# B.Sc. (Hons.) Biotechnology (Semester System)

## Examinations (Session 2020-21)

### B.Sc. (Hons.) 1st year (1st Semester) (July 2020)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course/Paper</th>
<th>Code</th>
<th>Theory</th>
<th>Practical</th>
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</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-101-T</td>
<td>50</td>
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<tr>
<td>2.</td>
<td>Punjabi/HCP</td>
<td>BIOT-102A/102A-T</td>
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<td>3.</td>
<td>Mathematics/Life Sciences</td>
<td>BIOT-103A/103A-T</td>
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<td>4.</td>
<td>Chemistry</td>
<td>BIOT-104-T</td>
<td>75</td>
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<td>5.</td>
<td>Physics</td>
<td>BIOT-105-T</td>
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<td>BIOT-105-P</td>
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<td>6.</td>
<td>Introduction to Biotechnology</td>
<td>BIOT-106-T</td>
<td>75</td>
<td>BIOT-106-P</td>
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Total Marks = 500

### B.Sc. (Hons.) 1st year (2nd Semester) (January 2021)

<table>
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<td>Course No.</td>
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<tr>
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<td>4.</td>
<td>Basic Biochemistry</td>
<td>BIOT-204-T</td>
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<td>5.</td>
<td>Cell Biology</td>
<td>BIOT-205-T</td>
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<td>6.</td>
<td>General Microbiology</td>
<td>BIOT-206-T</td>
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</table>

Total Marks = 500

The issue regarding the Semester in which the students are to be appear in the compulsory qualifying paper of ‘Environment & Road Safety’ is under consideration and the sorted matter will be uploaded in due course.
### B.Sc. (Hons.) 2nd year (3rd Semester) (July, 2020)

<table>
<thead>
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<th>S. No.</th>
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<td>2.</td>
<td>Genetics</td>
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<td>Immunology-I</td>
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<td>Plant Tissue Culture</td>
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<td>Animal Cell Culture</td>
<td>BIOT-Sem-III-V-T</td>
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Total Marks = 500

### B.Sc. (Hons.) 2nd year (4th Semester) (January, 2021)

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<td>Immunology-II</td>
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<td>2.</td>
<td>Biophysical and Biochemical Techniques</td>
<td>BIOT-Sem-IV-II-T</td>
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<td>Plant Biotechnology</td>
<td>BIOT-Sem-IV-III-T</td>
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<td>4.</td>
<td>Animal Biotechnology</td>
<td>BIOT-Sem-IV-IV-T</td>
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<td>Agro &amp; Industrial Biotechnology</td>
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# B.Sc. (Hons.) Biotechnology (Semester System)
## Examinations (Session 2020-21)

### B.Sc. (Hons.) 3rd year (5th Semester)

<table>
<thead>
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<th>S.No.</th>
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<td>Environmental Biotechnology</td>
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<td>4.</td>
<td>Enzymology</td>
<td>BIOT-Sem-V-IV-T</td>
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<td>5.</td>
<td>Summer Training</td>
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<td>BIOT-Sem-V-V-P</td>
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### B.Sc. (Hons.) 3rd year (6th Semester)

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<td>2.</td>
<td>Bioprocess Engineering and Technology</td>
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<td>3.</td>
<td>Food Biotechnology</td>
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<td>4.</td>
<td>Genomics and proteomics</td>
<td>BIOT-Sem-VI-IV-T</td>
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<td>5.</td>
<td>Intellectual property rights and Ethical Issues in Biotechnology and Entrepreneurship</td>
<td>BIOT-Sem-VI-V-T</td>
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**Total Marks = 500**
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<td>1.</td>
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<td>4.</td>
<td>Chemistry</td>
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<td>5.</td>
<td>Physics</td>
<td>BIOT-105-T</td>
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<td>6.</td>
<td>Introduction to Biotechnology</td>
<td>BIOT-106-T</td>
<td>75</td>
<td>BIOT-106-P</td>
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Total Marks = 500
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 communications and language learning 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 the 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 fussiness communication in particular, communication within organisations, 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. science in general or a specific area of science they are specializing in. Preferably, they should be given minor projects (to be completed within less than two weeks, and length not exceeding 10 pages) in consultation with teachers of science. However, the evaluation of the projects should be done only by the Language Teachers, who must keep all the basic criteria of good writing in mind while doing so.

(Note: In case of private candidates and students of School of Open Learning, the marks obtained by them out of 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)
Q1. 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.**

Q2. 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 only 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).

Q3. 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**

**Section II**

Q.4  This question shall test a student’s ability to write letters 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. **5 marks**

Q.6  One short questions to test the students’ understanding of various aspects of Business communication. **5 marks**

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**Semester I**

**Paper : HISTORY AND CULTURE OF PUNJAB FROM THE EARLIEST TIMES TO 1849**

**Course No: BIOT-102A-T**

Instructions for the paper-setter and candidates: (for paper in Semester I & II)

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 25-30 words each. of 1 mark. 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 5 places on map of 1 marks each and write explanatory note on any four of 1 marks each.
3. The paper-setter would avoid repetition between different types of question within one question paper.
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
7. Sikhism: new ideology of Guru Nanak; evolution of Sikh communityguruship,manji,masand; new institutions-gurdwara, sangat-pangat.
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, MunshiRam 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 .
Paper: Mathematics  
Course No: B1OT-103A-T

Theory : 67 marks  
Int. Assessment : 08 marks  
Total : 75 marks

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.

Objectives: -

• 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.

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:

**Mathematics (Practicals)**

Course No: **BIOI-103A-P**

**Practical : 22 Marks**
**Int. Assessment : 03 Marks**
**Total :25 Marks**

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. Functions (Graph of standard functions, modulus, greatest, integer, exponential, logex, signum, sin, cos, tan, cot, sec, cosec,) (2 to 3 practicals).
5. Increasing and Decreasing (Polynomial functions) – wavy curve method (2 practicals).

**Paper: Life Sciences**

Course No: **BIOI-103B-T**

**Theory: 67 marks**
**Internal Assessment: 8 marks**

**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.

**Objectives:**

- 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: Vascular system of dicot and monocot plants
Nutrition and Transport phenomena in plants.
An Introduction to Plant reproduction.
Plant responses to the environment (Short day and Long day Plants).

**Unit-II**

**Ecology:** Community interactions.

**Ecosystems:** Definition and components.

Food chain and food web.
Habitat.
Ecological succession.
Types of succession.

**Unit-III**

**Animal Anatomy and Physiology:**
Homeostasis and organization of animal body.
Circulation: Human Circulatory system, Mechanism of Circulation, Cardiac cycle
Respiration: Organs of respiration, mechanism of breathing, Exchange of gases
Nutrition and digestion: Mechanism of digestion of proteins and carbohydrates.
The immune response in Animals: B Cells and T Cells

Unit-IV

Animal Anatomy and Physiology:--
The endocrine system: Define glands, Pitutary, Pancreas, Thyroid and Parathyroid
Action and support by the muscles and skeleton system.
Reproduction: An introduction to reproduction in animals.

Reference Books:

Life Sciences (Practical)
Course No: BIOT-103B-P

Practical : 22Marks
Int. Assessment : 03 Marks
Total : 25 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.
5. Study of the slides/specimens and identification with reasons – Amoeba, Hydra, Tapeworm, Roundworm, Earthworm, Cockroach, Pila, Starfish, Shark Labeo, Frog, Lizard, Pigeon and Rabbit

Paper : Chemistry
Course No: BIOT-104-T

Theory : 67 marks
Int. Assest. : 08 marks
Total : 75 marks

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:
Without chemical reactions, biological systems cannot work. So understanding the concepts of basic chemistry inorganic, organic and various laws and their applications in Biotechnology is important.

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:** Absorption of light, Lambert-Beer Law, Photochemical principles, Stark-Einstein Law of Photochemical equivalence, Quantum yield of a photochemical reaction (with example). Fluorescence and Phosphorescence.

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 nucleophillic substitution reaction of Alkyl halides, SN2, and SN1 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:**

**Paper: Chemistry (Practicals)**

**Course No:** BIOT-104-P

Practical : 22 marks  
Int. Assessment : 03 Marks  
Total : 25 marks
1. Four ions including interfering ions.
2. Iodimetry and Iodometry
3. Redox titrations using ceric sulphate, potassium dichromate and potassium permanganate
4. Complexometric titration using EDTA of Ca++, Mg++ and Zn++
5. Analysis of a given organic compound (solid): Elemental Analysis,

Reference Books:

Paper: Physics Theory: 67 Marks
Code No: BIOT-105-1 Int Assess: 08 Marks

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.

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.

**Paper: Physics (Practical)**

Course No: BIOT-105-P

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.

**Paper: Introduction to Biotechnology**

Course No: BIOT-106-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.

**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
*Saccharomyces cerevisiae* and *Neurospora* in Biotechnology
Introduction to multicellular organisms as research models: *Drosophila melanogaster, Caenorhabditis elegans, Danio rerio, Mus musculus.*
*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 concept of genomics, transcriptomics, proteomics and metabolomics;
Introduction to basic techniques like sterilization, centrifugation, electrophoresis, chromatography, sonication.
Fundamentals of recombinant DNA technology: Restriction Enzymes, Type II Restriction endonucleases,
Vectors based on E.coli plasmids and their properties: pBR322, pBR327, pUC8.

Unit-III
Applications of biotechnology: today and tomorrow
Basics of Biotechnology in fermentation 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)
Course No: BIOT-106-P
Practical : 22 Marks
Int. Assess: 03 Marks
1. Introduction and use of basic equipment’s 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 (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. Sterilization techniques
6. Introduction to bioinformatic tools used in biotechnology.
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<td>1.</td>
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<td>4.</td>
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<td>BIOT-206-P</td>
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Total Marks = 500
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 learning 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 the 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) 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 and Group discussion etc.

Practical work:-
Teacher should assign some project or practical work to the students. This should be in the nature of guided activity, which the students shall have to complete under the direct supervision of the teacher. The students may be given projects on a variety of subjects relating to their discipline i.e. science in general or a specific area of science they are specializing in. Preferably, they should be given minor projects (to be completed within less than two weeks, and length not exceeding 10 pages) in consultation with teachers of science. However, the evaluation of the projects should be done only by the Language Teachers, who must keep all the basic criteria of good writing in mind while doing so.

(Note: In case of private candidates and students of School of Open Learning, the marks obtained by them out of 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)

Q1. 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.
Q2. 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 only 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).

Q3. 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

**Section II**

Q.4 This question shall test a student’s ability to write letters 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 questions to test the students’ understanding of various aspects of Business communication.  

5 marks

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**B.Sc. Ist Year 2nd Semester**

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

**Course No: BIOT-202A**

Max. Marks : 50

Theory : 45  
Internal Asst : 5  
Time : 3 Hours

Instructions for the paper-setter and candidates: (for paper in Semester I & II)

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 25-30 words each. of 1 mark. 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 5 places on map of 1 marks each and write explanatory note on any four of 1 marks each.

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

Max. Marks : 50
Objectives: To introduce the students to the history of Punjab region.

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.

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 os the Punjab, Part II(Medieval Period), Publication Bureau, Punjabi University, Patiala 1990(3rd edn.).

Paper: Statistics & Computer Fundamentals
Course No: BIOT-203-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.

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 neighbour 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:

Paper: Statistics and Computer Fundamentals (Practical)  Pract: 22 Marks
Course No: BIOT-203-P  Int Assess: 03 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:

Paper: Basic Biochemistry
Course No: BIOT-204-T

Theory: 67 Marks
Int Assess: 08 Marks

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.

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, p1, pka, Henderson Hasselbatch equation and its implications.

UNIT II
Lipids: Classification of lipids and fatty acids, general functions and structure 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 co-factors, steroids and peptide hormones.
Nucleic Acids: Structures of RNA & DNA

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:
Paper: Basic Biochemistry (Practical)
Course No: BIOT-204-P

1. Preparation of physiological buffers.
2. Verification of Beer-Lamberts law for p-nitrophenol.
3. Determination of Ka 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.

Practical: 22 Marks
Int. Assess: 03 Marks

Paper: Cell Biology
Course No: BIOT-205-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.

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 comparison 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)                           Practical : 22 Marks
Course No: BIOT-205-P                                      Int. Assess: 03 Marks

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

Paper: General Microbiology                                Theory: 67 Marks
Course No: BIOT-206-T                                        Int Asess: 08 Marks

Instructions for paper setters and candidates.
• Pattern Change should be UNIT wise.

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, fluroscent, 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. Types of microbial pathogens and diseases caused by them. Microbial interactions like symbiosis and antibiosis. Host defense mechanism against pathogens.

**Reference Books:**

**Paper: General Microbiology (Practical)**** Practical: 22 Marks**
Course No: BIOT-206-P **Int Assess: 03 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
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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\begin{tabular}{cc}
\textbf{Theory} & 67 marks \\
\textbf{Internal assest} & 08 marks \\
\textbf{Total} & 75 marks \\
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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.

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 cycle; regulation of Kreb 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; β-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)

Practical : 22 marks

Int. assessment : 03 marks

Total : 25 marks

Time : 3 hours

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

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 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 aberrations: polyploidy, aneuploidy, Chromosomal aberrations: Delition, 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)

Practical : 22 marks
Int. assessment : 03 marks
Total : 25 marks

Time : 3 hours

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

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.

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 immunogeniticy, 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


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:


Paper: Immunology-I (Practicals)
Course No.: BIOT-Sem-III-III-P

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

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

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: 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, proplast fusion, identification and characterization of somatic hybrids, applications of proplast 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)

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

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 characteristic. 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)

Practical : 22 marks

Int. assessment : 03marks
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) (January, 2019)

<table>
<thead>
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<th>Course/Paper</th>
<th>Code</th>
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<td>Course No.</td>
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<td>Immunology-II</td>
<td>BIOT-Sem-IV-I-T</td>
<td>75</td>
<td>BIOT-Sem-IV-I-P</td>
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<td>2.</td>
<td>Biophysical and Biochemical Techniques</td>
<td>BIOT-Sem-IV-II-T</td>
<td>75</td>
<td>BIOT-Sem-IV-II-P</td>
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<tr>
<td>5.</td>
<td>Agro &amp; Industrial Biotechnology</td>
<td>BIOT-Sem-IV-V-T</td>
<td>75</td>
<td>BIOT-Sem-IV-V-P</td>
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</tbody>
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Total Marks = 500
B.Sc. (Hons.) 2nd year (4th Semester)

Paper: Immunology-II
Course No.: BIOT-Sem-IV-I-T

Theory : 65 marks
Int. assessment : 10 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: This course will introduce students to the principles of advanced Immunology, both at the molecular and cellular levels.

Unit-I


Unit-II


Unit-III

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


Systemic Autoimmune Disease: Systemic lupus Erythmatosus (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)

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

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

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: 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 spectroflourimetry, Atomic absorption spectrophotometry: Equipment used and applications


Unit – II

Microscopy: Properties; Light and Bright field Microscopy, Dark field Microscopy; Phase contrast, Fluorescent and Confocal 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:


Biophysical And Biochemical Techniques (Practicals)

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

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

Paper: Plant Biotechnology
Course No.: BIOT-Sem-IV-III-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 objective of this course is to familiarize the students with different aspects of plant molecular biotechnology and techniques for plant genetic manipulations.

Unit – I

Genetic material of plant cells with an introduction to chloroplast and mitochondrial DNA.

Plant Promoter, Plant Selection markers and reporter genes.

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:


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

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 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)

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

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

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: 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

Emerging energy technologies in agro industries: production of vermiculture, composting, herbicides and biopesticides, production of biofertilizers: Blue green algae, azolla, fungi, mycorrhiza (VAM), bacteria – Azospirrilum, microbial biotransformations, single cell proteins (bacterial, fungal and algal).

Reference Books:

Agro & Industrial Biotechnology (Practicals)

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

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. (Hons.) 3rd year (5th Semester) (July, 2018)

<table>
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<td>Course No.</td>
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<td>1.</td>
<td>Molecular Biology</td>
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<td>Bioanalytical tools</td>
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<td>3.</td>
<td>Environmental Biotechnology</td>
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<td>4.</td>
<td>Bioinformatics</td>
<td>BIOT-Sem-V-IV-T</td>
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<td>5.</td>
<td>Enzymology</td>
<td>BIOT-Sem-V-V-T</td>
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Total Marks = 500
B.Sc. Hons Biotechnology 3rd year (5th Semester)

BIOT-Sem-V-I-T  MOLECULAR BIOLOGY

Theory : 67 marks

Int. asset : 08 marks

Total : 75 marks

Time : 3 hours

Objectives: To make the students understand the fundamental concepts which includes DNA structure, replication, transcription, translation, mutation, gene regulation.

UNIT-I

1. DNA: Chemical composition of DNA DNA structure-single stranded DNA, detailed account of double stranded DNA, BDNA, Z.DNA and other structural forms and their importance.

2. Genome organization in prokaryotes: Molecular nature of the genetic material, Composition and structure of prokaryotic DNA and RNA.

3. Genome organization in eukaryotes: Composition and structure of eukaryotic DNA and RNA. Characteristic features of highly repetitive DNA, Tandemly repetitive DNA and Mini and microsatellite DNA and Insertional elements and their role and importance

UNIT-II

4. DNA replication: Prokaryotic DNA replication; replication origin and site and structure and DNA Ter regions and structure. DNA polymerases, composition and features, replication factors and the mechanism of replication, leading strand and lagging strand synthesis, procesessivity and fidelity. Replication of single stranded DNA, M13 viral DNA.

5. Eukaryotic DNA replication; origins, replication initiation complexes and their assembly, licensing factors, DNA polymerases and their composition, telomerase and mode of action, replication factors, disassembly of chromatin components and reassembly during replication.
UNIT-III

6. Gene Expression: Overview of central dogma

7. RNAs: types, rRNAs; Structural features of rRNAs- prokaryotic and eukaryotic. tRNAs: structural features, their anticodon feature. mRNAs- prokaryotic and eukaryotic mRNAs, structural features,

8. Transcription: regulatory elements and mechanism of transcription regulation in prokaryotes and eukaryotes

UNIT IV

9. Translation: Overview and mechanism of translation process in prokaryotes, characteristics of the genetic code, structure and charging of tRNA,


REFERENCE BOOKS:


Malacinski, George M., 2005, Freifelder’s. Essentials of Molecular Biology, Narosa Publishing House, ND.


BIOT-Sem-V-I-T: Molecular Biology (Practical)

Practical : 20 marks

Int. assessment : 05marks

Total : 25 marks

Time : 3 hours

1. Preparation of Reagents for DNA isolation.
2. DNA isolation from plants.
3. Agarose gel electrophoresis of DNA.
4. Plasmid DNA isolation.
5. Isolation of genomic DNA from Bacteria.
6. Restriction digestion of DNA.

Reference Books:


BIOT-Sem-V-II-T : ENVIRONMENTAL BIOTECHNOLOGY

Theory : 67 marks

Int. assessment : 08 marks
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 course focuses on an introduction to environment, major threats to environment by various polluting agents and the remedies for the same, incorporating design and monitoring of waste treatment processes. As well as learning environmental technology fundamentals, with special focus on biological treatment processes, environmental management. The course is use of biotechnology to design cleaner manufacturing processes and to solve pollution problems. It is ideal for under graduates just embarking on their career, or scientists and engineers who have been working for a few years and wish to develop their career in this direction.
UNIT-I

Basics of Environment and Environmental pollution, air, water, soil and noise.

Air – Types, Sources & Effects,

Soil - Physicochemical and bacteriological analysis of soil, soil pollutants (fertilizers, insecticides fungicides, pesticides).

Noise pollution, its control and impact on human health.

Renewable and Non Renewable resources. and their Environmental Impacts.

Modern Fuels (gasohol, hydrogen and solar energy) and their Environmental Impacts.

UNIT-II


Anaerobic processes: Anaerobic digesters, upward flow anaerobic sludge blanket reactors.

General strategies for wastewaters treatment.

UNIT-III

Bioremediation of contaminated soil and its applications

Degradation of pesticides and other toxic chemicals by microorganism. Integrated Pest management Biodegradation of environmental pollutants: pesticides, hydrocarbons, dye, etc.

Biofertilizers for clean environment– Nitrogen fixing microorganism, enrichment of the soil with assimilable nitrogen

UNIT IV
Introduction to solid waste and municipal solid waste management: Sources, types, composition.

Bioabsorption of metals: Role of Microorganisms in biosorption and bioleaching.

Enrichment of ores by microorganisms

Bioindicators for detection of pollution

References Books:


Practical:- ENVIRONMENTAL BIOTECHNOLOGY
BIOT-Sem-V-II-T

Practical : 20 marks

Int. assessment : 05 marks
1. Detection of coli forms for determination of the purity of potable water.
2. Determination of chlorine in water
3. Determination of total alkalinity of water
4. Determination of dissolved oxygen concentration of water sample.
5. Determination of biological oxygen demand (BOD) of a sewage sample.
6. Determination of chemical oxygen demand (COD) of sewage sample.
7. Isolation of phosphate solubilizing microorganisms from soil.

Reference Books:

3. Practical Microbiology by Dr R.C. Dubey and D.K. Maheshwari, S.Chand Publications.

BIOINFORMATICS

Theory : 67 marks
Int. assessment : 08 marks

BIOT-Sem-V-III-T Total : 75 marks
Time : 3 hours

UNIT – I
Introduction to Bioinformatics, Biological Databases and Sequence analysis: Introduction, overview and needs of bioinformatics technology.

Primary Databases: Primary Sequence database i.e. GenBank & EMBL.

Secondary Databases: SwissProt/TrEMBL, Pfam.

Molecular Structure Databases: Protein Data Bank (PDB), SCOP, CATH. Understanding the structure of each database and using it on the web.

UNIT – II

Sequence Alignment

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-Waterman methods), Introduction to BLAST, types of BLAST, algorithm of BLAST and interpretation of its result.


Multiple sequence alignment: Methods of multiple sequence alignment. 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 and Glimmer.

UNIT IV


BIOT-Sem-V-IV-P: BIOINFORMATICS (Practicals)

Practical : 20 marks

Int. assessment : 05 marks

Total : 25 marks

Time : 3 hours

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.
UNIT – I

Structure and functions of enzymes: Historical background and general properties of enzymes, concept of active centre, binding sites, stereo specificity and ES complex formation, activation energy, Evidences for enzyme-substrate complex; Lock and key, Induced fit and Transition state hypotheses, Coenzymes and Cofactors- Prosthetic group, coenzymes involved in different metabolic pathways.

UNIT – II

Factors Affecting the Enzyme Activity: Concentration, pH and temperature. Kinetics of a single substrate enzyme catalysed reaction, derivation of Michealis-Menten Equation, significance of Km value, Vmax, Turnover number, Kcat. Enzyme activity, international units, specific activity,
Enzymes as thrombolytic agents, Anti-inflammator y agents, streptokinase, Isoenzymes

UNIT-III


UNIT – IV

Applications of Enzymes: Immobilized enzymes, industrial applications of immobilized enzymes, Thermophilic enzymes, amylases, lipases, Proteolytic enzymes in meat and leather industry, enzymes used in fermentation processes, cellulose degrading enzymes, Metal degrading enzymes.

Reference Books:

1. Fundamentals of Enzymology : Nicholas Price & Lewis Stevens
2. Biochemistry text books by Stryer, Voet and Lehninger

BIOT-Sem-V-IV-P: Enzymology (Practicals)

Practical : 20 marks
Int. assessment : 05 marks
1. Estimation of enzyme activity.
2. To study the Effect of pH on activity of enzyme.
3. To study the Effect of temperature on activity of enzyme.
4. To study the effect of substrate concentration on enzyme activity.
5. To estimate Km and Vmax of an enzyme and plot Line-Weaver Burk plot.

Reference Books:

Training : 80 marks
Int. assessment : 20 marks
Total : 100 marks

The students will undergo summer training after completion of 4th Semester and will be assessed in the 5th semester. The duration of training will be 4 to 6 weeks.
B.Sc. (Hons.) 3rd year (6th Semester) (Jan 2019)

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<td>Course No.</td>
<td>Marks</td>
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<td>4.</td>
<td>Genomics and proteomics</td>
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<td>5.</td>
<td>Intellectual property</td>
<td>BIOT-Sem-VI-V-T</td>
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Total Marks = 500
Objectives:

Genetic engineering refers to the process of manipulating the characteristics and functions of the original genes of an organism. The objective of this process is to introduce new physiological and physical features or characteristics. The students will learn how the genes can be cut and paste from one organism to another and what are its implications.

UNIT-I

1. Introduction to genetic engineering. Why gene cloning and DNA analysis is important. How to clone a gene - What is clone, Overview of the procedure

2. Tools in Recombinant DNA Technology:

Restriction and modifying enzymes, Type I, Type II and Type III enzymes and their characteristic features; restriction sequences, isoschizomers, rare cutting enzymes, enzyme cutting similar sequence in different manner.

DNA Modifying enzymes: Characteristics and applications of Nucleases – DNase and RNase, DNA-Pol I, Klenow fragment, T4DNA polymerase, T7 DNA polymerase, T4 Polynucleotide kinase, Phosphatase, Reverse transcriptase, Taq polymerase and Ligase. Terminal deoxy ribonucleotidyl transferase.

3. Polymerase Chain Reaction: Types and applications
Basic biology of plasmids and Phage vectors Basic features of plasmids, plasmid classification, Bacteriophage λ, lytic & lysogeny, Promoter control circuits. linear and circular forms of lambda vector, DNA cloning with single stranded DNA vectors.


Advanced Vectors: cosmid, phagemid, Bacterial Artificial Chromosomes (BACs), shuttle vectors, yeast artificial chromosomes.

UNIT-III

Preparation of genomic and cDNA library: Partial digests, Choice of vectors, Construction and Evaluation of a genomic library. cDNA library: mRNA enrichment, cDNA synthesis, Random, arrayed and Ordered library.


Preparation of nucleic acid probes: DNA and RNA labeling techniques, nick translation, random priming, end labelling, radioactive and non-radioactive labels.
UNIT-IV

Site directed mutagenesis (cassette, primer extension, RT, real time, multiplex, inverse), DNA sequencing (Maxam-Gilbert, Sanger, pyro).

Production of Protein from Cloned Genes: Special vectors for expression of foreign genes in E. coli, General problems with the production of recombinant protein in E. coli. Production of recombinant protein by eukaryotic cells.

Suggested readings:


BIOT-Sem-VI-I-P : GENETIC ENGINEERING (PRACTICAL)

Practical : 20 marks

Int. assessment : 05 marks

Total : 25 marks

Time : 3 hours

1. Demonstration of PCR.

2. Demonstration of Southern blotting.

3. Preparation of competent cells.

5. Spectrophotometer analysis of DNA.

BIOT-Sem-VI-II-T: BIOPROCESS ENGINEERING AND TECHNOLOGY

Theory : 67 marks

Int. assessment: 08 marks

Total : 75 marks

Time : 3 hours

Instructions for paper setters and candidates

• Set nine questions in all. 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

Fundamental principles of biochemical engineering.

Sterilization of air and media sterilization, design of batch sterilization process.

Del factor, sterilization cycle, continuous sterilization process

Unit – II
Microbial growth kinetics Simple kinetics of microbial growth (Batch and Continuous, Feed Back System), yield coefficient, doubling time, specific growth rate, internal and external feedback systems, metabolic and Biomass productivities, effect of temperature and pH on the product formation

Unit – III

Design of fermenter:

Components of Fermenter, Aseptic operation of the fermenters, control and measurement equipment of fermenters, pH and DO probes, impeller and spargers,

Unit – IV

Downstream 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.

Waste water treatment for fermentation process

Reference Books:

BIOT-Sem-VI-II-P: Bioprocess Engineering and Technology (Practicals)

Practical: 20 marks

Int. assessment: 05 marks

Total: 25 marks

Time: 3 hours

1. Demonstration of components and sterilization of fermenters and other accessories.
2. Determination of doubling time, yield coefficient for growth of microorganism.
4. Determination of Specific growth rate and maximum specific growth rate
5. Cell disruption by Sonicator
6. Demonstration of normal flow and cross flow filtration process.

Reference Books:

BIOT-Sem-VI-III-T : FOOD BIOTECHNOLOGY

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.

UNIT – I

Food and Microorganisms: History and scope of Food biotechnology, food as substrates for microbes, factors affecting growth of microorganisms, 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; Applications of enzymes in food technology.

UNIT – II

Principles of food preservation: Physical, chemical, and biological methods of preservations. Contamination, preservation and spoilage of different kind of foods: Milk and milk products (milk, butter, yoghurt and cheese), beverages (beer, wine, tea and coffee), meat and fish products (sausages, 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.

Fermented foods and their production: Bakers yeast, Bread, cheese, yoghurt, tofu, miso, tempeh, sauerkraut, meat and alcoholic beverages (beer and wine)

Production of algal, fungal and other microbial proteins (SCP and mushroom etc)

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

Genetically modified food (Golden rice, Favr savr tomato, protato, pomato etc)

UNIT –IV

Food and water borne diseases: Shigellosis, Salmonellosis, Cholera.

Food borne intoxications: Staphylococcal, Bacillus and Clostridium botulinum Exotoxins and Endotoxins, their mechanism of action

Rapid and advanced estimation methods (Immunoassays, nucleic acid probe) for detection of pathogens.

Reference Books:

Illustrated Publisher Springer).


BIOT-Sem-VI-III-P: FOOD BIOTECHNOLOGY (Practicals)

Practical : 20 marks

Int. assessment : 05 marks

Total : 25 marks

Time : 3 hours

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. Estimation of lactose in milk.
5. Methylene blue reductase test (MBRT) for determination of quality of milk.
6. Plating the milk samples for microbial contamination.
7. Demonstration for the identification of mushrooms by spore prints.
8. Checking the effect of pasteurization of milk by alkaline phosphatase.

Reference Books:

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

UNIT II

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

UNIT III

Introduction to protein structure, 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. Determination of sizes (Sedimentation analysis, gel filtration, SDS-PAGE); Native PAGE, Determination of covalent structures – Edman degradation.

UNIT IV


PRACTICALS

1. Use of SNP databases at NCBI and other sites
2. Use of OMIM database
3. Detection of Open Reading Frames using ORF Finder
4. Proteomics 2D PAGE database
5. Softwares for Protein localization.
6. Hydropathy plots
7. Native PAGE
8. SDS-PAGE

SUGGESTED READING


BIOT-Sem-VI-V-T

INTELLECTUAL PROPERTY RIGHTS AND ETHICAL ISSUES IN BIOTECHNOLOGY AND ENTREPRENEURSHIP

Theory : 90 marks

Int. assessment : 10 marks

Total : 100 marks

Time : 3 hours

Instructions for paper setters and candidates

Set nine questions in all. All questions carry equal marks.

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.

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).

Objective: To introduce the students to intellectual rights and how to use the current intellectual property system to protect and commercialize their biotechnological invention. This course also covers the ethical issues, controversies and social-ethical impact of biotechnology on society.

UNIT – I

IPR: Introduction to Intellectual Property Rights. Tangible and intangible property. Patents: Introduction to patent law and brief history (early GATT and TRIPS), conditions for patentability; procedure for obtaining patents, patent filing through PCT, rights of a patentee; patent infringements and litigation. Indian patent laws and amendments. Patents from an international perspective.

UNIT- II

Design, copyright and Trademark:

Copyright: Registration procedure and copyright authorities; assignment and transfer of copyright, copyright infringement and exceptions to infringement; software copyright.

Designs: Introduction to the law on industrial designs; registration and piracy; international perspective; commercial exploitation and infringement.

Trademark: Importance, Registration, Trademark infringement and piracy.

UNIT – III

Patenting in biotechnology: Biotechnology patents and its economic, ethical and depository considerations. Patentable subject matter and legal aspects of transfer of biotechnology in India. Other multilateral treaties & International conventions – Paris convention, CBD, UPOV, PGRFA. Writing a patent specification.
Information sources in patent literature search.

UNIT – IV

Entrepreneurship:

Entrepreneur and its types, Women Entrepreneurship. Selection of a product, Product line design and development processes, economics on material and energy requirement, stock the product and release the same for making

The basic regulations of excise: Demand for a given product, feasibility of its production under given constraints of raw material, energy input, financial situations export potential.

Reference Books:


