



# DEVI AHILYA VISHWAVIDYALAYA, INDORE

## School of Life Sciences


### 1.1.1


### Syllabus of all programs



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

Semester	Code	Course / Paper Title	Credit		Total Credit	Credits in Semester
			TH.	Pr.		
<b>I</b>	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	
<b>II</b>	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
<b>III</b>	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
<b>IV</b>	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

  
 Dr. Anjan 5/7/17  
 Ranjane Singh 5/7/17

  
 Dr. Pradeep 5/7/17  
 Thomas 5.7.17

## MSc Life Sciences: Biochemistry Semester I

Unit	Topics	Lectures
1	Amino Acids: Classification , structure and properties of amino acids. Non protein amino acids, methods of separation of amino acid mixture. Detection of amino acids.protein degradation and amino acid sequencing. N terminal and C terminal detection	6
2	Proteins: The peptide 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,measurement 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. Diagnostic 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.

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Varun  
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Ranvijay  
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Shrushti  
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Shomasini  
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Ranjana Sijl  
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SEMESTER - I		BASIC MICROBIOLOGY	COURSE: LSC-651
UNIT	TOPICS	LECTURES	
I	<b>Introduction to Microbiology</b>		
	Early Discoveries and experiments of Louis Pasteur	1	
	Discoveries in Medical Microbiology	1	
	Soil Microbiology and Plant pathology	1	
	Structure of bacteria	1	
	Methods of classification	1	
	Major groups of bacteria	1	
	Structure and life cycle of virus	1	
II	<b>Introduction to algae, fungi and parasites</b>	1	
	<b>Energy relations of microbes :</b>	1	
	Basic principles of bioenergetics	1	
	Respiration and fermentation	1	
	Photosynthesis in bacteria	1	
	Nitrogen cycle and biological nitrogen fixation	1	
III	Carbon cycle	1	
	Sulphur and phosphorous cycles	1	
	<b>Growth of microorganisms:</b> Phases of growth cycle, Determination of Generation time and Growth rate.	1	
	Types of microbial cultures- Batch, Continuous and Synchronous cultures	2	
IV	<b>Microbial growth measurement:</b> microbial growth based on cell number, cell mass and cell activity.	2	
	<b>Host Parasite Interaction:</b> 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	4	
V	<b>Control of microorganisms:</b> Microbial death curve under adverse condition.	2	
	Levels of control, Mechanisms action of physical agents- Heat, photochemical and ionizing radiations.	3	
	Chemical control of microorganisms – Phenol coefficient, Mechanisms of various chemical agents used for control of microorganisms.	3	
<b>Recommended Books</b>			
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	

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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	

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**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*, 8<sup>th</sup> Edition, Eduardo D. P. De Robertis, E. M. F. De Robertis, Lippincott Williams & Wilkins, 2010.
2. *The Cell: A Molecular Approach*, 6<sup>th</sup> Edition, Geoffrey M. Cooper, ASM Press 2013
3. *Cell and Molecular Biology: Concepts and Experiments*, 6<sup>th</sup> Edition, Gerald Karp, John Wiley & Sons, Inc. 2010
4. *Cancer: Principles and Practice of Oncology*, 9<sup>th</sup> 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
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
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
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
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

**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. I 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.

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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 of Chromosomes, Special type of chromosomes; Prokaryotic nucleoids, Chromatin structure and nucleosome; Chromosome banding. Sister chromatid exchange.	6
IV	Structural and numerical alteration in chromosome abnormalities- deletion, duplication, translocation, inversion. Haploid, aneuploids, polyploids. 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:**

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

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### MSc- III Semester: Plant Metabolism

	Topic	Lectures
Unit-1	Photosynthesis - Light harvesting complexes; mechanisms of electron transport; photoprotective mechanisms; CO <sub>2</sub> fixation-C <sub>3</sub> , C <sub>4</sub> 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 – N <sub>2</sub> 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:		
<ol style="list-style-type: none"> <li>1. Molecular mechanisms in Photosynthesis: Blankenship</li> <li>2. Plant Physiology: Taiz and Zeiger</li> <li>3. Introductory Plant Physiology: Noggle and Friez</li> <li>4. Plant Physiology: SC Dutta</li> <li>5. Plant Physiology: Salisbury</li> </ol>		

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**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 <i>Arabidopsis</i>	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:		
<ol style="list-style-type: none"> <li>1. Plant Physiology: Taiz and Zeiger</li> <li>2. Introductory Plant Physiology: Noggle and Friez</li> <li>3. Plant Physiology: SC Dutta</li> <li>4. Plant Physiology: Salisbury</li> </ol>		

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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
II	Nutritional requirement to cell, tissues and organs <i>in vitro</i> , various types of nutrient media, role of growth regulators Somatic embryogenesis and organogenesis in plants, differentiation theory. Isolation of cells, single cell cultures and cloning	2
		2
		2
		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. Protoplast isolation and culture, fusion of protoplasts, uptake properties of protoplasts Somatic hybrids, selection methods, intergeneric and interspecific hybrids, applications of somatic hybrids	2
		2
		2
		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 Academic 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.

Sanjiv  
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Aditya  
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	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	<p><i>Endocrine Physiology</i>                      Introduction to mammalian hormones and their basic characters,                      Differences between hormone and pheromone.                      Mode of actions of hormones, Feed back mechanism.</p> <p>Hormones of different Endocrine glands, their broad biochemical nature and their main functions.                      Outline of hormonal abnormalities with special reference to thyroid and pancreas.</p>	<p>2</p> <p>1</p> <p>3</p> <p>2</p>
2	<p><i>Physiology of Reproduction</i>                      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.</p>	<p>2</p> <p>2</p> <p>2</p> <p>3</p>
3	<p><i>Physiology of Fertility control</i>                      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.</p>	<p>1</p> <p>2</p> <p>2</p> <p>1</p>
4	<p><i>Thermoregulatory Physiology</i>                      Introduction:Thermoregulation in different animals, Body temperature and its variations in different conditions,                      Metabolic rate and its variations ,finding out metabolic rate in different organisms.                      Effective and Lethal temperature, Regulation of body temperature                      Effects of cold and heat</p>	<p>2</p> <p>4</p> <p>2</p> <p>1</p>

**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

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## Elective

### DEVELOPMENTAL BIOLOGY

UNIT	TOPIC	LECTURES
I	<b>Basic concepts of development:</b> 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	<b>Gametogenesis, fertilization and early development:</b> 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	<b>Morphogenesis and organogenesis in animals:</b> Cell aggregation and differentiation in Dictyostelium; axes and pattern formation in Drosophila, amphibia and chick; organogenesis – vulva formation in <i>Caenorhabditis elegans</i> ; 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
<b>Suggested books</b> <ol style="list-style-type: none"> <li>1. <i>Developmental Biology</i> by Scott F. Gilbert and Michael J. F. Barresi</li> <li>2. <i>Essential Developmental Biology</i> by Jonathan M. W. Slack</li> <li>3. <i>Principles of Development</i> by Lewis Wolpert and Cheryll Tickle</li> </ol>		

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## SYSTEM PHYSIOLOGY - ANIMAL

UNIT	TOPIC	LECTURES
I	<b>Blood and circulation:</b> Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, haemostasis.	3
II	<b>Cardiovascular System:</b> 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	<b>Respiratory system:</b> Comparison of respiration in different species, anatomical considerations, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.	3
IV	<b>Nervous system:</b> 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	<b>Excretory system:</b> 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 <b>Digestive system:</b> 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.

*Banerjee*  
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## 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. Coronary arteries and their significance. General principle of heart functions. Blood: Plasma and serum, Blood cells-RBC, WBC and platelets. Blood flow. Cardiac cycle and the measurement of cardiac output.	2 1 1 2
2	Abnormalities in Blood cells and Blood groups- Anemia and their types. Prevention and treatment of anemia. Polycythemia. Mechanism of blood clotting and abnormal blood clotting. Different types of blood groups and their clinical significance. Determining the blood groups. Blood donation and blood transfusion.	2 3 1
3	Congenital heart problems: Artery, septum, valve, node and bundle branch related abnormalities. Heart beat abnormalities, tachycardia, bradycardia, palpitation and heart arrhythmia. Heart block and pace maker problems.	2 1 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, Atherosclerosis vs arteriosclerosis, heart risk ratio and complication of hypertensions, Prevention and treatment of hypertension.	4 2 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. Causes of HA, detection of HA, ECG and TMT, Atherosclerosis vs arteriosclerosis, Complication of HA, Prevention and treatment of HA.	2 3 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 ed 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

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SEMESTER - II MOLECULAR BIOLOGY & GENETIC ENGINEERING COURSE: LSC-612

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

**Suggested books**

1. Current protocols in molecular biology. 2000. Ausbel *et. al*.
2. Molecular cloning Vol. 1-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

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## 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 acquired 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 of antibodies, quantitative precipitin titration, precipitin reaction in gel. immunoelectrophoresis, rocket immunoelectrophoresis, countercurrent electrophoresis, agglutination, immunofluorescence, FACS, ELISA, RIA, western blot, cell separation 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: Hypersensitivity 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 ; Elsevier publication
2. Immunology, 8th Edition; Male & Brostoff & Roth & Roitt ; Elsevier publication.
3. Kuby Immunology, 6<sup>th</sup> Edition ; Kindt & Goldsby & Osborne ; W.H. Freeman and company, New York.

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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
<b>Suggested Books :</b>		
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		

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**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 <i>Arabidopsis</i> , 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 , signalling and 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:		
<ol style="list-style-type: none"> <li>1. Plant Physiology: Taiz and Zeiger</li> <li>2. Introductory Plant Physiology: Noggle and Friez</li> <li>3. Plant Physiology: SC Dutta</li> <li>4. Plant Physiology: Salisbury</li> </ol>		

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

Units	Topics	lectures
1	<i>Endocrine Physiology</i> 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	<i>Physiology of Reproduction</i> 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	<i>Physiology of Fertility control</i> 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	<i>Cardio-vascular Physiology</i> 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

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M.SC. ( INDUSTRIAL MICROBIOLOGY) COURSE					
SEM.	CODE	COURSE TITLE	Credits		
			Theory	Practical	Total
I	IM- 601	BIOMOLECULES	3	4	26
	IM- 611	ANALYTICAL TECHNIQUES	3		
	IM- 621	CELL STRUCTURE AND CANCER BIOLOGY	3		
	IM- 631	GENETICS & MOLECULAR GENETICS	3	4	
	IM- 641	BIOSTATISTICS, BIOINFORMATICS & COMPUTER	3		
	IM- 651	BASIC MICROBIOLOGY	3		
II	IM- 602	PROTEINS AND ENZYMES	3	4	29
	IM- 612	MOLECULAR BIOLOGY & GENETIC ENGINEERING	3		
	IM- 622	BASIC IMMUNOLOGY	3		
	IM- 632	MICROBIAL METABOLISM	3	4	
	IM- 642	VIROLOGY	3		
	IM- 652	FERMENTATION TECHNOLOGY	3		
	CBS- 662	CHOICE BASED SUBJECT	3		
III	IM- 603	ENVIRONMENTAL & POLLUTION MICROBIOLOGY	3	4	29
	IM- 613	CLINICAL IMMUNOLOGY	3		
	IM- 623	INDUSTRIAL PRODUCTION PROCESSES	3		
	IM- 633	FOOD MICROBIOLOGY	3	4	
	IM- 643	MEDICAL MICROBIOLOGY	3		
	IM- 653	BIOPROCESS TECHNOLOGY & DOWN STREAM PROCESSING	3		
	CBS- 663	CHOICE BASED SUBJECT	3		
IV	IM- 604	INDUSTRIAL/ LABORATORY TRAINING & REPORT PREPARATION			20
TOTAL CREDITS					104
COMPREHENSIVE VIVA (4 CREDITS / SEMESTER)					16
CREDITS GRAND TOTAL					120

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SEMESTER-I		BIOMOLECULES	COURSE: IM - 601
UNIT	TOPICS	LECTURES	
I	<b>Carbohydrates:</b> Stereoisomerism, aldose and ketose family of monosaccharides.	2	
	Structure of oligosaccharides and polysaccharide.	2	
	Enzymatic degradation of polysaccharides.	2	
II	<b>Lipids:</b> Structure and types of fattyacids. Structure of triglycerides, phospholipids,	2	
	Glycolipids, sphingolipids, terpenes and steroids.	2	
III	<b>Amino acids</b> Classification, Structure and properties of amino acids.	2	
	Non – protein amino acids.	2	
	Protein degradation	2	
	Amino acid sequencing.	2	
IV	<b>Nucleic acids</b> Structure, physical and chemical properties of nucleic acids. Types of DNA and RNA.	2	
	Factors stabilizing double helical structure of DNA.	2	
	DNA melting, DNA packaging, DNA supercoiling,	2	
	Nucleic acid sequencing.	2	
			2
<b>Suggested books:</b>			
1. Principles of Biochemistry – Voet & Voet, John Wiley & Sons			
2. Introduction to protein structure - Branden and Tooze. Garland Publishing Company.			
3. Principles of Biochemistry. - Lehninger, 3rd edition by Nelson and Cox (Worth) 2000			
4. Biochemistry. - Stryer 5th edition W.H. Freeman 2001.			
5. Harper's Biochemistry, 1999 (McGraw-Hill).			
6. Principles of Biochemistry - Zubey GL. Parson WW and Vance DE (1994), WM.C. Brown Publishers, Oxford, England.			
7. Modern Microbiology. - Brige EA (1992), WM.C. Brown, Publishers, Oxford, England			

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SEMESTER-I		ANALYTICAL TECHNIQUES	COURSE:IM - 611
UNIT	TOPICS	LECTURES	
I	Cell Disruption techniques: Homogenisation, mechanical and non-mechanical methods of cell disruption	2	
	Separation methods:Centrifugation:Basic principle, Types, components.	2	
	Preparative centrifugation: differential velocity and density gradient centrifugation	2	
	Determination of sedimentation coefficient.	1	
II	Basic principle of chromatography, Paper, thin layer and column chromatography , Adsorption chromatography, Partition chromatography, HPLC, Gas Liquid chromatography, Gel filtration chromatography, Affinity chromatography, Ion exchange chromatography	1	
	SDS PAGE, native PAGE	2	
		2	
		2	
		2	
III	Spectroscopy	2	
	Beer-Lambert Law, components and applications of spectrophotometer, Spectrofluorometer, Atomic absorption spectrometer	1	
		2	
IV	Basic principle and applications of EPR and NMR spectroscopy	2	
	Radio-isotopic measurements, Basic principle and applications	2	
		2	
V	Microscopy	2	
	Basic Principle , components and applications of Light microscope and electron microscope, Phase contrast microscope, transmission and Scanning microscopy	1	
<b>Suggested Books:</b> Analytical techniques: Holme and Peck, Longman Scientific & Technicals, USA Analytical Instrumentation Handbook: Jack Cazes, CRC Press Bioanalytical chemistry, Manz, Pämme & Iossifidis, Imperial College Press  Analytical Techniques in Biochemistry and Molecular Biology: R Katoch  Biological Instrumentation and Methodology: PK Bajpai,  Principles and Techniques of Biochemistry and Molecular Biology: Wilson & Walker  Introduction to Instrumentation in Life Sciences: Bisen P.S and Sharma, A. CRC Press. Principles and Techniques of Biochemistry and Molecular Biology, 6 <sup>th</sup> Ed.- Wilson Keith and Walker John (2005) Cambridge University Press, New York.			

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SEMESTER – I GENETICS & MOLECULAR GENETICS		COURSE : IM- 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.	2
	Non-Mendelian inheritance patterns- Mitochondrial Inheritance.	2
	Lethality and Interaction of gene- Lethal effects and regression of genes in Drosophila, Mice and Plants.	2
	Interaction of genes- Two gene pairs affecting same character, Epistasis; complementary genes; Duplicate genes.	2
II	Physical basis of heredity- Nucleus, Chromosomes, Special type of chromosomes; Prokaryotic nucleoids, Chromatin structure and nucleosome; Chromosome banding.	3
	Cell division and error in cell division; Non-disjunction, Structural and numerical chromosomal abnormalities- deletion, duplication, translocation, inversion.	3
	Genetic disorders due to chromosomes in human; determination of sex, Sex linked inheritance.	2
III	Mutations- type of mutations, frameshift mutation, mutagenic agents, mechanism of mutagenesis, Ames Test.	2
	Gene transfer in bacteria- Transduction, Conjugation, F transfer, Hfr mediated chromosome transfer.	2
	Transposable genetic elements in plant and animals.	2
IV	Molecular Biology of DNA Replication - DNA replication is semi-conservative, Meselson-Stahl expt., Multiple Origins & bi-directional DNA replication in Eukaryotes,	2
	Replication of Virus & Theta replication of Circular DNA molecules, Rolling Circle replication, Plasmid DNA using a Rolling Circle, Unwinding, Stabilization & Stress relief,	2
	Initiation by a Primosome complex, Chain elongation & Proofreading, discontinuous replication of the lagging strand, Terminator sequencing of DNA.	2
V	Molecular Biology of Recombination - Molecular mechanisms of Recombination, Gene conversion, Mismatch repair, the Holliday model of recombination, Single strand break & repair model.	2
<p><b>Suggested Books:</b></p> <p>The Science of Genetics: George W. Burns, Paul J. Bottino Maxwell Macmillan International Editions, New York</p> <p>Concepts of Genetics : William S. Klug, Michael R. Cummings, Charlotte A. Spencer, Pearson Prentice Hall, New Jersey</p> <p>Gene – IX: Lewin Benjamin, Pearson Prentice Hall, Pearson Education, Inc., New Jersey</p> <p>Theory and Problems of Genetics: Susan L. Elrod, William D. Stansfield, Tata McGraw-Hill Publishing Company Limited, New Delhi.</p> <p>Molecular Biology of the Cell: Bruce Alberts, Garland Science, Taylor and Francis Group, New York</p> <p>Cell and Molecular Biology, concepts and experiments: Gerald Karp, John Wiley and Sons, Inc. New Jersey</p> <p>Molecular Cell Biology: Lodish, W. H. Freeman and Company, New York</p> <p>The Cell a Molecular Approach: Geoffrey M. Cooper, Robert E. Hausman, ASM Press and Sinauer, Washington</p> <p>Cell and Molecular Biology: Phillip Sheeler, Donald E. Bianchi, John Wiley and Sons, Inc., New Delhi</p> <p>Cell Biology – A Laboratory Handbook: Julio E. Celis, Academic Press, Harcourt Brace and Company Publishers, San Diego</p> <p>Genomes: T. A. Brown, Wiley-Liss, John Wiley and Sons, Inc. New Jersey</p> <p>Principles of Gene Manipulation : Sandy B. Primrose, Richard M. Twyman and R.W.Old, S. B. University Press.</p>		

*Prof. Fatima*

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*Dr. Ganesh*

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SEMESTER-I		BIOSTATISTICS, BIOINFORMATICS & COMPUTER	COURSE: IM-641
UNIT	TOPICS	LECTURES	
I	Introduction to Biostatistics: Introduction to Biostatistics; Methods of representation of statistical data; Population and sample designs; Random and Non random sampling methods. 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.	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.	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; 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.			

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SEMESTER - I		BASIC MICROBIOLOGY	COURSE: IM -651
UNIT	TOPICS	LECTURES	
I	<b>Introduction to Microbiology</b>		
	Early Discoveries and experiments of Louis Pasteur	1	
	Discoveries in Medical Microbiology	1	
	Soil Microbiology and Plant pathology	1	
	Microbes and molecular biology	1	
	Structure of bacteria	1	
	Methods of classification	1	
	Major groups of bacteria	1	
II	Structure and life cycle of virus	1	
	<b>Energy relations of microbes :</b>		
	Basic principles of bioenergetics	1	
	Respiration and fermentation		
	Photosynthesis in bacteria	1	
	Nitrogen cycle and biological nitrogen fixation	1	
III	Carbon cycle	1	
	Sulphur and phosphorous cycles	1	
	<b>Growth of microorganisms:</b> Phases of growth cycle, Determination of Generation time and Growth rate.	1	
IV	Types of microbial cultures- Batch, Continuous and Synchronous cultures	2	
	Microbial growth measurement: microbial growth based on cell number, cell mass and cell activity.	3	
V	<b>Control of microorganisms:</b> Microbial death curve under adverse condition.	2	
	Levels of control, Mechanisms action of physical agents- Heat, photochemical and ionizing radiations.	3	
	Chemical control of microorganisms – Phenol coefficient, Mechanisms of various chemical agents used for control of microorganisms.	3	
<b>Recommended Books</b>			
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	

*Prof. J. K. Jaiswal*

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SEMESTER - II		PROTEINS, VITAMINS AND ENZYMES	COURSE: IM -602
UNIT	TOPICS	LECTURES	
I	<b>Proteins:</b>		
	Amino acids and proteins		1
	Primary structure		1
	Determination of amino acid sequence		1
	Secondary structure		1
	$\alpha$ and $\beta$ helix		1
	Constraints for polypeptide		1
	Tertiary and quaternary structure		1
Protein hydrolysis and peptide maps		1	
II	<b>Vitamins :Role of vitamins in metabolism</b>		1
	Discovery and classification		1
	Structure and function of Thiamine and riboflavin		1
	Structure and function of pyridine nucleotides and Coenzyme-A		1
	Structure and function of vitamins pyridoxine, biotin, folic acid		1
	Structure and function of lipoic acid, vitamin B-12 and ascorbic acid		1
	Structure and function of vitamin A and D		1
Structure and function of Vitamin E and K		1	
III	<b>Enzymes : Structure</b>		1
	Discovery, classification and nomenclature		1
	Chemical kinetics and catalysts		1
	Enzyme kinetics and Michaels – Menton equation		1
	Modifications of Michaels – Menton equation		1
	Reversible inhibition of enzymes		1
	Irreversible inhibition		1
Substrate specificity		1	
IV	<b>Regulation of enzyme activity :</b>		
	Allosteric regulation		1
	Cumulative and coordinated regulation		1
	Isozymes		1
	Regulation by covalent modification		1
	Regulation by separate protein molecules		1
Zymogens		1	
<b>Suggested books</b> 1. Introduction to protein structure - Branden and Tooze. Garland Publishing Company. 2. Principles of Biochemistry. - Lehniger, 3rd edition by Nelson and Cox (Worth) 2000 3. Biochemistry. - Stryer 5th edition W.H. Freeman 2001. 4. Harper's Biochemistry, 1999 (McGraw-Hill). 5. Principles of Biochemistry - Zubey GL. Parson WW and Vance DE (1994), WM.C. Brown Publishers, Oxford, England.			

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SEMESTER - II MOLECULAR BIOLOGY & GENETIC ENGINEERING COURSE: IM -612

UNIT	TOPICS	LECTURES
I	Enzyme in recombinant DNA techniques	2
	Restriction endonucleases	1
	Reverse transcriptase	1
	DNA ligase	1
	Terminal transferases	1
	SI nuclease	1
	Exonuclease	1
	Polynucleotide kinase DNA polymerase I.	1
II	<b>Cloning vectors and Cloning strategies</b>	
	General characteristics of cloning vectors.	1
	Plasmid Vectors	1
	Phages and cosmid Vectors.	1
	YAC cloning vectors	1
	Construction of genomic and cDNA libraries. Screening and selection of specific DNA clones	1
III	<b>Molecular hybridization</b>	2
	In situ hybridization	1
	Southern Blots	1
	Northern and Slot blots	1
	Heteroduplex mapping DNA Microarray	1
IV	<b>Gene amplification and Genetic engineering in eukaryotes</b>	2
	PCR	2
	Gene Sequencing	1
	Site directed mutagenesis	1
	Antisense and Ribozyme Technology Gene transfer in animal cell culture	1
	Transgenic organisms with examples from mice and <i>Drosophila</i> .	1
	Transfer of plant genes by Ti plasmids.	1
V	<b>Replication and Gene expression</b>	
	DNA replication	2
	Transcription	2
	Translation. Regulation in Eukaryotes- transcriptional and post-transcriptional control	2 4

Suggested books

1. Current protocols in molecular biology. 2000. Ausbel *et. al*.
2. Molecular cloning Vol. 1-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

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SEMESTER –II		BASIC IMMUNOLOGY	COURSE: IM - 622
UNIT	TOPICS	LECTURES	
I	<b>Introduction to Immune Response</b> Origin of Immunology, Cells of the immune system, Organ of the Immune system Innate and Aquired immunity. Cellular and humoral immunity Toll receptors, and sensing of PAMP, signal transduction, NOD receptors	1 1 1	
II	<b>Immunoglobulins</b> Structure of Immunoglobulins, immunoglobulin fold immunoglobulin superfamily. different classes of immunoglobulins idotypic, isotypic, allotypic determinant theories of antibody formation, clonal selection theory generation of antibody diversity affinity maturation, allelic exclusion, class switching	2 2 2	
III	<b>Antigen antibody reaction</b> Antigenic determinant and haptens, valence and affinities of antibodies specificity, quantitative precipitin titration, precipitin reaction in gel, immunoelectrophoresis, agglutination, IF, immunoprecipitation, FACS, western blotting, cell separation techniques ELISA, RIA	2 1 1 1	
IV	<b>Complement pathways.</b> Classical, alternative and lectin pathway of complement activation, regulation, complement deficiency and complement fixation assay. <b>Monoclonal Antibody</b> Formation of monoclonal antibody. selection of hybrids in HAT media advantage of monoclonals and their use, Human monoclonals.	2 1 1 1	
V	<b>The major histocompatibility complex.</b> Class I and Class II MHC molecules, gene map of MHC, tissue distribution, Tissue typing. <b>Recognition of antigen</b> Need of MHC participation in antigen recognition, processing of antigen T cell receptor, APC-T cell interaction, MHC restriction. T cell activation, Th1,Th2 cells. T cytotoxic cells, super antigen. Activation of B cells, type I, type II thymus independent and thymus dependent antigens.	1 1 1 2 2	
<b>Suggested books:</b> Kuby Immunology Thomas J Kindt Barbara A Osborn, Richard A Goldsby Immunology David Male, J Brostoff David Roitt, Ivan Roitt. Cellular and Molecular Immunology AK Abbas, Andrew H Litchman Shiv Pillai Immunology Understanding Immune system. Kluas Erget.			

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SEMESTER-II		MICROBIAL METABOLISM	COURSE: IM- 632
UNIT	TOPICS	LECTURES	
I	Transport systems in Bacteria: Types of transport systems, PEP system of transport, ABC superfamily of transporters, OMPs, Ionophore antibiotics	2	
		2	
		2	
II	Nitrogen and Sulphur metabolism: Nitrogen cycle, N <sub>2</sub> fixation, its mechanism and regulation at genetic level, assimilation and reduction of nitrate and sulphate	1	
		2	
		1	
III	Protein metabolism: Genetic regulation of protein synthesis (Ara and Trp operon), regulation enzymatic level, types of feed back inhibition,	2	
		1	
		2	
IV	Lipid metabolism and regulation: synthesis and degradation of lipids, Fatty acid synthase complex, Beta oxidation	2	
		1	
		2	
V	Types of photosynthetic bacteria and pigments, types of bacterial reaction centres, electron transport chain, carbon fixation, ATP synthesis in Halobacteria	2	
		2	
		2	
		2	
		2	
<b>Suggested Books:</b> Microbial Metabolism & Biotechnology: E-Book <a href="http://www.twinamasiko.com/IOBB/Publications/Biotechnology_eBook.pdf">http://www.twinamasiko.com/IOBB/Publications/Biotechnology_eBook.pdf</a> Physiology and Biochemistry of Prokaryotes: David White Bacterial Physiology and Metabolism: BH Kim and GM Gadd Bacterial Metabolism: <u>Gerhard Gottschalk</u> Bacterial Metabolism: HW Doelle Microbial Energetics: EA Dawes			

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SEMESTER - II		VIROLOGY	COURSE: IM - 642
UNIT	TOPICS	LECTURES	
I	Principles of virology: Theories of virus evolution, General morphology and classification of viruses, Structural organization and chemistry of helical, icosahedral and complex viruses, plaque assay, TCID50, Virus-host cell interaction	2	
		2	
		1	
II	Cultivation and purification of viruses: In vivo, in vitro and in ovo systems for virus growth, estimation of yields, methods for purification of viruses, Isolation and determination of virus titer, entry into host cell, replication of nucleic acid, lytic and lysogenic cycles, biosynthesis of virion.	2	
		2	
		1	
III	Virus in diseases: Transmission of viruses with and without vectors, Viremia, Animal viruses; pathogenesis, disease development and laboratory diagnosis of viruses Hepatitis and influenza virus, Dengue virus, HIV, SARS, H1N1. Oncogenic viruses, DNA and RNA viruses.	1	
		2	
		2	
IV	Diagnostic methods in virology: Immunodiagnosis, haemagglutination and haemagglutination-inhibition tests, Complement fixation test, neutralization, Western blot, Ristocetin Induced Platelet Aggregation (RIPA), flowcytometry and Immunohistochemistry, Nucleic acid hybridization, PCR, microarray and nucleotide sequencing.	2	
		2	
		1	
V	Mechanism of host cell damage by virus: Host cell 'shut off', apoptosis, necrosis, stress response, alteration of signalling pathways, cellular basis of transformation, types of cytopathic effects, ultrastructural, cytopathology, Inhibition and inactivation of bacterial, plant and animal viruses.	2	
		2	
		1	
<b>Suggested books:</b>			
Microbiology. Nester, Roberts and Nester. 2005.			
Alcamo's Fundamentals of Microbiology. Pommerville, 2004.			
Clinical Microbiology. Srivastava, 2004.			
The Short Textbook of Medical Microbiology Including Parasitology. Jaypee. 2010.			
Introduction to Modern Virology (IV Edition) - Dimmock NJ, Primrose SB (1994), Blackwell Scientific Publications, Oxford.			
Virology-III Edition - Conrat HF, Kimball PC and Levy JA, Prentice Hall, Englewood, Cliff, New Jersey.			

SEMESTER – II FERMENTATION TECHNOLOGY		COURSE IM- 652
UNIT	TOPICS	LECTURES
I	History and development of industrial microbiology.	1
	Purposes for large scale cultivation of microorganisms.	1
	Concept of microbial strain, Sources of strains – Culture collections, Research laboratories, Industries.	2
	Screening program: Primary and secondary screening programs	1
II	Primary screening : Isolation of strains from natural resources- Isolation of strain producing growth inhibitory and growth promontory biochemicals, resistant strains, enzyme producers, starch, chitin, protein, lipid and hydrocarbon degraders.	2
	Secondary screening: Determination of identity of the fermentation product -	1
	Chromatographic (GC, HPLC) and Spectroscopic (UV, IR, Mass and NMR methods.	1
	Preservation and maintenance of industrial strains.	1
		2
III	Improvement of industrial strains: Regulatory mechanisms in microorganisms	1
	Mutation and methods adopted for selection of desired mutant.	2
	Types of fermentation systems: Submerged and Solid State fermentations.	2
	Production of Mycoparasite <i>Trichoderma</i> and enzyme Pectinase under Solid state fermentation conditions.	1
	Development of Inoculums: Master culture and working culture. Detection and assay of fermentation products.	2
IV	Fermentation equipments: Levels of fermentation – laboratory, pilot and production fermentors, Design of fermentors- characteristics, monitoring and control of pH, aeration, agitation, temperature and foam.	1
		2
		2
	Industrial sterilization processes: Microbial death curve, bioburden, specific death constant and decimal reduction time. Batch and continuous sterilization of medium, sterilization of air.	1
		2
V	Media for industrial fermentation: carbon, nitrogen and micronutrient sources.	2
		2
	Scaling up of fermentation processes: Constant parameters- Power input and Oxygen Transfer Rate.	1

**Suggested books:**

- Pinciples of Fermentation Technology (2<sup>nd</sup> Edn.), Stansby P.F, Whitaker, A and Hall, S. Pergamon Press, Elsevier, Oxford
- Fermentation and Enzyme Technology, Ed. Wang, D.I.C, Cooney, C.L. et al, John Wiley & Sons
- Fermentation : a practical approach, Ed. Mc Neil, B. and Harvey L.M., Oxford University Press, Oxford
- Fermentation Biotechnology, O.P Ward, Open University Press
- Industrial Microbiology, G.Reed, McMillan Press London
- Overproduction of Microbial Products, V. Krumphanzi, B.Sikyta, Z.Vanek, Academic Press
- Microbial Technology (Volume 1 & 2), H.J Pepler, D. Perlman, Academic Press
- Fermentation and Enzyme Technology, D.I.C Wang and C.L Coolney, John Wiley and sons, New York
- Computer control of fermentation processes, Ed. Omstead, CRC Press, Boca Raton, FL

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SEMESTER – II INDUSTRIAL PRODUCTION PROCESSES		COURSE IM -623
UNIT	TOPICS	LECTURES
I	<b>Immobilization of enzymes and microbial cells:</b> Methods of immobilization, Changes in kinetic pattern after immobilization, Whole cell immobilization, Industrial applications of immobilized enzymes and cells.	6
II	<b>Production of steroid hormone intermediates:</b> Precursors for steroid hormones, C-17-side chain cleavage of cholesterol, Biotransformation of cholesterol to male and female sex hormone intermediates, C-1(2)-dehydrogenation and 11- $\alpha$ hydroxylation, of steroidal substrates.	6
III	<b>Detailed study of the fermentative production processes of the following:</b> Antibiotics : Penicillins and Semisynthetic Penicillins Vitamins: : Riboflavin , Cobamide and Ascorbic acid.	6
IV	Organic acids: : Lactic acid Enzymes : Amylases and Pectinases Amino acids : Lysine and Glutamic acid	6
V	Industrial Solvent : Ethyl Alcohol Microbes as fermentation product: Microbial insecticides and Baker's yeast	6
<b>Suggested books:</b> Biotechnology – Edt. by H.J.Rehm & G.Reed, Vol 4. VCH Publications, Federal Republic of Germany Industrial Microbiology, G. Reed (Editor), CBS Publishers (AVI Publishing Company) Biology of Industrial Microorganisms. A.L. Demain. Textbook of Industrial Microbiology, - A. H. Patel. Industrial Microbiology - L. E. Cassida Industrial Microbiology - G. Reed. Principles of Fermentation Technology. Standbary P.F.A. Whitaker and Hall. 1995. Pergaman. McNeul and Harvey. 1990.		

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**SEMESTER – II FOOD MICROBIOLOGY**

**COURSE IM -633**

UNIT	TOPICS	LECTURES
I	<b>Food and Microbes</b> Food as a substrate for Microbial growth. Sources for food contamination. Biochemical changes in food by microorganisms. <b>Quality control of food products</b> Analytical methods and standards for raw, canned and fermented foods.	
II	<b>Food fermentations</b> Bread, malt beverages, Wine, vegetables, Milk tea, coffee, cocoa, vanilla,soysauce,tempeh and idli fermentations.	
III	<b>Microbes as source of food</b> SCP, Fat and Aminoacids. Mushroom production by solid state fermentation.	
IV	<b>Food Preservation Methods</b> Asepsis, High and Low temperature, Irradiation, Drying and food additives. Preservation of vegetables and fruits, Milk and Milk products and canned foods.	
V	<b>Food poisoning and food infections</b> Sources, symptoms and prevention of food borne bacterial and fungal diseases. <b>Seed microbiology and pathology</b> Introduction to seed borne pathogens, their morphology on the seed surface, methods for their rapid identification and control.	

**Suggested books:**

1. Food Microbiology. 2nd Edition By Adams
2. Basic Food Microbiology by Banwart George J.
3. Food Microbiology: Fundamentals and Frontiers by Dolle
4. Food Microbiology: Frazier, W. and Westhoff, D.
5. Fundamentals of Dairy Microbiology by Prajapati.
6. Essentials of Food Microbiology. Edited by John Garbult. Arnold International Students Edition.
7. Microbiology of Fermented Foods. Volume II and I. By Brian J. Wood. Elsevier Applied Science Publication.
8. Microbiology of Foods by John C. Ayres. J. Orwin Mundt. William E. Sandinee. W. H. Freeman and Co.
9. Dairy Microbiology by Robinson. Volume II and I.
10. Food Microbiology: Fundamentals and Frontiers. 2nd Edition by Michael P. Doyle, Larry R. Beuchat and Thomas I. Montville (Eds.), ASM Publications.

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SEMESTER – III ENVIRONMENTAL & POLLUTION MICROBIOLOGY		COURSE IM- 603
UNIT	TOPICS	LECTURES
I	<b>Ecological principles:</b> Biosphere Energy transfer Ecosystem management and role of microbes. Microbial life in extreme environments. Types of microorganisms in air and techniques of their sampling.	2 1 2 2 2
II	<b>Biodegradation of organic compounds in soil and water:</b> Degradation of xenobiotics and recalcitrant compounds. Lignin degradation. Carbohydrate degradation. Detergent degradation. Pesticide degradation. Aromatic compounds degradation. Fundamentals of Toxicology and Environmental carcinogens.	2 1 1 1 2 2 2
III	<b>Types of microbial population in soil</b> Mycorrhiza. Host fungus interaction and specificity. Role of microbes in N, P and S cycles. Symbiotic and non-symbiotic nitrogen fixation.	2 2 3 3
IV	<b>Bacteriological analysis of water and waste water</b> Standard plate count. Isolation of microbes from polluted water. Water borne diseases in man. Algal blooms and eutrophication. Waste water treatment.	1 2 2 3
<p><b>Suggested books:</b></p> <p>Environmental Microbiology By Raina M. Maier, Jan L. Pepper and Charles P. Gerba (1999) Academic Press.</p> <p>Environmental Science ; A Global Concern By William Cunningham and Saigo, B.W. (1995) Wm C. Brown Publishers USA.</p> <p>Microbial ecology. - Alexander, M. (1971) John Wiley and sons, Inc., New York.</p> <p>Introduction to soil microbiology. - Alexander, M. (1977), John, Wiley and Sons. Inc., NY</p> <p>Bioremediation - Baker, KH. and Herson, D.S. 1994. Mc Craw Hill Inc. New York.</p> <p>Advances in microbial ecology Vol-8, - K.C. Marshall, (1985) Plenum Press.</p> <p>Experimental Microbial Ecology - Burns R.G. and Slater J.H. (1982) Blackwell Scientific Publications, Oxford, London.</p> <p>Essays in agricultural and food microbiology - Norms, J.R. and Pettipher, G.L. (1987) John Wiley and Sons Singapore.</p> <p>Soil Biology - Burges, A and Raw, F. 1967 Academic Press, London.</p> <p>Introduction to soil Microbiology. - Martin Alexander, Wiley International edition, New York.</p> <p>Introduction to environmental microbiology. - Michel R. 1999. ASM book.</p> <p>Bioremediation - Baker, KH. and Herson, D.S. 1994. Mc Craw Hill Inc. New York.</p>		

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SEMESTER-III		CLINICAL IMMUNOLOGY	COURSE: IM- 613
UNIT	TOPICS	LECTURES	
I	<b>Cytokines</b> Properties of cytokines, four families of cytokines, cytokine receptors. cytokine antagonist, cytokine related disease, cytokine based therapies.	1	1
	<b>Immunity to infection</b> Vaccines, classical and modern methods of vaccine production.	2	2
	Immunity to bacterial ( TB/leprosy) , viral ( HIV) and parasitic (malaria ) infections. Escape mechanism. Congenital and acquired immunodeficiency.	2	2
II	<b>Hypersensitivity</b> Type I anaphylactic,	1	1
	Type II antibody dependent cytotoxic hypersensitivity	1	1
	Type III Immune complex mediated hypersensitivity,	1	1
	Type IV cell mediated delayed type hypersensitivity.	1	1
III	<b>Autoimmune Disorder</b> T cell differentiation in thymus, thymic selection and tolerance to self, mechanism of tolerance induction.	2	1
	Organ specific and systemic autoimmune diseases.	2	1
	Mechanism of autoimmunity. Treatment of autoimmune disorders.	1	1
IV	<b>Transplantation</b> Mechanism of graft rejection, prevention of graft rejection, immunosuppressive drugs , GVH reaction.	1	2
	<b>Tumor Immunology</b> Tumor antigens, Tumor evasion of the immune system Cancer immunotherapy.	2	1
<b>Books:</b> Essentials of Clinical Immunology:Helen Chapel, Manesal Havey, Siraj Mishab, Neil Snowden Immunobiology :Janeway and Travis Immune System : Peter Parham			

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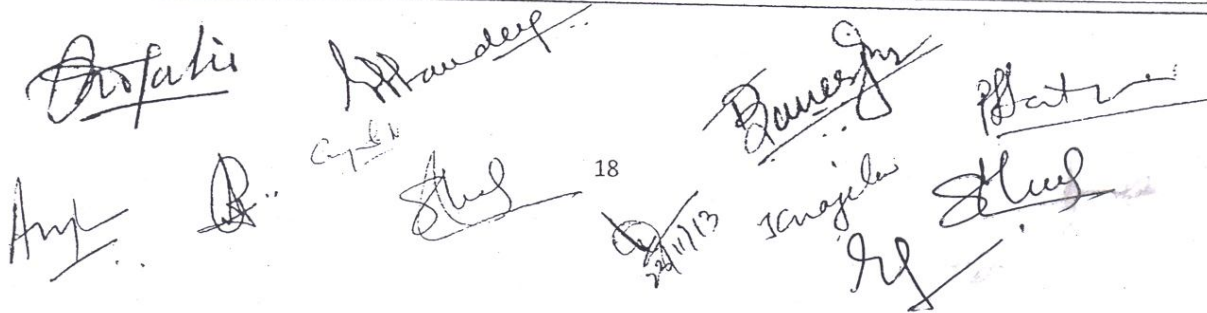
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SEMESTER – III		MEDICAL MICROBIOLOGY	IM- 643
UNIT	TOPICS	LECTURES	
I	Overview of Medical microbiology: Infectious diseases, Medically important microbes, Microbial diseases, sources, route of transmission Pathogenesis- adhesion, invasion, host cell damage, release of pathogens, Treatment, Prevention and control of microbial infections, infection and its types, opportunistic infection, Immunity to microbial diseases.	2	
		2	
		1	
II	Microbial diseases: Bacterial: <i>Staphylococcus, Streptococcus, Haemophilus, Shigella, Salmonella, Clostridium and Micobacterium</i> . Mycotic: <i>Trichophytons and Epidermophytons</i> Parasitic: <i>Entamoeba histolytica, Trapanosoma, Plasmodium and Balantidium</i> .	2	
		2	
		2	
III	Microbial Toxins: Microbial virulence and virulence factors- Signs and symptoms of microbial diseases, Toxins and poisons, Types of microbial toxins, Endotoxins, Exotoxins, LC <sub>50</sub> of toxins, Effective dose of toxins, Assay of toxins, Mechanism of action of Diphtheria, cholera, Staphylococcal toxin and Clostridial neurotoxins.	2	
		2	
		2	
IV	Diagnostic methods: Collection, transport and preliminary processing of clinical pathogens, Clinical; microbiological; immunological and molécular diagnosis of microbial diseases, Modern methods of microbial diagnosis.	2	
		2	
		1	
V	Principle of Chemotherapy: Chemotherapeutic agents, Mechanism of action of antimicrobial agents, Synthetic compounds and antibiotics, Drug resistance, Mechanisms of drug resistance, MDR.	2	
		2	
		2	
<b>Suggested books:</b>			
<p>Medical Microbiology. Greenwood, Slack and Peutherer, 2003.  Microbiology. Nester, Roberts and Nester. 2005.  Alcamo's Fundamentals of Microbiology. Pommerville, 2004.  Clinical Microbiology. Srivastava, 2004.  The Short Textbook of Medical Microbiology Including Parasitology. Jaypee. 2010.  Text of Microbiology, R. Ananthanarayanan and C.K. Jayaram Panicker, Orient Longman, 1997.  Medical Microbiology, Mackie and McCartney, Vol. 1 : Microbial Infection, Vol. 2 : Practical Medical Microbiology, Churchill Livingstone, 1996.  Microbiology in Clinical Practice, D.C. Shanson, Wright PSG, 1982.  Bailey and Scott's, Diagnostic Microbiology, Baron EJ, Peterson LR and Finegold SM, Mosby, 1990.</p>			



SEMESTER-III BIOPROCESS TECHNOLOGY & DOWNSTREAM PROCESSING		IM 653
UNIT	TOPICS	LECTURES
I	Overview of bioprocess technology	1
	Basic mass transfer concepts	2
	Determination of oxygen transfer rate	1
	Mass transfer across free surfaces	2
	Factors affecting volumetric mass transfer coefficient (K <sub>La</sub> )	1
II	Basic concepts of heat transfer.	1
	<b>Removal of insolubles :</b>	
	<i>Filtration</i> - General theory for filtration	1
	Conventional filtration equipment	1
	Continuous rotary filters	1
III	<i>Microfiltration</i> .	1
	<i>Centrifugation</i> - Settling of solids	1
	Tubular bowl centrifuges	2
	Disc type centrifuges.	2
	<i>Cell disruption</i> - Chemical and mechanical methods of cell disruption.	2
IV	<b>Product isolation</b>	1
	<i>Extraction</i>	1
	Batch extraction	1
	Staged extraction	1
	Differential extraction	1
	Fractional extractions.	1
	<i>Adsorption</i>	1
	Batch adsorption	1
	Continuous stirred tank adsorption	1
	Fixed bed adsorption	1
V	<b>Product purification</b>	1
	<i>Elution chromatography</i>	1
	Adsorbents	1
	Yield and purity	1
	Scaling up chromatography.	1
	<i>Precipitation</i>	1
	Precipitation with non-solvent	1
	Salt precipitation	1
	Temperature precipitation	1
	VI	<b>Polishing</b>
<i>Crystallization</i> - Basic concepts of crystallization		2
Nucleation		2
Crystal growth		1
Crystal size distribution		1
Recrystallization.		1
<i>Drying</i> - Basic concepts of drying		1
Conduction	1	
Adiabatic	1	
Spray drying methods.	2	
<b>Suggested books:</b>		
Biochemical Engineering Fundamentals, J.E Bailey & Ollis, DF, Mc.Graw Hill, India		
Bioprocess monitoring and control, Pons. M.N., Carl Hanser Verlag, Munich		
Process Engineering in Biotechnology, A.T Jackson Open University Press		
Bioprocess Engineering. - Michael Shiler and Kargi.		

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**M.Phil. course in Life Sciences is a two semester and 60 credit course**

Course Code	Course Title	Total credits
MLSC- 701	Research Methodology in Life Sciences-I	4
MLSC- 711	Research Methodology in Life Sciences-II	4
MLSC-721	Computer Applications	4
MLSC-731	Elective Paper-I	4
MLSC-741	Elective Paper-II	4
MLSC-751	Review of Literature	6
	Comprehensive viva	4
		30
MLSC-702	Assignments / Term paper	3
MLSC-712	Seminar (Project related)	3
MLSC-712	Project work Dissertation-10, Presentation-10, Viva-4	24
		30
	<b>TOTAL CREDITS 60</b>	

M.Phil. Syllabus, School of Life Sciences, Devi Ahilya Vishwavidyalaya, Indore. (2013)

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## Detailed syllabus for M. Phil. (Life Sciences)

Paper I : Research Methodology in Life Sciences –I		Course code MLSC-701 Credits- 4	Lecture
<b>Unit I</b> Methods in Instrumental Analysis	<b>Analytical techniques</b> Separation techniques: Adsorption chromatography, Partition chromatography, High performance liquid chromatography, Gas liquid chromatography, Ion exchange chromatography, affinity chromatography. Spectroscopy: Basic principle of light absorption, components and applications of spectrophotometer		6
<b>Unit II</b> Methods in Microbiology	<b>Micobiological methods:</b> Preparation and sterilization of solid and liquid culture media. Short time preservation of microbial strains. Long time preservation of microbial strains : Lyophilization and Cryo Preservation. Revival of cultures from lyophilized ampoules. Isolation of pure culture by streak plate, pour plate and sector plate methods. Staining techniques- Simple, Acid fast and Gram's staining techniques.		6
<b>Unit III</b> Methods in Molecular Biology	Isolation, purification and separation of nucleic acids, Polymerase Chain Reaction, Sequencing and Nucleic acid hybridization.		6
<b>Unit V</b> Methods in Cell Biology	<b>Cell Biology</b> Ultrastructure of prokaryotic and eukaryotic cell, plasma membrane, cell organelles, Cell communication and cell signalling, Isolation of plant and animal cells, histopathology, animal cell culture, cell culture media.		6
<b>Unit IV</b> Methods in Environmental Biology	Dissolved oxygen (DO) Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Total Organic Carbon (TOC)		6

M.Phil. Syllabus, School of Life Sciences, Devi Ahilya Vishwavidyalaya, Indore. (2013)

Paper II : RESEARCH METHODOLOGY IN LIFE SCIENCES-II		Course code MLSC-711 Credits- 4	Lectures
Unit I- Methods in Animal Sciences	Methods in animal sciences: <i>Basic principles and Management of laboratory animals</i> : Maintenance of animals, Provision of food, water, light and temperature for proper maintenance and breeding. Model experimental organisms and their handling methods, Experimental design for pre-clinical studies; <i>In vivo</i> and <i>in vitro</i> methods, Administration of drugs by different methods, Bioassay, hormone assay: RIA and ELISA.		6
Unit-II Methods in Plant Sciences	Effect of plant growth hormones ABA, Gibberelin on plant growth > Enzyme assays. IRGA measurement of chlorophyll a fluorescence to detect abiotic stress using PEA, PAM etc.		6
Unit-II- Methods in Biochemistry & Immunology	Techniques in Isolation, purification and stabilization of proteins from plants and animals, Protein detection methods, Separation based on physical and chemical properties, Common additives, detergents, protease inhibitors. Analysis of purity, estimation of concentration, ELISA, western blot, Heterologous expression		6
Unit IV- Methods in Organ and Tissue culture	Totipotency; Terminology used in Plant Tissue, Cell & Protoplast Culture Media Preparation, Sterilization techniques, Callus & Suspension Cultures. Differentiation, dedifferentiation & Redifferentiation. Explant culture ( root, stem & leaf cultures). Haploidy : Anther , Pollen , Unpollinated Ovary Culture, Bulbosum technique. Protoplast culture, Protoplast fusion techniques.		6
Unit- V Methods in statistical analysis	Basic terminologies in statistics, Hypotheses, Population and sample designs, Random and nonrandom sampling methods, diagrammatic and graphic presentation of data, Frequency distribution, Measures of central tendency, Measures of dispersion, Mean, Standard Deviation, Errors: Types of errors, Standard error; Analysis of Variance (ANOVA), Chi-square test, Post-hoc tests		6

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Paper III : COMPUTER APPLICATIONS		Course code MLSC-721 Credits- 4
	Topic	Lectures
Unit 1	Computer-Fundamentals of computer, Hardware and Software Major Components- Computer Peripherals, CPU, Internal Components, Memory; Input and Output Devices; Generations of Computers	7
Unit 2	Types of Computers; Operating system- Windows (Microsoft Word, Microsoft Power point, Microsoft Excel) and Unix. Multimedia network concepts; Applications of computers	9
Unit 3	Introduction to Internet-IP Address, Uniform Resource Locator. Networking –LAN, MANs, WANs and VPN. Applications of Internet- File Transfer protocol, File sharing, e-mail, the world wide web, Telenet, Voice telephony.	6
Unit 4	Web/Subject Directory-Yahoo, Microsofts MSN Search Engines-Google, AltaVista, Lycos Online Searching of biological Literature-Pubmed, BIOLINE International, Springer Link, UGC-Infonet.	7
Unit 5	Bioinformatics- Introduction and relation to molecular biology. Biological Databases-Primary Secondary and composite databases. Protein Sequence database-TrEMBL, SWISS-PROT, Protein Information Resource (PIR). Nucleotide sequence databases-Genebank, EMBL, DDJB. Structural Database-NDB, PDB, MMDB, SCOP. Analysis-Sequence alignment, Methods of Sequence alignment(BLAST and FASTA); Phylogenetic Analysis	9

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## ELECTIVE PAPERS

This paper will cover the syllabus related to the subject of project work

MSLC – 731	: Plant tissue culture techniques & Applications
MSLC – 741	: Photobiology
MSLC – 751	: Applied & Industrial microbiology
MSLC – 761	: Mammalian Endocrinology and Reproductive physiology
MSLC – 771	: Environmental biology
MSLC – 781	: Immunology
MSLC – 791	: Photosynthesis
MSLC – 801	: Endocrinology and Pharmacology

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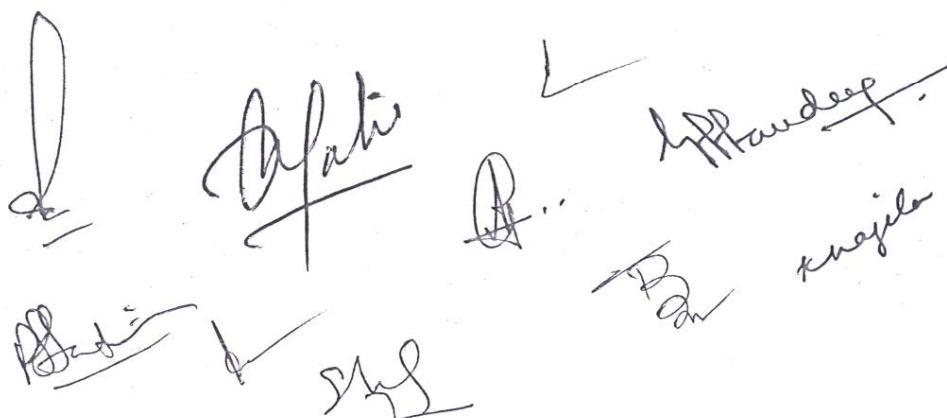
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Plant tissue culture techniques & Applications		Course code MLSC-731 Credits- 4	Lectures
Unit I	Historical background and Indian Scientists contribution in the area of Plant Tissue & Cell Culture. Totipotency . Techniques of cell and tissue culture, sterilization, aseptic tissue transfer. callus, suspension and batch cultures. Culture media - various types of nutrient media, role of growth regulators and additives.		1 1 1 2
Unit II	Differentiation, dedifferentiation and redifferentiation. Somatic embryogenesis and organogenesis in plants, differentiation theory. Clonal propagation and Micro-propagation techniques. Production of disease free plants by tissue culture methods .		2 2 2 1
Unit III	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 1 1 1
Unit IV	Protoplast isolation and culture, and different techniques of fusion of protoplasts. Somatic hybrids, selection methods, intergeneric and interspecific hybrids. Transfer of male sterility genes and the utility of the technique. Applications of somatic hybrids.		2 2 2 2
Unit V	Variability in tissue cultures, somaclonal, gametoclonal and protoclonal variations. Secondary metabolites produced from cell and suspension culture techniques. Application of Tissue & Cell culture in Agriculture, Horticulture and Industry.		2 2 2
<b>Suggested Books:</b>			
<ol style="list-style-type: none"> <li>1. Plant Tissue Culture: S.S. Bhojwani and M. K. Razdan, Elsevier Science, Netherlands</li> <li>2. Plant Cell and Tissue Culture: S. Narayanaswamy, Tata McGraw-Hill Publishing Company Limited, New Delhi.</li> <li>3. Plant Tissue culture: M. K. Razdan, Oxford &amp; IBH Publishing Co. Pvt. Ltd., New Delhi.</li> <li>4. Plant Cell and Tissue Culture: Indra K. Vasil and Trevor A. Thorpe Kluwer Academic Publishers.</li> <li>5. Plant Propagation by Tissue Culture: Edwin F. George, Michael A. Hall and Geert-Jan De Klerk, Springer,</li> <li>6. Basic Cell Culture : J.M. Davis, Oxford Univ. Press, New Delhi</li> <li>7. Plant Tissue Culture Engineering: S. Dutta Gupta and Yasuomi Ibaraki, Springer, Netherlands.</li> <li>8. Plant Biotechnology and Transgenic Plant: Krishi-Marja-Oksman-Caldentey, Wolfgang H. Barz, Marcel Dekker, Inc., New York.</li> <li>9. Principles of Gene Manipulation : Sandy B. Primrose, Richard M. Twyman and R.W. Old, S. B. University Press.</li> <li>10. Introduction to Genetic Engineering of Crop Plants: A. Rashid, I.K. International Publishing House Pvt. Ltd. Delhi.</li> </ol>			

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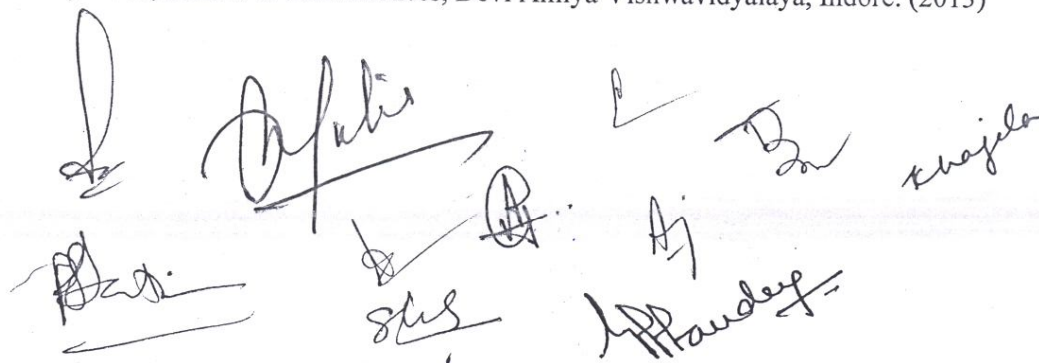
Photobiology		Course code MLSC-741 Credits- 4	Lectures
Unit I	Solar Spectrum and Ozone layer Photo-biological responses and photoreceptors in plants		6
Unit II	Phytochrome – structure, types and functions VLFR, LER and HIR responses Fast responses to phytochrome		6
Unit III	Cryptochrome and blue light photoreceptors Phototropism		6
Unit IV	UV – B photoreceptors; discovery and characterization Impact of UV – B on primary and secondary metabolism Agricultural importance of UV – B		6
Unit V	Photoperiodism in higher plant Florigen concept and biochemical regulation Vernalization and photo- thermal quanta for flowering		6
SUGGESTED BOOKS			
<ol style="list-style-type: none"> <li>1. Plant Growth and Regulation – Wilkins</li> <li>2. Lectures on Photomorphogenesis – H Mohr</li> <li>3. Phytochrome – K Mitrakos and W Shropshire</li> <li>4. Photobiology – Ed Bjorn. Lars Olof [Ed]</li> <li>5. Photobiology – Kohen et al</li> </ol>			

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Applied & Industrial Microbiology		Course code MLSC-751 Credits- 4	Lectures
Unit I	<p><i>Sources of commercially important microorganisms:</i>  <b>Indian Culture collections-</b> MTCC, NCIM, IARI, DMSRDE , HACC , ITCC, NBBCRU, NCDC, NTCCI , UMFFTD, MCC <i>etc.</i></p> <p><b>Major culture collections world over:</b> NRRL, ATCC, IFO, VKPM, AGAL <i>etc.</i></p> <p><i>Isolation of microorganisms from natural resources:</i>            Isolation of microbes producing growth promoting and growth inhibitory biochemicals .</p>		5
Unit II	<p><i>Isolation of microbes capable of degrading specific compounds:</i>            Isolation of microorganisms degrading Starch, Protein, Cholesterol and Cellulose.</p> <p><i>Isolation of Microbes useful in agriculture:</i> Rhizobium, PSM.</p> <p><i>Mutagenesis of bacterial culture by physical and chemical agents:</i> UV and NTG mutagenesis.</p>		5
Unit III	<p><i>Identification and selection of desired mutant blocked at specific sites of metabolism:</i>            Random selection and selection based on genetic, physiological and biochemical markers.</p> <p><i>Testing the efficiency of selected mutants in shake flask cultures:</i> Optimization of bioconversion parameters- Medium composition, pH, DO, Temperature, Inoculum age and size.</p>		5
Unit IV	<p><i>Extraction of product from broth cultures.</i> : Concept of Batch, staged, differential and fractional extractions</p> <p><i>Purification of biochemicals produced by microorganisms.:</i> Precipitation and Crystallization</p>		5
Unit V	<p><i>Chromatographic separation of microbial products and their identification.</i></p> <p><i>Quantification of microbial products by TLC, GC and HPLC.</i></p> <p><i>Basic concepts of submerged and solid state fermentation.</i></p>		5
<p><b>Suggested books:</b></p> <ol style="list-style-type: none"> <li>1. Principles of Fermentation Technology (2<sup>nd</sup> Edn.), Stansby P.F, Whitaker, A and Hall, S, Pergamon Press, Elsevier, Oxford</li> <li>2. Industrial Microbiology, G.Reed, McMillan Press London</li> <li>3. Industrial Microbiology, G. Reed (Editor), CBS Publishers (AVI Publishing Company)</li> <li>4. Biology of Industrial Microorganisms. A.L. Demain.</li> <li>5. Textbook of Industrial Microbiology, - A. H. Patel.</li> <li>6. Industrial Microbiology - L. E. Cassida</li> <li>7. Biochemical Engineering Fundamentals, J.E Bailey &amp; Ollis, DF, Mc.Graw Hill, India</li> <li>8. Bioprocess monitoring and control, Pons. M.N., Carl Hanser Verlag, Munich</li> <li>9. Process Engineering in Biotechnology, A.T Jackson Open University Press</li> </ol> <p>Bioprocess Engineering. – Michael Shiler and Kargi.</p>			

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<b>Mammalian Endocrinology &amp; Reproductive Physiology</b>		<b>Course code MLSC-761</b>	<b>Lectures</b>
		<b>Credits- Theory- 4</b>	
<b>Unit I</b>	<b>Basic concept of Endocrinology :</b> Hormones and pheromones: Basic criteria and their effects; Different mechanisms of hormone action; Feed back mechanism of hormones: Short loop, Long loop and ultra short feed back; Out line of different Endocrine glands , their locations, main hormones, biochemical nature and basic functions.		6
<b>Unit II</b>	<b>The Thyroid Gland:</b> Introduction; Anatomic features; Different thyroid hormones; types, biochemistry, synthesis, release, transport and metabolism; Effects of thyroid hormones and relative efficacy; Regulation of thyroid functions; Clinical importance: hyperthyroidism and hypothyroidism.		6
<b>Unit III</b>	<b>The Pancreas:</b> Introduction; Islets of Langerhans, Endocrine function of different islet cells, Insulin; structure, biosynthesis and secretion; Effects of insulin and mechanism of actions; Insulin deficiency and excess; Diabetes mellitus and its types; Symptoms, cure and prevention; Glucagon and its effects.		6
<b>Unit IV</b>	<b>Reproductive Physiology of Male:</b> Seasonal and continuous reproduction; Structure of testis, Endocrine and non-endocrine functions; Puberty; Abnormalities in male reproductive functions; Different methods of male fertility control.		6
<b>Unit V</b>	<b>Reproductive Physiology of Female:</b> Structure of ovary, Endocrine and non-endocrine functions; Puberty; Estrus and Menstrual cycles; Ovulation and menopause; Abnormalities in reproductive functions; Different methods of fertility control in human females.		6

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Environmental Biology		Course code MLSC-771 Credits- Theory- 4	Lectures
Unit I	Ecology and Environment, Ecological factors: Light and temperature; Conservation of flora and fauna: The endangered species; Biodiversity and natural resources.		5
Unit II	Environmental Segments- Concept and scope; Animal interrelationships; Animal adaptations, Population and environment.		5
Unit III	Environmental hazards; Oxygen and Ozone chemistry and significance; Green house effect, Sewage and waste water treatments. Noise pollution.		5
Unit IV	Environment and Community health; Fundamentals of toxicology; Environmental carcinogenesis. Toxicity of pesticides and organic solvents.		5
Unit V	State of the global environment; Natural resources, Energy and environment. Environmental management and audit; Environmental movements.		5
Suggested books:			
<ol style="list-style-type: none"> <li>1. Ecology- Subrahmanyam N.S. and AVSS Sambamurthy, Narosa Publications.</li> <li>2. Essentials of Environmental Science by Vasudevan, N. , Narosa Publications.</li> <li>3. Environmental Pollution: Health and Toxicity by SVS Rana, Narosa Publications.</li> <li>4. Environmental Chemistry by A.K.Dey , New Age International</li> </ol>			

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Immunology		Course code MLSC-781 Credits- Theory- 4	Lectures
Unit I	Acquired and Innate Immunity and its components, clonal selection theory		6
Unit II	Classical , Lectin and Alternative complement pathways, regulation and assay		6
Unit III	Antigen presentation and role of MHC in Immune response		6
Unit IV	Immune response to bacterial , viral and parasitic disease and their evasion		6

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Revised

ELECTIVE-I: PHOTOSYNTHESIS		Course code MLSC-791 Credits- Theory- 4	Lectures
Unit I	<i>History of Photosynthesis, Oxygenic and Anoxygenic photosynthesis, types and functions of Photosynthetic pigments, energy transfer mechanisms, Forsters resonance energy transfer (FRET)</i>		6
Unit II	<i>Light reactions: structure and function of Photosystem II, components of oxygen evolving complex, mechanism of oxygen evolution, S-state cycle, primary photochemistry, Q-cycle</i>		6
Unit III	<i>Light reactions: linear and non-linear Electron transport chain, Photosystem I, cyclic electron flow around PS II and PS I, structure and function of ATP synthase complex, binding change model of ATP synthesis.</i>		6
Unit IV	<i>Dark reactions: Calvin cycle, Rubisco: functions and regulation, Photorespiration, C<sub>3</sub>, C<sub>4</sub> and CAM mechanisms to adapt to photorespiration, regulation of dark reactions by light reactions</i>		6
Unit V	<i>Stress Physiology: Morphological and Physiological responses of high temperature, high salt stress, water stress. Effects of these stresses on the process of photosynthesis.</i>		6

**Proposed Books:**

1. Molecular mechanism of Photosynthesis: by R.Blankenship
2. Introductory Plant Physiology: by Noggle and Fritz
3. Handbook of Photosynthesis: by M Pessarkali
4. Plant Physiology: by L Taiz and E Zeiger
5. Stress responses of photosynthetic organism: K Satoh and N Murata

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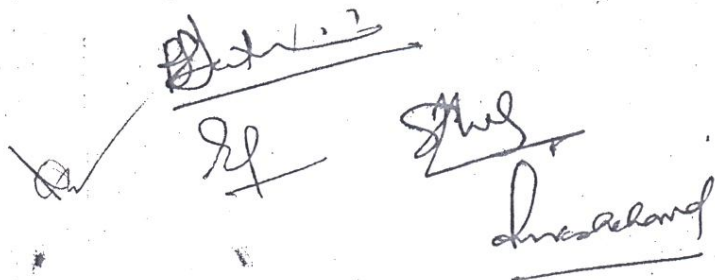
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Endocrinology and Pharmacology		Course code MLSC-801	Lectures
		Credits-Theory-4	
Unit-1	Concepts in endocrinology, overview of endocrine system, endocrine glands, incretin effect, endocrine disorder, molecular mechanism of hormone actions, feedback loop.		6
Unit-2	Drugs, hormones as drugs, types of drugs, Drug hormone interaction, chronic medication and hormones, commercial production of hormones, LC50, LD50, IC50		6
Unit-3	Concepts of bio-therapeutics, routes of drug administration, ligand-receptor interactions, factors affecting drugs absorption, pathway of drugs metabolism, drugs excretion.		6
Unit-4	Model organisms, spontaneous and induced models, creation of disease models, animals models of screening of anti-diabetic, cardio-protective, anti-inflammatory, hepato-protective, anti-tumour, anti-malarial and metabolic syndromes.		6
Unit-5	Types of in vivo studies, evaluation of natural molecules, Pre-clinical studies, clinical studies, enzymes inhibitors as drug candidates, isolation of enzyme inhibitors.		6

**Suggested books:**

1. *Ganong's Review of Medical Physiology*, Ganong WF, 23<sup>rd</sup> Edition, Mc Graw Hill Pub.
2. *Guyton and Hall Textbook of Medical Physiology*. John E. Hall, 12<sup>th</sup> Edition
3. *Biomedical Research*, Jagadeesh G, Murthy S & Gupta YK, Prakash A. 1<sup>st</sup> Edition, Lipincott Williams & Wilkins.
4. *Practical Manual of Experimental and Clinical Pharmacology*. Medi B & Prakash A. 1<sup>st</sup> Edition, Jaypee Bros.
5. *Pharmacology and Pharmacotherapeutics*. Satoskar RS & Bhandarkar SD, 13<sup>th</sup> Edition
6. *Clinical Pharmacology*, Laurence DR, 8<sup>th</sup> Edition, Churchil Livingstone


  
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## SYLLABUS FOR Ph.D. COURSE WORK (BOTANY)

Course	Title	Credits
I	Research Methodology	4
II	Review of published research in the relevant field	3
III	Computer Applications	3
IV	Research Methodology in Subject – Botany	3
V	Comprehensive Viva-Voce	3
	<b>Total credits</b>	<b>16</b>

### COURSE - 1- RESEARCH METHODOLOGY

**Objective:** To gain knowledge in general about research and its methodologies and common tools and techniques adopted for pursuing research.

Introduction to research	Introduction to Research, Formal Science and Empirical Science, Scientific Research, Research Types, Research Design Process, Errors in Research. Formulation of research problem, Hypothesis, hypothesis generation, null and alternate hypothesis, Hypothesis testing. Data collection: Primary and secondary data, measurement scales nominal, ordinal ratio and interval, sampling.
Research Ethics	Nature and purpose of ethics, Ethical Norms. Introduction, Overview, and Research Misconduct. Selected topics, including: Data Management, Bias, Conflict of Interest, plant and Animal Subjects, Stem Cells, Authorship, Publication, Peer Review, Collaboration, Mentoring, Social Responsibility and Whistle blowing.
Statistical Methods	Data Analysis: Data presentation use of various charts like bar charts, histograms etc. Descriptive Statistics: Measures of central tendency and dispersion, Probability distributions – Normal, Binomial and Poisson distribution. Parametric and non-parametric statistics. Quantitative techniques: Levels of significance, Regression and correlation coefficient. Use of computers in quantitative analysis.
Research Paper Writing	Introduction to publications. Research Journals (types), Peer review process, Paper submission (Offline and online submission). Research paper writing steps and process. IMRAD system, Paper presentations, Report writing (Including pre-writing considerations and Thesis writing).

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# SYLLABUS FOR Ph.D. COURSE WORK (BOTANY)

Paper: Research Methodology: Credits = 3

## UNIT 1 - Biodiversity Techniques for Assessment and Conservation; Field and Herbarium Methods and Microtomy; Histochemical techniques and Ethnobotany:

- (I) Biodiversity Techniques for Assessment and Conservation - Biodiversity assessment techniques: Baseline studies, Monitoring & Modeling Techniques. Conservation Techniques.
- (II) Field and Herbarium Methods- Purpose of plant collection; kinds of field work, documentation, drying and preservation; identification, Artificial key preparation of specimens.
- (III) Microtomy and Histochemical techniques.
- (IV) Ethnobotany – general ideas about Ethnobotanical studies and medicinal plants.

## UNIT 2 - Cytogenetical techniques, Colorimetry and Spectrophotometry:

- (I) Cytogenetical techniques -Mitotic and meiotic chromosome preparations techniques.
- (II) Colorimetry and Spectrophotometry -UV and visible light spectroscopy ; Infrared and Raman spectroscopy; resonance Raman's spectroscopy; Nuclear Magnetic Resonance (NMR); Electron Spin Resonance spectroscopy (ESR)-principle, instrumentation and application

## UNIT 3- Chromatography, Electrophoretic Techniques, Nucleic Acids and Molecular Marker:

- (I) Chromatography -General Principle; types and applications: TLC, GLC and HPLC.
- (II) Electrophoretic Techniques - separation of protein by SDS-PAGE.
- (III) Nucleic Acids (Isolation; purification) and molecular marker (RFLP; RAPD; ISSR) - Isolation of Plant genomic DNA, restriction digestion of plasmid DNA; Polymerase chain reaction, RAPD and ISSR. analysis of its markers.
- (IV) Plant tissue culture techniques- Plant tissue culture media preparation and culture of explants segments; Micropropagation via organogenesis and somatic embryogenesis; cell suspension culture; anther and embryo culture; determination of genetic fidelity. encapsulation technique for artificial seed production.

## UNIT 4- Plant Breeding, Palynological Techniques , Palaeobotanical Techniques :

- (I) Plant Breeding – Conventional plant breeding, mutation breeding, QTL mapping and Marker assisted selection for crop improvement .
- (II) Palynological Techniques -Palynological processing; Contamination; Acetolysis technique: Residue mounting, embedding and storage.
- (III) Palaeobotanical Techniques.

## UNIT 5 - Mycology and Plant Pathological techniques and Techniques in Phycology and Pollutants:

- (I) Mycology and Plant Pathological techniques- Isolation of pathogenic microorganisms– methods and biochemical characterization. Isolation of soil fungi and Screening techniques for antimicrobial activity; Long-term storage of plant pathogens.
- (II) Techniques in Phycology–Algal sampling: Phytoplankton, benthos and periphyton; preservation, processing and analysis of phytoplankton; diatoms; cyanobacteria; estuarine and marine forms; freshwater culture and mass cultivation of algae; techniques for extraction.
- (III) Pollutants- Analysis of water, soil and air; measurement of BOD, COD, pH, Conductivity, Carbon and Nitrogen.

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### Course-III Computer Applications.

Objective : To gain theoretical knowledge and practical experience about the use of various Computer software and statistical tools for application in research work.

Unit-I MS Word	Features and applications related to presentation of text in suitable format and saving the data for future applications.
Unit-II MS Excel	Construction of power point presentation from the experimental data. Design and application of formulae for calculation and their application to the experimental data. Use of Statistical tools, in preparation of graphs, histograms, charts and diagrams. Use of various presentation techniques.
Unit-III MS Power Point	Preparation of power point presentation based on the topic of research. Insertion of figures, graphs, charts in presentation. Preparation of scientific posters for presentation Use of various presentation techniques.
Unit-IV Use of SPSS & Internet Applications.	Methods of preparation of data sheets and entering the data according to its characteristics. Use of various statistical tools on SPSS. Overview of networking, Internet and its applications. Exploring various websites and search engines for collecting quality literature and secondary data related to research work.
Unit-V Bioinformatics	What is bioinformatics and its relation with molecular biology. Examples of related tools (FASTA, BLAST, RASMOL), Databases(GENBANK, Pubmed, PDB ) and software(RASMOL, Ligand Explorer). Introduction to Sequences and alignments; Local alignment and Global alignment, Phylogenetic analysis.

### Course-IV Review of Literature :

**Objectives : To collect the available literature in the chosen field of research, preparation of chronological order about the development of various sub-topics in the field, identification of gaps in the knowledge and preparation of objectives to bridge those gaps.**

Sources of research material, literature survey, compiling records.

Kinds of scientific documents-research paper, review paper, book review, theses and conference and project reports.

Components of a research paper-IMRAD system, title, author and addresses, abstracts.

Dealing with publishers-submission of manuscripts and ordering reprints.

Oral and poster presentation of research papers in conference/symposia.

Preparation and submission of research projects proposal to funding agencies.

To develop communication skills for presentation of research findings.

To understand and follow ethical issues in research.

**Respective supervisors will evaluate literature reviews submitted by the student and recommend the topic for registration. The supervisor will also help in developing communication skill and address ethical issues in research.**

**Comprehensive Viva: As per the provision of Ordinance-31, a student will appear for comprehensive viva.**



## SYLLABUS FOR Ph.D. COURSE WORK [LIFE SCIENCES]

COURSE	TITLE	CREDITS
COURSE-I	Research Methodology	4
COURSE-II	Research Methodology in Life Sciences	3
COURSE-III	Computer Application	3
COURSE-III	Review of Literature	3
	Comprehensive Viva	3
	Total Credits	16

**COURSE - I- RESEARCH METHODOLOGY**

**Objective:** To gain knowledge in general about research and its methodologies and common tools and techniques adopted for pursuing research.

<b>Unit I</b> Introduction to research	Introduction to Research, Formal Science and Empirical Science, Scientific Research, Research Types, Research Design Process, Errors in Research. Formulation of research problem.
<b>Unit II</b> Hypothesis and data collection	Hypothesis, hypothesis generation, null and alternate hypothesis, Hypothesis testing. Data collection: Primary and secondary data, measurement scales nominal, ordinal ratio and interval, sampling
<b>Unit III</b> Research Ethics	Nature and purpose of ethics, Ethical Norms. Introduction, Overview, and Research Misconduct. Selected topics, including: Data Management, Bias, Conflict of Interest, Animal Subjects, Human Subjects, Stem Cells, Authorship, Publication, Peer Review, Collaboration, Mentoring, Social Responsibility and Whistle blowing.
<b>Unit IV</b> Biostatistics	Measures of central tendency and Dispersion. Probability distribution- Normal, Binomial and Poisson distribution. Parametric and Non-parametric statistics, Confidence interval. Errors. Quantitative Techniques, Levels of significance. Regression and Correlation coefficient. Use of computers in Quantitative analysis.
<b>Unit V</b> Research Paper Writing	Introduction to publications. Research Journals (types), Peer review process, Paper submission (Offline and online submission). Research paper writing steps and process. IMRAD system, Paper presentations, Report writing (Including pre-writing considerations and Thesis writing).

**Course-II Research Methodology**

Objective : To gain theoretical knowledge and practical experience about various methodologies commonly employed in research field of Life Sciences.

<b>Unit-I</b> Microbiological Methods	Solid and liquid culture media. Sources of types strains of microorganisms. Revival of culture from lyophilized ampoules. Preservation and maintenance of microbial cultures. <b>Techniques of plant tissue and cell culture : Explant Culture, Anther and pollen culture, protoplast culture and protoplast fusion. **</b>
<b>Unit-II</b> Analytical Methods	Chromatography: Principle, design and application of TLC, GC and HPLC. Electrophoresis: Agarose and Polyacrylamide Gel Electrophoresis (PAGE,SDS,PAGE) Centrifugation: Types of rotors, Ultracentrifugation. Spectroscopy : Basic principles and applications of UV-Visible Spectrophotometry
<b>Unit-III</b> Methods in Physiology	Various assay procedures: Bioassay, hormones assay by RIA and ELISA. Safety evaluation of drug/compound. Basic principles of Management of laboratory animals. Plant hormone assays Methods to study photosynthesis in plants
<b>Unit-IV</b>	Production of antibodies from laboratory animals. Monoclonal antibodies. Western blot methods of band detection. Isolation of various immune cells and their functional assays. Proteomics, methods and applications.
<b>Unit-V</b> Methods in Molecular Biology.	Isolation, purification and separation of nucleic acids. Hybridization techniques-Southern and Northern Blotting. Polymerase chain reaction and its applications. Microarray, RT PCR.

\*\* Added in BoS meeting dated 5/12/2017.

### **Course-III Computer Applications.**

Objective : To gain theoretical knowledge and practical experience about the use of various Computer software and statistical tools for application in research work.

Unit-I MS Word	Features and applications related to presentation of text in suitable format and saving the data for future applications.
Unit-II MS Excel	Construction of power point presentation from the experimental data. Design and application of formulae for calculation and their application to the experimental data. Use of Statistical tools, in preparation of graphs, histograms, charts and diagrams. Use of various presentation techniques.
Unit-III MS Power Point	Preparation of power point presentation based on the topic of research. Insertion of figures, graphs, charts in presentation. Preparation of scientific posters for presentation Use of various presentation techniques.
Unit-IV Use of SPSS & Internet Applications.	Methods of preparation of data sheets and entering the data according to its characteristics. Use of various statistical tools on SPSS. Overview of networking, Internet and its applications. Exploring various websites and search engines for collecting quality literature and secondary data related to research work.
Unit-V Bioinformatics	What is bioinformatics and its relation with molecular biology. Examples of related tools (FASTA, BLAST, RASMOL), Databases(GENBANK, Pubmed, PDB ) and software(RASMOL, Ligand Explorer). Introduction to Sequences and alignments; Local alignment and Global alignment, Phylogenetic analysis.

### **Course-IV Review of Literature :**

**Objectives : To collect the available literature in the chosen field of research, preparation of chronological order about the development of various sub-topics in the field, identification of gaps in the knowledge and preparation of objectives to bridge those gaps.**

Sources of research material, literature survey, compiling records.

Kinds of scientific documents-research paper, review paper, book review, theses and conference and project reports.

Components of a research paper-IMRAD system, title, author and addresses, abstracts.

Dealing with publishers-submission of manuscripts and ordering reprints.

Oral and poster presentation of research papers in conference/symposia.

Preparation and submission of research projects proposal to funding agencies.

To develop communication skills for presentation of research findings.

To understand and follow ethical issues in research.

**Respective supervisors will evaluate literature reviews submitted by the student and recommend the topic for registration. The supervisor will also help in developing communication skill and address ethical issues in research.**

**Comprehensive Viva: As per the provision of Ordinance-31, a student will appear for comprehensive viva.**

SCHOOL OF LIFE SCIENCES, D.A.V.V.,INDORE.

**SYLLABUS FOR Ph.D. COURSE WORK [Zoology]**

COURSE	TITLE	CREDITS
COURSE-I	Research Methodology	4
COURSE-II	Research Methodology in Zoology	3
COURSE-III	Computer Application	3
COURSE-III	Review of Literature	3
	Comprehensive Viva	3
	Total Credits	16

**COURSE - I- RESEARCH METHODOLOGY**

**Objective:** To gain knowledge in general about research and its methodologies and common tools and techniques adopted for pursuing research.

<b>Unit I</b> Introduction to research	Introduction to Research, Formal Science and Empirical Science, Scientific Research, Research Types, Research Design Process, Errors in Research. Formulation of research problem.
<b>Unit II</b> Hypothesis and data collection	Hypothesis, hypothesis generation, null and alternate hypothesis, Hypothesis testing. Data collection: Primary and secondary data, measurement scales nominal, ordinal ratio and interval, sampling
<b>Unit III</b> Research Ethics	Nature and purpose of ethics, Ethical Norms. Introduction, Overview, and Research Misconduct. Selected topics, including: Data Management, Bias, Conflict of Interest, Animal Subjects, Human Subjects, Stem Cells, Authorship, Publication, Peer Review, Collaboration, Mentoring, Social Responsibility and Whistle blowing.
<b>Unit IV</b> Biostatistics	Measures of central tendency and Dispersion. Probability distribution- Normal, Binomial and Poisson distribution. Parametric and Non-parametric statistics, Confidence interval. Errors. Quantitative Techniques, Levels of significance. Regression and Correlation coefficient. Use of computers in Quantitative analysis.
<b>Unit V</b> Research Paper Writing	Introduction to publications. Research Journals (types), Peer review process, Paper submission (Offline and online submission). Research paper writing steps and process. IMRAD system, Paper presentations, Report writing (Including pre-writing considerations and Thesis writing).

*Sanjila*

*H. P. Handeep*

*Dr. C. S. Shrivastava*  
*CPA M. V. P. Swinethan*

**DAVV, INDORE**  
**SYLLABUS FOR Ph.D. COURSE WORK**  
**ZOOLOGY (2017-18)**

Course-I – RESEARCH METHODOLOGY (Zoology)

Unit – I	Concept of research, scope and importance, Scientific Writing. Animal house Management, laboratory and field experimental data collection and analysis, Rule and regulation for animal experiments.
Unit – II	Chromatography: Principle, design and application of TLC, GC and HPLC Electrophoresis: Agarose and Polyacrylamide Gel Electrophoresis (PAGE, SDS PAGES). Centrifugation: Types of rotors, Ultracentrifugation. Spectroscopy: UV-Visible spectrophotometry, Atomic Absorption Spectroscopy.
Unit – III	Microscopy – Simple, compound, Phase contrast and Electron Microscope. Microtome and microtomy.
Unit – IV	Staining techniques: Histological (Single, double and triple Staining) and Histochemical techniques (Basic : Protein, Lipids and Carbohydrates- PAS). Biochemical Techniques – Protein, nucleic acid, SGOT, SGPT, Blood Glucose estimation.
Unit – V	Water Sampling & Water analysis- Chloride, DO, BOD, COD, Turbidity Alkalinity, PO <sub>4</sub> , SO <sub>4</sub> , pH and Nitrate.

*Senajala*

*Appaandeeep*

*Dr. S. Shrinika*

*Dr. M. P. Sankar*

### Course-III Computer Applications.

**Objective :** To gain theoretical knowledge and practical experience about the use of various Computer software and statistical tools for application in research work.

Unit-I MS Word	Features and applications related to presentation of text in suitable format and saving the data for future applications.
Unit-II MS Excel	Construction of power point presentation from the experimental data. Design and application of formulae for calculation and their application to the experimental data. Use of Statistical tools, in preparation of graphs, histograms, charts and diagrams. Use of various presentation techniques.
Unit-III MS Power Point	Preparation of power point presentation based on the topic of research. Insertion of figures, graphs, charts in presentation. Preparation of scientific posters for presentation Use of various presentation techniques.
Unit-IV Use of SPSS & Internet Applications.	Methods of preparation of data sheets and entering the data according to its characteristics. Use of various statistical tools on SPSS. Overview of networking, Internet and its applications. Exploring various websites and search engines for collecting quality literature and secondary data related to research work.
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*Senajida*

*Dr. Handeep*

*Dr. S. Srinobas*  
*(To M. P. Chandra)*