

Center for Animal Sciences

M.Sc. Program in Life Sciences (Specialization: Animal Sciences)

Semester – III

| Course Code | Course Title | L (hr) | T (hr) | P (hr) | Cr |
|-------------|---------------------------------------|--------|--------|--------|-----------|
| | Core Courses* | | | | |
| ENV.504 | Ecological Principles | 3 | 1 | | 4 |
| LAS.512 | Animal Evolution and Development | 3 | 1 | | 4 |
| LAS.527 | Lab Course (Practicals) -III | | | 8 | 4 |
| | Elective Courses (Opt any one) | | | | |
| LSS.551 | Genetic Engineering | 2 | | | 2 |
| LAS.553 | Cancer Biology | 2 | | | 2 |
| | Research | | | | |
| LAS.599 | Research Project (part - I) | | | 16 | 8 |
| | Total Credits | | | | 22 |

L: Lectures; T: Tutorial; P: Practical; Cr: Credits; *Compulsory courses

Examination Pattern

A: Continuous Assessment: Based on Objective Type Tests (10 Marks), Term paper (10 Marks), and Assignments(s) (5 Marks)

B: Pre-Scheduled Mid Semester Test-1: Based on Objective Type & Subjective Type Test (By Enlarged Subjective Type) (25 Marks)

C: Pre-Scheduled Mid Semester Test-2: Based on Objective Type & Subjective Type Test (By Enlarged Subjective Type) (25Marks)

D: End-Term Exam (Final): Based on Objective Type Tests (25 Marks)

Core Courses:

ENV.504: Ecological Principles

4 Credits

| Learning Objective: This subject introduces the environment, ecology and ecosystems, looks at how we can study ecosystems to explore the effect that humans are having on the environment. | | |
|---|--|-----------------|
| Unit | Syllabus | Lectures |
| 1. | Introduction to Ecology: Definition, principle and scope of ecology, major branches, history, origin and evolution of life, geological scale. Habitat and niche, adaptation, ecosystem, biotic and abiotic factors, food chain, food web, trophic level. Biogeography – classification and zones. | 14 |
| 2. | Ecosystem Dynamics: Concept and components of ecosystem, ecological pyramids, energy flows in different ecosystems, energy models, ecosystem productivity. Types and characteristics of ecosystem- terrestrial (forest, desert, grassland) and aquatic (pond, marine), wetlands, estuaries, natural and man-made ecosystems, forest types in India. Biogeochemical cycles – cycling of water, nutrients. | 14 |
| 3. | Population and Community Ecology: Population characteristics, population interaction; prey-predator relationships, competition, exploitation, mutualism, Theories of population growth, population dynamics, regulation. Concept of metapopulation, demes and dispersal, niche- concept and types, keystone species, Flagship species and umbrella species; dominant species, ecotone, edge effect, ecotypes, plant indicators; ecological succession – types and mechanism, Theory of Island Biogeography, abundance and distribution of species; factors leading to commonness, rarity and vulnerability of extinction of species. Green data book. | 14 |
| 4. | Biodiversity: Definition, levels of biodiversity, measurements of biodiversity, values of biodiversity. Hot spots of biodiversity, Biodiversity hotspots of India, threats to biodiversity, Biological Invasion: concept; pathways, process, mechanism, impacts, examples of major invasive species in India. Speciation- types and process, Causes of species extinction. Endangered and threatened species, IUCN Categories of threatened species, Red data book, List of threatened flora and fauna in India. Biodiversity conservation; Ecotourism, responsible tourism, role of inter-governmental, government and non-government organizations, legal initiatives for wildlife and forest conservation, wetland conservation, ecosystem management at national and international level; Convention on Biodiversity. | 14 |
| Suggested Reading: | | |
| 1. Thomas M. Smith and Robert Leo Smith (2012). Elements of Ecology. Benjamin Cummings Publishing Company, 8th edition. | | |
| 2. Michael Begon, Robert W. Howarth and Colin R. Townsend (2014). Essentials of Ecology. Wiley Publishers, 4th edition. | | |
| 3. Odum, E. and Barrett, G.W. (2004). Fundamentals of Ecology. Cengage Learning, 5th edition. | | |
| 4. Prasanthrajan, M and Mahendran, P.P. (2008). A Text Book on Ecology and Environmental | | |

Science.

5. Sharma, P.D. (2005). Ecology and Environment. Rastogi Publications, India.
6. Verma, P.S. Agarwal, V.K. (2000). Environmental Biology: Principles of Ecology. S. Chand publishers, India.
7. Majid Husain (2015). Environment and Ecology. Access Publishing, 3rd edition.

LAS.511: Animal Evolution and Development

3 Credits

Learning Objective: The purpose of this course is to familiarize the student with the basic principles of evolutionary biology. The course in developmental biology is an introduction to animal development and places special emphasis on mammalian and human development. The principal objective is to introduce students to the developmental processes that lead to the establishment of the body plan of vertebrates and the corresponding cellular and genetic mechanisms.

| Unit | Syllabus | Lectures |
|------|--|----------|
| 1. | Evolutionary Thoughts & Origin of Life: Lamarckism, Darwinism, Concepts of variation, adaptation, Mendelism, Spontaneity of mutations, Theories of phyletic gradualism vs. punctuated equilibria, Modern evolutionary synthesis. Origin of basic biological molecules, Abiotic synthesis of organic monomers and polymers, Concept of Oparin and Haldane, Miller's experiment, The first cell, Evolution of prokaryotes and eukaryotes, Hardy Weinberg Law. | 12 |
| 2. | Paleontology and Molecular Evolution: The evolutionary time scale, Eras, periods and epoch, Major events in the evolutionary time scale, Stages in primate evolution including <i>Homo sapiens</i> . Concepts of neutral evolution, Molecular divergence and molecular clocks, Molecular tools in phylogeny, Classification and identification; Origin of new genes and proteins; Gene duplication and divergence. | 14 |
| 3. | Basic Concepts of Development: Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics in analysis of development. Gametogenesis, Fertilization and Early Development: Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development and double fertilization in plants; zygote formation, cleavage, blastula formation, embryonic fields, gastrulation and formation of germ layers in animals; embryogenesis. | 14 |
| 4. | Morphogenesis and Organogenesis in Animals: Cell aggregation and differentiation in Dictyostelium; axes and pattern formation in Drosophila, amphibia and chick; organogenesis – vulva formation in Caenorhabditis elegans, eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons, post embryonic development- larval formation, metamorphosis; environmental regulation of normal development; sex determination. Animal Breeding: History & methods of animal breeding with an emphasis on livestock and poultry breeding & aquaculture. | 14 |

Suggested Reading:

1. Darwin, C.R. (1911). *On the origin of species by means of natural Selection, or preservation of favoured races in the struggle for life*. Hurst Publishers, UK.
2. Dawkins, R. (1996). *The Blind Watchmaker*, W.W. Norton & Company Jones and Bartlett Publishers.
3. Futuyma, D.J. (2009). *Evolution*. Sinauer Associates Inc. USA.
4. Hake, S. and Wilt, F. (2003). *Principles of Developmental Biology*. W.W. Norton & Company, New York, USA.
5. Hall, B.K. and Hallgrímsson, B. (2007). *Strickberger's Evolution*. Jones and Bartlett Publishers, India.
6. Lewin, R. (2004). *Human Evolution - An Illustrated Introduction*. Wiley-Blackwell, USA.
7. Scott, F. and Gilbert, S.F. (2010). *Developmental Biology*. Sinauer Associates, Inc. USA.
8. Slack, J.M.W. (2005). *Essential Developmental Biology*, Wiley-Blackwell, USA.

Elective Courses:**LAS.552: Cancer Biology****2 Credits**

Learning Objective: This course will summarize the importance of understanding cell biology in the study of cancer, its causes, its progression, mechanism and its treatment. This course also describes the various cancer prevention mechanisms including risk assessment, screening, and lifestyle and environmental modification.

| Unit | Syllabus | Lectures |
|------|---|----------|
| 1. | Biology and Classification of Cancer: Classification, phenotype of a cancer cell, Causes of cancer –DNA tumor viruses, RNA tumor viruses, Cell cycle and its control-role of protein kinases, checkpoints, kinase inhibitor and cellular response. Different forms of cancers, Diet and cancer, screening and early detection, tumor markers and molecular tools for early diagnosis of cancer | 10 |
| 2. | Basis of Cancer: Oncogenes, Tumor suppressor genes, Aberrations in signaling pathways, Oncogenic mutations in growth promoting proteins, Mutations causing loss of growth-inhibition and cell cycle control, Role of carcinogens and DNA repair in cancer | 8 |
| 3. | Oncogenesis and Apoptosis: Intracellular proteolytic cascade, Cascade of caspase proteins, Adapter proteins, Bcl-2, IAP family proteins, Extra cellular control of cell division, Tumor necrosis factor and related death signals | 8 |
| 4. | Metastasis and Cancer therapy: Heterogeneity of metastatic phenotype, Metastatic cascade, Basement membrane disruption, Three step theory of invasion, Proteinase and tumor cell division, Different forms of cancer therapy, Chemotherapy, Radiation therapy, Detection of cancers, Prediction of aggressiveness of cancer, Advances in cancer detection, Use of signal targets towards therapy of cancer and gene therapy. | 10 |

Suggested Reading:

1. Dimmock, N.J. and Primrose, S.B. (2005). *Introduction to modern virology*. Bookbarn International, UK.
2. Ford, C.H.J., Casson, A.G. and Macdonald, F. (2004). *Molecular biology of cancer*. Bios Scientific Publishers, USA.
3. King, R.J.B. and Robins M.W. (2006). *Cancer Biology*. Prentice Hall, USA.
4. Margaret, A.K. and Peter, J.S. (2005). *Introduction to the cellular and molecular biology of cancer*. Oxford University Press, USA.
5. Neoptolemos, L.J. (1994). *Cancer: A molecular approach*. Blackwell Publishing, USA.
6. Phillis, R., Goodwin, S. and Palladino, M.A. (2002). *Biology of cancer*. Benjamin-cummings Publishing Company, USA.

LSS.551: Genetic Engineering

2 Credits

Learning Objective: The aim of this core-course is to acquaint the students to versatile tools and techniques employed in recombinant DNA technology. A sound knowledge on methodological repertoire allows students to innovatively apply these in basic and applied fields of biological research.

| Unit | Syllabus | Lectures |
|------|---|----------|
| 1. | Tools of Genetic Engineering: Restriction enzymes, Enzymes in genetic engineering, recombinant cloning vectors & their biology (Plasmid-, Phage-, and yeast-based), transformation and selection, genomic and cDNA library construction & DNA-sequencing techniques, RFLP, RAPD and AFLP techniques. | 8 |
| 2. | Recombinant Expression Systems & Mutagenesis: prokaryotic (Fusion proteins, surface display, removal of selectable marker genes, secretion into periplasm & medium) & eukaryotic (Sachharomyces cerevisiae, Pichia pastoris, Baculovirus-insect, Mammalian cell expression system), oligonucleotide-directed and site-directed mutagenesis. | 10 |
| 3. | Molecular Biotechnology of Microbial Systems: Vaccines (subunit-, peptide-, attenuated-, DNA- and vector-based), Enzymes, Antibiotics, Bioremediation, Gene therapy. | 8 |
| 4. | Molecular Biotechnology of Eukaryotic Systems: Engineering of plants (Ti-based system, Chloroplast engineering, Insect resistance, Salt & Drought stress & Oxidative stress), Transgenic animals (Transgenic mice, Transgenic livestock, Transgenic poultry), Regulation of recombinant DNA technology, Concerns about safety of consuming genetically modified foods, concerns about the impact of genetically modified organisms on the environment. | 10 |

Suggested Reading:

1. Molecular Biotechnology: Principles and Applications of Recombinant DNA by Bernard J. Glick, Jack J. Pasternak, Cheryl L. Patten, 4th edition.
2. Principles of Gene Manipulation by Sandy B. Primrose, Richard Twyman, Bob Old Seventh edition.
3. An introduction to genetic engineering, Third edition by Dr. Desmond S.T. Nicholl.
4. Molecular cloning by R. Green and Joseph Sambrook, 4th Edition, CSHL Press.

LAS.527: Lab Course (Practicals) – III

1. Animal handling: mice/rat/rabbit
2. Perfusion
3. Polyclonal antibody raising
4. Isolation of Lymphocytes from whole blood
5. Cell trypsinization and Cell count (Hemocytometer)
6. MTT Assay
7. Cell cycle monitoring by flow cytometry
8. Microscopic examination of human parasite life cycles (amoeba, cestodes, nematodes, and plasmodium)
9. Animal cell transfection(lipid based and electroporation)
10. Determination and estimation of adulterants in foods: honey, fats, oils, and spices
11. Plan and preparation of suitable therapeutic diets based on patient needs for various disease/disorders

Note: Practicals may be added/modified from time to time depending on available faculties/facilities.

LAS.599: Research Project (Part – I)

8 Credits

Course Objective: The objective of dissertation part I would be to ensure that the student learns the nuances of the scientific research and writing skills. Herein the student will have to write her/his synopsis including an extensive review of literature with simultaneous identification of scientifically sound (feasible and achievable) objectives backed by a comprehensive and detailed methodology.

Updated on: 22-07-2016