FACULTY OF SCIENCE

SYLLABI

FOR

B.Sc. (HONOURS) BIOINFORMATICS
1st & 2nd SEMESTER, 3rd & 4th SEMESTER
& 3rd YEAR

EXAMINATIONS 2015-2016

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# OUTLINES OF TESTS, SYLLABI AND COURSES OF READING FOR

## B. Sc. (Hons.) BIOINFORMATICS

### SEMESTER – I

<table>
<thead>
<tr>
<th>Paper Code</th>
<th>Lectures/week (Th+Prac)</th>
<th>Name of paper</th>
<th>Theory</th>
<th>Practical</th>
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<tr>
<td>BIN-1001</td>
<td>3</td>
<td>English - I</td>
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<tr>
<td>BIN-1004 / BIN-1005</td>
<td>6+3</td>
<td>Life Sciences / Mathematics</td>
<td>75 (60+15)</td>
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<td>BIN-1006</td>
<td>6+3</td>
<td>Chemistry-I</td>
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<tr>
<td>BIN-1007</td>
<td>6+3</td>
<td>Introduction to Biochemistry</td>
<td>75 (60+15)</td>
<td>BIN-1057 25 (20+5)</td>
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<tr>
<td>BIN-1008</td>
<td>6+3</td>
<td>Introduction to Bioinformatics</td>
<td>75 (60+15)</td>
<td>BIN-1058 25 (20+5)</td>
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**Total Marks (Semester – I)** 395 105

### SEMESTER – II

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<tr>
<th>Paper Code</th>
<th>Lectures/week (Th+Prac)</th>
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<th>Theory</th>
<th>Practical</th>
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<tr>
<td>BIN-2001</td>
<td>3</td>
<td>English-II</td>
<td>45 (40+5)</td>
<td>05</td>
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<tr>
<td>BIN-2002/ BIN-2003</td>
<td>3</td>
<td>Punjabi-II / HCP-II</td>
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<tr>
<td>BIN-2004</td>
<td>6+3</td>
<td>Statistics and Computer Fundamentals</td>
<td>75 (60+15)</td>
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<td>BIN-2005</td>
<td>6+3</td>
<td>Chemistry-II</td>
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<td>BIN-2006</td>
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<td>Physics</td>
<td>75 (60+15)</td>
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<tr>
<td>BIN-2007</td>
<td>6+3</td>
<td>C-Language and programming</td>
<td>75 (60+15)</td>
<td>BIN-2057 25 (20+5)</td>
</tr>
</tbody>
</table>

**Total Marks (Semester – II)** 395 105

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.
### SEMESTER – III (SESSION: 2015-2016)

<table>
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<tr>
<th>Paper Code</th>
<th>Lectures/week (Th+Prac)</th>
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<th>Theory</th>
<th>Practical</th>
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<tbody>
<tr>
<td>BIN-3001</td>
<td>6+3</td>
<td>Fundamentals of Molecular Biology and Genetic Engineering-I</td>
<td>100 (80+20)</td>
<td>BIN-3051 25 (20+5)</td>
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<tr>
<td>BIN-3002</td>
<td>6+3</td>
<td>Computational Methods in Biomolecular Sequence and Phylogenetic Analysis</td>
<td>100 (80+20)</td>
<td>BIN-3052 25 (20+5)</td>
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<tr>
<td>BIN-3003</td>
<td>6+3</td>
<td>Computer Operational System and Organization</td>
<td>100 (80+20)</td>
<td>BIN-3053 25 (20+5)</td>
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<tr>
<td>BIN-3004</td>
<td>6+3</td>
<td>Statistical Methods</td>
<td>100 (80+20)</td>
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<td><strong>Total Marks (Semester –III)</strong></td>
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### SEMESTER – IV (SESSION: 2016-2017)

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<tr>
<td>BIN-4001</td>
<td>6+3</td>
<td>Fundamentals of Molecular Biology and Genetic Engineering - II</td>
<td>100 (80+20)</td>
<td>BIN-4051 25 (20+5)</td>
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<tr>
<td>BIN-4002</td>
<td>6+3</td>
<td>Computational Methods in Biomolecular Sequence and Structure Analysis</td>
<td>100 (80+20)</td>
<td>BIN-4052 25 (20+5)</td>
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<tr>
<td>BIN-4003</td>
<td>6+3</td>
<td>Object Oriented Programming In C++</td>
<td>100 (80+20)</td>
<td>BIN-4053 25 (20+5)</td>
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<tr>
<td>BIN-4004</td>
<td>6+3</td>
<td>Project Work based on Programming</td>
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<td>-</td>
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<td><strong>Total Marks (Semester –IV)</strong></td>
<td><strong>425</strong></td>
<td><strong>75</strong></td>
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</table>
Note: (i) There will be one paper of 40 marks, 5 marks are reserved for the Internal assessment and 5 for the Practical work. Total is 50.

(ii) The paper shall consist of Two Units, Unit I will be text specific and Unit II shall deal with different aspects of Communication and Language Skills.

(iii) For Unit I, the prescribed text is Varieties of Expression Ed. A.H.Tak. Foundation Books. Only four Prose chapters and two dramas have been recommended for study. The relevant sections, however, are as follows:

**Unit I**
- **Prose:** Chapters 1-4
- **Drama:** Dramas 1-2

**Unit II**

*Note (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:

- **Business Communication:** It shall focus on different aspects of communication in general and business communication in particular, communication within organizations, types of communication, and significance of positive attitude in improving communication.
- **Writing Skills:** This section shall focus on letters of all kinds, tender notices, auction notices, public notices; and memos.

**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. business, commerce, accounts etc. 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 commerce. 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 40 will be proportionately increased out of 50).*

**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 Unit I shall be as follows:
- **Section I** (It is text-based and corresponds to Unit I in the syllabus)
  - Q.1 It shall consist of six short questions. Three from Prose and three from drama (not exceeding 50-60 words) out of which, a student will be expected to attempt any two from Prose and two from Drama. This question shall be based upon the prescribed text Varieties of Expression and cover a wide range of issues, topics and problems.  **10 marks**

  Q.2 It shall consist of four long questions. Two from Prose and two from Drama (not exceeding 100-150 words) out of which a student will be expected to attempt two-one from Prose and one from Drama.  **5 marks**

*Note: The question 1 & 2 should be so designed as to cover all the chapters prescribed (Prose & Drama)*
Q.3. 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 five words in one column and asked to match them with words/meanings in the next column. 5 marks

UNIT II

Q.4. This question shall test a student’s ability to write letter of various kinds (not more than 200 words). Again, there will be internal choice here. 5 marks


Q.6 One short question to test the students’ understanding of various aspects of Business Communication. 5 Marks
Course Title: PUNJABI

1. पंजाबी विषय तथा अनुपालन
2. पाठ-विचार
3. विभागवत

बंद

आउट-आउट (बिहार उ. बनारस पैर,)
मंडल: भ. पारिवारिक विषय उ. भ. विभाग विषय संपूर्ण पूर्ण पत्र: गुरु गणेश चंद्र पुरस्कारी, आम्रपाल, 2006

1. आउट-आउट पूर्ण पत्र के विषय क्या हिचें पूर्ण पत्र का विश्लेषण 5 अंक
   (2 हिचें 1)
2. आउट-आउट पूर्ण पत्र विचारक के विचार रूप से पत्र के माध्यम से पत्र विचार 3+5 - 8 अंक
   (2 हिचें 1)
3. बंद हिच पूर्ण पत्र (आउट-आउट) दीवार विचारक के तत्त्व 5 अंक
   संरचना पूर्ण पत्र विचें हिचें पत्र के पत्र (7 में 5)
4. मतलबी अध्ययन के पूर्ण पत्र के सारांश भाषिकांश रूप से पत्र विचार 7 अंक
   (2 से विचा)
5. विभागवत: (3+3+4=10 अंक)
   a) विभागवत (विचा)
   b) विभागिता (विचा)
   c) भाषाशीलता शी विचा विचा विचा
6. पूर्ण पत्र विच पारिवारिक विषय के सारांश, उपचार के लिए 10 अंक
   विशेष मायन: मार्क पत्र विच पत्र उद्देश्य विच 6 पारिवारिक
1. The syllabus has been divided into four Units. There shall be 9 questions in all. The first question is compulsory and shall be short answer type containing 10 short questions spread over the whole syllabus to be answered in about 25 to 30 words each. The candidates are required to attempt any 5 short answer type questions carrying 5 marks i.e. 1 mark each. Rest of the paper shall contain 4 units. Each Unit shall have two essay type questions and the candidate shall be given internal choice of attempting one question from each Unit-IV in all. Each question will carry 10 marks.

2. For private candidates, who have not been assessed earlier for internal assessment, the marks secured by them in theory paper will proportionately be increased to maximum marks of the paper in lieu of internal assessment.

The paper-setter must put note (2) in the question paper.

3. One question from Unit-IV shall be set on the map.

Explanation:
1. Each essay type question would cover about one-third or one-half of a topic detailed in the syllabus.
2. The distribution of marks for the map question would be as under:
   Map : 6 Marks
   Explanatory Note : 4 Marks

In case a paper setter chooses to set a question of map on important historical places, the paper setter will be required to ask the students to mark 6 places on map of 1 mark each and write explanatory note on any two of 2 marks each.

3. The paper-setter would avoid repetition between different types of question within one question paper.

PAPER:  HISTORY AND CULTURE OF PUNJAB FROM THE EARLIEST TIMES TO 1849
Max. Marks : 50
Theory : 45
Internal Assessment : 05
Time : 3 Hours

Objectives: To introduce the students to the history of Punjab region.
Pedagogy: Lectures, library work and discussions.

UNIT I
2. Vedic Age: socio-economic life; development of caste; position of women.
3. Religion: vedic religion; impact of Buddhism and Jainism on the region.

UNIT II
4. Society and Culture c. 1000 A.D.: Socio-economic life; religious life; education
5. Cultural Reorientation: main features of Bhakti; origin and development of Sufism

UNIT III
9. Institution of Khalsa: new baptism; significance

UNIT IV
11. Society and Culture under Maharaja Ranjit Singh: social mobility; painting and architecture; literature.

Suggested Readings:
5. Basham, A.L : The Wonder That was India, Rupa Books, Calcutta (18th rep.), 1992
6. Sharma, B.N : Life in Northern India, Munshi Ram Manohar Lal, Delhi, 1966
7. Singh, Kirpal : History and Culture of the Punjab, Part II (Medieval Period), Publication Bureau, Punjabi University, Patiala 1990 (3rd edn.).

Note: The following categories of the students shall be entitled to take option of History & Culture of Punjab in lieu of Punjabi as compulsory subject:
A. That the students who have not studied Punjabi upto class 10th.
B. Ward of / and Defence Personnel and Central Govt. Employee/Employees who are transferrable on all India basis.
C. Foreigners
Objective
It introduces the students of Non-medical background to the concepts of biological sciences which are integral understanding and application of Bioinformatics.

General Instruction
The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
A candidate is required to attempt five questions in all by selecting two questions, from each unit and the first compulsory question.

UNIT I

General Biology: The nature of life, definition of life, Characteristics of life. Differences between animals and plants. Principal divisions in Biology, Importance of Biology
Introduction to Various systems in human body: Digestive system, Respiratory system, circulatory system, endocrine system, Reproductive system
Basic anatomy of flowering plants

Basics of Cell Biology: Definition of cell, fundamental cell types, differences between prokaryotic and eukaryotic cell types, cell structure, cell wall, plasma membrane
Different organelles and their functions. Cell division, cell cycle and its regulation.

UNIT II


General microbiology: A brief history of microbiology, Microbes in our lives, Definition of microorganisms, naming and classification of microorganisms (Bacteria, Viruses). The diversity of microorganisms – Bacteria, Fungi, Protozoa, Algae, Viruses, Multicellular Animal
Microorganisms living in humans and animals, their role, microorganisms used to produce food and chemicals., Disease causing microorganisms.

Recommended books:
BIN 1054       LIFE SCIENCES (Practical Course)       Max Marks 25 (20+5)

1. Preparation of Media, Cotton Plugging and Sterilization
3. Gram staining, other staining methods
4. Growth curve of bacteria
5. To study cell structure from onion leaf peels
6. Examination of various stages of mitosis and meiosis

BIN 1005       MATHEMATICS

<table>
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<tr>
<th></th>
<th>Theory</th>
<th>Int. ass.</th>
<th>Time</th>
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<tr>
<td></td>
<td>60</td>
<td>15</td>
<td>3 Hours</td>
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</table>

**Objective**
The objective is to introduce students about basic Mathematics including real members, functions, complex numbers, Trigonometric, Matrices and Determinates, Calculus, Differential Equations and Linear Programming. These techniques are useful in solving Bioinformatics Problems.

**General Instruction**
The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
A candidate is required to attempt five questions in all by selecting two questions, from each unit and the first compulsory question.

**UNIT I**

**Set, relation and functions:**
Set, Product of sets, relations, Functions (Polynomials, Trigonometric, Exponential, logarithmic, modulus) and their Graphs.

**Permutations, Combinations, Binomial Theorem:** Fundamental Principle of Counting, Permutations, Binomial theorem for positive integral indices, General and Middle terms etc.

**UNIT II**

**Limit, Continuity and Differentiability:** Limit and continuity of the functions, Differentiability of functions, Chain rule, Derivatives of Functions in Parametric Forms.

**Simple application of Derivatives:** Rate of Change of Quantities, Increasing and Decreasing Functions.

**Integration (Definite and indefinite):** Integration as an Inverse Process of Differentiation, Methods of Integration, Fundamental theorem of Calculus, Area under simple curves.
Recommended books:
2. Textbook of NCERT (For class XI & XII), 2006.

BIN 1055 MATHEMATICS (PRACTICAL) Max Marks 25 (20+5)

1. Sets (Venn-Diagram, Union, Intersection, Difference of sets, Symmetric Difference of sets, Complement of sets).
2. Relations (graphical representation of relation from set A to set B or set A to set A).
3. Functions (Graph of standard functions, modulus, greatest, integer, exponential, \( \log x \), signum, sin, cos, tan, cot, sec, cosec).
4. Increasing and Decreasing (Polynomial functions).

BIN-1006 CHEMISTRY- I

Theory : 60
Int. asst. : 15
Time : 3 Hours

Objective To introduce the basic concepts of Chemistry with application in biological Sciences

General Instruction
The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
A candidate is required to attempt five questions in all by selecting two questions, from each unit and the first compulsory question.

UNIT I

Periodic properties
Position of elements in the periodic table, effective nuclear charge and its calculations, atomic and ionic radii, ionization energy, electron affinity and electronegativity definition, methods of determination trends in periodic table and applications in predicting and explaining behaviour

Coordination compounds
Introduction, Wener’s coordination theory, naming of coordination compounds, Stereochemistry, Geometrical isomerism and optical isomerism in compounds having coordination number 4 and 6.
Bonding in metal complexes

Chemical bonding
Valence bond theory and its limitations.
Molecular Orbital Theory.
Weak interactions; Hydrogen bonding and Van der waals forces.

**Fundamental aspects of organic chemistry**, inductive effect, electrometric effect, resonance, hyperconjugation, types of reagents, electrophiles and nucleophiles, types of organic reactions. Reaction intermediates – carbocations, carbanions, free radicals, carbenes (with examples)
Mechanisms and stereochemistry of nucleophile substitution reactions of alkyl halides, SN2 and SN1 reactions with energy diagram. The elimination- Addition mechanism (benzyne mechanism) and nucleophilic aromatic substitution reactions.

**UNIT II**

**Physical properties and molecular structure**
Optical activity, Polarization, orientation of dipoles in an electric field, dipole moment, magnetic properties.

**Solutions**
Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient, Dilute solution, Osmotic pressure, its law and measurements. Elevation of boiling point and depression of freezing point.

**Chemical kinetics**
Scope, rate of reaction, influencing factors such as concentration, temperature, pressure, solvent etc., theories of chemical kinetics, Arrhenius Equation, Concept of Activation energy.
Acids and Bases, pH, buffer action, pK. Acids and Bases strengths, acidity and basicity of solvents. Acid-base reaction

**Recommended books:**

**BIN 1056 CHEMISTRY I (Practical Course)**

Max Marks 25 (20+5)

**Inorganic qualitative analysis**
Four ions.

**Volumetric analysis**
Iodimetry, iodometry, redox titrations using ceric sulphate, potassium dichromate and potassium permanganate
Complexometric titrations using EDTA of Ca++, Mg++, and Zn++.
Objective
Introduction to Biochemistry exposes the students to study chemistry of biomolecules.

General Instruction
The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
A candidate is required to attempt five questions in all by selecting two questions, from each unit and the first compulsory question.

UNIT - I

Chemical Foundations:
Water. Chemistry of water, ionization of water, equilibrium constant and concepts of weak acid and base, pH, pI, pKa, Henderson-Hasselbach equation and concepts of buffers in biology in brief.


UNIT – II

Introduction to Proteins & Protein Structure: Primary, Secondary, Tertiary and Quartenary Structure.

Enzymes:
General properties, specificity, classification, efficiency, regulation of enzyme activity (rate, concentration, time, pH, temperature), enzyme kinetics---rate equations, steady state, Michaelis – Menten equation.


Recommended Books:

BIN-1057 INTRODUCTION TO BIOCHEMISTRY – PRACTICAL

Max Marks:25 (20+5)

1. Verification of Beer Lambert law for p-nitrophenol or cobalt chloride
2. Determination pKa value of p-nitrophenol
3. Estimation of carbohydrate in given solution by Anthrone method
4. Protein estimation by Lowry’s method
5. Separation of lipids by Thin layer chromatography

BIN-1008 INTRODUCTION TO BIOINFORMATICS

Theory : 60
Int. ass. : 15
Time : 3 Hours

Objective
Introduction to Bioinformatics exposes the students to study biomolecules and their integration in information technology which is the basis of Bioinformatics.

General Instruction
The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
A candidate is required to attempt five questions in all by selecting two questions, from each unit and the first compulsory question.

UNIT – I

Sequence databases: Primary and secondary databases, Nucleotide sequence database, nucleotide sequence flat files. Sequence formats: Genbank, FASTA, ASN.1, Genpept.

Protein sequence databases: PIR, SwissProt, Uniprot. Information retrieval from The NCBI resource: Entrez.

UNIT – II

Sequence Alignment:
Pairwise sequence alignment: Global alignment, Local alignment, Scoring functions, concepts behind General gap, affine gap penalty and amino acid substitution matrices, Statistical significance.
**Multiple Sequence alignment:** SP (Sum of Pairs) measure to determine scoring function, Tree alignments, Motifs and Profile, Alignment representation and Applications, ClustalW, ClustalX and T-coffee.

**Recommended Books:**


**BIN-1058 INTRODUCTION TO BIOINFORMATICS (PRACTICAL)**

Max Marks: 25 (20+5)

1. Understanding and using Sequence information resources on web: EMBL, Genbank, Entrez
2. Understanding and using Protein information resources on web: PDB, Swissprot, TrEMBL
3. Using BLAST and Interpretation of results
4. Multiple sequence alignment using ClustalW
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ENVIRONMENT AND ROAD SAFETY EDUCATION (SEMESTER – II)

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, 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.

Practical
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 un-attempted 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.
Semester II
(English) Examination

Note: (i) There will be one paper of 40 marks, 5 marks are reserved for the Internal assessment and 5 for the Practical work. Total is 50.

(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 Skills.

(iii) For Unit I, the prescribed text is Varieties of Expression Ed. A.H.Tak. Foundation Books. Only four Prose chapters and two dramas have been recommended for study. The relevant sections, however, are as follows:

Unit I
- Prose: Chapters 5-8
- Drama: Dramas 3-4

Unit II

Note (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:

Writing Skills: This section shall focus on précis-writing, curriculum vitae; short, formal reports (not exceeding 200 words) 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, Audio-Visual Aids and Power-Po int Presentations. Apart from this, the students shall also be given basic lessons in Effective Listening, Non-Verbal Communication, How to Prepare for an Interview & 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. business, commerce, accounts etc. 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 commerce. 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 40 will be proportionately increased out of 50.

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:

Unit I (It is text-based and corresponds to Unit I in the syllabus)
- Q.1 It shall consist of six short questions. Three from Prose and three from drama (not exceeding 50-60 words) out of which, a student will be expected to attempt any four. Two from Prose and two from Drama. This question shall be based upon the prescribed text Varieties of Expression and cover a wide range of issues, topics and problems. Ten marks
Q.2 It shall consist of four long questions - Two from Prose and two from Drama (not exceeding 100-150 words) out of which a student will be expected to attempt two - one from Prose and one from Drama.

5 marks

Note: The question 1 & 2 should be so designed as to cover all the chapters prescribe (Prose & Drama).

Q.3 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 five words in one column and asked to match them with words/meanings in the next column.

5 marks

UNIT II

Q.4 Short Survey Report (150-200 words) with internal choice.
5 marks

Q.5 Precis of 200 words.
10 marks

Q.6 Definition/Format of modern forms of communication to be tested.
B.Sc. (Hons.) Bioinformatics, Biotechnology

सभी टेन कुल
अप्रैल / मई 2016 के लिए एम्बियर लिस्ट

वेल, बिल : 50
सिधांत : 45
सेंटर अधिग्रहण : 5
समय : 3 पृष्ठ

पाठथर

1. घरानी बागानों से अभियंता
2. पेंडू-इंजेक्शन
3. विभागहर

बैठाकर अभियंता-अभियंता (विभाग द्वारा बनाए संसाधित)

संक्षेप : डॉ. इंरविलाल सिंह द्वारा डॉ. बनभान सिंह संघ पुरवस्तु: खुदा ताजब एंट्र पूरी-पूरी, अभिभाषण, 2006

1. आभ-अभियंता पुमायें द्वारा सुधारित दिशा पुर्व मौलिक (2 बिंदु)
2. आभ-अभियंता पुमायें दिशाओं द्वारा सुधारित दिशा (3+5-8 बिंदु)
3. वेंटिल विभाग आभ-अभियंता (आभ-अभियंता) दीर्घासंक्षिप्त बागानों राज
   संसाधित पुमायें दिशाओं दिशा पुर्व (7 बिंदु)
4. बागानी आभ अभियंता के मंगलम पूर्व चलन अभियंता द्वारा पेंडू-इंजेक्शन (2 बिंदु)
5. विभागहर:
   (3+3+4=10 बिंदु)
   इ) विभाग संक्षिप्त
   अ) बागाने हेतु में अन्य संपत्ति
   ब) भवनरंगी ती बागाने दिशा बिंदु

6. पुमायें दिशा बागानी बागानों से सीरेन, जस्ता देखाया
   (6 पृष्ठियाँ)

विशेष रेट : संघर्ष पाठ श्रृंखला दिशा दिशा 6 पृष्ठियाँ
**HISTORY AND CULTURE OF PUNJAB IN THE COLONIAL AND POST INDEPENDENCE TIMES**

**INSTRUCTIONS FOR THE PAPER –SETTER AND CANDIDATES: (FOR PAPER in semester 1 AND 2)**

4. The syllabus has been divided into four Units. There shall be 9 questions in all. The first question is compulsory and shall be short answer type containing 10 short questions spread over the whole syllabus to be answered in about 25 to 30 words each. The candidates are required to attempt any 5 short answer type questions carrying 5 marks i.e. 1 mark each. Rest of the paper shall contain 4 units. Each Unit shall have two essay type questions and the candidate shall be given internal choice of attempting one question from each Unit-IV in all. Each question will carry 10 marks.

5. For private candidates, who have not been assessed earlier for internal assessment, the marks secured by them in theory paper will proportionately be increased to maximum marks of the paper in lieu of internal assessment.

   **The paper-setter must put note (2) in the question paper.**

6. One question from Unit-IV shall be set on the map.

**Explanation:**

4. Each essay type question would cover about one-third or one-half of a topic detailed in the syllabus.

5. The distribution of marks for the map question would be as under:

<table>
<thead>
<tr>
<th>Component</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Map</td>
<td>6</td>
</tr>
<tr>
<td>Explanatory Note</td>
<td>4</td>
</tr>
</tbody>
</table>

   In case a paper setter chooses to set a question of map on important historical places, the paper setter will be required to ask the students to mark 6 places on map of 1 mark each and write explanatory note on any two of 2 marks each.

6. The paper-setter would avoid repetition between different types of question within one question paper.

**PAPER:**

**HISTORY AND CULTURE OF PUNJAB IN THE COLONIAL AND POST INDEPENDENCE TIMES**

<table>
<thead>
<tr>
<th>Component</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max. Marks</td>
<td>50</td>
</tr>
<tr>
<td>Theory</td>
<td>45</td>
</tr>
<tr>
<td>Internal Assessment</td>
<td>05</td>
</tr>
<tr>
<td>Time</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>

**Objectives:** To introduce the students to the history of Punjab region in modern times.

**Pedagogy:** Lectures, library work and discussions.

**UNIT I**

1. Introduction of Colonial Rule: administrative changes; means of communication; western education.

2. Agrarian Development: Commercialization of agriculture; canalization and colonization.
3. Social Classes: agrarian groups; new middle classes

UNIT II
5. Socio Religious Reform Movements: activities of Arya Samaj; Singh sabhas; Ahmadiyas.
6. Development of Press & literature: growth of press; development in literature

UNIT III
7. Emergence Of Political Consciousness: Agrarian uprising 1907; Ghadar.
8. Gurudwara Reform Movement: Jallianwala Bagh; foundation of SGPC and Akali Dal; Morchas.
9. Struggle for Freedom: activities of revolutionaries - Babbar Akalis, Naujawan Bharat Sabha; participation in mass movements – non co-operation, civil disobedience, Quit India.

UNIT IV
10. Partition and its Aftermath: resettlement; rehabilitation
12. MAP: Major Historical places: Delhi, Kurukshetra, Jaito, Ferozepur, Ambala, Amritsar, Lahore, Ludhiana, Qadian, Jalandhar, Lyallpur, Montgomery.

Suggested Readings:
1. Singh, Kirpal :History and Culture of the Punjab, Part II(Medieval Period), Publication Bureau, Punjabi University, Patiala 1990(3rd edn.).
Objective
To introduce students about basic concepts of Biostatistics including Distributions and Probability and also Introduction to computers and their Systems/Storage.

General Instruction
The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
A candidate is required to attempt five questions in all by selecting two questions, from each unit and the first compulsory question.

Statistical Methods

UNIT I
Introduction to biostatistics, types of data, methods of data collection, classification and tabulation of data. Diagrammatic and graphical representation of data, frequency distribution, cumulative frequency distribution and their graphical representation, histogram, frequency polygon, frequency curve and ogives.
Concept of Central tendency and their measures, dispersion and their measures, Central moments, Skewness, kurtosis and their measures, Box and whisker plot.

Basic concepts of probability theory, Baye’s theorem and conditional probability. Random Variables (discrete and continuous), probability mass function, probability density function, cumulative distribution function and their properties.
Mathematical expectation (single and bivariate), expectation of sum of random variables, Variance and Covariance, moment generating and probability generating functions.
Uniform, Bernoulli, Binomial and Poisson distributions and Normal distributions. Fitting of binomial, poisson and normal distributions.

Computer fundamentals

UNIT II
Computers: General introduction to computers, organization of computers, digital and analogue computers, computer algorithms.
Introduction to computers and its uses: milestones in hardware and software – batch oriented / online/realtime applications
Computers as a system: Basic concepts, stored programs, functional units, and their interrelation: communications with computer.

Recommended books:
1. Introductory probability and statistical applications, P.L. Meyer, 1970
5. Introduction to Biostatistics (1973) Sokal & Rohif – Toppan Co Japan

BIN 2054  STATISTICS AND COMPUTER FUNDAMENTALS (PRACTICAL)
Max Marks :25 (20+5)
1. Presentation of data by frequency tables, diagrams, graphs
2. Calculation of measures of central tendency
3. Calculation of measures of dispersion
4. Calculation of measures of skewness and kurtosis
5. Fitting of binomial distribution
6. Fitting of Poisson distribution

BIN-2005  CHEMISTRY II
Theory : 60
Int. ass. : 15
Time : 3 Hours

General Instruction
The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
A candidate is required to attempt five questions in all by selecting two questions, from each unit and the first compulsory question.

UNIT I
**Electrochemistry and Redox reactions:** Half-reactions, oxidation/reduction potential, electrochemical cell, reversibility, reference electrodes, Nernst equation, chemical potential from Nernst equation. Handsren Haselbach Equation, Decomposition Potential, Liquid junction potential, Overvoltage and polarisation, Corrosion

**UNIT II**

**Photochemistry:** Photochemical principles, Quantum yield, Fluorescence and phosphosphorescence

IR spectroscopy: The theory of stretching and bending modes, the selection rules and how to use them to predict number of IR active bands.

Raman spectra- brief introduction. Rotational Raman and Rotational Vibrational spectra

Magnetic resonance spectroscopy: NMR -Basic concepts including chemical shifts and coupling. Differences between NMR and ESR. Applications

**Molecular Spectroscopy:** Differences between Atomic and molecular spectroscopy. Absorption and emission spectroscopy. Wavelength and relative energies.

UV/Vis spectroscopy: Beer Lamberts law, extinction coeffcieints

**Recommended Books:**

8. Physical Chemistry by PW Atkins

**BIN: 2055 PHYSICAL CHEMISTRY (PRACTICAL)**

**Maximum marks 25 (20+5)**

1. Study of distribution law by iodine distribution between water and CCl₄. Given standard solution Na₂S₂O₃
2. **Surface tension:** Determination of surface tension of a given liquid by Stalgmimeter
3. **Viscosity:** Determination of viscosity of a pure liquid (Acetone, ethanol, propanol, butanol, glycol) (Effect of hydrogen bonding on viscosity)
4. **Refractometry:** Determine refractive index of a given liquid as a criterion for its purity (Benzene i.e. commercial) benzene + A.R. acetone
5. **Polarimetry:** Determination of the percentage composition of and optically active solution.
6. **Conductometry:**
   - (a) Determination of specific and equivalent conductance of electrolyte (NaCl and HCl)
   - (b) pH of buffer solution
   - (c) Acid base titration of HCl Vs NaOH
   - (d) Determination of ionization of a weak acid (CH₃COOH)
Objectives: -
Physics is one of the important basic sciences. Introduction to basic course of Physics will enhance the grasping of subject.

General Instruction
The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
A candidate is required to attempt five questions in all by selecting two questions, from each unit and the first compulsory question.

UNIT – I
Science, Physics and Life Sciences- An introduction to apparent differences and the underlying overlap (atomic nature of matter). Units of measurement and ranges (from the smallest to the largest known) for different physical quantities viz. mass, length, time, current, temperature, luminosity, etc. with suitable examples from bio/physical sciences.

Coulomb’s law for point charges; electric field due to point charge and electric dipole (on axial line and equator line- Qualitative only), electric flux; Gauss’s theorem and its applications (line of charge and sheet of charge).

Electric potential due to point charge, group of charges and dipole (on axial line and equatorial line), potential difference as line integral of electric field- Qualitative only, capacitance; series and parallel arrangements, energy stored in the electric field of capacitor, current, currant density, equation of continuity, Ohm’s law in vector form.

UNIT – II
Interference of waves, phase and path differences, theory of interference fringes, Young’s experiment, coherent sources.

Diffraction of light, rectilinear propagation, Resolving power of telescope and microscope, Compound Microscope ( Principle, construction, ray diagram , only formula for magnifying power- No derivation), fluorescent microscope(concept only). Polarization, introduction,

Quantum theory of light, X-rays diffraction, electron microscope, Uncertainty Principle (statement only), applications of Uncertainty Principle (particle in a box, existence of electron in Nucleus and atom).

Radioactivity and its laws; half-life and mean life, uses of radioactivity.

Reference Books:
Physics (Practical) 

1. Introduction and practice the concepts of proper measurement, data recording, and data presentation; stress to be laid on use of proper units, least count, error & its propagation, graph plotting & least square fitting. (Simple measuring devices available in the lab may be used to create basic data).
2. Resolving power of Telescope/Microscope.
3. Rotation of the plane of polarization of a solution using a Polarimeter.
4. Use of C.R.O. as a display & measuring device.
5. Capacitance by flashing and quenching of a neon lamp.

Reference Books:
1. Laboratory Manual of Physics for Undergraduate classes by D. P.Khandelwal

BIN-2007 “C” LANGUAGE AND PROGRAMMING

Objective
To introduce basic concepts of “C” Language, which is required to do programming and solve problems related to Bioinformatics.

General Instruction
The question paper will have seven questions, and each question have 12 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
The remaining six questions will be set out of the Units I and II consisting of three questions from each unit.
A candidate is required to attempt five questions in all by selecting two questions, from each unit and the first compulsory question.

UNIT I

Introduction to ‘C’ Language
Character set, variable and Identifiers, Built-in data types, Variable Definition, Arithmetic operations and Expressions, Constants and Literals, Simple assignment statement, Basic input/output statement
Simple ‘C’ Programs

Conditional statement and Loops
Decision making, Conditions, Relational Operators, Logical connectives
If Statement, If-else statement
Loops: while loop, do while loop, for loop, Nested loops, Switch statement, structural programming  
Programs related to decision making statements, loops  

Arrays  
One dimensional arrays, Array manipulation; Searching, Insertion, Deletion of an element from an array. Finding the largest/smallest element in an array; Two dimensional arrays, Addition/Multiplication of two matrices, Transpose of a square matrix, Null terminated strings as array of characters, Representation sparse matrices, Strings, operation on strings 

UNIT II  
Functions  
Top-down approach of problem solving, Modular programming and functions, Standard library of C functions, Prototype of a function: Formal parameter list, Return Type function Call, Block Structure, Passing arguments to a function: Call by reference, call by value, Recursive functions, Arrays as function arguments  

Structure and Unions  
Structure variables, initialization, structure assignment, nested structure, structures and functions, structures and arrays, arrays of structures, structures containing arrays, unions  

Pointers  
Address Operators, Pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, Arrays and Pointers, Pointer arrays  
File Processing  
Concept of Files, Files operating in various modes and closing of a file, Reading from a file, writing to a file.  

Recommended books:  

BIN 2057 ‘C’ PROGRAMMING (PRACTICAL)  
Max Marks :25 (20+5)  
1. Write a program to calculate a prime number even and odd numbers  
2. Write a function to read a matrix of size m x n from the keyboard  
3. Write a program to add and subtract a two-three matrix simultaneously  
4. Write a program to print the following output using for loops  
5. Programming problems on Arrray, Pointer and Files
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.

**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)**
11. Concept and Significance of Road Safety.
12. Role of Traffic Police in Road Safety.
15. How to obtain Driving License.
17. Common Driving mistakes.
18. Significance of First-aid in Road Safety.
19. 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**

**Websites:**
(e) [www.chandigarhpolice.nic.in](http://www.chandigarhpolice.nic.in)
(f) [www.punjabpolice.gov.in](http://www.punjabpolice.gov.in)
(g) [www.haryanapolice.gov.in](http://www.haryanapolice.gov.in)
(h) [www.hppolice.nic.in](http://www.hppolice.nic.in)
BSc (Hons) Bioinformatics Semester III

BIN-3001 FUNDAMENTALS OF MOLECULAR BIOLOGY AND GENETIC ENGINEERING - I

<p>| | |</p>
<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Theory</td>
<td>80</td>
</tr>
<tr>
<td>Int. ass.</td>
<td>20</td>
</tr>
<tr>
<td>Time</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>

Objective
The Contents are related to the fundamental of molecular biology and their application in recombinant DNA technology.

General Instruction
The question paper will have nine questions, and each question have 16 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
The remaining eight questions will be set out of the Units I and II consisting of four questions from each unit.
A candidate is required to attempt five questions in all by selecting two questions from each unit and the first compulsory question.

UNIT I
Introduction to Molecular Biology:
Properties of DNA polymerases, Synthesis of Leading and lagging strands
DNA Repair: Photo-reactivation, excision repair, post replication repair, SOS repair etc.

UNIT II
Transcription: RNA polymerase in prokaryotes – its molecular composition, role of each component of RNA polymerase, mechanism of transcription, Eukaryotic transcription
Regulation of gene expression in prokaryotes and eukaryotic: Transcriptional control; enzyme induction and repression, constitutive synthesis of enzymes and catabolite repression. The lac operon. The trp operon.

Recommended books
BIN-3051  Fundamentals of Molecular Biology and Genetic Engineering-I  
(PRACTICAL) 

Max Marks 25 (20+5) 

1. Isolation of Genomic DNA and Quantization of DNA  
2. Isolation of bacterial plasmid DNA  
3. Agarose gel electrophoresis of DNA  
4. Microscopy, chromosome staining 

BIN-3002  COMPUTATIONAL METHODS IN BIOMOLECULAR  
SEQUENCE AND PHYLOGENETIC ANALYSIS 

Theory : 80  
Int. ass. : 20  
Time : 3 Hours 

Objective 
In this paper, sequence and phylogenetic analysis of proteins and nucleotides using various  
computational tools which are important to study conservation in different species is covered. 

General Instruction 
The question paper will have nine questions, and each question have 16 marks. The first question  
would be compulsory having sub-parts covering the entire syllabus in the form of short and  
objective type questions. 
The remaining eight questions will be set out of the Units I and II consisting of four questions  
from each unit.  
A candidate is required to attempt five questions in all by selecting two questions from each unit  
and the first compulsory question. 

UNIT I 
Introduction to Alignments- Global and Local 
Scoring matrices: Protein and nucleotide scoring matrices i.e. PAM, BLOSUM, Gonett.  
Constructing scoring matrices. Difference between PAM and Blosum. 

Database homology search: Concepts behind  
BLAST: Applications & Biological Significance; homology, similarity & identity  
Statistical significance of BLAST: E value, Scores  
BLAST versions- BLASTp, BLASTn  
Difference between FASTA and BLAST
UNIT II

Phylogenetic analysis: Basic terminology in Phylogenetics
Distance and parsimony methods; Clustering methods.
Rooted and unrooted trees, Brief introduction to Bootstrapping & Jackknifing, Introduction to Phylip and PAUP packages.

Recommended books:


BIN-3052 COMPUTATIONAL METHODS IN BIOMOLECULAR SEQUENCE AND PHYLOGENETIC ANALYSIS (PRACTICAL)
Max Marks 25 (20+5)

1. BLAST page at NCBI and its features
2. BLASTp and BLASTn analysis and data interpretation: E value, Scores
   Building Phylogenetic trees using Phylip:
3. Distance based method
4. Character based method

BIN-3003 COMPUTER OPERATIONAL SYSTEM AND ORGANIZATION

<table>
<thead>
<tr>
<th>Theory</th>
<th>: 80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Int. ass.</td>
<td>: 20</td>
</tr>
<tr>
<td>Time</td>
<td>: 3 Hours</td>
</tr>
</tbody>
</table>

Objective
To make students familiar with Evolution of Computers, Organization of Computers, Concepts of Assembly language and System maintenance.

General Instruction
The question paper will have nine questions, and each question have 16 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
The remaining eight questions will be set out of the Units I and II consisting of four questions from each unit.
A candidate is required to attempt five questions in all by selecting two questions from each unit and the first compulsory question.
UNIT I

Computer Organisation:
Evolution of computers, stored program concept and Von Neumann Architecture, Information representation and codes, Building blocks and computer;
Combinatorial Block:
Gates, Multiplexes, decoders, Encoders etc. Sequential Building Block: Flip Flop, Registers, Counters, Random access memory; Register Transfer Language and micro-operations; concept of Bus, data movement among registers, Language to represent conditional data transfer, data movement from/to memory, Arithmetic and logical operations along with register transfer.

Architecture of a simple processor:
A simple computer Organization and instruction set, instruction execution in terms of Microinstructions, Concepts of interrupt and simple I/O organization, Implementation of the processor using building blocks; CPU organization with large registers, stacks and handling of interrupts and subroutines, instruction pipelining.

UNIT II

Concepts of Assembly Language Programming:
Machine and assembly language, Pseudo operations, subroutines in assembly language, interrupt and I/O programming

I/O Organization:
Handshake based communication, vector and priority interrupts, DMA based data transfer; memory Organisation: basic cell of static and dynamic RAM, building large memories using chips associative memory, Cache memory organization, Virtual memory organization.

System Maintenance:
Introduction to various physical components of a computer, Physical Inspection of a PC and internal cards, Diagnostics on a PC, Functional description of various modules and cards. Various types of display and other peripherals used in a PC. Installing a software. Detection of viruses and protection on a PC.

Recommended Books:
BIN-3053 COMPUTER OPERATIONAL SYSTEM AND ORGANIZATION
(PRACTICAL)
Max Marks 25 (20+5)

Part I: Studying various physical components of computer system

1. Study of system configuration (System settings)
2. Inspection and functional description of hardware components
   - I/O Devices: Monitor, Keyboard, Mouse, Speaker, Printer, Microphone, Scanner
   - Memory: Primary – RAM, BIOS ROM
   - Secondary- Hard Disk (HDD), CD Drive, Floppy Disk (FDD)
   - Mother board with Add on (Internal) cards
   - BUS: PCI, ISA etc.
     Parallel and Serial Transfer

Part II: Installing a Software
1. MS DOS: Commands, Formatting, Partitioning of Hard disk, Booting, Starting system with bootable disk
2. Installation of Software:
   - Windows operating system
   - MS office, Antivirus, Photoshop, C/C++ and other utility software
   - Adding / Removing new hardware devices (device drivers detection and installation)

Part III: System Maintenance
1. Disk Utilities: Defragmentation, Scanning
2. System Protection: Antivirus check for system; fixed and removable disk
3. Diagnostics on a PC
4. PC Troubleshooting

BIN-3004 STATISTICAL METHODS

Theory : 80
Int. ass. : 20
Time : 3 Hours

Objective
To study the concepts of correlation, Regression, Estimation and Testing of parametric and non-parametric Hypotheses.

General Instruction
The question paper will have nine questions, and each question have 16 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
The remaining eight questions will be set out of the Units I and II consisting of four questions from each unit.
A candidate is required to attempt **five questions** in all by selecting two questions from each unit and the **first compulsory question**.

**UNIT-I**

Bivariate data, scattered diagram, Karl Pearson’s and Spearman’s rank correlation. coefficient. Linear regression analysis including two variables.

Sampling distributions, Estimation of population means and proportions, confidence intervals for the parameters of normal distribution under different conditions (two sample problems also). Determination of sample size for estimating means and proportions.

**UNIT-II**

The basic idea of significance test. Tests of hypotheses for the parameters of a normal distribution (two sample problems also). Tests for the significance of correlation coefficient. Categorical data: Proportions and their testing for large samples, Tests of association, goodness-of-fit using Chi-square test, Yates correction.

Analysis of variance, one-way and two-way classifications. Brief exposure of three basic principles of design of experiments, treatment, plot and block. The analysis of completely randomized design, randomized complete Block Design. Introduction to non-parametrics :Sign test, Wilcoxon signed-rank test and mann-whitney test.

**Recommended Books:**


**BIN-3054 STATISTICAL METHODS (PRACTICAL)**

Max Marks 25 (20+5)

1. Practical Problems based on correlation coefficient, spearman’s rank correlation
2. Problems based on simple regression
3. Practical based on z- test and t-test (i.e. Testing of Mean in both cases when variance is known and when variance is unknown (one sample problem). Also to find the confidence interval of population mean.
4. Practical based on testing of single proportion and difference of proportions
5. Practical on association
6. Practical on Chi-square test of goodness of fit.
## OUTLINES OF TESTS, SYLLABI AND COURSES OF READING FOR
### B. Sc. (Hons.) BIOINFORMATICS
#### SEMESTER – IV (SESSION: 2016-2017)

<table>
<thead>
<tr>
<th>Paper Code</th>
<th>Lectures/week (Th+Prac)</th>
<th>Name of paper</th>
<th>Theory</th>
<th>Practical</th>
</tr>
</thead>
</table>
| BIN-4001   | 6+3                     | Fundamentals of Molecular Biology and Genetic Engineering - II | 100 (80+20) | BIN-4051  
25 (20+5) |
| BIN-4002   | 6+3                     | Computational Methods in Biomolecular Sequence and Structure Analysis | 100 (80+20) | BIN-4052  
25 (20+5) |
| BIN-4003   | 6+3                     | Object Oriented Programming In C++ | 100 (80+20) | BIN-4053  
25 (20+5) |
| BIN-4004   | 6+3                     | Project Work based on Programming | 125 | - |
| **Total Marks (Semester –IV)** | 425 | 75 |
Objective

The Contents are related to the fundamental of molecular biology and their application in recombinant DNA technology.

General Instruction
The question paper will have nine questions, and each question have 16 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
The remaining eight questions will be set out of the Units I and II consisting of four questions from each unit.
A candidate is required to attempt five questions in all by selecting two questions from each unit and the first compulsory question.

UNIT-I
Translation: The genetic code. Prokaryotic and Eukaryotic Translation
Modification of RNA : 5’ – CAP formation, 3’ – end processing polyadenylation, Splicing, Editing, Nuclear export of mRNA & mRNA stability

UNIT-II
Recombinant DNA: History and scope of recombinant DNA technology
DNA modifying enzymes

Cloning and expression vectors:
Characteristics of cloning and expression vectors; plasmid, phages, and cosmid vectors, multipurpose cloning vectors, shuttle vectors, bacterial, yeast, plant and mammalian expression vectors. BACs and YACs.
Preparation of genomic and cDNA libraries.

Practical
1. Restriction digestion of DNA with one restriction enzyme
2. Southern blot hybridization with non radioactive probe
3. RFLP
4. PCR

Recommended Books:

BIN-4051 FUNDAMENTALS OF MOLECULAR BIOLOGY AND GENETIC ENGINEERING (PRACTICAL)

Max Marks 25 (20+5)

1. Isolation of Genomic DNA and Quantization of DNA
2. Isolation of bacterial plasmid DNA
3. Restriction digestion of DNA with one restriction enzyme
4. Southern blot hybridization with non radioactive probe
5. Microscopy, chromosome staining
6. RFLP

UNIT-I

Gene prediction methods: searching by signal, searching by content, homology based predictions, Markov models, Hidden Markov models in gene prediction.
Gene prediction tools: Genscan, Glimmer, Grail.
Promoter analysis and predictions for prokaryotic and eukaryotic Genomes
RNA structure prediction.

UNIT II

Protein Structure Prediction
Secondary structure prediction methods: CHAU FASMAN, GOR, Neural Network
Tertiary Structure prediction methods- Homology Modeling, Threading/Fold recognition and Ab initio methods.

Recommended books:

BIN-4052 COMPUTATIONAL METHODS IN BIOMOLECULAR SEQUENCE ANALYSIS(PRACTICAL)
Max Marks 25 (20+5)

Gene Prediction Tools:
1. GenScan
2. Glimmer

Protein Structure Modeling Using:
3. SPDB viewer
4. Modeller

BIN-4003 OBJECT ORIENTED PROGRAMMING in C++

| Theory | : 80 |
| Int. ass. | : 20 |
| Time | : 3 Hours |

Objective
To introduce the concept of object oriented programming in C++ which is helpful in writing programs to solve the problems in Bioinformatics.

General Instruction
The question paper will have nine questions, and each question have 16 marks. The first question would be compulsory having sub-parts covering the entire syllabus in the form of short and objective type questions.
The remaining eight questions will be set out of the Units I and II consisting of four questions from each unit.
A candidate is required to attempt **five questions** in all by selecting two questions from each unit and the **first compulsory question**.

**UNIT-I**

**Methodologies:** Concept of structured and object-oriented programming, Advantages of OOPs methodologies.


Operator overloading and Function overloading, Inheritance: Extending classes, Types of inheritance, Virtual base class, Problems with multiple inheritance, Containership, Virtual function, Polymorphism : Compile and Runtime, Pure Virtual Function, this pointer.

**UNIT-II**

Files and streams, building class Libraries in C++, File Handling in C++, Reading and Writing text files, Reading and writing binary files, Template classes and functions, Exception Handling.

Introduction to data structures like Arrays, Linked-list and stack and their implementation, Data Searching and Sorting algorithms.

**Recommended Books:**
3. The C++ Programming Languages by Stroustrup, Addison Wesely, 2001
6. Data structures by Tanenbaum, PHI, 1997

**BIN- 4053  OBJECT ORIENTED PROGRAMMING IN C++ (PRACTICAL)**

**Max Marks 25 (20+5)**

1. Create a class employee and calculate gross salary. Demonstrate how private member functions can be accessed within a class.
2. Write a program to add, subtract, multiply and divide two complex numbers using classes.
3. Write program to illustrate the concept of various types of constructors.
4. Write program to overload binary + operator using member function.
5. Write program to demonstrate the concept of multiple inheritance.
6. Write program that implements run time polymorphism using virtual function.
7. Program to perform reading/writing operations on a file using stream classes.
8. Program to demonstrate exception handling.
9. Program to search a given number from a given list of numbers using linear as well as binary search.
10. Program to demonstrate various sorting algorithms.

BIN-4004    Project Work Based on Programming

Every student will submit a thesis report based on the work carried out under the guidance of Department faculty, pertaining to the syllabi of Programming. The report will be evaluated in terms of quality of written work, experimental and performance in the viva-voce by internal and/or external examiner(s).
### Outlines of Courses for B.Sc. (Hons.) Bioinformatics  3rd Year

<table>
<thead>
<tr>
<th>Paper Code</th>
<th>Subject</th>
<th>Lectures / week</th>
<th>Max Marks</th>
</tr>
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<tbody>
<tr>
<td>BIN-3001</td>
<td>Introduction to \textit{PERL} Programming</td>
<td>6</td>
<td>90+10=100</td>
</tr>
<tr>
<td>BIN-3002</td>
<td>Fundamentals of Genomics</td>
<td>6</td>
<td>90+10=100</td>
</tr>
<tr>
<td>BIN-3003</td>
<td>Introduction to Proteins and Proteomics</td>
<td>6</td>
<td>90+10=100</td>
</tr>
<tr>
<td>BIN-3004</td>
<td>Genetics &amp; Evolution</td>
<td>6</td>
<td>90+10=100</td>
</tr>
<tr>
<td>BIN-3005</td>
<td>Biochemical and Molecular Biology techniques</td>
<td>6</td>
<td>90+10=100</td>
</tr>
<tr>
<td>BIN-3006</td>
<td>Cell Biology &amp; Immunology</td>
<td>6</td>
<td>90+10=100</td>
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<td>BIN-3051</td>
<td>Introduction to PERL Programming (Practical)</td>
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<td>BIN-3052</td>
<td>Fundamental of Genomics (Practical)</td>
<td>3</td>
<td>45+5=50</td>
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<tr>
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<td>3</td>
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<tr>
<td>BIN-3056</td>
<td>Cell Biology &amp; Immunology (Practical)</td>
<td>3</td>
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</tr>
<tr>
<td>BIN-3057</td>
<td>Project Work</td>
<td>6</td>
<td>100</td>
</tr>
</tbody>
</table>

Total = (Theory + Practical) = 600 + 300+100 = 1000
BIN-3001 INTRODUCTION TO PERL PROGRAMMING

Total marks: 100
Theory : 90
Int. ass. : 10
Teaching Hours : 60
Time : 3 Hours

Objective
Since Bioinformatics relies highly on Biological database and introduction to PERL Programming is necessary for better understanding the architecture of databases.

Instructions for the paper-setters and Candidates

Note:
1. Nine questions will be set in all, uniformly distributed over the entire syllabus i.e. two from each unit.
2. Q. No. 1 will be of objective type (containing 9 parts of 2 marks each) covering the entire syllabus will be compulsory.
3. The candidates will be required to attempt five questions in all by selecting atleast one question from each unit.
4. The questions (2-8) may be divided into atleast two parts and each question (2-8) will carry equal marks.

UNIT I
Introduction to PERL
What is PERL; Comparison with other languages like JAVA, C, PHP, Python; Install PERL on Windows and UNIX environment; Installing PERL modules; Writing and running a PERL script; Numeric data and string literals; How to store string/numbers in variables; Input/output variables;

UNIT II
Concept of Programming
Operators (Unary, Binary, Multiplicative, Conditional, logical etc.); Control Statements (IF, DO, WHILE, FOR); Defining and calling functions; List Processing; Arrays handling; Input from command (ARGV, ARGC); Reading values from file and screen; Writing/appending in files.

UNIT III
Pattern Matching
Manipulation of strings; Regular expressions; Pattern-Matching Operators; Standard Modules; Subroutines; Using system command; Important functions (split, index, substr, chomp, length, reverse, shift, sort)

UNIT IV
Perl and Internet
Introduction to TCP/IP protocol; Internet applications; HTML and submission forms; installation/configuration of Apache; Common Gateway Interface (CGI); Reading and processing HTML forms; using perl with web servers.

Reference Books:

**BIN- 3051**  **INTRODUCTION TO PERL PROGRAMMING – PRACTICAL**
Max.Marks 50 (45+5)

1. Write a script code to illustrate “while” and “do” operator
2. Write a script code to illustrate use of Arithmetical and String operators
3. Write a Perl script that declares three arrays and assigns lists to them
4. Write a code to show ascending and descending sorting
5. Write a script code that read a HTML form via CGI

**BIN-3002**  **FUNDAMENTALS OF GENOMICS**

Total Marks: 100
Theory : 90
Int. Ass. : 10
Teaching Hours : 60
Time : 3 Hours

**Objective**
The fundamentals of genomics dealing with gene structures and elements are covered.

**Instructions for the paper-setters and Candidates**
**Note:**
1. Nine questions will be set in all, uniformly distributed over the entire syllabus i.e. two from each unit.
2. Q. No. 1 will be of objective type (containing 9 parts of 2 marks each) covering the entire syllabus will be compulsory.
3. The candidates will be required to attempt five questions in all by selecting atleast one question from each unit.
4. The questions (2-8) may be divided into atleast two parts and each question will carry equal marks.

**UNIT I**
**Human Genome as a model:** History of Genome sequencing project. The human Genome project. Organization of the Human genome. The human genome sequence: annotation – Repeats, coding regions, non-coding regions. Genome sizes. Genome Annotation.

**UNIT II**
**DNA sequencing methods** – manual & automated: Maxam and Gilbert and Sangers method. Chain termination method, Pyrosequencing
**Genome Sequencing methods:** Shotgun & Hierarchical (clone contig) methods, Computer tools for sequencing projects: Genome sequence assembly software.
UNIT III
Polymorphisms: Repeats and Single Nucleotide Polymorphisms (SNPs), SNP detection methods: SSCP, PCR-based, dHPLC sequencing, SNP and disease.
Molecular markers: RFLP, VNTR, RAPD, SSR, AFLP

UNIT IV
Managing and Distributing Genome Data: Web based servers and softwares for genome analysis: ENSEMBL, VISTA, UCSC Genome Browser, NCBI genome. Selected Model Organismal Genomes and Databases.

Reference Books:

BIN-3052 FUNDAMENTALS OF GENOMICS (PRACTICAL)
Max. Marks 50 (45+5)

1. Use of SNP databases at NCBI and other sites
2. Use of OMIM database
3. NCBI Genome site
4. Detection of Open Reading Frames using ORF Finder
5. Use of Saccharomyces Genome Database (SGD)
6. Repeat masking software tool

BIN-3003 INTRODUCTION TO PROTEINS AND PROTEOMICS
Total Marks: 100
Theory : 90
Int. Ass. : 10
Teaching Hours : 60
Time : 3 Hours

Objective
Sequence Analysis of proteins is integral to Bioinformatics and therefore introduction to the proteins and the concepts will help students to apply bioinformatics tools on biological data.

Instructions for the paper-setters and Candidates
Note:
1. Nine questions will be set in all, uniformly distributed over the entire syllabus i.e. two from each unit.
2. Q. No. 1 will be of objective type (containing 9 parts of 2 marks each) covering the entire syllabus will be compulsory.
3. The candidates will be required to attempt five questions in all by selecting at least one question from each unit.
4. The questions (2-8) may be divided into at least two parts and each question (2-8) will carry equal marks.

UNIT - I
Proteins: Chemical properties of proteins. Physical interactions that determine the property of proteins. Short-range interactions, electrostatic forces, van der waal interactions, hydrogen bonds, Hydrophobic interactions.

UNIT - II
Proteins: Determination of sizes (Sedimentation analysis, gel filtration, SDS-PAGE); Native PAGE, Determination of covalent structures – Edman degradation.

UNIT - III

UNIT - IV

Recommended Books:

BIN-3053 INTRODUCTION TO PROTEINS AND PROTEOMICS (PRACTICAL)
Max. Marks 50 (45+5)

1. Proteomics 2D PAGE database
2. Softwares for Protein localization – PSORT2
3. Hydropathy plots
4. Native PAGE
5. SDS PAGE
Objective
Introduction to the Principles of genetics will help students to acknowledge the phenomena which results in gene diversity and evolution.

Instructions for the paper-setters and Candidates
Note:
1. Nine questions will be set in all, uniformly distributed over the entire syllabus i.e. two from each unit.
2. Q. No. 1 will be of objective type(containing 9 parts of 2 marks each) covering the entire syllabus will be compulsory.
3. The candidates will be required to attempt five questions in all by selecting atleast one question from each unit.
4. The questions (2-8) may be divided into atleast two parts and each question (2-8) will carry equal marks.

UNIT I
Mendel’s work- modified mendelian ratios, epistasis, incomplete dominance, multiple alleles, lethal genes, penetrance, expressivity, pleiotropy.

UNIT II
Structure and organization of eukaryotic genome – Chromosomal DNA, its packaging, polytene and lampbrush chromosomes. Chromosome theory of inheritance- Cell division, linkage, crossing over, recombination, genetic mapping- chromosome mapping, gene mapping, X-inactivation, sex linked inheritance, mitochondrial inheritance.

UNIT III
Phage lambda genetics- gene organization of phage lambda, lytic cycle, lysogenic cycle. Mutagenesis in Bacteria- types of mutants, mutagenic agents, isolation and characterization of mutants, reversion, suppression, transposable elements.

UNIT IV

Reference Books:

BIN-3054 GENETICS & EVOLUTION - PRACTICAL

1. Demonstration of Law of Segregation (use of coloured beads, capsules)
2. Demonstration of Law of Independent assortment (use of coloured beads, capsules)
3. Calculation of variance in respect of pod length and numbers of seeds/pods.
4. Calculation of gene frequencies (use of coloured beads, capsules)
5. Preparation and study of mitosis and meiosis slides.

BIN-3005 BIOCHEMICAL AND MOLECULAR BIOLOGY TECHNIQUES

Total Marks: 100
Theory : 90
Int. ass. : 10
Teaching Hours : 60
Time : 3 Hours

Objective
Biochemical and Molecular Biology techniques are taught to students so that they are aware of the principles, protocols/methodology involved in the generation of wet lab experimental data and its interpretation.

Instructions for the paper-setters and Candidates

Note:
1. Nine questions will be set in all, uniformly distributed over the entire syllabus i.e. two from each unit.
2. Q. No. 1 will be of objective type (containing 9 parts of 2 marks each) covering the entire syllabus will be compulsory.
3. The candidates will be required to attempt five questions in all by selecting at least one question from each unit.
4. The questions (2-8) may be divided into at least two parts and each question (2-8) will carry equal marks.

UNIT I

UNIT II
Microscopy: Light Microscopy, Phase contrast microscopy, Electron Microscopy, Confocal Microscopy, Fluorescence microscopy. Flow Cytometer (Fluorescence assisted cell sorting)
UNIT III

Chromatography: definition and principles and types- paper, thin-layer, adsorption, gas, Reverse phase chromatography and HPLC.
Principles and techniques of protein purification: ion-exchange, affinity, gel-filteration.

UNIT IV

Biochemical Methods of Analysis
Electrophoresis: Principles, types- moving, paper, starch gel, agar gel, immunoelectrophoresis, Isoelectric focusing.
Colorimetry, Fluorimetry and Spectrometry: Principle of Beer and Lambert’s Law, description and application.
Centrifugation, Ultracentrifugation for protein and nucleic acids preparation and fractionation.

Recommended Books:

BIN-3055 BIOCHEMICAL AND MOLECULAR BIOLOGICAL TECHNIQUES- PRACTICAL

Max. Marks 50 (45+5)

1. Polymerase chain reaction
2. Southern Blotting
3. Principles of compound, phase contrast, electron microscopy
4. Use and care of light compound microscope
5. Verification of Beer and Lambert’s law using CoCl₂.5H₂O (in water) and K₂Cr₂O₇ in water
6. Thin Layer Chromatography
7. Paper Chromatography
8. Agarose Gel Electrophoresis
9. SDS PAGE
10. Differential Centrifugation
Objective
Cells & immune system involve interaction of various bio-molecules resulting in normal functions or various pathophysiological conditions. So the students are exposed to the underlying concepts and phenomena of Cell Biology & Immunology.

Instructions for the paper-setters and Candidates
Note:
1. Nine questions will be set in all, uniformly distributed over the entire syllabus i.e. two from each unit.
2. Q. No. 1 will be of objective type (containing 9 parts of 2 marks each) covering the entire syllabus will be compulsory.
3. The candidates will be required to attempt five questions in all by selecting atleast one question from each unit.
4. The questions (2-8) may be divided into at least two parts and each question will carry equal marks.

UNIT I
The cell theory. The cell membrane: membrane composition and organization. Cell membranes as a permeability barrier.
Translocation of proteins across the ER membrane: Signal hypothesis, Signal recognition particles, Signal peptides.
Folding in the ER: Cotranslational translocation, glycosylation in the ER, The role of the ER chaperones.
Translocation across prokaryotic membranes.

UNIT II
Phagocytosis, Receptor mediated Endocytosis of biologically important molecules, toxins. Importance of endosome in endocytosis
Trafficking to the chloroplast and mitochondria

UNIT III
Immune system: humoral immunity
Introduction, Lymphocytes: their origin and differentiation, Types of immune responses
B-lymphocytes and their activation, structure and function of immunoglobin, immunoglobin classes and subclasses, generation of antibody diversity, major histocompatibility complex.

UNIT IV
Immune System: Cellular Immunity:
Thymus derived lymphocytes (T cells) and their classification, Antigen presenting cells (APC),
Macrophages, langerhans cells their origin and functions, mechanisms of phagocytosis,
Identification of cell type of immune systems, immunosupression, immune tolerance, Monoclonal antibodies. Stem Cells.

Reference Books:

BIN-3056 CELL BIOLOGY & IMMUNONLOGY (PRACTICAL)
Maximum Marks 50 (45+5)

1. TLC and DLC for Blood samples
2. Determination of cell number (viable/non-viable)
3. Ficoll density gradient, separation of cell types
4. Cell agglutination reaction
5. SDS-PAGE
6. ELISA
7. Western Blot.

BIN – 3057 PROJECT WORK
Max. Marks: 100

Every student will submit a thesis report based on the work carried out under the guidance of Department faculty, pertaining to the syllabi of Bioinformatics. The report will be evaluated in terms of quality of written work, experimental and performance in the viva-voce by internal and/or external examiner(s).

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