SOPHIA COLLEGE

(AUTONOMOUS)

Affiliated to the University of Mumbai

Syllabus for Semesters III to IV

Program : B.Sc.

Course: Life Sciences

(Choice Based Credit System with effect from the year 2022-23)

Sophia College (Autonomous)
S.Y.BSc. Life Sciences Syllabus

Choice based Credit and Grading System Academic year 2022-2023

SEMESTER III

COURSE CODE	UNIT	TOPIC HEADINGS	CREDITS	LECTURES
Paper I	**Comparative physiology- I**			**45**
SBSLSC301	1	Physiology and Homeostatic Maintenance	6	15
	2	Control and Coordination in plants and animals		15
	3	Sex determination and sexual differentiation		15
SBSLSCP301	Practical		2	
Paper II	**Life processes at the tissue, organ and organism levels: A Biochemical Approach- I**			**45**
SBSLSC302	1	Enzymes and their environment	6	15
	2	Metabolism - Energy from Carbohydrates		15
	3	Metabolism - Energy from Lipids and Proteins		15
SBSLSCP302	Practical		2	15
Paper III	**Population approach: population and communities as regulatory unit-I**			**45**
SBSLSC303	1	Concepts in Evolution and Population Genetics	6	15
	2	Biostatistics–I		15
	3	Infectious diseases–I & Bioinformatics–I		15
SBSLSCP303	Practical		2	

Sophia College (Autonomous)
S.Y.BSc. Life Sciences Syllabus

Choice based Credit and Grading System
Academic year 2022-2023

SEMESTER IV

COURSE CODE	UNIT	TOPIC HEADINGS	CREDITS	LECTURES
Paper I	**Comparative physiology- II**			**45**
SBSLSC401	1	Integration and Coordination	6	15
	2	Adaptations to Physiological stress		15
	3	Homeostasis during infections		15
SBSLSCP401		Practical	2	
Paper II	**Life processes at the tissue, organ and organism levels: A Biochemical Approach- II**			**45**
SBSLSC402	1	Metabolism: Anabolism of biomolecules	6	15
	2	Nucleic acids		15
	3	Regulation of gene expression and Integration of metabolism		15
SBSLSCP402		Practical	2	15
Paper III	**Population approach: population and communities as regulatory unit-II**			**45**
SBSLSC403	1	Evolution and its consequences	6	15
	2	Biostatistics–II		15
	3	Infectious diseases–II & Bioinformatics–II		15
SBSLSCP403		Practical	2	

SEMESTER III

COURSE CODE: SBSLSC301

PAPER –I: COMPARATIVE PHYSIOLOGY- I

Course Objective :

CO 1: Outline physiology and homeostatic maintenance

CO 2: Compare and contrast the control and coordination in plants and animals

CO 3: Gain knowledge about sex determination and sexual differentiation

Course Outcome:

Students will be able to

LO 1: compare and contrast diverse mechanisms and this provides a cohesive understanding of physiology.

LO 2: interpret the nervous system in diverse genera

LO 3: identify the process of sexual maturation and gamete development across the plant and animal kingdom

THEORY

(Total Lectures: 45)

Course code	Unit	Topic headings	Credits	Lectures
SBSLSC301	**1**	**Physiology and Homeostatic Maintenance A. Transport and Circulation**	**2**	**15**
		1. Transport in plants – Transport of water and inorganic solutes – transpiration, stomatal function and regulation, role of proton pumps and factors affecting ascent of xylem sap. Transport of organic solutes – mechanism and its regulation		3
		2. Circulation in animals – (a) Animals without a circulatory system eg. hydra and jellyfish (b) Open and closed circulatory system eg. Insects vs worms		3
		3. Vertebrate circulatory system –heart, single and double circulation.		3
		Specific adaptations – mammals at high altitudes and diving mammals Cardiovascular system in health and disease – exercise, hypertension and atherosclerosis		3

		B. Respiration and Gaseous exchange Aerobic and anaerobic respiration Gas exchange in small animals (across surface) and cutaneous respiration in frogs. Gas exchange in plants – also pneumatophores Gaseous exchange in invertebrates – trachea in insects, book lungs in scorpion Gaseous exchange in vertebrates – gills and lungs Respiratory pigments – O2 and CO2 balance		**3**
SBSLSC301	**2**	**Control and Coordination in plants and animals** 1. Phylogenetic development of the Nervous System – nerve net, nerve plexus and ganglionated nervous system in hydra, starfish and earthworm. 2. Human Nervous System – CNS and PNS overview 3. Nature of the Nerve Impulse – Resting potential, Action Potential 4.Transmission of Nerve impulses and synapses Behaviour and behavioural adaptations (Neuronal) – Innate and learned behaviour (Habituation) with an example of Aplysia Behavioural Strategies in Bird Migration (Physiological Aspect-Accumulation of body fat and thermoregulation, Nonstop long-distance flight.)	**2**	**15** 3 2 3 2 3 2

SBSLSC301	**3**	**Sex determination and sexual differentiation** 1. Basis of Sex Determination (a) Plants: e.g. Maize/Papaya (b) Animals: Role of SRY gene and Aromatase (c) Role of environmental factors – Temperature and Parthenogenesis in insects e.g. Wasp/Honey bee/Ants (d) Plant-animal interaction for reproduction e.g. Fig wasp / Gall wasp (e) Sex reversal 2. Sex differentiation of gonads, internal external genitalia – e.g : Human 3.Early gametogenic development in plants alternation of generation. e.g: moss/ Ferns. Double fertilization: E.g. angiosperms 4. Ovarian and testicular functions, puberty and regulation of uterine changes in menstrual cycle, menopause, pregnancy, parturition, lactation. 5. Artificial regulation of reproduction: Use of contraceptive methods	**2**	**15** 5 3 3 3 1
SBSLSCP301		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 Floral parts from the given flower (*Hibiscus* and *Pancretium*) study of microscopic structure of anthers, ovules, and seed structure (Maize and Okra) 5. Study of pollen germination using *Vinca* flower (*in vitro*)		2

		6. a. Study of pollen germination in *Vinca* (*in vivo*) b. Tracing the path of the pollen tube along the stylar canal using Aniline blue stain 7. Study of effect of temperature and caffeine on heartbeat of Daphnia 8. Principle and working of home pregnancy test slide 9. Observation and Study of locally collected Leaf Gall 10. Study of plant diseases: Permanent slides/local samples **Note: Students will be continuously monitored for their active participation during lab sessions.**		

SEMESTER III

COURSE CODE: SBSLSC302

PAPER –II: LIFE PROCESSES AT THE TISSUE, ORGAN AND ORGANISM LEVELS: A BIOCHEMICAL APPROACH- I

Course Objective :

CO 1 :Familiarize students with the basic biochemical process in the cells and tissues and their regulation .

CO2: Acquaint the students to the lipid and protein catabolism by demonstrating its significance in terms of real life examples

CO3: Introduce students to different techniques used to extract and purify enzymes and the parameters to study enzyme kinetics and further how enzyme activity is regulated

Course Outcome:

Students will be able to

LO1 : understand the basic biochemical process.

LO2 :relate the process involving their food metabolism and respiration.

LO3: inculcate the knowledge of lipid and protein metabolism and relate the knowledge to host metabolic processes

THEORY

(Total Lectures: 45)

Course code	Unit	Topic headings	Credits	Lectures
SBSLSC302	**1**	**Enzymes and their environment** 1. Extraction, purification of Enzymes techniques used: Dialysis, Gel-filtration, Ion-exchange, Affinity chromatography and Spectrophotometry 2. General protocol of enzyme extraction using the examples of RUBISCO from plants and LDH from animals. 3. Meaning an significance of Specific Activity 4. Enzyme Classification (With an example of each) 5. Effect of pH and Temperature	**2**	**15**

		6. Co-enzymes and co-factors: NAD, FAD, Mn, Mg, Zn and Cu (one reaction each) 7. Enzyme Kinetics (MM, LB) 8. Regulation of enzyme activity: Inhibitors, Activators and feed-back control 9. Allosteric enzymes (Kinases in Glycolysis) and their significance in metabolic regulation		
SBSLSC302	**2**	**Metabolism – Energy from Carbohydrates A. Carbohydrates – Catabolism** 1. Glycolysis – a)Brief Historical background b)process and metabolic regulation 2. Citric Acid Cycle– a) Brief Historical background b) Process and regulation. c) Importance as a central amphibolic pathway unifying all primary biological processes. d) Anaplerosis **B. Bioenergetics:** 1. Electron Transport System i. Localisation and ii. Sequence of electron transporters 2. Oxidative Phosphorylation i. Mitchell's Chemiosmotic Hypothesis ii. ATP synthesis iii. Control of respiration, uncoupling and metabolic poisons	**2**	15 9 2 4

SBSLSC302	**3**	**Metabolism – Energy from Lipids and Proteins** **A. Lipids–Catabolism:** 1. Lipolysis 2. Role of Carnitine in mitochondrial Permeability 3. Beta– oxidation of fatty acids and integration into Kreb'scycle 4. Ketone bodies and their significance **B. Proteins –Catabolism:** 1. Protein Degradation and liberation of amino-acids 2. Deamination, Transamination of amino-acids and ammonia disposal by Urea cycle. 3. Decarboxylation of amino-acids and integration into Kreb's cycle	**2**	**15** 7 8
SBSLSCP302		**A. Instrumentation / Technique** - pH metry - Colorimetry - Titration **B- Process / Concept and immediate Relevance** - Extraction, Purification - Analysis/Estimation - GLP (Good Laboratory practices) incorporated into every practical Acid, bases and buffers 1. pH meter - a) principle & instrumentation and b) determination of pH (titration of Acids/Bases/Buffers/ 'chameleon balls'). *(in FY the students were introduced to the concept of pH measurement of familiar liquids-here tech & details are given- practically understanding buffering using Glycine / titration curve)*		

		2. Protein precipitation by pH manipulation (Casein from Milk/Curds) *(From previous experiment and pH manipulation, proteins can be precipitated)* **3. Enzymology** Urease(from Jack beans)/Lipase/Protease (from detergents) *(Enzyme activity can be detected and estimated – using colorimetry)* **ii.** Histochemical localization of Enzymes (Acid Phosphatase) *(Enzyme activity can be localized)* **4. Estimation /Quantitation:** **i.** Colorimetric Protein Estimation by Biuret Method (Enzyme extract/Casein from previous experiments). *(Proteins, such as the isolate from experiment can be estimated by color reaction)* **ii**. Colorimetric Cholesterol Estimation / total Lipid Estimation from egg. *(lipid metabolism an important component of our systems, content can be estimated by color reaction)* **iii.**Colorimetric estimation of Inorganic Phosphates by Stannous chloride method. *(Estimation of biologically relevant inorganic ions by colorimetric method)* **iv.** Titrimetric estimation of Ascorbic acid (VitC). *(Estimation of biological materials by non- colorimetric method)* **Students will be continuously monitored for their active participation during lab sessions**.	**2**	

SEMESTER III

COURSE CODE: SBSLSC303

PAPER –III: POPULATION APPROACH: POPULATION AND COMMUNITIES AS REGULATORY UNIT-I

Course Objective :
CO 1 :Familiarize students with the basic bioinformatics tools, database and application
CO2: Acquaint the students to statistics and data analysis.
CO3: Make the student understand the evolutionary concepts and population studies

Course Outcome:
Students will be able to
LO 1 : analyze data in terms of statistical significance
LO 2 :comprehend the process of evolution.
LO3: develop proficiency in using bioinformatics tools and apply the knowledge in designing a short term project

THEORY

(Total Lectures: 45)

Course code	Unit	Topic headings	Credits	Lectures
SBSLSC303	**1**	**Evolution** 1. Darwinism- concepts of variation, adaptation, struggle, fitness and natural selection, spontaneity of mutations, Conceptual arguments for evolution by Natural Selection given by Charles Darwin and Alfred Wallace 2. Evidences of evolution- homologous, anatomical, geographical, biochemical, fossil- formation, types of fossils, fossil records and living fossils, Artificial selection 3. Evolutionary history: The evolutionary time scale; eras, periods and epoch; major events in the evolutionary timescale 4. Populations and allelic frequencies, Hardy Weinberg Equilibrium, change in gene frequencies due to selection, mutation, migration and genetic drift (Bottleneck effect& Founders' effect) 5. Origin of variability, polymorphism, types of natural selection – directional, stabilizing and disruptive, selectionist vs neutralist	**2**	**15** 3 2 3 4 3

SBSLSC303	**2**	**Biostatistics–I:** 1. Probability- addition law and multiplication law, random variable, probability mass function 2. Binomial, Poisson and Normal distribution 3. Skewness, Kurtosis, Confidence limits 4. Bivariate data, scatter diagram and its uses, Karl Pearson's correlation coefficient 5. Regression equations and their uses	**2**	**15** 3 5 4 3
SBSLSC303	**3**	**Infectious Diseases–I and Bioinformatics–I:** **Infections in Plants** 1. Tobacco mosaic virus, 2. Crown gall bacterial infection 3. Puccinia fungal infection **Bioinformatics–I:** Concept of information network: internet, IP address, TCP/IP, FTP, HTTP, HTML and URLs **(A)** Introduction to bioinformatics, History, Applications of bioinformatics **(B)** Biological databases and their types – Primary and secondary databases withexamples, specialized databases with examples of species database (Human/Yeast/Dicty) as well as disease database(HIV base), possible limitations of databases. **(C)** Important databases: NCBI, EMBL, DDJB, Uniprot/SwissProt, NextProt, PDB **(D)** Sequence alignments **1.** Pairwise versus multiple **2.** Local and global **3.** BLAST and its variants	**2**	**15** 3 2 5 5

SBSLSCP303		1. Correlation (Using serial dilution and OD, Data from Paper II and Using MSEXCEL / Population genetics data) 2. Regression Analysis (Using serial dilution and OD, Data from Paper II and Using MS EXCEL / Population genetics data) 3. Probability testing using suitable example 4. Normal Distribution using suitable example 5. NCBI: Searching for protein and nucleotide sequence in FASTA and GenBank formats using NCBI 6. Use of BLAST to search for a single nucleotide or protein sequence 7. Use of BLAST to compare two sequences 8. Testing of Hardy-Weinberg law using suitable examples of gene and allelic frequencies -Sex linked (One each) 9. Project proposal based on Bioinformatics/ Biostatistics/ Population Genetics /Evolution	**2**	

SEMESTER IV

COURSE CODE: SBSLSC401

PAPER –I: Comparative physiology- II

Course Objectives

CO1: Interpret the Integration and coordination in the living system.

CO2: Gain knowledge of endocrine glands and hormones

CO3: Identify the mechanisms of homeostasis during infections

Course Outcomes

Students will be able to

LO 1: Develop an understanding of homeostatic mechanisms and cellular communications

LO 2: Delineate the conditions due to derailing of homeostasis as happening in case of stress.

LO 3: Inculcate an understanding of defense mechanisms in case of infections plants and animals

THEORY

(Total Lectures: 45)

Course code	Unit	Topic headings	Credits	Lectures
SBSLSC401	**1**	**Unit I. Integration and Coordination** **A. Homeostatic mechanisms and cellular communication** Terminology: Homeostasis and Feedback loop, variables, receptors, integrators, effectors **B. Biochemical basis of cell signaling** Types of hormones: Lipid-derived, amino acid derived and peptide hormone. Mechanism of hormone action: 1. Hormone receptor interactions 2. Receptor specificity 3. Receptor affinity 4. Saturation 5. Agonist and Antagonist	**2**	**15** 1 4

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		Intracellular signalling from receptors: 1.Ion channel receptor 2. G protein-coupled receptors 3. Enzyme-linked receptors 4. Target cell response.		3
		C. Endocrine glands and their hormones (An Overview) Pineal Gland and Circadian system, Hypothalamus and Pituitary Thyroid, Parathyroid, Pancreas, Adrenal cortex, Testis and Ovary.		2
		D. Plant hormone homeostasis: Signalling and functions during development. Auxins, Gibberellic acid, Cytokinin, Abscisic acid, Ethylene		2
		E. Interdependence of Muscle and support systems: Role of muscle in locomotion Eg Locomotion in earthworm Locomotion in humans – axial and appendicular skeleton and points of contact. Types of skeletons – hydrostatic (nematodes), exoskeleton (arthropods/molluscs) and endoskeletons (vertebrates) Homeostatic problems with locomotion: Muscular dystrophy/ sprain and strain/Osteoarthritis. Support system in plants – herbaceous and woody plants		3

SBSLSC401	**2**	**Adaptations to Physiological stress A. Ion & Water Homeostasis** 1. In plants – water and salt regulation under normal and stressed conditions 2. In animals – Phylogenetic review of organs and processes - contractile vacuole, flame cells, nephridium, Malpighian tubules, kidney and skin in man 3. Concept of osmoregulation and processes associated with osmoregulation (ultrafiltration, selective re-absorption, secretion, acid-base regulation) 4.Nitrogenous excretory products (ammoniotelism, ureotelism and uricotelism) 5. Case studies: mammals in arid regions (camel); salt glands in birds. **B. Homeostasis to stress: Thermal physiology:** 1. Plant adaptation in extreme thermal conditions 2. Thermal strategies in poikilotherms Homeotherms, ecto and endotherms. 3. Fever, Hyperthermia, heat exhaustion and heat stroke. 4. Antifreeze proteins. **C. Fuel Homeostasis during exercise and Stress:** 1. Regulation of energy stores: control of food intake 2. Role of Leptin, Ghrelin and Kisspeptin 3. Eating disorders: Anorexia and Bulimia Nervosa 4. Overweight and obesity 5. Type I and Type II Diabetes	**2**	**15** 3 6 6

SBSLSC401	**3**	**Homeostasis during infections** **A. Host Parasite Relationship** 1. Virulence factors and toxins: virulence factors, exotoxins, enterotoxins, Endotoxins 2. Host factors in infection: host risk factors, innate resistance 3. Parasite escape mechanisms **B. Defense mechanisms in plants** Biomolecules such as secondary metabolites, surface protectants and enzymes **C. Defense mechanisms in animals** 1. Innate and Adaptive Immunity 2. Introduction to primary and secondary Lymphoid organs and Lymphatic Systems 3.Mechanisms of Innate Immunity – In Invertebrates(hemocytes)and in Vertebrates (physical, physiological barriers, phagocytosis, inflammation) 4. Mechanisms of Adaptive Immunity – T and B cells. (Mode of Recognition of Antigen)	**2**	**15** 2 2 2 2 7
SBSLSCP401		1. Estimation of chlorophyll stability Index and carotenoid stability index in leaf tissue. 2. Estimation of ABA content in leaf and root. 3. Alkaloid separation by TLC 4. ABO blood typing 5. Detection of activity of plant hormone (Dose dependent response). 6. Widal Test-Qualitative. 7. Streak plating (T, Pentagon and Quadrant –Any 2) to isolate microorganisms from a mixed culture using differential media. 8. Antibiotic sensitivity of microorganism (Plant extract, Tetracycline/Gentamycin) 9. Study of Histological features of Endocrine glands	**2**	

SEMESTER IV

COURSE CODE: SBSLSC402

PAPER –II: LIFE PROCESSES AT THE TISSUE, ORGAN AND ORGANISM LEVELS: A BIOCHEMICAL APPROACH- II

Course Objectives :

CO 1 :Familiarize students with the basic biochemical process in the cells and tissues and their regulation .

CO2: Understand the molecular process involved in gene expression

CO3: Introduced to anabolism of biomolecules like carbohydrate, lipids and amino acids, further they will get deeper understanding photorespiration and C3 and C4 cycles in photosynthesis

Course Outcomes:

Students will be able to

LO 1 : understand the basic biochemical process.

LO 2 : relate the process involving their food metabolism and respiration.

LO 3: understand the process involving gene expression.

THEORY

(Total Lectures: 45)

Course code	Unit	Topic headings	Credits	Lectures
SBSLSC402	**1**	**Metabolism:** **Anabolism of biomolecules:** **A. Carbohydrate Anabolism:** 1. Gluconeogenesis 2. Pentose phosphate pathway 3. Short account of polysaccharide synthesis (Glycogen) **B. Lipids Anabolism:** 1. Fatty acid biosynthesis 2. Cholesterol biosynthesis (4 Stages – Condensation, Conversion, Polymerization and Cyclization) and prostaglandin biosynthesis **C. Amino-acid Anabolism:** 1. Transamination and its significance 2. Glutamate and Glutamine metabolism and significance **D. Photosynthesis** 1. Photophosphorylation, Hill reaction 2. C3 and C4cycles 3. Photorespiration	**2**	**15** 4 3 2 6

SBSLSC402	**2**	**Nucleic acids:** Chemistry of nucleic acids – 1.Existence of two pathways for purine and pyrimidine synthesis and Significance of the 'salvage pathway'. 2.Transcription 1. Prokaryotes - binding, initiation, elongation & termination 2. Eukaryotes - only in terms of different RNA polymerase along with promoters RNA processing – of rRNA, tRNA and mRNA (5'cap, poly A tail and intron splicing (snRNPs only). 3. Concept of Reverse transcription.	**2**	**15** 3 5 5 2
SBSLSC402	**3**	**Regulation of gene expression and Integration of metabolism** 1. Translation: Genetic code; Translation system – Prokaryotes and Eukaryotes, posttranslational modification(Phosphorylation, methylation and Acetylation) 2. Regulation of gene expression and its significance (a) Operon model (Lac and Trp). (b) Alternate splicing (c) Concept of RNAi	**2**	**15** 5 5 5

SBSLSCP402		**This practical involves the following points relevant to Biochemistry:** **A. Instrumentation / Technique** PAGE (Demonstration) Chromatography – Paper, Thin layer, Column **B. Process / Concept and immediate Relevance** - Extraction, Purification - Analysis/Estimation **-** GLP (Good Laboratory practices) incorporated into every practical Separation / Extraction techniques 1. Extraction and Detection of RNA/Ribose Sugars. *(Extraction of nucleic acid and detection by color reaction)* 2. Chromatography of Sugars –Circular Paper *(Separation of carbohydrates and detection by color reaction)* 3. Thin Layer Chromatography for separation of Plant Pigments *(Slide technique)* *(Separation techniques for charged, uncharged materials based on solvent partition)* 4. Solvent Extraction of Lipids**.** (Extraction of lipid and proportional estimation by weight) 5. Column Chromatography of Proteins / Pigments. *(Separation technique for proteins/ other materials based on charge/size)* 6. Protein separation by PAGE *(Demonstration)* *(Separation techniques for charged materials based on electrophoretic mobility)* *7&8.* Plant enzyme *(Qualitative / Quantitative)* *9.* Interpretation of pathological reports based on the biochemical analysis.	**2**	

COURSE CODE: SBSLSC403

PAPER III POPULATION APPROACH: POPULATION AND COMMUNITIES AS REGULATORY UNIT-II

Course Objectives

CO1: Make students understand the significance of origin of species, and human evolution
CO2: Familiarize with the biostatistic tests relevant to biological data collection
CO3: Introduce the student to medically significant viral infectious diseases
CO4: provide an first hand knowledge of the advanced *in silico* tools

Course Outcomes

Students will be able to
LO1: develop an understanding of how life originated and subsequently evolution patterns in human as well as the society
LO2: perform and determine that provided biological data set and statistically significant or insignificant. Additionally, the students will be able to apply their knowledge in the short term projects
LO3: understand the disease mechanisms of different infectious diseases
LO4: utilize the theory and practical knowledge of *in silico* tool and apply the database in validating their project data set or other given data set

THEORY

(Total Lectures: 45)

Course code	Unit	Topic headings	Credits	Lectures
SBSLSC403	**1**	**Evolution and its consequences:** 1. Origin of Species: a) Species concept, Allopatric and sympatric speciation, isolating mechanism preventing exchange in populations. Rates of speciation punctuated or gradual. b) Life history theory 2. Human evolution: Factors in Human Origin: Bipedalism, improvement in food acquisition, improved predator avoidance and reproductive success, Tool making, Hunter gatherer societies and evolution of communication –speech and language. Altruism and kin selection	**2**	**15** 5 6

		. 3. Evolution and Society: a) Cultural vs biological evolution, b) Social Darwinism and eugenics, c) Reproductive technologies and genetic engineering impact on human culture, d) Gene machine vs intelligent design arguments.		4
SBSLSC403	**2**	**Biostatistics–II** 1. Hypothesis and its types, errors in testing and its types, level of significance 2. Analysis of variance one-way classification, F-test 3. Test for equality of two means, Paired and unpaired t-tests. 4. Comparison between Parametric and Non parametric test 5. Chi Square test for independence 2x2 table	**2**	**15** 3 3 3 3 3
SBSLSC403	**3**	**Infectious Diseases-II & Bioinformatics II** **Infectious Diseases -II** (to be discussed with respect to epidemiology, aetiology, pathology (of target tissue only), diagnosis, therapy, preventive measures and vaccines) 1. Vector borne Diseases –Malaria/ EBOLA/Zika 2. Viral Disease – AIDS/Herpes 3. Bacterial Diseases – Tuberculosis/Leprosy/ Typhoid 4. Fungal Diseases – Candidiasis/Ringworm 5. Helminthic Diseases –Filariasis	**2**	**15** 7

		Bioinformatics–II: 1. Phylogenetic Analysis (a) Concept of homologues - paralogous and orthologous genes, xenologs (b)Rooted versus unrooted trees (c) Cladogram and phylograms (d)Choice of sequence – nucleic acid/protein (e) Maximum parsimony method 2. Gene prediction (a) Concept of six frame translation (b)Annotation of putative genes, ORF finding (c) Gene prediction methods – Homology and Ab *initio*		4 5
SBSLSCP403		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. Finding ORF in prokaryotes – manual/NCBI ORF finder 5. Phylogenetic analysis using Globin gene and Mitochondrial DNA 6. Paired and unpaired t test 7. Analysis of variance one-way classification 8. Chi square distribution (In all statistical analysis use of Excel should be introduced) 9. Project report based on Bioinformatics/Biostatistics/ Population Genetics/Evolution	**2**	

Note: All practicals in each course in both semesters have to be understood in terms of Instrumentation, Technique, Concept and Relevance *or whichever may be applicable*

REFERENCE BOOKS

SBSLSC 301 and 401

1. **Plant physiology**, Taiz and others,6th edition (2014), SinauerAssociates.
2. **Essential Developmental Biology**, J.M. W. Slack, 2nd edition (2006), BlackwellPublishers.
3. **Developmental Biology**, Scott Gilbert, 9th edition (2010), Sinauer Associates.
4. **Fundamentals of physiology** - A Human perspective L Sherwood, 5th edition(2006),ThomsonBrooks.
5. **Embryology of Angiosper**ms, Bhojwani and Bhatnagar, 4th edition (1999) New Delhi VikasPub.
6. **Vander's Human Physiology**, Widmaier, Raff, Strand, 10th edition (2006) McGraw HillInt.
7. **Principles of Animal Physiology**, C Moyes and Schulte, 2nd edition (2007) PeasonEducation.
8. **Microbiology**, Davis, Dulbecco and Ginsberg (1990) Lippincott Company,Philadelphia.
9. **Textbook of Microbiology**, Ananthanarayanan and Panniker, 5th edition (1996)OrientLongman.

SBSLSC 302 and 402

1. **Lehninger's Principles of Biochemistry**, Nelson and Cox, 4th edition (2005)W. H FreemanPublishers.
2. **Biochemistry**, J.M. Berg, J L Tymencko and L. Stryer, 5th edition (2002)W H Freeman andco.
3. **Fundamentals of Biochemistry**, D.Voet , J. G.Voet, 1st ed (2004)John Wiley &Co., New YorkPratt.
4. **Principles of Biochemistry**, Lehninger.A, 2nd Edition (1993)CBS Publishers andDistributors,
5. **Principles of Biochemistry**, Zubay G.L, Parson W.W. and Vance D.E., 1st edition (1995) W. C.Brown.
6. **An Introduction to Genetic Analysis**, Griffiths A.J. etal, 7th edition (2002), W. H. Freeman(London).
7. **Concepts of Genetics**, Robert Brooker, 2nd edition (2015), McGraw-HillEducation.
8. **Karp's Cell Biology**, Iwasa, Janet, Mashall, Wallace, Global edition (2018), John Wiley &Sons.

SBSLSC 303 and 403

1. **Strickberger's Evolution**, B. Hall and B. Hallgrimsson. 4th Edition (2008). Jones andBartlett. 2. **Remarkable Creatures:** Epic Adventures in Search of the Origin of Species, Sean B. Carrol,(2009), MarinerBooks.
3. **Population Genetics**, M.B.Hamilton,(2009),Wily-Blackwell.
4. **Population Genetics: A Concise Guide** J.H.Gillespie,(2004),Johns Hopkins UniversityPress.
5. **Lamarck's revenge:** How epigenetics is revolutionizing our understanding of evolution's past and present**,** Peter Ward, 1st edition (2018), BloomsburyPublishers.
6. **Methods in Biostatistics**, B.K.Mahajan, 8thEdition,(2010)Jaypee.
7. **Fundamental concepts of Bioinformatics**, Krane and Raymer(2003),BenjaminCummings.
8. **Bioinformatics for Dummies**,Jean-Michel Claverie, Cedric Notredame, (2003), John Wiley &Sons.
9. **Biostatistics,** Veer Bala Rastogi, 3rd edition (2015),Medtech.

10. **Medical Microbiology: A guide to microbial infections**. Greenwood, Slack, Peutherer and Barer, 17th edition, (2007) ChurchillLivingstone.