

M. SC. LIFE SCIENCES

The syllabus for M. Sc. Life Science based on semester with credit based pattern comprises of four semesters. The examination shall be of 04 core theory papers, each with 4 credits ($4 \times 4 = 16$ credits), 2 elective papers of 2 credits each ($2 \times 2 = 4$ credits), 1 laboratory course of 4 credits ($1 \times 4 = 4$ credits) and 1 moral/remedial/community service paper of 1 credit ($1 \times 1 = 1$ credit). The fourth semester consists of 2 core papers for 12 and 8 credits and 2 elective papers of 2 credits each ($2 \times 2 = 4$ credits) and one compulsory paper with 1 credit ($1 \times 1 = 1$ credit). Thus, each semester offers 24 credits ($4 \times 24 = 96$ credits). Each 4 credit theory paper is equivalent to 100 marks and the laboratory course consists of four modules (i.e. one module from each core paper). The Examination in each theory paper and laboratory course shall be of three hours duration.

Special Features of Our Programme

1. Dual Degree course
2. Special syllabi on the pattern of UGC -NET with Research/Professional Orientation
3. Choice Based Credit System (CBCS)
4. Semester Pattern

Eligibility criteria:

1. Graduate degree in any discipline of Life Sciences/Animal Science/Agricultural Sciences/Medical Sciences or other allied subjects like Biotechnology/ Microbiology/ Biochemistry with 50% (40% for SC/ST/PH) aggregate marks from a recognized University.
2. Reservation as per University rules.

BABASAHEB BHIMRAO AMBEDKAR UNIVERSITY
Department of Applied Animal Sciences
Syllabus of M. Sc. Life Science as per UGC Guidelines on CBCS
Course Structure

Semester – I					
Sl. No.	Paper Code	Paper Title	Type	L+T+P	Total Credits
1.	LS-101	Physical and Biological Chemistry	Core Course	3+1+0	04
2.	LS-102	Principles of Microbial Sciences	Core Course	3+1+0	04
3.	LS-103	Molecular Cell Biology	Core Course	3+1+0	04
4.	LS-104	Developmental Biology and Toxicology	Core Course	3+1+0	04
5.	LS-105	Laboratory Course (Module I,II,III,IV)	Core Course	0+0+4	04
Any two from following					
1.	LS-106	Population Ecology	Elective Course	2+0+0	02
2.	LS-107	Biodiversity Conservation	Elective Course	2+0+0	02
3.	LS-108	Biochemistry	Elective Course	2+0+0	02
Compulsory Course					
*	MPDC-105	Remedial Language Course (English/Hindi)	Foundation Course	-	01
Semester – II					
Sl. No.	Paper Code	Paper Title	Type	L+T+P	Total Credits
1.	LS-201	Principles of Plant Sciences	Core Course	3+1+0	04
2.	LS-202	Mammalian Physiology	Core Course	3+1+0	04
3.	LS-203	Ethology & Evolution	Core Course	3+1+0	04
4.	LS-204	Inheritance Biology & Genetics	Core Course	3+1+0	04
5.	LS-205	Laboratory Course (Module I,II,III,IV)	Core Course	0+0+4	04
Any two from following					
1.	LS-206	Population Genetics and Evolution	Elective Course	2+0+0	02
2.	LS-207	Principles of Parasitology	Elective Course	2+0+0	02
3.	LS-208	Medical and Veterinary Entomology	Elective Course	2+0+0	02
Compulsory Course					
*	MPDC-205	Moral Studies	Foundation Course	-	01
Semester – III					
Sl. No.	Paper Code	Paper Title	Type	L+T+P	Total Credits
1.	LS-301	Immunology & Immunotechnology	Core Course	3+1+0	04
2.	LS-302	Analytical & Separation Techniques	Core Course	3+1+0	04
3.	LS-303	Bioinstrumentation	Core Course	3+1+0	04
4.	LS-304	Molecular Biology and Animal Biotechnology	Core Course	3+1+0	04
5.	LS-305	Laboratory Course	Core Course	0+0+4	04
Any two from following					
1.	LS-306	Aquarium Management	Elective Course	2+0+0	02
3.	LS-307	Fish Processing Technology	Elective Course	2+0+0	02
4.	LS-308	Conservation of Exploited Fisheries resources	Elective Course	2+0+0	02
Compulsory Course					
*	MPDC-305	Community Service	Foundation Course	1+0	01
Semester – IV					
Sl. No.	Paper Code	Paper Title	Type	L+T+P	Total Credits
1.	LS-401	Dissertation and Viva-voce	Core Course	2+2+8	12
2.	LS-402	Study Tour/Field Attachment and Viva-voce	Core Course	-	08
Any two from following					
1.	LS-403	Techniques and Tools for Biology	Elective Course	2+0+0	02
2.	LS-404	Biostatistics and Bioinformatics	Elective Course	2+0+0	02
3.	LS-405	Good Laboratory Practices and Research Methodology	Elective Course	2+0+0	02
Compulsory Course					
*	MPDC 405	Ambedkar Studies	Foundation Course	1+0	01

SEMESTER I

LS 101: Physical and Biological Chemistry

Credit: 4

Total Marks: 70

Unit – 1 : Chemical Foundation

- Structure of Atom, Molecules, Chemical bonds and Stabilizing interactions
- Acids , Bases , Salts , pH , Reaction kinetics
- Properties of water, Solutions, Buffers.
- Physico-chemical properties of the living cell.

Unit – 2 : Energy and Thermodynamics

- Bioenergetics, oxidative phosphorylation, Coupled reaction, Group transfer
- First and second Law of thermodynamics, Concept of Free energy
- Principles of catalysis, Enzymes and Enzyme kinetics, Enzyme regulation
- Allosteric enzymes and Isozymes

Unit – 3 : Biomolecules - I

- Classification, Nomenclature, Structure and properties of carbohydrates
- Structure and functions of Lipids: Phospholipids and Glycolipids.
- Structure and functions of Steroid
- Metabolism of carbohydrate and lipids

Unit – 4 : Biomolecules - II

- Structures, physical properties and functions of amino acids.
- Conformation of proteins(primary, secondary, tertiary, quaternary domains, motifs)
- Conformation of nucleic acids [helix, (A,B,Z), t-RNA, micro RNA]
- Metabolism of amino acids and nucleotides

Suggested Readings:

- Lehninger Biochemistry, Nelson & Cox 6th edition, W.H. Freeman & Company
- Harper's Illustrated Biochemistry by Robert K. Murray, Lange
- Biochemistry C.K. Mathews, K. E. Van Holde, K. G. Ahern Pearson Education , N Delhi 2003
- Biochemistry J. M. Berg, J. L. Tymoczko & L. Stryer W.H.Freeman & Co., NY 2004
- Biochemistry and Mol. Biology W.H. Elliott & D.C. Elliott Oxford Press, Oxford 2005
- Chemistry for Life Sciences Sutto R., Rockett B. & Swindells P Taylor & Francis, London 2000

LS102 : Principles of Microbial Sciences

Credit: 4

Total Marks: 70

Unit – 1 : Microbial Taxonomy

- Importance and systems of Classification
- Status of Microorganisms into kingdoms
- Basic principles of nomenclature and classification
- Criteria used for classification and identification of microorganisms

- Genetic approaches used for microbial taxonomy.
- Numerical Taxonomy
- Bergey's Manual
- Present State of Bacterial, fungal and Viral taxonomy

Unit – 2: Morphology, Reproduction and Significance

- Bacteria – *Staphylococcus* (Gram positive) and *Escherichia* (Gram negative) as model examples
- Moulds – *Rhizopus*, *Penicillium*, *Puccinia* as model examples
- Yeasts – *Saccharomyces* as model example
- Bacterial Viruses – Coliphage T₄ and Lamda phage as model examples
- Animal Viruses – Adenovirus and Influenza virus as model examples
- Plant Viruses – TMV as model example

Unit – 3: Microbial physiology and Genetics

- Principles of microbial nutrition :
 - a) Modes of uptake of nutrients in microorganisms
 - b) Nutritional requirements of microorganisms
 - c) Nutritional classification of microorganisms
- An overview of microbial metabolism
- Microbial growth :
 - d) Growth in prokaryotes and modes of cell division
 - e) Mathematical nature and expression of growth.
 - f) Normal growth curve of microbial population and Diauxic growth .
 - g) Continuous cultivation of microorganisms.
 - h) Methods for measurement of microbial growth.
 - i) Effect of environment on microorganisms
- General principles of Microbial Genetics:
 - DNA and its replication
 - Bacterial plasmids and Transposable elements
 - Recombination methods: Transfection, Transduction, Conjugation, Parasexuality.

Unit – 4: Elements of Microbial Technology:

- Concept of fermentation, Range of fermentation products and processes
- Sources of Industrial Microbes: Isolation, Selection and Screening of industrially important microbes,
- Strain improvement programme,
- Media formulations for fermentation process,
- Bioreactor design,
- Optimization and control of fermentation process parameters,
- Scale-up and scale-down in bioprocess,
- Typical Microbial Fermentation Products :
 - I. Antibiotics : Penicillin,
 - II. Enzymes : Amylase,
 - III. Organic acids : Citric acid
 - IV. Organic solvents : Ethanol
 - V. Amino acids : Lysine
 - VI. Vitamins : B12

Suggested Readings:

- Dairy Microbiology H. A. Modi Aaviskar Pub, Jaipur 2009
- Developments In Food Microbiology R. Davis Applied Sci. Publ., London 2004
- Elementary Microbiology, Vol. 1 & 2 H. A. Modi Akta Prakasan, Nadiad 1996
- Food Microbiology M.R. Adams and M.O. Moss, The Royal Society of Chemistry ; Cambridge 2000
- General Microbiology M. M. Michael, J. Stanier *et al* Latest
- Introductory Food Microbiology H.A. Modi Aavishkar Pub., Jaipur 2007
- Principles of Microbiology R. M. Atlas

LS 103 : Molecular Cell Biology

Credit: 4

Total Marks: 70

Unit – 1: Evolution of the Cell:

- Cell as a unit of living organisms.
- Diversity of cell size and shapes,
- Structure of Prokaryotic and Eukaryotic cells,
- Single cell to multicellular organism
- Cell - Cell interactions; Cell adhesions, and cell junctions
- Molecular Basis of the Cell and Macromolecular recognition process

Unit – 2: Biomembrane and Cytoskeleton :

- Molecular organization of Biomembrane: Ultrastructure and molecular composition of membrane,
- Physical and Dynamic properties of membrane,
- Movement of molecules/ions across biomembrane and Human perspective-defects in ion channels.
- Cytoskeleton topography: Membrane Cytoskeleton interactions,
- Microtubule and its dynamics, motor proteins,
- Microfilament and its functions, Intermediate filaments and their functions

Unit – 3: Cell Organelles I:

- Molecular organization of Mitochondria
- Respiratory Chain Complexes – Organization and Stoichiometry,
- Q- cycle, Mechanism of Oxidative Phosphorylation, uncouplers and inhibitors;
- Molecular organization of Chloroplast,
- Photosynthetic pigments, Photosystem I & II
- Ultrastructure and Functions of Nucleus

Unit – 4: Cell Organelles II:

- Molecular Organization and functions of:
- Endoplasmic reticulum,
- Golgi complex
- Lysosomes and disease;
- Microbodies: Peroxisomes
- Ribosomes

Suggested Readings:

- Cell and Molecular Biology De Robertis, E.D.P. and De Robertis E M F
- Cell and Molecular Biology Garald Karp J. Wiley & Sons, NY
- Cell Biology – Structure and Function David E. Sadawa, Jones and Barttett Pub., IND.
- Cell Biology LabFax G.B.Dealtry & D. Rickwood Bios Scientific Pub.
- Cell Biology, Genetics, Molecular Biology, Evolution and Ecology P.S. Verma, V.K. Agarwal S. Chand Pub., N Delhi
- Cell Growth and Division, A Practical Approach. R. Basega, IRL Press, Oxford Univ. Latest
- Cell in Development and inheritance EB Wilson MacMilan, NY Latest

LS 104 : Developmental Biology and Toxicology

Credit: 4

Total Marks: 70

Unit – 1: Dynamics of Cell Growth

- Cell cycle, Cell division -molecular aspects, mechanics, regulation
- Cell growth; Growth factors,
- Cell differentiations: Molecular basis of differentiation
- Cell aggregation
- Cell transformation, Cell ageing (senescence), Cell death

Unit – 2 : Reproduction

- Histology of Gonads
- Gametogenesis
- Types of Ovum and eggs
- Ultrastructure of Sperm
- Fertilization : External , Internal , artificial , in *Vitro*
- Embryo Transfer

Unit – 3 : Development of Embryo:

- Cleavage and its patterns
- Fate maps and their significance
- Organizers
- Gastrulation; - Embryonic germ layer, tracking of Migrating cells,
- Establishing Multicellularity,
- Epithelial Mesenchymal interactions.
- Regeneration: Factors, fields gradients and polarity

Unit – 4 : Animal Toxicology:

- General Principles and terminology,
- Types of toxicity
- Factors affecting toxicity,
- Acute, subacute and chronic toxicity,
- Classification of toxicants
- Estimation of toxicity; LD₅₀; LC₅₀;
- Teratogens, Food additives and contaminations; Air, water and soil pollutants
- Genotoxicity

Suggested Readings:

- Developmental Biology by Gilbert
- An introduction to Embryology B. I. Balinsky A East West Press, N Delhi 2004
- Developmental Biology P.S. Verma and V.K. Agarwal Press S. Chand.
- Human Embryology Inderbir Singh and G.P. Pal Press Jaypee Brothers Pub

LS 105 : Laboratory Course

Module I: Physical and Biological Chemistry

1. Water analysis and hardness of water
2. Preparation of solution of different concentration
3. Preparation of buffers, understanding Henderson Hasselbach equation
4. To demonstrate effect of temperature, pH and substrate concentration on enzyme activity.
5. Qualitative estimations of carbohydrates, proteins and lipids

Module II: Principles of Microbial Sciences

1. Preparation of microbial media (bacteria, yeast, algae)
2. Sterilization : principles and operations- Autoclave, Hot air oven, Filtration, Laminar air flow
3. Isolation of bacteria (streak plate, spread plate, pour plate, serial dilution)
4. Identification of micro-organism from the habitats (simple staining, differential staining, acid fast staining)
5. Methods of inoculation of different microbes in selective media
6. Microscopic measurements, haemocytometer.

Module III: Molecular Cell Biology

1. Cell cycle analysis – onion root tip experiment
2. Cell counting and viability test
3. Sub cellular fractionation of cellular organelle (nuclear, mitochondrial and cytosolic fraction) by differential centrifugation
4. Extraction of DNA from biological sample
5. Quantification of DNA (optical density method)
6. To demonstrate selective permeability of an artificial membrane (cellophane)
7. Estimation of Nucleic acid to Protein ratio
8. To demonstrate separation of nucleic acid by gel electrophoresis

Module IV: Developmental Biology and Toxicology

1. Slide preparation of different developmental stages of mammalian embryos
2. Fertilized egg preparation and identification through ink marking
3. Toxicity tests- Aquatic toxicity, food toxicity, and air borne toxicity
4. Genotoxicity- micronuclei, single strand breakage (comet assay)
5. Estimation of LD₅₀ and LC₅₀

Elective Courses

LS-106: Population Ecology

Credit: 2

Total Marks: 70

Unit 1

- Population Growth: Growth of organisms with non-overlapping generations, exponential growth, Verhulst – Pearl logistic growth model.
- Case studies (field and laboratory), Stochastic and time lag models of population growth, stable age distribution, population growth projection using Leslie Matrix

Unit 2

- Competition and Niche Theory: intraspecific and interspecific competition, history of niche concepts, theory of limiting similarity
- Mutualism: Evolution of mutualism, Plant – pollinator and animal – animal interactions basic models

Unit 3

- Population Regulation: Extrinsic and Intrinsic Mechanisms
- Case studies in population dynamics: one or two examples from areas such as fisheries, wildlife, and biological control of agricultural pests.
- Ecological Modeling: Fundamentals of constructing models and testing them

Unit 4

- Life history strategies: Evolution of life history traits, longevity and theories of ageing, energy apportionment between somatic growth and reproduction.
- Parental investment and offspring, reproductive strategies – ecology and evolution of sex and mating systems, optimal body size, r and k selection

LS-107: Biodiversity Conservation

Credit: 2

Total Marks: 70

Unit 1

- Concept of Biodiversity introduction, evolution, factors promoting biodiversity, Brief account on the diversity of unicellular & multicellular animal.
- High biodiversity, global biodiversity, biodiversity value, use and importance of biodiversity.

Unit 2

- Cellular and molecular aspects of biodiversity. Rise of biological diversity – photosynthetic prokaryotes, Microbial diversity in soil marine prokaryotic diversity genetic species & ecosystem diversity.
- Terrestrial & aquatic biodiversity.

Unit 3

Threats to biological diversity, loss of biodiversity & its courses, listing of threatened biodiversity including vulnerable, rare, threatened, endangered & extinct plant & animal species.

Unit 4

Concept of conservation, conservation values & ethics, inventorisation of biological resources, Action plan of conservation, conservation of rare & endangered species, conservation through network of protected areas, Role of NGO's in conservation activities & conservation & sustainable development.

LS-108: Biochemistry

Credit: 2

Total Marks: 70

Unit 1

- Scope of biochemistry: Biological processes of living systems. Water and its functions
- Dissolved gases and their properties. pH, buffer, acids and bases.
- Bioenergetics - Laws of thermodynamics and its relevance to biological systems. High-energy phosphate bonds and its role in energy capture and transfer

Unit 2

- Proteins – Biomedical importance. Structure and functions of proteins. Amino acid structure and properties. Primary and higher orders of protein. Protein folding. Nitrogenase system.
- Enzymes - Classification and general properties. Kinetics. Mechanisms of enzyme action (chymotrypsin). Regulation of enzyme activities.
- Lipids -Lipids of physiologic significance, membrane lipids, cholesterol. Synthesis and Oxidation of fatty acids. Ketogenesis

Unit 4

- Carbohydrates- Carbohydrates of physiologic significance. Metabolism. Glycolysis & Krebs cycle: Pathway & regulation. Oxidative metabolism: electron transport chain, oxidative phosphorylation. Gluconeogenesis. Hexose monophosphate Shunt.
- Minerals: Classifications, properties and biological significance.
- Vitamins: Classifications, properties and biological significance.

MPDC-105: Remedial Language Course (English/Hindi)

Credit: 1

SEMESTER II

LS 201 : Principles of Plant Sciences

Credit: 4

Total Marks: 70

Unit – 1 : Plant Anatomy & Cytology

- Shoot and Root Apical Meristem, Cellular manifestation and factors affecting development, Shoot apex of Pteridophyta, Gymnosperm and Angiosperm, lateral roots, root hairs
- Epidermis, stomata, trichomes, types, role
- Secretory Ducts and Laticifers, types, development, function
- Plant cell: - Structure, Models and functions of Plasma membrane,
- Structure and functions of Plasmodesmata
- Plant vacuole; Tonoplast membrane; functions,
- Chloroplast- ultrastructure and functions; genome

Unit – 2 : Plant Physiology

- Growth and Development: Concepts, qualitative – quantitative changes
- Growth regulators, biosynthesis, bioassay, mechanism of action, physiological effects, applications (auxin, cytokinin, gibberellins, ABA, ethylene),
- Plant Tissue Culture- basics
- Physiological effects and role of jasmonic acid, polyamines, brassinosteroids, salicylic acid

Unit – 3 : Environmental Biology

- Concept and dynamics of ecosystem – Organization and functions, Types, Energy flow, food chain, food web and trophic levels; ecological pyramids;
- Biogeochemical cycles (C, N, P and S)
- Ecological factors: Soil, light, water etc, Principle of limiting factors; biotic factors,
- Productivity; – Biomes and productivity including biodiversity.
- Population ecology – concept, types, fluctuation, factors regulating size, autecology, morality, natality
- Ecological succession and Niche theory

Unit – 4 : Plant Breeding

- Plant breeding – objectives, origin, domestication, hybrid vigour
- Principles and methods of plant Breeding, Self pollinated crops, cross pollinated crops, Clonal crops
- Plant Introductions – NBPGR

Suggested Readings:

- Plant Breeding B.D. Singh
- Plant Physiology Taiz L& Zeiger E
- Plant Tissue Culture Razdan M. K.
- Plant Physiology by Salisbury & Ross

LS 202 : Mammalian Physiology;

Credit: 4

Total Marks: 70

Unit – 1 : Movement and Coordination

- Organization of Body
- Structure of skeletal, cardiac and smooth and Physiology of muscle contraction.
- Structure of Brain and Neurons.
- Physiology of nerve impulse conduction, excitability of membranes, electrical and chemical transmission between cells.
- Chemical coordination - Endocrine organs and Hormones,

Unit – 2 : Respiration and Nutrition

- Physiology of respiration
- Exchange and transport of gases and its regulation.
- Physiology of digestion, regulation of food intake and digestive secretions.
- Nutrition and metabolism

Unit – 3 : Transport and Defence

- Physiology of blood – compositions & structure, Haemopoiesis, coagulation,
- Heart : beat, initiation , conduction and regulation
- Physiology of Circulation
- Immune response

Unit – 4 : Excretion and Reproduction

- Internal structure of Kidney and Nephron
- Fluid and electrolytes balance, Acid Base balance,
- Physiology of Excretion, Roles of kidney in body water regulation.
- Male Reproductive functions
- Female Reproductive functions

Suggested Readings:

- Anatomy and Physiology Thibodeau G.A. & Patton K.T. Mosby 1996
- Marshall's Physiology of Reproduction Vol 1 and 2 G. E. Lamming. Churchill Livingstone 1990
- Principles of Anatomy and physiology Tortora G.J. & Grabowski S. R. 2001
- Textbook of Medical physiology Guyton A.C. and Hall. J.E.
- The Physiology of Reproduction Vol. 1 and 2 E. Knobil and J. D. Neill. Raven Press, NY 1988

LS 203 : Ethology and Evolution;

Credit: 4

Total Marks: 70

Unit – 1 : General aspect of Behaviour

- Introduction of Behaviour
- Evolutionary approach to Behaviour, Levels of Natural selection
- Genetic basis of behaviour, Hereditary and Behaviour
- Sensory world of animals – Physical stimulus and Behavioural equipments
- Behavioural patterns -Individual and Homing Behaviour,

- Instinct , imprinting and learning Behaviour; Mechanism of learning,

Unit – 2 : Interactive Behaviour

- Reproductive behavioural patterns, Courtship, Mating and Parental cares,
- Stickle Back behaviour
- Social organization and Behaviours – Dominance, Territoriality, Aggression and social facilitation,
- Animal communication systems and role of pheromones in communication
- Dance language of the bees
- Human ethology - General aspects.

Unit – 3 : Evolution I

- Animal diversity and its significance
- Concept of Evolution,
- Origin of life on Earth
- Molecules to Cell, Origin of Prokaryotic and Eukaryotic Cell
- Source of Evolution,
- Variations; Role of Mutations; Recombination; Polyploidy; Isolation,

Unit – 4 : Evolution II

- Adaptation- various types, Habitat preference,
- Natural selection, Evolution in Action;
- Concept of Species – Speciation, Genetic drift, Hardy-Weinberg law;
- Mimicry; Polymorphism, Molecular phylogeny;
- Tempo of Evolution, Macro and Micro – evolution;
- Trends in Evolution, Future prospects.

Suggested Readings:

- Animal Behaviour McFarland D.
- Animal Behaviour & Evolutionary Approach Alcock J.
- Comparative animal Behaviour Donald A. Dewsbury McGraw Hill Book 1978
- Integral animal behaviour David E Davis. MacMillian Co, NY 1967
- Evolution by Eaton H.
- Evolution by Strickberger Prentice Hall
- Animal Behaviour & Evolutionary Approach Alcock J.
- Cell Biology, Genetics, Molecular Biology, Evolution and Ecology P.S. Verma, V.K. Agarwal S. Chand Pub., N Delhi 2004

LS 204 : Inheritance Biology / Genetics

Credit: 4

Total Marks: 70

Unit – 1: Mendelian Genetics

- Genetics – principles of inheritance, pea as a model hybrids
- Gene interactions, linkage and crossing over, genetic mapping
- Extra chromosomal inheritance, chloroplast, Mitochondria, genome and genes.

Unit -2: Quantitative Genetics

- Polygenic inheritance, heritability & its measurements, QTL mapping
- Mutation : Types, causes, & detection , mutant types, lethal, conditional ,

biochemical , loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis

Unit -3: Alterations of chromosomes & recombination

- Deletion, duplication, inversion, translocation, ploidy and their genetic manipulation
- Homologous and non homologous recombination including transposition, site specific recombination

Unit- 4: Applied Biology

- Transgenic animals and plants
- Molecular approaches to diagnosis
- Bioremediation and phytoremediation
- Biosensors

Suggested Readings:

- Genetics and origin of species Dobzhansky
- Human Cytogenetics – A practical approach (Vol. I & II) Rooney & Czepulkowski IRL Press at Oxford University Press, NY 1992
- Principles of Genetics E. J. Gardner, M. J. Simmons & D. P. Snustad John Wiley & Sons, NY 2001
- Principles of Genetics Robert H. Tamarin Tata McGraw Hill, N Delhi 2002
- Applied Molecular Genetics. Miesfield Wiley & Sons Publication 1999
- Basic Genetics R. F. Weaver & P. W. Hedrick Wm C. Brown Pub, Oxford 1995
- Cell Biology, Genetics, Molecular Biology, Evolution and Ecology P.S. Verma, V.K. Agarwal S. Chand Pub., N Delhi 2004

LS 205: Laboratory Course

Credit: 4

Total Marks: 70

Module I: Principles of Plant Sciences;

1. Determination of primary production of an area by harvest method
2. Determination of primary production of an area by chlorophyll method
3. Determination of primary aquatic production by harvest method
4. Effect of water and salinity stress on chlorophyll content of leaves
5. Estimation of the total nitrogen content of a plant using Kjeldahl's method
6. Estimation of ascorbic acid in ripe and unripe fruits
7. Assaying IAA oxidase activity in green and senescent leaves
8. Studies on induction of amylase activity by GA3 in germinating cereal grains

Module II: Mammalian Physiology

1. Study of heart of cockroach, determination of the rate of heart beat in Daphnia, study of permanent preparation of whole mounts and LS of following hearts: fish (2-chambered), frog (3-chambered), mammal (4-chambered)
2. Study of ECG in human
3. Study of accessory respiratory organs: Anabas, Clarius, Sacchobranthus and Boleophthalmus
4. Study of nutritional apparatus: amoeba, L.S. of Hydra, Planaria, digestive system of cockroach and earthworm (by demonstration only), detection of activity of digestive enzymes Invertase, amylase, protease and lipase.

Module III: Ethology and Evolution

1. Mathematical problems in Population genetics, Hardy-Weinberg Law
2. Study of animal interaction:
 - a) Commensalism
 - b) Mutualism
 - c) Antibiosis: effect of antibiotic on bacterial growth on Petri plate
 - d) Parasitism
 - e) Predation

Module IV: Inheritance Biology / Genetics

1. Mendelian Genetics – problem solving
2. Gene mapping
 - a) Bacterial transduction
 - b) Transformation in E. coli DH5 α
 - c) Bacterial conjugation, interrupted mating experiment
 - d) Phage growth and Titration
3. Demonstration of PCR
4. Comparison of genomes- bioinformatics analysis

Elective Courses

LS-206: Population Genetics and Evolution

Credit: 2

Total Marks: 70

Unit - 1

- Concepts of Evolution and theories of organic evolution with an emphasis on Darwinism.
- Neo-Darwinism: Hardy-Weinberg law of genetic equilibrium, detailed account of destabilizing forces, natural selection, mutation, genetic drift, migration, meiotic drive.

- Quantifying genetic variability: Genetic structure of natural populations, phenotypic variation, models explaining changes in genetic structure of populations, factors affecting human disease frequency.

Unit - 2

- Genetics of quantitative traits in populations: Analysis of quantitative traits, quantitative traits and natural selection, estimation or heritability, genotype environmental interactions, inbreeding depression and heterosis, molecular analysis of quantitative traits, phenotypic plasticity.
- Genetics of speciation: phylogenetic and biological concept of species, patterns and mechanisms of reproductive isolation, models of speciation (allopatric, sympatric, parapatric).

Unit - 3

- Molecular Evolution: Gene evolution, evolution of gene families, molecular drive, assessment of molecular variation.
- Origin and evolution of economically important microbes and animals.
- Population and genetics and ecology: Metapopulations, monitoring natural populations, why small populations become extinct, loss of genetic variations, conservation of genetic resources in diverse taxa.

Unit - 4

- Different types of evolution, evolutionary trends in animals, theories of evolution including modern synthetic theory, laws of evolutions, evolution of horse, elephant and man.
- Biogenetic law, evidences of organic evolution, mutation including modern concept, genetic drift.

LS-207: Principles of Parasitology

Credit: 2

Total Marks: 70

Unit 1

Nature of parasitism, Scope of the subject, definitions and concept of parasitism and parasites. Animal associations. Hyper-parasitism. Origin of parasite. Modes of parasitic invasion and escape.

Unit 2

Consequences of parasitism: Parasitic adaptations (morphological, anatomical, embryonic and larval). Various types of life histories of parasites. Origin of imermediate hosts and paratenic hosts.

Unit 3

Factors influencing parasitic fauna: Influence of age of the host on parasite fauna; Food of the host and its mode of life. Migration of the hosts, Effects of geographical distribution on parasitic fauna. Influence of human activity on parasite.

Unit 4

Host-parasite relationship: Influence of parasites on host. Mechanical action; Withdrawal of substances necessary for the normal metabolism of the host. Effects of the parasites on the host. Host's reaction to parasite. Host specificity.

LS-208: Medical and Veterinary Entomology**Credit: 2****Total Marks: 70****Unit 1**

Introduction to medical entomology. General features, life cycle patterns and classification of Diptera. Morphological peculiarities, life cycle and disease relationship of mosquitoes belonging to family Culicidae of Orthorrhapha.

Unit 2

Morphology, life cycle and disease relationship of *Phlebotomus*, *Simulium* and *Tabanus* of suborder Orthorrhapha. Brief account of non blood sucking flies of suborder Cyclorrhapha (i.e. Eye flies, blow flies and flesh flies). Flies as mechanical vector of disease. Different types of Myiasis.

Unit 3

Morphology, life cycle and disease relationship of Cyclorrhapha blood sucking flies (i.e. *Stomoxys*, *Glossina* and *Phippobosca*). Morphology of Lice, Bugs and fleas and their disease relationship.

Unit 4

General account of Acarina. Morphology, life cycle and disease relationship of different genera belonging to the families Ixodidae and the Argasidae. Brief account of Mites (*Trombicula*, *Dermanyssus*, *Liponyssus*, *Pediculoides*, *Tyroglyphus*, *Sarcoptes*) and their disease relations.

MPDC-205: Moral Studies**Credit: 1**

SEMESTER III

LS 301 : Immunology and Immunotechnology

Credit: 4

Total Marks: 70

Unit – 1 : Basic Immunology I

- History and Significance of Immunology,
- Immunity and its types,
- Introduction to Immune system, Cells and Organs involved,
- Complement system,
- Cytokines and their significance,
- Cancer and Immune responses (Tumour Immunology),

Unit – 2 : Basic Immunology II

- Antigens – General Properties and Criteria for antigens, Types of Antigens
- Antigenicity, MHC and HLA complex,
- Immunoglobulins : Basic structure and types,
- Immunogenetics : Genetic basis of Clonal selection and Generation of antibody diversity,
- *In vivo* antigen-antibody interactions

Unit – 3: Immunotechnology

- *In-vitro* antigen-antibody reactions and diagnostic significance ,
- Agglutination tests,
- Precipitation and Immunodiffusion tests,
- Modern tests like ELISA, (RIA), RAST, FAT,
- Hybridoma technology and applications of Monoclonal antibodies,
- Vaccines and immunotherapy,

Unit – 4: Dysfunction Immunity

- Hypersensitivity reactions,
- Tolerance and auto-immunity; Auto immune diseases,
- Immunodeficiency and their consequences, - HIV
- Transplantation Immunology,
- Hazards of Vaccine,

Suggested Readings:

- Immunology (Kuby) R.A. Goldsby, T. J. Kindt, B. A. Osborne, J. Kuby W. H. Freeman & Co. NY 2002 Immunology Ivan M. Roitt, Jonathan Brostoff and David K. Male Glower Medical Pub. Mosley / London 2000
- Immunology and Immunotechnology A.K.Chakravarty
- A Text Book of Immunology By J.K. Sinha & S. Bhattacharya, Academic Publishers
- Monoclonal Antibodies : Principles and Practice J. W. Golding Academic Press, NY Latest

LS 302 : Analytical and Separation Techniques

Credit: 4

Total Marks: 70

Unit – 1: Spectroscopic Methods:

- Principles of biophysical methods used for analysis of Biomolecules,
- Electrochemistry: pH meter – Principles and applications,
- Electromagnetic Spectrum; Light , Absorption of Light,
- Principle of Spectroscopy,
- Types of spectrometer/detectors: UV, Visible
- ORD/CD, Fluorescence, Infra-red spectroscopy,
- NMR spectrometer, X-ray Crystallography,
- Flame-photometry;
- Atomic absorption spectroscopy, MS and MALDI-TOF

Unit – 2: Chromatography

- Principles of Chromatographic Separation, Solvent extraction; Theory, principle and applications of Paper, Gel-permeation(Size exclusion), Ion-exchange and Affinity chromatography; Thin layer chromatography (TLC),
- HPTLC, HPLC and Gas chromatography;
- Super critical fluid Chromatography;

Unit – 3 : Centrifugation

- Theory and Principles of Centrifugation, Sedimentation velocity and Sedimentation Equilibrium
- Types of Centrifugation and centrifuge machines:- Preparative and Analytical,
- Differential Centrifugation, Density Gradient Centrifugation
- Ultracentrifugation (velocity and buoyant density),

Unit – 4 : Electrophoresis

- Basic Principles of Electrophoresis, Factors affecting Separation, Theory and Applications of Paper, Starch, Agarose and Polyacrylamide (Native and SDS) Gel Electrophoresis
- Gradient Gel Electrophoresis
- Iso-electric focussing, 2D and Capillary electrophoresis, Blotting Techniques

Suggested Readings:

- Principles & Techniques of Biochemistry and Molecular Biology K. Wilson & J. Walker Cambridge University Press, NY 2006
- Basic techniques in Molecular Biology Surzycki's Press, Springer Verlag.
- Techniques in Microscopy and Cell Biology A. K. Sharma Tata MacGraw Hill Pub. Co., N Delhi 1991
- Light Microscopy in Biology A. J. Lacey IRL Press, Oxford Univ. Press, New York, 1989

LS 303 : Bioinstrumentation

Credit: 4

Total Marks: 70

Unit – 1: Histochemical and Microtome:

- **Sample preparation:** In situ fixation of tissue/ organ, Dehydration of tissue,
Preparation of paraffin wax block
- **Microtomy:** Principles & types, sample preparation and sectioning parameters
- **Histochemical procedures:** Staining procedures (H&E), Immunohistochemical procedures (DAB and immunofluorescence)

Unit – 2 : Microscopy

- Principles, working and application of Bright field and Dark field microscope,
- Phase contrast and Interference, Differential Interference Contrast Microscope,
- Fluorescence Microscopy; Immunofluorescence, Confocal Microscopy,
- Specimen fixation, processing and staining in Light Microscopy,

Unit – 3 : Electron Microscopy & Imaging

- Electron Microscopy; TEM, SEM, and STEM,
- Cryoelectron microscopy;
- Processing of Biological sample for EM,
- Special Techniques in EM: Negative staining,
- Shadow casting and Freeze fracture deep etch replication techniques;
- Micro CT (CAT, PET);
- Cytometry and Flow Cytometry,

Unit – 4 : Radiochemical Methods :

- Principles and applications of tracer techniques in biology: Techniques of RIA, IRMA, EIA and radio receptor assay;
- Radiation Dosimetry; Radioactive isotopes and half life of isotopes;
- Liquid scintillation spectrometry; Autoradiography;
- Principles of Bio-assay and applications,
- Effect of radiation on Biological system

Suggested Readings:

- Principles & Techniques of Biochemistry and Molecular Biology K. Wilson & J. Walker Cambridge University Press, NY 2006
- Basic techniques in Molecular Biology Surzycki's Press, Springer Verlag.

- Techniques in Microscopy and Cell Biology A. K. Sharma Tata MacGraw Hill Pub. Co., N Delhi 1991
- Light Microscopy in Biology A. J. Lacey IRL Press, Oxford Univ. Press, New York, 1989
- Molecular Biotechnology S. B. Primrose Blackwell Sci. Pub., Oxford 1994
- Recombinant DNA and Biotechnology Krenzer & Massey ASM Press, USA 2000
- Textbook of Biotechnology H.K. Das Latest

LS 304 : Molecular Biology and Animal Biotechnology

Credit: 4

Total Marks: 70

Unit – 1 : Molecular Biology :

- Chromatin chemistry,
- DNA, Histones, Non-histone proteins,
- Organization of Chromosomes:
- DNA Replication and Regulation, DNA Repair mechanism,
- Transcription and Regulation of Gene Expression
- Cytogenetics and Molecular genetics of Cancer; Oncogenes,
- Cellular Communication: Intra cellular interactions,
- Receptor ligand interaction;
- Signal transduction, role of second messengers and G-proteins, Signalling Molecules

Unit – 2 : Molecular Genetics

- Isolation and Purification of DNA,
- Chemical synthesis of DNA and Sequencing,
- Recombinant DNA techniques, Types of vectors,
- Gene cloning, Restrictions enzymes,
- Introduction of DNA/Gene into living cell,
- PCR system and gene amplification, Blotting techniques,
- RFLP and DNA fingerprinting, Applications in present perspective.
- Human genome Project, Gene therapy, Microarrays. FISH

Unit – 3 Animal Cell Culture

- Laboratory, equipments and Conditions for Animal cell culture,
- Cell dissociations and preparations of primary cell culture,
- Cell synchronization of animal cells and Characterization – Measurement of Viability and Cytotoxicity, Growth parameters
- Culture media for animal cell culture and their requirements
- Risks and Safety in the animal cell culture,

Unit – 4 : Animal Biotechnology

- Short-term and mass cultivations,
- Cultivation of specialized cells *i.e.* Nerve cell, skin cells and Haemopoetic stem cell (bone marrow);
- Cell Banks, Stem cells and their applications,
- Techniques of Isolation and Purification of Enzymes
- Various techniques used for the Immobilization of enzymes,
- Applications of immobilized enzyme in Biotechnology.

Suggested Readings:

- Molecular Biotechnology S. B. Primrose Blackwell Sci. Pub., Oxford 1994
- Recombinant DNA and Biotechnology Krenzer & Massey ASM Press, USA 2000
- Textbook of Biotechnology H.K. Das Latest
- Molecular Bio methods Hand book Rapley & Walker Latest
- Molecular Biology LabFax T.A. Brown Bios Sci. Publ., Oxford 1991
- Molecular Biology of the Cell B. Albert, A. Johnson, J. Levis, M. Raff, K. Roberts, & P. Walter. Garland Science 2002
- Molecular Biology of the Reproductive System Decretser. Academic Press, NY Latest
- Molecular Biotechnology S. B. Primrose Blackwell Sci. Pub., Oxford 1994
- Molecular Cell Biology H. Lodish, D. Baltimore, A. Berk, S. L. Zipursky, P. Matsudara and J. Darnell, Scientific American books, USA 1995
- Molecular Cloning : A Laboratory Manual J. Sambrook, E. F. Fritsch, & T. Maniatis ColdSpring Harbor Lab. Presss, NY 2000

LS 305: Laboratory Course

Credit: 4

Total Marks: 70

Module I: Immunology and Immunotechnology

1. Grouping of blood and Rh typing
2. Latex agglutination test for rheumatoid factor and pregnancy
3. ELISA (kit)
4. Antigen-Antibody reaction- Agglutination (Blood grouping testing)
5. Antibody titration (Ouchterlony Double Diffusion)
6. Antigen-Antibody reactions – Immunoelectrophoresis, Rocket immune-electrophoresis
7. Antigen-antibody reactions-Coomb's test
8. Antigen- antibody reactions-ELISA

Module II: Analytical and Separation Techniques

1. Quantitative estimations of carbohydrate (glucose)
2. Quantitative estimations of proteins (albumin)
3. Quantitative estimations of lipids
4. Column Chromatography- separation of a mixture of proteins and salt using Sephadex column
5. Paper chromatography- ascending and descending- separation of amino acids
6. Thin layer chromatography of amino acids
7. Demonstration of HPLC

Module III: Bioinstrumentation

1. Counting of viable and dead cells using hemocytometer
2. Nucleus staining, Karyotyping
3. Demonstration of SDS-PAGE
4. Detection of protein in sub cellular extracts by western blotting
5. RNA isolation from blood
6. Quantification of RNA by O.D. method
7. Integrity of RNA by electrophoresis

Module IV: Molecular Biology and Animal Biotechnology

1. Preparation of culture media and Reagents-Media composition , Nutrition, Hormone
2. In vitro culture-
 - a) washing and sterilization
 - b) Preparatory steps for primary tissue culture
 - c) Aseptic tissue transfer
 - d) Incubation of culture
 - e) Cell lines
 - f) cryopreservation
3. Gene transfer:
 - a) Electroporation
 - b) Transfection
4. Analysis at the level of gene transcription-
 - a) Northern blot
 - b) Real- Time PCR
5. Analysis of DNA protein interactions: Electrophoretic mobility shift assay (EMSA)
6. Transgenic mice- Homologous and Heterologous typing using kit

Elective Courses

LS-306: Aquarium Management

Credit: 2

Total Marks: 70

Unit 1

Ornamental fishes: taxonomy, general and identifying character of
Fresh water ornamental fish: Catfish, Cichlids, Cyprinids, Live-bearers, Loaches,
Neotropical electric fish, Pufferfish, Rainbowfish , Spiny eels, cypriniforms
Marine water ornamental fish: Angelfish, Butterfly fish , Damsels, Dartfish, Dragonets,
Eels, Flatfish, Gobies, Lionfish, Parrotfish, Pipefish, Pseudochromis, Rabbitfish, Rays,
Scorpionfish, Seahorse, Squirrelfish, Sharks , Snappers, Tangs, Tilefish, Triggerfish,
Wrasse

Unit 2

Aquarium types, Infrastructure: filters, heater, refugium, calcium reactor, feed pump, bog-wood, driftwood, air-stone, live rock, substrate, fish-cam, fish feeder, lighting, other accessories, Food and feeding, management, Coloration and Pigmentation: category; types; formation; dietary, neuronal, hormonal control; Uses and functions; morphology and physiology of color changes and its significance

Unit 3

Culture: Gonads (ovary, testis) morphology, histology and physiology, Endocrine and environmental control over gonadal cycle, Reproduction, fertilization, Different developmental stages

Unit 4

Diseases and treatment : Ectoparasite, endoparasites: protozoan, helminth, arthropods, bacterial, fungal, viral parasites, their symptoms, pathogenicity, treatments and prophylaxis

LS-307: Fisheries Processing Technology

Credit: 2

Total Marks: 70

Unit 1

Fishing crafts; Principles of design and construction; Corrosion protection; Craft, materials - wood, marine plywood, fibreglass, reinforced plastic, aluminium, steel, ferro-cement; Bio-deterioration and preventive measures; Different types of fishing vessels in India; General arrangements of fishing vessels; Modern navigation equipment, navigation and fishing lights; Life saving devices

Unit 2

Principles of fish preservation; Preservation of fish, sanitary requirements for maintenance of quality, processing ways of fish, Fish trade and its component,

Unit 3

Fish craft as secondary earning of the fish trade person. Secondary utilization of fishery waste, as organic fertilizer, composition of fish waste in agriculture benefits, decorative piece as fish crafts, useful conversion of fish waste, different ways and their techniques.

Unit 4

Economic importance of fish, it's by products and application, their processing ways, Fish market as a big trade, understanding of fish trade, employment types linked with fish trade, gender role in fish trade.

LS-308: Conservation of Exploited Fisheries resources

Credit: 2

Total Marks: 70

Unit 1

Major fisheries resources, Aquaculture: fish, shellfish and molluscs , Target and non-target, Distribution, composition, trends and dynamics of major exploited fishery resources in hill streams, rivers, reservoirs, lakes, lagoons, estuaries, territorial waters, oceanic waters, deep sea oceanic islands; Straddling/shared stocks and non-conventional resources; Sports, game and ornamental fisheries; Major commercially exploited stocks, their potentials, status, bionomics, methods of capture and yields;

Unit 2

Issues related to capture fisheries; Fish Stock Assessment, Endangered and threatened species, *in-situ* and *ex-situ* conservation; genetic conservation, Fisheries and Biodiversity Acts; Juvenile fishing, destructive gears, by-catch and discards; Status and impact of exotic species, accidental introductions; Guidelines and policies for exotics.

Unit 3

Reasons of over exploitation and results, reasons of extinction of fish species and results, importance of fishery resources, Markets and trade policy, Biodiversity and Conservation, Present trend of dwindling fisheries resources, direct and Indirect effects of human intervention in rivers, habitat modification and improvement (rehabilitation of channels and flood plains),

Unit 4

Limitation of the environmental impact of fishing, **objectives for sustainable, exploitation of stocks, technical measures** to promote more selective fishing , type of vessels authorised to fish; limiting fishing effort; **recovery plans for stocks, Decision-making and consultation**, protection and restoration of fish movements (different types of fish passes and enhancement of fish migration), management and repair of riverine vegetation, stock enhancement strategies like introduction of new species, pre- and post- stocking management, potential risk of stocking

MPDC – 305: Community Service

Credit: 1

SEMESTER IV

LS-401 Dissertation and Viva-voce

Credit: 12

Total Marks:

LS-402: Study Tour/Field Attachment and Viva-voce

Credit: 8

Total Marks: 200

Elective Courses

LS-403: Techniques and Tools for Biology

Credit: 2

Total Marks: 70

Unit: 1

- Principles and uses of analytical instruments: pH meter, colorimeter, UV-Visible spectrophotometer, ultracentrifuge, densitometer, spectrofluorometer, chemiluminometers, radioactivity counters, differential scanning calorimeter, HPLC, and NMR spectrometers.

Unit: 2

- Microscopy: principle of light transmission, electron, phase-contrast, fluorescence, confocal, scanning electron microscopes. Microphotography and image analyzers.
- Microbiological techniques: media preparation and sterilization, inoculation and growth monitoring, use of fomenters, biochemical mutants and their uses, and microbial assays.

Unit: 3

- Cell culture techniques: design and functioning of tissue culture laboratory, cell proliferation measurements, cell viability testing, culture media preparation and cell harvesting methods.
- Cryotechniques: cryopreservation for cells, tissue, organisms, cryotechniques for microscopy, freeze-drying for physiologically active substances.

Unit: 4

- Separation techniques in biology: thin layer chromatography, electrophoresis, and centrifugation and density gradient centrifugation.
- Radioisotope and mass isotope techniques in biology: sample preparation for radioactive counting, autoradiography, metabolic labeling and magnetic resonance imaging.

LS-404: Biostatistics & Bioinformatics

Credit: 2

Total Marks: 70

Unit 1: General Statistics & Probability

- Introduction, scope, applications and uses of statistics, collection and classification of data, census and sampling surveys, graphs and diagrams, central tendency and its measures: arithmetic mean, median, dispersion and its measure: range and its coefficient, variance and standard deviation, coefficient of variation.

- Bivariate data, scatter diagram and interpretation, calculation and interpretation of Karl Pearson's correlation coefficient, equation of the lines of regression and properties of regression lines.
- Probability. Definition, addition and multiplicative laws (without proof). Random variable and its distribution, binomial probability distribution, examples and conditions, means and variance, Poisson probability distribution, examples and conditions, means and variance, continuous variable, normal distribution, use of normal probability table for finding probabilities.

Unit 2- Population Sampling

- Population parameters and sample statistics, sampling techniques: simple random sampling, stratified random sampling, systematic sampling, standard error.
- Estimation: point & interval, Estimators of population mean & proportion (without proof), confidence intervals for population mean & proportion. Data, graphical presentation of data – frequency distribution Sample means and standard deviations.

Unit 3- Experimental design

- Testing of hypothesis and its types, errors, levels of significance, one-tailed, and two-tailed tests, tests for single mean and single proportion, equality of the two population means and two population proportions.
- Chi-square test, Student's test for significance, fisher's Z test. Experimental designs completely randomized, randomised block and factorial experimental designs. Analysis of variance for different experimental designs, F distribution. Correlation and regression, linear and non-linear regression, multiple regression. Non-parametric tests.

Unit 4- Bioinformatics Tools

- Introduction to Bioinformatics, Basic concepts of biological databases;
- Access to sequence databases on the Internet,
- Protein and Genome Information Resources,
- Computer tools for sequence analysis: finding and retrieving sequences.

LS-405: Good Laboratory Practices & Research Methodology

Credit: 2

Total Marks: 70

Unit – 1

- Safety in laboratories, Use, Care and Maintenance of common laboratory equipments: Microscope, pH meter, colorimeter/ spectrophotometer, analytical balance, centrifuge, electrophoresis apparatus, glassware; general safety measures; personal protection; chemical hazards; spillage and waste disposal; first aid.
- Research methodology: Meaning of research; objective of research; motivation in research; types of research; research approaches; significance of research; research

methods versus methodology; Research and scientific methods; Importance of knowing how research is done; Research process; Criteria for good research.

Unit – 2

- Research problem and research design: Selecting research problem; necessity of defining a problem; techniques involved in defining the problem; meaning of research design; need for research design; important concepts related to research design; different research designs; basic principles of experimental design; important experimental designs. Interpretation and report writing: Meaning of interpretation; technique of interpretation; precautions in interpretation; significance of report writing; layout of research report; types of reports; Presentation of research work- oral, poster and writing research paper; Precautions for writing research report.
- Review of related literature: Understanding the role of review; how to begin a search for related literature- Library reference, recording and indexing, classification of references, internet sites for biological references; downloading the information through internet; requests for reprints through e-mail and post; classification and filing of reprints. Writing research proposal: Characteristics of a proposal; content and organization of a proposal; weakness in proposal seeking funding.

Unit 3

- Defining research question, Approaches and Methodology, Documentation and presentation of data, Analysis and Interpretation of Data, Writing of research proposal, report and Research paper: Meaning and types – Structure –Documentation : Footnotes and Bibliography-Editing the final draft –Evaluating the final draft –Checklist for the good proposal /research/report.

Unit 4

- Basic knowledge of organizing conferences, symposia, workshop, exhibition etc.
- A brief idea of funding agencies such DST, DBT, ICMR, CSIR and UGC. Role of Intellectual Property Rights (IPR) in Research and development.
- Ethical, legal, social and scientific issues in biological research.

MPDC 405: Ambedkar Studies

Credit: 1