JAI HIND COLLEGE AUTONOMOUS

Syllabus for F.Y.BSc

Course : Biotechnology

Semester : I

Credit Based Semester & Grading System

With effect from Academic Year 2018-19

List of Courses

Course: Biotechnology **Semester: I**

SR. NO.	COURSE CODE	COURSE TITLE	NO. OF LECTURES / WEEK	NO. OF CREDITS
FYBSc				
1	SBT101	INTRODUCTION TO BIOTECHNOLOGY	3	2
2	SBT102	GENETICS	3	2
3	SBT1PR1	PRACTICAL	6	2
4	SBT103	BIODIVERSITY, EXPERIENTAL MODELS AND ECOLOGY	3	2
5	SBT104	TECHNIQUES IN BIOLOGICAL SCIENCES	3	2
6	SBT1 PR2	PRACTICAL	6	2
7	SBT105	FUNDAMENTALS IN CHEMISTRY 1	3	2
8	SBT106	FUNDAMENTALS IN CHEMISTRY 2	3	2
9	SBT1PR3	PRACTICAL	6	2

Semester I – Theory

Course code: SBT101	**Introduction to Biotechnology (Credits : 2 Lectures/Week: 3)**	
	Objectives: • To acquaint students with the various fields in Biotechnology • To provide an overview of the different applications of Biotechnology • To offer an understanding of Fermentation Techniques **Outcomes:** 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.	
Unit I	**Scope and Introduction to Biotechnology** a) **Introduction** i) Definition. ii) History of Biotechnology. iii) Traditional and Modern Biotechnology. b) **Branches of Biotechnology** (Red Biotechnology, White Biotechnology, Blue Biotechnology, Green Biotechnology) i) Medical Biotechnology. ii) Industrial Biotechnology. iii) Marine and Aquatic Biotechnology. iv) Agricultural Biotechnology. v) Environmental Biotechnology c) **Milestones in Biotechnology** d) **Current scenario in India** e) **Biosafety and Ethics in Biotechnology**	**15 L**
Unit II	**Applications of Biotechnology** **a) Agriculture** i) Biotechnological applications in crop and livestock improvements ii) Modifications in Plant Quality - Golden rice; Hybrid crops iii) Molecular Pharming, Plant based vaccines **b) Environmental Biotechnology** i) Renewable energy resources ii) Bioremediation **c) Industrial Biotechnology** i) Food Biotechnology ii) Biopharmaceutical Applications **d) Advances in Biotechnology** i) Human Genome Project ii) Animal Cloning iii) Genetic counseling and Gene therapy iv) Diagnostics and therapeutic molecules	**15 L**
	Introduction to Fermentation Technology **a) Fermentation: Design and systems** i) Design of a basic fermentor	**15 L**

Unit III	ii) Baffles , Spargers, Impellers iii)Mechanically agitated and Pneumatically agitated bioreactors iv)Unique designs of bacterial and fungal fermentations **b) Fermentation Technology& types** Microbial fermentations- Types of fermentation with an example each: Surface, Submerged, Aerobic and Anaerobic fermentation, Solid state fermentation. **c) Applications of Fermentation Technology:** **(**Flow-sheet format)Antibiotics, Vaccines, Enzymes and Beverages.	

Additional References:

1. Dubey R C. (2006). A textbook of Biotechnology. S Chand and Company Ltd.
2. Ramavat K. G., and Gopal S. (2009). Comprehensive Biotechnology. 4Th Revised Edition. S. Chand and Company Ltd.
3. Bhatia S. C. (2005). Textbook of Biotechnology. Atlantic Publishers.
4. Kalaichelvan P. T., and Pandi I.A. (2007). Bioprocess Technology. MJP Publishers.
5. McNeil B., and Harvey L. M. (1990). Fermentation – A practical approach. Oxford University Press.
6. Puvanakrishnan R., Sivasubramanian S., and Hemalatha T. (2012). Microbial Technology – Concepts and applications. MJP Publishers.
7. Casida L E. (1968). Industrial Microbiology. John Wiley and Sons.
8. Patel A H. (1984). Industrial Microbiology. Macmillan India Ltd.
9. Stanbury P., Whitaker A., and Hall S. (1995). Principles of Fermentation Technology. 2nd Edition. Butterworth Heineman.

Course code: SBT102	**Genetics (Credits : 2 Lectures/Week: 3)**	
	Objectives: ➢ To acquaint students with concepts in Genetics ➢ To understand the concept of heredity and variation ➢ To reinforce the structure and organization of genetic material To establish a clear knowledge of the role of genetic material in bacteria and viruses in genetic analyses: Plasmids, cosmids, transposons **Outcomes:** 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**.**	
Unit I	**Fundamentals of Genetics Introduction** **a) Mendel's Law of Heredity** i) Monohybrid Cross: Principle of Dominance and segregation ii) Dihybrid Cross: Principle of Independent Assortment iii) Trihybrid Crosses iv) Rediscovery of Mendel's principles v) Applications of Mendel's Principle; Punnett Square vi) Mendel's Principle in Human Genetics, Pedigree analysis and Examples of Human Genetic traits **b) Extension of Mendelian Genetic Principles; Incomplete Dominance and Co-dominance** i) Multiple alleles ; Allelic series ii) Variations among the effect of the mutation iii) Genotype and Phenotype **c) Environmental effect on the expression of human genes** i) Gene interaction and Epistasis	**15 L**
Unit II	**Structure and Organization of Eukaryotic Genetic Material** **a) Structure of Eukaryotic Chromosomes** i) Structure of Chromosomes ii) Shapes of metaphase chromosomes iii) Histone and non-histone proteins **b) Packaging of DNA** i) Nucleosome structure ii) Packing of DNA into chromosome **c) Chromosome study** - Chromosome banding - Types **d) Karyotype Analysis** i) Study of human karyotype Study of genetic abnormalities (Turner's Syndrome, Klinefelter's syndrome, Down's Syndrome, Cri-du-chat Syndrome, Philadelphia Syndrome)	**15 L**
Unit III	**Microbial Genetics** **a) Structural characteristics of Bacterial and Viral chromosomes** i) Bacterial Chromosome ii) Phage Chromosome **b) Genetic analysis of bacteria** i. Prototrophs and Auxotrophs **c) Bacteriophages and other carriers** i) Lytic and Lysogenic cycle	**15 L**

	ii) Development of a phage iii) Introduction to other carriers like Plasmids, cosmids and transposons	

Additional References:

1) Russell P. J. (1998). Genetics. 5th Edition. Benjamin/Cummings Publishing Company Inc.
2) Russell P. J. (2016). Essential iGenetics. 3rd Edition. Pearson Education..
3) Gardner E., Simmons M., and Snustad D.P. (1991). Principles of Genetics. 8th Edition. John Wiley and Sons Inc.
4) Maloy S. R., Cronan J. E., and Freifelder D. (2006). Microbial Genetics. 2nd Edition. Narosa Publishing House.

Course code: SBT103	**Biodiversity, Experimental Models and Ecology** **(Credits : 2 Lectures/Week: 3)**	
	Objectives: ➢ To acquaint students with concept of diversity in Biology, particularly in relation to plant, animal, and microbial diversity. ➢ To introduce the various types of experimental models used in Biological Sciences ➢ To study the role of the ecosystem and the various interactions that sustains it. **Outcomes:** 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.	
Unit I	**Biodiversity** **a) Biodiversity** i) Concept of biodiversity ii) Taxonomical, Ecological and genetic diversity and its significance **b) Introduction to plant and animal diversity** **c) Introduction to microbial diversity** (Structure, Habitats, Examples & Applications) i) Eubacteria ii) Archaebacteria iii) Protists iv) Viruses **d) Bacteria** i) Classification, Types and morphology (size, shape and arrangement) ii) Reproduction & growth- Binary fission, conjugation and endospore formation iii) Significance and uses of bacteria **e) Biotechnology in Biodiversity conservation** i) Field Gene Banks ii) Seed Banks iii) Pollen Banks iv) DNA Banks v) Germplasm preservation: Cryobiology **f) Biotechnology in enrichment of Biodiversity**	**15 L**
Unit II	**Experimental Models** **a) Significance and criteria for selection** **b) Eukaryotic experimental organisms** i) *Drosophila melanogaster* ii) Albino mouse iii) Guinea pig iv) Hamster v) Monkey vi) *Saccharomyces cerevisiae* vii) *Neurosporacrassa*	**15 L**

	viii) *Zea mays* ix) *Pisumsativum* **c) Prokaryotic experimental organisms** i) *Escherichia coli* ii) *Caulobactercrescentus*	
Unit III	**Ecosystem and Interactions** **a) Ecology and Biogeography** ii. Ecosystems, Definition and Components. iii. Structure and Function of Ecosystems iv. Aquatic and Terrestrial Ecosystems, Biotic and Abiotic Factors, Trophic Levels. v. Food Chain and Food Web, Ecological Pyramids (Energy,Biomass and Number) vi. Nutrient Cycle and Biogeochemical Cycles: Water, C, O, N and S. b) **Interactions**- Commensalism, Mutualism, Predation and Antibiosis, Parasitism.	**15 L**

Additional References:

- Ramavat K. G., and Gopal S. (2009). Comprehensive Biotechnology. 4Th Revised Edition. S. Chand and Company Ltd.
- Willey J. M., Sherwood L., Sherwood L. M., WoolvertonC. J., Woolverton C. Prescott's Microbiology. (2010). 8th Edition. McGraw Hill.
- Santra S. C. (2011). Environmental Science. 2nd Edition. New Central Book Agency (P) Ltd.
- Odum E. P., and Barrett G. W. (2005). Fundamentals of Ecology. Thomson Brooks/Cole.
- Verma P. S.,and Agarwal V. K. (1983/2016Rp). Environmental Biology: Principles of Ecology. S. Chand and Company Pvt. Ltd.
- Russell P. J. (1998). Genetics. 5th Edition. Benjamin/Cummings Publishing Company Inc.
- Russell P. J. (2016). Essential iGenetics. 3rd Edition. Pearson Education.
- Gardner E., Simmons M., and Snustad D.P. (1991). Principles of Genetics. 8th Edition. John Wiley and Sons Inc.

Course code: SBT104	**Techniques in Biological Sciences (Credits : 2 Lectures/Week:3)**	
	Objectives: ➢ To provide a basic understanding of the need and methods of sterilization ➢ To impart skill in handling and culture of Microorganisms ➢ To reinforce the use of microscope and study the various types of stains and staining methods to be used for visualization of specimens. **Outcomes:** 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.	
Unit I	**Sterilization Techniques** **a) Sterilization and Disinfection** i) Definitions of and differences between Sterilization and disinfection ii) Applications of sterilization and disinfectants in Biological sciences. iii) **Physical agents-** Sunlight, Drying, heat, Steam under pressure, Gases, Radiation and filtration iv) **Chemical agents and their mode of action-** Phenol and Phenolic compounds; Aldehydes, Halogens, Quaternary Ammonium compounds, heavy metals, Alcohols and Detergents v) **Ideal Disinfectant** - examples and evaluation of disinfectants	**15 L**
Unit II	**Microbial Cell Culture Techniques** **a) Microbial Cell Culture Techniques** i) Nutrition and Cultivation of microorganisms- Carbon, Oxygen, Hydrogen, Nitrogen, Phosphorous, Sulphur& Growth factors ii) Classification of different nutritional types of organisms b) **Design and types of culture medium** i) Liquid and Solid media, ii) Simple/ basal media and complex media, iii) Synthetic, Enriched, Enrichment media, iv) Selective, differential and indicator media v) Sugar media, transport media vi) Anaerobic media c) **Concept of isolation and methods of isolation , pure culture techniques** d) **Culturing anaerobic organisms** e) **Preservation of microbial cultures**- Principle & methods	**15 L**
Unit III	**Microscopy and Staining Techniques** **a) Microscopy-** Introduction, Definition, general applications in biological sciences **b) Types of microscopy** i) Light or Optical Microscope Simple and Compound microscopes. Principle, parts, functions	**15 L**

	and applications ii) Phase contrast microscope iii) Dark field/ Dark ground microscope **c) Stains and staining solutions** i) Definition of Dye and Chromogen ii) Structure of Dye and Chromophore iii) Functions of mordant and fixatives iv) Natural and synthetic dyes v) Simple staining, Differential staining and Acid fast staining with examples	

Additional References:

- Pelczar M.J., Chan E.C.S., Kreig N.R. (2006). Microbiology. 6th Edition. The Mc Grew Hill Companies Inc., NY.
- Willey J. M., Sherwood L., Sherwood L. M., Woolverton C. J., Woolverton C. Prescott's Microbiology. (2010). 8th Edition. McGraw Hill.
- Ananthanarayan R. and Panikar C. K. J. (2009). Textbook of Microbiology. 8Th Edition. Universities Press.

Course code: SBT105	**Fundamentals in Chemistry – I** **(Periodic table and Periodicity of elements, Concepts in Organic Nomenclature, Water and buffers) (Credits : 2 Lectures/Week: 3)**	
	Objectives: ➢ To provide an overview of the Periodic Table and relate elements specifically important in Biological systems. ➢ To acquaint students with basic concepts of Chemistry like Classification and Nomenclature of organic compounds. ➢ To study the nature and role of water and buffers in relation to the biological system. ➢ To equip the student with skills required for calculations in preparation of solutions of various concentrations and strengths. **Outcomes:** At the end of this course, the student would be well versed with the different chemical elements with special emphasis on Biologically active elements. The Nomenclature of organic compounds (with special emphasis on Bio-organic molecules and industrially important compounds). 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.	
Unit I	**Periodic Table and Periodicity of elements** **a) Long form of Periodic Table** i. Classification of elements ii. transition elements iii. and inner transition elements **b) Periodicity in properties of elements :** (Simple Numerical problems based on topic to be covered) i. Ionic size and Atomic size ii. Ionization gain enthalpy iii. Electron enthalpy iv. Slater's rule ; Effective nuclear charge v. Electronegativity: Pauling, Mulliken and AlredRochow electronegativity	**15 L**
Unit II	**Nomenclature of Organic compounds** **a) IUPAC Nomenclature and Classification of organic compounds** i) Alkanes ii) Alkenes iii) Alkynes iv) Cyclic Hydrocarbons/Alicyclic Hydrocarbons v) Aromatic compounds vi) Alcohols and Ethers vii) Carboxylic acids and its derivatives viii) Amines and Amides ix) Alkyl Halides x) Heterocyclic compounds **b) Applications of organic molecules** i) Applications of organic compounds in biological sciences- Brief concept of bioorganic molecules ii) Industrial applications of organic compounds c) **Electronic Effects of organic compounds**	**15 L**

	i) Inductive Effect ii) Electromeric Effect iii) Mesomeric Effect iv) Hyperconjugative Effect v) Resonance	
Unit III	**Chemical Bonding** **a) Ionic Bond** i) Nature of Ionic bond ii) Structure of NaCl, KCl and CsCl iii) Factors influencing the formation of ionic bonds b) **Covalent Bonds** i) Nature of covalent bond Structure of CH_4, NH_3 , H_2O c) **Coordinate Bonds -** Nature of coordinate bond d) **Non-covalent Bonds –**Van Der Waal's Forces: Dipole-dipole and dipole-induced dipole **a) Hydrogen Bonds** i) Theory of Hydrogen bonding ii) Types of Hydrogen bonding with examples RCOOH, ROH e) Salicyladehyde, Amides and Polyamides	**15 L**

Additional References:

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

Course code: SBT106	**Fundamentals in Chemistry - II (Thermodynamics, Stereochemistry and Chemical Bonding)(Credits : 2 Lectures/Week: 3)**	
	Objectives: ➢ To acquaint students with the concepts and fundamentals of Thermodynamics. ➢ To build concepts in Stereochemistry by providing an understanding of the relative spatial arrangement of atoms in molecules. ➢ To help students understand the types and significance of chemical bonds. **Outcomes:** This Course is designed to impart basic knowledge in the area of Thermodynamics. The students will be able to understand Stereochemistry of organic molecules and their practical significance 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.	
Unit I	**Thermodynamics** **a) Introduction** i) System, surrounding, boundaries, sign conventions, State Functions ii) Internal Energy and Enthalpy: Significance, examples (Numericals expected) **a) Thermodynamics** i) Laws of thermodynamics and its limitations, Mathematical expression ii) Qualitative discussion of Carnot cycle for ideal Gas and Mechanical efficiency iii) Laws of Thermodynamics as applied as to biochemical systems Concept of entropy, Entropy for Isobaric, Isochoric and Isothermal processes	**15 L**
Unit II	**Stereochemistry** **a) Isomerism** i) Types of isomerism- chain, position and functional ii) Stereoisomerism Chirality **a) Geometric Isomerism and Optical Isomerism** i) Enantiomers ii) Diastereomers iii) Racemic mixtures- Cis-Trans, threo, erythro and miso isomers iv) Diastereomerism (Cis-trans isomerism) in Alkenes and cycloalkenes Cycloalkynes (3and 4 membered ring) **a) Conformation** i) Conformations of ethane ii) Difference between configuration and conformation **a) Configuration** i) Asymmetric Carbon atom ii) Stereogenic /Chiral centres iii) Chirality iv) Representation of configuration by “flying wedge formula”	**15 L**

	a) Projection Formulae i) Fischer, Newman and Sawhorse ii) The interconversion of the formulae	
Unit III	**Water and Buffers** **a) Chemistry of Water** i) Properties of Water ii) Interaction of water with solutes -polar, non-polar and charged iii) Non- polar compounds in water - change in its structure & hydrophobic effect iv) Role of water in biomolecular structure and function v) Water as a medium for life **a) Solutions** i) Normality ii) Molarity iii) Molality iv) Mole fraction v) Mole concept vi) Solubility vii) Weight ratio, volume ratio, and Weight: Volume ratio, concentration v/s amount, standard abbreviations Ppb, ppm, micrograms, nanograms, millimoles and milliequivalents (numericals expected) **a) Primary and Secondary standards** i) Preparation of standard solutions ii) Principle of volumetric analysis **a) Acids and bases** i) Lowry-Bronsted and Lewis concepts ii) Strong and Weak acids and bases iii) Ionic product of water : pH, pKa, pKb iv) Hydrolysis of salts **a) Buffer solutions** i) Concept of buffers ii) Types of buffers iii) derivation of Henderson equation for acidic and basic buffers iv) pH of buffer solution Blood buffer system	**15 L**

Additional References:

1. Puri, B. R., Sharma, L.R., and Pamania, M.S. (2017). *Physical Chemistry*, 47th Edition, Vishal Publishing Company.
2. Kapoor, K.L. (2006). *Textbook of Physical Chemistry*. McMillan Publishers
3. Barrow, G.M. ( ) *Physical Chemistry*. 6th Edition. Tata McGraw Hill Publishing Co. Ltd. New Delhi
4. Atkins P. W., and Paula J. De. (2014). *Physical Chemistry*. 10th ed., Oxford University, 12 press.
5. Levine, I. N., *Physical Chemistry*, 6th Edition. 2010, Tata McGraw Hill
6. Morrison, R. T.; Boyd, R. N. (2012). *Organic Chemistry*. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
7. Finar, I. L. (2012). *Organic Chemistry (Volume 1)*. Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

8. Solomons, T.W.G. (2009).*Organic Chemistry*. John Wiley & Sons, Inc.
9. Kalsi, P. S. (2005) *Stereochemistry Conformation and Mechanism*. New Age International
10. Ahluwalia, V.K.; Parashar, R.K. (2006) *Organic Reaction Mechanisms*.Narosa Publishing House.
11. Mukherji; Singh; Kapoor. (2002) *Reaction Mechanisms in Organic Chemistry*.McMillan
12. Plummer D. (2001). An Introduction to Practical Biochemistry. 3rd Edition. Tata McGraw Hill Edu. Pvt. Ltd. New Delhi, India.
13. Lehninger, Nelson D and Cox M. (2008). Principles of Biochemistry. 5th Edition. W.H. Freeman and company, NY.
14. Murray R. Harper's Illustrated Biochemistry. (2017). 27th Edition. Lange Publications.

Semester I – Practical

Course Code: SBT1PR1	**Introduction to Biotechnology & Genetics** **(Credits : 2 Practicals/Week :6)**
	1. Introduction to Biotechnology Laboratory 2. Introduction to glassware used 3. Introduction to common laboratory instruments Electronic Balance, pH Meter, Water Bath, Hot air Oven, Autoclave, Incubator, Rotary Shaker, Vortex mixer, Centrifuge 4. Meat tenderization using papain 5. Fermentative production of alcohol 6. Enumeration of microbes using micrometer stage slide 7. Microscopic determination of yoghurt/ milk microbial flora 8. Qualitative analysis of DNA by DPA method 9. Qualitative analysis of RNA by Orcinol method 10. Isolation of gDNA from onion sample 11. Differential staining of WBC 12. Study of Karyotype 13. Problems on Mendelian Genetics 14. Problems on Gene Mapping 15. Study of any branch of Biotechnology and its applications 16. Visit to a Biotechnology Institute /Industry and report writing. 17. **Internal --- Differential staining of WBC and Qualitative analysis of DNA/RNA**

Course code: SBT1PR2	**Biodiversity, Experimental models and Ecology &Techniques in Biological Sciences** **(Credits : 2 Practicals/Week: 6)**
	1. Study of permanent slides of BGA 2. Enrichment of Algae. 3. Cultivation of fungi and microscopic examination using lacto cotton phenol blue 4. Observation of pleomorphic Rhizobia from nodules of Fenugreek sample 5. Staining of plant tissues using single staining technique 6. Slide culture technique of *Nocardia* and*Streptomyces* 7. Cultivation of drosophila using various media 8. Differentiation and identification of male and female drosophila from cultured sample 9. Demonstration of antibiosis 10. Study of Interactions – Commensalism, Mutualism, Predation, Antibiosis and Parasitism. 11. Components and working of Simple and Compound microscope 12. Monochrome staining of bacteria (*Bacillus* and *E. Coli*) 13. Differential staining- Gram staining

	14. Sterilization – Laboratory glassware and media using autoclave 15. Preparation of media – Nutrient Broth, Nutrient Agar, Mac Conkey Agar, Sabouraud's Broth and Agar 16. Aseptic Transfer technique- Broth in tubes and Molten media in Petri plates 17. Isolation of microorganisms: T streaking method 18. Preservation of microorganisms: Inoculation on a slant/ Oil overlay/ Low temperature 19. Visit to a nature park / Laboratory and report writing. 20. Internal—Monochrome staining and Isolation of microorganisms

Course Code: SBT1PR3	**Fundamentals In Chemistry I &II** **(Credits :2 Practicals/Week: 6)**
	1. Safety measures, accidents, first aid and good practices in chemistry laboratory 2. Working and use of a digital Balance 3. Functioning and standardization of pH meter 4. Preparation of standard solutions – Molar, Molal and Normal 5. Preparation of buffers 6. Determination of strength of HCl and standardization using borax from commercial sample 7. Qualitative analysis of inorganic compounds – any 3 8. Characterization of organic compounds a. Containing only CHO elements (no element test). Compounds belonging to following classes Carboxylic acid Phenol Aldehyde/Ketone Ester Alcohol Hydrocarbon b) Containing CHO and N, S, Halogen elements (elements tests to be done. Compounds belonging to following classes Amides Amines Nitro compounds Thiamide Haloalkane Haloarene 9. Dissociation constant of weak acids by incomplete titration method using pH meter. 10. Determination of enthalpy of dissolution of salts like KNO_3 11. Determination of rate constant for hydrolysis of ester using HCl as catalyst 12. To study the reaction between potassium persulphate and potassium iodide kinetically and hence to determine the order of reaction. 13. **Internal – Identification of any two organic compounds**

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 : Case studies /Infographics / Case studies / Market survey / Model / Problems

II. Semester End Examination (SEE)- 60 Marks