



**VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY**

**JNANASAGARA CAMPUS, BALLARI-583105**

**Department of Studies in Zoology**

**SYLLABUS**

**Master of Science**

**(IV Semester)**

**With effect from:**

**2022-23**

Distribution of Courses/Papers in Postgraduate Programme IV Semester as per Choice Based Credit System (CBCS) Proposed for PG Program in Zoology

**IV-SEMESTER**

Semester No.	Category	Subject code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
				IA	SEE	Total	L	T	P		
FOURTH	DSC11	21ZOO4C11L	Biodiversity and Conservation	30	70	100	4	-	-	4	3
	DSC12	21ZOO4C12L	Toxicology	30	70	100	4	-	-	4	3
	DSE3	21ZOO4E3AL	A) Agricultural Zoology and Entomology	30	70	100	4	-	-	4	3
		21ZOO4E3BL	B) Applied Zoology								
		21ZOO4E3CL	C) Animal Biotechnology								
	DSE4	21ZOO4E4AL	A) Genetic Engineering	30	70	100	4	-	-	4	3
		21ZOO4E4BL	B) Histology and Histotechniques								
		21ZOO4E4CL	C) Livestock Management and Animal Husbandry								
	GEC2	21ZOO4G2AL	A) Global Environmental Issues	15	35	50	2	-	-	2	1
		21ZOO4G2BL	B) Public Health, Hygiene and diseases								
21ZOO4G2CL		C) Human reproductive health issues and Sex Education									
DSC11L9	21ZOO4C11P	Biodiversity and Conservation Lab	20	30	50	-	-	4	2	4	
Project	21ZOO4C1R	Research Project	30	70	100		-	8	4	4	
<b>Total Marks for IV Semester</b>						<b>600</b>			<b>24</b>		

**Department Name: Zoology**

**Semester-III**

**DSC11: Biodiversity and Conservation**

<b>Course Title:</b> Biodiversity and Conservation	<b>Course code:</b> 21ZOO4C11L
<b>Total Contact Hours:</b> 56	<b>Course Credits:</b> 04
<b>Formative Assessment Marks:</b> 30	<b>Duration of ESA/Exam:</b> 3 h
<b>Summative Assessment Marks:</b> 70	

**Course Outcomes (CO's):**

**At the end of the course, students will be able to:**

1. Understanding the basics of science of biodiversity in an ecological context.
2. Learning tools and techniques relevant to monitoring of biological diversity
3. Design a field based project with rationale and appropriate methodology.
4. Interpret basics of science of biodiversity conservation covered in Modules
5. Study and understand the animals around us and their significance.
6. Know the importance of understanding the legal context for conservation management.
7. Know the main elements of the legal framework that underpins biodiversity conservation nationally and internationally.
8. Understand the meaning of the term "Stakeholders" and 'governance' and the relevance of both to biodiversity conservation.

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
1	Biodiversity: Concepts, Definition. Values of biodiversity: Consumptive use and Productive use; Social, Ethical, Aesthetic, Option & Environment service values. Biodiversity at global, national and local levels. Hot spots of biodiversity; India as a mega diversity nation. Endemism and endemic species.	11
2	Genetic diversity: Nature and origin of genetic variations; Measurement of genetic diversity. Species diversity: History and origin of species diversity; Species diversity indices; Measures of diversity – Alpha, Beta & Gamma diversity. Ecosystem diversity: Classification and nature of ecosystems (in brief); Ecosystem diversity of India (in brief) Agro- biodiversity: Origin and evolution of cultivated species diversity; Vavilovian centers ; Diversity in domesticated animal species.	12

3	Threats to biodiversity: Deforestation & habitat destruction, Hunting & Overexploitation; Introduction of exotic species, Pollution. Endangered, Vulnerable, Rare and Threatened species. Conservation of Biodiversity: Objectives and action plans; Strategies – In-situ and Ex-situ conservation; Peoples movement, Role of educational Institutions and NGO's, Biodiversity Awareness programmes	10
4	Biodiversity and Biotechnology: Role of Biotechnology in Assessment of biodiversity and bioresources; Biodiversity conservation; Utilization of Biodiversity / Bioresources. GMO's and their impact on biodiversity. Biodiversity legislation: Legal aspects with special reference to India; CITES; Trade related Intellectual Property Rights.	11
5	Biodiversity conventions: Earth Summit and other conventions; Convention on Biological Diversity. Biodiversity Management: Organizations associated with biodiversity management– IUCN, UNEP, UNESCO, WWF, FAD,WCMC –their role and contributions. Bioprospecting; Biopiracy; Biosafety. Future strategies for Biodiversity Conservation in India.	12
<b>References:</b> <ol style="list-style-type: none"> <li>1. Dasmann. F Raymond. Wildlife Biology. Wiley Eastern Ltd. India.1982.</li> <li>2. Encyclopedia of Nature and Science. Vols 1-18. Bay Books Pvt. Ltd. Sydney, 1974.</li> <li>3. Burnie. D. (Ed). Animal: the Definitive Visual Guide to the Worlds Wildlife. D.K. Publications, 2001.</li> </ol>		

**DSC12: Toxicology**

<b>Course Title:</b> Toxicology	<b>Course code:</b> 21ZOO4C12L
<b>Total Contact Hours:</b> 56	<b>Course Credits:</b> 04
<b>Formative Assessment Marks:</b> 30	<b>Duration of ESA/Exam:</b> 3 h
<b>Summative Assessment Marks:</b> 70	

**Course Outcomes (CO's):****At the end of the course, students will be able to:**

1. learn basic principles of signaling pathways and mechanisms of cell death
2. Understand mechanisms of systemic and organ toxicity induced by xenobiotics; and learn how to analyze and interpret complex data sets in toxicological research and deliver a scientific presentation.
3. To acquire knowledge on principles of toxicology and governing toxic responses to chemical exposures.
4. To learn the presence of toxic substances in the environment and poisonous substances of plant and animal origin
5. Introduce students the various procedures in the field of toxicology
6. Teach students how toxicants interact with target organs.
7. To learn the risk assessment of toxic substances and their applications in various fields.

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
1	<p><b>Fundamentals of Toxicology:</b></p> <p>Definition, scope and basic divisions of toxicology.</p> <p>Basic concept of toxicology: Toxicants and toxicity.</p> <p>Factors affecting toxicity: species and strains, age, sex, nutritional status, hormone, environmental factors.</p> <p>Dose; Effect and response; dose response relationships; margin of safety; toxicity curves; cumulative toxicity.</p> <p>Concept of QSAR, Toxicogenomics, Molecular toxicology and chronotoxicology.</p>	11
2	<p><b>Toxicologic testing methods:</b></p> <p>Acute and chronic toxicity tests, LD50, LC50 and ED50. Teratogenicity testing. Reproductive toxicology– Effect of xenobiotics on male and female reproductive organs/cells in mammals. Organ/tissues specific toxicity. Toxicity of metals (Lead, Mercury, Arsenic, Cadmium). Pesticide toxicity- Acute and Chronic effects of organophosphate, Organochlorine and Carbamate insecticides, Toxicity of pyrethroids. Bio-magnification. Natural toxins- Import microbial, plant and animal toxins.</p>	11

	Treatment of toxicity- Antidotal therapy. NOEL/NOAEL.	
3	<p><b>Applied Toxicology:</b></p> <p>Regulatory toxicology, Regulatory agencies, Regulation of Industrial chemicals in USA and EU, Regulation of pesticides, regulation of pharmaceuticals, regulation of food additives.</p> <p>Cosmetic toxicology- Toxicity of shampoos, conditioners, bleachers, dyes, allergic and respiratory disorders.</p> <p>Wildlife toxicology- Susceptibility of wildlife to chemicals, Acute ecological hazards, Toxicology of chemicals in birds and mammals, Integrated approach to wildlife toxicology.</p> <p>Forensic toxicology- Specimen sample collection, types of testing, detection of poisons, applications of forensic toxicology.</p>	11
4	<p><b>Toxicants of public health:</b></p> <p>Toxic chemicals and their effects: pesticides; heavy metals; fertilizers; food additives.</p> <p>Radioactive substances; automobile emissions.</p> <p>Toxic chemicals in the environment; bioconcentration and biomagnifications.</p> <p>Occupational diseases: Pneumoconiosis (silicosis, Anthracosis, Byssinosis, Bagassosis, Asbestosis, Farmers lung), Plumbism, and occupational dermatitis.</p>	11
5	<p><b>Systemic Toxicology:</b></p> <p>Basics of organ toxicity: Target organs, organ selectivity and specificity.</p> <p>Hepatotoxicity: susceptibility of the liver; Types of liver injury and biochemical mechanism.</p> <p>Pulmonary toxicity: Lung injury, systematic lung toxins, lung pathology.</p> <p>Renal toxicity: susceptibility of the kidney to toxicants; Chemical induced renal injury.</p> <p>Neuro toxicity: Effect of toxic agents on neurons, ion channel neurotoxins; Lesions of neural tissue.</p>	12
<p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Environmental Biology and Toxicology. P. D. Sharma. Rasthogi Publications.</li> <li>2. Text Book of Pharmacology &amp; Toxicology by Goodman &amp; Gillman</li> <li>3. Williams, P.L.; James, R. C. Roberts, S.M. (2003) Principles of Toxicology: Environmental and Industrial Applications, John Wiley &amp; Sons, Inc.</li> <li>4. Klaassen, C. (2007) Casarett and Doull's Toxicology The basic science of poisons – McGraw-Hill.</li> <li>5. Duffs, J. and Worth, H. (2006) Fundamental Toxicology, RSC Publishing.</li> <li>6. Phillip L. Williams, 2000. Principles of Toxicology, JOHN WILEY &amp; SONS, INC.</li> </ol>		

DSE3: A) Agricultural Zoology and Entomology

<b>Course Title:</b> A) Agricultural Zoology and Entomology	<b>Course code:</b> 21ZOO4E3AL
<b>Total Contact Hours:</b> 56	<b>Course Credits:</b> 04
<b>Formative Assessment Marks:</b> 30	<b>Duration of ESA/Exam:</b> 3 h
<b>Summative Assessment Marks:</b> 70	

**Course Outcomes (CO's):**

**At the end of the course, students will be able to:**

1. Students will be acquainted with the different types of metamorphosis, larva and pupa found in insects.
2. They will also learn about fertilization, development of oocyte, blastoderm formation blastokinesis and organogenesis.
3. They will also have a knowledge about the different types of reproduction in insects, hatching and shedding of embryonic cuticle.
4. Interpret the various methods of pest control by understanding the lifecycle of microbes, insects and other animals.

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
1	Principles and practices of pest control. Methods of pest control- Chemical Biological, Microbiological, Microbial, Integrated control. Organochlorine, Insecticides, Organophorous insecticides, Carbamates, Acaricides, Nematicides, Rodenticides, Molluscicides and Botanical pesticides. Pheromonal and Hormonal control. Chemosterilants and genetic control.	11
2	Biology and control of following insect pests of agricultural importance: Termites, Rice weevils, Castor hairy caterpillar, codling moth, mango mealy bug, Cotton white fly, citrus psylla and cabbage Caterpillar. Biology and control of some important Phytoparasitic nematodes; Anguina, Xiphinemasp & Heterodera sp.	11
3	External morphology of the insect's body i.e. head, thorax and abdomen, their appendages and function. Insect integument and its derivatives, Structure of insect cuticle and its function Head: origin, type, structure, types of mouth parts and antennae Thorax: Areas and sutures of tergum, sternum and pleuron, pterothorax; wings: structure and modification, wing venation, wing coupling apparatus; Legs: structure and modifications. Abdomen: Segmentation and appendages,	12

	genitalia and their modifications Stridulatory organs and sound producing organs.	
4	Glandular system: Salivary glands, poison glands, wax glands, coxal glands and scent glands. Sensory system: mechanical stimuli, sense of vision, organs of smell, tastes and hearing. Circulatory system: heart, haemolymph and circulation, phosphorescence. Respiratory system: Spiracles and their general structure, trachea and tracheoles. Digestive canal and digestion in insects.	11
5	Types of metamorphosis. Development of Imago :- fertilization, development of oocyte, cleavage and blastoderm formation, germ band formation, blastokinesis. Organogenesis. Viviparity, polyembryony, parthenogenesis paedogenesis. Hatching and shedding of embryonic cuticle, number and duration of instars, types of larva, pupa and its significance.	11

**References:**

1. Awasti V.B. 2009 Introduction to general entomology 3rd Ed. Scientific publication (India), Jodhpur.
2. Rajendra singh. 2007. Elements of Entomology. Published by Rakeshkumar. Rastogi and Rastogi Publications. Gangotri, Shivaji Road. Meerut.
3. Alpheus S. Packard, 1898, A text book of entomology, Macmillan company, London.
4. Trigunayat M.M. 2009, A Manual of practical entomology, scientific publishers, Jodhpur, India.
5. David BV & Ananthkrishnan TN. 2004. General and Applied Entomology. Tata-McGraw Hill, New Delhi.
6. Duntson PA. 2004. The Insects: Structure, Function and Biodiversity. Kalyani Publ., New Delhi.
7. Evans JW. 2004. Outlines of Agricultural Entomology. Asiatic Publ., New Delhi.
8. Atwal, A. S. and Dhaliwal G.S.1997.Agriculture pests of South Asia and their management. Kalyani Publishers New Delhi.



**DSE3: B) Applied Zoology**

<b>Course Title:</b> B) Applied Zoology	<b>Course code:</b> 21ZOO4E3BL
<b>Total Contact Hours:</b> 56	<b>Course Credits:</b> 04
<b>Formative Assessment Marks:</b> 30	<b>Duration of ESA/Exam:</b> 3 h
<b>Summative Assessment Marks:</b> 70	

**Course Outcomes (CO's):****At the end of the course, students will be able to:**

1. To understand the basic concept of pearl culture.
2. To provide the elementary knowledge regarding the Anatomical and Physiological aspects of fresh water oysters.
3. To familiarize with the various types of implantation methods and pearl culture surgery techniques.
4. Production of pearl and its marketing for economic gain.
5. Understand the scope and importance of piggery.
6. Comprehend the various technical and managerial aspects involved in piggery.
7. Identify the support available from various government agencies for piggery.
8. Identify Breeds and hybrids of rabbit
9. Management of pregnant and lactating rabbits, Production of rabbit for slaughter.

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
1	History, scope and importance of apiculture, Classification of honeybees with special reference to Indian species, Morphology and structural adaptations of honey bees, Social organization, division of labour, comb building, communication in honeybees. Beekeeping- rearing equipments, honey bee species employed in rearing, queen rearing, Flora and seasonal management. Honey bee diseases, pests and predators and their control.	11
2	Global silk production, quality and quantity of silk produced in India, economics of silk production, foreign exchange. Features of Saturnidae and Bombycidae. Races of mulberry silkworms, classification based on voltinism, moulting and geographic origin. Structure and functions of Silk glands. Seed cocoons, preservation, egg production, incubation, artificial hatching, seed organisation and seed area. Protozoan, Fungal, Viral and Bacterial diseases and their control measures.	11
3	Introduction to pearl culture. Global and national status of pearl culture, History of pearl culture, Significance of pearl culture. Types of oysters	12

	Fresh water oysters, Internal anatomy: Alimentary canal and associated structure, Food and feeding habit of Oyster. Pearl oyster Surgery, Selection of Oyster, Half round Pearl culture. Caring of pearl oyster. Harvesting of Pearls. Sorting of Pearl. Marketing and economics concerned with Pearl Culture. Generation of funds.	
4	Importance and scope for Piggery Farming, selection of land and construction of shed and its maintenance. Various breeds of pigs, Feeding of Pigs, Breeding practices, Care and Management of new born piglets. General Management of Piggery unit, Common Diseases in pigs and their control. Economics of a Piggery unit, Waste management in piggery.	11
5	Scope of rabbit farming, breeds and their distributions in India. Selection, care and management of breeding stock for commercial purpose. Identification, care and management of rabbits. Care of new born, growing stock. Breeding and selection techniques for optimal production of rabbit. Feeds and feed production for rabbit. Hygienic care and Housing for rabbit production, Rabbit meat production. Disposal and utilization of fur and wool and recycling of waste by products.	11

**References:**

1. Mishra R C (1999). Perspectives in Indian Apiculture. Allied Scientific Publishers, Bikaner, India. Srivastava (1979). Applied Entamology. Vol. II.
2. Singh S (1962). Beekeeping in India. ICAR, New Delhi, India. Snodgrass R E (1956). Anatomy of the Honeybee. Cornell University Press, Ithaca, New York.
3. Winston M (1984). The Biology of the Honeybee. Harvard Uni Press, London, U K
4. Shukla G S and Upadhyay V B (2007). Economic Zoology, 4th revised edn. Rastogi publications, Meerut, india.
5. Pillay TVR & Kutty MN. 2005. Aquaculture- Principles and Practices. Blackwell.
6. Introduction to Fishes. Silver Line 3. Srivastava C.B.L. (2014). Fishery Science and Indian Fisheries.
7. Haws Maria (March2002) The basics of pearl farming: a Layman's manual: (U.S.A). CTSA publications.
8. Le Jia Li (2014)New technologies to promote freshwater pearl culture (China) Ocean Press publications.
9. William F Roth (2013) Rabbit Culture and Standard; A Complete and Official Standard of All the Rabbits. Nabu Press; Primary Source ed. Edition.126 pages.
10. Nityan and Pathak, Usha Rani Mehra, Kishore Kumar Baruah (2014).Rabbit Production

**DSE3: C) Animal Biotechnology**

<b>Course Title:</b> C) Animal Biotechnology	<b>Course code:</b> 21ZOO4E3CL
<b>Total Contact Hours:</b> 56	<b>Course Credits:</b> 04
<b>Formative Assessment Marks:</b> 30	<b>Duration of ESA/Exam:</b> 3 h
<b>Summative Assessment Marks:</b> 70	

**Course Outcomes (CO's):****At the end of the course, students will be able to:**

1. Understand the animal cell culture, animal diseases and its diagnosis
2. Gain the knowledge for therapy of animal infections
3. Know the concepts of micromanipulation technology and transgenic animal technology
4. Use the knowledge gained in this section to apply in the field of clinical research
5. Use various techniques involved in making of transgenic animals
6. Integrate assisted reproductive biotechnology techniques in livestock improvement.
7. Utilize animal production technologies for sustainable agriculture and food security

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
1	Introduction to basic tissue culture techniques; chemically defined and serum free media; animal cell cultures, their maintenance and preservation; various types of cultures suspension cultures, organ cultures. Bacterial and viral diseases in animals; monoclonal antibodies and their use in diagnosis; molecular diagnostic techniques like PCR, in-situ hybridization; northern and southern blotting.	11
2	Concepts of transgenic animal technology; strategies for the production of transgenic animals and their importance in biotechnology; stem cell cultures in the production of transgenic animals. Identification and transfer of gene influencing better production and disease resistance.	10
3	Gene transfer methods in animals: Microinjection, Retrovirus mediated gene delivery, Embryonic stem cell mediated gene transfer; Knockout model systems & their utility; Somatic cell nuclear transfer cloning; In Vitro Fertilization, Embryo production, preservation and transfer; Sperm and embryo sexing; Intracytoplasmic sperm injection (ICSI); Cryopreservation and gamete banking.	11
4	Gene therapy, mapping of human genome. RFLP and applications. DNA finger printing and Forensic Science. Molecular diagnosis of Genetic disorders.	11

5	Valuable products from cell culture, vaccines, recombinant proteins, monoclonal antibodies, hybrid antibodies, hybrid antibodies, interferon, insulin, growth hormone.	12
---	--	----

**References:**

1. Ranga M.M. Animal Biotechnology. Agrobios India Limited, 2002
2. Freshney RI (1992) Animal cell culture: a practical approach, Oxford University Press
3. Singh B, Gautam SK (2013) Text Book of Animal Biotechnology, TERI
4. Singh B, Mal G, Gautam SK, Mukesh M (2019) Advances in Animal Biotechnology, Springer
5. Butler M (2003) Animal Cell Culture and Technology, Taylor & Francis
6. Freshney, E. D. 2000. Animal Cell Culture: A practical approach. John Wiley Pub., New York.
7. Mather, J.P. and Barnes, D. (Eds.). 1998. Animal Cell Culture Methods (Methods in Cell Biology.VOL. 57). Academic Press, London.
8. Animal cell culture – A practical approach Ed. By John R.W. Masters (IRL Press)

DSE4: A) Genetic Engineering

<b>Course Title:</b> A) Genetic Engineering	<b>Course code:</b> 21ZOO4E4AL
<b>Total Contact Hours:</b> 56	<b>Course Credits:</b> 04
<b>Formative Assessment Marks:</b> 30	<b>Duration of ESA/Exam:</b> 3 h
<b>Summative Assessment Marks:</b> 70	

**Course Outcomes (CO's):**

**At the end of the course, students will be able to:**

1. Gain practical skill on handling biological molecules
2. Apply knowledge to develop new rDNA with suitable markers
3. Develop a skill in operation of instruments
4. Give a probable solution to social problems related to health and disease
5. Perform experiments on extraction of DNA from unknown samples, etc.

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
1	<b>Principles of Genetic Engineering:</b> Nucleic acids and their isolation techniques, Principles of isolation, purification and quantification. <b>DNA modifying enzymes:</b> RENS, nucleases, polymerases, ligases, kinases and phosphatases. Cloning vectors: Plasmids, phages, cosmids and artificial chromosomes. Cloning hosts: Escherichia coli, Saccharomyces, animal cells.	11
2	<b>Gene transfer:</b> Physical and vector mediated methods and cloning methods, directional and TA cloning methods. Construction and screening of DNA libraries: genomic library, cDNA library and expression libraries. <b>PCR:</b> Principles and methodology. Types: RT-PCR, AFLP, RFLP, inverse PCR and real time PCR with their applications. DNA fingerprinting technique and its applications.	11
3	<b>DNA sequencing:</b> DNA sequencing methods and their applications, Maxam and Gilbert's method and Sanger's method. Automated sequencing technique and capillary gel electrophoresis, Next generation sequencing methods (NSG). Isolation and characterization of genes from genomic <i>DNA libraries</i> . New strategies for gene knockout.	11
4	Construction and screening of human antibody libraries using phage display. Down-regulation of gene expression in mammalian systems via current siRNA technology. <b>DNA engineering techniques:</b> Gel electrophoresis of nucleic acids and proteins using agarose and polyacrylamides.	11

5	<b>Blotting of macromolecules and hybridization:</b> probe selection and labeling. <b>Principles of hybridization:</b> gene screening-colony, plaque, dot, southern and northern blotting techniques. Antibody screening; oligonucleotide synthesis; promoter characterization, site directed mutagenesis; generation of transgenic animals: Drosophila and Mouse.	12
<p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Brown, T. A. (1995): Gene Cloning: An introduction. Chapman and Hall, London</li> <li>2. William Wu, Michael Welsh, Peter Kaufman, Helen Zhang (2004): Gene Biotechnology II edition, CRC press, LLC, USA</li> <li>3. Brown, T. A. (2015): Gene Cloning: An introduction. 7th edition. Chapman and Hall, London</li> <li>4. Glick, B. R. and Pasternak, J. J. (1994): Molecular Biotechnology: Principles and applications of recombinant DNA. ASM Press, Washington D.C.</li> <li>5. Kreuzer, H. and A. Massey. (2001): Recombinant DNA and Biotechnology. ASM Press, Washington DC.</li> <li>6. Primrose, S. B., and R. M. Twyman. (2006): Principles of gene manipulation and Genomics, Blackwell Publishing MA. USA.</li> <li>7. Biotechnology in Environmental Management: edited by G.R. Pathade and P.K. Goel. Jaipur, ABD, 2004</li> <li>8. Biotechnology in Environmental Management/edited by T.K. Ghosh, T. Chakrabarti and G. Tripathi. New Delhi, A.P.H. Pub., 2005</li> <li>9. Peppler and Periman ; Microbial technology ; 2nd Ed; Academic press; 2004</li> <li>10. Barnum SR ; Biotechnology ; Indian edition ; Vikas pub.; 1998</li> <li>11. Baker KH ; Bioremediation. McGraw Hill , New York</li> <li>12. Daniel L. Hartl &amp; Elizabeth W. Jones : Genetics – analysis of Genes &amp; Genomes</li> <li>13. Benjamin A. Pierce : genetics – a conceptual approach</li> </ol>		

**DSE4: B) Histology and Histotechniques**

<b>Course Title:</b> B) Histology and Histotechniques	<b>Course code:</b> 21ZOO4E4BL
<b>Total Contact Hours:</b> 56	<b>Course Credits:</b> 04
<b>Formative Assessment Marks:</b> 30	<b>Duration of ESA/Exam:</b> 3 h
<b>Summative Assessment Marks:</b> 70	

**Course Outcomes (CO's):**

**At the end of the course, students will be able to:**

1. Isolate and distinguish different tissues from an organ sample
2. Describe the structure of various tissues in animal organism
3. Perform histological procedures for observation
4. Classify different tools used in histological techniques
5. Draw and illustrate organ histology of human body etc.

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
1	<p><b>Microscopy and tissue preparation:</b> Principles and resolution of conventional microscopes, phase contrast, SEM and TEM. Tissue processing.</p> <p><b>Cell structure:</b> Membranes and transport across membranes, junctions.</p> <p><b>Epithelia:</b> Classification, structure, location and functions. Projections from cell surface.</p> <p><b>Glands:</b> Classification and structural organization.</p>	11
2	<p><b>General connective tissue:</b> components, different forms of connective tissue. <b>Cartilage:</b> general structure, types, distribution and functions.</p> <p><b>Bone:</b> structure, elements of bone tissue, types of bone, formation and growth &amp; development of bone. <b>Muscular tissue:</b> structure of different types of muscles, Mechanism of contraction of muscles.</p>	11
3	<p><b>Lymphatics and lymphoid tissues:</b> Diffuse and dense, cells capillaries and nodes. The spleen, the thymus, MALT, tonsils. <b>Blood:</b> components, haemopoiesis. Mononuclear phagocyte system. <b>Nerve tissue:</b> Anatomical classification, structure of nerve components, types of neurons, Neuroglia. Histology of species sensory organs: human eye and ear.</p>	11
4	<p><b>Hepatobiliary system and pancreas:</b> Histology of liver, duct system and functions. Extrahepatic biliary apparatus. Exocrine pancreas, histology and endocrine pancreas.</p>	11

	<b>Oral structures:</b> Pictomicrograph study of structure of teeth, tongue and salivary glands. T.S. of Oesophagus, stomach, duodenum, jejunum, ileum and large intestine.	
5	<b>Histotechniques:</b> Outline of methods employed in histology: preparation, fixation and fixatives. Dehydration, clearing and paraffin embedding methods. <b>Microtomy:</b> mechanics, set and dry sectioning. <b>Staining:</b> substances, techniques and mechanism. Methods for special organs, tissues and cell components. Outline methods for histopathological processes.	12

**References:**

1. Neelam Vasudeva and Sabita mishrea (2014): Inderbir singh's text book of human physiology, seventh edition, Jaypee brothers medical publishers pvt.ltd. New Delhi.
2. Carleton H.M (1957): Histological techniques for normal and pathological tissues, III edition, Oxford University press.
3. Grerchen L. Humason. Animal tissue techniques. W.H Freeman and Company.
4. PoSing Leung. The gastrointestinal system: Gastrointestinal, nutritional and hepatobiliary physiology. Springer.
5. Stevens amd Lowe. Human Histology by James Lowe, Peter Anderson and Susan Anderson. Elsevier.
6. Wojciech P. Histology: a text and atlas correlated with cell and molecular biology. Wolters Kluwer.
7. Kleith Moore, Persaud and Mark Torchia. The developing human: clinically oriented embryology, eleventh edition. Elsevier.
8. K Laxminarayan. Histological techniques, second edition, Bhalani.
9. Sangita Chouhan and Seema Gupta. Histology: A text and practical book.
10. Piper Treuting, Suzanne Dintzis and Kathleen Montine. Comparative anatomy and histology: a mouse, rat and human atlas. Elsevier.



**DSE4: C) Livestock Management and Animal Husbandry**

<b>Course Title:</b> C) Livestock Management and Animal Husbandry	<b>Course code:</b> 21ZOO4E4CL
<b>Total Contact Hours:</b> 56	<b>Course Credits:</b> 04
<b>Formative Assessment Marks:</b> 30	<b>Duration of ESA/Exam:</b> 3 h
<b>Summative Assessment Marks:</b> 70	

**Course Outcomes (CO's):**

**At the end of the course, students will be able to:**

1. Gain knowledge on identification of animal husbandry animals
2. Describe management practices in detail
3. Design a concrete animal house model with all prerequisites
4. Perform disease management in the farm
5. Assess the economical products from the animal husbandry, etc.

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
1	<b>Introduction:</b> history of livestock rearing, Live stock farming zones in India, Common animal husbandry terms. Zoological classification of common domestic animals. Ruminants and non-ruminants. Animal husbandry in India – present and future. Body parts of domestic animals, general management practices.	11
2	<b>Breeds of livestock:</b> Breeds of cattle, buffaloes, sheep, goats and pigs. <b>Breeding of farm animals:</b> material basis and economic traits of inheritance, selection and culling, breeding systems. <b>Animal housing:</b> types, planning farm housing, requirements, manure disposal and constructional details of different structures. <b>Animal nutrition:</b> Composition and preparation of common feed and fodder, hay making, silage making, computation of balanced rations and feeding standard.	11
3	<b>Sheep, Goat and Swine production:</b> feeding, breeding, management and economics. <b>Livestock production management:</b> roles of the personelle, livestock production system, Economic considerations in livestock farming. Marking, feeding, breeding and prophylactic record keeping. Livestock production in rural development, planning and management of livestock development project. Livestock development programmes in the country.	11

4	<p><b>Livestock extension:</b> Features of livestock extension, adoption potential, constraints of extension services, low cost instructional materials. Privatisation of extension, rapid and participatory rural appraisals.</p> <p><b>Livestock in natural calamities:</b> common natural calamities, emergencies for livestock during natural disasters, delayed consequences of disasters and feeding during scarcity conditions.</p>	11
5	<p><b>Health management:</b> signs of good health, animal diseases, control of parasites, deficiency diseases of livestock, first aid on animal farms. Integrated farming practices in Indian context. <b>By-products:</b> Leather, hydes, hoof, horn, collagen, fur and other economic products and their usage.</p>	12
<p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Vincent Martin: Animal husbandry and livestock management, Callisto reference, ISBN: 10-1641-162-287, 13-978-164-1162-289</li> <li>2. V.N Goutham: A text book of livestock production and management, Avishkar publisher, Jaipur, ISBN: 978-8179105-528</li> <li>3. Sastry NSR and Thomas CK: Livestock production and management, Kalyani publishers.</li> <li>4. GC Banerjee. A text book of animal husbandry, 8th edition. Oxford and IBH Publishing company, New Delhi.</li> <li>5. P.N. Bhat and MP Yadav. Animal Husbandry: Research, education and development.</li> <li>6. Lesley A Colby, Megan Nowland and Lucy Kennedy. Clinical laboratory animal medicine, fifth edition. Wiley Blackwell.</li> <li>7. P. Mathialagan. A textbook of animal husbandry: extension and education. CNS Publishers and Distributors. WB.</li> <li>8. John Campbell, Douglas and Kren Campbell. Animal Husbandry: biological sciences and production. Medtech, a division of scientific international.</li> </ol>		

**GEC2: A) Global Environmental Issues**

<b>Course Title:</b> A) Global Environmental Issues	<b>Course code:</b> 21ZOO4G2AL
<b>Total Contact Hours:</b> 28 (02 L-0-0)	<b>Course Credits:</b> 02
<b>Formative Assessment Marks:</b> 15	<b>Duration of ESA/Exam:</b> 1 h
<b>Summative Assessment Marks:</b> 35	

**Course Outcomes (COs):****At the end of the course, students will be able to:**

1. Understand the fundamental issues of environment
2. Analyze different sources of environmental problems and methods of measurement of pollution.
3. Examine economic growth and quality of life.
4. Examine the microbiology of waste water treatment and its various schemes.

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
1	Basic concepts and issues, global environmental problems - ozone depletion, UV-B, greenhouse effect and acid rain due to anthropogenic activities, Fisheries depletion, Eutrophication, their impact and biotechnological approaches for management.	9
2	Environmental pollution - types of pollution, Air, water and land pollution. sources of pollution, measurement of pollution, fate of pollutants in the environment, Ocean acidification, Bioconcentration, bio/geomagnification.	10
3	Aerobic decomposition process - activated sludge, oxidation ponds, trickling filter, towers, rotating discs, rotating drums, oxidation ditch. Anaerobic decomposition process - anaerobic filters, up- flow anaerobic sludge blanket reactors. Treatment schemes for sewage from dairy, distillery, tannery, sugar and pharma industries.	9
<b>References (indicative)</b>		
<ol style="list-style-type: none"> <li>1. Frances, H. (2012). Global Environmental Issues (2nd edition) Willey-Blackwell</li> <li>2. Mahesh, R. (2007) Environmental Issues in India: A Reader. Pearson-Longman.</li> </ol>		

**GEC2: B) Public Health, Hygiene and diseases**

<b>Course Title:</b> B) Public Health, Hygiene and diseases	<b>Course code:</b> 21Z004G2BL
<b>Total Contact Hours:</b> 28 (02 L-0-0)	<b>Course Credits:</b> 02
<b>Formative Assessment Marks:</b> 15	<b>Duration of ESA/Exam:</b> 1 h
<b>Summative Assessment Marks:</b> 35	

**Course Outcomes (COs):****At the end of the course, students will be able to:**

1. To provide knowledge on different health indicators and types of hygiene methods.
2. To impart knowledge on different health care programmes taken up by India
3. To make student understand the latest concepts of health such as HIA, EIA, SIA and SEA
4. To enable student with disaster mitigation strategies
5. To create awareness on community health and hygiene
6. To enrich knowledge on communicable and non-communicable diseases and their control

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
1	<p><b>Health Basics of Nutrition</b></p> <p>Health - Determinants of health, Key Health Indicators, Environment health &amp; Public</p> <p>Health Policy &amp; Health Organizations: Health Indicators and National Health Policy of Govt. of India-2017; Functioning of various nutrition and health organizations in India viz., NIN (National Institution of Nutrition), FNB (Food and Nutrition Board), ICMR (Indian Council of Medical Research), IDA (Indian Dietetics Association), WHO-India, UNICEF-India.</p> <p>National Health Mission: National Rural Health Mission (NRHM) Framework, National Urban Health Mission (NUHM) Framework.</p> <p>Women &amp; Child Health Care Schemes: Reproductive, Maternal, Newborn, Child and Adolescent Health (RMNCH+); Janani Shishu Suraksha Karyakaram (JSSK); Rashtriya Bal Swasthya Karyakram(RBSK); India Newborn Action Plan (INAP); Adolescent Health- Rashtriya Kishor Swasthya Karyakram (RKSK).</p> <p>Disaster Management – Containment, Control and Prevention of Epidemics and Pandemics – Acts, Guidelines and Role of Government and Public</p> <p>Nutrition – definition, importance, Good nutrition and mal nutrition; Balanced Diet: Basics of Meal Planning</p>	10

	Carbohydrates –functions, dietary sources, effects of deficiency. Macro and micro minerals –functions, effects of deficiency; food sources of Calcium, Potassium and Sodium; food sources of Iron, Iodine and Zinc Importance of water– functions, sources, requirement and effects of deficiency.	
3	<b>Hygiene</b> Definition; Personal, Community, Medical and Culinary hygiene; WASH (WATER, Sanitation and Hygiene) programme Rural Community Health: Village health sanitation & Nutritional committee (Roles & Responsibilities); About Accredited Social Health Activist (ASHA); Village Health Nutrition Day, Rogi Kalyan Samitis. Community & Personal Hygiene: Environmental Sanitation and Sanitation in Public places Public Awareness through Digital Media - An Introduction to Mobile Apps of Government of India: NHP, Swasth Bharat, No More Tension, Pradhan Mantri Surakshit Mantritva Abhiyan (PM Suman Yojana), My Hospital (Mera aspataal), India fights Dengue, JSK Helpline, Ayushman Bhava, Arogya Setu, Covid 19AP.	9
4	<b>Diseases</b> Communicable diseases and their preventive and control measures. Measles, Malaria, Hepatitis, Cholera, Filariasis, HIV /AIDS Corona Virus (Covid-19). Non-Communicable diseases and their preventive measures. Genetic diseases, Cancer, Cardio vascular diseases, Chronic respiratory disease, Diabetes, Epilepsy. Health Education in India – WHO Programmes – Government and Voluntary Organizations and their health services – Precautions, First Aid and awareness on epidemic/sporadic diseases.	9
<b>References</b>		
<ol style="list-style-type: none"> <li>1. Bamji, M.S., K. Krishnaswamy &amp; G.N.V. Brahmam (2009) Textbook of Human Nutrition (3rd edition) Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.</li> <li>2. Swaminathan (1995) Food &amp; Nutrition(Vol I, Second Edition) The Bangalore Printing &amp;Publishing Co Ltd., , Bangalore.</li> <li>3. Vijaya Khader (2000) Food, nutrition &amp; health, Kalyan Publishers, New Delhi.</li> <li>4. Srilakshmi, B., (2010) Food Science, (5th Edition) New Age International Ltd., New Delhi.</li> <li>5. Weblinks: <a href="https://nhm.gov.in/">https://nhm.gov.in/</a></li> <li>6. Park and Park, 1995: Text Book of Preventive and Social Medicine –Banarsidas Bhanot Publ. Jodhpur – India.</li> <li>7. Verma, S. 1998: Medical Zoology, Rastogi publ. – Meerut – India 2. Singh, H.S. and Rastogi, P. 2009: Parasitology, Rastogi Publ. India. 3. Dubey, R.C and Maheswari, D.K. 2007: Text Book of Microbiology- S. Chand &amp; Co. Publ. New Delhi – India.</li> </ol>		

**GEC2: C) Human reproductive health issues and Sex Education**

<b>Course Title:</b> C) Human reproductive health issues and Sex Education	<b>Course code:</b> 21Z004G2CL
<b>Total Contact Hours:</b> 28 (02 L-0-0)	<b>Course Credits:</b> 02
<b>Formative Assessment Marks:</b> 15	<b>Duration of ESA/Exam:</b> 1 h
<b>Summative Assessment Marks:</b> 35	

**Course Outcomes (COs):**

**At the end of the course, students will be able to:**

1. To educate the student on clean sexual habits thereby warding off sexually transmitted diseases.
2. Compare and contrast the structure and functions of the male and female reproductive system. Significance of hormones in pregnancy, parturition and lactation.
3. Understand the process of human reproduction, to know the human life cycle, including the physical and emotional changes that take place during human puberty and adolescence.
4. Appreciate the importance of relationships within and outside the family and to understand their changing nature.
5. Consolidate understanding of the nature and methods of transmission of HIV/AIDS and other sexually transmitted diseases.

<b>Unit</b>	<b>Description</b>	<b>Hours</b>
1	Human Reproductive physiology – Reproductive systems of Male and Female. Brief Description and Hormonal regulation of Gametogenesis, Onset of Puberty, Menstrual cycle, Menopause – Causes for concern, Psychosocial adjustments, Fertilization, Implantation, Pregnancy and parturition. Assisted Reproduction: In-utero -fertilization and test tube baby – Legal and Ethical issues	9
2	Reproductive Health – Meaning, objectives, goals and Issues related to reproductive health. Sexual health and Sexually transmitted Diseases - Syphilis, Gonorrhoea, Chlamydia, Genital Herpes and AIDS. Intended and unintended pregnancies – teenage pregnancy. Infertility and Factors causing infertility – Stress, Problems in ovulation, blocked or scarred fallopian tubes, endometriosis and low sperm count.	10
3	Sex education: Adolescent sexual activity, teenage pregnancy, sexual harassment, sexual awareness and policies (legal aspects), lesbian and gay-sex, bisexual, transgender youth, adolescent stress management	9
<b>References (indicative)</b>		
<ol style="list-style-type: none"> <li>1. Common sexual problems and solutions by Dr. Prakash Kothari, UBS Publishers and Distributors Ltd.</li> <li>2. Guyton &amp; Hall. Textbook of Medical Physiology.</li> <li>3. Mac E. Hadley. Endocrinology. Pearson Education, Singapore.</li> <li>4. Turner, CD and Bagnara, J.T. General and Comparative Endocrinology, 1998.</li> </ol>		

**DSC11L9: Biodiversity and Conservation Lab**

<b>Course Title:</b> Biodiversity and Conservation Lab	<b>Course code:</b> 21Z004C11P
<b>Total Contact Hours:</b> 56 (0-0-4P/week)	<b>Course Credits:</b> 02
<b>Formative Assessment Marks:</b> 20	<b>Duration of ESA/Exam:</b> 4 h
<b>Summative Assessment Marks:</b> 30	

**Course Outcomes (CO's):****At the end of the course, students will be able to:**

1. Interpret basics of science of biodiversity conservation covered in Modules
2. Study and understand the animals around us and their significance.
3. Know the importance of understanding the legal context for conservation management.
4. Know the main elements of the legal framework that underpins biodiversity conservation nationally and internationally.

<b>SL No</b>	<b>List of experiments</b>	<b>Hours</b>
1	Determine the required size of quadrat to study the vegetation by species area curve method.	
2	Determine the required number of quadrat to study the vegetation in a given area by species area curve method.	
3	Analyze the vegetation by quadrat method. i. Line transect method ii. Belt transect method	
4	Estimate the litter arthropod diversity by a trap method.	
5	Analyze the population structure of tree species in a given area.	
6	Estimate the standing forest floor litter.	
7	Nutrients cycling in forest: Soil sampling & Organic carbon analysis.	
8	Identify marine and fresh water planktons (preserved water samples may be used).	
9	Separate, mount and study the appendages of prawn ;penaeid and non-penaeid.	
10	Study of animal architecture (photographs / diagram / abandoned specimen) ; Hive of honey bee, nest of paper wasp, nest of potter wasp, Mount of termite, Nests of Weaver Bird and tailor bird.	
11	Comparative study of mouth parts (preserved specimen / diagrams only); House fly, female Mosquito, Cockroach, Butterfly / moth, Bug, beetle.	
12	Using photographs / paintings / coloured drawings identify and study distribution and ecological role of common bivalves and gastropods that	

	occur along a sea-shore.	
13	Compare and interpret given sonograms of bird calls (any two e.g. Courtship calls, Alarm calls)	
14	Identify and describe false colour images of land use patterns from a satellite image; City, reservoir, forest, agricultural land, sea-shore.	

**References:**

1. EIA – A Biography Clark, B. D., Bissel, B. D. and Watheam, P. School of Forestry and Environment, SHIATSDeemed University, Allahabad.
2. Wildlife Ecology, Conservation and Management Anthony R.E. Sinclair, John M. Fryxell and Graeme Caughly Blackwell Publishing, U.S.A. 2006.
3. Collection and preservation of animals Jairajpuri M. S. Zoological Survey of India 1990
4. Biodiversity conservation in managed and protected areas Katwal/Banerjee Agrobios, India 2002.
5. Biodiversity and its conservation in India Negi, S.S. Indus Publishing Co., New Delhi. 1993.
6. Wildlife Ecology, Conservation and Management Sinclair, Anthony R.E., Fryxell, John M. and Caughly, Graeme Blackwell Publishing, U.S.A. 2006.
7. Vertebrate Zoology and Evolution. Yadav, B.N. IBD, Dehradun. 2000
8. Indian Wildlife Resources Ecology and Development Sharma, B.D Daya Publishing House, Delh
9. Collection and preservation of animals Jairajpuri M. S. Zoological Survey of India 1990



**Project: Research Project**

<b>Course Title:</b> Research Project	<b>Course code:</b> 21ZOO4C1R
<b>Total Contact Hours:</b> 56 (0-0-8P/week)	<b>Course Credits:</b> 04
<b>Formative Assessment Marks:</b> 30	<b>Duration of ESA/Exam:</b> 4 h
<b>Summative Assessment Marks:</b> 70	

**Course Outcomes (CO's):**

**At the end of the course, students will be able to:**

To do independent research at national and international standard.

**Aim:** (a) Application of knowledge to real life situation (b) to introduce research methodology. Topic of dissertation may be chosen from any area of Zoology and may be laboratory based, field based or both or computational, with emphasis on originality of approach. It may be started during 3<sup>rd</sup> /4<sup>th</sup> semester and shall be completed by the end of the 4<sup>th</sup> semester. The Dissertation to be submitted should include (a) background information in the form of introduction (b) objectives of the study (c) materials and methods employed for the study (d) results and discussion thereon (e) summary and conclusions and (f) bibliography. Apart from these sections, importance of the results, originality and general presentation also may be taken into consideration for evaluation.

**CBCS Question Paper Pattern for M.Sc. Zoology Semester End Examination with Effect from the AY 2021-22**

**Disciplines Specific Core (DSC) and Discipline Specific Elective (DSE)**

Paper Code:

Paper Title:

Time: 3 Hours

Max. Marks: 70

Note: Answer any *FIVE* of the following questions with Question No. 1 (Q1) Compulsory, each question carries equal marks.

Q1. 14 Marks

Q2. 14 Marks

Q3. 14 Marks

Q4. 14 Marks

Q5. 14 Marks

Note: Question No.1 to 5, *one question from each unit* i.e. (Unit I, Unit II, ....). The Questions may be a whole or it may consists of sub questions such as a,b, c etc...

Q6. 14 Marks

Note : Question No.6, *shall be from Unit II and III*, the Question may be a whole or it may consists of sub questions such as a,b, c etc...

Q7. 14 Marks

Note: Question No.7, *shall be from Unit IV and V*, the Question may be a whole or it may consists of sub questions such as a,b, c etc...

Q8. 14 Marks

Note: Question No-8 shall be from *Unit II, Unit III , Unit IV and Unit V*.

The question shall have the following sub questions and weightage. i.e a – 05 marks, b – 05 marks, c – 04 marks.

\*\*\*\*\*

## **Skill Enhancement Courses (SECs)**

**Paper Code:**  
**Time: 1 Hours**

**Paper Title:**  
**Max. Marks: 30**

There shall be Theory examination of Multiple Choice Based Questions [MCQs] with Question Paper set of A, B, C and D Series at the end of each semester for SECs for the duration of One hour (First Fifteen Minutes for the Preparation of OMR and remaining Forty-Five Minutes for Answering thirty Questions). The Answer Paper is of OMR (Optical Mark Reader) Sheet.

\*\*\*\*\*

## **Question Paper Pattern for Subjects with Tutorial**

For the subjects with Tutorial component, there is no Semester-End Examination (SEE) to the component C3. The liberty of assessment of C3 is with the concerned faculty. The faculty must present innovative method of evaluation of component C3 before the respective BoS for approval and the same must be submitted to the Registrar and Registrar (Evaluation) before the commencement of the academic year.

\*\*\*\*\*