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 Science

Course: Life Sciences at the Molecular and Cellular levels

Semester-II

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

Semester II			
Course Code	**Course Title**	**Credits**	**Lectures/ Week**
SLSC201	Life Sciences at the Molecular and Cellular levels	2	3

Semester II – Theory

Course Code: SLSC201	**Course Title: Life Sciences at the molecular and cellular levels**	**Credits: 02 Lectures/Week: 03**
Course Objectives	To understand various cell organelles and their functions. To learn the process of cell division at cellular level. To conceptualize various cytoskeletal elements.	
Course Outcomes	**Upon successful completion of this course, the student will be able to:** **a)** Demonstrate knowledge of basic concepts of cell biology and of those properties that are common to most eukaryotic cells. **b)** Describe the function and the composition of the plasma membrane. **c)** Explain the importance of cytoskeletal elements. **d)** Understand the basis and significance of mitosis and meiosis **e)** Develop evidence-based critical thinking in cell biology with in depth knowledge of the role of different cell organelles in the critical developmental processes.	
Unit I	**Features of living cells:** **Nucleus:** **a)** Structure of an inter phase 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)	**15L**

	Golgi Complex: **a)**Structure, origin, and relationship to Endoplasmic reticulum. **b)**Role in synthesis, storage and secretion of zymogen and glycol proteins **Lysosomes:** **a)** Primary and secondary lysosomes and their functions **b)**Lysosome associated diseases (Tay Sachs and Silicosis)	
Unit II	**Energy Metabolism:** **Mitochondria:** **a)** Structure and Biochemical composition of inner, outer membranes &the matrix with a brief mention of oxidative phosphorylation metabolism in the Mitochondrion, **b)**Mitochondria associated diseases (any one example) **Plastids:** **a)**Types **b)**Chloroplast morphology, **c)**Structure of thy lakoid membrane, photosynthetic pigments & **d)**A brief mention of photophosphorylation; chloroplast DNA **Peroxisomes:** Structure and function in plant and animal cells.(a brief mention of catalase activity in plant and animal cells)	**15L**
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	**15L**

	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, Metaphase, 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	
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	

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Program: B.Sc Life Science

Course: Elementary Genetics, Ecology and behaviour

Semester-II

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F.Y. B.Sc. Life Science Syllabus

Semester II			
Course Code	**Course Title**	**Credits**	**Lectures/ Week**
SLSC202	Elementary Genetics, Ecology and behaviour	2	3

Semester II – Theory

Course Code: SLSC202	**Course Title: Elementary Genetics, Ecology and behaviour**	**Credits:02 Lectures/Week: 03**
Course Objectives:	To understand basics of Genetics, ecology and their correlation to behaviour.	
Course Outcomes:	**Upon successful completion of this course, the student will be able to:** **a)** Understand Gene concept, Mendelian inheritance along with problem-solving – mono and dihyrbrid crosses, Sex-linked inheritance, pedigree analyses **b)** Correlate Non-Mendelian inheritance, intra-allelic and inter-allelic gene interactions **c)** Differentiate types of mutations and human congenital disorders **d)** Apply the Principles of genetic engineering **e)** Understand the Principles of ecology, ecological succession, ecosystems, Biogeocycles, Interspecific interactions and behavioural 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 **e)** Sutton's Hypothesis **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 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) **c)**Recent Advances in Genetic Engineering	**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:** **i)**Basic types of ecosystems, **ii)**Thermal vents as an ecosystem **Bio – geocycles:** **a)** Carbon **b)**Nitrogen **c)** Sulphur **d)**Phosphorus	**15L**

	Pollution: Types of pollutant and pollution (Air and water, Soil, Radioactive) **Inter specific 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	
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	

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Course: Life Sciences Practical

Semester-II

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Semester II			
Course Code	**Course Title**	**Credits**	**Lectures/Week**
SLSC2PR	Life Sciences Practical (Semester-II)	2	6

Semester II – Practical

Course:	Course Title: Life Sciences Practical (Semester-II) Credits: 02 Practical/Week:02
SLSC2PR	**Course Objectives:** This course is designed to demonstrate practical skills in the use of tools and techniques common to Life Sciences. It will emphasize on Practical application of theory content in the syllabus and to have a hands-on experience for a project based learning.
	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 behaviour **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.** Study and comparison of Monocot and Dicot Stomata (Temporary mounting) and Stomatal movement **6. Animal Biodiversity:** Part I: Classification of Animals – Invertebrates Part II: Classification of Animals – Vertebrates Part III:Digital recording and detailed classification of one animal from campus/ local environment **7. 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 **8. Soil analysis:** **a.** Soil Texture **b.** Soil water content **9.** Pedigree charts and analysis using suitable examples
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: Pubmed Assignment on a topic related to the syllabus / Model-making / Field trip report

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 two Practicals = 50+50=100