

Mahakaushal University, Jabalpur (M.P.)



Scheme & Syllabus

For

B.Sc. with Research/honors

Zoology

2022-23

Duration of Course: 4 Years

Examination Mode: Semester

Examination System: CBCS

**Mahakaushal University
Village-Aithakheda, Mukunwara Road, Post- Tilwara Jabalpur (M.P.) 482003**

Credit Distribution

SEMESTER SYSTEM			Credits Required								
			Sem	MJ	MI	DSE	GEC/ OEC	AECC	SEC SB/VB	FW	Total Credit
Level 5	Certificate	1 st Year Pass (Sem I+Sem II)	I	6	6		4	4			20
			II	6	6		4	4			20
Level 6	Diploma	2 nd Year Pass (Sem III+Sem IV)	III	6	6		4		4		20
			IV	6	6		4		4		20
Level 7	Degree	3 rd Year Pass (Sem V+Sem VI)	V	6		4			4	6	20
			VI	6		8				6	20
Level 8	Honors/ Research	4 th Year Pass (Sem VII+Sem VIII)	VII	6	4	4				6	20
			VIII	6	4					10	20
Total Credit				48	32	16	16	8	12	28	160

SEMESTER SYSTEM			Credits Required								
			MJ	MI	DSE	GEC/ OEC	AECC	SEC SB/VB	FW	Total Credit	
Level 5	Certificate	1 st Year Pass	12	12		8	8			40	
Level 6	Diploma	2 nd Year Pass	12	12		8		8		40	
Level 7	Degree	3 rd Year Pass	12		12			4	12	40	
Level 8	Honors/ Research	4 th Year Pass	12	8	4				16	40	
Total Credit			48	32	16	16	8	12	28	160	

For Regular Students Course Duration:

Min. Years for Completing UG Degree	3 Years
Min Years for Completing UG (Hons.) Degree	4 Years
Maximum Years for Completing UG Degree	6 Years
Max Years for Completing UG (Hons.) Degree	8 Years

Faculty of Science

Major: Zoology

Sem	Major	Minor	DSE	Open Elective/ Generic Elective	AECC	SEC		FW	Total Credits
						Skill Based	Value Based		
1	MJ-I (4+2)	MN-I (4+2)		OEC-I (4)	AECC-I (4)				20
2	MJ-II (4+2)	MN-II (4+2)		OEC-II (4)	AECC-II (4)				20
3	MJ-III (4+2)	MN-III (4+2)		OEC-III (4)		SECSB-I (4)			20
4	MJ-IV (4+2)	MN-IV (4+2)		OEC-IV (4)		SECSB-II (4)			20
5	MJ-V (4+2)		DSE-I (4)				SECVB (4)	Field Work (6)	20
6	MJ-VI (4+2)		DSE-II (4) DSE-III (4)					Internship (6)	20
7	MJ-VII (4+2)	MN-V (4)	DSE-IV (4)					Minor Project (6)	20
8	MJ-VIII (4+2)	MN-VI (4)						Major Research Project (10)	20
Total Credits	48	32	16	16	8	8	4	28	160

Major/Minor

Course Code	Category	Paper	Credits
BZOO101T	MJ/MI	Non-chordates I: Protista to Pseudocoelomates	4
BZOO101P	MJ/MI	Non-chordates I: Protista to Pseudocoelomates Lab	2
BZOO201T	MJ/MI	Principles of Ecology	4
BZOO201P	MJ/MI	Principles of Ecology Lab	2
BZOO301T	MJ/MI	Non-chordates II: Coelomates	4
BZOO301P	MJ/MI	Non-chordates II: Coelomates Lab	2
BZOO401T	MJ/MI	Cell Biology	4
BZOO401P	MJ/MI	Cell Biology Lab	2
BZOO501T	MJ/MI	Diversity of Chordates	4
BZOO501P	MJ	Diversity of Chordates Lab	2
BZOO601T	MJ/MI	Physiology: Controlling and Coordinating Systems	4
BZOO601P	MJ	Physiology: Controlling and Coordinating Systems Lab	2
BZOO701T	MJ	Fundamentals of Biochemistry	4
BZOO701P	MJ	Fundamentals of Biochemistry Lab	2
BZOO801T	MJ	Comparative Anatomy of Vertebrates	4
BZOO801P	MJ	Comparative Anatomy of Vertebrates Lab	2

Department Specific Elective

BZOO101D-I	DSE	Physiology: Life Sustaining Systems	4
BZOO101D-II	DSE	Biochemistry of Metabolic Processes	4
BZOO102D-I	DSE	Molecular Biology	4
BZOO102D-II	DSE	Principles of Genetics	4
BZOO103D-I	DSE	Animal Behaviour and Chronobiology	4
BZOO103D-II	DSE	Animal Biotechnology	4
BZOO104D-I	DSE	Reproductive Biology	4
BZOO104D-II	DSE	Wild Life Conservation and Management	4

Skill Enhancement Course (Skill Based) (Any Two)

Course Code	Category	Paper	Credits
BZOO101SB	SEC-SB	Apiculture	4
BZOO102SB	SEC-SB	Aquarium Fish Keeping	4
BZOO103SB	SEC-SB	Medical Diagnostics	4
BZOO104SB	SEC-SB	Research Methodology	4
BZOO105SB	SEC-SB	Sericulture	4

Open Elective Compulsory Course/ Generic Elective Compulsory Course

Course Code	Category	Paper	Credits
OECC101-I	OEC	Fundamental of Computer	4
OECC101-II	OEC	Environmental Studies	4
OECC102-I	OEC	Entrepreneurship	4
OECC102-II	OEC	Principle of Management	4
OECC103-I	OEC	Nutrition and Fitness	4
OECC103-II	OEC	Current Concerns in Public Health Nutrition	4
OECC104-I	OEC	Travel and Tourism	4
OECC104-II	OEC	Tourism Operation Software Skills	4

Ability Enhancement Compulsory Course

Course Code	Category	Paper	Credits
AECC101	AECC	English Language-I	4
AECC102	AECC	English Language-II	4

Skill Enhancement Course (Value Based) (Any One)

Course Code	Category	Paper	Credits
SECVB101	SEC-VB	Constitution of India	4
SECVB102	SEC-VB	Yoga in Life	4
SECVB103	SEC-VB	National Service Scheme (NSS)	4
SECVB104	SEC-VB	Health & Wellness	4
SECVB105	SEC-VB	Sports	4

Field Work

Course Code	Category	Paper/Description	Credits
BFWF-501	FW	Field work is the process of observing and collecting data about people, cultures, and natural environments.	6
BFWI-601	FW	The aim of the internship provides a direction to the activities, helps to focus on a result, and to assess the result achieved.	6
BFWP-701	FW	The objective of the minor project is to provide an opportunity for students to undertake short research training outside the classroom to solve real-world issues.	6
BFWR-801	FW	Project objectives describe the desired outcome of a project, which is often a tangible object. It's beneficial to create objectives for your project because creating a specific goal for you helps everyone know what they're supposed to be working toward.	10

BZOO101T: Non-chordates I: Protista to Pseudocoelomates

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Unit-I

(18 Lectures)

Protista, Parazoa and Metazoa: General characteristics and Classification up to classes, Study of Euglena, Amoeba and Paramecium, Life cycle and pathogenicity of Plasmodium vivax and Entamoeba histolytica, Locomotion and Reproduction in Protista, Evolution of symmetry and segmentation of Metazoa.

Unit-II

(8 Lectures)

Porifera: General characteristics and Classification up to classes, Canal system and spicules in sponges.

Unit-III

(12 Lectures)

Cnidaria: General characteristics and Classification up to classes, Metagenesis in Obelia, Polymorphism in Cnidaria, Corals and coral reefs.

Unit-IV

(14 Lectures)

Ctenophora: General characteristics and Evolutionary significance.

Platyhelminthes: General characteristics and Classification up to classes, Life cycle and pathogenicity of Fasciola hepatica and Taenia solium.

Unit-V

(8 Lectures)

Nemathelminthes: General characteristics and Classification up to classes, Life cycle and pathogenicity of Ascaris lumbricoides and Wuchereria bancrofti, Parasitic adaptations in helminthes.

Reference Books:

- Classification to be followed from “Barnes, R.D. (1982). Invertebrate Zoology, V Edition”

BZOO101P: Non-chordates I: Protista to Pseudocoelomates Lab

Practical:

1. Study of whole mount of Euglena, Amoeba and Paramecium, Binary fission and Conjugation in Paramecium
2. Examination of pond water collected from different places for diversity in Protista
3. Study of Sycon (T.S. and L.S.), Hyalonema, Euplectella, Spongilla
4. Study of Obelia, Physalia, Millepora, Aurelia, Tubipora, Corallium, Alcyonium, Gorgonia, Metridium, Pennatula, Fungia, Meandrina, Madrepora
5. One specimen/slide of any ctenophore
6. Study of adult Fasciola hepatica, Taenia solium and their life cycles (Slides/microphotographs)
7. Study of adult Ascaris lumbricoides and its life stages (Slides/micro-photographs)
8. To submit a Project Report on any related topic on life cycles/coral/ coral reefs.

Reference Books:

- Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition.
- Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
- Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson

BZOO201T: Principles of Ecology

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4 0 2

Unit-I

(6 Lectures)

Introduction to Ecology: History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of physical factors.

Unit-II

(24 Lectures)

Population: Unitary and Modular populations, Unique and group attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion, Exponential and logistic growth, equation and patterns, r and K strategies, Population regulation - density-dependent and independent factors, Population interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition and Predation, functional and numerical responses.

Unit-III

(12 Lectures)

Community: Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological succession with one example, Theories pertaining to climax community

Unit-IV

(14 Lectures)

Ecosystem: Types of ecosystems with one example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies, Nutrient and biogeochemical cycle with one example of Nitrogen cycle, Human modified ecosystem.

Unit-V

(4 Lectures)

Applied Ecology: Ecology in Wildlife Conservation and Management.

Reference Books:

- Colinvaux, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
- Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
- Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
- Robert Leo Smith Ecology and field biology Harper and Row publisher
- Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Pres

BZOO201P: Principles of Ecology Lab

Practical:

- 1.** Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided.
- 2.** Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community.
- 3.** Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO₂.
- 4.** Report on a visit to National Park/Biodiversity Park/Wild life sanctuary.

Reference Books:

- Colinvaux, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
- Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
- Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
- Robert Leo Smith Ecology and field biology Harper and Row publisher
- Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Pres

BZOO301T: Non-chordates II: Coelomates

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Unit-I

(12 Lectures)

Introduction to Coelomates: Evolution of coelom and metamerism

Annelida: General characteristics and Classification up to classes, Excretion in Annelida.

Unit-II

(16 Lectures)

Arthropoda: General characteristics and Classification up to classes, Vision and Respiration in Arthropoda, Metamorphosis in Insects, Social life in bees and termites.

Unit-III

(4 Lectures)

Onychophora: General characteristics and Evolutionary significance.

Unit-IV

(16 Lectures)

Mollusca: General characteristics and Classification up to classes, Respiration in Mollusca, Torsion and detorsion in Gastropoda, Pearl formation in bivalves, Evolutionary significance of trochophore larva.

Unit-V

(12 Lectures)

Echinodermata: General characteristics and Classification up to classes, Water-vascular system in Asteroidea, Larval forms in Echinodermata, Affinities with Chordates.

Reference Books:

- Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition
- Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
- Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson

BZOO301P: Non-chordates II: Coelomates Lab

Practical:

1. Study of following specimens:
 - Annelids - Aphrodite, Nereis, Heteronereis, Sabella, Serpula, Chaetopterus, Pheretima, Hirudinaria
 - Arthropods - Limulus, Palamnaeus, Palaemon, Daphnia, Balanus, Sacculina, Cancer, Eupagurus, Scolopendra, Julus, Bombyx, Periplaneta, termites and honey bees
 - Onychophora - Peripatus
 - Molluscs - Chiton, Dentalium, Pila, Doris, Helix, Unio, Ostrea, Pinctada, Sepia, Octopus, Nautilus
 - Echinodermates - Pentaceros/Asterias, Ophiura, Clypeaster, Echinus, Cucumaria and Antedon
2. Study of digestive system, septal nephridia and pharyngeal nephridia of earthworm.
3. T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm.
4. Mount of mouth parts and dissection of digestive system and nervous system of Periplaneta*
5. To submit a Project Report on any related topic to larval forms (crustacean, mollusc and echinoderm)

Reference Books:

- Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition
- Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science
- Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson

BZOO401T: Cell Biology

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Unit-I

(10 Lectures)

Overview of Cells: Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions

Plasma Membrane: Various models of plasma membrane structure, Transport across membranes: Active and Passive transport, Facilitated transport, Cell junctions: Tight junctions, Desmosomes, Gap junctions

Unit-II

(10 Lectures)

Endomembrane System: Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes.

Unit-III

(16 Lectures)

Mitochondria and Peroxisomes: Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis, Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis, Peroxisomes

Cytoskeleton: Structure and Functions: Microtubules, Microfilaments and Intermediate filaments.

Unit-IV

(12 Lectures)

Nucleus: Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus, Chromatin: Euchromatin and Hetrochromatin and packaging (nucleosome).

Unit-V

(12 Lectures)

Cell Division: Mitosis, Meiosis, Cell cycle and its regulation

Cell Signalling: GPCR and Role of second messenger (cAMP)

Reference Books:

- Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
- Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.

BZOO401P: Cell Biology Lab

Practical:

1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis.
2. Study of various stages of meiosis.
3. Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells.
4. Preparation of permanent slide to demonstrate:
 - i) DNA by Feulgen reaction
 - ii) DNA and RNA by MGP
 - iii) Mucopolysaccharides by PAS reaction
 - iv) Proteins by Mercurobromophenol blue/Fast Green.

Reference Books:

- Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
- Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.

BZOO501T: Diversity of Chordates

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Unit-I

(10 Lectures)

Introduction to Chordates: General characteristics and outline classification

Protochordata: General characteristics of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata.

Unit-II

(6 Lectures)

Origin of Chordata: Dipleurula concept and the Echinoderm theory of origin of chordates, Advanced features of vertebrates over Protochordata

Agnatha: General characteristics and classification of cyclostomes up to class.

Unit-III

(14 Lectures)

Pisces: General characteristics of Chondrichthyes and Osteichthyes, classification up to order Migration, Osmoregulation and Parental care in fishes

Amphibia: Origin of Tetrapoda (Evolution of terrestrial ectotherms); General characteristics and classification up to order; Parental care in Amphibians.

Unit-IV

(14 Lectures)

Reptilia: General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and Biting mechanism in snakes

Aves: General characteristics and classification up to order Archaeopteryx-- a connecting link; Principles and aerodynamics of flight, Flight adaptations and Migration in birds.

Unit-V

(16 Lectures)

Mammals: General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages

Zoogeography: Zoogeographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, distribution of vertebrates in different realms.

Reference Books:

- Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
- Pough H. Vertebrate life, VIII Edition, Pearson International.
- Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
- Hall B.K. and Hallgrímsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.

BZOO501P: Diversity of Chordates Lab

Practical:

1. **Protochordata:** Balanoglossus, Herdmania, Branchiostoma, Colonial Urochordata
Sections of Balanoglossus through proboscis and branchiogenital regions, Sections of Amphioxus through pharyngeal, intestinal and caudal regions. Permanent slide of Herdmania spicules
2. **Agnatha:** Petromyzon, Myxine
3. **Fishes:** Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeneis, Anguilla, Hippocampus, Tetrodon/ Diodon, Anabas, Flat fish
4. **Amphibia:** Ichthyophis/Ureotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra
5. **Reptilia:** Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus
Key for Identification of poisonous and non-poisonous snakes
6. **Aves:** Study of six common birds from different orders. Types of beaks and claws
7. **Mammalia:** Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceus. Mount of weberian ossicles of Mystus, pecten from Fowl head
Dissection of Fowl head (Dissections and mounts subject to permission) Power point presentation on study of any two animals from two different classes by students (may be included if dissections not given permission)

Reference Books:

- Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
- Pough H. Vertebrate life, VIII Edition, Pearson International.
- Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
- Hall B.K. and Hallgrímsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.

BZOO601T: Physiology: Controlling and Coordinating Systems

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Unit-I

(10 Lectures)

Tissues: Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue

Bone and Cartilage: Structure and types of bones and cartilages, Ossification, bone growth and resorption.

Unit-II

(10 Lectures)

Nervous System: Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Types of synapse, Synaptic transmission and, Neuromuscular junction; Reflex action and its types - reflex arc; Physiology of hearing and vision..

Unit-III

(12 Lectures)

Muscle: Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and tetanus.

Unit-IV

(10 Lectures)

Reproductive System: Histology of testis and ovary; Physiology of male and female reproduction; Puberty, Methods of contraception in male and female.

Unit-V

(18 Lectures)

Endocrine System: Histology of endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas, adrenal; hormones secreted by them and their mechanism of action; Classification of hormones; Regulation of their secretion; Mode of hormone action, Signal transduction pathways for steroidal and non-steroidal hormones; Hypothalamus (neuroendocrine gland) -

principal nuclei involved in neuroendocrine control of anterior pituitary and endocrine system;
Placental hormones.

Reference Books:

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hecourt Asia PTE Ltd. /W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.

BZOO601P: Physiology: Controlling and Coordinating Systems Lab

Practical:

1. *Recording of simple muscle twitch with electrical stimulation (or Virtual)
2. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex).
3. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells.
4. Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell, Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid.
5. Microtomy: Preparation of permanent slide of any five mammalian (Goat/white rat) tissues.

(*Subject to UGC guidelines)

Reference Books:

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hecourt Asia PTE Ltd. /W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.

BZOO701T: Fundamentals of Biochemistry

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Unit-I

(8 Lectures)

Carbohydrates: Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates.

Unit-II

(8 Lectures)

Lipids: Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids

Unit-III

(14 Lectures)

Proteins: Amino acids: Structure, Classification and General properties of α -amino acids; Physiological importance of essential and non-essential α -amino acids

Proteins: Bonds stabilizing protein structure; Levels of organization in proteins; Denaturation; Introduction to simple and conjugate proteins

Immunoglobulins: Basic Structure, Classes and Function, Antigenic Determinants

Unit-IV

(12 Lectures)

Nucleic Acids: Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids
Cot Curves: Base pairing, Denaturation and Renaturation of DNA Types of DNA and RNA, Complementarity of DNA, Hypo-Hyperchromaticity of DNA.

Unit-V

(18 Lectures)

Enzymes: Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of K_m and V_{max} ,

Lineweaver-Burk plot; Multi-substrate reactions; Enzyme inhibition; Allosteric enzymes and their kinetics; Regulation of enzyme action.

Reference Books:

- Cox, M.M and Nelson, D.L. (2008). Lehninger's Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
- Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw- Hill Companies Inc.
- Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.
- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). Molecular Biology of the Gene, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub.

BZOO701P: Fundamentals of Biochemistry Lab

Practical:

1. Qualitative tests of functional groups in carbohydrates, proteins and lipids.
2. Paper chromatography of amino acids.
3. Action of salivary amylase under optimum conditions.
4. Effect of pH, temperature and inhibitors on the action of salivary amylase.
5. Demonstration of proteins separation by SDS-PAGE.

Reference Books:

- Cox, M.M and Nelson, D.L. (2008). Lehninger's Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
- Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw- Hill Companies Inc.
- Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.
- Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). Molecular Biology of the Gene, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub.

BZOO801T: Comparative Anatomy of Vertebrates

L T P
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Unit-I

(8 Lectures)

Integumentary System: Structure, functions and derivatives of integument.

Unit-II

(8 Lectures)

Skeletal System: Overview of axial and appendicular skeleton, Jaw suspensorium, Visceral arches.

Unit-III

(16 Lectures)

Digestive System: Alimentary canal and associated glands, dentition

Respiratory System: Skin, gills, lungs and air sacs; Accessory respiratory organs.

Unit-IV

(14 Lectures)

Circulatory System: General plan of circulation, evolution of heart and aortic arches

Urinogenital System: Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri.

Unit-V

(14 Lectures)

Nervous System: Comparative account of brain Autonomic nervous system, Spinal cord, Cranial nerves in mammals

Sense Organs: Classification of receptors Brief account of visual and auditory receptors in man.

Reference Books:

- Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education
- Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies
- Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons
- Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House

BZOO801P: Comparative Anatomy of Vertebrates Lab

Practical:

1. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs.
2. Disarticulated skeleton of Frog, Varanus, Fowl, Rabbit.
3. Carapace and plastron of turtle /tortoise.
4. Mammalian skulls: One herbivorous and one carnivorous animal.
5. Dissection of rat to study arterial and urinogenital system (subject to permission).
6. Study of structure of any two organs (heart, lung, kidney, eye and ear) from video recording (may be included if dissection not permitted)
7. Project on skeletal modifications in vertebrates (may be included if dissection not permitted)

Reference Books:

- Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education
- Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies
- Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons
- Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House

Department Specific Elective

BZOO101D-I: Physiology: Life Sustaining Systems

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Unit-I

(14 Lectures)

Physiology of Digestion: Structural organization and functions of gastrointestinal tract and associated glands; Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Hormonal control of secretion of enzymes in Gastrointestinal tract.

Unit-II

(12 Lectures)

Physiology of Respiration: Histology of trachea and lung; Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood; Respiratory pigments, Dissociation curves and the factors influencing it; Carbon monoxide poisoning; Control of respiration.

Unit-III

(8 Lectures)

Renal Physiology: Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance.

Unit-IV

(14 Lectures)

Blood: Components of blood and their functions; Structure and functions of haemoglobin
Haemostasis: Blood clotting system, Kallikrein-Kininogen system, Complement system & Fibrinolytic system, Haemopoiesis, Blood groups: Rh factor, ABO and MN.

Unit-V

(12 Lectures)

Physiology of Heart: Structure of mammalian heart; Coronary circulation; Structure and working of conducting myocardial fibers. Origin and conduction of cardiac impulses Cardiac cycle; Cardiac output and its regulation, Frank-Starling Law of the heart, nervous and chemical regulation of heart rate. Electrocardiogram, Blood pressure and its regulation.

Reference Books:

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hecourt Asia PTE Ltd. W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons.
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
- Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills

BZOO101D-II: Biochemistry of Metabolic Processes

L T P
4 0 0

Unit-I

(10 Lectures)

Overview of Metabolism: Catabolism vs Anabolism, Stages of catabolism, Compartmentalization of metabolic pathways, Shuttle systems and membrane transporters; ATP as "Energy Currency of cell"; coupled reactions; Use of reducing equivalents and cofactors; Intermediary metabolism and regulatory mechanisms.

Unit-II

(16 Lectures)

Carbohydrate Metabolism: Sequence of reactions and regulation of glycolysis, Citric acid cycle, Phosphate pentose pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis.

Unit-III

(14 Lectures)

Lipid Metabolism: β -oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbon atoms; Biosynthesis of palmitic acid; Ketogenesis.

Unit-IV

(10 Lectures)

Protein Metabolism: Catabolism of amino acids: Transamination, Deamination, Urea cycle; Fate of C-skeleton of Glucogenic and Ketogenic amino acids.

Unit-V

(10 Lectures)

Oxidative Phosphorylation: Redox systems; Review of mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System.

Reference Books:

- Cox, M.M and Nelson, D.L. (2008). Lehninger Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.
- Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.
- Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
- Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.

BZOO102D-I: Molecular Biology

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Unit-I

(16 Lectures)

Nucleic Acids: Salient features of DNA and RNA Watson and Crick model of DNA

DNA Replication: DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative, bidirectional and semi-discontinuous replication, RNA priming, Replication of circular and linear ds-DNA, replication of telomeres.

Unit-II

(10 Lectures)

Transcription: RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors.

Unit-III

(12 Lectures)

Translation: Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis in prokaryotes: Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain; Inhibitors of protein synthesis; Difference between prokaryotic and eukaryotic translation.

Unit-IV

(16 Lectures)

Post Transcriptional Modifications and Processing of Eukaryotic RNA: Structure of globin mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA

Gene Regulation: Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from lac operon and trp operon; Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencer elements; Gene silencing, Genetic imprinting.

Unit-V

(6 Lectures)

DNA Repair Mechanisms: Pyrimidine dimerization and mismatch repair

Regulatory RNAs: Ribo-switches, RNA interference, miRNA, siRNA.

Reference Books:

- Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter: Molecular Biology of the Cell, IV Edition.
- Cooper G. M. and Robert E. Hausman R. E. The Cell: A Molecular Approach, V Edition, ASM Press and Sinauer Associates.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
- Lewin B. (2008). Gene XI, Jones and Bartlett
- McLennan A., Bates A., Turner, P. and White M. (2015). Molecular Biology IV Edition. GS, Taylor and Francis Group, New York and London.

BZOO102D-II: Principles of Genetics

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Unit-I

(8 Lectures)

Mendelian Genetics and its Extension: Principles of inheritance, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Sex-linked, sexinfluenced and sex-limited characters inheritance.

Unit-II

(12 Lectures)

Linkage, Crossing Over and Chromosomal Mapping: Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence, Somatic cell hybridization.

Unit-III

(10 Lectures)

Mutations: Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), Molecular basis of mutations in relation to UV light and chemical mutagens; Detection of mutations: CLB method, attached X method.

Unit-IV

(14 Lectures)

Sex Determination: Chromosomal mechanisms of sex determination in Drosophila and Man

Extra-chromosomal Inheritance: Criteria for extra-chromosomal inheritance, Antibiotic resistance in Chlamydomonas, Mitochondrial mutations in Saccharomyces, Infective heredity in Paramecium and Maternal effects

Polygenic Inheritance: Polygenic inheritance with suitable examples; simple numericals based on it.

Unit-V

(16 Lectures)

Recombination in Bacteria and Viruses: Conjugation, Transformation, Transduction, Complementation test in Bacteriophage

Transposable Genetic Elements: Transposons in bacteria, Ac-Ds elements in maize and P elements in Drosophila, Transposons in humans).

Reference Books:

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India
- Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings
- Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings
- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co
- Fletcher H. and Hickey I. (2015). Genetics. IV Edition. GS, Taylor and Francis Group, New York and London.

BZOO103D-I: Animal Behaviour and Chronobiology

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Unit-I

(12 Lectures)

Introduction to Animal Behaviour: Origin and history of Ethology; Brief profiles of Karl Von Frish, Ivan Pavlov, Konrad Lorenz, Niko Tinbergen, Proximate and ultimate causes of behaviour, Methods and recording of a behaviour.

Unit-II

(10 Lectures)

Patterns of Behaviour: Stereotyped Behaviours (Orientation, Reflexes); Individual Behavioural patterns; Instinct vs. Learnt Behaviour; Associative learning, classical and operant conditioning, Habituation, Imprinting.

Unit-III

(10 Lectures)

Social and Sexual Behaviour:

Social Behaviour: Concept of Society; Communication and the senses; Altruism; Insects' society with Honey bee as example; Foraging in honey bee and advantages of the waggle dance.

Sexual Behaviour: Asymmetry of sex, Sexual dimorphism, Mate choice, Intra-sexual selection (male rivalry), Inter-sexual selection (female choice), Sexual conflict in parental care.

Unit-IV

(12 Lectures)

Introduction to Chronobiology: Historical developments in chronobiology; Biological oscillation: the concept of Average, amplitude, phase and period. Adaptive significance of biological clocks.

Unit-V

(16 Lectures)

Biological Rhythm: Types and characteristics of biological rhythms: Short- and Long- term rhythms; Circadian rhythms; Tidal rhythms and Lunar rhythms; Concept of synchronization

and masking; Photic and non-photic zeitgebers; Circannual rhythms; Photoperiod and regulation seasonal reproduction of vertebrates; Role of melatonin.

Biological Clocks: Relevance of biological clocks; Chronopharmacology, Chronomedicine, Chronotherapy.

Reference Books:

- David McFarland, *Animal Behaviour*, Pitman Publishing Limited, London, UK.
- Manning, A. and Dawkins, M. S, *An Introduction to Animal Behaviour*, Cambridge, University Press, UK.
- John Alcock, *Animal Behaviour*, Sinauer Associate Inc., USA.
- Paul W. Sherman and John Alcock, *Exploring Animal Behaviour*, Sinauer Associate Inc., Massachusetts, USA.
- *Chronobiology Biological Timekeeping*: Jay. C. Dunlap, Jennifer. J. Loros, Patricia J. DeCoursey (ed). 2004, Sinauer Associates, Inc. Publishers, Sunderland, MA, USA
- *Insect Clocks* D.S. Saunders, C.G.H. Steel, X., Afopoulou (ed.)R.D. Lewis. (3rdEd) 2002 Baren and Noble Inc. New York, USA
- *Biological Rhythms*: Vinod Kumar (2002) Narosa Publishing House, Delhi/ Springer-Verlag, Germany.

BZOO103D-II: Animal Biotechnology

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Unit-I

(8 Lectures)

Introduction: Concept and scope of biotechnology.

Unit-II

(12 Lectures)

Molecular Techniques in Gene manipulation-I: Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage, M13, BAC, YAC, MAC and Expression vectors (characteristics). Restriction enzymes: Nomenclature, detailed study of Type II. Transformation techniques: Calcium chloride method and electroporation.

Unit-III

(12 Lectures)

Molecular Techniques in Gene manipulation-II: Construction of genomic and cDNA libraries and screening by colony and plaque hybridization Southern, Northern and Western blotting DNA sequencing: Sanger method Polymerase Chain Reaction, DNA Finger Printing and DNA micro array.

Unit-IV

(18 Lectures)

Genetically Modified Organisms: Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knock out mice. Production of transgenic plants: Agrobacterium mediated transformation. Applications of transgenic plants: insect and herbicide resistant plants.

Unit-V

(10 Lectures)

Culture Techniques and Applications: Animal cell culture, Expressing cloned genes in mammalian cells, Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anemia)

Recombinant DNA in medicines: Recombinant insulin and human growth hormone, Gene therapy.

Reference Books:

- Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis. II Edition, Academic Press, California, USA.
- Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology - Principles and Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA.
- Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA.
- Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. V Edition, John Wiley and Sons Inc.
- Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA- Genes and Genomes- A Short Course. III Edition, Freeman and Co., N.Y., USA.
- Beauchamp, T.I. and Childress, J.F. (2008). Principles of Biomedical Ethics. VI Edition, Oxford University Press.

BZOO104D-I: Reproductive Biology

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Unit-I

(12 Lectures)

Reproductive Endocrinology: Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones, and prostaglandins, hypothalamo – hypophyseal – gonadal axis, regulation of gonadotrophin secretion in male and female; **Reproductive System:** Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation.

Unit-II

(12 Lectures)

Functional anatomy of male reproduction: Outline and histological of male reproductive system in rat and human; **Testis:** Cellular functions, germ cell, stem cell renewal; **Spermatogenesis:** kinetics and hormonal regulation; **Androgen synthesis and metabolism;** **Epididymal function and sperm maturation;** **Accessory glands functions;** **Sperm transportation in male tract.**

Unit-III

(12 Lectures)

Functional anatomy of female reproduction-I: Outline and histological of female reproductive system in rat and human; **Ovary:** folliculogenesis, ovulation, corpus luteum formation and regression; **Steroidogenesis and secretion of ovarian hormones;** **Reproductive cycles (rat and human) and their regulation, changes in the female tract**

Unit-IV

(12 Lectures)

Functional anatomy of female reproduction-II: Ovum transport in the fallopian tubes; Sperm transport in the female tract, fertilization; **Hormonal control of implantation;** **Hormonal regulation of gestation, pregnancy diagnosis, foeto – maternal relationship;** **Mechanism of parturition and its hormonal regulation;** **Lactation and its regulation.**

Unit-V

(12 Lectures)

Reproductive Health: Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminology used in family planning.

Reference Books:

- Austin, C.R. and Short, R.V. reproduction in Mammals. Cambridge University Press.
- Degroot, L.J. and Jameson, J.L. (eds). Endocrinology. W.B. Saunders and Company.
- Knobil, E. et al. (eds). The Physiology of Reproduction. Raven Press Ltd.
- Hatcher, R.A. et al. The Essentials of Contraceptive Technology. Population Information Programme.

BZOO104D-II: Wild Life Conservation and Management

L T P
4 0 0

Unit-I

(16 Lectures)

Introduction to Wild Life: Values of wild life - positive and negative; Conservation ethics; Importance of conservation; Causes of depletion; World conservation strategies.

Evaluation and management of wild life: Habitat analysis, Physical parameters: Topography, Geology, Soil and water; Biological Parameters: food, cover, forage, browse and cover estimation; Standard evaluation procedures: remote sensing and GIS.

Unit-II

(10 Lectures)

Management of habitats: Setting back succession; Grazing logging; Mechanical treatment; Advancing the successional process; Cover construction; Preservation of general genetic diversity; Restoration of degraded habitats.

Unit-III

(12 Lectures)

Population estimation: Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation; Faecal analysis of ungulates and carnivores: Faecal samples, slide preparation, Hair identification, Pug marks and census method.

Unit-IV

(10 Lectures)

Management planning of wild life in protected areas: Estimation of carrying capacity; Eco tourism / wild life tourism in forests; Concept of climax persistence; Ecology of perturbation.

Unit-V

(12 Lectures)

Management of excess population: Bio- telemetry; Care of injured and diseased animal; Quarantine; Common diseases of wild animal

Protected areas: National parks & sanctuaries, Community reserve; Important features of protected areas in India; Tiger conservation - Tiger reserves in India; Management challenges in Tiger reserve.

Reference Books:

- Caughley, G., and Sinclair, A.R.E. (1994). *Wildlife Ecology and Management*. Blackwell Science.
- Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). *People and Wildlife, Conflict or Co-existence?* Cambridge University.
- Bookhout, T.A. (1996). *Research and Management Techniques for Wildlife and Habitats*, 5 th edition. The Wildlife Society, Allen Press.
- Sutherland, W.J. (2000). *The Conservation Handbook: Research, Management and Policy*. Blackwell Sciences
- Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). *Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory*. Blackwell Publishing.

Skill Based: Skill Enhancement Courses

BZOO101SB: Apiculture

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Unit-I

(10 Lectures)

Biology of Bees: History, Classification and Biology of Honey Bees Social Organization of Bee Colony.

Unit-II

(14 Lectures)

Rearing of Bees: Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth, Bee Pasturage, Selection of Bee Species for Apiculture, Bee Keeping Equipment, Methods of Extraction of Honey (Indigenous and Modern).

Unit-III

(12 Lectures)

Diseases and Enemies: Bee Diseases and Enemies, Control and Preventive measures.

Unit-IV

(12 Lectures)

Bee Economy: Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc.

Unit-V

(12 Lectures)

Entrepreneurship in Apiculture: Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens.

Reference Books:

- Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
- Bisht D.S., Apiculture, ICAR Publication.
- Singh S., Beekeeping in India, Indian council of Agricultural Research, New Delhi.

BZOO102SB: Aquarium Fish Keeping

L T P
4 0 0

Unit-I

(10 Lectures)

Introduction to Aquarium Fish Keeping: The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes.

Unit-II

(14 Lectures)

Biology of Aquarium: Fishes Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish.

Unit-III

(12 Lectures)

Food and feeding of Aquarium fishes: Use of live fish feed organisms. Preparation and composition of formulated fish feeds.

Unit-IV

(12 Lectures)

Fish Transportation: Live fish transport - Fish handling, packing and forwarding techniques.

Unit-V

(12 Lectures)

Maintenance of Aquarium: General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry.

Reference Books:

- Aquarium : Fish Keeping C B L Srivastava Published by Kitab Mahal.
- Marine Aquarium (Fish: Keeping and Breeding Them in Captivity) Boruchowitz, Davie. Published by Chelsea House Publications (1998).

- Aquarium Setting Up (Fish: Keeping and Breeding Them in Captivity) Axelrod, Herbert R. Published by Chelsea House Publications (1998).
- The Tropical Freshwater Aquarium Problem Solver: Practical and Expert Advice on Keeping Fish and Plants Sand ford, Gina Published by Voyageur Press (MN) (1998).
- Aquariums: The Complete Guide to Freshwater and Saltwater Aquariums, Jan 2009 by Thierry Maitre-alain (Author), Chrisitan Piednoir (Author)

BZOO103SB: Medical Diagnostics

L T P
4 0 0

Unit-I

(16 Lectures)

Introduction: Introduction to Medical Diagnostics and its Importance

Diagnostics Methods Used for Analysis of Blood: 10 Blood composition, Preparation of blood smear and Differential Leucocyte Count (D.L.C) using Leishman's stain, Platelet count using haemocytometer, Erythrocyte Sedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.).

Unit-II

(12 Lectures)

Diagnostic Methods Used for Urine Analysis: Urine Analysis: Physical characteristics; Abnormal constituents.

Unit-III

(12 Lectures)

Non-infectious Diseases: Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/Kit.

Unit-IV

(10 Lectures)

Infectious Diseases: Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis.

Unit-V

(10 Lectures)

Tumours: Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs).

Reference Books:

- Park, K. (2007), Preventive and Social Medicine, B.B. Publishers.
- Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology, II Edition, Bhalani Publishing House.
- Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses.
- Guyton A.C. and Hall J.E. Textbook of Medical Physiology, Saunders.
- Robbins and Cortan, Pathologic Basis of Disease, VIII Edition, Saunders.
- Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.

BZOO104SB: Research Methodology

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Foundations of Research: Meaning, Objectives, Motivation: Research Methods vs Methodology, Types of Research: Analytical vs Descriptive, Quantitative vs Qualitative, Basic vs Applied

Research Design: Need for research design: Features of good design, Important concepts related to good design- Observation and Facts, Prediction and Explanation, Development of Models. Developing a research plan: Problem identification, Experimentation, Determining experimental and sample designs

Data Collection, Analysis and Report Writing: Observation and Collection of Data-Methods of data collection- Sampling Methods, Data Processing and Analysis Strategies, Technical Reports and Thesis writing, Preparation of Tables and Bibliography. Data Presentation using digital technology

Ethical Issues: Intellectual property Rights, Commercialization, Copy Right, Royalty, Patent law, Plagiarism, Citation, Acknowledgement

Reference Books:

- Anthony, M, Graziano, A.M. and Raulin, M.L. 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
- Walliman, N. 2011. Research Methods- The Basics. Taylor and Francis, London, New York.
- Wadhera, B.L.: Law Relating to Patents, Trade Marks, Copyright Designs and Geographical Indications, 2002, Universal Law publishing.
- C.R.Kothari: Research Methodology, New Age International, 2009.
- Coley, S.M. and Scheinberg, C.A. 1990, "Proposal writing". Stage Publications.

BZOO105SB: Sericulture

L T P
4 0 0

Unit-I

(10 Lectures)

Introduction: Sericulture: Definition, history and present status; Silk route Types of silkworms, Distribution and Races Exotic and indigenous races Mulberry and non-mulberry Sericulture.

Unit-II

(14 Lectures)

Biology of Silkworm: Life cycle of Bombyx mori Structure of silk gland and secretion of silk.

Unit-III

(12 Lectures)

Rearing of Silkworms: Selection of mulberry variety and establishment of mulberry garden, Rearing house and rearing appliances, Disinfectants: Formalin, bleaching powder, RKO, Silkworm rearing technology: Early age and Late age rearing, Types of mountages, Spinning, harvesting and storage of cocoons.

Unit-IV

(12 Lectures)

Pests and Diseases: Pests of silkworm: Uzi fly, dermestid beetles and vertebrates, Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial, Control and prevention of pests and diseases.

Unit-V

(12 Lectures)

Entrepreneurship in Sericulture: Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres.

Reference Books:

- Manual on Sericulture; Food and Agriculture Organisation, Rome 1976
- Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, Bangalore
- Silkworm Rearing and Disease of Silkworm, 1956, Ptd. By Director of Ptg., Stn. & Pub. Govt. Press, Bangalore
- Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
- Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan 1972.
- Manual of Silkworm Egg Production; M. N. Narasimhanna, CSB, Bangalore 1988.
- Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
- A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
- Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986.