A. C. 25/5/2011

UNIVERSITY OF MUMBAI

Syllabus for the F.Y.B.Sc.
Program: B.Sc.
Course : Life Science

(Credit Based Semester and Grading System with effect from the academic year 2011–2012)

F.Y.B.Sc. Life Science Syllabus modified for Credit System
To be implemented from the Academic year 2011-2012
Semester I

Course Code	Title	Credits
USLSC101		**2 Credits (45 lectures)**
Unit I : 1. Molecular logic of a living cell: An introduction to Life Sciences of the topics that follow. 2. Physiological Role of water: Structure of water molecules, ionic interactions, ionic product of water, concept of pH, buffer and buffering system in cells, role of inorganic ions. 3. Proteins: Amino acids: Classification, chemical reactions (Ninhydrin, Edmans, Sangers) of amino acids, peptides, protein structure, globular proteins (Haemoglobin) & Fibrous proteins (keratin), structure of proteins, types of bonds contributing to protein structure. 4. Carbohydrates: Structure, chemical and physical properties of monosaccharides, disaccharides (maltose, sucrose, lactose), polysaccharides (starch, glycogen and cellulose).		**15 Lectures**
Unit II : 1. Lipids: Classification of lipids (simple, derived and complex with one eg each). 2. Nucleic acids: Structure of nucleosides and nucleotides, structure of nucleic acid (A,B,Z forms). The structure of DNA lends itself to its function as hereditary molecule 3. Separation techniques: Paper and thin layer chromatography, principle of electrophoresis, Differential centrifugation, salting in and salting out (ammonium sulphate fractionation).		**15 Lectures**
Unit III : 1. Introduction to concept of prokaryotic and eukaryotic cell: a. Microscopy as a tool for cell biology studies:Principles of light and electron microscopy. Prokaryotic cell structure example E.coli b. Eukaryotic cell structure example Yeast (unicellular), Plant and Animal cell (multicellular). c. Evolutionary origin of organells and endosymbiont hypothesis. 2. Virus: Virion structure , Life cycle of bacteriophage (Lytic,Lysogenic), Plant and Animal virus (one example each) 3. Microbial growth: Influencing factors, culture media (enriched and minimal), isolation, preservation, life cycle and growth curve of E.coli. 4. Cell membrane: a. Membrane models: Unit memorane and Fluid Mosaic Model of Singer and Nicholson (membrane lipids and proteins in brief). b. Membrane junctions:Tight,gap,septate,demosomes. c. Membrane transport:Diffusion,osmosis,passive and active transport. Endocytosis and Exocytosis		**15 Lectures**

Course Code	Title	Credits
USLSC102		**2 Credits (45 lectures)**
Unit I : 1. Multicellularity- Patterns of organization – Multicellularity in relation to functions in plants and animals. (Volvox, Sponges etc, as examples), Organization to tissues and organs. An introduction to plant and animal tissues (Details to be taught in the Laboratory with examples) 2. Systems & their functional coordination in man: Digestive system, Circulatory system, Respiratory system, Excretory system, Respiratory system, Skeletal system, Muscular system 3. Control and co-ordination through (a) Endocrine system & (b) Nervous system.		**15 Lectures**
Unit II : 1. Special mechanisms 1. A. Transport mechanisms for plant and animals: Inorganic solutes: transpiration & the mechanism of the regulation of stomatal function & the role of k+ ions. Organic solutes: mechanism & its regulation, munch's hypothesis; Ascent of sap- Jolly dixon's theory. Circulation in animals- An overview of open and closed circulation. 1 B. Certain other special adaptations in plants and animals: (1) digestion- insectivorous plants , digestion without a tract in taenia. (2) respiration- pneumatophores, cutaneous respiration in frog. (3) excretion-salt glands, concept of cloaca in reptiles.		**15 Lectures**
Unit III : 1. Study of populations and elementary biostatistics 1.1 Characteristics of populations, Natality, Mortality, Density, Age Structure, Sex Ratio, Population growth, curve (J shaped and S shaped) Factors influencing the changes in a population: e.g. Birth Control Measures, famine, war. 1.2 Elementary biostatistics (a) Purpose of Biostatistics: Data collection, Discrete and continuous variables, qualitative and quantitative Biostatistics. (b) Study of Class Intervals and calculation of frequency (c) Representation - tabular and graphical - line graph, frequency curve, Ogive curve, histogram and pie diagram. (Examples will be dealt with in the practicals - in Excel format) (d) Measures of central tendency_mean, median, mode & standard deviation. 2. Ecology 2.1 Principles of Ecology 2.2 Food chains, flow of energy, food webs, trophic levels, ecological pyramids and their efficiencies Ecological succession - an introduction 2.3 Ecosystems - Types: (One example of each) (a) Terrestrial (b) Aquatic (c) Thermal vents as an ecosystem 2.4 Interspecific Interactions - Commmensalism, Mutualism, Parasitism, Amensalism, Symbiosis 2.5 Behavioral Ecology: (a) Basic behavioral patterns - taxis, tropism, reflex, instinct and conditioned behavior (b) Ecological adaptations - Camouflage and Mimicry (c) Biological clocks and rhythms		**15 Lectures**

Course Code	Title	Credits
USLSCP1	**PRACTICALS**	**2 Credits**
SECTION – I 1. An Introduction to Laboratory Discipline and Good Lab Practices. Survey of organization of Lab Instruments, Chemicals and Glassware. 2. Elementary Microbial techniques : Disinfection and Sterilization 3. Microbial staining technique: Use of buttermilk or any other convenient source (Gram staining, Monochrome, Cell wall staining) 4. Study of cell structure and movements in plant and animal cells. 5. Onion peels cell structure with appropriate staining. *Vallisnaria*: Cytoplasmic streaming. *Paramoecium* from hay infusion. Students must be demonstrated how to develop a culture. 6. 5. Detection of DNA from onion or any other convenient cost effective system. (Students to be asked to work out with the help of a price list from the chemical manufacturer/dealer the cost of this experiment as over the week assignment) 7. 6. Calibration of pH meter with standard buffer pH 4 and pH 9 as per GLP and checking of pH for common foodstuff e.g., Milk, Cola drink, lime juice or any other relevant sample. 8. Paper chromatography: ascending type. Separation of selected amino acids. Field work: Excursion (Minimum of four hours): Report writing		**45 Lectures**
SECTION – II 1. Study of Dicot / Monocot stomata or study of stomatal movements in *Vinca* leaves or any other suitable system. 2. Using hemocytometer count number of cells per dl of suspension (RBC/ yeast cells) 3. Observe different WBC using Geimsa / Leishman's stain 4. Comparison between Dicot and Monocot stem 5. Comparison between Dicot and Monocot root 6. Animal tissues - study of permanent slides • Epithelial - squamous, cuboidal, epithelial • Connective - Areolar, adipose, cartilage, bone • Muscular - striated, non-striated, cardiac • Nervous - Medullated, non-medullated 7. Study of Barr Body 8. Histochemical localization of carbohydrates, proteins and lipids from the following and any other convenient system. a) Starch grains from potato or pea, b) Muscle, c) Fat bodies of cockroach/Drosophila/ Groundnut)		**45 Lectures**

Course Code	Title	Credits
USLSC201		**2 Credits (45 lectures)**
Unit I : 1. Structure of cell wall: a. Bacterial cell wall: Gram positive and Gram negative. b. Plant cell wall: Primary and Secondary 2. Nucleus: Structure of an interphase nucleus : nuclear membrane, nucleolus, nucleosome model, euchromatin and heterochromatin, lampbrush and polytene chromosomes 3. Ribosomes: Subunits in prokaryotes and eukaryotes (including those within chloroplast and mitochondria); ER-Ribosome complex 4. Endoplasmic Reticulum, Golgi Apparatus: a. Endoplasmic reticulum: Structure (including sarcoplasmic reticulum) Role in protein synthesis (ER-Ribosome complex) an transport b. The Golgi Apparatus:Structure, origin and relationship to Endoplasmic reticulum. Role in synthesis, storage and secretion of zymogen and glycoproteins.		**15 Lectures**
Unit II : 1. Lysosomes Types of lysosomes. Primary and secondary lysosomes & their functions. Lysosome associated diseases-Tay sachs, Silicosis. 2. Peroxisomes and Glyoxisomes : Structure and function in plant and animal cells. 3. Mitochondria : Structure of inner, outer membranes & the matrix with a brief mention of oxidative phosphorylation, Mitochondria associated diseases (any one example) 4. Plastids : Types, chloroplast morphology, structure of thylakoid membrane, photosynthetic Pigments & a brief mention of photo-phosphorylation, chloroplast DNA		**15 Lectures**
Unit III : 1. Cytoskeletal elements: a. Microfilaments: Structure and function in striated muscle fibres. Role in cytoplasmic streaming in plants. b. Mictolubules: Structure as in cilia or in flagella, mechanism in movement. Function in mitotic spindle. c. Intermediate filaments: Structure and function. 2. Cell cycle and cell division: a. Cell cycle (G0,G1,S,G2, M phases) b. Mitosis and Meiosis & their significance		**15 Lectures**

Course Code	Title	Credits
USLSC202		**2 Credits (45 lectures)**
Unit I : 1. Genetics 1.1 Mendelian inheritance: Concept of homozygous, heterozygous, phenotype, genotype, alleles; Mendel's laws and mono& di hybrid ratios with problems, chi square- for 3:1and 2:1 ratios. Use sickle cell anemia as an example to explain the concept of gene. 1.2 Chromosomal inheritance: Sutton's hypothesis, sex linked inheritance, study of human pedigrees e.g. sex -linked dominant and recessive; autosomal dominant and recessive.		**15 Lectures**
Unit II : 1. Modofication of Mendel's laws: Gene interaction: Incomplete domonance, Codominance; Multiple genes; Multiple alleles :blood groups ; Epistasis, Linkage, Sex limited, Sex-influenced. 2. Mutations: 2.1 Point mutations 2.2 Chromosomal aberrations: Structural: deletion, duplication, inversion, translocation Numerical: euploidy and aneuploidy (e.g downs, turners, klienfelter, cri-du-chat) 2.3 Brief introduction to genetic engineering and its application in Medicine (e.g Insulin) and in agriculture (e.g. bt cotton)		**15 Lectures**
Unit III : 1. Biodiversity 1.1 Origin and evolution of life, Geological Time Scale - only ERAS. Theories of origin of life - Spontaneous, Biogenesis Theories of Evolution: Lamark's Theory of Inheritance of Acquired Characters, Darwin's Theory of Evolution: selection in action - e.g.Industrial Melanism; Common Origin of all organisms (Evidences: Anatomical, Embryological, paleontological and genetic) 1.2 Principles of taxonomy and systems of classifications (Details to be taught in the laboratory/Field (See the Practical Syllabus)		**15 Lectures**

Course Code	Title	Credits
USLSCP2	**PRACTICALS**	**2 Credits**
SECTION – I 1. Preparation of solutions of known concentrations from a stock solution of a colour compound ($KMnO_4$/ $K_2Cr_2O_7$ / $KCrO_4$ / $CuSO_4$) 2. Verification of Beer Lambert's Law. Estimation of lambda max of any of the solutions used in exp 9. 3. Qualitative tests for carbohydrates (wheat rice atta) lipids (groundnut oil) and proteins (any edible protein) 4. Mitosis in onion root tip. Colchicine treated (overnight)/ control (untreated). Introduce the concept of mitotic index. 5. Detection of dehydrogenase enzyme activity (sprouting grams, beans, muscle) 6. Estimation of Catalase enzyme activity using paper disc rising time technique. 7. Study of electron micrographs as listed below - both normal and pathological • Mitochondria • Lysosome • Basement membrane / Junctions • Cilia		**45 Lectures**
SECTION – II 1. Part I: Classification of Plants: Using common plants prescribed in the chart provided 2. Part II: Classification of Animals Invertebrates prescribed in the chart provided 3. Part III: Classification of Animals Vertebrates prescribed in the chart provided 4. Study of mouth parts in insects • Biting and chewing type - cockroach • Piercing and sucking type - Mosquito • Sponging and lapping type - Housefly 5. Data entry into computers - Provide data for height and weight or any other biologically interesting data 6. Process the data using suitable software and calculate mean, median, mode and standard deviation and depict in the form of histogram. Excursion/ Field work (Ecology based).		**45 Lectures**

Scheme of Examination:

The performance of the learners shall be evaluated into two parts. The learner's performance shall be assessed by Internal Assessment with 40% marks in the first part & by conducting the Semester End Examinations with 60% marks in the second part.

The Course having Practical training will have Practical Examination for 50 marks at the end of Semester, out of which 30 marks for the Practical task assigned at the time of examination. The 20 marks are allotted as Internal Assessment.

The allocation of marks for the Internal Assessment and Semester End Examinations are as shown below:-

Internal Assessment: It is defined as the assessment of the learners on the basis of continuous evaluation as envisaged in the Credit based system by way of participation of learners in various academic and correlated activities in the given semester of the progamme.

Semester End Assessment : It is defined as the assessment of the learners on the basis of Performance in the semester end Theory/ written/ Practical examination.

Modality of Assessment :
Internal Assessment - 40% **40 marks.**

a) Theory **40 marks**

Sr No	Evaluation type	Marks
1	Two Assignments/Case study/Project	20
2	One class Test (multiple choice questions objective)	10
3	Active participation in routine class instructional deliveries(case studies/ seminars//presentation)	05
4	Overall conduct as a responsible student, manners, skill in articulation, leadership qualities demonstrated through organizing co-curricular activities, etc.	05

b) Practicals **20 marks**

Sr No	Evaluation type	Marks
1	Two best practicals	10
2	Journal	05
3	Viva	05

B) External examination - 60 %
Semester End Theory Assessment - 60% **60 marks**

i. Duration - These examinations shall be of two hours duration.
ii. Theory question paper pattern :-
1. There shall be four questions each of 15 marks. On each unit there will be one question & fourth one will be based on entire syllabus.
2. All questions shall be compulsory with internal choice within the questions. Each question will be of 20 to 23 marks with options.
3. Questions may be sub divided into sub questions a, b, c, d & e only & the allocation of marks depends on the weightage of the topic.

Practical External Assessment **30 marks**