M.Sc. (Life Science) course effective from June / July 2017

Semester	Code	Course / Paper Title	Credit		Total Credit	Credits in Semester
			TH.	Pr.		
I	LSC-601	Bio-Chemistry	3	1	4	
	LSC-611	Analytical Techniques	3	1	4	
	LSC-621	Cell-Biology	3	1	4	
	LSC-631	Basic Genetics	3	1	4	
	LSC-641	Biostatistics, Bioinfo. & computers	2		2	22
	LSC-651	Basic Microbiology	3	1	4	
II	LSC-602	Immunology	3	1	4	
	LSC-612	Molecular Biology & Genetic Engg.	3	1	4	
	LSC-622	Environmental Biology	3	1	4	
	LSC-632	Animal Physiology	3	1	4	
	LSC-642	Elective I	3		3	
	LSC-652	Elective II	3		3	22
III	LSC-603	Plant Metabolism	3	1	4	
	LSC-613	Plant Biotechnology : Tissue & Cell Culture	3	1	4	
	LSC-623	Biodiversity & toxicology	3	1	4	
	LSC-633	Elective I	3		3	
	LSC-643	Elective II	3		3	18
IV	LSC-604	Project work (Quality, Presentation & Timely Submission)	10 + 2		12	12
		Comprehensive Viva-Voce	4 Credits / Sem		16	16
		Total Credits for the Program				90

5/7/17

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MSc Life Sciences: Biochemistry Semester I

Unit	Topics	Lectures
1	Amino Acids: Classification , strucuture and properties of amino acids. Non protein amino acids, methods of separation of amino acid mixture. Detection of amio acids.protein degradation and amino acid sequencing. N terminal and C terminal detection	6
2	Proteins: The pepetide bond, primary secondary , tertiary and quaternary structure.Alpha helix, beta plated sheet, beta turn, super secondary structure, motifs. Position and number of disulfide bonds.Constraints for polypeptide confirmation. Ramachandran plot. Isolation and purification of proteins.Criterion of purity.	8
3	Enzymes: Classification and nomenclature,Enzyme kinetics and Michaelis -Menton equation,measurment of enzyme activity, specific activity, turnover number, Kinetics of enzyme inhibition, Mechanism of enzyme action. Factors contributing to the catalytic efficiency of enzymes	10
4	Regulation of enzyme activity: Allosteric enzymes , cumulative and coordinated regulation. Isozymes, covalent modification, zymogen. Diagonostic importance of enzymes.	6
5	Vitamins and co enzymes; Discovery and deficiency symptoms,structure function and biochemical reactions regulated by vitamins, co enzymes.	6

Suggested Books:

1. Principles of Biochemistry Voet & Voet John Wiley & sons
2. Principles of Biochemistry . Lehninger by Nelson and Cox .
3. Biochemistry Lubert stryer . W.H.freeman .
4. Principles of Biochemistry Zubey G.L Parson WW. Oxford. England.

SEMESTER - I	BASIC MICROBIOLOGY	COURSE:LSC-651
UNIT	**TOPICS**	**LECTURES**
I	**Introduction to Microbiology** Early Discoveries and experiments of Louis Pasteur Discoveries in Medical Microbiology Soil Microbiology and Plant pathology Structure of bacteria Methods of classification Major groups of bacteria Structure and life cycle of virus Introduction to algae, fungi and parasites	1 1 1 1 1 1 1 1 1 1
II	**Energy relations of microbes :** Basic principles of bioenergetics Respiration and fermentation Photosynthesis in bacteria Nitrogen cycle and biological nitrogen fixation Carbon cycle Sulphur and phosphorous cycles	1 1 1 1 1 1
III	**Growth of microorganisms:** Phases of growth cycle, Determination of Generation time and Growth rate. Types of microbial cultures- Batch, Continuous and Synchronous cultures **Microbial growth measurement:** microbial growth based on cell number, cell mass and cell activity.	1 2 2
IV	**Host Parasite Interaction**: Pathogenesis, recognition and entry process of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, virus induced cell transformation, pathogen induced diseases in plants and animals	2 4
V	**Control of microorganisms:** Microbial death curve under adverse condition. Levels of control, Mechanisms action of physical agents- Heat, photochemical and ionizing radiations. Chemical control of microorganisms – Phenol coefficient, Mechanisms of various chemical agents used for control of microorganisms.	2 3 3

Recommended Books

1. Fundamental Principles of Bacteriology — Salle
2. Biology of Microorganisms — Brock, Madigan
3. Microbiology — Pelczar, Chan & Kreig
4. Text Book on Principles of Bacteriology, Virology & Immunology — Topley and Wilson
5. General Microbiology — Stainer, Ingharam, Wheelis
6. General Microbiology — Robert Boyd
7. An Introduction to Microbiology — Tauro, Kapoor, and Yadav
8. Introductory Practical Microbiology — Jayababu Mudili

SEMESTER - II	MOLECULAR BIOLOGY & GENETIC ENGINEERING	COURSE: LSC-612
UNIT	**TOPICS**	**LECTURES**

	Analytical techniques	COURSE: ISC 611
UNIT	TOPICS	LECTURES
I	Cell disruption techniques: Homogenisation, Mechanical and non-Mechanical methods of cell disruption Separation techniques: centrifugation: basic principle, types , components, preparative centrifugation: differential velocity and density gradient centrifugation	2 2 1
II	Basic principle of Chromatography: paper, thin layer and column chromatography, Adsorption chromatography, High performance chromatography, HPLC, GLC, Ion-exchange chromatography, Affinity chromatography	2 2 1
III	Spectroscopy: Beer-Lambert Law, Principle, components and applications of spectrophotometer, spectrofluorimeter, Atomic absorption spectrometer	2 2 1
IV	Basic principle, components and applications of ESR, NMR spectroscopy Radioisotopes: Basic principle and applications in Biology	2 2 1
V	Microscopy: Basic principle, components, types and applications . Light and electron microscope, transmission and scanning microscopy	2 2 1
	Suggested Books: 1. Analytical techniques: Holme and Peck 2. Analytical Instrumentation handbook: Jack Cazes, CRC press 3. Analytical techniques in Biochemistry and Molecular biology: R Katoch 4. Biological Instrumentation and methodology: PK Bajpai	

M. Sc.- I SEMESTER: Cell Biology

	Topic	Lectures
Unit-1	Overview of the cell: Evolution of the cell, Prokaryotes to eukaryotes, Single cell to multi-cellular cell structure and organization in plants and animals. Membrane structure and function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes, extra-cellular matrix	1 2 2
Unit-2	Structural organization and function of intracellular organelles: Cell wall, nucleus, mitochondria, golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility. Ribosome and protein synthesis: Ribosome, structure of 70S & 80S, polyribosomes, protein synthesis	2 2 2
Unit-3	Cell signalling: primary messengers, cell-cell communication, modes of cell signalling, signal transduction pathways, cell junctions Overview of the extracellular signalling, signalling pathways, membrane receptors, G-Protein coupled receptors and their effectors, Receptor tyrosine kinases, Ligand-gated channels, Integrins, Second messengers, cAMP, phospholipids and Calcium, insulin signalling	1 2 2 1
Unit-4	Cell regulation: Cell growth and division, Cell cycle, phases of cell cycle, mitotic events, cell cycle check points, maturation promoting factor (MPF), cyclins and cdk, cell Synchrony Cell culture: differentiation medium, primary, diploid and established cell lines	2 3
Unit-5	Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth. Stem cells, potencies of stem cells, embryonic stem cells, adult stem cells, SCNT, iPS	2 2 2

Suggested books:

1. *Cell and Molecular Biology*, 8th Edition, Eduardo D. P. De Robertis, E. M. F. De Robertis, Lippincott Williams & Wilkins, 2010.
2. *The Cell: A Molecular Approach*, 6th Edition, Geoffrey M. Cooper, ASM Press 2013
3. *Cell and Molecular Biology: Concepts and Experiments*, 6th Edition, Gerald Karp, John Wiley & Sons, Inc. 2010
4. *Cancer: Principles and Practice of Oncology*, 9th Edition, Vincent T. DeVita, Jr., Theodore S. Lawrence, Steven A. Rosenberg, Lippincott Williams and Wilkins, 2011.
5. *The Biology of Cancer*, Robert A. Weinberg, Garland Science, 2012.
6. *Introduction to Cancer Biology*, Robin Hesketh Cambridge University Press, 2013
7. *Stem Cells: Scientific Progress and Future Research Directions*, NIH Monograph University Press of The Pacific, 2004
8. *Research Methodology : Methods and Techniques*, C.R Kothari New Age International Publishers, 2004

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SEMESTER-I	BIOSTATISTICS, BIOINFORMATICS & COMPUTER	COURSE: LSC 641
UNIT	**TOPICS**	**LECTURES**
I	Introduction to Biostatistics: Introduction to Biostatistics; Concept of variables in biological systems, parametric and non-parametric data, classification, tabulation, graphical and diagrammatic representation of numerical data Measures of central tendency: Mean, Median, Mode. Concept of probability. Concept of correlation and regression.	2 2 2
II	Statistical applications in biology: Experimental designs; measures of dispersion: standard deviation, standard error; test of significance: Student's t test, Paired and unpaired t test; Analysis of variance (ANOVA), Chi- square test, introduction to multivariate analysis	2 2 2
III	Introduction to Computers: Fundamentals of computer; Major components: CPU, input and output devices, Memory; Operating systems: Windows and Unix. Hardware, software; Introduction to Internet: LAN, WAN.	2 2 1
IV	Software packages and applications in biology: Microsoft office: MS word, Excel, power point; Application of SPSS; Application of computers: Applications of internet: Multimedia network concepts, e-mail, introduction to online tools for data storage (google docs, cloud storage)	2 2 1
V	Introduction to Bioinformatics and its applications: Basics of bioinformatics; Biological Databases-Primary, Secondary and composite databases; Methods of Sequence alignment, BLAST and FASTA; primer designing tools; Whole genome analysis; Microarray.	2 2 1

Suggested books:

1. Introductory Biostatistics, Chap T. Le, 2003
2. Bioinformatics an introduction. J. J. Ramsden, 2006
3. Introduction to Bioinformatics: A theoretical and practical approach. S.A. Krawetz and David D. Womble, 2003.
4. Bioinformatics: Sequence, structure and databanks, A practical approach. Des Higgins and Willie Taylor, 2003.
5. Bioinformatics: Genes, Proteins and computers. Orengo, Jones and Thornton, 2003
6. Bioinformatics, Sequence and Genome Analysis. David W. Mount, 2004
7. IBM PC and PCXT, User's Reference Manual. Gilbert Held, 2007
8. Introduction to Computer Science. Satish Jain, 2008.
9. Statistics in Biology, Bliss C.I.K. (1967): Vol. 1 Mc Graw Hill, New York.
10. Statistics for Biologists. Campbell R.C. (1974): Cambridge University Press, Cambridge.
11. Wardlaw, A.C. (1985): Practical Statistics for Experimental Biologists. John Wiley and Sons., Inc., New York.

5.7.17 5/7/17 5/7/17 5/7/17 5.7.17 5/7/17 5/7/17 5/07/17

SEMESTER – I BASIC GENETICS		COURSE : LSC 631
UNIT	**TOPICS**	**LECTURES**
I	Mendelian Genetics- Mendel's law's of inheritance; Back cross, Test cross, Monohybrid, Dihybrid, Trihybrid cross; Deviation from Mendel's findings; Forked line Method. Non-Mendelian inheritance patterns- Mitochondrial Inheritance.	6
II	Lethality and Interaction of gene- Lethal effects and regression of genes in Drosophila, Mice and Plants. Interaction of genes- Two gene pairs affecting same character, Epistasis; complementary genes; Duplicate genes.	6
III	Physical basis of heredity- Nucleus, Structure ofChromosomes, Special type of chromosomes; Prokaryotic nucleoids, Chromatin structure and nucleosome; Chromosome banding. Sister chromatid exchange.	6
IV	Structural and numerical altercation in chromosome abnormalities- deletion, duplication, translocation, inversion. Haploid, aneuploids, polyhaploids. Genetic disorders due to chromosomes in human; determination of sex, Sex linked inheritance.	6
V	Genetic disorders due to chromosome in human; determination of sex, Sex linked inheritance.	6
VI	Mutations- type of mutations, frameshift mutation, mutagenic agents, mechanism of mutagenesis, Ames Test.	3
VII	Gene transfer in bacteria- Transduction, Conjugation, F transfer, Hfr mediated chromosome transfer.	2

Suggested Books:

1. The Science of Genetics: George W. Burns, Paul J. Bottino Maxwell Macmillan International Editions, New York
2. Concepts of Genetics : William S. Klug, Michael R. Cummings, Charlotte A. Spencer, Pearson Prentice Hall, New Jersey
3. Cell and Molecular Biology, Concepts and experiments: Gerald Karp.
4. Gene – IX: Lewin Benjamin, Pearson Prentice Hall, Pearson Education, Inc., New Jersey
5. Theory and Problems of Genetics: Susan L. Elrod, William D. Stansfield, Tata McGraw-Hill Publishing Company Limited, New Delhi.
6. Molecular Biology of the Cell: Bruce Alberts, Garland Science, Taylor and Francis Group, New York
7. Cell and Molecular Biology, concepts and experiments: Gerald Karp, John Wiley and Sons, Inc. New Jersey
8. Molecular Cell Biology: Lodish, W. H. Freeman and Company, New York
9. The Cell a Molecular Approach: Geoffrey M. Cooper, Robert E. Hausman, ASM Press and Sinauer, Washington
10. Cell and Molecular Biology: Phillip Sheeler, Donald E. Bianchi, John Wiley and Sons, Inc., New Delhi
11. Cell Biology – A Laboratory Handbook: Julio E. Celis, Academic Press, Harcourt Brace and Company Publishers, San Diego
12. Genomes: T. A. Brown, Wiley-Liss, John Wiley and Sons, Inc. New Jersey
13. Principles of Gene Manipulation : Sandy B. Primrose, Richard M. Twyman and R.W.Old.

5.7.17 5/7/17 5/7/17 5/7/17 5.7.17 5/7/17 5/07/17 5/7/17

MSc- III Semester: Plant Metabolism

	Topic	Lectures
Unit-1	Photosynthesis - Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO2 fixation-C3, C4 and CAM pathways	1 2 2
Unit-2	Respiration and photorespiration – Citric acid cycle; plant mitochondrial electron transport and ATP synthesis; alternate oxidase; photorespiratory pathway.	2 2 1
Unit-3	Nitrogen metabolism – N2 cycle, structure and function of Nitrogenase, nitrification, denitrification, ammonification; Incorporation of nitrogen in amino acids	2 2 1
Unit-4	Water and Solute transport– SPAC: soil-plant-atmosphere-continuum; uptake, transport and translocation of water, ions, solutes ; Transpiration, factors affecting rate of transpiration	2 2 1
Unit-5	Stress physiology – Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses, chlorophyll a fluorescence technique to assess stress in plants	2 2 1

Suggested Books:

1. Molecular mechanisms in Photosynthesis: Blankenship
2. Plant Physiology: Taiz and Zeiger
3. Introductory Plant Physiology: Noggle and Frietz
4. Plant Physiology: SC Dutta
5. Plant Physiology: Salisburry

5-7-17 5/7/17 5/7/17 5/7/17 5-7-17 5/7/17 5/7/17

MSc- III Semester: Photomorphogenesis

	Topic	Lectures
Unit-1	Morphogenesis and organogenesis in plants: organization of shoot and root apical meristem, shoot and root development, leaf development and phyllotaxy, transition to flowering, floral meristems and floral development in *Arabidopsis*	1 2 2
Unit-2	Sensory photobiology: structure, function and mechanisms of action of phytochromes, stomatal movement, photoperiodism and biological clocks.	2 2 1
Unit-3	Responses to blue and UV light: solar UV, cryptochromes and phototropins, UV-A and UV-B photoreceptors, photoresponses of UV-A and UV-B, UV-B deleterious effects.	2 2 1
Unit-4	Physiology of flowering: photoperiodism and circadium rhythms, phytochrome and flowering, florigen concept, regulation of flowering by plant growth regulators, genes involved in flowering, Vernalisation.	2 2 1
Unit-5	Senescence: Patterns of Senescence,physiological changes during senescence,hormonal control of senescence.Programme cell death in plants.	2 2 1

Suggested Books:

1. Plant Physiology: Taiz and Zeiger
2. Introductory Plant Physiology: Noggle and Frietz
3. Plant Physiology: SC Dutta
4. Plant Physiology: Salisburry

SEMESTER - III	PLANT BIOTECHNOLOGY: TISSUE & CELL CULTURE	COURSE: LSC-653
UNIT	**TOPICS**	**LECTURES**
I	Historical background and terminology used in cell & tissue culture,Concept of totipotency	1
	Basic techniques of cell and tissue culture, sterilization, aseptic tissue transfer, callus, suspension and batch cultures	1 2
II	Nutritional requirement to cell, tissues and organs *in vitro*, various types of nutrient media, role of growth regulators	2
	Somatic embryogenesis and organogenesis in plants, differentiation theory.	2
	Isolation of cells, single cell cultures and cloning	2
III	Variability in tissue cultures, somaclonal, gametoclonal and protoclonal variations	1
	Micro-propagation , clonal propagation and application in agriculture, horticulture & forestry	2
	Production of disease free plants by tissue culture methods	2
IV	Androgenic and gynogenic haploids, various techniques of producing haploids , applications of haploids in agriculture. Embryo culture and embryo rescue techniques. Endosperm culture, applications and limitations.	2
	Protoplast isolation and culture, fusion of protoplasts, uptake properties of protoplasts	2
	Somatic hybrids, selection methods, intergeneric and interspecific hybrids , applications of somatic hybrids	2
V	Cybrids, transfer of male sterility genes by conventional and unconventional methods	2
	Artificial seeds and their applications	1
	Production of secondary metabolites and pharmaceutical compounds from cell and suspension cultures	2
	Genetic transformation – Agrobacterium mediated gene delivery, Ti and Ri plasmids, Disarming the Ti plasmids, binary vectors, selectable markers, direct gene transfer techniques, chloroplast transformation, transgenic plants and their applications in agriculture	3
	Transgenic organisms – positive and negative impacts of genetically modified crops	1

Suggested Books:

1. Plant Tissue Culture: S.S. Bhojwani and M. K. Razdan, Elsevier Science, Netherlands
2. Plant Cell and Tissue Culture: S. Narayanaswamy, Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. Plant Tissue culture: M. K. Razdan, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
4. Plant Cell and Tissue Culture: Indra K. Vasil and Trevor A. Thorpe Kluwer Acadmic Publishers
5. Plant Propagation by Tissue Culture: Edwin F. George, Michael A. Hall and Geert-Jan De Klerk, Springer, Netherlands
6. Basic Cell Culture : J.M. Davis, Oxford Univ. Press, New Delhi
7. Plant Tissue Culture Engineering: S. Dutta Gupta and Yasuomi Ibaraki, Springer, Netherlands
8. Plant Biotechnology and Transgenic Plant: Krishi-Marja-Oksman-Caldentey, Wolfgang H. Barz, Marcel Dekker, Inc., New York
9. Principles of Gene Manipulation : Sandy B. Primrose, Richard M. Twyman and R.W.Old, S. B. University Press.
10. Introduction to Genetic Engineering of Crop Plants: A. Rashid, I.K. International Publishing House Pvt. Ltd. New Delhi.

M.Sc. Life Science Paper - **Biodiversity and Toxicology**

	Topic	Lectures
Unit-1	Introduction to biodiversity: Concepts of biodiversity and wild life; Components of biodiversity: genetic, species and ecosystem diversity ; Ecological, economical and social importance of plants and animals; India as a mega-diversity nation; Concept of native and exotic species, Endemic flora and fauna ; Hot spots and cold spots ; Red data lists.	8
Unit-2	Current status of wild life in India. Endangered, threatened and extinct Species., Concept of extinction threshold and extinction debt. Status of Medicinal plants. Outline of Phytochemicals and their uses .Factors responsible for their decline.	6
Unit-3	Conservation of biodiversity, In-situ and ex-situ conservation. Role of environmental factors in their management; Wildlife reserves in India, wild life sanctuaries, national parks and biosphere reserves; Strategies for conservation and propagation ; Biodiversity prospecting, IPR of biodiversity and its products, patent protection and bio-piracy.	7
Unit-4	General characteristics and classification of Pisces. Morphology of typical Teleost- Labeo and of typical Elasmobranch - Scoliodon. Kinds and importance of capture fishery and Riverine fisheries, Fisheries of Back water . Strategies for fish breeding and management.	6
Unit-5	Introduction to toxicology. Factors affecting environmental toxicants. Chemical toxicity. Drug induced toxicity. Routs of toxicant entry. Toxicity testing (acute, sub-acute and chronic toxicity tests, LD-50, LC-50s mechanism of their prevention. Study of Heavy Metals (Pb, Mg,Cd) toxicology on living system its effects. Toxicity of Pesticides and effects of Environment and Soil Toxicology.	6

Suggested books.

1.Biodiversity and Its Conservation in India . By Sharad S Negi

2. Biodiversity Conservation and Poverty Alleviation: Exploring the Evidence for a Link. By Dilys Roe, et al

3.A Guide to Understanding and Restoring Global Aquatic Biodiversity and Fishery Resources By Gene S. Helfman

4. A Comprehensive Guide to Toxicology in Preclinical Drug Development. By *Ali S Faqi*

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Semester-III APPLIED ANIMAL PHYSIOLOGY Core paper , Course code……

Units	Topics	lectures
1	*Endocrine Physiology* Introduction to mammalian hormones and their basic characters, Differences between hormone and pheromone. Mode of actions of hormones, Feed back mechanism. Hormones of different Endocrine glands, their broad biochemical nature and their main functions. Outline of hormonal abnormalities with special reference to thyroid and pancreas.	2 1 3 2
2	*Physiology of Reproduction* Male reproductive system: Testis and accessory organs. Testosterone and its functions. Overview of reproductive abnormalities in male. Female reproductive system: ovaries and accessory organs. Female sex hormones and their functions. Estrus and Menstrual cycles. Overview of reproductive abnormalities in female.	2 2 2 3
3	*Physiology of Fertility control* An overview on the need of fertility control Different methods of fertility control in male. Different methods of fertility control in female. Natural method of fertility control.	1 2 2 1
4	*Thermoregulatory Physiology* Introduction:Thermoregulation in different animals, Body temperature and its variations in different conditions, Metbolic rate and its variations ,finding out metabolic rate in different organisms. Effective and Lethal temperature, Regulation of body temperature Effects of cold and heat	2 4 2 1

Suggested books:

1. Guyton and Hall: Text Book of Medical Physiology (11th edn 2006, W.B. Saunders)
2. Ganong: Review of Medical Physiology (22nd edn 2005, Lang Medical Publications)
3. Keel et al: Samson Wright's Applied Physiology (13th edn 1989, Oxford Press)
4.Hand Book of Physiology, American Physiological Society, Oxford University Press, Multiple volumes set.
5. Human Physiology, the Basis of Medicine, by G. Pocock and C. D. Richards, Oxford Univ. Press, New York

5.7.17 5/7/17 5/7/17 5.7.17 5/7/17 5/7/17

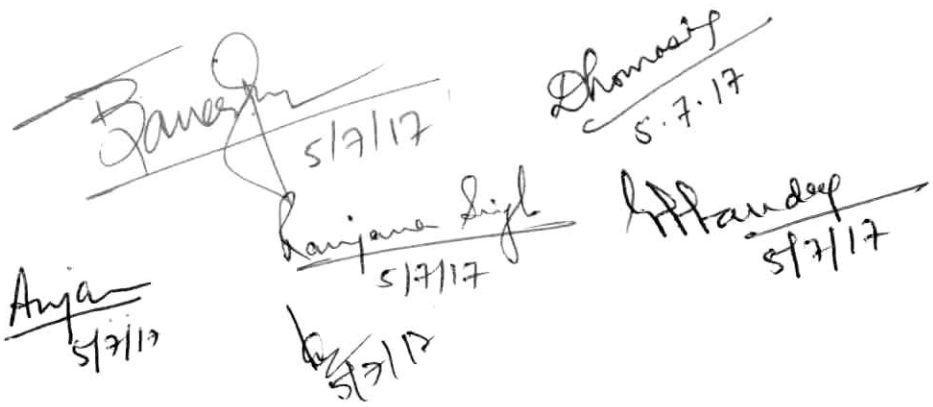
Elective

DEVELOPMENTAL BIOLOGY

UNIT	TOPIC	LECTURES
I	**Basic concepts of development**: Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development.	6
II	**Gametogenesis, fertilization and early development**: Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis, establishment of symmetry in plants; seed formation and germination.	6
III	**Morphogenesis and organogenesis in animals**: Cell aggregation and differentiation in Dictyostelium; axes and pattern formation in Drosophila, amphibia and chick; organogenesis – vulva formation in *Caenorhabditis elegans*; eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development-larval formation, metamorphosis; environmental regulation of normal development; sex determination.	6
IV	Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristem; shoot and root development; leaf development and phyllotaxy; transition to flowering, floral meristems and floral development in Arabidopsis and Antirrhinum.	4
V	Programmed cell death, aging and senescence.	2

Suggested books

1. ***Developmental Biology*** by Scott F. Gilbert and Michael J. F. Barresi
2. ***Essential Developmental Biology*** by Jonathan M. W. Slack
3. ***Principles of Development*** by Lewis Wolpert and Cheryll Tickle



SYSTEM PHYSIOLOGY - ANIMAL

UNIT	TOPIC	LECTURES
I	**Blood and circulation**: Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis.	3
II	**Cardiovascular System**: Comparative anatomy of heart structure, myogenic heart, specialized tissue, ECG – its principle and significance, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above.	3
III	**Respiratory system**: Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.	3
IV	**Nervous system**: Neurons, action potential, gross neuroanatomy of the brain and spinal cord, central and peripheral nervous system, neural control of muscle tone and posture. Sense organs: Vision, hearing and tactile response.	4
V	**Excretory system**: Comparative physiology of excretion, kidney, urine formation, urine concentration, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.	4
VI	Stress and adaptation **Digestive system**: Digestion, absorption, energy balance, BMR.	2

Suggested books

1. ***Guyton and Hall***: Text Book of Medical Physiology (11th ed 2006, W.B. Saunders)
2. ***Ganong***: Review of Medical Physiology (22nd ed 2005, Lang Medical Publications)
3. ***Keel et al***: Samson Wright's Applied Physiology (13th ed 1989, Oxford Press)
4. ***Hand Book of Physiology***, American Physiological Society, Oxford University Press, Section 7: Multiple volumes set.

5/7/17 5/7/17 5.7.17 5/7/17 5/7/17 5/7/17

Elective (AK)

CARDIOVASCULAR ABNORMALITIES AND THEIR REGULATIONS (Elective paper)

Objective: As heart related problems are increasing day by day, every one is to understand the different problems and how to control them. Students after a detailed understanding can not only take care of themselves, but also suggest /guide others on how to prevent and control hypertension and other heart related problems.

Unit	*Course content*	*No of lecturs*
1	Outline of Blood Vascular System: Heart and its structural details. Arteries and veins.	*2*
	Coronary arteries and their significance.	*1*
	General principle of heart functions.	*1*
	Blood: Plasma and serum, Blood cells-RBC, WBC and platelets.	*2*
	Blood flow. Cardiac cycle and the measurement of cardiac output.	
2	Abnormalities in Blood cells and Blood groups- Anemia and their types. Prevention and treatment of anemia. Polycythemia.	*2*
	Mechanism of blood clotting and abnormal blood clotting. Different types of blood groups and their clinical significance. Determining the blood groups.	*3*
	Blood donation and blood transfusion.	*1*
3	Congenital heart problems: Artery, septum, valve, node and bundle branch related abnormalities.	*2*
	Heart beat abnormalities, tachycardia, bradycardia, palpitation and heart arrhythmia.	*1*
	Heart block and pace maker problems.	*2*
4	Hypertension and coronary artery diseases : Blood pressure and Resistance, Hypertension vs high B.P., types of hypertension, symptoms of hypertension, causes of hypertension, detection of hypertension, coronary artery diseases and risky hypertension,	*4*
	Atherosclerosis vs arteriosclerosis, heart risk ratio and complication of hypertensions,	*2*
	Prevention and treatment of hypertension.	*2*
5	Heart attack and its care: Heart attack (HA) vs heart failure. Reasons for silent and normal heart attack. Symptoms of HA, angina and Angina pectoris.	*2*
	Causes of HA, detection of HA, ECG and TMT, Atherosclerosis vs arteriosclerosis,	*3*
	Complication of HA, Prevention and treatment of HA.	*1*

Suggested books:

1. Guyton and Hall: Text Book of Medical Physiology (11th ed 2006, W.B. Saunders)
2. Ganong: Review of Medical Physiology (22nd ed 2005, Lang Medical Publications)
3. Keel et al: Samson Wright's Applied Physiology (13th ed1989, Oxford Press)
4.Hand Book of Physiology, American Physiological Society, Oxford University Press, Multiple volumes set.
5. Human Physiology, the Basis of Medicine, by G. Pocock and C. D. Richards, Oxford univ. Press, New York

5/7/17 5/7/17 5/7/17

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SEMESTER - II MOLECULAR BIOLOGY & GENETIC ENGINEERING COURSE: LSC-612		
UNIT	**TOPICS**	**LECTURES**
I	**Enzyme in recombinant DNA techniques**	
	Restriction endonucleases	2
	Reverse transcriptase	1
	DNA ligase	1
	Terminal transferases	1
	SI nuclease	1
	Exonuclease	1
	Polynucleotide kinase	1
	DNA polymerase I.	1
II	**Cloning vectors and Cloning strategies**	
	General characteristics of cloning vectors.	1
	Plasmid Vectors	1
	Phages and cosmid Vectors.	1
	YAC cloning vectors	1
	Construction of genomic and cDNA libraries.	1
	Screening and selection of specific DNA clones	1
III	**Molecular hybridization**	
	In situ hybridization	2
	Southern Blots	1
	Northern and Slot blots	1
	Heteroduplex mapping	1
	DNA Microarray	1
IV	**Gene amplification and Genetic engineering in eukaryotes**	
	PCR and its applications; RAPD, RFLP, AFLP techniques	2
	Gene Sequencing	2
	Site directed mutagenesis	1
	Antisense and Ribozyme Technology , microRNA regulation	1
	Gene transfer in animal cell culture, Gene knockouts, Transgenic organisms with examples from mice and *Drosophila.*	1
	Transfer of plant genes by Ti plasmids.	1
		1
V	**Replication and Gene expression**	
	DNA replication	2
	Transcription	2
	Translation.	2
	Regulation in Eukaryotes- transcriptional and post-transcriptional control	4
	DNA damage, repair and recombination	2

Suggested books

1. Current protocols in molecular biology. 2000. Ausbel *et. al.*
2. Molecular cloning Vol. I-III. Sambrook and Russel. 2001. CSH press.
3. Principles of gene manipulation. 1994. Old and Primrose, Blackwell Scientific Publications.
4. Molecular Cloning. 3 volumes. Sambrose and Russell, 2000. CSH Press.
5. Genome analysis. Four volumes. 2000. CSH Press.
6. Principles and techniques of biochemistry and molecular biology, 6th Ed. - Wilson Keith and Walker John (2005) Cambridge University Press, New York.
7. Gene Cloning

MSc Life Sciences: Immunology Semester II

Unit	Topics	Lectures
1	Introduction to immune response; Cells of the immune system.Organs of the immune system.Innate and aquired immunity. Cellular and humoral immunity. Toll receptors, PAMP, signal transduction, NOD receptors. Classical, lectin and alternative complement pathways.	6
2	Antigens : structure and properties. Antigenicity, haptens, adjuvants. Antibodies: Structure of antibodies , immunoglobulin classes, immunoglobulins fold, immunoglobulin superfamily, idiotypic, isotypic, allotypic determinant. Clonal selection theory, generation of antibody diversity, affinity maturation, class switching, allelic exclusion. Monoclonal antibodies.	8
3	Antigen antibody reactions: Valence and affinity pf antibodies, quantitative precipitin titration, precipitin reaction in gel. immunoelectrophoresis, rocket immunoelectrophoresis, countercurrent electrophoresis, agglutination, immunofluorescence, FACS, ELISA, RIA, western blot, cell seperation techniques.	6
4	Major histocompatibility complex: MHC I and MHC II molecules, gene map, tissue distribution and tissue typing. T cell receptor complex, Processing of antigen and Presentation of antigen by MHC class I and MHC class II molecules, APC T cell interactions, MHC restrictions. Th1 and Th2 cells.super antigen.	10
5	Brief introduction to clinical immunology: Hypersenstivity type I, II, III, IV. Auto immunity mechanism and disease. HIV, Modern and classical methods of vaccine production.	6

Suggested Books.

1. Cellular and Molecular Immunology, 8th Edition; Abbas & Lichtman & Pillai ; Elseviar publication
2. Immunology, 8th Edition; Male & Brostoff & Roth & Roitt ; Elseviar publication.
3. Kuby Immunology, 6th Edition ; Kindt & Goldsby & Osborne ; W.H. Freeman and company, New York.

SEMESTER-II : LSC- ENVIORNMENTAL BIOLOGY		
Unit	**Description**	**No. of Lectures**
I	Ecosystem concept – Structure and Function; Ecological pyramids; Energy flow in ecosystem- food chain, food web and tropic levels	**4**
II	Structure and Development of a community; Analytical and Synthetic characters; Nature of ecological succession and climax; Ecological Factors: Light and Temperature.	**4**
III	Basic concept of population growth, Interactions among populations and its dynamics; Population characteristics; Interspecific and Intraspecific competitions and its significance.	**4**
IV	Soil composition; Soil Forming processes; Soil profile and Soil types: Physical Chemical and Biological properties of the Soil: Soil erosion and its control.	**4**
V	Sources, nature and biological effects of different water pollutants, water treatment- domestic and industrial waste, Eutrophication, Monitoring techniques and Methodology-dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD) and total organic carbon (TOC).	**6**
VI	Fundamentals of Toxicology; Environmental Carcinogens ; Acid rain ; Green house effect and climate change. Noise pollution-Sources, nature and effects; Radioactive pollution-protection and management, pesticide and plastic pollution, Environmental Impact Assessment and Environmental Audit.	**8**

Suggested Books :

i) Ecology by Subrahmaniyam N.S & Sambamurty A.V.S.S
pub: Narosa Pub. House.

ii) Forest Resources : Conversation & Mangement
by H.D. Kumar
pub: Affiliated East-West Press Pvt Ltd.

iii) Enviornmental pollution : Health & Toxicology
by: SVS Rana.
Pub : Narosa.Pub.House

iv) Essentials of Enviornmental Science
by : N. Vasudevan
Pub : Narosa Pub House

MSc- II Semester: Plant Physiology

	Topic	Lectures
Unit-1	Morphogenesis and organogenesis in plants: organization of shoot and root apical meristem, shoot and root development, leaf development and phyllotaxy, transition to flowering, floral meristems and floral development in *Arabidopsis,* structure, function and mechanisms of action of phytochromes,	1 2 2
Unit-2	Plant Hormones: History, structure, mechanism of action, signalling and applications of Auxin, gibberlin, Cytokinins	2 2 1
Unit-3	Plant Hormones: History, structure, mechanism of action , signallingand applications of ABA, ethylene, secondary metabolites	2 2 1
Unit-4	Physiology of flowering: photoperiodism and circadium rhythms, phytochrome and flowering, florigen concept, regulation of flowering by plant growth regulators, genes involved in flowering, Vernalisation.	2 2 1
Unit-5	Senescence: Patterns of Senescence,physiological changes during senescence,hormonal control of senescence.Programme cell death in plants.	2 2 1
Suggested Books: 1. Plant Physiology: Taiz and Zeiger 2. Introductory Plant Physiology: Noggle and Frietz 3. Plant Physiology: SC Dutta 4. Plant Physiology: Salisburry		

Semester-III APPLIED ANIMAL PHYSIOLOGY Core paper , Course code……

Units	Topics	lectures
1	*Endocrine Physiology* Introduction to mammalian hormones and their basic characters, Differences between hormone and pheromone. Mode of actions of hormones, Feed back mechanism. Hormones of different Endocrine glands, their broad biochemical nature and their main functions. Outline of hormonal abnormalities with special reference to thyroid and pancreas.	2 1 3 2
2	*Physiology of Reproduction* Male reproductive system: Testis and accessory organs. Testosterone and its functions. Overview of reproductive abnormalities in male. Female reproductive system: ovaries and accessory organs. Female sex hormones and their functions. Estrus and Menstrual cycles. Overview of reproductive abnormalities in female.	2 2 2 3
3	*Physiology of Fertility control* An overview on the need of fertility control Different methods of fertility control in male. Different methods of fertility control in female. Natural method of fertility control.	1 2 2 1
4	*Cardio-vascular Physiology* Outline of Blood Vascular System: Heart and its structural details. General principle of heart functioning. Out line of Cardiac problems: Hypertension vs. high B.P., symptoms and causes of hypertension, Atherosclerosis vs. arteriosclerosis, heart risk ratio and complication of hypertensions, Prevention and treatment of hypertension. Heart attack (HA) vs. heart failure. Reasons for heart attack. Symptoms of HA, Angina and Angina pectoris. Prevention and treatment of Coronary artery disease & HA.	2 4 2 1

Suggested books:

1. Guyton and Hall: Text Book of Medical Physiology (11th edn 2006, W.B. Saunders)
2. Ganong: Review of Medical Physiology (22nd edn 2005, Lang Medical Publications)
3. Keel et al: Samson Wright's Applied Physiology (13th edn 1989, Oxford Press)
4.Hand Book of Physiology, American Physiological Society, Oxford University Press, Multiple volumes set.
5. Human Physiology, the Basis of Medicine, by G. Pocock and C. D. Richards, Oxford Univ. Press, New York