JAI HIND COLLEGE
BASANTSING INSTITUTE OF SCIENCE
&
J.T.LALVANI COLLEGE OF COMMERCE
(AUTONOMOUS)

"A" Road, Churchgate, Mumbai - 400 020, India.

Affiliated to
University of Mumbai

Program: B.Sc

Proposed Course: Biotechnology

Semester I

Credit Based Semester and Grading System (CBCS) with effect from the academic year 2020-21

*F.Y.B.Sc. Biotechnology Sem I Syllabus*

**Academic year 2020-2021**

| **Semester 1** | | | |
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| **Course code** | **Course Title** | **Credits** | **Lectures /Week** |
| SBT101 | Introduction to Biotechnology | 2 | 3 |
| SBT102 | Genetics | 2 | 3 |
| SBT103 | Biodiversity and Experimental models | 2 | 3 |
| SBT104 | Techniques in Biological Sciences | 2 | 3 |
| SBT105 | Fundamentals In Chemistry I | 2 | 3 |
| SBT106 | Fundamentals In Chemistry II | 2 | 3 |
| SBTP101 | Introduction to Biotechnology and Genetics | 2 | 6 |
| SBTP102 | Biodiversity, Experimental models And Techniques in biological sciences | 2 | 6 |
| SBTP103 | Fundamentals In Chemistry I & II | 2 | 6 |

**Semester I – Theory**

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| **Course Code: SBT101** | **Introduction to Biotechnology (Credits: 02, Lectures/Week: 03)** | **02 Credits** |
| **Learning Objectives** | ➢ To acquaint students with the various fields in Biotechnology<br>➢ To provide an overview of the different applications of Biotechnology<br>➢ To offer an understanding of basics of Fermentation Techniques | |
| **Course description** | At the end of this course, the student would have a good understanding of the field of Biotechnology, its scope and applications. Also, the student will be well familiar with a very important aspect viz. Fermentation Techniques which are most widely used in industry. | |
| | **THEORY** | **(45 lectures)** |
| **Sub Unit** | **Unit – I: Scope and Introduction to Biotechnology** | **15 L** |
| | a) **Introduction**<br>i) Definition.<br>ii) History of Biotechnology.<br>iii) Traditional and Modern Biotechnology.<br>b) **Branches of Biotechnology** (Red Biotechnology, White Biotechnology, Blue Biotechnology, Green Biotechnology)<br>i) Medical Biotechnology.<br>ii) Industrial Biotechnology.<br>iii) Marine and Aquatic Biotechnology.<br>iv) Agricultural Biotechnology.<br>v) Environmental Biotechnology<br>c) **Milestones in Biotechnology**<br>d) **Current scenario in India and the world**<br>e) **Biosafety and Ethics in Biotechnology** | |
| | **Unit – II: Applications of Biotechnology** | **15 L** |
| | **a) Agriculture**<br>i) Biotechnological applications in crop and livestock improvements<br>ii) Modifications in Plant Quality - Golden rice; Hybrid crops<br>iii) Molecular Pharming, Plant based vaccines<br>**b) Environmental Biotechnology**<br>i) Renewable energy resources<br>ii) Bioremediation<br>**c) Industrial Biotechnology**<br>i) Food Biotechnology<br>ii) Biopharmaceutical Applications<br>**d) Advances in Biotechnology** | |

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| | i) COVID-19 World pandemic<br>ii) Human Genome Project<br>iii) Animal Cloning<br>iv) Genetic counselling and Gene therapy<br>v) Diagnostics and therapeutic molecules | |
| | **Unit – III: Introduction to Fermentation Technology** | **15 L** |
| | **a) History of Fermentation**<br>i) History of Fermentation technology<br>ii) Major contributors of fermentation techniques<br><br>**b) Fermentation: Design and systems**<br>iii) Design of a basic fermentor<br>iv) Baffles, Spargers, Impellers<br>v) Mechanically agitated and Pneumatically agitated bioreactors<br>vi) Unique designs of bacterial and fungal fermentations<br><br>**c) Types of Fermentation methods**<br>Microbial growth kinetics<br><br>Microbial fermentations- Types of fermentation with one example each: Surface, Submerged, Aerobic and Anaerobic fermentation, Solid state fermentation.<br><br>**d ) Applications of Fermentation Technology:**<br><br>**(**Flow-sheet format) Antibiotics, Vaccines, Enzymes and Beverages. | |
| **CA (Continuous Assessment)** | 1. CA1- Written test<br>2. CA2 –Case studies | |
| **References:** | • Dubey R C. (2006). A textbook of Biotechnology. S Chand and Company Ltd.<br>• Ramavat K. G., and Gopal S. (2009). Comprehensive Biotechnology. 4Th Revised Edition. S. Chand and Company Ltd.<br>• Bhatia S. C. (2005). Textbook of Biotechnology. Atlantic Publishers.<br>• Kalaichelvan P. T., and Pandi I.A. (2007). Bioprocess Technology. MJP Publishers.<br>• McNeil B., and Harvey L. M. (1990). Fermentation – A practical approach. Oxford University Press.<br>• Puvanakrishnan R., Sivasubramanian S., and Hemalatha T. (2012). Microbial Technology – Concepts and applications. MJP Publishers.<br>• Casida L E. (1968). Industrial Microbiology. John Wiley and Sons.<br>• Patel A H. (1984). Industrial Microbiology. Macmillan India Ltd. Stanbury P., Whitaker A., and Hall S. (1995). Principles of Fermentation Technology. 2nd Edition. Butterworth Heineman. | |

| Course Code: SBT102 | Genetics (Credits: 02, Lectures/Week: 03) | 02 Credits |
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| **Learning Objectives** | ➢ To acquaint students with concepts in Genetics<br>➢ To understand the concept of heredity and variation<br>➢ To reinforce the structure and organization of genetic material<br>➢ To establish a clear knowledge of the role of genetic material in bacteria and viruses in genetic analyses: Plasmids, cosmids, transposons . | |
| **Course description** | At the end of this course, the student would be equipped with the knowledge and understanding of the basic concepts in eukaryotic and prokaryotic genetics. Students will also develop an insight of basic concepts of experimental methods and tools used in Genetics studies. | |
| | **THEORY** | **(45 lectures)** |
| **Sub Unit** | **Unit – I: Fundamentals of Genetics** | **15 L** |
| **1.** | **a) Mendel's Law of Heredity**<br>i) Monohybrid Cross: Principle of Dominance and segregation<br>ii) Dihybrid Cross: Principle of Independent Assortment<br>iii) Trihybrid Crosses<br>iv) Rediscovery of Mendel's principles<br>v) Applications of Mendel's Principle; Punnett Square<br>vi) Mendel's Principle in Human Genetics,<br>vii) Pedigree analysis<br>viii) Examples of Human Genetic traits<br><br>**b) Extension of Mendelian Genetic Principles; Incomplete Dominance and Co-dominance**<br>i) Genotype and Phenotype | |
| | **Unit – II: Structure and Organization of Eukaryotic Genetic Material** | **15 L** |
| **1.** | **a) Structure of Eukaryotic Chromosomes**<br>i) Structure of Chromosomes<br>ii) Shapes of metaphase chromosomes<br>iii) Histone and non-histone proteins<br>**b) Packaging of DNA**<br>i) Nucleosome structure<br>ii) Packing of DNA into chromosome<br>**c) Chromosome study -** Chromosome banding - Types<br>**d) Karyotype Analysis**<br>i) Study of human karyotype | |

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| | ii) Study of genetic abnormalities (Turner's Syndrome, Klinefelter's syndrome, Down's Syndrome, Cri-du-chat Syndrome, Philadelphia Syndrome) | |
| | **Unit – III: Microbial Genetics** | **15 L** |
| **1.** | **a) Structural characteristics of Bacterial and Viral chromosomes**<br>i) Bacterial Chromosome<br>ii) Phage Chromosome<br>**b) Genetic analysis of bacteria**<br>i. Prototrophs and Auxotrophs ( wild type and nutritional mutants)<br>ii. Use of selective media in isolation of mutants<br>**c) Bacteriophages and other carriers**<br>i) Terminology associated with Bacteriophage<br>ii) Types of bacteriophage<br>iii) Lytic and Lysogenic cycle<br>iv) Development of a phage in a host<br>**d) DNA and RNA viruses**<br>**e)** Introduction to other carriers like Plasmids, cosmids and transposons | |
| **CA**<br><br>**(Continuous Assessment)** | 1. CA 1- Written test<br>2. CA 2 – Infographics | |
| **References:** | • Russell P. J. (1998). Genetics. 5th Edition. Benjamin/Cummings Publishing Company Inc.<br>• Russell P. J. (2016). Essential iGenetics. 3rd Edition. Pearson Education..<br>• Gardner E., Simmons M., and Snustad D.P. (1991). Principles of Genetics. 8th Edition. John Wiley and Sons Inc.<br>• Maloy S. R., Cronan J. E., and Freifelder D. (2006). Microbial Genetics. 2nd Edition. Narosa Publishing House. | |

| Course Code: SBT103 | **Biodiversity and Experimental Models (Credits: 02, Lectures/Week: 03)** | **02 Credits** |
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| **Learning Objectives** | ➢ To acquaint students with concept of diversity in Biology, particularly in relation to plant, animal, and microbial diversity.<br>➢ To introduce the various types of experimental models used in Biological Sciences<br>➢ To study the role of the ecosystem and the various interactions that sustains it. | |
| **Course description** | At the end of this course, the student would have the knowledge of the concept of biodiversity. The student will learn about some popularly used model organisms and their role in understanding Biological processes. Also the student should be able to understand the constitution of the ecosystem and appreciate the importance of the various interactions of the ecosystem. | |
| | **THEORY** | **(45 lectures)** |
| **Sub Unit** | **Unit – I: Biodiversity - I** | **15 L** |
| **1.** | **a) Biodiversity**<br>i) Concept of biodiversity<br>ii) Taxonomical, Ecological and genetic diversity and its significance<br>**b) Introduction to plant and animal diversity**<br>**c) Introduction to microbial diversity** (Structure, Habitats, Examples & Applications)<br>i) Eubacteria<br>ii) Archaebacteria | |
| | **Unit – II: Biodiversity - II** | **15 L** |
| **1.** | **a) Introduction to microbial diversity** (Structure, Habitats, Examples & Applications)<br>i) Protists<br>ii) Viruses<br>**b) Bacteria**<br>i) Classification, Types and morphology (size, shape and arrangement)<br>ii) Reproduction & growth- Binary fission, conjugation and endospore formation<br>iii) Significance and uses of bacteria<br>**c) Biotechnology in Biodiversity conservation**<br>i) Field Gene Banks<br>ii) Seed Banks<br>iii) Pollen Banks<br>iv) DNA Banks<br>v) Germplasm preservation: Cryobiology<br>**d) Biotechnology in enrichment of Biodiversity** | |

| | Unit – III: Experimental Models | 15 L |
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| **1.** | **a) Significance and criteria for selection**<br>**b) Eukaryotic experimental organisms**<br>i) *Drosophila melanogaster*<br>ii) Albino mouse<br>iii) Guinea pig<br>iv) Hamster<br>v) Monkey<br>vi) *Saccharomyces cerevisiae*<br>vii) *Neurospora crassa*<br>viii) *Zea mays*<br>ix) *Pisum sativum*<br>**c) Prokaryotic experimental organisms**<br>*i) Escherichia coli*<br>*ii) Caulobacter crescentus* | |
| **CA**<br><br>**(Continuous Assessment)** | 1. CA1- Written test<br>2. CA2- Case studies | |
| **References:** | • Ramavat K. G., and Gopal S. (2009). Comprehensive Biotechnology. 4Th Revised Edition. S. Chand and Company Ltd.<br>• Willey J. M., Sherwood L., Sherwood L. M., Woolverton C. J., Woolverton C. Prescott's Microbiology. (2010). 8th Edition. McGraw Hill.<br>• Santra S. C. (2011). Environmental Science. 2nd Edition. New Central Book Agency (P) Ltd.<br>• Odum E. P., and Barrett G. W. (2005). Fundamentals of Ecology. Thomson Brooks/Cole.<br>• Verma P. S., and Agarwal V. K. (1983/2016Rp). Environmental Biology: Principles of Ecology. S. Chand and Company Pvt. Ltd.<br>• Russell P. J. (1998). Genetics. 5th Edition. Benjamin/Cummings Publishing Company Inc.<br>• Russell P. J. (2016). Essential iGenetics. 3rd Edition. Pearson Education.<br>• Gardner E., Simmons M., and Snustad D.P. (1991). Principles of Genetics<br>• 8th Edition. John Wiley and Sons Inc. | |

| Course Code: SBT104 | Techniques in Biological Sciences (Credits: 02, Lectures/Week: 03) | 02 Credits |
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| **Learning Objectives** | ➢ To provide a basic understanding of the need and methods of sterilization<br>➢ To impart skill in handling and culture of Microorganisms<br>➢ To reinforce the use of microscope and study the various types of stains and staining methods to be used for visualization of specimens. | |
| **Course description** | At the end of this course, the student would be equipped with the knowledge and understanding of the basic skills in laboratory techniques viz. sterilization, microbial cell culture & cell lines techniques, microscopy and staining techniques to view specimens under a microscope. | |
| | **THEORY** | **(45 lectures)** |
| **Sub Unit** | **Unit – I: Sterilization Techniques** | **15 L** |
| **1.** | **a) Sterilization and Disinfection**<br>i) Definitions of and differences between Sterilization and disinfection<br>ii) Applications of sterilization and disinfectants in Biological sciences.<br>iii) **Physical agents**-<br>Sunlight, Drying, heat, Steam under pressure, Gases, Radiation and filtration<br>iv) **Chemical agents and their mode of action**-<br>Phenol and Phenolic compounds; Aldehydes, Halogens, Quaternary Ammonium compounds, heavy metals, Alcohols and Detergents<br>v) **Ideal Disinfectant** - examples and evaluation of disinfectants | |
| | **Unit – II: Microbial Cell Culture Techniques** | **15 L** |
| **1.** | **a) Microbial Cell Culture Techniques**<br>i) Nutrition and Cultivation of microorganisms- Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorous, Sulphur & Growth factors<br>ii) Classification of different nutritional types of organisms<br>b) **Design and types of culture medium**<br>i) Liquid and Solid media,<br>ii) Simple/ basal media and complex media,<br>iii) Synthetic, Enriched, Enrichment media,<br>iv) Selective, differential and indicator media<br>v) Sugar media, transport media<br>vi) Anaerobic media | |

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| | c) **Concept of isolation and methods of isolation , pure culture techniques**<br>d) **Culturing anaerobic organisms**<br>e) **Preservation of microbial cultures**- Principle & methods | |
| | **Unit – III: Microscopy and Staining Techniques** | **15 L** |
| **1.** | **a) Microscopy-** Introduction, Definition, general applications in biological sciences<br>**b) Types of microscopy**<br>i) Light or Optical Microscope<br>Simple and Compound microscopes. Principle, parts, functions and applications<br>ii) Phase contrast microscope<br>iii) Dark field/ Dark ground microscope<br>**c) Stains and staining solutions**<br>i) Definition of Dye and Chromogen<br>ii) Structure of Dye and Chromophore<br>iii) Functions of mordant and fixatives<br>iv) Natural and synthetic dyes<br>v) Simple staining, Differential staining and Acid fast staining with examples | |
| **CA**<br><br>**(Continuous Assessment)** | 1. CA 1- Written test<br>2. CA 2- Market survey | |
| **References:** | • Pelczar M.J., Chan E.C.S., Kreig N.R. (2006). Microbiology. 6th Edition. The Mc Grew Hill Companies Inc., NY.<br>• Willey J. M., Sherwood L., Sherwood L. M., Woolverton C. J., Woolverton C. Prescott's Microbiology. (2010). 8th Edition. McGraw Hill.<br>• Ananthanarayan R. and Panikar C. K. J. (2009). Textbook of Microbiology. 8Th Edition. Universities Press. | |

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| **Course Code: SBT105** | **Fundamentals in Chemistry – I (Periodic table and Periodicity of elements, Concepts in Organic Nomenclature, Chemical bonding) (Credits: 02, Lectures/Week: 03)** | **02 Credits** |
| **Learning Objectives** | ➢ To provide an overview of the Periodic Table and relate elements specifically important in Biological systems.<br>➢ To acquaint students with basic concepts of Chemistry like Classification and Nomenclature of organic compounds.<br>➢ To study the nature and role of water and buffers in relation to the biological system.<br>➢ To equip the student with skills required for calculations in preparation of solutions of various concentrations and strengths. | |
| **Course description** | At the end of this course, the student would be well versed with the different chemical elements with special emphasis on Biologically active elements.<br><br>The Nomenclature of organic compounds (with special emphasis on Bio-organic molecules and industrially important compounds).<br><br>Also, an overview of the Nature and role of water and buffers is being introduced to help the student appreciate the importance of the various buffer systems and their applicability in Biotechnology. | |
| | **THEORY** | **( 45 lectures)** |
| **Sub Unit** | **Unit I: Periodic Table and Periodicity of elements** | **15 L** |
| **1.** | **a) Long form of Periodic Table**<br>i. Classification of elements<br>ii. Transition elements; and<br>iii. Inner transition elements<br>**b) Periodicity in properties of elements :**<br>( Simple Numerical problems based on topic to be covered)<br>i. Ionic size and Atomic size<br>ii. Ionization gain enthalpy<br>iii. Electron enthalpy<br>iv. Slater's rule ; Effective nuclear charge<br>v. Electronegativity: Pauling, Mulliken and Alred Rochow electronegativity | |
| **Sub Unit** | **Unit II: Nomenclature of Organic compounds** | **15 L** |
| **1.** | **a) IUPAC Nomenclature and Classification of organic compounds**<br>i) Alkanes<br>ii) Alkenes<br>iii) Alkynes | |

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| | iv) Cyclic Hydrocarbons/Alicyclic Hydrocarbons<br>v) Aromatic compounds<br>vi) Alcohols and Ethers<br>vii) Carboxylic acids and its derivatives<br>viii) Amines and Amides<br>ix) Alkyl Halides<br>x) Heterocyclic compounds | |
| **2.** | **a) Applications of organic molecules**<br>i) Applications of organic compounds in biological sciences- Brief concept of bioorganic molecules<br>ii) Industrial applications of organic compounds | |
| **3.** | **a) Electronic Effects of organic compounds**<br>i) Inductive Effect<br>ii) Electromeric Effect<br>iii) Mesomeric Effect<br>iv) Hyperconjugative Effect<br>v) Resonance | |
| **Sub Unit** | **Unit III: Chemical Bonding** | **15 L** |
| **1.** | **a) Ionic Bond**<br>i) Nature of Ionic bond<br>ii) Structure of NaCl, KCl and CsCl<br>iii) Factors influencing the formation of ionic bonds | |
| **2.** | **a) Covalent Bonds**<br>i) Nature of covalent bond<br>ii) Structure of $CH_4$, $NH_3$ , $H_2O$ | |
| **3.** | **Coordinate Bonds -** Nature of coordinate bond | |
| **4.** | **Non-covalent Bonds –**Van Der Waal's Forces: Dipole-dipole and dipole-induced dipole | |
| **5.** | **a) Hydrogen Bonds**<br>i) Theory of Hydrogen bonding<br>ii) Types of Hydrogen bonding with examples: RCOOH, ROH<br>iii) Salicylaldehyde, Amides and Polyamides | |
| **CA**<br><br>**(Continuous Assessment)** | 1. CA 1 – Written test<br>2. CA 2 – Model | |

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| **References:** | **Unit 1:**<br>1. Shriver, D. F. and Atkins, P. W. 1999, *Inorganic chemistry*, 3 rd Ed., Oxford University Press,<br>2. Jolly, W. L. , 1993, *Modern inorganic chemistry*, McGraw Hill Book Co.<br>3. Douglas, B. E. and McDaniel, H., *Concepts and models in inorganic chemistry*, 1994,3 rd Ed., John Wiley & Sons, Inc., New York,<br>4. Huheey, J.E. , 1993, *Inorganic Chemistry*, Prentice Hall.<br>5. Lee, J.D., 1993, *Concise Inorganic Chemistry*, ELBS<br>6. Shriver D. F. & Atkins P. W., 1994 *Inorganic Chemistry*, third Edition, Oxford press<br>**Unit 2**<br>1. Morrison, R. T.; Boyd, R. N. 2012. *Organic Chemistry*. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).<br>2. Finar, I. L. 2012. *Organic Chemistry (Volume 1)*. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).<br>3. Solomons, T.W.G. 2009.*Organic Chemistry.* John Wiley & Sons, Inc.<br>**Unit 3**<br>1. Bahl, Tuli and Anand, *Advanced Inorganic Chemistry*, Volume I and II<br>2. Prakash,S., Tuli, G.D., Basu, S.K., Madan, R.D., *Advanced Inorganic Chemistry*, Volume I<br>3. Shriver, D.F., P.W. Atkins, C. H. Langford, 3rd edition, *Inorganic Chemistry*, Oxford University Press<br>4. Lee, J.D. *Concise Inorganic Chemistry*, (1991), ELBS<br>5. Douglas, B.E. and McDaniel, D.H., (1970), *Concepts & Models of Inorganic Chemistry*<br>6. Day, M.C. and Selbin, J., (1962), *Theoretical Inorganic Chemistry*, ACS Publications<br>7. James E. Huehey, *Inorganic Chemistry*, (1983), Harper & Row Publishers, Asia. |

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| **Course Code: SBT106** | **Fundamentals in Chemistry – II (Thermodynamics, Stereochemistry and Water and Buffers) (Credits: 02, Lectures/Week: 03)** | **02 Credits** |
| **Learning Objectives** | ➢ To acquaint students with the concepts and fundamentals of Thermodynamics.<br>➢ To build concepts in Stereochemistry by providing an understanding of the relative spatial arrangement of atoms in molecules.<br>➢ To help students understand the types and significance of chemical bonds. | |
| **Course description** | This Course is designed to impart basic knowledge in the area of Thermodynamics.<br>The students will be able to understand Stereochemistry of organic molecules and their practical significance<br>The student will also be able to appreciate the nature and role of chemical bonds in the formation of compounds. This is followed by an emphasis on practical applications. | |
| | **THEORY** | **(45 lectures)** |
| **Sub Unit** | **Unit I: Thermodynamics** | **15 L** |
| **1.** | **a) Introduction**<br>i) System, surrounding, boundaries, sign conventions, State Functions<br>ii) Internal Energy and Enthalpy: Significance, examples<br>iii) (Numerical expected) | |
| **2.** | **a) Thermodynamics**<br>i) Laws of thermodynamics and limitations, Mathematical expression<br>ii) Qualitative discussion of Carnot cycle for ideal Gas and Mechanical efficiency<br>iii) Laws of Thermodynamics as applied to biochemical systems<br>iv) Concept of entropy, Entropy for Isobaric, Isochoric and Isothermal processes | |
| **Sub Unit** | **Unit II: Stereochemistry** | **15 L** |
| **1.** | **a) Isomerism**<br>i) Types of isomerism- chain, position and functional<br>ii) Stereoisomerism<br>iii) Chirality | |

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| **2.** | **a) Geometric Isomerism and Optical Isomerism**<br>i) Enantiomers<br>ii) Diastereomers<br>iii) Racemic mixtures- cis-trans, Threo, Erythro and meso isomers<br>iv) Diastereomerism (cis-trans isomerism) in Alkenes and cycloalkenes<br>v) Cycloalkenes (3and 4 membered ring) | |
| **3.** | **a) Conformation**<br>i) Conformations of ethane<br>ii) Difference between configuration and conformation | |
| **4.** | **a) Configuration**<br>i) Asymmetric Carbon atom<br>ii) Stereogenic & Chiral centres<br>iii) Chirality<br>iv) Representation of configuration by "Flying Wedge" formula | |
| **5.** | **a) Projection Formulae**<br>i) Fischer, Newman and Sawhorse<br>ii) The interconversion of the formulae | |
| **Sub Unit** | **Unit III: Water and Buffers** | **15 L** |
| **1.** | **a) Chemistry of Water**<br>i) Properties of Water<br>ii) Interaction of water with solutes -polar, non-polar and charged<br>iii) Non- polar compounds in water - change in its structure & hydrophobic effect<br>iv) Role of water in biomolecular structure and function<br>v) Water as a medium for life | |
| **2.** | **a) Solutions**<br>i) Normality<br>ii) Molarity<br>iii) Molality<br>iv) Mole fraction<br>v) Mole concept<br>vi) Solubility<br>vii) Weight ratio, volume ratio, and Weight: Volume ratio, concentration v/s amount, standard abbreviations<br>viii) Ppb, ppm, micrograms, nanograms, millimoles and milliequivalents (numerical expected) | |
| **3.** | **a) Primary and Secondary standards**<br>i) Preparation of standard solutions<br>ii) Principle of volumetric analysis | |

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| **4.** | **a) Acids and bases**<br>i) Lowry-Bronsted and Lewis concepts<br>ii) Strong and Weak acids and bases<br>iii) Ionic product of water : pH, pKa, pKb<br>iv) Hydrolysis of salts | |
| **5.** | **a) Buffer solutions**<br>i) Concept of buffers<br>ii) Types of buffers<br>iii) Derivation of Henderson equation for acidic and basic buffers<br>iv) pH of buffer solution<br>v) Blood buffer system | |
| **CA**<br><br>**Continuous Assessment** | 1. CA 1 - Written test<br>2. CA 2 – Problems | |
| **References:** | **Unit 1**<br>1. Puri, B. R., Sharma, L.R., and Pamania, M.S. (2017). *Physical Chemistry*, 47th Edition, Vishal Publishing Company.<br>2. Kapoor, K.L. (2006). *Textbook of Physical Chemistry*. McMillan Publishers<br>3. Barrow, G.M. ( ) *Physical Chemistry*. 6th Edition. Tata McGraw Hill Publishing Co. Ltd. New Delhi<br>4. Atkins P. W., and Paula J. De. (2014). *Physical Chemistry*. 10th ed., Oxford University, 12 press.<br>5. Levine, I. N., *Physical Chemistry*, 6th Edition. 2010, Tata McGraw Hill<br>**Unit 2**<br>1. Morrison, R. T.; Boyd, R. N. (2012). *Organic Chemistry*. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).<br>2. Finar, I. L. (2012). *Organic Chemistry (Volume 1)*. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).<br>3. Solomon, T.W.G. (2009).*Organic Chemistry*. John Wiley & Sons, Inc.<br>4. Kalsi, P. S. (2005) *Stereochemistry Conformation and Mechanism*. New Age International<br>5. Ahluwalia, V.K.; Parashar, R.K. (2006) *Organic Reaction Mechanisms.* Narosa Publishing House.<br>6. Mukherji; Singh; Kapoor. (2002) *Reaction Mechanisms in Organic Chemistry* McMillan<br>**Unit 3.**<br>1. Plummer D. (2001). An Introduction to Practical Biochemistry. 3rd Edition. Tata McGraw Hill Edu. Pvt. Ltd. New Delhi, India.<br>2. Lehninger, Nelson D and Cox M. (2008). Principles of Biochemistry. 5th Edition. W.H. Freeman and company, NY.<br>3. Murray R. Harper's Illustrated Biochemistry. (2017). 27th Edition. Lange Publications. | |

*SEM I Biotechnology Practical Syllabus*

**Academic year 2020-2021**

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| **Course Code: SBTP101** | **Introduction to Biotechnology and Genetics**<br><br>**Credits : 02 Practical /Week: 02** |
| **Learning Objectives** | • To familiarise students with Biotechnology lab set up and common lab glassware<br>• To acquaint students with the principles, applications and working of instruments like pH meter, water bath, vortex, Hot air oven Autoclave, centrifuge and others<br>• To enumerate bacterial and fungal cells using micrometer<br>• To isolate DNA from plant root tips using chemical method<br>• To study DNA and RNA using qualitative tests<br>• To solve problems in genetics<br>• To understand and study karyotype |
| | 1. Introduction to Biotechnology Laboratory<br>2. Introduction to glassware used<br>3. Introduction to common laboratory instruments<br>Electronic Balance, pH Meter, Water Bath, Hot air Oven, Autoclave, Incubator, Rotary Shaker, Vortex mixer, Centrifuge<br>4. Meat tenderization using papain<br>5. Fermentative production of alcohol<br>6. Enumeration of microbes using micrometer stage slide<br>7. Microscopic determination of yoghurt/ milk microbial flora<br>8. Qualitative analysis of DNA by DPA method<br>9. Qualitative analysis of RNA by Orcinol method<br>10. Isolation of gDNA from onion sample<br>11. Study of Karyotype<br>12. Problems on Mendelian Genetics<br>13. Problems on Gene Mapping<br>14. Visit to a Biotechnology Institute /Industry and report writing. |

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| **Course Code: SBTP102** | **Biodiversity, Experimental models and Techniques in Biological Sciences (Credits : 02 Practical/Week: 02** |
| **Learning Objectives** | • To examine permanent slide and characterize BGA microscopically<br>• To study algae using enrichment method<br>• To carry out slide culture technique for Nocardia and Streptomyces<br>• To understand the basics of bacteriology using culture techniques and microbial media preparation<br>• To learn to handle microbes using aseptic transfer technique<br>• To learn sterilization technique and study its applications<br>• To learn preservation techniques for microbes<br>• To isolate bacteria using Streak plate / T plate technique |
| | 1. Study of permanent slides of BGA<br>2. Enrichment of Algae.<br>3. Cultivation of fungi and microscopic examination using lacto cotton phenol blue<br>4. Slide culture technique of *Nocardia* and *Streptomyces*<br>5. Cultivation of drosophila using various media<br>6. Differentiation and identification of male and female drosophila from cultured sample<br>7. Components and working of Simple and Compound microscope<br>8. Monochrome staining of bacteria (*Bacillus* and *E. Coli*)<br>9. Differential staining- Gram staining<br>10. Sterilization – Laboratory glassware and media using autoclave<br>11. Preparation of media – Nutrient Broth, Nutrient Agar, MacConkey Agar, Sabouraud's Broth and Agar<br>12. Aseptic Transfer technique<br>13. Isolation of microorganisms: T streaking method<br>14. Preservation of microorganisms<br>15. Visit to a nature park / Laboratory and report writing. |

| Course Code: SBTP103 | **Fundamentals in Chemistry I &II**<br><br>**Credits : 02 Practical /Week: 02** |
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| **Learning Objectives** | • To learn Good practices for a Chemistry lab and familiarize students with safety measures<br>• To study pH equation and measure pH using pH meter<br>• To calculate and prepare buffers of choice at a specified pH<br>• To carry out qualitative analysis of inorganic salts<br>• To identify functional groups and characterize organic compounds<br>• To learn chemical titration technique |
| | 1. Safety measures, accidents, first aid and good practices in chemistry laboratory<br>2. Working and use of a Digital Balance<br>3. Functioning and standardization of pH meter<br>4. Preparation of standard solutions – Molar, Molal and Normal<br>5. Preparation of buffers<br>6. Determination of strength of HCl and standardization using borax from commercial sample<br>7. Qualitative analysis of inorganic compounds<br>8. Characterization of organic compounds<br>a) Containing only C H O as elements (no element test). Compounds belonging to following classes<br>Carboxylic acid<br>Phenol<br>Aldehyde/Ketone<br>Ester<br>Alcohol<br>Hydrocarbon<br>b) Containing C H O and N, Halogen as elements (element tests to be done). Compounds belonging to following classes<br>Amides<br>Amines<br>Nitro compounds<br>Haloalkane<br>9. Dissociation constant of weak acids by incomplete titration method using pH meter.<br>10. Determination of enthalpy of dissolution of salt - $KNO_3$ |

## Evaluation Scheme

**[A] Evaluation scheme for Theory courses**

**I. Continuous Assessment ( C.A.) - 40 Marks**

**(i) C.A.-I : Test – 20 Marks of 40 mins. duration**

**(ii) C.A.-II : Assignment/Project etc**

**II. Semester End Examination ( SEE)- 60 Marks**

**[B] Evaluation scheme for Practical courses**

**I. Internal Practical/ continuous assessment**

**II. Semester end Practical Exam**

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