2101: Enzymes</td>
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<td>2. BC-2102: Carbohydrate Metabolism</td>
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<tr>
<td>3. BC-2103: Metabolism of Nitrogenous Compounds</td>
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<td>4. BC-2151: Practical</td>
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<td>1. BC-2201: Bioenergetics &amp; Enzymes Kinetics</td>
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<td>2. BC-2202: Lipid Metabolism</td>
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<td>3. BC-2203: Membrane Biochemistry</td>
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<td>4. BC-2251: Practical</td>
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#### Biochemistry (SUBSIDIARY)

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<td>Botany/Anthropology (2 years Course)</td>
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<tr>
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<td>2. BCS-2173: Practical</td>
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<td>Botany/Anthropology (2 years Course)</td>
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<tr>
<td>1. BCS-2271: Molecular Biology</td>
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</tr>
<tr>
<td>2. BCS-2273: Practical</td>
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<td>Microbiology/Bio-Physics/Zoology (1 year Course)</td>
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<tr>
<td>1. BCS-2174: Biomolecules and their metabolism</td>
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<tr>
<td>2. BCS-2176: Practical</td>
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<th>4th Semester</th>
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<tr>
<td>Microbiology/Bio-Physics/Zoology (1 year Course)</td>
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<tr>
<td>1. BCS-2274: Enzymology and molecular biology</td>
<td>75</td>
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<td>2. BCS-2276: Practical</td>
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</table>
BIOCHEMISTRY (MAJOR)

B.Sc.(HS) 3rd Semester

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
Introduction to enzymes, nomenclature & classification of enzymes. Properties: nature of active site, units of enzyme activity, turnover number, apoenzyme-cofactor association, isozymes, zymogens.

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

Books Suggested

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 understand the catabolism & anabolism of carbohydrates, regulation & malfunction.

UNIT-I

UNIT-II
Metabolic pathways for the degradation of carbohydrates: Tricarboxylic acid cycle (amphibolic nature, anaplerotic reactions, inhibitors), phosphogluconate pathway, glycogenolysis, gluconate pathway and glyoxylate cycle. Regulation of glycolysis, TCA cycle and HMP pathway – metabolic and hormonal.

UNIT-III
Major pathways for biosynthesis of carbohydrates: gluconeogenesis and glycogenesis, regulation of glycogen metabolism, glycogen storage diseases. Biosynthesis of disaccharides, cell wall polymers and mucopolysaccharides, shuttle systems for moving reducing equivalents.

UNIT-IV

Books Suggested

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, Anticancerous drugs targeting nucleic acid metabolism, Disorders of Purine and Pyrimidine metabolism.

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 and Oxidative Phosphorylation.

**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.

**Books Suggested**

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 & their derivatives.

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

Books Suggested
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 make students aware of structural and functional aspects of membranes. Highlighting the significance of their compositional heterogeneity & to various cell functions.

UNIT-I


UNIT-II


UNIT-III


UNIT-IV


Books Suggested

1. Jain MK. Introduction to Biological membranes, John Wiley and sons New York, 1988
2. Vance DE & Vance JE, Biochemistry of lipids and Biomembranes, Benzamin Cummings 1985
4. Lodish H. Molecular Cell biology of cell, WH Freeman, 2004
5. Various review articles.

BC-2251: Practical 1+1+1
Objective: To learn the metabolic pathways of carbohydrates, lipids, amino acids and nucleic acid.

UNIT-I

UNIT-II

UNIT-III

UNIT-IV

Books Suggested
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: To learn the nature of genetic material, its expression and recombinant DNA technology.

UNIT-I

UNIT-II

UNIT-III

UNIT-IV

Books Suggested


BCS-2273: 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 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


Books Suggested


BCS-2176: Practical 0+0+1
B.Sc.(HS) Biochemistry (Subsidiary) 4th Semester
For Microbiology/Biophysics/Zoology (1 year course)

BCS-2274: Enzymology and molecular biology 4+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 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.

Books Suggested


BCS-2276: Practical 0+0+1
## B.Sc.(H.S.) 3rd year Semester System

### MAJOR (BIOCHEMISTRY)

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<th>5th Semester</th>
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<td>1. BC-3101: Fundamentals of Molecular Biology-I</td>
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<tr>
<td>2. BC-3102: Endocrinology</td>
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<td>4+0+0</td>
</tr>
<tr>
<td>3. BC-3103: Immunology</td>
<td>100</td>
<td>4+0+0</td>
</tr>
<tr>
<td>4. BC-3104: Biochemical Techniques</td>
<td>100</td>
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</tr>
<tr>
<td>5. BC-3151: Practical</td>
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<tr>
<td>1. BC-3201: Fundamentals of Molecular Biology-II</td>
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<td>2. BC-3202: Plant Biochemistry</td>
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<tr>
<td>3. BC-3203: Neurobiology</td>
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<tr>
<td>4. BC-3204: Nutritional Biochemistry</td>
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<td>5. BC-3251: Practical</td>
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B.Sc. (H.S) 3rd Year (5th Semester) Biochemistry (Major)

**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-I**

**Objective:** Introduction to nature of genetic material, replication and transcription. Nature & discovery of Genetic code, protein biosynthesis and targeting.

**Unit-I**

**Unit-II**

**Unit-III**

**Unit-IV**


**Books Suggested**
1. Freifelder, D. Essential of Molecular Biology, 1998 (3rd Ed.)
BC-3102: 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 feed back 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.

Books Suggested

BC-3103: IMMUNOLOGY

Objective: A comprehensive core course providing an overview of different components of the immune system, their generation, functions and malfunctions as well as immunological techniques.

Unit I

Unit II
Immunological techniques: precipitation and agglutination reactions, immunodiffusion, immunoelectrophoresis, immunoassays, hybridoma technology, abzymes, flowcytometry, magnet/fluorescence activated cell sorting, cell cloning, proliferation and apoptosis assays, animal models, vaccine-types and development.

Unit III
Modes of immune response: Antigen processing and presentation, cytokines, chemokines as mediators. Lymphocyte development. Activation of T & B lymphocytes, immunological tolerance; effector mechanisms of cell mediated and humoral immune responses. Regulation of immune responses.
Unit IV
Behavior of immune system in defense and disease: Immune response to microbes- an overview of various pathogens; Types, classification and examples of the following: congenital and acquired immunodeficiencies; Immune response against tissues: autoimmunity and autoimmune diseases; transplantation and rejection; immunity with respect to tumors; hypersensitivity.

Books Suggested

BC-3104: BIOCHEMICAL TECHNIQUES-II
Objective: The aim of the courses to provide in depth knowledge of various experimental/Instrumentation techniques in biochemistry

Unit I

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
Nuclear magnetic resonance (NMR) and Electron spin resonance (ESR): Theory, applications. Atomic spectrometry, mass-spectrometry: Matrix assisted laser desorption ionization (MALDI).

Books Suggested

BC-3151: Practical
BC-3201: FUNDAMENTALS OF MOLECULAR BIOLOGY-II

Objective: to familiarize the students with regulation of gene expression, gene cloning and mechanism of development.

Unit-I
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-II

Unit-III

Unit-IV
Cellular and molecular mechanisms of development; Drosophila melanogaster; Gradients decide compartments, maternal gene products establish gradients in early embryogenesis, anterior-posterior development by gene regulators, dorsal ventral development uses, receptor-ligand interactions, compartments determine cell fate at blastula stage, complex loci involved in regulation, homebox and homeotic genes, Nematode (C elegans) development.

Books Suggested
1. Freifelder, D. Essential of Molecular Biology, 1998 (3rd Ed.)

BC-3202: PLANT BIOCHEMISTRY

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

Unit I
Electron transport and energy coupling in plant mitochondria. Cyanide resistant respiration.
**Unit II**

**Unit III**
Introduction to phenyl propanoid metabolism, introduction to alkaloids, lignins and flavanoids, Biosynthesis of some important alkaloids, structural components of cell wall. Signals regulating the growth and development of plant organs: phytohormones - auxins, gibberellins, cytokines, abscisic acid and ethylene. Steroid and peptide hormones in plants. Phytochromes.

**Unit IV**

**Books Suggested**

**BC-3203: NEUROBIOLOGY**

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

**Unit I**

**Unit II**

**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); Huntingdon’s disease, Parkinson’s Disease (PD) and Multiple sclerosis

Books Suggested

BC-3204: NUTRITIONAL BIOCHEMISTRY

Objective: To provide information on concept of nutrition & health and understand the physiological and biochemical significance of micronutrients and macronutrients.

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
Vitamins: Sources, structure, biochemical 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.

Unit IV
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.
Physiological role of Iodine, Chlorine, Cobalt, Phosphorus, Manganese, Molybdenum.

Books Suggested

BC-3251: Practical

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