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: IV

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

S.Y.B.Sc. Life Sciences Syllabus

Academic year 2018-2019

Semester IV			
Course Code	**Course Title**	**Credits**	**Lectures /Week**
SLSC401	Comparative Physiology	03	03
SLSC402	Life processes at the tissue, organ and organism levels: A Biochemical Approach	03	03
SLSC403	Population approach: population and communities as regulatory unit	03	03
SLSC4PR	Practicals	2.5	09

Semester IV – Theory

Course code: SLSC401	Comparative Physiology (Credits:03 Lectures/Week:03)	
	Objectives: • Homeostatic mechanisms that are essential for survival • Cell signaling, how cells communicate with each other • Neuroendocrinology, glands and hormones involved • Plant growth regulators • Nervous System • Propagation of Nerve impulses and synapses • Behaviour and behavioural adaptations in Animals **Outcomes:** Comparative approach to Physiology should indicate and remind students that in isolated, narrow sub disciplines there is also a wealth of information that can be obtained from unrelated and distant organisms. Thus comparing and contrasting diverse mechanisms provides a cohesive understanding of physiology. Further understanding normal physiology also helps in treatment of diseases which leads to its alteration	
Unit I	Homeostasis to stress: • Thermal physiology: a) Plant adaptation in extreme thermal conditions. b) Thermal strategies in poikilotherms and homeotherms, ecto and endotherms c) Temperature regulating reflexes, acclimatization. d) Fever, Hyperthermia, heat exhaustion and heat stroke e) Thermogenesis: shivering and nonshivering thermogenesis, Hyperthermia induced by pyrogens f) Antifreeze proteins g) Therapeutic hypothermia • Fuel Homeostasis during exercise and Stress a) Regulation of energy stores: control of food intake b) Role of Leptin, Ghrelin and Kisspeptin c) Eating disorders: Anorexia and Bulimia Nervosa d) Overweight and obesity e) Type I and Type II Diabetes	**15 L**
Unit II	• **Host Parasite Relationship** a) Virulence factors and toxins: virulence factors, exotoxins, enterotoxins, endotoxins b) Host factors in infection: host risk factors, innate resistance c) Parasite escape mechanisms	**15 L**

	• **Defence mechanisms in plants** a) Biomolecules such as secondary metabolites, surface protectants and enzyme • **Defence mechanisms in animals** a) Innate and Adaptive Immunity b) Introduction to primary and secondary lymphoid organs and Lymphatic systems c) Mechanisms of Innate Immunity – In invertebrates (hemocytes) and in vertebrates (physical and physiological barriers, phagocytosis and inflammation) d) Mechanisms of Adaptive Immunity – T and B cells (Mode of Recognition of Antigen)	
Unit III	**Infectious Diseases** (To be discussed with respect to etiology, pathogenesis, clinical manifestations, diagnosis, therapy, prophylaxis, epidemiology) a) Malaria b) Dengue c) HIV (AIDS) d) Zika Virus e) Avian influenza f) Ebola virus g) SARS h) Tuberculosis i) Typhoid **Clinical Trials:** a) Introduction – Definition, History b) Design and Ethical Considerations c) Protocol and Endpoints d) Population, Recruitment and Baseline Assessment e) Randomization, Stratification and Blinding f) Path-breaking Clinical Trials	**15 L**

References:

1. Taiz and Zeiger. (2010). Plant physiology, (5th edition). Sinauer Associates.
2. Gilbert, S. (2010). Developmental Biology, (9th edition). Sinauer Associates.
3. Sherwood L. (2006). Fundamentals of physiology- A Human perspective, (5th edition). Thomson Brooks
4. Bhojwani and Bhatnagar. (1999). Embryology of Angiosperms,(4th edition). New Delhi, Vikas Pub.
5. Widmaier, Raff, Strand. (2006). Vander's Human Physiology,(10th edition,). Mc Graw Hill Int. Edition.
6. Moyes and Schulte. (2007). Principles of Animal Physiology,(2nd edition). Pearson Education.

7. Greenwood, Slack and Peutherer. (2007). Medical Microbiology: A guide to microbial infections, (17th edition).
8. Davis, Dulbecco and Ginsberg. (1990). Microbiology. Philadelphia, Lippincott Company.
9. Ananthanarayanan and Panniker. (1996). Textbook of Microbiology, (5th edition).Orient Longman.
10. J.M. W. Slack. (2006). Essential Developmental Biology, (2nd edition). Blackwell publishers.

Semester IV – Theory

Course code: SLSC402	**Life processes at the tissue, organ and organism levels: A Biochemical Approach (Credits:03 Lectures/Week:03)**	
	Objectives: On completion of the course, the student must be able to describe: • Role of enzymes as biocatalysts, with introductory knowledge on enzyme kinetics. • Basic cellular energy metabolism utilizing glucose and fatty acids • Elementary amino acid metabolism viz. transamination, deamination & urea cycle. • Composition & role of oxidative phosphorylation and photophosphorylation systems in cellular ATP synthesis. **Outcomes:** • To understand the detailed functioning of a cell it is necessary to study it at the molecular level. Basic biochemical processes in cells and tissues and their regulation and integration are the mainstay of a normal functional cell	
Unit I	**Metabolism - Anabolism of biomolecules** • **Carbohydrate Anabolism** a) Gluconeogenesis b) Pentose phosphate pathway c) Short account of polysaccharide (Glycogen) synthesis • **Lipids Anabolism** a) Fatty acid biosynthesis b) Cholesterol (4 Stages –Condensation, Conversion, Polymerization an Cyclization) and prostaglandin biosynthesis • **Amino-acid Anabolism** a) Transamination and its significance b) Glutamine synthesis • **Photosynthesis** a) Photophosphorylation, Hill reaction b) C3 and C4 cycles c) Photorespiration	**15L**
Unit II	**DNA Replication & Transcription** a) DNA replication system in prokaryotes – process with proteins and enzymes involved (with domains of DNA polymerase) b) Transcription: ▪ Prokaryotes – Initiation, elongation & termination ▪ Eukaryotes – in terms of different RNA polymerase and promoters. ▪ RNA processing (Post-transcriptional modification) – of rRNA, tRNA and mRNA (5'cap, poly-A tail and intron splicing (snRNPs only) c) Concept of Reverse transcription	**15L**

Unit III	**Translation & Regulation of gene expression** a) Translation: Genetic code; Translation system (Initiation, Elongation, Termination) b) Post translational Modification (Phosphorylation, methylation and Acetylation) c) Regulation of gene expression and its significance: ▪ Operon model (Lac, Trp) ▪ Alternate splicing ▪ Concept of RNAi	**15L**
	References: 1. Nelson.D.M. AND Cox.M. (2005). Lehninger's Principles of Biochemistry, (4th edition).New York, W.H.Freeman Publishers. 2. Berg.J.M., Tymenko.J.L. and Stryer.L. (2002). Biochemistry, (5th edition). New York.W.H.Freeman and Co. 3. Voet.D., Voet.J.G. (2004). Fundamentals of Biochemistry, (1st edition). New York, John Wiley & Co. 4. Zubay G.L, Parson W.W. and Vance D.E. (1993). Principles of Biochemistry, (2nd edition). CBS Publishers and Distributors. 5. Griffiths A.J. et.al. (2000). An Introduction to Genetic Analysis, (7th edition). W.H.Freeman.	

Semester IV – Theory

Course code: SLSC403	**Population approach: population and communities as regulatory unit (Credits:03 Lectures/Week:03)**	
	Objectives: On completion of the course, the student must be able to: • List and describe the evidence for evolution and its required corollaries. • Describe the mechanisms by which evolution occurs. Provide detailed explanations of the processes of evolution by mutation, migration, genetic drift, non-random mating, and natural selection. • Explain adaptation, providing examples from several different fields of biology (e.g., cell biology, physiology, conservation biology, bioinformatics, medicine, behaviour, etc.) • Describe the history of life on earth. Identify major evolutionary transitions over time, and explain the tools and evidence that support current hypotheses of the history of life. • Solve basic biostatistics problems such as probability as well as describe the three statistical distributions • Differentiate between correlation and regression and solve problems related to them **Outcomes**: Population dynamics of human population are not only dependent on biological forces but also social forces. Unit I focuses on Evolutionary concepts and Population studies. Quantification is an important aspect of modern biology. A clear understanding of how to handle measurements and biological variation in a variety of experimental setups is obligatory. Unit II and III include fundamentals of biostatistics and bioinformatics. Further elementary bioinformatics has been added to introduce students to 'in silico" laboratories available	
Unit I	**Evolution and its consequences:** a) Origin of Species: Biological species concept, morphological species, Allopatric and sympatric speciation, Isolating mechanism preventing exchange in populations. Rates of speciation- punctuated or gradual. Life history of a species, Mitochondrial DNA and tracing human phylogeny and extinctions b) Human evolution: Factors in Human Origin: Bipedalism, improvement in food acquisition, improved predator avoidance and reproductive success, Hunter gatherer societies and evolution of communication – speech and language. Tool making. Altruism and kin selection. c) Evolution and Society: Cultural vs. biological evolution, social Darwinism, eugenics, reproductive technologies and genetic engineering – impact on human culture, gene machine vs. Intelligent design arguments.	**15L**
Unit II	**Biostatistics:** a) Introduction to hypothesis testing, One tailed and two tailed tests, Type I and Type II errors, concept of p value, z test b) Analysis of variance one way classification c) Test for equality of two means, Paired and unpaired t-tests d) Comparison between Parametric and Non parametric test e) Chi Square test for independence 2x2 table, test for goodness of fit	**15L**

Unit III	**Bioinformatics:** a) DNA and Protein sequence Data analysis: Annotation of gene sequence Genetic code and Frame translation to amino acids, concept of six frame translation. b) Phylogenetic Analysis: ▪ Concept of paralogous and orthologous genes. ▪ Phylogenetic Trees – Types of trees, Clade and types of clades, Bootstrapping, Construction of trees (Phenetic and Cladistic method), Maximum Parsimony method. ▪ Concept of paralogous and orthologous genes ▪ Nucleic acid based phylogenies ▪ Softwares used for phylogenetics	**15L**
	References 1. B. Hall and B. Hallgrimsson. (2008). Strickberger's Evolution, (4th Edition). Jones and Bartlett Publishers. 2. Carrol S.B. (2009). Remarkable Creatures: Epic Adventures in Search of the Origin of Species.Mariner Books. 3. Hamilton.M.B. (2009). Population Genetics. Willey-Blackwell. 4. Gillespie.J.H. (2004). Population Genetics: A Concise Guide. John Hopkins University Press. 5. Mahajan.B.K. (2010). Methods in Biostatistics of Medical students and Research Workers. 6. Krane and Raymer. (2003). Fundamental concepts of Bioinformatics. Benjamin Cummings Publication. 7. Clair and Visick. (2010). Exploring Bioinformatics – A Project-based Approach St. Jones and Barlett publisher. 8. Claverie.J.M. and Notredame.C. (2003). Bioinformatics for Dummies. John Wiley & Sons	

Semester IV – Practical

Course Code:SLSC4PR	(Credits:2.5 Practicals/Week:03)

Paper-I:

1. Extraction and detection of Plant alkaloids, saponines, tannins and volatile oils from suitable plant source.
2. Alkaloid separation by TLC
3. ABO blood typing
4. Principle and working of home pregnancy test slide.
5. Widal Test- Qualitative.
6. Streak plate isolation of microorganisms
7. Antibiotic sensitivity of microorganisms
8. Study of effect of temperature and caffeine on heart beat of *Daphnia*
9. Interpretation of pathological reports based on the biochemical analysis.

Paper-II

1. Estimation of RNA/Ribose Sugars.
2. Chromatography of Sugars – Circular Paper Chromatography
3. Thin Layer Chromatography for separation of Plant Pigments (Slide technique)
4. Solvent Extraction of Lipids.
5. Column Chromatography of Proteins or Plant Pigments.
6. Protein separation by PAGE (Demonstration)
7. Plant enzyme (Qualitative / Quantitative)

Paper -III

1. (a) Comparative Anatomy of Brain (Invertebrate to vertebrate)
   (b) Study of Fossils (Any two)
2. Human Karyotyping – Normal and Abnormal (Numerical and Structural)
3. *Chironomous* Larva- Study of Giant Chromosome from Salivary Glands
4. Analysis of variance one way classification
5. Applications of t distribution
6. Chi square distribution

   Note: (In all statistical analysis use of Excel should be introduced)
7. Bioinformatics: (Using free online tools)
   - Phylogenetic tree construction
   - Concept of ORF
   - Annotation of a Gene Sequence (Manual and using online tool)
   - Frame translation (Manual and using online tool E.g. Bioline)
8. Project report based on Bioinformatics/Biostatistics/ Population Genetics / Evolution

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 :

Paper – I: Case Study (20 marks)

Paper – II: Critical analysis of two contradictory scientific papers (20 marks)

Paper – III: (a) Crossword (10 marks) (b) Mind map (10 marks)

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