FACULTY OF SCIENCE
SYLLABI

FOR
B.Sc. (HONOURS) BIOTECHNOLOGY
1st, 2nd SEMESTER, 3rd and 4th SEMESTER
& 3rd YEAR
EXAMINATIONS 2015-2016

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# B.Sc. (Hons.) Biotechnology (Semester System)
## Examinations 2015-2016

### B.Sc. (Hons.) 1st year (1st Semester)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course/Paper</th>
<th>Code</th>
<th>Theory</th>
<th>Practical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Course No.</td>
<td>Marks</td>
<td>Course No.</td>
</tr>
<tr>
<td>1.</td>
<td>English</td>
<td>BIOT-Sem-I-I-T</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Punjabi/HCP</td>
<td>BIOT-Sem-I-II-T</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Physics</td>
<td>BIOT-Sem-I-V-T</td>
<td>75</td>
<td>BIOT-Sem-I-V-P</td>
</tr>
<tr>
<td>6.</td>
<td>Introduction to Biotechnology</td>
<td>BIOT-Sem-I-VI-T</td>
<td>75</td>
<td>BIOT-Sem-I-IV-P</td>
</tr>
</tbody>
</table>

Total Marks = 500

### B.Sc. (Hons.) 1st year (2nd Semester)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course/Paper</th>
<th>Code</th>
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<th>Practical</th>
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<tr>
<td></td>
<td></td>
<td>Course No.</td>
<td>Marks</td>
<td>Course No.</td>
</tr>
<tr>
<td>1.</td>
<td>English</td>
<td>BIOT-Sem-II-I-T</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Punjabi/HCP</td>
<td>BIOT-Sem-II-II-T</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Basic Biochemistry</td>
<td>BIOT-Sem-II-IV-T</td>
<td>75</td>
<td>BIOT-Sem-II-V-P</td>
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<tr>
<td>5.</td>
<td>Cell Biology</td>
<td>BIOT-Sem-II-V-T</td>
<td>75</td>
<td>BIOT-Sem-II-II-P</td>
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<tr>
<td>6.</td>
<td>General Microbiology</td>
<td>BIOT-Sem-II-VI-T</td>
<td>75</td>
<td>BIOT-Sem-II-III-P</td>
</tr>
</tbody>
</table>

Total Marks = 500

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.
### B.Sc. (Hons.) 2nd year (3rd Semester) (July 2015)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course/Paper</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Theory</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Course No.</td>
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<tr>
<td>2.</td>
<td>Genetics</td>
<td>BIOT-Sem-III-II-T</td>
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<tr>
<td>3.</td>
<td>Immunology-I</td>
<td>BIOT-Sem-III-III-T</td>
</tr>
<tr>
<td>5.</td>
<td>Animal Cell Culture</td>
<td>BIOT-Sem-III-V-T</td>
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</tbody>
</table>

Total Marks = 500

### B.Sc. (Hons.) 2nd year (4th Semester) (January 2016)

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course/Paper</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>Theory</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Course No.</td>
</tr>
<tr>
<td>1.</td>
<td>Immunology-II</td>
<td>BIOT-Sem-IV-I-T</td>
</tr>
<tr>
<td>2.</td>
<td>Biophysical and Biochemical</td>
<td>BIOT-Sem-IV-II-T</td>
</tr>
<tr>
<td></td>
<td>Techniques</td>
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</tr>
<tr>
<td>5.</td>
<td>Agro &amp; Industrial Biotechnology</td>
<td>BIOT-Sem-IV-V-T</td>
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</table>

Total Marks = 500
### Outline of courses for B.Sc. 3\textsuperscript{rd} year Hons.)  Biotechnology

<table>
<thead>
<tr>
<th>Papers</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Theory</th>
<th>Practicals</th>
<th>Total</th>
<th>Work load</th>
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</thead>
<tbody>
<tr>
<td>Paper I</td>
<td>BIOT - 301</td>
<td>Genetic Engineering and recombinant DNA Technology</td>
<td>100</td>
<td>50</td>
<td>150</td>
<td>6 3</td>
</tr>
<tr>
<td>Paper II</td>
<td>BIOT - 302</td>
<td>Tools in Bioinformatics</td>
<td>100</td>
<td>50</td>
<td>150</td>
<td>6 3</td>
</tr>
<tr>
<td>Paper III</td>
<td>BIOT - 303</td>
<td>Animal Tissue Culture and Biotechnology</td>
<td>100</td>
<td>50</td>
<td>150</td>
<td>6 3</td>
</tr>
<tr>
<td>Paper IV</td>
<td>BIOT - 304</td>
<td>Genomics and Proteomics</td>
<td>100</td>
<td>50</td>
<td>150</td>
<td>6 3</td>
</tr>
<tr>
<td>Paper V</td>
<td>BIOT - 305</td>
<td>Bioprocess Engineering and Technology</td>
<td>100</td>
<td>50</td>
<td>150</td>
<td>6 3</td>
</tr>
<tr>
<td>Paper VI</td>
<td>BIOT - 306</td>
<td>Food Biotechnology</td>
<td>100</td>
<td>50</td>
<td>150</td>
<td>6 3</td>
</tr>
<tr>
<td>Paper VII</td>
<td>BIOT - 307</td>
<td>On Job Training</td>
<td>100</td>
<td>----</td>
<td>100</td>
<td>-- --</td>
</tr>
</tbody>
</table>

**Total Marks 1000**

**BIOT- 307: On Job Training**

The job training will be done after completion of B.Sc.2\textsuperscript{nd} year and same will be evaluated in B.Sc.3\textsuperscript{rd} year (BIOT-307).
## B.Sc. (Hons.) 1st year (1st Semester)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course/Paper</th>
<th>Code</th>
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<td>6.</td>
<td>Introduction to Biotechnology</td>
<td>BIOT-Sem-I-VI-T</td>
<td>75</td>
<td>BIOT-Sem-I-IV-P</td>
</tr>
</tbody>
</table>

**Total Marks = 500**
Paper: English
Code No: BIOT-Sem-I-I-T

Semester I
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.5 Memos/Tender Notices/Auction Notices/Public Notices.  

10 marks

Q.6 One short question to test the students’ understanding of various aspects of Business Communication.  

5 Marks
Course Title : PUNJABI    Course Number : 111

बेंच अंद : 50

सिलेबस : 45

हिंदापूर्व आयोगें : 5

पढ़ाबूम

पंजाबी विषय का अभ्यास

प्रेल-विद्यालय

किंवड़वल

वेळम

आउट-आउट (विद्या और वस्त्र संगदि),

मंचापुर : डा. सुविदाकाश सिंह ट्रिट्स डा. विकास बिंध विवेक : जान वालब ट्रिट्स पुलिसवाली,

अभियंत्र, 2006

(2 हिचें 1)
आउट-आउट प्रमोज के विद्या बाहा चिंचे पूरा मिष्टे विशेषविधिए 5 अंद

3+5 = 8 अंद

बेंच विशेषी पुष्ट-प्रमोज (आउट-आउट) सीमा विद्या के ताल

(2 हिचें 1)

विषय प्रकृत-प्रमोज (आउट-आउट) सीमा विद्या के ताल

(7 हिचें 5)

मंचापुर नेता आयक ने मंचापुर नेता चरिफ्ल भक्षियों बाहे प्रेल तिक्टर

(4 हिचें 4)

विशेषविधिए: 3+3+4=10 अंद

(3)

बेंच अभ्यस्तता

(4)

विद्या तथा वस्त्र या मिलके विधान

(5)

आयुविलियां दी कार्य कह लिके

प्रमोज विशेष अभियंता वस्त्र के नीचे, दीक्षा दे बाहराइस

विशेष एक्षम : साधन पाठ वड़ कटी ट्रांस किंवड़ 6 पीटीबाल
SEMESTER I
HISTORY AND CULTURE OF PUNJAB FROM THE EARLIEST TIMES TO 1849
INSTRUCTIONS FOR THE PAPER –SETTER AND CANDIDATES: (FOR PAPER in semester 1 AND 2)

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:

<table>
<thead>
<tr>
<th>Part</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.

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
Instructions for paper setters and candidates

- Set nine questions in all from three sections. All questions carry equal marks.
  - Section A will cover Unit I & II
- Set 2 questions from each unit out of which any 2 are to be attempted
  - Section – B will cover Unit – III & IV
- Set 2 questions from each unit out of which any 2 are to be attempted
  - Section – C will be compulsory and will have 7 – 10 short answer type (not objective type) questions covering the whole syllabus.

Objectives: -
Mathematics

- To study the different concepts of limits, differentiation, integration and calculus so as to apply these concepts in biotechnology.
- To learn solutions to quadratic, cubic equations, differential equation, linear equation and thus study the applications in biotechnology.

Paper: Mathematics

UNIT – I

Numbers
Different kinds of numbers, integer, rational and irrational, surds and their properties, Fractional indices.
Complex numbers, conjugate, modulus and argument of a complex number.

UNIT – II

Set, relation and function
Set, product sets, relations, functions (polynomials, trigonometric, exponential), graphical representation of functions

Limit
Sequences, limits of sequences, series, limits of functions

UNIT III

Calculus
Differentiation: Calculating gradients of chords first and higher order derivatives. Applications increasing and decreasing functions, maximum and minimum points, Derivatives as rates of change.

Integration
Finding a function from its derivative, definite integral, indefinite integral, calculating areas for bounded regions.

Differential Equations
Forming differential equations solving first order differential equation and second order differential equation with constant co-efficients, growth equation, applications.
UNIT – IV
Linear Programming
Elementary statistics

**Representation of Data:** Discrete data, continuous data, histogram, polygons, frequency curves,
The Mean, variability of data-The standard deviation, Median, quintiles, percentile
Skewness

**Reference Books:**
   International, New Delhi).
   and Training, New Delhi).

**Mathematics (Practicals)**

<table>
<thead>
<tr>
<th>Practical : 22 Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Ass.: 3 Marks</td>
</tr>
</tbody>
</table>

1. Computation of mean, variance and standard deviation using given (preferably biological) data (2 to 3 practicals).
2. Sets (Venn-Diagram, Union, Intersection, Difference of sets, Symmetric Difference of sets, Complement of sets) (2 practicals).
3. Relations (graphical representation of relation from set A to set B or set A to set A) (1 practical).
4. Histogram, frequency polygon, ogives, pie chart, bar diagrams (2 to 3 practical).
5. Solving linear programming problem using graphical methods (2 practical).

**Paper: Life Sciences**

<table>
<thead>
<tr>
<th>Theory: 67 Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal Ass.: 8 Marks</td>
</tr>
</tbody>
</table>

**Instructions for paper setters and candidates**

- Set nine questions in all from three sections. All questions carry equal marks.
  - Section A will cover Unit I & II
  - Set 2 questions from each unit out of which any 2 are to be attempted
  - Section – B will cover Unit – III & IV
  - Set 2 questions from each unit out of which any 2 are to be attempted
  - Section – C will be compulsory and will have 7 – 10 short answer type (not objective type) questions covering the whole syllabus.

**Life Sciences**

- To increase scientific vocabulary and understanding of a variety of life science concepts.
- To learn about the anatomy and physiology of animals and animal systems.
- To study ecology and ecosystems.

**Unit-I**

**An introduction to life on earth.**

**Plant Anatomy and Physiology:**

Structure of land plants.
Nutrition and Transport phenomena in plants.
Plant reproduction and development.
Plant responses to the environment.

Unit-II

Ecology:- Community interactions.
Ecosystems:- Definition and components.
Food chain and food web.
Habitat.
Ecological succession.
Types of succession.
Animal behaviour:-Definition and learning.

Unit-III

Animal Anatomy and Physiology:-
Homeostasis and organization of animal body.
Circulation.
Respiration.
Nutrition and digestion.
Urinary system and homeostasis.
The immune response.

Unit-IV

Animal Anatomy and Physiology:-
The endocrine system.
Nervous system.
The senses.
Action and support by the muscles and skeleton system.
Reproduction.

Reference Books:

Life Sciences (Practical)

Practical : 22 Marks
Internal Ass.: 3 Marks

1. To study cell structure from onion leaf peels.
2. To study ultra structure of cell organelles through photographs.
3. To study digestive, Respiratory, Circulatory, Endocrine and Reproductive system of Human body through charts/ model.
4. Study of the slides/specimens and identification with reasons – Bacteria, Oscillatoria, Spirogyra, Rhizopus, Mushroom, yeast, liverwort, moss, fern, lichen, one monocotyledon and dicotyledon.


**Paper: Chemistry**

**Theory: 67 marks**

**Code No: BIOT-Sem-I-IV-T**

**Internal Ass.: 8 Marks**

**Instructions for paper setters and candidates**

- Set nine questions in all from three sections. All questions carry equal marks.
  - Section A will cover Unit I & II
  - Set 2 questions from each unit out of which any 2 are to be attempted
  - Section – B will cover Unit – III & IV
  - Set 2 questions from each unit out of which any 2 are to be attempted
  - Section – C will be compulsory and will have 7 – 10 short answer type (not objective type) questions covering the whole syllabus.

**Objectives:**

- To learn the concepts of chemical thermodynamics, chemical equilibrium and their applications.
- To learn about compounds of carbon, their sources, mechanism of reactions and utility in daily life.
- To study concepts of stereochemistry and spectra of organic molecules.

**UNIT – I**

a) **Chemical bonding:** Elementary treatment of valence bond theory and molecular orbital theory. Ionic bonding, multiple bonds, multi-center bonds, metallic bonding, hydrogen bonding and its significance.

b) **Periodic properties:** Position of elements in the periodic table, effective nuclear charge and its calculation, atomic and ionic radii, ionization energy, electron affinity, electronegativity. Trends in periodic table and application in predicting and explaining the chemical behavior.

c) **Molecular Spectroscopy:** Difference between atomic and molecular spectroscopy, absorption and emission spectroscopy, regions of electromagnetic spectrum. Infrared and Raman spectra, basic principle and information from Infrared and Raman spectra. Principle of NMR, chemical shift values and its applications. Importance of mass spectroscopy in chemistry and biology.

**UNIT – II**

a) **Solutions:** Ideal and non-ideal solutions, method of expression concentrations of solution, activity and activity coefficients, dilute solution, Osmotic pressure, its law and measurements, Elevation of boiling point and depression of freezing points.

b) **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.
UNIT – III

a) **Photochemistry:**

b) **Coordination compounds:** Introduction, Wener’s coordination theory, naming of coordination compounds, isomerism and stereochemistry in coordination compounds

UNIT – IV

a) **Fundamentals:** inductive effect electromeric effect, resonance, hyperconjugation, types of reagents, electrophiles and nucleophiles, types of organic reaction intermediates, carbocations, free radicals, carbenes (with example). Nomenclature and classification of Alkyl halide, method of formation, chemical reaction, mechanisms and stereochemistry of nucleophilic substitution reaction of Alkyl halides, $\text{SN}_2$, and $\text{SN}_1$ reaction with energy diagram.

b) **Carboxylic Acids and derivatives:** Structure of carboxylic acids and derivatives. Acidity of carboxylic acids, effects of substitution on acidic strengths, chemical properties of carboxylic acids. HVZ reaction with mechanism. Relative stability and reactivity and reactivity of acid chloride, esters, anhydrides, amides, mechanism of esterification.

Reference Books:

**Chemistry (Practical)**

1. Inorganic qualitative analysis
2. Four ions including interfering ions.
3. Iodimetry and Iodometry
4. Redox titrations using ceric sulphate, potassium dichromate and potassium permanganate
5. Complexometric titration using EDTA of Ca++, Mg++ and Zn++
6. Analysis of a given organic compound (solid): Elemental Analysis,

**Reference Books:**
Objectives: -
Physics is one of the important basic sciences and Biotechnology is based upon these. Introduction to basic course of Physics will enhance the grasping of subject.

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.

UNIT – II
Coulomb’s law for point charges; electric field due to point charge and electric dipole (on axial line and equator line), 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, capacitance; series and parallel arrangements, energy stored in the electric field of capacitor, current, current density, equation of continuity, Ohm’s law in vector form.

UNIT - III
Interference of waves, phase and path differences, theory of interference fringes, Young’s experiment, coherent sources, Llyod’s mirror, Fresnel Biprism, intensities of maxima and minima.

Diffraction of light, rectilinear propagation, Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at single slit, Rayleigh criterion for resolving power, Resolving power of telescope and microscope, Compound Microscope ( Principle, construction, ray diagram, formula for magnifying power), fluorescent microscope(concept only), Polarization, introduction.

UNIT – IV
Quantum theory of light, X-rays diffraction, Compton effect, Bragg’s law, de Broglie wave equation, phase velocity and group velocity, 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:
2. Electricity and Magnetism : Berkeley physics course vol. II.

Physics (Practical)  
Practical : 22 Marks  
Internal Ass.: 3 Marks

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).

1. Resolving power of Telescope/Microscope.
2. Rotation of the plane of polarization of a solution using a Polarimeter.
3. Use of C.R.O. as a display & measuring device.
4. Capacitance by flashing and quenching of a neon lamp.

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

Paper: Introduction to Biotechnology  
Theory: 67 Marks
Code No: BIOT-Sem-I-VI-T  
Internal Ass.: 8 Marks

Instructions for paper setters and candidates
• Set nine questions in all from three sections. All questions carry equal marks.
  o Section A will cover Unit I & II
• Set 2 questions from each unit out of which any 2 are to be attempted
  o Section – B will cover Unit – III & IV
• Set 2 questions from each unit out of which any 2 are to be attempted
  o Section – C will be compulsory and will have 7 – 10 short answer type (not objective type) questions covering the whole syllabus.

Objectives: -
This course will introduce the basic concepts of biotechnology to the students. They will learn about the history of biotechnology; the foundations of modern biotechnology; the role of biotechnology in fermentation industry, environment and modern medicine and the ethical implications of biotechnology.

Unit-I
Advent, scope and basics of biotechnology
Bacteria as workhorses of biotechnology; E. coli as the model bacterium
Yeast and fungi in Biotechnology
Introduction to multicellular organisms as research models: *Drosophila melanogaster*, *Caenorhabditis elegans*, *Daniorerio*, *Musmusculus*
*Arabidopsis thaliana* as model for plant genetics,
Role of viruses and bacteriophages in biotechnology

**Unit-II**
Structure and function of the cell: the basic unit of life
Prokaryotic and Eukaryotic cells
Biomolecules in a cell (DNA, RNA and proteins)
Introduction to genomics, transcriptomics, proteomics and metabolomics; bioinformatics and its role in biotechnology.
Introduction to basic techniques like sterilization, centrifugation, electrophoresis, chromatography, sonication.
Fundamentals of recombinant DNA technology: Restriction Enzymes, Vectors and their properties.

**Unit-III**
Applications of biotechnology: today and tomorrow
Basics of Biotechnology in fermentation and pharmaceutical processes.
Green technology to control pollution.
Role of biotechnology in diagnostics, introduction to gene therapy.

**Unit-IV**
Biotechnology and society: genetically modified organisms (GMOs) - transgenic plants and animals and their applications in biotechnology.
Public concerns and risks associated with genetic engineering: Bioterrorism and biowarfare.
Ethical, social and legal implications of biotechnology.

**Reference Books:**
Introduction to Biotechnology (Practical)  

Practical : 22 Marks  
Internal Ass.: 3 Marks

1. Introduction and use of basic equipments in a biotechnology laboratory (Auto-pipettes, pH meter, centrifuges, light microscope, electrophoretic apparatus, vortex mixer, magnetic stirrer, rocker, laminar hoods, autoclave, sonicator)

2. Handling and disposal of hazardous reagents (acids, carcinogenic chemicals like acrylamide, ethidium bromide) and concept of chemical hoods

3. Good laboratory practices followed in biotechnology laboratory (sterility, DNase/ RNAse free space, separate area for protein work, possible means of contamination and its control etc)

4. Cell disruption and cell lysis of animal/plant/bacterial cell

5. Separation and estimation of extracellular and intracellular proteins

6. Quantification of nucleic acids by colorimetry (orcinol)

7. Introduction to bioinformatic tools used in biotechnology
### Semester – II

**B.Sc. (Hons.) 1st year (2nd Semester)**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Course/Paper</th>
<th>Code</th>
<th>Theory Course No.</th>
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<td>1.</td>
<td>English</td>
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<td>BIOT-Sem-II-V-P</td>
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<td>5.</td>
<td>Cell Biology</td>
<td>BIOT-Sem-II-V-T</td>
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<td>BIOT-Sem-II-II-P</td>
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<td>6.</td>
<td>General Microbiology</td>
<td>BIOT-Sem-II-VI-T</td>
<td>75</td>
<td>BIOT-Sem-II-III-P</td>
<td>25</td>
<td></td>
</tr>
</tbody>
</table>

**Total Marks = 500**
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.
Websites:
(a) www.chandigarhpolicenic.in
(b) www.punjabpolice.gov.in
(c) www.haryanapolice.gov.in
(d) www.hppolice.nic.in
Paper: English  
Code No: BIOT-Sem-II-I-T

Semester II

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-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 & 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. 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 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.
मभेस्त्र बुधवार
अप्रैल / भागी 2016 के सिम्बियुम राष्ट्रीय

वर्ग अंब: 50
सिफ्टडी: 45
सिमिटर भममेंट: 5
मध्य: 3 पृष्टें

पाठभूमि
1. भंजशी वाणी लय आधिकार
2. पंडव-विषय
3. विषयवस्तु

वेळा
आधार-आधार (बिनर दे बच संज्ञाप)
संध्याकः: डॉ. मूवियली सिविल डॉ. डॉ. पिन्हार सिविल मण्ड़ पुरवार्ड: एकु ठ रंगः देश पुरवार्दालिकी, अभिन्नमय, 2006

1. आधार-आधार पुम्बुर शे वाणी बाना विचें पृथग पड़िया 5 अंब
विषयवस्तु (2 विचें 1)
2. आधार-आधार पुम्बुर विचे विचलीं वाणी रा विचे चेत शे मात 3+5 = 8 अंब
विषयवस्तु (2 विचें 1)
3. वेळा विचली पाठ-पुम्बुर (आधार-आधार) डीवर्सी वाणी रा रवर संध्याकः पुम्बुर विचें लिंडे पृथग शे पंडव (7 विचें 5)
4. मण्डली अने अधिवास शे संख्या शे बर्लुर भममेंट बने पंडव विषयवस्तु 7 अंब
(2 विचें 1)
5. विषयवस्तु:
(3+3+4=10 अंब)
(1) विषयवस्तु विच
(2) वानवे दुः शे पंडव विच
(3) भूमाचार्य शे वानवे विच वानवे
6. पुम्बुर विच पामिन वाणीवाणी शे नीच, रवर शे विषयवस्तु 10 अंब
एसिऑर: मध्य नर्म लय रद्दे विच शी 6 पीलीमय
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)

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:

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:

   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.

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

Max. Marks : 50
Theory : 45
Internal Assessment : 05
Time : 3 Hours

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.).
Instructions for paper setters and candidates

- Set nine questions in all from three sections. All questions carry equal marks.
  - Section A will cover Unit I & II
- Set 2 questions from each unit out of which any 2 are to be attempted
  - Section – B will cover Unit – III & IV
- Set 2 questions from each unit out of which any 2 are to be attempted
  - Section – C will be compulsory and will have 7 – 10 short answer type (not objective type) questions covering the whole syllabus.

Objectives:

- To learn applications of statistics in the field of biology.
- To study concepts of probability, averages, distributions, tests of deviations, correlation and linear regression.
- To learn to design experiments and analysis of results by tests of significance or analysis of variance.

UNIT – I

An introduction, types of data, collection, classification and tabulation of the primary data, secondary data, discrete data and continuous data, diagramatic and graphical representation of grouped data, frequency distribution {univariate and bivariate}, cumulative frequency distribution and their graphical representation, histogram frequency polygon.

Concept of central tendency or location and their measures, partition values: quantiles, deciles and percentiles, dispersion and their measures, relative dispersion.

UNIT – II

Binomial distribution, Poisson distribution as a limiting form of binomial distribution and properties of these distributions, moments, moment generation function, cumulate generating function, geometric distribution and exponential distribution and properties of these distributions.

Normal distribution
Correlation and regression analysis
Hypothesis testing
Markov models
Cluster analysis
  - Nearest neighbor search
  - Search using stem numbers
  - Search using text signature
Concepts of Probability.

UNIT – III

Computers: General introduction to computers, organization of computers, digital and analogue computers, computers algorithms.
Introduction to computers and its uses: Milestones in hardware and software-batch oriented/online/real time applications.
Compute as systems: Basic concepts, stored programs, functional units and their interrelation-communication with computer.

UNIT – IV

Data storage devices:
Primary storage: Storage address and capacity, type of memory.
Secondary storage devices: Magnetic tape-data representation and R/W; Magnetic disks, fixed and removable, data representation and R/W; Floppy and hard disks, optical disks CD-Rom, mass storage devices.
Input/output devices: Key-tape/diskette devices, light pin Mouse, joystick, source data automation.
Printed outputs: Serial, line, page, printers, plotters, voice response units.

Reference Books:

Statistics and Computer Fundamentals (Practical)

Practical: 22 Marks
Internal Ass.: 3 Marks

1. Presentation of data by frequency tables, diagrams and graphs.
2. Calculation of measures of central tendencies, skewness and Kurtosis.
3. Calculation of dispersion.
5. Probability
6. Basics of computer: Basic commands-File creation, copying, moving and deleting in DOS & windows, Using e-mail, browsers, search engines.

Reference Books:
Instructions for paper setters and candidates

- Set nine questions in all from three sections. All questions carry equal marks.
  - Section A will cover Unit I & II
  - Set 2 questions from each unit out of which any 2 are to be attempted
  - Section – B will cover Unit – III & IV
  - Set 2 questions from each unit out of which any 2 are to be attempted
  - Section – C will be compulsory and will have 7 – 10 short answer type (not objective type) questions covering the whole syllabus.

Course Objectives
To make student conversant with the biochemical aspect of cell, chemical structure & function of various biomolecules.

UNIT – I
Water: Physico chemical properties of water, dissociation and association constants. pH and buffers, pl, pka, Henderson Hasselbatch equation and its implications.

Carbohydrates: Structure of important mono, di-, oligo- and polysaccharides, glycoproteins, peptidoglycan, glycolipids and lipopolysaccharides. Reaction of monosaccharides.

UNIT II
Lipids: Classification of lipids and fatty acids, general functions of major lipid subclasses, acylglycerols, phosphoglycerols, phosphoglycerides, sphingolipids, glycosphingolipids and terpenes, sterols, steroids: Prostaglandins.

UNIT – III
Vitamins and hormones: Types of vitamins and their chemistry, vitamins as cofactors, steroids and peptide hormones.

UNIT IV
Proteins: Structure of amino acids, nonprotein and rare amino acids and their chemical reactions. Structural organization of proteins (primary, secondary, tertiary and quaternary domain structure), protein classification and function. Forces stabilizing primary, secondary and tertiary structure.

Reference Books:
Basic Biochemistry (Practical)       Practical: 25 Marks
Internal Ass.: 3 Marks

1. Preparation of physiological buffers.
2. Verification of Beer-Lamberts law for p-nitrophenol.
3. Determination of pKa value of p-nitrophenol.
4. Estimation of carbohydrates in given solution by Anthrone method.
5. The determination of acid value and saponification value of a fat.

Paper: Cell Biology       Theory: 67 Marks
Code No: BIOT-Sem-II-V-T       Internal Ass.: 8 Marks

Instructions for paper setters and candidates
• Set nine questions in all from three sections. All questions carry equal marks.
  o Section A will cover Unit I & II
• Set 2 questions from each unit out of which any 2 are to be attempted
  o Section – B will cover Unit – III & IV
• Set 2 questions from each unit out of which any 2 are to be attempted
  o Section – C will be compulsory and will have 7 – 10 short answer type (not objective type) questions covering the whole syllabus.

Course Objectives
• To understand the detailed overview of eukaryotic cell and its inner components
• To understand the processes of cell transport and cell locomotion
• Introduction to stem cells and their applications

Practical skills will be imparted to the students through critically designed practical related to the subjects.

Unit I
Cell as a basic unit of living systems: the cell theory, pre-cellular evolution, artificial creation of "cells", broad classification and ultrastructure of cell types (PPLOs, Bacteria, eukaryotic microbes, plant and animal cells), tissue, organ and organism at different level of organization of other genetically similar cells; biochemical composition of cells (proteins, lipids, carbohydrates, nucleic acids and metabolic pool).

Ultrastructure of cell membrane and cell organelle: structure and function of cell organelles, ultrastructure of cell membrane, cytosol, golgi bodies, vacuoles, endoplasmic reticulum (rough and smooth), ribosomes, cytoskeletal structures (actin microtubules etc), mitochondria, chloroplast, lysosomes, peroxisomes, nucleus (nuclear membrane, nucleoplasm, nucleolus)

Unit II
Cellular transport: Passive & active transport, permeases, sodium, potassium, Calcium, ATPase pumps, lysosomal and vacuolar membrane, ATP dependent proton pumps, co-transport, symport, antiport, transport into prokaryotic cells, endocytosis and exocytosis, entry of viruses and toxins into cells.
Unit III
Cell locomotion: Amoeboid, Flagellar and Ciliar.
Chromosomes: discovery, morphology, chemical composition, structural organization of chromatids, centromere, telomere, chromatin, nucleosome organization, euchromatin and heterochromatin, special chromosomes (polytene, lampbrush chromosomes), banding patterns in human chromosomes.

Unit IV
Basics of stem cells: Introduction to concepts in stem cell biology, Cell differentiation in multicellular organisms: (renewal, potency: Totipotent, pleuripotent, multipotent); types of stem cells: early embryonic stem cells, blastocyst embryonic stem cells, fetal stem cells, umbilical cord stem cells, adult stem cells; applications; ethical issues related to stem cells.

Reference Books:

Paper: Cell Biology (Practical)

1. To study the parts and function of a light microscope
2. To prepare a wet mount of onion peel for microscopy
3. Counting of cells using haemocytometer
4. Subcellular fractionation of spinach cells
5. To study cell locomotion of amoeba
6. To study flagellar motility in bacteria by hanging drop technique
7. To study cell transport in cell membrane by following experiments
   1) Diffusion through artificial membrane: transport of albumin and glucose solution through dialysis bag.
   2) To study the effect of membrane disrupting agents in beet root
8. Quantitative analysis of cell membrane lipids by TLC

Practical: 22 Marks
Internal Ass.: 3 Marks
Instructions for paper setters and candidates

- Set nine questions in all from three sections. All questions carry equal marks.
  - Section A will cover Unit I & II
  - Set 2 questions from each unit out of which any 2 are to be attempted
    - Section – B will cover Unit – III & IV
  - Set 2 questions from each unit out of which any 2 are to be attempted
    - Section – C will be compulsory and will have 7 – 10 short answer type (not objective type) questions covering the whole syllabus.

Course Objectives

Microbes play significant role in understanding medical science and industries so study of microbes from basic to advance level, with understanding of biochemistry, cell structure and application makes this paper significant.

UNIT – I

Principle of microscopy: Bright field, dark field, phase contrast, fluorescent, electron microscopy.

UNIT – II

Microbial classification: Bacteria, fungi
Morphology of bacteria, viruses and fungi with major emphasis on bacterial structure specially cell wall. Gram positive and Gram negative bacteria. Microbial spores, sporulation/germination process.

UNIT – III

Microbial growth, nutritional biodiversity, phases of growth, generation time, growth rate, monoauxic, diauxic and synchronous growth. Chemostat
Physical and chemical agents to kill microbes, sterilization and pasteurization processes.

UNIT – IV

Normal micro flora in human/ animals. Types of microbial pathogens and diseases caused by them. Microbial interactions like symbiosis and antibiosis. Host defense mechanism against pathogens.

Reference Books:

General Microbiology (Practicals)  

Practical: 22 Marks  
Internal Ass.: 3 Marks  

1. Cleaning of glass wares, preparation of media, cotton plugging and sterilization.  
2. Isolation of microorganisms from air, water and soil samples.  
3. Dilution and pour plating techniques.  
4. Gram staining, spore staining, motility  
5. Growth curve of microorganisms.  

Reference Books:  
B.Sc. (Hons.) 2\textsuperscript{nd} year (3\textsuperscript{rd} Semester)

Paper: Biochemistry  
Course No.: BIOT-Sem-III-I-T

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- Set nine questions in all. All questions carry equal marks.
- Five questions to be attempted.
- Question number one will be compulsory having 7-10 short answer types covering the whole syllabus (Not objective type and no short notes).
- Set two questions from each Unit, and each question should be further divided in two to three parts. Any one question to be attempted from each unit.

Objective: To familiarize the students with the biochemical activities taking place at cellular level, highlighting the enzymatic reactions, metabolic pathways and biochemical aspect.

Unit- I

Unit- II
Carbohydrate metabolism: Biosynthesis and degradation of glucose; feeder pathways of glycolysis; Kreb cycle, amphibolic nature of the Kreb’s cycle; regulation of Krebs cycle, regulation of gluconeogenesis. Glycogen metabolism. Mitochondrial electron transport chain, oxidative phosphorylation; regulation of ATP synthesis.

Unit- III
Lipid Metabolism: Biosynthesis and degradation of fatty acids; $\beta$ oxidation of saturated, unsaturated and polyunsaturated fatty acids. Formation of ketone bodies, their function and physiological significance. Fatty acid synthesis: multifunctional enzyme complex in eukaryotes, function of citrate. Regulation of fatty acid metabolism. Cholesterol metabolism: Biosynthesis of cholesterol and its regulation.

Unit- IV
Amino acid metabolism: Biosynthesis of nutritionally non-essential amino acids; catabolism of carbon skeleton of amino acids. Conversion of amino acids to specialized products; amino acids as precursors of porphyrins, bile pigments and biogenic amines. Nucleic acid metabolism: Biosynthesis of purine and pyrimidine nucleotides; salvage reactions. Catabolism of purines and pyrimidines, urea cycle.

Reference Books:

**Biochemistry (Practical)**

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1. Estimation of DNA by the diphenylamine reaction.
2. Determination of reducing sugars using 3, 5-dinitrosalicylic acid and Benedict’s test.
3. Determination of iodine number of fat.
4. Determination of extinction coefficient of nucleic acids.

**Paper: Genetics**

**Course No.: BIOT-Sem-III-II-T**

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- Five questions to be attempted.
- Question number one will be compulsory having 7-10 short answer types covering the whole syllabus (Not objective type and no short notes).
- Set two questions from each Unit, and each question should be further divided in two to three parts. Any one question to be attempted from each unit.

**Objective:** The focus of this course is on the science of heredity with emphasis on the basics of Mendelian and molecular genetics. It will familiarize students with chromosome organization, linkage, chromosome mapping, chromosome aberrations, mutations and microbial genetics.

**Unit – I**

Mendelian laws of inheritance, Sex determination in drosophila, plants and animals, sex linkage, Non-disjunction as a proof of chromosomal theory of inheritance. Numerical chromosome aberration polyploidy, aneuploidy, Chromosomal aberrations: duplications, inversions, translocations, position effects.
Unit – II
Gene interactions, sex linked inheritance. Crossing over: molecular mechanism and cytological proof, Recombination, linkage, gene mapping, Three point testcross, interference, coincidence, recombination frequencies, Tetrad analysis, somatic cell hybridization for gene linkage studies, Hereditary defects.

Unit – III
Population genetics: Hardy-Weinberg equilibrium, gene and genotypic frequencies, Chi-square test, probability, pedigree analysis.
Mutation: Spontaneous versus induced mutations, types of mutations, mutagenic agents: Physical, chemical and radiation, molecular basis of mutations, mechanisms of DNA repair, mutations frequency, correlation between mutagenicity and carcinogenicity,

Unit – IV
Basic microbial genetics: Conjugation, transduction, transformation, isolation of auxotrophs, replica plating techniques, analysis of mutations in biochemical pathway, one gene – one enzyme hypothesis. Extra chromosomal inheritance: mitochondrial and chloroplast genetic systems.

Reference Books:

Genetics (Practical)

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1. Examination of permanent slides of various stages of mitosis and meiosis and different types of chromosomes.
2. Demonstration of law of segregation and independent assortment (use of dried peas, colored peas, capsules etc.).
4. Use of Chi-square for prediction of phenotype/genotype frequencies of parents from progeny and vice-versa, epistasis.
5. Detection of blood groups (ABO & Rh factors).
6. Calculation of variance in respect of pod length and number of seeds/pod.
7. Calculation of gene frequencies and random mating (colored beads, capsules).
8. Dermatographics: Palm print taking and finger tip patterns.

**Paper: Immunology-I**

**Course No.: BIOT-Sem-III-III-T**

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- Five questions to be attempted.
- Question number one will be compulsory having 7-10 short answer types covering the whole syllabus (Not objective type and no short notes).
- Set two questions from each Unit, and each question should be further divided in two to three parts. Any one question to be attempted from each unit.

**Objectives:** To understand general aspects of immune system like different components of the immune system, Generation and functions of these components, Knowledge of basic immunological techniques.

**Unit-I**

1. **Introduction**
   - i) Overviews of immune system – Historical perspectives
   - ii) Innate and acquired immunity
   - iii) Clonal nature of immune response

2. **Cells of the immune system**
   - Hematopoiesis and differentiation, lymphocyte trafficking, B-lymphocytes, T-lymphocytes, macrophages, dendritic cells, Natural killer cells and lymphocyte activated killer cells, eosinophils, neutrophils & mast cells.

**Unit-II**

3. **Organs of the immune system**
   - Primary and secondary lymphoid organs, systemic function of immune system.

4. **Lymphocyte Trafficking:**
   - Cell surface proteins, Cell Adhesion molecules (Integrin, Selectin, Cadherin family and Ig Superfamily).

5. **Antigen**
   - Immunogenicity Vs. antigenicity, factors effecting immunogeneticity, nature of immunogen, epitopes, heptans and antigenicity, pattern recognition receptors.

**Unit-III**

6. **Immunoglobulins:** Structure of antibody, antibody effector function, antibody classes and biological activities, antigenic determinants on Immunoglobulins, Immunoglobulins superfamilies.

7. **Major histocompatibility complex:**
   - General organization and inheritance, MHC molecules and genes, genetic map, cellular distribution, regulation of MHC expression and disease susceptibility, antigen presentation.
Unit-IV

8. **Hybridoma Technology**: Production of Monoclonal Antibodies, applications of polyclonal and monoclonal antibodies.

9. **Antigen–Antibody interactions**: Strength of interaction, cross reactivity, antibody affinity, avidity. Antigen-antibody interactions as tools for research and diagnosis: precipitation and agglutination reactions, immunodiffusion, immunoelectrophoresis, immunoassays, Enzyme linked immunosorbent assay (ELISA), Radioimmunoassay (RIA), western blot, Immunofluorescence.

Reference Books:

Basic Immunology (Practicals)

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1. Lymphoid organs and their microscopic organization.
2. Differential leucocytes count.
3. Separation of serum from blood.
4. Separation of plasma from blood.
5. Ouchterlony Double Diffusion
6. Radial immuno diffusion test using specific antibody and antigen.
7. Agglutination (Blood group testing).

Paper: Plant Tissue Culture
Course No.: BIOT-Sem-III-IV-T

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• Set two questions from each Unit, and each question should be further divided in two to three parts. Any one question to be attempted from each unit.

**Objective:** To introduce the students with fundamentals and applications of plant tissue culture. This course will expose students to the methods of culturing, maintaining and regenerating plants species.

**Unit – I**
Cellular totipotency and differentiation in plants.
Plant Culture Media and their composition.
Sterilization techniques for glassware and tissue culture media.
Micropropagation: Establishment of aseptic culture, various stages, advantages and disadvantages.

**Unit – II**
Organogenesis; somatic embryogenesis; somaclonal variation, its genetic basis and application in crop improvement. Cell/callus line selection for resistance to herbicide, stress and diseases. Role of tissue culture in rapid clonal propagation, production of pathogen - free plants and "synthetic seeds" haploid and Triploid plant production & their application.

**Unit – III**
Protoplast and somatic hybridization: Isolation, culture and plant regeneration, protoplast fusion, identification and characterization of somatic hybrids, applications of protoplast hybridization technology.

**Unit – IV**
Secondary metabolites: Secondary Plant products from cultured cells and their industrial applications.
Cryopreservation of germplasm: Short term and long term conservation of plant genetic resources, *In situ* and *Ex situ* conservation of plants

**Reference Books:**

**Plant Tissue Culture (Practical)**

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1. Laboratory design set up for a plant tissue culture laboratory.
2. How to clean glass/plastic ware.
3. Preparation of complex nutrient medium (Murashige and Skoog’s medium).
4. To select, prune, sterilize and prepare an explant for culture.
5. To culture different explants for raising callus cultures.
7. To demonstrate various steps of micropropagation.

**Paper: Animal Cell Culture**

**Course No.: BIOT-Sem-III-V-T**

**Theory**: 67 marks  
**Int. assessment**: 08 marks  
**Total**: 75 marks  
**Time**: 3 hours

**Instructions for paper setters and candidates:-**  
• Set nine questions in all. All questions carry equal marks.  
• Five questions to be attempted.  
• Question number one will be compulsory having 7-10 short answer types covering the whole syllabus (Not objective type and no short notes).  
• Set two questions from each Unit, and each question should be further divided in two to three parts. Any one question to be attempted from each unit.

**Objective:** The major emphasis of this course is to introduce the students to the field of Animal cell-culturing and its importance to mankind. The students will also learn the techniques involved in animal cell culture.

**Unit – I**

History of development of cell cultures, natural surroundings for animal cells, simulating natural conditions for animal cells, metabolic capabilities of animal cells.  
Biology of cultured cells: The culture environment, cell adhesion, proliferation, differentiation, signaling, evolution of cell lines. Equipments and materials for animal cell culture technology.

**Unit II**

Introduction to the balanced salt solutions and simple growth medium. Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium. Role of carbon dioxide. Role of serum and supplements.  
Serum & protein free defined media and their application.  
Animal cell culture Techniques: Dispersion and disruption of tissues; primary cultures, anchorage and non-anchorage dependent cells; secondary culture, transformed animal cells.

**Unit – III**

Established/continuous cell lines, commonly used animal cell lines, their origin and characteristics. Maintenance and growth kinetics of cells in culture, differentiation of cells,
Measurement of growth and viability of cells in culture. Cytotoxicity assays & their applications.

**Unit – IV**

Characterization of Cell lines and their authentication, Cell fusion and production of monoclonal antibodies.
Transformation and immortalization, cryopreservation.
Bio-Safety & Bioethics.

**Reference Books:**


**Animal Cell Culture (Practical)**

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1. Fumigation of animal cell culture laboratories.
2. Maintenance of aseptic conditions and sterilization method.
4. Isolation of lymphocytes for culturing.

**B.Sc. (Hons.) 2nd year (4th Semester)**

**Paper: Immunology-II**

**Course No.: BIOT-Sem-IV-I-T**

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- Five questions to be attempted.
- Question number one will be compulsory having 7-10 short answer types covering the whole syllabus (Not objective type and no short notes).
- Set two questions from each Unit, and each question should be further divided in two to three parts. Any one question to be attempted from each unit.
**Objective:** This course will introduce students to the principles of advanced Immunology, both at the molecular and cellular levels.

**Unit-I**

1. **B Cell Activation, Differentiation:** B-Cell Activation and Proliferation, In Vivo Sites for Induction of Humoral Responses, T-dependent and T-independent antigens.

2. **Organization and expression of Immunoglobulins gene:** Genetic model, multigene organization, generation of antibody diversity.

**Unit-II**

3. **Receptors and Signaling:** T-Cell Receptors: Structure and Roles, T-Cell Receptor Complex.

4. **T-Cell Maturation, Activation, and Differentiation:** Thymic Selection of the T-Cell Repertoire, T_{H}-Cell Activation, T-Cell Differentiation, Cell Death and T-Cell populations, Peripheral-T-Cells.

5. **Complement system:** Function, Components- Classic, Alternative, Mannose binding proteins, activation, Regulation of the Complement System, Biological Consequences of Complement Activation.

**Unit-III**

6. **Hypersensitivity:** Type I, Type II, Type III and Type IV Hypersensitivity reactions and their implications.

7. **Autoimmunity:** Organ specific autoimmune diseases: Hashimoto’s Thyroditis, Insulin-dependent Diabetes Mellitus, Grave’s disease, Mysthenia Gravis.

**Systemic Autoimmune Disease:** Systemic lupus Erythematous (SLE).

**Unit-IV**

8. **Transplantation immunology:** Immunologic Basis of Graft Rejection, Clinical Manifestations of Graft Rejection, General Immunosuppressive Therapy, Specific Immunosuppressive Therapy, Immune Tolerance to Allografts, Clinical Transplantation

9. **Vaccines and Vaccination** – principles of vaccination, passive & active immunization, immunization programs, adjuvants, bacterial vaccines, viral vaccines, polysaccharide vaccines, DNA vaccines, recombinant vaccines, vaccines to other infectious agents, tumor vaccines.

**Reference Books:**


**Immunology-II (Practical)**

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1. Performing enzyme linked immunosorbent assay (ELISA).
2. Rocket immuno-electrophoresis for antigen antibody interaction.
3. Isolation of mononuclear cells from peripheral blood and viability test by dye exclusion methods.
4. Total leucocyte count (TLC).
5. Isolation of IgG from serum.

Paper: Biophysical and Biochemical Techniques
Course No.: BIOT-Sem-IV-II-T

Instructions for paper setters and candidates:-
• Set nine questions in all. All questions carry equal marks.
• Five questions to be attempted.
• Question number one will be compulsory having 7-10 short answer types covering the whole syllabus (Not objective type and no short notes).
• Set two questions from each Unit, and each question should be further divided in two to three parts. Any one question to be attempted from each unit.

Objective: To enable the students learn important tools and techniques based on biophysical and biochemical principles so that they can understand application of these techniques in biotechnology

Unit – I
Principle, working and applications of Spectrophotometry (UV & visible) and spectrofluorimetry, Atomic absorption spectrophotometry: Equipment used and applications Infrared and Raman spectroscopy. ORD and circular dichroism, Nuclear Magnetic Resonance and Electron Spin Resonance spectroscopy, Magnetic Resonance Imaging.
Electrophoresis: Principle, types & applications.

Unit – II
Microscopy: Properties; Light and Bright field Microscopy, Dark field Microscopy; Phase contrast, Fluorescent and Confocal microscopy, Electron microscopy: Scanning and Transmission Electron Microscopy.
Centrifugation: Principle, types & applications.

Unit – III
Crystallography: Physical basis of crystallization; formation of crystals; Mounting of crystals X-ray diffraction: Braggs law; Diffraction of x-rays by crystals
Overview of chromatography; Gas chromatography and HPLC

Unit – IV
Radioisotope techniques: Radiotracers; GM counter, proportional and scintillation counters, autoradiography.
Mass spectrometry: Physical basis; Instrument used; ionization modes; Applications Collaboration of MS with other techniques: GCMS and LCMS.

Reference Books:
1. Identification of the provided sample using some of the spectroscopic techniques.
2. Quantitative analysis by UV/Visible spectrophotometry.
3. Use and care of light microscope.
4. Demonstration of radioisotopic techniques
5. Gel filtration chromatography
Transformation of plant cells; different type of vectors including viral vectors and their benefits.

**Unit –II**

Modes of gene delivery in plants: Particle bombardment, electroporation, microinjection; Advantages and disadvantages

Agrobacterium mediated gene transfer, natural pathogen mode of infection, vir gene functions, Ti / Ri plasmids, Screening and selection of transformants, PCR and hybridization methods; Transgene selection and silencing; Generation and maintenance of transgenic plants.

**Unit – III**

Transgenic plants: Genetic modification of plants for herbicide resistance, Pest resistance, virus resistance Bacterial and fungal resistance. Delayed fruit ripening, improved protein composition. Bt cotton, golden rice and some others as examples.

**Unit – IV**

Plant cell as factories for production of industrial enzymes, biodegradable plastics, antibodies, edible vaccines; manipulation of metabolic pathways for production of fatty acids, industrial oils, terpenoids, flavanoids.

**Reference Books:**

**Plant Biotechnology (Practicals)**

Practical : 22 marks
Int. assessment : 03marks
Total : 25 marks
Time : 3 hours

1. Aseptic culture techniques for establishment and maintenance of cultures
2. Preparation of stock solutions of MS basal medium and plant growth regulator stocks.
3. Micropropagation of Tobacco plant by leaf disc culture.
4. Isolation of plant genomic DNA by modified CTAB method.
5. DNA check run by Agarose Electrophoresis.
6. Agrobacterium tumefaciens-mediated plant transformation.

**Paper: Animal Biotechnology**

**Course No.: BIOT-Sem-IV-IV-T**
Instructions for paper setters and candidates:-
• Set nine questions in all. All questions carry equal marks.
• Five questions to be attempted.
• Question number one will be compulsory having 7-10 short answer types covering the whole syllabus (Not objective type and no short notes).
• Set two questions from each Unit, and each question should be further divided in two to three parts. Any one question to be attempted from each unit.

Objective: The major emphasis of this course is to introduce the students to the advances in the field of Animal and their importance to mankind.

Unit-I
Organotypic and histotypic cultures: Organotypic culture: Gas and nutrient exchange, structure integrity, growth, differentiation, advantages and applications. Methods, advantages and applications of histotypic culture.
Three dimensional culture and tissue engineering: Concept of tissue engineering, components of tissue engineering, cells imaging in 3D construct.

Unit-II
In vitro fertilization (IVF) in Humans and Embryo Transfer in Livestock.
Cell culture based vaccines: Cells as virus host/cell culture based vaccines, cells as protein factory/cell expression system and cells as antigen presenter/personalized vaccine.
Scaling up of the animal cell culture: different methods of scale up at laboratory and industrial level.

Unit-III
Transgenic animals and their applications: Concept of transgenics, Methods of gene transfer, selection of clone containing DNA insert and application of transgenic animals (Food, environment, recombinant proteins, drugs etc.). Safety and ethical issues of transgenic animals.

Unit-IV
Production of various products of human use using animal cell culture:
Antibiotics production
Human Growth factors
Insulin and other Hormones

Essential Readings:
3. Animal cell culture and technology by Michaelis Butler. BIOS Scientific Publisher (2003).

**Animal Biotechnology (Practicals)**

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1. Growing the cell monolayers, *in vitro*.
2. Trypsinization of the monolayers and cell counting using hemocytometer.
3. To check the viability of the cells using Trypan Blue dye exclusion assay.
4. Checking the cytotoxicity of the compounds using MTT Assay.

**Paper: Agro & Industrial Biotechnology**

**Course No.: BIOT-Sem-IV-V-T**

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- Five questions to be attempted.
- Question number one will be compulsory having 7-10 short answer types covering the whole syllabus (Not objective type and no short notes).
- Set two questions from each Unit, and each question should be further divided in two to three parts. Any one question to be attempted from each unit.

**Objective:** This course will introduce students to the concepts of agriculture as industry. This course will help students to understand the application of fundamental concepts like transgenic approaches to improve crop plants, microbial culture maintenance, and metabolite purification at industrial level.

**Unit I**

Basic concept of agriculture as industry: Industrially important microbes, its screening, selection and identification.
Maintenance and preservation of industrially important microbial cultures.
Differences between microbial industrial process and chemical industrial process.

**Unit II**

Improvement programme of industrial microbes, mutational programme of penicillin producing microorganisms, selection pressure in maintaining the hyper producer, lowering of production due to reversal of mutations, media formulation and process optimization of industrial and agro industrial microbes.

**Unit III**

Microbes in agro industries and industrial biotechnology: Introduction of primary and secondary metabolites, production of vitamin B12, alcohol, wine, beer, cheese, bread, citric acid, gluconic
acid, antibiotics (penicillin), enzymes (amylases, cellulases, lipases and proteases) and their industrial applications.

**Unit IV**


**Reference Books:**

**Agro & Industrial Biotechnology (Practicals)**

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1. Counting of Microbial cells by serial dilution techniques (Spread plate and pour plate).
3. Screening of industrial enzymes (cellulase, protease, amylase *etc.* ) from different soil samples.
4. Production of enzymes by submerged and solid state fermentation.
B.Sc. (Biotechnology) 3rd Year

BIOT-301: Genetic Engineering and Recombinant DNA Technology

Theory : 90 marks
Int. assessment : 10 marks
Total : 100 marks
Time : 3 hours

Instructions for paper setters and candidates

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• Five questions to be attempted.
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• Set two questions from each Unit, and each question should be further divided in two to three parts. Any one question to be attempted from each unit.

Unit – I

Introduction to gene cloning, DNA manipulative enzymes-Nucleases, ligases, polymerases, modifying enzymes, restriction enzymes and its nomenclature, reverse transcriptase, topoisomerases, plasmids- Basic features of plasmids, plasmid classification, blunt and sticky ends, linkers, adapters, homopolymer tailing.

Unit – II

Vectors: Cloning vectors for *E. coli* - Nomenclature, pBR322, pBR327, pUC8, pGEM3Z.


Unit – III

Cloning vectors for yeast and fungi, YEp, YIp, YRp, artificial chromosomes, YAC, application of YAC, identification of a recombinant from a gene library, methods of clone identification, radioactive and non-radioactive DNA and RNA labeling techniques, nick translation, random priming, Site directed mutagenesis (cassette, primer extension, RT, real time, multiplex, inverse), DNA sequencing (Maxam-Gilbert, Sanger, pyro).
Unit- IV

Southern, Northern and western blotting, colony hybridization, in situ hybridization, dot blot technique, genomic cloning, transformation of E. coli, yeast and plant cells.

PCR: Types, applications and limitations.

Applications of rDNA technology to medicine, agriculture & environment.

Reference Books:


BIOT- 301: Genetic Engineering and recombinant DNA Technology (Practicals)

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1. DNA isolation from plants.
2. DNA isolation from E. coli.
3. Spectrophotometer analysis of DNA.
4. Agarose gel electrophoresis of DNA.
5. Plasmid DNA isolation.
6. Restriction digestion of DNA.
7. Demonstration of Southern blotting.
8. Preparation of competent cells.
10. Demonstration of PCR.

Reference Books:

BIOT- 302: Tools in Bioinformatics

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Instructions for paper setters and candidates

- Set nine questions in all. All questions carry equal marks.
- Five questions to be attempted.
- Question number one will be compulsory having 7-10 short answer types covering the whole syllabus (Not objective type and no short notes).
- Set two questions from each Unit, and each question should be further divided in two to three parts. Any one question to be attempted from each unit.

Unit – I

Introduction to bioinformatics

Introduction, overview and needs of bioinformatics technology.

Biological databases

Primary Databases: Nucleotide sequence database (GenBank, EMBL), protein sequence database.
Secondary Databases: SwissProt/TrEMBL, conserved domain database, Pfam.
Molecular Structure Databases: Protein Data Bank (PDB), SCOP, CATH.
Understanding the structure of each database and using it on the web, searching database using SRS, Entrez.

Unit – II

Sequence analysis

Introduction to sequence alignment and its applications.

Pair wise sequence alignment: Concept of global and local alignment, Dot Plot, algorithm for pair wise sequence alignment (Needleman Wunsch, Smith-watterman methods), Introduction to BLAST, types of BLAST, algorithm of BLAST and interpretation of its result.


Multiple sequence alignment: Methods of multiple sequence alignment, Tools of MSA–ClustalW, TCoffee; Position specific scoring matrices, introduction to consensus sequences, motifs and profiles.
Unit – III

Phylogenetic Analysis

Introduction to phylogenetic analysis and its application, phylogenetic tree topologies, methods of phylogenetic tree construction and tools.

Genome Annotation

Concept of genome annotation, methods of gene identification.

Tools of gene identification: GenScan, Grail, GeneID and Glimmer.

Unit – IV

Protein Structure Prediction

Concepts and strategies of protein structure prediction, methods of secondary structure prediction, methods of protein tertiary structure prediction.

Structure visualization tool – RasMol.

Reference Books:


BIOT- 302: Tools in Bioinformatics (Practicals)

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</table>

2. Performing DOTPLOT on web.
3. Retrieving amino acid and nucleotide sequence from sequence databases using Entrez.
4. Performing BLASTp/n and interpreting its results.
5. Performing PSI-BLAST.
7. Finding ORF in nucleotide sequence using NCBI ORF FINDER.
8. Using GenScan to identify exons in nucleotide sequence.
9. Download protein structure form PDB and visualize it using RasMol.
Reference Books:


BIOT-303: Animal Cell Culture and Biotechnology

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Unit – I

History of development of cell cultures, the natural surroundings for animal cells, stimulating natural conditions for animal cells, metabolic capabilities of animal cells.

Animal cell culture Techniques: Dispersion and disruption of tissues; primary cultures, anchorage and non-anchorage dependent cells; secondary culture, transformed animal cells, established/ continuous cell lines measurement of growth and viability of cells in culture, tissue culture media: Components their importance, serum free media.

Unit – II

Cell lines availability, commonly used animal cell lines, their origin and characteristic, growth kinetics of cells in culture, differentiation of cells, organ culture, expressing cloned protein genes in animal cell cultures. Cytotoxicity assays & their applications.

Unit – III

Applications of animal cell culture:
Cell fusion and production of monoclonal antibodies
Scale up methods for propagation of anchorage dependent and suspension cell culture
Bioreactors for large scale culture of cells. Micro carrier culture.
Transplanting cultured cells.

Unit – IV

Genetic engineering in production or regulatory proteins, blood products, vaccines and hormones, transgenic animals and production of useful products in transgenic animals. In vitro fertilization, embryo transfer. Cloning: Methodology and its applications, ethics in cloning.
Reference Books:

2. Jenkins, Nigel. Animal Cell Biotechnology: Methods and Protocols

BIOT- 303: Animal Cell Culture and Biotechnology (Practicals)

<table>
<thead>
<tr>
<th>Practical</th>
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<tbody>
<tr>
<td>1. Sterilization techniques: Theory and practical</td>
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<td>a). Glass ware sterilization</td>
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<td>b). Media sterilization</td>
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<td>c). Fumigation of laboratories.</td>
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<td>2. Sources of contamination and decontamination measures.</td>
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<td>3. Preparation of Hanks balanced salt solution.</td>
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<td>5. Isolation of lymphocytes for culturing.</td>
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<td>6. Primary lymphoid culture.</td>
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<td>7. DNA isolation and its quantification from animal tissue.</td>
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<td>8. Resolving DNA on agarose Gel.</td>
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| Time | 3 hours |

Reference Books:

BIOT- 304: Genomics and Proteomics

Theory : 90 marks
Int. assessment: 10 marks
Total : 100marks
Time : 3 hours

Instructions for paper setters and candidates

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Unit – I
Organization and structure of genome
Model organisms and genome size.
Unicellular and multicultural genome: Lessons learned, sequencing of genomes, evolution of genome.
Genome identification.
Mapping of genome
Construction of genomic libraries, vector, mapping strategies (genetic maps, physical maps, cytological maps, comparative maps) and techniques (FISH, radiation hybrid mapping, finger printing)

Unit – II
cDNA library construction and screening
Methods development, justification for subtraction, normalization and fingerprinting; identification of cDNA’s encoding rare messages, EST projects and their utility in research
Next generation sequencing techniques
Sequencing by synthesis: Solexa & 454.
Sequencing strategies for human genome.

Unit – III
Genome annotation and bioinformatics
How to identify genes, inferring gene function, database construction and searching.
Comparative genomics
Protein evolution from exon shuffling, protein structural genomics, gene function by sequencing comparison.
Global expression profiling
Whole genome analysis of mRNA and protein expression, types of microarray and applications.

Unit – IV

Proteomics:
Definition of Proteome
Tools for proteomics: 2D Electrophoresis, High throughput techniques for proteome analysis (Protein arrays)
Applications of Proteomics
**Mapping protein interactions**

Methods- Two hybrid, phage display, mass spectrometry.

**The Rise of Omics**

Impact on other fields (toxicogenomics, chemical genomics, Pharmacogenomics).

**Reference Books:**


**BIOT – 304: Genomics and Proteomics**

**Practical: 45 Marks**

**Int. Assesment: 05 Marks**

**Total: 50 Marks**

**Time: 3 hrs.**

1. RFLP
2. Database Searching from NCBI and EBI
3. Demonstration of Mass Spectrometry
4. Genome Mutagenesis by chemical and radiation method
5. Southern blotting
6. Protein – Protein interaction
7. RNA Isolation
8. Acquaintance/use of Genome Sequencing Software

**Reference Books:**

BIOT-305: Bioprocess Engineering and Technology

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- Set two questions from each Unit, and each question should be further divided in two to three parts. Any one question to be attempted from each unit.

**Unit – I**

Fundamental principles of biochemical engineering
Sterilization of air and media sterilization, design of batch sterilization process.
Del factor, sterilization cycle, continuous sterilization process, sterilization of fermenters.

**Unit – II**

**Microbial growth kinetics**

Simple kinetics of microbial growth, yield coefficient, doubling time, specific growth rate, substrate inhibition kinetics, product inhibition kinetics, internal and external feed back systems, metabolic and Biomass productivities, effect of temperature and pH on the product formation

**Unit – III**

**Design of fermenter**

Introduction
Types of fermenters: Batch, fed batch, CSTBR, plug flow and air lift.
Aseptic operation of the fermenters, control and measurement equipments of fermenters, pH and DO probes, impeller and spargers, agitation and its kinetics.

**Unit – IV**

**Down stream processing**

Removal of microbial cells and other solid materials, foam separations, filtration, industrial filters, centrifugations and industrial centrifuges, cell Disruption, aqueous two phase extraction system, super critical extraction, whole broth process.
Effluent treatment: Aerobic and anaerobic slug treatment process.
Fermentation economics

**Reference Books:**


**BIOT- 305: Bioprocess Engineering and Technology (Practicals)**

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1. Demonstration of sterilization of fermenters and other accessories.
2. Determination of doubling time, yield coefficient for growth of microorganism.
4. Determination of $K_L a$ for given process.
5. Determination and BOD and COD value of given waste sample.

**Reference Books:**

BIOT-306: Food Biotechnology

Instructions for paper setters and candidates

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Unit – I

Food and Microorganisms: Composition of food, food as substrates for microbes (intrinsic and extrinsic factors), factors affecting growth of microorganisms, role of microbes in the production of new proteins, food SCP-mushroom, food yeast’s, algal proteins, applications of enzymes in food processing.

Fermented foods: Bread, cocoa, coffee, tea, cheese, yoghurt, meat and alcoholic beverages.

Unit – II

Principles of food preservation: Physical, chemical, and biological methods of preservation.

Contamination, preservation and spoilage of different kind of foods: Milk and milk products (milk, butter, yoghurt and cheese), beverages (alcohols, tea and coffee), meat and fish products (flesh foods), vegetables and fruits.

Unit – III

Food adulterants and food additives: Major food adulterants, types and their methods of assay, food additives their function and uses, flavoring agents, coloring agents and vitamins as food additives.

Probiotics, biofortified foods, fortified foods, functional foods, nutraceuticals, organic foods.

Biotechnology and future foods (Golden rice, protato).

Unit – IV

Food and water borne diseases: Shigellosis, salmonellosis, cholera.

Food borne intoxications: Staphylococcal, Bacillus and Clostridium.
Detection of microorganisms in food: Sampling plan & procedure for microbial analysis; Qualitative methods to isolate pathogenic microorganisms, test for bacterial toxins in foods;

Quantitative methods for microbial enumeration: Direct enumeration, indirect estimations and standard and recommended methods; Rapid methods and automation: Immunoassays, nucleic acid probe for detection of pathogens.

Reference Books:


**BIOT- 306: Food Biotechnology (Practicals)**

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1. Isolation and identification of microorganisms in spoiled food (fungi and bacteria).
2. Inhibitory effect of low temperature on microbial growth.
3. Production and estimation of ethanol.
4. Production of vinegar.
5. Estimation of lactose in milk.
6. Methylene blue reductase test (MBRT) for determination of quality of milk.
7. Plating the milk samples for microbial contamination.
8. Demonstration for the identification of mushrooms by spore prints.
9. Checking the effect of pasteurization of milk by alkaline phosphatase.

Reference Books:


**BIOT- 307: On Job Training**

Job training for 4-6 weeks during the summer vacations at the end of the B.Sc. 2nd year and should be evaluated in the B.Sc. 3rd year. The report to be presented before the three member committee to be appointed by Principal.

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