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: Life Sciences

Semester: II

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

F.Y.B.Sc. Life Science Syllabus

Academic year 2018-2019

Semester II			
Course Code	**Course Title**	**Credits**	**Lectures /Week**
SLSC201	Life Sciences at the molecular and cellular levels	2	3
SLSC202	Elementary genetics, ecology and behavior	2	3
SLSC2PR	Practical	2	6

Semester II – Theory

Course: SLSC201	Life Sciences at the molecular and cellular levels (Credits: 02 Lectures/Week: 03)	
	Objectives: On completion of the course, the student must be able to: ▪ Differentiate between prokaryotes and eukaryotes. ▪ Students will understand the structures and basic components eukaryotic cells, with respect to membranes and organelles. ▪ Describe the function and the composition of the plasma membrane. ▪ Understand how the endoplasmic reticulum and Golgi apparatus interact with one another and know with which other organelles they are associated. ▪ Understand the structure and function of the mitochondria and chloroplast. ▪ Understand the basis and significance of mitosis and meiosis **Outcomes:** This paper 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.	
Unit I	**Features of living cells:** **Nucleus:** a) Structure of an interphase nucleus : Nuclear membrane, nucleolus, b) Nucleosome model c) Euchromatin and heterochromatin d) Lampbrush and Polytene chromosomes **Endoplasmic Reticulum:** a) Structure and function (including sarcoplasmic reticulum) b) Role in protein synthesis (ER- Ribosome complex) and transport (Signal hypothesis) **Ribosomes:** Biochemical composition of Subunits in prokaryotes and eukaryotes (including those within chloroplast and mitochondria) **Golgi complex:** a) Structure, origin and relationship to Endoplasmic reticulum. b) Role in synthesis, storage and secretion of zymogen and glycoproteins **Lysosomes:** a) Primary and secondary lysosomes and their functions b) Lysosome associated diseases (Tay Sachs and Silicosis)	**15L**
Unit II	**Energy Metabolism:** **Mitochondria:** a) Structure and Biochemical composition of inner, outer membranes & the matrix with a brief mention of oxidative phosphorylation. b) Mitochondria associated diseases (any one example)	**15L**

	Plastids: a) Types b) Chloroplast morphology, c) Structure of thylakoid membrane, photosynthetic pigments & d) A brief mention of photo-phosphorylation; chloroplast DNA **Peroxisomes:** Structure and function in plant and animal cells.	
Unit III	**Cytoskeleton, Structure of Cell Wall and Cell division:** **Cytoskeletal elements**: **a) Microfilaments:** i) Structure and function in striated muscle fibers, Sliding filament theory ii) Role in Cytoplasmic streaming in plants. **b) Microtubules:** i) Structure as in cilia or in flagella, mechanism in movement ii) Function in mitotic spindle **c) Intermediate Filaments:** Types, Structure and function **Structure of Cell Wall:** a) Bacterial Cell wall:Gram positive and Gram negative b) Fungal cell wall c) Plant cell wall: Primary and secondary **Cell Division:** **a) Cell cycle:** i) Phases: G0, G1, S, G2, M phases ii) Regulation of Cell cycle **b) Mitosis and its significance:** i) Karyokinesis: Prophase, Prometaphase, Metahase, Anaphase, Telophase ii) Cytokinesis in plant and animal cell **c) Meiosis and its significance:** i) Phases: Meiosis I and II ii) Concept of recombination and Holliday Model of recombination	**15L**
	References: 1. Molecular Biology of the Cell , B.A.Alberts, A. Johnson ., J. Lewis, M. R. K. Roberts, P.Walters, Garland Science Publication,5th Ed,2008 2. G.Karp, , John Wiley and Sons Inc.,2005 3. The World of Cell,W.M. Becker, L.J. Kleinsmith, J. Hardin.., Pearson Education. 5thEd. 2003 4. The Cell - A molecular approach, G.M.Cooper, R.E. Hausman, ASM Press Washington, D.C. 2007 5. Molecular Cell Biology ,H.Lodish, A. Berk, C.A. Kaiser, M. Krieger, M.P.Scott, A. Bretscher, H. Ploegh, P. Mortsudira. W.H. Freeman and Company, N.Y., 6thEd.,2008 6. Cell Biology,Smith and Wood,Chapman and Hall, 1992	

Semester II – Theory

Course: SLSC202	Elementary genetics, ecology and behavior (Credits:02 Lectures/Week:03)	
	Objectives: The course will be focused on the following topics ▪ Gene concept, Mendelian inheritance along with problem solving –mono and dihyrbrid crosses, Sex-linked inheritance, pedigree analyses ▪ Non-Mendelian inheritance, intra-allelic and inter-allelic gene interactions ▪ Types of mutations and human congential disorders ▪ Principles of genetic engineering and its applications ▪ Principles of ecology, ecological succession, ecosystems ▪ Biogeocycles, pollution ▪ Interspecific interactions and behavioral ecology **Outcomes:** Articulate Genetic laws, Biogeocycles and behavioral ecology	
Unit I	**Genetics I:** **Mendelian Inheritance** a) History of genetics b) Mendel's Laws and Mono & Dihybrid ratios with problems c) Basic structural elements of a gene d) Inheritance of sickle cell anaemia **Chromosomal inheritance** a) Sex-linked inheritance in humans and drosophila b) Study of human pedigrees (e.g. Sex linked dominant and recessive; autosomal dominant & recessive; Y linked and mitochondrial)	**15L**
Unit II	**Genetics II:** **Modification of Mendel's laws:** a) Gene interactions - Incomplete dominance, co-dominance, Multiple alleles, Polygenic inheritance, Epistasis, Linkage, Sex limited and sex influenced traits, Penetrance and Expressivity, Lethal alleles, b) Cytoplasmic inheritance c) Concept of epigenetics **Mutations :** a) Point Mutations b) Chromosomal aberrations: i) Structural: deletion, duplication, inversion, translocation. ii) Numerical: Aneuploidy (e.g. Downs, Turners, Klienfelter's syndrome), Polyploidy (autopolyploidy and allopolyploidy) **Principles of Genetic Engineering and its applications** a)Medicine (e.g., Insulin) b) Agriculture (e.g., Bt. cotton)	**15L**

Unit III	**Ecology and Behaviour:** **Principles of Ecology** a) food chains b) flow of energy c) food webs d) trophic levels e) ecological pyramids & their efficiencies **Ecological succession: Primary and secondary** **Ecosystems -** Thermal vents as an ecosystem **Bio - geocycles:** a) Carbon b) Nitrogen c) Sulphur d) Phosphorus **Pollution -** Types of pollutant and pollution (Air and water) **Interspecific Interactions:** a) Commensalism b) Mutualism c) Parasitism d) Amensalism e) Symbiosis **Behavioural Ecology** a) Innate & Learned behaviour b) Ecological adaptations - camouflage & mimicry c) Biological clocks and rhythms	**15L**

References:

1.Genetics: A Molecular Approach, Russel P, Pearson Education India,2009
2. Genetics: A Conceptual Approach, Pierce B,WH Freeman,2014
3. Introduction to Genetic Analysis, Griffiths A,W H Freeman & Co,2007
4. Biology, Raven P, McGraw-Hill Education, 2013
5. Campbell Biology: Concepts & Connections, Reece JB., Taylor MR., Simon EJ., Dickey JL.Global Edition, Pearson,2015

Semester II – Practical

Course: SLSC2PR	Credits: 02 Practicals/Week:02
	Paper – I: Life Sciences at the molecular and cellular levels 1. Eukaryotic cell structure and size: a. Staining of onion peel b. Micrometry: Using the microscope to measure size of onion cells / nucleus/ different pollen grains 2. Movements in plants and animals: a. Cytoplasmic streaming in *Vallisnaria / Hydrilla* b. Culturing and observation of *Paramoecium* from Hay infusion 3. Histochemical localization: a. Starch grains of Peas b. Proteins of Peas c. Lipids of groundnut d. DNA and RNA from onion peel using methyl green pyronin staining 4. Differential Staining: Gram staining 5. Enzymology: Detection of Dehydrogenase enzyme activity using suitable plant material 6. Separation of amino acids using Paper Chromatography 7. Study and comparison of Monocot and Dicot Stomata (Temporary mounting) and Stomatal movement 8. Study of Electron Micrographs: Nucleus, Mitochondria, Ribosome

	Paper – II: Elementary genetics, ecology and behavior

1. Differential WBC staining
2. Study of mitosis in onion root tip and calculation of mitotic index
3. Study of Meiosis (Demonstration/ Photograph)
4. Detection of Barr Body
5. Animal Biodiversity:
    a. Part I: Classification of Animals – Invertebrates
    b. Part II: Classification of Animals – Vertebrates
    c. Digital recording and detailed classification of one animal from campus/ local environment
6. Biostatistics:
    a. Purpose of Biostatistics: Data collection and types of data.
    b. Study of Class Intervals and calculation of frequency
    c. Representation – tabular and graphical – line graph, frequency curve, Ogive curve, histogram and pie diagram. (Also represented using computers – Excel)
    d. Measures of central tendency – Mean, Median, Mode
    e. Measures of dispersion – Standard deviation and Variance
7. Soil analysis:
    a. Soil Texture
    b. Soil water content
8. Pedigree charts and analysis using suitable examples
9. Study of mouthparts of mosquito and housefly

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 : Pubmeb Assignment on a topic related to the syllabus

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