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. Life Sciences

Course: Life Sciences at the Molecular and Cellular levels

Semester-I

Credit Based Semester and Grading System (CBSGS) with effect from the academic year 2021-22

F.Y.B.Sc. Life Sciences Syllabus

Semester – I			
Course Code	**Course Title**	**Credits**	**Lectures /Week**
SLSC101	Life Sciences at the Molecular and Cellular levels	2	3

Semester I – Theory

Course Code: SLSC101	**Course Title: Life Sciences at the molecular and cellular levels**	**02 Credits**
Course Objectives	Understand prokaryotic and eukaryotic cell structures. Study microbial growth and life cycle of viruses. Learn about biomolecules and techniques used to separate them.	
Course Outcomes	**Upon successful completion of this course, the student will be able to:** **a)** Differentiate between prokaryotes and eukaryotes. **b)** Explain the fundamental chemical processes and interactions that prevail in living systems **c)** List the simple precursors which give rise to large biomolecules such as proteins, carbohydrates, lipids, nucleic acids. **d)** Apply the tools that may be used in the study of biomolecules and cells. **e)** Explain the microbial growth **f)** Explain the applications of separation techniques.	
	THEORY	**45 Lectures**
Sub-Unit	**Unit – I: Features of living cells**	**15 Lectures**
1.	**Molecular Logic of a living cell:** An introduction to Life Sciences stressing the significance of the topics that follow	**01**
2.	**Physiological Role of water:** **a)** Structure of water molecule **b)** Ionic interactions **c)** Ionic product of water **d)** Concept of pH **e)** Buffers: Types (Acidic and Basic buffer) and Role of Buffers in biological system	**03**
3.	**Proteins:** **a)** Amino acids: Classification (Nutritional and Structural) **b)** Chemical reactions (Ninhydrin test for amino acids), Zwitter ion **c)** Peptide bond formation and Primary structure of protein **d)** Secondary (α and β), Tertiary (Myoglobin) and Quaternary structure (Haemoglobin) and types of bonds contributing to protein structure	**06**

	e) Globular proteins (Hemoglobin) & Fibrous proteins (keratin), **f)** Protein sequencing - Sanger, Edman's method.	
4.	**Carbohydrates:** Classification and Structure, chemical and physical properties: **a)** Monosaccharides (Glucose, galactose, Fructose, (glyceraldehydes, Simple Aldose, Simple Ketoses, D-glucose, Conformation of D-glucose, Epimers) **b)** Disaccharides (maltose, sucrose, lactose), **c)** Polysaccharides (starch, glycogen and cellulose)	**05**
Sub-Unit	**Unit – II: Macromolecules & Separation techniques**	**15 Lectures**
1.	**Lipids:** **a)** Classification of lipids (simple, derived and complex with one example each). **b)** A brief note on saturated, unsaturated, hydoxy and branched chain fatty acids **c)** Biological role of fatty acids	**03**
2.	**Nucleic Acid:** **a)** Structure of nucleosides and nucleotides **b)** Structure of nucleic acids (A,B,Z forms) **c)** Structure of DNA lends itself to its function as hereditary molecule.	**06**
3.	**Separation Techniques:** **a) Filtration:** Gravity filtration, vacuum filtration, ultra filtration **b) Chromatography:** Techniques based on: Solubility – Paper chromatography, TLC Charge – Ion exchange chromatography Size – Size Exclusion chromatography Affinity of molecules – Affinity Chromatography Sophisticated Chromatography techniques – HPLC **c) Electrophoresis:** Brief overview of AGE, PAGE, 1-D and 2-D electrophoresis	**06**

	d) Centrifugation: Differential centrifugation, Density gradient centrifugation	
Sub-Unit	**Unit – III: Concept of prokaryotic and eukaryotic cells**	**15 Lectures**
1.	**Study of Prokaryotic and Eukaryotic cell:** **a)** Microscopy as a tool for Cell Biology studies: Principles of light and electron microscopy **b)** Prokaryotic cell structure. E.g.*E. coli* **c)** Eukaryotic cell structure: Plant and Animal cell **d)** Evolutionary origin of organelles (Endosymbiont Theory)	**05**
2.	**Viruses:** **a)** Virion structure **b)** Bacteriophage (Virulent and Temperate) and their Life cycles (Lytic and Lysogenic) **c)** Plant viruses: TMV **d)** Animal virus: DNA virus – E.g. HSV, RNA virus – E.g. MMTV, COVID-19 (briefly, details in SY in Medical Microbiology)	**05**
3.	**Microbial growth:** **a)** Microbial culture media – Selective, Differential, Enriched, Enrichment, Minimal, Transport media **b)** Factors influencing bacterial growth – pH, temperature, pressure, nutrients, oxygen levels, salt concentration. **c)** Isolation techniques – Streak plate, Spread plate, Pour-plate (Bulk-seed) techniques, single cell isolation. **d)** Preservation of bacteria **e)** Growth curve of bacteria (Eg.*E. coli*.)	**05**
CA (Continuous Assessment)	**CA – I: Test (20 marks)** **CA – II: Poster making (20 marks)**	

References	**1.** U. Satyanarayan. (2006) Biochemistry. Allied Publishers. **2.** E.S. West and W. Todd. (1961) Textbook of Biochemistry, 3rd Ed. Mcmillan. **3.** Harper's Physiological Chemistry (2016). 31st Edition. Lange. **4.** A.C. Deb. (2001). Biochemistry. Books and Allied Publ. **5.** E.E. Conn, P.K. Stumpf. (1987) Outlines of Biochemistry, 5th Ed. Wiley Publishers	

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Program: B.Sc. Life Sciences

Course: Introduction to Plant and Animal Life Processes

Semester-I

Credit Based Semester and Grading System (CBSGS) with effect from the academic year 2021-22

F.Y.B.Sc. Life Sciences Syllabus

Semester – I			
Course Code	**Course Title**	**Credits**	**Lectures /Week**
SLSC102	Introduction to Plant and Animal life processes	2	3

Semester I – Theory

Course Code: **SLSC102**	**Course Title: Introduction to Plant and Animal life processes**	**02 Credits**
Course Objectives	Learn concepts of anatomy and physiology like nutrition, digestion, circulation in plants and animals.	
Course Outcomes	**Upon successful completion of this course, the student will be able to:** **a)** Understand types of nutrition in plants and animals; nutritional adaptations; anatomy and physiology of digestion; evolutionary adaptations **b)** Explain functions of organ systems and cellular functions (Life processes including transport and circulation in plants and animals; support and locomotion, respiration and gaseous exchange, excretion, and osmoregulation) **c)** Integrate physiology from the cellular and molecular level to the organ system and organismic level of organization. **d)** Understand the role of body systems and mechanisms in maintaining homeostasis **e)** Analyze the implications of life processes on overall health and diseased state.	
	THEORY	**45 Lectures**
Sub-Unit	**Unit – I: Multicellularity, specialized function and physiology**	**15 Lectures**
1.	**Concept of multicellularity and division of labor:** (*Volvox* and sponges as examples) **a)** Specialization of animal cells and plant cells with respect to function **b)** Classification – 5 kingdoms and three domains of life **c)** Control and Coordination (Endocrine, Nervous, Immune, Reproduction)	**05**

2.	**Nutrition and Digestion:** **a)** Auxotrophic nutrition **i)** Prokaryotes - photosynthetic and chemosynthetic bacteria **ii)** Eukaryotes - plants (importance of photosynthesis, macro and micro-nutrientsin **b)** Heterotrophic nutrition **i)** Holozoic nutrition - fluid feeders (eg. housefly), microphagous (eg.amoeba or paramecium), macrophagous (mammals) **ii)** Saprophytic (fungi) and parasitic (tapeworm) nutrition Nutritional adaptations eg. Carnivorous plants and symbiotic nitrogen fixation	**07**
3.	**Digestive systems of mammals:** (with respect to function of each organ) Evolutionary adaptation associated with diet eg. dental, stomach and intestine (ruminant)	**03**
Sub-Unit	**Unit – II: Life processes – I**	**15 Lectures**
1.	**Transport and Circulation in plants:** Transport in plants- Transport of water and inorganic solutes, transpiration, stomatal function and regulation, role of proton pumps and factors affecting ascent of xylem sap. Transport of organic solutes - mechanism and its regulation	**04**
2.	**Circulation in animalsa)** **a)**Types of circulatory system: **i)** Open and closed system **ii)** Single and Double Circulation; **b)** Circulating fluids - water, coelomic fluid, blood & lymph **c)** Hearts - Types of hearts, single chambered, two chambered, three chambered, Incompletely four chambered, Four chambered **d)** Cardiovascular system in health and disease- exercise, hypertension and atherosclerosis	**06**
3.	**Support and Locomotion** **a)** Overview of locomotion/support structures in lower invertebrates. **b)** Types of skeletons - hydrostatic (nematodes), exoskeleton (arthropods/molluscs) and endoskeletons (vertebrates) **c)** Locomotion in invertebrates: earthworm **d)** Locomotion in vertebrates - axial and appendicular skeleton	**05**

Sub-Unit	Unit – III: Life processes – II	15 Lectures
1.	**Respiration and Gaseous Exchange:** **a)** Aerobic and anaerobic respiration, Gas exchange in small animals (across surface) and cutaneous respiration. **b)** Gas exchange in plants pneumatophores. **c)** Gaseous exchange in invertebrates - trachea in insects, book lungs in scorpions. **d**) Gaseous exchange in vertebrates - gills in Fishes; counter-current exchange and lungs in Man. **e)** Respiratory pigments - haemoglobin, structure and function. O2 and CO2 Transport	**07**
2.	**Excretion and Osmoregulation:** **a)** Nitrogenous excretory products (ammonia, urea and uric acid) Case studies : mammals in arid regions (camel); salt glands in birds **b)** Phylogenetic review of Excretory organs and processes - contractile vacuole, flame cells in liver-fluke, malpighian tubules in cockroach, Nephron in vertebrates. **c)** Concept of osmoregulation and processes associated with osmoregulation – Ultra filtration, Reabsorption, Tubular secretion	**08**
CA **(Continuous Assessment)**	**CA – I: Test (20 Marks)** **CA – II: Poster making (20 Marks)**	
References	**1.** Sherwood L. (2008) Human Physiology: From cells to Systems, Cengage Learning **2.**Zao, Stabler, Smith, Lokuta, Griff. (2012) PhysioEx 9.0 for human physiology, Benjamin Cummings **3.** Simon EJ., Dickey JL., Reece JB., Hogan KA.(2015)Campbell **4.**Essential Biology with Physiology, Pearson **5.**Raff H., Widmaier E., Strang K. (2014) Vander's Human Physiology, McGraw-Hill Education	

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Program: B.Sc. Life Sciences

Course: Life Sciences Practical

Semester-I

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F.Y.B.Sc. Life Sciences Syllabus

Semester – I			
Course Code	**Course Title**	**Credits**	**Lectures /Week**
SLSC1PR	Life Sciences Practical (Semester-I)	2	3

Semester I – Practical

Course Code SLSC1PR	Course Title: Life Sciences Practical (Semester-I)	Credits: 02
Course Objectives	To encourage problem based learning, corresponding with the theory syllabus the practicals have been introduced either as stand alone, or those that may be converted into short projects. These project based experiments could be recorded in a project format in addition to the journal work.	
PRACTICAL – I		
1.	**An introduction to Laboratory discipline:** **a.** GLP (Good Laboratory practices) **b.** Lab safety (instruments and chemicals) **c.** Survey of the organization of laboratory instruments, chemicals and glassware	
2.	**Introduction to Elementary microbial techniques:** **a.** Sterilization & Disinfection **b.**Compound Microscope	
3.	**Basic Microbial staining techniques:** **a.** Monochrome Staining **b.**Cell wall staining	
4.	**Making Solutions/chemicals:** **a.** Normal, Molar and percentage solutions (Concept and calculations) **b.** Preparation of solutions of particular concentrations	
5.	**Colorimetry:** **a.** Basic Principle and working **b.**Estimation of Lambda max of a coloured solution **c.** Verification of Beer Lambert's law for a coloured solution	
6.	**Extraction of DNA from a suitable plant source**	
7.	**Qualitative detection of:** **a.** Carbohydrates (Molisch Test) **b.** Proteins (Biuret Test) **c.** Lipids (Spot test and solubility test)	
8.	**pH Meter:** **a**. Principle of working of pH meter and calibration of the pH Meter with standard buffers **b**. Checking of pH for common foodstuff or other relevant samples	

PRACTICAL – II	
1.	**Study of Tissues :** **a. Plant Tissues:** **i.** Observation of permanent slides of T.S. of Sunflower and Maize stem and root **ii.** Comparison between Dicot stem and Monocot stem (Temporary mounting) **iii** Comparison between Dicot root and Monocot root (Temporary mounting) **b. Animal Tissues (Permanent slides)** **i.** Epithelial – Squamous, Cuboidal, epithelial **ii.** Connective – Areolar, Adipose, cartilage, bone **iii.** Muscular – Striated, non- striated, Cardiac **iv.** Nervous – Medullated, non-medullated neurons
2.	**Enumeration of cells using Haemocytometer**
3.	**Diversity of Life (using specimens/pictures/models):** **i.** Five Kingdom Classification **ii.** Classification of Monera, Protista, Fungi **iii.** Classification of Plants **iv.** Digital recording and detailed classification of one plant from campus/ local environment
4.	**Comparative assessment of mouth-parts of insects:** **a.** Biting and Chewing type –Eg. Cockroach (if available or from photograph) **b.** Piercing and sucking type – Eg. Mosquito **c.** Sponging type – Eg. Housefly
5.	**Mounting of nephridium of earthworm and study of permanent slide of kidney**
	CA(Continuous Assessment)
	Journal :- 05 marks **Worksheet booklet :- 05 marks** **Minor experiment :- 10 marks** **Total:-20 marks**

Evaluation Scheme

[A] Evaluation scheme for Theory courses

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

(i) C.A.-I : Test – 20 Marks

(ii) C.A.-II : Poster-making /Quiz based on videos viewed

II. Semester End Examination (SEE) - 60 Marks

[B] Evaluation scheme for Practical courses

I. Continuous Assessment (C.A.) - 20 Marks

II. Semester End Examination (SEE) - 30 Marks

Grand total of Practical I + Practical II = 50+50=100