Scheme & Syllabus of Bachelor of Science (Bio Technology) (B Sc IT) 

By
Department of Academics
Maharaja Ranjit Singh State Technical University, Bathinda

( Established by Govt. of Punjab vide Punjab Act No. 5 of 2015 and Section 2(f) of UGC)
## 1st Semester

<table>
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Load Allocation</th>
<th>Marks Distribution</th>
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<td>BSBT-109(B)**</td>
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<td>BSBT-113</td>
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<td>360 Internal 540</td>
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</table>

BSBT-109(B)** and BSBT-115** : For students having passed 10+2 with Math to take compulsory deficiency course and to be awarded Satisfactory and Non-Satisfactory during their final results by MRSSTU.
(BSBT – 101) Technical Writing & Communication Skills

Unit –I
Communication, its types and significance: Communication, Process of communication its kinds, channels and role in the society.

Reading skills: Process of reading, reading purposes, models, strategies methodologies, reading activities, structure of meaning techniques.

Unit –II
Writing skills: Elements of effective writing, writing styles, scientific and technical writing.

Grammar: Transformation of sentences, words used as different parts of speech, one word substitution, abbreviations, technical terms etc.

Business correspondence: Business letters, elements of business writing, kinds of business letters, office order memorandum, report, purchase order, quotations and tenders, job application letters, personal resume and curriculum vitae etc.

Unit –III
Listening skills: Process of listening, barriers to listening, effective listening skills, feedback skills.

Speaking skills: Speech mechanism, organs of speech, production and classification of speech sounds, phonetic transcription, skills of effective speaking, components of an effective talk, oral presentation and the role of audio visual aids in it.

Unit –IV
Discussion, meeting and telephone skills: Group discussion, conducting a meeting, attending telephonic calls

Recommended Books

2. Bansal, RK and Harrison, JB. Spoken English
3. Wright, Chissie. Handbook of Practical Communication Skills
(BSBT – 103) Inorganic Chemistry

Unit-I
Periodic Properties Position of elements in the periodic table, effective nuclear charge and its calculations, atomic and ionic radii, ionization energy, electron affinity and electro negativity definition, methods of determination sends in periodic table and applications in predicting and explaining the chemical behavior. Chemistry of Noble gases Chemical properties of noble gases, chemistry of xenon, structure and bonding, in xenon compounds, clathrates, types and stability.

Unit –II
Chemical Bonding
(a) Covalent bond, directional characteristics of covalent.
(b) Valence bond theory and its limitations.
(c) Various types of hybridization and shapes of inorganic molecules and ions-BeF2, SnCl2, XeF4, BF3, NH4, H2O, ClF4, ICl2, PF6, SF6 and IF7.
(d) Molecular orbital theory, Homonuclear (elements and ions of 1st and 2nd row) and heteronuclear BO, CN, CO', NO, CO, CN'), Multicenter bonding in electron deficient molecules (BORANES).
(e) Weak interactions, Hydrogen bonding & vandor walls forces.

Unit –III
Coordination compounds Introduction, Werner’s coordination theory, naming of coordination compounds, stereochemistry, Geometrical isomerism and optical isomerism in compounds having coordination number 4 and 6.

Unit –IV
Bonding in metal complexes Valence bond theory, electro neutrality and back bonding, limitations of VB theory, Crystal field theory, Splitting of d orbitals, calculation of CFSE in high spin and low spin, octahedral and high spin tetrahedral complexes, thermodynamic effects of CF splitting, paramagnetism, diamagnetism, ferromagnetism and anti-ferromagnetism. Molecular Orbital theory, _ acid complexes

Recommended Books

2) Inorganic Chemistry by Puri, Sharma and Kalia
3) F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry
(BSBT – 105) Introduction & Fundamentals of Biotechnology

Unit –I
Introduction to Biotechnology: Modern Biotechnology, Branches of Biotechnology and its scope.

Unit –II
Biological systems in Biotechnology: Prokaryotic systems (E. coli, Bacillus), eukaryotic systems (Saccharomyces), mammalian and non-mammalian cells in culture, organismal systems.

Unit –III
Basic techniques in Biotechnology:
- Centrifugation (Principle, types and applications)
- Electrophoresis (Principle, support media, protein and N.S. Electrophoresis)
- Chromatography (Principle, types and applications)
- Lyophilization (Principle, mechanism and applications)
- Basic Microscopy (Principle, various types of microscopes and introduction to electron microscopy)
- Radioisotopy (various types of radioisotopes and instrumentation)
- Spectroscopy

Unit –IV
Microbiology and its scope, Microbial culture- its characteristics and types, Methods of isolating pure culture, Maintenance and preservation of cultures, Media (used for cultivation of microbes) and its types Cultivation of micro organisms: Bacteria, Algae and Fungi.

Books Recommended

1. McGregor, C.W.; Membrane separation in Biotechnology; Marcel Dekker, Inc, New York.
3. Biotol Series (I - IV); Techniques used in Bioproduct Analysis; Buterworth Heineman, U.K.
Computer Application in Biotechnology (BSBT – 107)

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

Unit –II

Unit –III
Input/Output Devices: Key-tape/diskette devices, light pen mouse, joystick, source data automation, Printed outputs: serial, line, page, printers, Plotters, voice response units

Unit –IV
Introduction to Bioinformatics: Internet and the Biologist, Bibliographic databases, genebank sequence database, sequence analysis using GCG, sequence alignment and database searching, Multiple sequence alignments, Phylogenetic analysis, Prediction of Protein structures, submitting DNA sequences to the database, The NCBI data model

Recommended Books

(BSBT-109) Biostatistics

(To be made effective on students taking admission in 2010)

Unit –I
Logarithms And Antilogarithms (Basic Concepts), Definition- Biostatistics and its importance- Collection and Classification of data- Sample Methods of sampling- Classification of data, Representation Of Data : Frequency distribution-Histogram- Frequency Polygon- Frequency Curve- Normal Frequency Curve Relative Frequency Curve- Comulative Frequency Curve or Ogive

Unit –II
Measures Of Central Tendency : Objectives- Arithmetic Mean- Geometric Mean- Harmonic Mean- Mode- Median, Quartiles, Deciles, Percentiles, Measures Of Dispersion : Range- Quartile Deviation- Mean Deviation- Standard Deviation- Coefficient of Variation

Unit –III

Unit –IV
Test Of Hypothesis :Test of Significance- Sampling Distribution and Standard Error- Hypothesis Testing- Degrees of Freedom, F-Test Abd Analysis Of Variance : Test of Hypothesis on equality of variances- Analysis of Variance (ANOVA) - One way classification- Two way classification- Least Significance Difference (LSD) test, Chi-Square Test : Chi-square test vs other tests-Application of chi-square test- Goodness of Fit-Test of independence, Application of Computers In Biostatistics

Recommended Books

2. Statistical Methods by S.P.Gupta, Publisher S.Chand & Co, New Delhi

3. Statistics by R.S.N. Pillai & V. Bagavathi, Publisher S.Chand & Co, New Delhi
Basics of Biosciences BSBT – 109(B)

(Deficiency Course for Students having passed 10+2 with Math)

Unit I
Diversity in the living world
The living world, Biological classification, Kingdom Monera, Kingdom Protista, Kingdom Fungi, Plant kingdom, Classification of animals in general

Unit II
Structural organization in plants
Morphology of flowering plants, Anatomy of plants,

Unit III
Structural organization in animals. Structural organization in animals – animal tissues, morphology and anatomy of animals

Unit IV
Cell structure and functions
Cell – Basic unit of life
Bio-molecules
Cell cycle and cell division
Inorganic Chemistry Lab (BSBT-111)

LIST OF PRACTICALS

1. Inorganic qualitative analysis.
2. Four ions including interfering ions.
3. Volumetric Analysis.
4. Iodimetry, Iodometry, Redox titrations using \( \text{Ce(SO}_4\text{)}_2 \), \( \text{K}_2\text{Cr}_2\text{O}_7 \) and \( \text{KMnO}_4 \), Complexometric titrations using \( \text{EDTA Ca}^{++}, \text{Mg}^{++}, \text{Zn}^{++}, \text{Ni}^{++} \)

Introduction & Fundamentals of Biotechnology Practical (BSBT-113)

LIST OF PRACTICALS

1. Introduction to instrumentation: - Centrifuges, Autoclaves, Spectrophotometers, Microscopes, Laminar hoods, incubators.
2. Centrifugation including ultra-centrifugation.
3. Polyacrylamide gel electrophoresis for proteins.

Basics of Bioscience Lab (BSBT-115)

(Deficiency Course for Students having passed 10+2 with Math)

LIST OF PRACTICALS

Taxonomy:
1. Description of flowers including floral diagram, floral formula, V.S. of flower of the representative genera of families mentioned in syllabus.
2. Each student required to submit a family wise herbarium consisting of at least 20 properly pressed and mounted plants.

Computer Application in Bio-Technology (BSBT-117)

LIST OF PRACTICALS

1. Familiarization of the computer system
2. Loading window, closing, maximizing, icon shifting & ordering.
3. Changing drives and searching files and understanding file extensions.
4. Saving files, protecting and unprotecting.
5. Formatting floppies and practice on virus recognisation and protection.
6. Practice with control panel and file manager.
7. Practice with MS Word, Operating and closing document, Preparation of document, setting of document, familiarization with various tools, mail-merge practice.
8. Internet Browsing.
# 2nd Semester

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<th>S. No</th>
<th>Course No</th>
<th>Course Title</th>
<th>L</th>
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Cell Biology (BSBT-102)

Unit I
Cell as a basic unit of living systems: The cell theory. Broad and detailed classification of cell types within an organism. Different levels of organization of cells.

Unit II

Unit III
Structure and function of cell organelles: Ultrastructure of cell membrane, cytosol, golgi bodies, endoplasmic reticulum (rough and smooth), ribosomes. Cytoskeletal structures (actin, microtubules etc.) Mitochondria, chloroplasts, lysosomes, peroxisomes. Nucleus (nuclear membrane, nucleoplasm, nucleolus, chromatin)

Unit IV
Fixation and Staning; Freeze drying and freeze substitution, Microtome and Embedding, Chemical basis of staining, Cytophotometric Methods.

Recommended Books

Cell and molecular Biology: De Roberties
Cell Biology: Bruce Albert’s
Cell Biology: Dowben
**General Microbiology (BSBT – 104)**

**Unit I**

**Unit II**

**Unit III**
Microbial growth, nutritional biodiversity, phases of growth, generation time, growth rates, monoauxic, diauxic and synchronous growth, chemostat Microbes in extreme environment like high temperature and high/ low pH Physical and chemical agents to kill microbes, sterilization and pasteurization processes

**Unit IV**

**Recommended books**

Physical Chemistry (BSBT-106)

Unit-1
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 an exchange 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. Enthalpy of formation, enthalpy of ionisation and second law of thermodynamics, entropy and Gibb’s free energy, Carnot’s cycle, Gibb’s Hemholtz equation, Third law of thermodyanamics, Nernst heat theorem. Thermodynamics of simple mixture, partial molar quantities and their significance, chemical potential, chemical potential in a mixture of ideal gases.

Unit-2
Solution: Definition, types of solutions, vapour pressur of solution and Raoult’s law. Factors influencing the solubility of gas in liquids, Henry’s Law. Ideal solutions, Distillation of ideal solutions, lever rule, vapour pressure of ideal solutions and non ideal pressure, depression in freezing point, elevation in boiling point, osmotic pressure. Their common features and applications.

Phase Equilibria:
Definition of phase, component and degree of freedom phase rule and its thermodynamic derivation clausius clapeyron (Derivation not included) phase diagrams of water system, KI water system.

Unit-3
Chemical Kinetics:
Rate of reaction, constant factors influencing rate of reaction, order, molecularity, rate equations for 1$^{st}$ order, 2$^{nd}$ order & 3$^{rd}$ order reactions. Half life complex reactions, consecutive reactions, parallel reactions, chain reactions and opposing reactions. Activation energy and theories of reactions rates collision theory and transition state theory of bimolecular processes. Catalysis, acid base catalysis.
Unit-4
Electrochemistry
Specific conductance, molar conductance and their dependence on electrolyte concentration, ionic equilibria and conductance, theory of strong electrolytes. Transport number conductometric titrations. pH scale. Buffer solutions, salt hydrolysis.

Electrochemical Cells:
Electrochemical cells, calculations of $^\Delta G$, $^\Delta H$, $^\Delta S$ and potentiometer determination of pH, Potentiometer titrations.

Recommended Books
1. Atkin’s Physical Chemistry by Peter Atkins and Julio de Paulk. Publisher Oxford University Press
2. Textbook of Physical chemistry by Samuel Glasston. MacMillan India Ltd
Biochemistry (BSBT – 108)

Unit-I
Enzymes: General properties factors affecting enzyme activity regulation of enzyme activity, steady state kinetics, first order and second order kinetics, covalent modifications, classification, nomenclature types of inhibitors, inhibitors, immobilized enzymes, Ribozymes.

Unit-II
Metabolism: Metabolic pathways, biochemical reaction mechanism, energy rich metabolites, inter organ metabolic pathways.
Carbohydrate metabolism: Biosynthesis and degradation of carbohydrates; feed pathways for glycolysis; Pentose pathway Kreb’s Cycle: Enzymes of Kreb’s cycle, amphibolic 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: Digestion and absorption Biosynthesis and degradation of fatty acids; metabolism of triacyl glycerols; cholesterol metabolism, ketonobodies. Nitrogen Metabolism: Reduction and assimilation of atmospheric nitrogen, Biosynthesis and degradation of amino acids; amino acids as precursors of heme; biogenic amines; biosynthesis of degradation of nucleic acids.

Recommended Books


Genomics. Introduction, genome sequencing projects, comparative genomic, gene prediction and counting. Genome evolution.

**Recommended Books**
2. *Genes VIII* by Benjamin Lewin. Publisher: Prentice Hall.
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**Cell Biology Lab (BSBT-112)**

**List of Practicals**

1. Sub Cellular Fractionation and marker enzymes  
2. Mitosis and Meiosis  
3. Vital staining for visualizing cell organelles  
5. Instrumental methods for Cell Biology- Centrifugation, Chromatography.  
6. Microscopy: Bright field, phase contrast and fluorescence microscopy.  
7.  

**General Microbiology Lab (BSBT-114)**

1. Aseptic techniques  
2. Cleaning of glass wares, Preparation of media, Cotton plugging and sterilization  
3. Personal hygiene Microbes from hands, Tooth-Scum 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.  
7. Identification of isolated bacteria  
8. Gram staining, other staining methods, metabolic characterization (e.g., IMVic) tests  
9. Growth curve of microorganisms.  
11. Testing of water quality  
12. Test for antibodies against given bacteria  
13. One step growth of bacteriophage.  
14. Culture from body fluids (Stool, Urine, Blood).  
15. Alcoholic and mixed acid fermentation.  

**Books recommended**
Benjamin/Cummings Publishing Company.
LIST OF PRACTICALS

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 Stalgiminter.
5. Determination of viscosity of a pure liquid (acetone, ethanol, propanol, butanol, glycol) (effect of hydrogen bonding on viscosity).
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 BaC12.
   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).
LIST OF PRACTICALS

1. Estimation of $\alpha$-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 salt precipitation
7. Chromatographic methods for separation of macromolecules
   - Paper chromatography
   - Thin layer chromatography
   - Gel permeation chromatography

Recommended Books:


Genetics Lab (BSBT-120)

1. Probability – Coin tossing and color blindness
3. Model Preparation related to theory