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: F.Y.B.Sc. (Semester-I)

Proposed Course: Life Sciences

Credit Based Semester and Grading System (CBCS) with effect from the academic year 2019-20

F.Y.B.Sc. Life Sciences Syllabus

Academic year 2019-2020

Semester – I			
Course Code	**Course Title**	**Credits**	**Lectures /Week**
SLSC101	Life Sciences at the molecular and cellular levels	2	3
SLSC102	Introduction to plant and animal life processes	2	3
SLSC1PR	Practical	2	6

Semester I – Theory

Course Code: **SLSC101**	**Course Title: Life Sciences at the molecular and cellular levels**	**02 Credits**
Learning Objectives	The course aims to: ▪ Introduce the students to fundamental chemical processes and interactions that prevail in living systems ▪ Familiarize the students with biological molecules that are crucial for the maintenance of structure/function in an organism ▪ Introduce the students to the tools that may be used in the study of biomolecules and cells	
Course description	The first step to appreciate life forms is to understand the molecular logic of a living cell. This course develops the concept of biochemical basis of plant and animal life and the underling uniformity that forms the basis of all organisms at the cellular level.	
	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 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 e) Globular proteins (Hemoglobin) & Fibrous proteins (keratin), f) Protein sequencing - Sanger, Edman's method.	**06**
4.	**Carbohydrates:** Classification and Structure, chemical and	**05**

	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)	
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 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, ultrafiltration 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 d) **Centrifugation:** Differential centrifugation, Density gradient centrifugation	**06**
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	**05**

	b) Bacteriophage (Virulent and Temperate) and their Life cycles (Lytic and Lysogenic) c) Plant viruses (E.g. TMV) d) Animal virus (DNA virus – E.g. HSV, RNA virus – E.g. MMTV)	
3.	**Microbial growth:** a) Factors influencing bacterial growth – pH, temperature, pressure, nutrients, oxygen levels. b) Microbial culture media – Selective, Differential, Enriched, Enrichment, Minimal, Transport media 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	

Course Code: **SLSC102**	**Course Title: Introduction to plant and animal life processes**	**02 Credits**
Learning Objectives	The course aims to: ▪ Explain types of nutrition in plants and animals; nutritional adaptations; anatomy and physiology of digestion; evolutionary adaptations ▪ 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) ▪ Integrate physiology from the cellular and molecular level to the organ system and organismic level of organization. ▪ Explain the role of body systems and mechanisms in maintaining homeostasis	
Course Description	Physiology involves the study of how living systems function, from the molecular and cellular level to the systems level, and emphasizes an integrative approach to studying the biological functions of the plant and animal systems.	
	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 nutrients in plants) b) Heterotrophic nutrition i) Holozoic nutrition - fluid feeders (eg. housefly), microphagous	**07**

	(eg. amoeba or paramecium), macrophagous (mammals) ii) Saprophytic (fungi) and parasitic (tapeworm) nutrition Nutritional adaptations eg. Carnivorous plants and symbiotic nitrogen fixation	
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 animals** 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, Incompletely four chambered, Four chambered d) Cardiovascular system in health and disease- exercise, hypertension and atherosclerosis	**06**
3.	**Support and Locomotion** a) Types of skeletons - hydrostatic (nematodes), exoskeleton (arthropods/molluscs) and endoskeletons (vertebrates) b) Locomotion in earthworm c) 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 scorpion. d) Gaseous exchange in vertebrates - gills in Fishes; counter current exchange and lungs in Man. e) Respiratory pigments - haemoglobin, structure and function. O_2 and CO_2 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 - Ultrafiltration, 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	

Semester I – Practical

Course Code SLSC1PR	Course Title: SEMESTER – I PRACTICALS	02 Credits
Learning 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.	a. An introduction to Laboratory discipline and GLP (Good Laboratory practices) b. Lab safety (instruments and chemicals) c. Survey of the organization of laboratory instruments, chemicals and glassware	**03**
2.	Introduction to Elementary microbial techniques: a. Sterilization & Disinfection b. Microbial Staining technique and Microscopy: i. Monochrome Staining ii. Gram Staining iii. Cell wall staining	**04**
3.	a. Normal, Molar and percentage solutions (Concept and calculations) b. Preparation of solutions of particular concentrations	**02**
4.	Colorimetry: a. Estimation of Lambda max of a coloured solution b. Verification of Beer Lambert's law for a coloured solution	**02**
5.	Extraction of DNA from a suitable plant source	**01**
6.	Qualitative detection of Carbohydrates, Lipids and Proteins	**01**
7.	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	**02**
CA (Continuous Assessment)	Journal – 05 marks Worksheet booklet – 05 marks Minor experiment – 10 marks Total: 20 marks	

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 – Medulated, non-medulated neurons	**03** **02**
2.	Enumeration of cells using Haemocytometer	**01**
3.	Differential WBC Staining	**01**
4.	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	**04**
5.	Comparative assessment of mouth parts of insects according to function ass given below: a. Biting and Chewing type – Eg. Cockroach (if available or from photograph) b. Piercing and sucking type – Eg. Mosquito c. Sponging type – Eg. Housefly	**03**
6.	Mounting of nephridium of earthworm and study of permanent slide of kidney	**01**
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 of 40 min. duration

(ii) C.A.-II : Poster-making

II. Semester End Examination (SEE)- 60 Marks

[B] Evaluation scheme for Practical courses

I. Continuous Assessment (C.A.) For each Practical – 20 Marks

II. Semester End Examination (SEE) For each Practical – 30 Marks

Grand total of two Practicals = 50+50=100