PANJAB UNIVERSITY, CHANDIGARH
SYLLABUS FOR 3-YEARS DEGREE COURSES IN BIOTECHNOLOGY

- Year-wise marks distribution for B.Sc (Hons.) course:
  1<sup>st</sup> year 1000
  2<sup>nd</sup> year 1000
  3<sup>rd</sup> year 1000

  Grand Total 3000

w.e.f. the admission 2010 onwards
(2010-2011)

Outline of courses for B.Sc. 1<sup>st</sup> Year (Hons.) Biotechnology

<table>
<thead>
<tr>
<th>Papers</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Theory</th>
<th>Practicals</th>
<th>Total</th>
<th>Work load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper I</td>
<td>BIOT - 101</td>
<td>English</td>
<td>50</td>
<td>--</td>
<td>50</td>
<td>3</td>
</tr>
<tr>
<td>Paper II</td>
<td>BIOT - 102</td>
<td>Punjabi or Punjab History and</td>
<td>50</td>
<td>--</td>
<td>50</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Culture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper III</td>
<td>BIOT - 103</td>
<td>Physics (Basic and Applied)</td>
<td>100</td>
<td>50</td>
<td>150</td>
<td>6</td>
</tr>
<tr>
<td>Paper IV</td>
<td>BIOT - 104</td>
<td>Chemistry</td>
<td>100</td>
<td>50</td>
<td>150</td>
<td>6</td>
</tr>
<tr>
<td>Paper V</td>
<td>BIOT– 105(a)</td>
<td>Life Sciences or Mathematics</td>
<td>100</td>
<td>50</td>
<td>150</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>BIOT– 105(b)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>--</td>
</tr>
<tr>
<td>Paper VI</td>
<td>BIOT - 106</td>
<td>Statistics and Computer Fundamentals</td>
<td>100</td>
<td>50</td>
<td>150</td>
<td>6</td>
</tr>
<tr>
<td>Paper VII</td>
<td>BIOT - 107</td>
<td>General Microbiology</td>
<td>100</td>
<td>50</td>
<td>150</td>
<td>6</td>
</tr>
<tr>
<td>Paper VIII</td>
<td>BIOT - 108</td>
<td>Cell Biology</td>
<td>100</td>
<td>50</td>
<td>150</td>
<td>6</td>
</tr>
</tbody>
</table>

  Total Marks | 1000

*Mathematics for +2 medical students and Life Sciences for +2 non-medical students.

The students of B.A./B.Sc./B.Com. have also to study the subject of “Environment Education”. This is a compulsory qualifying paper which the students are required to qualify in the 1<sup>st</sup>/2<sup>nd</sup>/3<sup>rd</sup> year of the course. The examination will be conducted by the University.
### Outlines of Courses for B.Sc. Biotechnology (Honours) 2nd Year.
(For old syllabus) 2010-2011

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of Paper</th>
<th>Theory</th>
<th></th>
<th>Practical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>Marks</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td></td>
<td>period's</td>
<td></td>
<td>period's</td>
</tr>
<tr>
<td></td>
<td></td>
<td>per week</td>
<td></td>
<td>per week</td>
</tr>
<tr>
<td>BIOT-201</td>
<td>Physical Chemistry</td>
<td>3</td>
<td>75</td>
<td>4</td>
</tr>
<tr>
<td>BIOT-202</td>
<td>Advance Life Sciences</td>
<td>3</td>
<td>75</td>
<td>4</td>
</tr>
<tr>
<td>BIOT-203</td>
<td>Biochemistry</td>
<td>3</td>
<td>75</td>
<td>4</td>
</tr>
<tr>
<td>BIOT-204</td>
<td>Cell Biology</td>
<td>3</td>
<td>75</td>
<td>4</td>
</tr>
<tr>
<td>BIOT-205</td>
<td>Immunology</td>
<td>3</td>
<td>75</td>
<td>4</td>
</tr>
<tr>
<td>BIOT-206</td>
<td>Molecular Biology &amp; Genetics</td>
<td>3</td>
<td>75</td>
<td>4</td>
</tr>
<tr>
<td>BIOT-207</td>
<td>Agro and Industrial Applications of Microbes</td>
<td>3</td>
<td>75</td>
<td>4</td>
</tr>
<tr>
<td>BIOT-208</td>
<td>On Job Training</td>
<td>-</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>BIOT-209</td>
<td>Hons. Paper I: Bio Analytical Techniques</td>
<td>3</td>
<td>75</td>
<td>-</td>
</tr>
<tr>
<td>BIOT-210</td>
<td>Hons. Paper II: Introduction to Bioinformatics</td>
<td>3</td>
<td>75</td>
<td>-</td>
</tr>
</tbody>
</table>

Total Marks = 1000
• Outlines of Courses for B.Sc. Biotechnology (Honours) 3rd year. (For old syllabus) 2010-11.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Name of Paper</th>
<th>Theory</th>
<th>Practical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total period's per week</td>
<td>Marks</td>
</tr>
<tr>
<td>BIOT-301</td>
<td>rDNA Technology</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>BIOT-302</td>
<td>Plant Tissue Culture &amp; Plant Biotechnology</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>BIOT-303</td>
<td>Animal Tissue Culture and Animal Biotechnology</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>BIOT-304</td>
<td>Patent Laws in Biotechnology and Entrepreneurship</td>
<td>1</td>
<td>100</td>
</tr>
<tr>
<td>BIOT-305</td>
<td>Bioprocess Engineering</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>BIOT-306</td>
<td>Project Work</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>BIOT-307</td>
<td>Advances in Bioinformatics</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>BIOT-308</td>
<td>Hons. Paper III : Food Biotechnology OR Nanotechnology</td>
<td>3</td>
<td>75</td>
</tr>
<tr>
<td>BIOT-309</td>
<td>Hons. Paper IV : Environmental Biotechnology</td>
<td>3</td>
<td>75</td>
</tr>
</tbody>
</table>

Total Marks = 1000

**BIOT-307: On Job Training**

On job training for 4-6 weeks during the summer vacations at the end of the B.Sc. 2nd year and should be evaluated in the B.Sc. 3rd year. The report to be presented before the three members committee to be appointed by Principal.
B.Sc. 1st Year (Hons.) Biotechnology

ENVIRONMENT EDUCATION

(25 Hrs. course)

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

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

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

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

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

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

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

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

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

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

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

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

13. **Human Population and Environment**:
    Population growth and family welfare programme, Human Health. HIV AIDS.
    Human Rights.

14. **Social Issues**:
    Environmental Ethics: Issues and possible solutions, problems related to
    lifestyle, sustainable development; Consumerisms and waste generation.

15. **Local Environmental Issues**:
    Environmental problems in rural and urban areas. Problem of Congress Grass &
    other weeds, problems arising from the use of pesticides and weedicides, smoking
    etc.

    **Practicals**:
    Depending on the available facility in the college, a visit to vermicomposting
    units or any other
    such non-polluting eco-friendly site or planting/caring of vegetation/trees could
    be taken.
Note: Above 15 topics to be covered in 25 hour lectures in total, with 2 lectures in each topics from 2 to 11 and one each for the topics 1 and 12 to 15.

- **Examination Pattern:**
  
  Fifty multiple choice questions (with one correct and three incorrect alternatives and no marks deduction for wrong answer or un-attempted question)

- All questions compulsory i.e. no choice.

- Qualifying marks 33 per cent i.e. 17 marks out of 50.

- Total marks : 50.

- Duration of Examination : 60 minutes.

- Spread of questions : Minimum of 2 questions from each of the topics 1 and 12 to 15. Minimum of 4 questions from topics 2 to 11.
BIOT-101: English

Max. Marks: 50 marks
Theory : 45 marks
Int. Ass. : 5 marks
Time : 3 hours

Section A

1. Story:
   One long essay type question on character / incident or theme.
   (with internal choice) 8 Marks

2. Prose:
   One long essay type question on summary / theme.
   (with internal choice) 7 Marks

3. Poetry:
   Summary 5 Marks
   Central idea 5 Marks
   Reference to the context 5 Marks
   (Internal choice in all the above)

Section B

1. Word formation from the prose and story section of ‘Colours of Expression’ and their use in sentences.
   Form nouns
   Form verbs
   Form adjectives (5 out of 8) 5 Marks

2. Official and business letters, letters to the editors. 5 Marks

3. Comprehension of unseen passages. 5 Marks

Reference Books:


Instruction to paper setters

As per instructions for English paper in other B.Sc. courses.
| 1H   | gzikph eftsk dk nfXn?B | 12 nze |
| 2H   | gzikph ejkDh dk nfXn?B | 13 nze |
| 3H   | eftsk s/ ejkDh Bkb ;zpzXs bx{ T[ZsoK tkb/ ggôB | 5 nze |
| 4H   | gZsoFftjko               | 10 nze |
| 5H   | ftnkeoD                  | 10 nze |

| e'o; |
| 1H   | nkswFnBksw (eftsk s/ eEk ;zrqfj) ;zgkde vkJ ;[fjzdopho f;zx s/ vkJ tfonkw f;zx ;zX{} gqekôeL r[o{ BkBe d/t :{Bhtof;Nh, nzfwqs;o, 2006 | 5 nze |
| 6H   | ;oekoh ns/ nypko d/ ;zgkde B{z ubzs w;fbnK pko/ gZso fbyDk (d' u'A fJe) | 10 nze |
| 7H   | ftnkeoDL T) ftôokw fuzBQ n) tkeK B{z jo gZy'A ;'X e/ fbyDk j) w[jtfonK dh tkeK ftu tos'A | 3030 (3030) T) | 4 nze |
|      |                            | 4 nze |
PAPER 2: HISTORY AND CULTURE OF PUNJAB

Theory: 45 marks
Internal Assessment: 5 marks
Total: 50 marks
Time: 3 hours

One Paper

General Instructions:
1. In all, nine questions will be set. Each question will carry 9 marks.
2. First question shall be Short Answer type containing 15 short questions spread over the whole syllabus. Candidates will attempt nine questions out of the fifteen questions in about 25 to 30 words each. Each short question will carry 1 mark, totalling 9×1=9 marks. The first question is compulsory.
3. Rest of the paper shall contain 4 units. Each unit shall have two essay type questions and the candidate shall attempt one question from each unit – 4 in all.
4. 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 (4) in the question paper.

HISTORY AND CULTURE OF PUNJAB 1200-1849 A. D.

UNIT-I
1. Society in the Punjab during the Afghan rule.
2. The Punjab under the Great Mughals.

UNIT-II
4. Guru Nanak: His teachings; concept of Langar and Sangat.

UNIT-III
7. Martyrdom of Guru Tegh Bahadur; foundation of the Khalsa by Guru Gobind Singh.
8. Banda Bahadur and his achievements; Sikh Struggle for sovereignty from 1716 to 1765; role of Dal Khalsa, Rakhi, Gurmata and Misl.
9. Ranjit Singh’s rise to power; civil and military administrations; relations with the British.
UNIT-IV

10. Social change with special reference to the position of women.

11. New developments in language, literature, architecture in the Punjab during the Medieval Period.

12. Famous Folk tales of Medieval Punjab.

Suggested Readings:

1. Singh, Kirpal, History and Culture of the Punjab, Part-II (Medieval Period), Publication Bureau, Punjabi University, Patiala, 1990 (3rd edn.).

   N.B. - The required detail and depth would conform to the treatment of the subject in the above survey. (This book will also form the basis of the short answer questions).


Note: - The following categories of the students shall be entitled to take the option of History & Culture of Punjab in lieu of Punjabi as compulsory subject:

   (a) That the students who have not studied Punjabi upto class 10th.

   (b) Wards of and Defence Personnel and Central Government employee/employees who are transferable on all India basis.

   (c) Foreigners.
BIOT- 103: Physics (Basic and Applied)

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 provide basic knowledge of physics to biotech students.

UNIT – I
(MECHANICS)

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.
Basics of vector algebra, definition of gradient, divergence and curl.
Central forces, equation of motion under central forces, elastic collision (one dimensional), coefficient of restitution, mass - energy equivalence.

UNIT – II
(ELECTRICITY AND MAGNETISM)

Coulomb’s law for point charges; electric field due to point charge and electric dipole (on axial line and equatorial 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, currant density, equation of continuity, Ohm’s law in vector form.

Biot- Savart law and its applications for circular current carrying coil (at centre and on the axis), Ampere - Circuital law and its application for solenoid and straight conductor carrying current, magnetic permeability and magnetic susceptibility, magnetic materials (ferromagnetism paramagnetic and diamagnetism) and their properties.
UNIT - III  
( OPTICS )

Interference of waves, phase and path differences, theory of interference fringes, Young’s experiment, coherent sources, Lloyd’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).

Polarisation, introduction, polarization by reflection and refraction, Brewester’s law, Mallus law, double refraction, Nicol Prism and its use, optical activity, specific rotation, Half-shade polarimeter.

Brief features of laser and its applications in Biology ; optical fibres and its applications.

UNIT – IV  
( MODERN PHYSICS )

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.

Books recommended:

2. Electricity and Magnetism : Berkeley physics course vol. II.
BIOT- 103: Physics (Basic and Applied) (Practical)

Practical Exam : 45 marks
Int. assessment : 05 marks
Total Marks : 50 marks
Time Allowed : 3 hours

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. Young’s modulus by bending beam method.

3. Resolving power of Telescope/Microscope.

4. Rotation of the plane of polarization of a solution using a Polarimeter.

5. Laser interference & diffraction.

6. Use of C.R.O. as a display & measuring device.

7. Using compound pendulum measure time period as a function of distance of centre of suspension from centre of mass, plot relevant graphs and determine radius of gyration and acceleration due to gravity.

8. To study the magnetic field produced by a current carrying solenoid using a search coil and calculate permeability of air.

9. Capacitance by flashing and quenching of a neon lamp.

10. Use of CRO for Lissajous figures.

Books recommended:

1. Laboratory Manual of Physics for Undergraduate classes by D. P. Khandelwal
2. B.Sc. Physics Practicals by C. L. Arora
BIOT 104: Chemistry

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

Ia) Quantum Chemistry: Quantization of radiation energy, wave particle duality and uncertainty principle. Schrodinger wave equation (SWE), physical interpretation of wave function, quantization, solution of SWE for particle in one dimension box, quantum numbers, radial and angular probability distribution of electrons.


c) 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.

d) 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

IIa) 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.

c) **Molecular velocities:** Root mean, average and most probable velocities, qualitative discussion of Maxwell’s distribution of molecular velocities, collision number, mean free path.

d) **Electrochemical Cells:** Electrode potential, electromotive force (EMF). Reversible and irreversible cells, measurement of EMF of a cell. Nernst equation. Reference electrodes and other electrodes, standard electrode potential. Activity and activity coefficient determination from EMF results. Applications.

**UNIT – III**

IIIa) **Chemical equilibrium:** The nature of Chemical Equilibrium, The equilibrium constant, External effect on equilibria- concentration and temperature effects, Equilibria in non-ideal situations, calculation with equilibrium constant.

b) **Catalysis:** Homogeneous Catalysis acid base catalysis, enzyme catalysis (Michaelis-Menten equation). Heterogeneous catalysis. Unimolecular surface reactions.

c) **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.

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

**UNIT – IV**

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

b) **Alcohols and Phenols:** Mechanism of dehydration, acidity, Fries rearrangement, Mechanism of Kolbe’s reaction, Reimer Teimann reaction and mechanism.
c) **Aldehydes and ketones:** Common methods of preparation and reactivity. Keto-enol tautomerism, aldol condensation, Cannizaro’s reaction. The Wittig’s reaction, Perkin’s reaction.

d) **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:**

**BIOT- 104: Chemistry (Practicals)**

<table>
<thead>
<tr>
<th></th>
<th>Practical : 45 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Int. Assessment : 05 Marks</td>
</tr>
<tr>
<td></td>
<td>Total : 50 marks</td>
</tr>
<tr>
<td>Time : 3 hours</td>
<td></td>
</tr>
</tbody>
</table>

- Inorganic qualitative analysis
- Four ions including interfering ions.
- Iodimetry and Iodometry
- Redox titrations using ceric sulphate, potassium dichromate and potassium permanganate
- Complexometric titration using EDTA of Ca++, Mg++, and Zn++
- Analysis of a given organic compound (solid): Elemental Analysis, Detection of Functional groups and melting point. The functional groups are acids, phenols, amines, carbohydrates, thiourea etc.

**Reference Books:**
BIOT- 105(a) : Life Sciences

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 10-12 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

General Biology: The nature of life, definition of life, characteristics of life, differences between animals and plants, principal divisions in biology, importance of biology.
Introduction to various systems in human body: Digestive system, respiratory system, circulatory system, endocrine system, reproductive system.

UNIT – II

Basics of cell biology: Definition of cell- fundamental cell types, difference between prokaryotic and eukaryotic cell types, cell structure cell wall, plasma membrane.
Different organelles and their functions.
Cell division, cell cycle and its regulation.
Basic of genetics and evolution: Mendel’s work and experiments, gene bearer of heredity character, chemical basis of heredity.
Chromosome structure, alterations in structure, human karyotype,

UNIT – III

Varity of living organisms; Systematic; need, history and types of classifications (artificial, natural, phylogenetic); biosystematics; binomial nomenclature; Two kingdom system, Five kingdom system, their merits and demerits; zoological parks and museums.
Salient features of non-chordates up to phylum level and chordates (up to class level).
UNIT – IV

Biology in human welfare
Population, environment and development; Population growth and factor-(fatality, mortality, immigration, emigration, age and sex ratio); impact of population growth; reproductive health; common problems of adolescence (drugs, alcohol and tobacco); social and moral implication; mental and addictive disorder; Risks of indiscriminate use of drugs and antibiotics; population as a resource.
Brief account of some common animal diseases; biopesticides; genetically modified food; bio-war, biopiracy; biopatent; and sustainable agriculture.
AIDS, STD, cancer (types, causes, diagnosis, treatment)
Basic concepts of ECG, EEG, CT scan, MRI and ultrasound.

Reference Books:


BIOT- 105(a) : Life Sciences (Practical Course)

<table>
<thead>
<tr>
<th>Practical</th>
<th>45 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Int. assessment</td>
<td>05 marks</td>
</tr>
<tr>
<td>Total</td>
<td>50 marks</td>
</tr>
<tr>
<td>Time</td>
<td>3 hours</td>
</tr>
</tbody>
</table>

1. To study cell structure from onion leaf peels.
2. To study various stages of mitosis and meiosis.
3. To study ultra structure of cell organelles through photographs.
4. To study digestive, Respiratory, Circulatory, Endocrine and Reproductive system of Human body through charts/ model.
5. To study Chromosome structure though charts/slides.
6. Study of the slides/specimens and identification with reasons – Bacteria, oscillatoria, Spirogyra, Rhizopus, Mushroom, yeast, liverwort, moss, fern, lichen, one monocotyledon and one dicotyledon.
8. To study the symptom and pathogen of the following diseases: Malaria, Tetanus, Polio, Taeniasis, Ascariasis, AIDS and STD.
BIOT- 105: (b) Mathematics

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.
- Five questions to be attempted.
- Question number one will be compulsory having 10-12 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

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.

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 – II

Elementary mathematical logic.
Elementary trigonometry, addition subtraction, A-B, C-D formulas.
Concept of A.P, G.P., natural numbers, elementary computing binary system

Binomial Theorem
Expanding \((x+y)^n\), Binomial coefficients, Binomial theorem

UNIT – III

Matrices and vectors
Matrix algebra, determinants, applications vector in space,
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:

BIOT- 105: (b) Mathematics (Practicals)

<table>
<thead>
<tr>
<th></th>
<th>Practical</th>
<th>Int. Assessment</th>
<th>Total</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>: 45 Marks</td>
<td>: 05 Marks</td>
<td>: 50 Marks</td>
<td>: 3 hours</td>
</tr>
</tbody>
</table>

1. Computation of mean, variance and standard deviation using given (preferably biological) data (2 to 3 practicals).
2. Sets (Venn-Diagram, Union, Intersection, Difference of sets, Symmetric Difference of sets, Complement of sets) (2 practicals).
3. Relations (graphical representation of relation from set A to set B or set A to set A) (1 practical).
4. 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).
6. Plotting of irrational number 2, 3, 5 etc. on numbe line (1 practical).
7. Curve tracing (using Maxima and minima, symmetry along X-axis, Y-axis, Y=X, Y=X, point of intersection with X-axis and Y-axis, f(x), f (x) (3 to 4 practical).
8. Histogram, frequency polygon, ogives, pie chart, bar diagrams (2 to 3 practical).
9. Aragand plane (Plotting of complex numbers) (1 practical).
10. Binary to Decimal, Decimal to Binary, Binary addition, subtraction, multiplication (2 to 3 practical).

BIOT- 106: Statistics and Computer Fundamentals

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.
- 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.

Statistical Methods (Unit-1 & Unit-II)

UNIT – I

1. An introduction, types of data, collection, classification and tabulation of the primary data, secondary data, discrete data and continuous data, deagammatic and graphical representation of grouped data, frequency distribution {univariate and bivariate}, cumulative frequency distribution and their graphical representation, histogram frequency polygon.
2. Concept of central tendency or location and their measures, partition values: quantiles, deciles and percentiles, dispersion and their measures, relative dispersion.
3. Moments (single and double variables) and their relationships, Karl Pearson’s, Beta & Gamma coefficients, Charlier’s checks and Sheppard’s correction for moments for grouped data (without derivation), skewness & kurtosis and their measures.

UNIT – II

4. Mathematical expectation (single and bivariate), expectation of sum of random variables, variance and covariance, moment generating and cumulate generating function.
5. 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
7. Statistical packages.

Computer Fundamental (Unit-III & IV)

UNIT – III
Computers: General introduction to computers, organization to 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 addressed 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.
Reference Books:


BIOT-106: Statistics and Computer Fundamentals (Practicals)

<table>
<thead>
<tr>
<th>Practical</th>
<th>05 marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Int. Assessment</td>
<td>05 marks</td>
</tr>
<tr>
<td>Total</td>
<td>50 marks</td>
</tr>
<tr>
<td>Time</td>
<td>3 hours</td>
</tr>
</tbody>
</table>

1. Presentation of data by frequency tables, diagrams and graphs.
2. Calculation of measures of central tendencies.
3. Calculation of measures of skewness and Kurtosis.
5. Fitting of binomial distribution.
6. Fitting of Poisson distribution.
7. Probability.
8. Bivariate frequency table.
10. Basic commands-File creation, copying, moving and deleting in Linux & Windows.
1. Using e-mail, browsers, search engines.

Reference Books:

BIOT- 107: General Microbiology

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

Biogenesis vs abiogenesis, Koch postulates, discovery of antibiotics.
 Principle of microscopy: Bright field, dark field, phase contrast, fluroscent, electron microscopy.

UNIT – II

Microbial classification: Bacteria, fungi and algae.
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
Microbes in extreme environment like high temperature and high/ low pH values
Physical and chemical agents to kill microbes, sterilization and pasteurization processes.

UNIT – IV

Normal micro flora in human/ animals. Types of microbial pathogens and diseases caused by them. Microbial interactions like symbiosis and antibiosis etc. Host defense mechanism against pathogens.
Nitrogen fixing microbes in agriculture.
Photosynthesis
Fermentation and its products
Production of heterologous proteins in microbes.
Reference Books:


BIOT: 107: General Microbiology (Practicals)

1. Aseptic techniques.
2. Cleaning of glass wares, preparation of media, cotton plugging and sterilization.
3. Personal hygiene- microbes from hands, tooth-scums and other body parts.
4. Isolation of microorganisms from air, water and soil samples.
5. Dilution and pour plating techniques.
6. Enumeration of microorganisms total vs viable counts.
8. Gram staining, other staining methods, metabolic characterization (e.g. IM V.C) tests.
9. Growth curve of microorganisms.
10. Antibiotics sensitivity of microbes using antibiotic discs.
12. Alcoholic and mixed acid fermentation.

Reference Books:

BIOT-108: Cell Biology

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
Cell as a basic unit of life. The cell theory.
Broad classification of cell types: Prokaryotic cells (PPLO & bacteria) and eukaryotic cells (plant and animal).
Structure and function of cell organelles: Ultra structure of cell membrane, cytosol, endoplasmic reticulum, golgi bodies, ribosome’s, mitochondria, chloroplast, lysosomes, peroxisomes, cytoskeletal system, (actin and microtubules), cilia, flagella and nucleus.

UNIT – II
Cell division and Cell cycle (amitosis, mitosis, meiosis, stages of cell cycle)
Level of organization (cell, tissue, organ and organisms).
Cell differentiation in multicellular organisms: Totipotent, pleuripotent, multipotent.
Cell senescence and death: Apoptosis and necrosis.

UNIT – III
Water: Physico chemical properties of water, dissociation and association constants. pH and buffers, pl, pka, Hasselberg Handerson equation and its implications.
Carbohydrates: Structure of important mono, di-, oligo- and polysaccharides, glycoproteins, peptidoglycan, glycolipids and lipopolysaccharides. Reaction of monosaccharides.
Lipids: Classification of lipids and fatty acids, general functions of major lipid subclasses, acyglycerols, phosphoglycerols, phosphoglycerides, sphingolipids, glycosphingolipids and terpenes, sterols, steroids: Prostaglandins.
UNIT – IV
Vitamins and hormones: Types of vitamins and their chemistry, vitamins as cofactors, steroids and peptide hormones.
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:
BIOT- 108: Cell Biology

Preparation of physiological buffers.

1. Verification of Beer-Lamberts law for p-nitrophenol.
2. Determination pK\text{a} value of p-nitrophenol.
3. Estimation of carbohydrates in given solution by Anthrone method.
4. The determination of acid value & saponification value of a fat.
5. Separation of lipids by thin layer chromatography.
7. To study the parts of light compound microscope and their working.
8. To study the prokaryotic cells: \textit{(Lactobacillus, E. Coli, Blue green algae)}, eukaryotic cells (amoeba, fungi, algae) and various tissues (liver, lung kidney, testis, ovary and skin) from permanent/temporary slides.
10. Cytochemical techniques to study carbohydrates and lipids.
11. To study mitosis from (root tips of onion/ garlic) and meiosis from grasshopper.

Reference Books:
B.Sc. (Biotechnology) Part-II

BIOT : 201 PHYSICAL CHEMISTRY

Instructions for paper setters and candidates

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

UNIT-I

Chemical Thermodynamics: State of a system, state variables, thermodynamic equilibrium, thermodynamic properties, Intensive and Extensive properties, various types of processes. First law of Thermodynamics, internal energy and enthalpy, change in internal energy and change in enthalpy for expansion of real and ideal gases under isothermal and adiabatic conditions for reversible and irreversible processes. Relation between \( C_p \) and \( C_v \). Internal energy change and enthalpy change in a chemical process. Hess’s Law of heat summation. Enthaply of formation, enthalpy of ionisation and calculation of bond dissociation energies form thermochemical data.

Second law of thermodynamics, entropy and Gibb’s free energy, Carnot’s cycle, Calculation of entropy change for reversible and irreversible processes under isothermal and non-isothermal conditions. Gibbs Hemholtz equation. Third law of thermodyanamics Nernst heat theorem, calculation of absolute entropies of substances.

Thermodynamics of simple mixtures, Partial molar quantities and their significance, chemical potential, Gibbs Duhem equation, variation of chemical potential with temperature and pressure, Chemical potential in a mixture of ideal gases. Meaning of chemical equilibrium, homogeneous and heterogeneous equilibrias. Thermodyanamic derivation of law of chemical equilibrium, Van’t Hoff relation, Relation between free energy
change and equilibrium constants $K_p$, $K_c$ and $K_f$. Temperature and pressure dependence of equilibrium constant.

**UNIT-II**

Solutions: Definition, types of solutions, vapour pressure of solution and Raoult's law. Factors influencing the solubility of gas in liquids, Henry's Law. Ideal solutions, Duhem Margules equation. Distillation of ideal solutions, Lever rule, vapour pressure of ideal solutions and non ideal solutions. Distillation of non-ideal solutions. Azeotropes colligative properties, lowering of vapour pressure, depression in freezing point, elevation in boiling point, osmotic pressure. Their common features and applications. Thermodynamic derivation of elevation in boiling point, depression in freezing point and osmotic pressure. Van't Hoff factor and its application to calculate degree of association and degree of dissociation.

Phase Equilibria:
Definition of phase, component and degree of freedom, Phase rule and its thermodynamic derivation. Derivation of Clausius-Clapeyron equation and its importance in phase equilibria, phase diagrams of water system, KI water system and lead-silver system.

Electrochemical Cells:

**UNIT-III**

Chemical Kinetics:
Ionic Equilibria and Conductance:

UNIT-IV

Molecular Spectroscopy:

Magnetic Resonance Spectroscopy:
Principles underlying NMR and Difference between NMR and ESR, structural information from magnetic resonance spectroscopy. Applications of ESR.

Electronic Spectra and Photochemistry:
BIOT: 201 PHYSICAL CHEMISTRY (Practical Course)

Physical Chemistry experiments:
2. Study of distribution law of Benzoic acid between benzene and water.
3. Determination of adsorption isotherm of oxalic acid on charcoal.
4. Surface tension: determination of surface tension of a given liquid by Stalgmimeter.
6. Refractometry: Determine refractive index of a given liquid as a criterion for its purity. (Benzene i.e. commercial) benzene + A.R. acetone).
7. Polarimetry: Determine the %age composition of an optically active solution.
8. Conductometry:
   a) Determination of cell constant
   b) Determination of specific and equivalent conductance of electrolyte (NaC1 and HC1).
   c) Precipitation titration of Na2SO4 vs BaCl2.
   d) Neutralization titrations NaOH vs HC1 and NaOH vs CH3COOH.
9. a) pH of buffer solution.
   b) Acid base titration HC1 vs. NaOH.
   c) Determination of ionization constant of a week acid (CH3COOH).
10. Calorimetry:
    a) Determination of Heat of neutralization
      i) Strong acid-strong base
      ii) Weak acid-strong base
11. Photometry:
    Verification of Lambert beer’s law for solution of CoC12. 5H2O (in water) and K2Cr2O7 (in water.)
Instructions for paper setters and candidates

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

UNIT-I

Water relations, osmosis, transpiration, water potentials, its components, physiological and molecular adaptations in plants with respect to cold-heat-drought and salt stress. Heat shock proteins, dehydrins, late embryogenesis abundant proteins, role of different osmolytes in stress tolerance.

UNIT-II

Plant Pathology & epidemiology: Definition, classification, mode of transmission and control measures of plant diseases. Disease resistance host pathogen interaction. Phytoalexins, PR proteins.

A detailed account of the following plant diseases with respect to casual agents, symptoms, epidemiology, disease cycle and their control measures. Black stem rust of wheat, loose smut of wheat, late and early blight of potato, False smut of rice, Bacterial blight of rice, Red rot of sugarcane. Viral diseases of potato, Yellow vein mosaic of bhindi, Bunchy top of banana, Downy mildew of bajra.

UNIT-III

Introduction to parasitology (pertaining to various terminologies in use). Brief account of life history, mode of infection and pathogenicity of the following pathogens with reference to man, prophylaxis and treatment, Entamaeba, Trypanosoma, Leishmania, Giardia, Trichomonas and Plasmodium.

Histopathological changes in organs in relation to diseases such as livers, cirrhosis, nephrosis, tumors, cancer, AIDS.
UNIT-IV

Arthropod vectors of human diseases: Malaria, Yellow fever, Dengue haemorrhagic fever, Filariasis, Plague and Epidemic typhus, Distribution and control of the above mentioned vectors.

General account of diseases such as AIDS, Hepatitis, typhoid and cholera, their occurrence and eradication programmes. General account of drug therapy and drug resistance.


Books Recommended:

BIOT: 202  ADVANCED LIFE SCIENCES (Practical Course)
Total Marks 25

- Estimation of relative water content of leaf
- Measurement of osmotic potential of different tissues by Chardokov method
- Study of plant pathogens
- Symptoms of the diseases
- Morbid anatomy of the plants (only those diseases are to be studies which are included in the syllabus)
- Preparation of blood smear showing different stages of plasmodium
- Study of permanent slides and specimens of parasitic protozoans, helminth and arthropods mentioned in theory syllabus.
- Pathological examination of blood and urine.

Blood tests:
Erythrocyte sedimentation rate
Bleeding time
Clotting time
Prothrombin time
Instructions for paper setters and candidates

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

UNIT-I
Enzymes: Classification, nomenclature, general properties, regulation of enzyme activity, steady state kinetics, first order and second order kinetics, covalent modifications, inhibitors, Immobilized enzymes, Ribozymes.

UNIT-II
Metabolism: Metabolic pathways, biochemical reaction mechanism, energy rich metabolites, interorgan metabolic pathways.
Carbohydrate metabolism: Biosynthesis and degradation of carbohydrates; feed pathways for glycolysis; Kreb’s Cycle: Enzymes of Kreb’s cycle, amphilobic nature of the Kreb’s cycle; regulation of Kreb’s cycle regulation of carbohydrate metabolism.

UNIT-III
Electron transport and Oxidative phosphorylation
Mitochondrial electron transport chain, oxidative phosphorylation; regulation of ATP synthesis.

UNIT-IV
Lipid Metabolism: Biosynthesis and degradation of fatty acids; metabolism of triacyl glycerols; cholestrol metabolism, complex lipids.
Nitrogen Metabolism: Reduction and assimilation of atmospheric nitrogen, Biosynthesis and degradation of amino acids; amino acids as precursors of heme; biogenic amines; biosynthesis and degradation of nucleic acids.
Porphyry : Translation, Transcription, Replication
Books Recommended:


BIOT: 203 BIOCHEMISTRY-II (Practical Course)  
Total Marks 25

1. Estimation of α-amylase activity from saliva
2. Assay of acid phosphatase activity
3. Effect of temperature on enzyme activity
4. Effect of pH on enzyme activity
5. Determination of Km for acid phosphatase
6. Purification of protein using ammonium sulfate precipitation
7. Chromatographic methods for separation of macromolecules
   - Paper chromatography
   - Thin layer chromatography
   - Gel permeation chromatography

Books Recommended:
BIOT : 204  CELL BIOLOGY

Instructions for paper setters and candidates

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

UNIT-I
Cell as a basic unit of living systems. The cell theory. Precellular evolution: artificial creation of cells.
Broad classification of cell types: PPLO’s, bacteria, eukaryotic, microbes, plant and animal cells. A detailed classification of cell types within an organism. Cell, tissue organ and organisms as different levels of organizations of otherwise genetically similar cells.

UNIT-II
Ecological amplitude of cells in high altitude, sediments, arctic, hotspring, arid, brackish, extremophytes and freshwater environments.
Biochemical composition of cells (proteins, lipids, carbohydrates, nucleic acids and the metabolic pool)
Biological Membranes: Supramolecular architecture of membranes; solute transport across membranes, model membranes and lipsomes.

UNIT-III
Structure and function of cell organelles, ultra structure of cell membrane, cytosol, Golgo bodies, endoplasmic reticulum (rought and smooth), ribosomes, cytoskeletal structures (actin, microtubules etc.) Mitochondria, chloroplasts, lysosomes, peroxysomes, nucleus (nuclear membrane, nucleoplasm, nucleolus chromatin).

UNIT-IV
Cell division and cell cycle: mitosis, meiosis, stages of cell cycle, binary fisssion amitosis.
Cell-cell interaction
Cell locomotion (armoeboid, flagellar and ciliar)
Cell senescence and death: Apoptosis and necrosis
Cell differentiation in plants and animals: totipotent, multipotent, pleuripotent cell.

**Books Recommended:**

**BIOT: 204 CELL BIOLOGY (Practical Course)**

**Total Marks 25**

Microscopy:
(a) Principles of compound, phase contrast, electron microscopy
(b) Use and care of Light compound microscope.

Study of cells:
- a) Prokaryotic cells: Lactobacillus, E.Coli, Blue green algae
- b) Eukaryotic cells. Testicular material (for studies of spermatogenesis)

Microtomy: Introduction of the instrument, its use, care, section cutting and stretching.

Preparation of permanent slides: Principles and procedures; section cutting of tissues and staining of tissues with Haematoxylin/eosin method.

Study of permanent slides of various tissues (gut region, liver, lung, spleen, kidney, pancreas testis, ovary, tongue, skin etc.)

Cytochemical techniques to study carbohydrates, nucleic acids and proteins.

Study of electron micrographs of various cell organelles-plasma membrane, Mitochondria, Golgi complex, Lysosomes, Endoplasmic Reticulum (smooth and granular), Cilia, Centrioles, inclusions like glycogen, lipids etc.

**Books Recommended:**
BIOT : 205 IMMUNOLOGY

Instructions for paper setters and candidates

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

UNIT-I
Introduction: Types of immunity-innate and adaptive; features of immune response-memory. Specificity and recognition of self and non-self; terminology and approaches to the study of immune system; immunity to viruses bacteria; fungi and tumours; vaccines.

Unit-II
Cells and organs of the immune system.
Lymphoid cells, heterogeneity of lymphoid cells, T-cells, B-cells, Null cells; Monocytes, Polymorphs, primary and secondary lymphoid organs-thymus, Bursa of fabricius, spleen, lymph nodes, lymphatic system, Mucosa Associated Lymphoid Tissue (MALT), Lymphocyte traffic

UNIT-III
Humoral Immunity
Antigen-antibody interactions; affinity and avidity; high and low affinity antibodies, immuno-globulins, classes and structure, molecular mechanism of generation of antibody diversity, complement fixing antibodies and complement cascade.
Cell Mediated Immunity
T-cell subsets and surface markers, T-dependent and T-independent antigens, recognition of antigens by T-cells and role of MHC, structure of T-cell antigen receptors.

UNIT-IV
Immunodiagnostic Procedures.
Various types of immunodiffusion and immunoelectrophoretic procedures, Immunoblot, ELISA, RIA, Agglutination of pathogenic bacteria, Haemagglutination and Haemagglutination inhibition.
**Books Recommended:**


**BIOT: 205 IMMUNOLOGY (Practical Course)**

**Total Marks 25**

1. Differential leucocytes count
2. Total leucocytes
3. Total RBC count
4. Haemagglutination assay
5. Haemagglutination inhibition assay
6. Separation of T and B cells from PBMC by nylon wool method
7. Separation of serum from blood
8. Enumeration of T-Cells by E-rosetting method.
9. Double immunodiffusion test using specific antibody and antigen.
10. Separation of peritoneal macrophages from rat
11. Isolation of mononuclear cells from peripheral blood and viability test by dye exclusion methods.
12. Direct and indirect ELISA.

**Books Recommended:**

BIOT : 206 MOLECULAR BIOLOGICAL AND GENETICS

Instructions for paper setters and candidates

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

UNIT-I
Nature of genetic material, nucleic acids, DNA replication
Organization of Chromosomes: Genome size and complexity, the supercoiling of DNA, the structure of prokaryotic and eukaryotic chromosome, Polytene chromosomes, euchromatin and heterochromatin, satellite DNA, centromere and telomere structure. Mendelian Laws of inheritance, gene interactions.

UNIT-II
Gene linkage and chromosome mapping: Linkage and recombination of genes in chromosomes, crossing over and its molecular mechanism, gene mapping by three point test crosses, mapping by tetrad analysis, somatic cell hybridization for gene linkage studies, recombination within genes.

UNIT-III
Mutation: Spontaneous versus induced mutations, types of mutations, the molecular basis of mutations, mechanisms of DNA repair, mutations, frequency, correlation between mutagenicity and carcinogenicity, mutagenic agents, chemical and radiation.

Basic microbial genetics: Conjugation, transduction, transformation, isolation of auxotrophs, replica plating techniques, analysis of mutations in biochemical pathway, one gene – one enzyme hypothesis.

UNIT-IV
Extrachromosomal inheritance, mitochondrial and chloroplast genetic systems: sex linked inheritance.
Population Genetics: Hardy-Weinberg equilibrium, gene and genotypic frequencies, introduction of eugenics.
Books Recommended:

BIOT: 206 MOLECULAR BIOLOGY & GENETICS (Practical Course)
Total Marks 25

1. Demonstration of Law of segregation and Independent assortment (use of coloured beads, capsules etc.) Numericals for segregation and independent assortment. Use of Chi2 for prediction of phenotype/genotype frequencies of parents from progeny and vice-versa, Epistasis.
2. Segregation demonstration in preserved material (Maize)
3. Detection of Blood groups (A B O & Rh factors)
4. Inheritance of other human characteristics, ability to tast PTC, Thiourea
5. Calculation of variance in respect of pod length and number of seeds/pod
6. Calculation of gene frequencies and random mating (coloured beads, capsules)
7. Paternity disputes (blood groups)
8. Dermatographics: Palm print taking and finger tip patterns.
9. Preparation and study of mitosis slides from buccal mucosa and onion root tips by squash method.
10. Preparation and study of meiosis slides from meristem tissue by squash method.
11. Demonstration of sex chromatin from buccal smear using thionin stain.
Set nine questions in all in three sections. All questions carry equal marks.
- Section A will cover Unit I & II
- Set 2 questions from each unit and any 2 is to be attempted
- Section – B will cover Unit – III & IV
- Set 2 questions from each unit and any 2 is to be attempted
- Section – C will be compulsory and will have 7 – 10 short answer type (not objective type) questions covering the whole syllabus.

UNIT-I

Introduction: 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 processes and chemical industrial processes.

UNIT-II

Improvement of industrial microbes:
Improvement programme of industrial microbes, mutational programme of penicillin producing microorganisms, selection pressure in maintaining the hyper producing microbes, revertant back of higher yielding microbes into lower production, media formulation and process optimisation of industrial and agro industrial microbes.

UNIT-III

Industrial and agro-industrial microbes.
Microbes involved in antibiotics, pharmaceutical drugs, enzymes production, solvent production, surfactants, aq culture, vermiculture, composting, herbicides and biopesticides production, biotransformation, nitrogen fixation, organic acids production, vitamins, aminoacids, single cell protein, biofertilizers, alcohols, wine, beers, mycotoxins.

Microbial processes in Agrobiotechnology
Introduction, plant microbe interactions, BT gene in BT cotton, Rhizobium, Azospirillum, Azobacter, Anabena in nitrogen fixation, agrobacterium, Spirulina production, soil treatment with microbes, Mycorrhizal fungi, microbial pesticides, mycoherbicides.
UNIT-IV
Microbial process in industrial biotechnology
Introduction, primary and secondary metabolites production, production of vitamins, B_{12}, alcohols, wine beer, cheese, bread, citric acid, penicillins, glutamic acid, cellulases, proteases in leather industries Biochips.

BIOT: 207 AGRO AND INDUSTRIAL APPLICATIONS OF MICROBES (Practical)

Total Marks 25

1. Autoclaving
2. Microbial cells counting by serial dilution techniques.
3. Microbial cell counting by pore plate techniques.
4. Measurement of bacterial size
5. Screening of cellulase producing microorganism from wood degrading soil.
6. Antibiotic sensitivity of the above microorganism
7. Minimum inhibitory concentration of a antibiotics for the above microorganism.
8. Additive and synergistic effect of two drugs on the above microorganisms.
9. Plating the milk samples for microbial contamination.
10. MBRT Test for determination of milk quality.

BIOT: 208 JOB TRAINING

Total Marks 100

Job training for at least 6 weeks during the summer vacations at the end of the 1st year B.Sc. and should be evaluated in the 2nd year of B.Sc. The report to be presented before the three members Committee to be appointed by Principal from attached syllabus.
BIOT : 209 BIOANALYTICAL TECHNIQUES

Instructions for paper setters and candidates

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

UNIT I

1. Centrifugation : Principle, types, application
2. Electrophoresis : Principle, types, application

UNIT II

3. Spectrophotometry (UV & Visible) and spectroflourimetry, atomic absorption Spectrophotometry

UNIT III


UNIT IV

6. Radioisotope techniques: radiotracers GM Counter, Proportional and Scintillation counters, autoradiography, Mass spectrometry-GCMS and LCMS.

BIOT: 209 BIOANALYTICAL TECHNIQUES (Practical Course)

- Identification of the provided sample using some of the spectroscopic techniques.
- Performance of electrophoresis of proteins, DNA.
- Practical demonstration of the above mentioned techniques.
Books:


BIOT : 210 INTRODUCTION TO BIOINFORMATICS

Instructions for paper setters and candidates

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

UNIT I

1. Introduction to Genes and Proteins, Genome Sequences, ORFs, Genes, Introns, Exons, Splice Variants, DNA/RNA, Secondary structure, Triplet Coding, Protein sequences, Protein Structure, Secondary, Tertiary, Quarternary, The notion of Homology.
2. Sequence Information Sources, EMBL, GENBANK, Entrez, Unigene, Understanding the structure of each source and using it on the web.

UNIT II

3. Protein Information Sources, PDB, SWISSPROT, TREMBL, Understanding the structure of each source and using it on the web.
UNIT III
5. Sequence and Phylogeny analysis, Detecting Open Reading Frames, Outline of sequence Assembly, Mutation Matrices, Pairwise Alignments, Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment Phylogenetic Analysis.

UNIT IV
7. Protein Structure: Protein structure classification, Structure Analysis, Secondary structure prediction methods, Comparative modeling.
8. Genome Annotation: Pattern and repeat finding, Gene identification tools.

References:
2. Bioinformatics: A practical guide to the analysis of genes and proteins, Ed. By Baxvanis, 1998 $64.95

BIOT: 210 INTRODUCTION TO BIOINFORMATICS (Practical Course)
Total Marks 25

Sequence information resource
Understanding and using on web:
EMBL
Genbank
Entrez
Unigene
Protein information resource
Understanding and using on web
PDB
Swissprot
TrEMBL
Using BLAST and interpretation of results.
Multiple sequence alignment using Clustal W
PAGE
PAGE
B.Sc. (Biotechnology) Part-III

BIOT : 301 rDNA TECHNOLOGY

Instructions for paper setters and candidates

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

UNIT-I
Introduction, Historical Enzymes Restriction enzymes, Ligases, DNA polymerase, kinases, Reverse transcriptase, Econucleases Phosphatase.

UNIT-II
Vectors: Plasmid, Cosmics, Lambda, Vectors (Intentional and Replacement vectors) M-13, Phagemids

UNIT-III
Radioactive and non-radioactive DNA and RNA labelling techniques: Nick translation, random priming, Sequencing

UNIT-IV
Southern and Northern blotting, hybridization
Introduction to site directed mutagenesis
PCR and its Applications
Transformation of E.coli Yeast, animal and plant cells, Genomic cloning, cDNA cloning, colony hybridization.
Application of rDNA technology to medicine agriculture and environment.

BIOT: 301 rDNA TECHNOLOGY (Practical Course) 

Total Marks 25

1. DNA isolation from plants
2. DNA isolation from E.coli
3. Spectrophotometer analysis of DNA
4. Agarose gel electrophoresis of DNA
5. Plasmid DNA isolation
6. Restriction digestion of DNA
7. Southern Blotting
8. Making competent cells

Books Recommended:

BIOT : 302 PLANT TISSUE CULTURE AND PLANT BIOTECHNOLOGY

Instructions for paper setters and candidates

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

UNIT-I

Plant nutrition and deficiency symptoms, Plant growth regulators and their physiological functions and role in morphogenesis, plant water relationships.

UNIT-II

Culture media, culture techniques, sterilisation techniques: for glassware, tissue and media.
UNIT-III
Totipotency, somatic embryogenesis, micropropagation, somaclonal variation.

Protoplast culture and somatic cell hybridization, Induction of haploids and polyploidy through tissue culture, embryo rescue embryo culture, Production of secondary metabolites by plant tissue culture.

UNIT-IV
Gene transfer in plant cells (vector mediated & direct) their application production of transgenics.

BIOT: 302 PLANT TISSUE CULTURE AND PLANT BIOTECHNOLOGY (Practical Course)

Total Marks 25

1. Sources of contamination and decontamination measures.
2. How to clean glass/plastic ware
3. Operational use of an autoclave.
4. Functions and operations of a Laminar Air Flow Hood
5. Preparation of simple growth nutrient (knop’s medium), full strength, half strength, solid and liquid.
6. Preparation of complex nutrient medium (Murashige & Skoog’s medium)
7. Laboratory design set up for a PTC laboratory.
8. Plugging and sealing of culture vessels.
9. To selection, Prune, sterilize and prepare an explant for culture.
10. Significance of growth hormones in culture medium.
11. To culture different explants for raising callus cultures.
12. To demonstrate various steps of Micropropagation.

Books Recommended:

UNIT-I

History of development of cell cultures, the natural surroundings of animal cells, stimulating natural conditions for animal cells, metabolic capabilities of animal cells.
Sterilization techniques: Aseptic techniques in animal tissue culture; sterilization of culture media, glassware and tissue culture laboratory, detection of contamination, safety considerations in ATC laboratory.

UNIT-II

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

UNIT-III

Commonly used animal cell lines, their origin and characteristic, growth kinetics of cells in culture, differentiation of cells, organ culture, expressing cloned protein genes in animal cell cultures.
Applications: Cell fusion and production of monoclonal antibodies; scale up methods for propagation of anchorage dependent and suspension cell culture; Bioreactors for large scale culture of cells, micro carrier culture, transplanting cultured cells.

UNIT-IV

Genetic Engineering in animal cells: Transformation of animal cells, vectors and expression vectors, Genetic Engineering in production or regulatory proteins, blood products, vaccines and hormones, Transgenic
animals and production of useful products in transgenic animals. *In vitro* fertilization, embryo transfer, cloning: methodology and its applications, ethics in cloning.

**Books Recommended:**
7. Rasko, I., and Downes, C.S. (1995), Genes in Medicine, Champan & Hall

**BIOT: 303 ANIMAL TISSUE CULTURE AND ANIMAL IOTECHNOLOGY (Practical Course)**

Total Marks 25

1. Sterilization techniques: Theory and Practical  
   - Glass ware sterilization  
   - Media sterilization  
   - Laboratory sterilization

2. Sources of contamination and decontamination measures.
3. Preparation of Hanks Balanced salt solution
4. Preparation of Minimal Essential Growth medium
5. Isolation of lymphocytes for culturing
6. Isolation of rat macrophages from peritoneum for culturing
7. Primary Lymphoid culture
8. DNA isolation from animal tissue
9. Quantification of isolated DNA
10. Resolving DNA on Agarose Gel.

**Books Recommended:**
Instructions for paper setters and candidates

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

UNIT-I


UNIT-II

Intellectual/Industrial property and its legal protection in research, design and development.

UNIT-III

Patenting in Biotechnology, economic, ethical and depository considerations.
Patentable subject matter and legal aspects of transfer of Biotechnology in India. Writing a patent specification.
Information sources in Patent Literature search.

UNIT-IV

Entrepreneurship
Selection of a product, line, design and development processes, economics on material and energy requirement, stock the product and release the same for making etc. 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 etc.

Suggested Readings:

3. Universal law publishing, Delhi 2001, Intellectual Property; patents, copy right, trade marks and allied rights by Cornish, W.R.

BIOT : 305 BIOPROCESS ENGINEERING

Instructions for Paper-setters and candidates
- Set nine questions in all Q.No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.
- All questions carry equal marks.

UNIT-I
Introduction
Fundamental principles of Chemical Engineering and biochemical engineering. Applications of physical and chemical laws on biological samples e.g., light reaction, photolysis of water, enzymatic reaction and simple kinetics.

UNIT-II
Microbial Growth Kinetics:
Simple kinetics of microbial growth, yield coefficient, doubling time, specific growth rate, substrate inhibition kinetics, product inhibition kinetics, internal and external feed back systems, metabolic and biomass productivities, effect of temperature, pH and inducer on product synthesis.

Sterilization:
Introduction air and media sterilizations, design of batch sterilization process, Del factor, sterilization cycle, continuous sterilization process, sterilization of fermenters.
UNIT-III

Design of fermenter:

UNIT-IV

Down stream processing:
Introduction, removal of microbial cells and other solid matters. Foam separation, filtration, industrial filters and its principles, centrifugation and industrial centrifuges, cell disruption, aqueous two phase extraction system, super critical fluid extraction, whole broth processing, effluent treatment, aerobic and anaerobic slug treatment process, fermentation economics.

Books Recommended:

BIOT: 305 BIOPROCESS ENGINEERING (Practical course)

Total Marks 25

Students will go for two week training in fermentation technology in industry/institute and the students will be required to submit written report of their training which will be evaluated by the teacher who has taught theory course.

BIOT : 306 PROJECT WORK

M.Marks : 200

Marks for project work will be divided in:
1. Regularity for carrying and research work = M.Marks 50 (assessment by internal teacher / supervisor)
2. Preparation of the report /quality of work carried out = M.M.100
3. Presentation / Viva = M.Marks 50
Instructions for Paper-setters and candidates

- Set nine questions in all Q.No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.
- All questions carry equal marks.

UNIT – I

Sequence Alignment and Databases:

1. Pairwise Alignment:
   Local & Global alignment; Dot plot, Statistical significance, Scoring Functions, PAM & BLOSUM, Needleman and Wunsch algorithm, Smith-Waterman algorithm.

2. Multiple Alignment:
   Consensus, Motifs and Profiles, Position Specific Scoring Matrices, Clustal W, Clustal X, Hidden Markov Models, Conserved Domain Database (CDD), BLOCKS, PRINTS, PROSITE.

UNIT – II

Introduction to Drug Designing & QSAR:

1. Drug Designing:
   Different approaches to drug designing, Basic principle of similarity and complementarity, High Throughput vs. rational drug designing, Use of computer modeling technique to drug designing, Target Identification & Validation, Active site analysis, Docking a ligand in active site of a target, Scoring and Lead optimization.

2. Basic concepts in Quantitative Structure Activity Relationship (QSAR):
   Objective of QSAR, Development of Hansch QSAR equation, QSAR Descriptors

UNIT – III

Modeling of Protein:

1. Homology Modeling:
   Sequence alignment, Coordinate assignment, Prediction of protein structure, Physicochemical Interactions in proteins in aqueous media; Threading, Fold recognition methods, Molecular Dynamics.
2. Techniques for proteins:
   Basic principles of protein sequencing, Protein synthesis; Isolation, purification, characterization and estimation, Basic Principles of X-ray Diffraction, NMR.

UNIT – IV

Phylogenetic Analysis:
1. Evolutionary change in nucleotide sequences, Rates and patterns of nucleotide substitution.
2. Terminology of phylogenetic trees – Branches, Nodes, Internal Nodes, Rooted and Unrooted trees.
3. Phylogenetic estimation – Distance Matrix Methods, Maximum Parsimony Methods, Maximum Likelihood Methods, Putting confidence limits on phylogenies, Sampling errors, Bootstrapping.

References:
2. Biochemistry by Voet & Voet.
3. Molecular Modelling Principles and Applications by Andrew Leach.
5. Introduction to Bioinformatics by Baxevenis

BIOT: 307 ADVANCE IN BIOINFORMATICS (Practical Course)

Total Marks 25

1. Using NCBI
2. Using BLAST and interpretation of results
3. Using CLUSTAL – W & T-Coffee and interpretation of results
4. Understanding structure of CCD, BLOCKS, PRINTS and PROSITE
5. Using Flex-X
6. Using Modeller and Expasy server
7. Preparation of Cladogram and Phylogram
Instructions for Paper-setters and candidates
- Set nine questions in all Q.No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.
- All questions carry equal marks.

UNIT I

1. Microbial role in food process operations and production of new proteins food SCP mushroom, food yeast’s algal proteins, fermentation as a method of preparing and preserving foods.

UNIT II

2. Food additives like colouring, flavours and vitamins. Organisms and their use in pickling, producing colour and flavours, alcoholic beverages and other products.

UNIT III

3. Mechanism of enzyme function and reactions in process techniques-starch and sugar conversion process, baking by analysis, deoxygenating and desugaring by glucose oxides beer mashing and chill-proofing cheese making by protease’s and various other enzyme catalytic actions in food processing process wastes-whey, molasses, starch substrates and other waste for bioconversion to useful products.

UNIT IV

4. Prospects of Food Biotechnology in World problem particularly in developing countries. (India and China).

Books:

BIOT: 308 FOOD BIOTECHNOLOGY (Practical Course)

Total Marks 25

1. Isolation and Identification of microorganisms of Spoiled food (Fungi and bacteria)
2. Isolation of Aspergillus flavus from spoiled Food.
3. Inhibitory effect of low temp. on microbial growth.
4. Estimation of Ethanol.
5. Production of Vinegar.
6. Litmus Milk Reaction
7. Methylene blue test for microbial contamination of milk.
8. Demonstration for the identification of mushrooms by Spore prints

OR

NANOTECHNOLOGY

Instructions for paper setters and candidates

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

1. Overview of Nanotechnology: definition, history the new technological revolution, industrial and economic impact.
2. Introduction of Nanoscale physics: quantum mechanics, infinite potential well, energy, quantization, electron wave function, quantum confined Stark effect.
3. Low Dimensional Systems: Quantum Wells, Quantum Wires, and Quantum Dots, and their applications.
4. Properties of individual nanoparticles: optical properties, electronic properties
5. Carbon Nanostructures: Carbon Nanotubes and Buckey balls, their fabrication and applications
6. Magnetic Nanoparticles: properties and applications, spin valves, spintronics

Text Books:


BIOT: 309 ENVIRONMENTAL BIOTECHNOLOGY

Instructions for Paper-setters and candidates

- Set nine questions in all Q.No. 1 (Objective type) is compulsory.
- Set 2 questions from each unit and one is to be attempted.
- Divide the questions into 3-4 short answer questions.
- All questions carry equal marks.

UNIT-I

1. Environment: Basic Concepts and issues.
2. Environmental Pollution: types of pollution, Methods for the measurement of pollution; methodology of environmental management – the problem solving approach, its limitations.
3. Air pollution and its control through Biotechnology.

UNIT-II

7. Treatment schemes for waste waters of dairy, distillery, tannery, sugar, antibiotic industries.
UNIT-III

8. Microbiology of degradation of Xenobiotics in Environment – Ecological considerations, decay behaviour & degradative plasmids; Hydrocarbons, substituted hydrocarbons, oil pollution, surfactants, pesticides.
10. Biopesticides in integrated pest management.

UNIT-IV

12. Global Environmental Problems: Ozone depletion, UV-B, green-house effect and acid rain, their impact and biotechnological approaches for management.

ENVIRONMENTAL BIOTECHNOLOGY (Practical Course)

Total Marks 25

1. Detection of coliforms for determination of the purity of potable water.
2. Determination of total dissolved solids of water.
3. Determination of dissolved oxygen concentration of water sample.
4. Determination of biological oxygen demand (BOD) of a sewage sample.
5. Determination of chemical oxygen demand (COD) of sewage sample.

Suggested Books:

4. Introduction to Biodeterioration, D. Allsopp and K.J. Seal, ELBS/Edward Arnold.

.........