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: S.Y.B.Sc. (Semester-III)

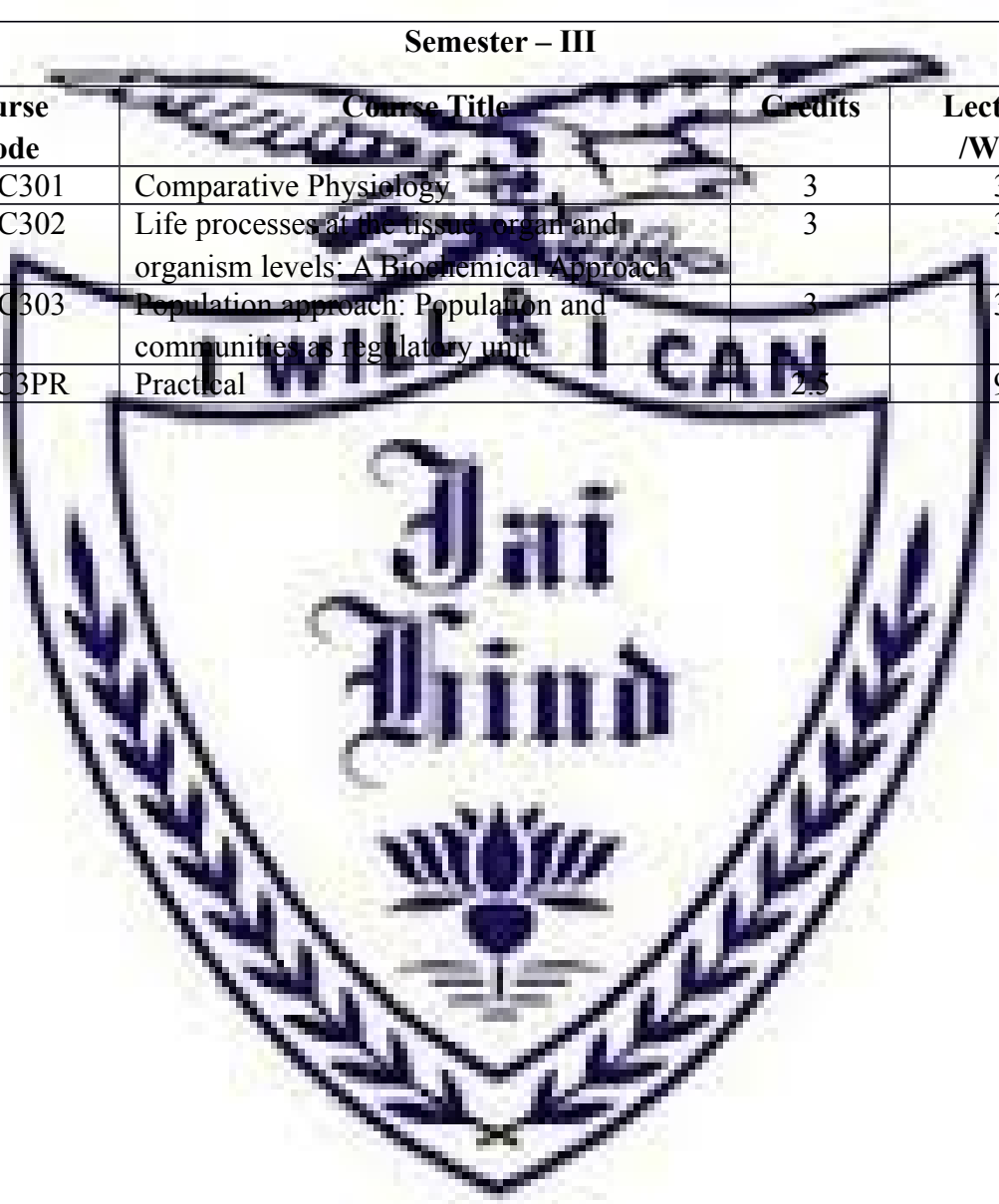
Proposed Course: Life Sciences

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

S.Y.B.Sc. Life SciencesSyllabus

Academic year 2019-2020

Semester – III			
Course Code	**Course Title**	**Credits**	**Lectures /Week**
SLSC301	Comparative Physiology	3	3
SLSC302	Life processes at the tissue, organ and organism levels: A Biochemical Approach	3	3
SLSC303	Population approach: Population and communities as regulatory unit	3	3
SLSC3PR	Practical	2.5	9



Semester III – Theory

Course Code: SLSC301	Course Title: Comparative Physiology	03 Credits
Learning Objectives	The course aims to provide a thorough understanding of: • 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	
Course Description	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	
	THEORY	**45 lectures**
Sub-Unit	**Unit I: Homeostasis**	**15**
1	**Homeostatic mechanisms and cellular communication**	
	a) Control systems in homeostasis and components of homeostatic control	**01**
	a) An overview of cell signalling and biochemical basis of cell signalling b) Release and transport of chemical messengers, communication of signal to target cell	**03**
	c) Types of chemical messengers, second messengers, signal amplification, types of receptors, Regulation of receptors and cell signalling	**03**
2	**Neuro-Endocrine glands and their hormones**	**05**
	a) Pineal, Hypothalamus, Pituitary, Thyroid, Parathyroid, Pancreas, Adrenal cortex, Testis and Ovary	
	b) Steroid hormone: Ecdysone	
3.	**Structure and functions of Plant Growth Regulators** Auxins, Giberillicacid,Cytokinin, Abscisic acid, Ethylene	**03**
Sub-Unit	**Unit II: Control and Coordination in plants and animals**	**15**

1.	**Animals**	
	a) Phylogenetic development of the Nervous System – nerve net, nerve plexus and ganglionated nervous system in hydra, starfish and earthworm	**01**
	b) Human Nervous System – CNS and PNS overview, Neurons and Glial cells and their role	**02**
	c) Nature of the Nerve Impulse – Ion channels and pumps, Resting potential, Action Potential	**02**
	d) Propagation of Nerve impulses and synapses (Chemical and electrical)	**03**
	e) Behaviour and behavioural adaptations (Neuronal) – Innate and learned behaviour	**02**
	f) Behavioral Strategies in Bird Migration (Physiological aspect-Accumulation of body fat and thermoregulation)	**02**
2.	**Plants:**	
	Plant movements – Tropisms, Taxes, Nasties and Kinesis – discuss with suitable examples with reference to physiology	**03**
Sub-Unit	**Unit III: Developmental Biology**	**15**
1.	**Reproduction and Development**	
	a) Basis of Sex Determination i) Plants: Maize ii) Animals: Role of SRY gene and Aromatase b) Role of environmental factors – i) Temperature and Parthenogenesis in insects Eg. Wasp/Honey bee/Ants ii) Plant-animal interaction for reproduction: Fig wasp / Gall wasp iii) Sex reversal	**04**
2.	Alternation of generations in plants Eg. *Adiantum*	**01**
3.	Sex differentiation of gonads, internal and external genitalia	**01**

4.	Ovarian and testicular functions, puberty and regulation of uterine changes in menstrual cycle, menopause, pregnancy, parturition, lactation	**02**
5.	Artificial regulation of reproduction: Use of contraceptive methods	**01**
6.	**Gametogenesis and early development:**	
	a) Plants: i) Microsporogenesis and megasporogenesis ii) Types of ovules and fertilization iii) Development of embryo in monocot and dicot plants	**04**
	(b) Animals: Cleavage and development of embryo in frog	**02**
References:	1.Raff H., Widmaier E., Strang K. (2014) Vander's Human Physiology, McGraw-Hill Education 2. Taiz L., Zeiger E. (2010) Plant Physiology, Sinauer Associates, Inc. 3. Tortora GJ., Derrickson B. (2013) Principles of Anatomy and Physiology, John Wiley & Sons Inc. 4. J.M.W. Slack. (2006) Essential Developmental Biology, 2nd edition. Blackwell Publishers 5. Scott Gilbert. (2010) Developmental Biology, 9th edition. Sinauer Associates. 6. L Sherwood. (2006) Fundamentals of physiology - A Human perspective, 3th edition. Thomson Brooks. 7.Bhojwani and Bhatnagar. (1999) Embryology of Angiosperms, 4th edition. New Delhi Vikas Pub.	

Course Code: SLSC302	**Course Title: Life processes at the tissue, organ and organism levels: A Biochemical Approach**	**03 Credits**
Learning Objectives	On completion of the course, the student must be able to describe: 1. Role of enzymes as biocatalysts, with introductory knowledge on enzyme kinetics. 2. basic cellular energy metabolism utilizing glucose and fatty acids 3. elementary amino acid metabolism viz. transamination, deamination & urea cycle 4. Composition & role of oxidative phosphorylation and photophosphorylation systems in cellular ATP synthesis.	
Course description	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	
	THEORY	**45 lectures**
Sub-Unit	**UNIT I: Enzymes**	**15**
1.	Introduction, Brief History, Working of an enzyme	**02**
2.	International Classification System	**01**
3.	Effect of pH and Temperature, Enzyme concentration and Substrate concentration	**02**
4.	Co-enzymes and co-factors : NAD, FAD, Mn, Mg, Zn and Cu	**02**
5.	Kinetics (M-M, L-B plots)	**02**
6.	Enzyme Inhibitors (Irreversible and Reversible), feed-back inhibition	**03**
7.	Purification of Enzyme, Specific activity of Enzyme (Fractionation techniques and Chromatographic techniques)	**02**
8.	Allosteric enzymes (using any one example)	**01**
Sub-Unit	**UNIT II Metabolism - Energy from Carbohydrates:**	**15**
1.	**Carbohydrates Catabolism** a) Glycolysis – Brief Historical background, process and metabolic regulation b) Citric Acid Cycle – Brief Historical background - Process and regulation - Importance as a central amphibolic pathway unifying all primary biological processes - Anaplerosis	**08**

2.	**Bioenergetics:**	
	a) Electron Transport System i) Localization ii) Sequence of electron transporters	**03**
	b) Oxidative Phosphorylation i) Mitchell's Chemiosmotic Hypothesis ii) ATP synthesis iii) Control of respiration, uncoupling and metabolic poison	**04**
Sub-Unit	**UNIT III: Metabolism - Energy from Lipids and Proteins**	**15**
1.	**Lipids – Catabolism**	**07**
	a) Lipolysis	
	b) Role of Carnitine in mitochondrial permeability	
	c) Beta– Oxidation of fatty acids and integration into Kreb's cycle	
	d) Ketone bodies and their significance	
2.	**Amino Acids – Catabolism**	**08**
	a) Protein Degradation liberating amino-acids	
	b) Deamination, Transamination & ammonia disposal by urea Cycle	
	c) Decarboxylation & integration into Kreb's cycle	
References:	1. J.M. Berg, J L Tymenicko and L. Stryer. (2002). Biochemistry. New York: W H Freeman and co. 5th edition 2. D.Voet, J. G. Voet. (2004). Fundamentals of Biochemistry. New York: John Wiley &Co 3. Zubay G. L, Parson W.W. and Vance D.E. (1995). Principles of Biochemistry. NY: W. C. Brown 4. Lehninger, D.L Nelson and M.M. Cox. (2005). Principles of Biochemistry. New York. W. H Freeman Publishers	

Course Code: SLSC303	Course Title: Population approach: population and communities as regulatory unit	03 Credits
Learning 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, behavior, 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 biostatistic problems such as probability as well as describe the three statistical distributions ▪ Differentiate between correlation and regression and solve problems related to them	
Course Description	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	
	THEORY	**45 lectures**
Sub-Unit	**UNIT I: Concepts in Evolution and Population Genetics**	**15**
1.	Darwinism: Conceptual arguments for evolution by Natural Selection given by Charles Darwin and Alfred Wallace	**01**
2.	Evidences for evolution: Comparative anatomy and embryology, Fossil records and living fossils, Artificial selection	**02**
3.	Study of Evolution in context of human genetic diseases (BRCA –I / Huntington's/ Thalassemia)	**03**
4.	Populations and allelic frequencies, Hardy Weinberg Equilibrium, change in gene frequencies due to selection, mutation, migration and genetic drift (founders effect)	**05**
5.	Origin of variability, polymorphism, kinds of selection – directional stabilizing and disruptive, selectionist versus neutralist	**04**

Sub-Unit	**UNIT II: Biostatistics**	**15**
1.	Introduction to probability, addition law and multiplication law	**03**
2.	Binomial, Poisson and Normal distribution	**05**
3.	Bivariate data, scatter diagram and its uses, Karl Pearson's correlation coefficient	**04**
4.	Regression equations and their uses	**03**
Sub-Unit	**Unit III: Bioinformatics**	**15**
1.	Introduction to bioinformatics: a) Various branches of Bioinformatics b) Concept of information net work: internet, IP address, TCP/IP, FTP, HTTP, HTML and URLs	**03**
2.	Virtual libraries – The European Molecular Biology Network (EMBnet), The National Center for Biotechnological Information (NCBI), PubMed and its applications	**04**
3.	Concept of databases and their use in Biology: Primary, Secondary and composite databases	**02**
4.	Types of Databases: a) Nucleotide Database (Genbank) b) Protein Database (PDB/ExPaSy) c) Database searching (BLAST Search)	**04**
5.	Sequence Alignment – Multiple, Global	**02**
References:	1. Krane and Raymer (2003). Fundamental concepts of Bioinformatics. Benjamin Cummings Publication. 2. Krane and Raymer (2003). Exploring Bioinformatics – A Project-based Approach St. Jones and Bartlett Publishers. 3. Jean-Michel Claverie, Cedric Notredame. (2003) Bioinformatics for Dummies. John Wiley & Sons. 4. Mahajan BK. (2010) Methods in Biostatistics, JPB. 5. Arora, Malhan. (2010) Biostatistics. Himalaya Publishing House. 6. Simon EJ, Dickey JL., Reece JB., Hogan KA. (2015) Campbell Essential Biology with Physiology. Pearson 7. Raven P. (2015) Biology. McGraw Hill Education.	

Semester III – Practical

Course Code SLSC3PR	Course Title: SEMESTER – III PRACTICALS	2.5 Credits
Learning Objectives	Toencourage problem based learning and 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.	Good Laboratory Practices	
2.	Demonstration of reproductive system and location of endocrine glands in Albino Mouse Male and Female (Virtual Lab)	
3.	Microtome and preparation of Endocrine gland slides from above dissected specimen or any suitable plant specimen	
4.	Study of Histological features of Endocrine glands.	
5.	A complete study of Frog Embryology (Egg to Tadpole to Adult)	
6.	Study of Floral parts from the given flower (*Hibiscus* and *Pancretium*)	
7.	Study of microscopic structure of anthers , ovules. Seed structure (Maize and Okra)	
8.	Study of pollen germination Using *Vinca* flower (*in vitro*)	
9.	Study of pollen germination in *Vinca* (*in Vivo)*	
10.	Detection of activity of plant hormones (Dose dependent response)	
11.	Observation and Study of locally collected Leaf Gall and any other one plant disease.	
PRACTICAL – II		

1.	pH meter – Principle & instrumentation, Determination of pH	
2.	Glycine curve	
3.	Protein precipitation by pH manipulation (Casein from Milk)	
4.	Determination of Km of an enzyme: Urease/ Protease/ Amylase	
5.	Histochemical localization of Enzymes (Acid Phosphatase)	
6.	Colorimetric Protein Estimation by Biuret Method	
7.	Colorimetric Cholesterol Estimation / total Lipid Estimation from egg	
8.	Colorimetric estimation of Phosphates/Phosphorus	
9.	Titrimetric estimation of Ascorbic acid (Vitamin C)	
PRACTICAL – III		
1.	Correlation (Also using MS EXCEL)	
2.	Regression Analysis (Also using MS EXCEL)	
3.	Probability testing using suitable example	
4.	Normal Distribution using suitable example	
5.	Testing of Hardy-Weinberg law using suitable examples of gene and allelic frequencies -Sex linked (One each)	
6.	Bioinformatics: (Using free online tools) - Use of Pubmed - Use of various types of Databases – Nucleic acid, Protein, Primary, Secondary, Structure - Database searching – BLAST search - Sequence Alignment – Multiple, Global	
7.	Project proposal 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 of 40 min. duration

(ii) C.A.-II : Skit, Literature Review, Software Algorithm

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 three Practicals = 50+50+50=150