

**SCHEME AND SYLLABUS UNDER
CHOICE BASED CREDIT SYSTEM
B.Sc. WITH ZOOLOGY (REGULAR COURSE)**

	CORE COURSE (12)	Ability Enhancement Compulsory Courses AEC (2)	Skill Enhancement Courses SEC (4)	Discipline Specific Elective DSE (6)
I	DSC-1A: Animal Diversity DSC-2A: Botany DSC-3A: Chemistry	English/Hind/MIL Communication		
II	DSC-1B: Comparative Anatomy and Development Biology of Vertebrates DSC-2B: Botany DSC-3B: Chemistry	Environmental Science		
III	DSC-1C: Human Physiology DSC-2C: Botany DSC-3C- Chemistry		SEC-1 : Sericulture	
IV	DSC-1D: Genetics and Evolutionary Biology DSC-2D: Botany DSC-3D: Chemistry		SEC- 2: Aquarium Fish Keeping	
V			SEC- 3: Public Health & hygiene	DSE-1A: Immunology DSE-2A: Botany DSE-3A: Chemistry
VI			SEC-4: Apiculture	DSE-1B: Animal Biotechnology DSE-Botany II DSE-Chemistry II

Discipline Core Courses: Zoology

DSC-1A: Animal Diversity

DSC-1B: Comparative Anatomy and Developmental Biology of Vertebrates

DSC-1C: Human Physiology

DSC-1D: Genetics and Evolutionary Biology

Discipline Specific Electives: Zoology (Any two)

DSE-1A: Immunology

DSE-1B: Animal Biotechnology

Skill Enhancement Courses (SCE)

SCE- 1 : Sericulture

SCE- 2 : Aquarium Fish Keeping

SCE- 3 : Public Health and Hygiene

SCE- 4 : Apiculture

Note: The students of B.Sc. Zoology pass course adopting Chemistry in their course should take Chemistry syllabus from Life Sciences.

Bodoland University
Department of Zoology
Curriculum Structures for UG syllabus for B.Sc. (Regular Course)
No. of papers =12+12=24, Total Credits= 120
Total Marks=2100

SEM-I						
Paper Code	Course	Credit	Credit Distribution (L+T+P)	End Sem Marks	Internal Marks	Total Marks
ZOO-101R	DSC-1A: Animal Diversity	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-102R	DSC-2A	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-103R	DSC-3A	6	4+0+2	60(Theo)+20(Pract)	20	100
COMM-104HR	AEC: AECC-1: English/Hind/MIL (Communication)	2	2+0+0	50	-	50
Total		20	20	290	60	350

SEM-II						
Paper Code	Course	Credit	Credit Distribution (L+T+P)	End Sem Marks	Internal Marks	Total Marks
ZOO-201R	DSC-1B: Comparative Anatomy and Developmental Biology of Vertebrates	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-202R	DSC-2B	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-203R	DSC-3B	6	4+0+2	60(Theo)+20(Pract)	20	100
COMM-204HR	AEC: AECC-2: Environmental Science	2	2+0+0	50	-	50
Total		20	20	290	60	350

SEM-III						
Paper Code	Course	Credit	Credit Distribution (L+T+P)	End Sem Marks	Internal Marks	Total Marks
ZOO-301R	DSC-1C: Human Physiology	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-302R	DSC-2C	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-303R	DSC-3C	6	4+0+2	60(Theo)+20(Pract)	20	100
ZOO-304HR	AEC: SEC-1: Sericulture	2	2+0+0	50	-	50
Total		20	20	290	60	350

SEM-IV						
Paper Code	Course	Credit	Credit Distribution (L+T+P)	End Sem Marks	Internal Marks	Total Marks
ZOO-401R	DSC-1D: Genetics and Evolutionary Biology	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-402R	DSC-2D	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-403R	DSC-3D	6	4+0+2	60(Theo)+20(Pract)	20	100
ZOO-404HR	AEC: SEC-2: Aquarium Fish Keeping	2	2+0+0	50	-	50
Total		20	20	290	60	350

SEM-V						
Paper Code	Course	Credit	Credit Distribution (L+T+P)	End Sem Marks	Internal Marks	Total Marks
ZOO-D1HR	DSE-1A: Immunology	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-502R	DSE-2A	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-503R	DSE-3A	6	4+0+2	60(Theo)+20(Pract)	20	100
ZOO-504R	AEC: SEC-3: Public Health & hygiene	2	2+0+0	50	-	50
Total		20	20	290	60	350

SEM-VI						
Paper Code	Course	Credit	Credit Distribution (L+T+P)	End Sem Marks	Internal Marks	Total Marks
ZOO-D2HR	DSE-1B: Animal Biotechnology	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-602H	DSE-2B	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-603R	DSE-3B	6	4+0+2	60(Theo)+20(Pract)	20	100
ZOO-604R	AEC: SEC-4: Apiculture	2	2+0+0	50	-	50
Total		20	20	290	60	350

1ST SEMESTER SYLLABUS (REGULAR)

SEM-I						
Paper Code	Course	Credit	Credit Distribution (L+T+P)	End Sem Marks	Internal Marks	Total Marks
ZOO-101R	DSC-1A: Animal Diversity	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-102R	DSC-2A	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-103R	DSC-3A	6	4+0+2	60(Theo)+20(Pract)	20	100
COMM-104HR	AEC: AECC-1: English/Hind/MIL (Communication)	2	2+0+0	50	-	50
Total		20	20	290	60	350

DSC-1A: ANIMAL DIVERSITY

THEORY

(CREDITS 4)

Unit 1: Kingdom Protista	4 Lectures
General characters and classification up to classes; Locomotory Organelles and locomotion in Protozoa	
Unit 2: Phylum Porifera	3
General characters and classification up to classes; Canal System in <i>Sycon</i>	
Unit 3: Phylum Cnidaria	3
General characters and classification up to classes; Polymorphism in Hydrozoa	
Unit 4: Phylum Platyhelminthes	3
General characters and classification up to classes; Life history of <i>Taenia solium</i>	
Unit 5: Phylum Nematelminthes	5
General characters and classification up to classes; Life history of <i>Ascaris lumbricoides</i> and its parasitic adaptations	
Unit 6: Phylum Annelida	3
General characters and classification up to classes; Metamerism in Annelida	
Unit 7: Phylum Arthropoda	5
General characters and classification up to classes; Vision in Arthropoda, Metamorphosis in Insects	
Unit 8: Phylum Mollusca	4
General characters and classification up to classes; Torsion in gastropods	
Unit 9: Phylum Echinodermata	4
General characters and classification up to classes; Water-vascular system in Asteroidea	
Unit 10: Protochordates	2
General features and Phylogeny of Protochordata	
Unit 11: Agnatha	2
General features of Agnatha and classification of cyclostomes up to classes	
Unit 12: Pisces	4
General features and Classification up to orders; Osmoregulation in Fishes	
Unit 13: Amphibia	4
General features and Classification up to orders; Parental care	
Unit 14: Reptiles	4
General features and Classification up to orders; Poisonous and non-poisonous snakes, Biting mechanism in snakes	
Unit 15: Aves	5
General features and Classification up to orders; Flight adaptations in birds	
Unit 17: Mammals	5
Classification up to orders; Origin of mammals	
Note: Classification of Unit 1-9 to be followed from “Barnes, R.D. (1982). <i>Invertebrate Zoology</i> , V Edition”	

PRACTICAL

(CREDITS 2)

1. Study of the following specimens:
2. *Amoeba*, *Euglena*, *Plasmodium*, *Paramecium*, *Sycon*, *Hyalonema*, and *Euplectella*, *Obelia*, *Physalia*, *Aurelia*, *Tubipora*, *Metridium*, *Taenia solium*, Male and female *Ascaris lumbricoides*, *Aphrodite*, *Nereis*, *Pheretima*, *Hirudinaria*, *Palaemon*, *Cancer*, *Limulus*,

Palamnaeus, Scolopendra, Julus, Periplaneta, Apis, Chiton, Dentalium, Pila, Unio, Loligo, Sepia, Octopus, Pentaceros, Ophiura, Echinus, Cucumaria and *Antedon, Balanoglossus, Herdmania, Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla, Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis*, Any six common birds from different orders, *Sorex*, Bat, *Funambulus, Loris*

3. Study of the following permanent slides:
4. T.S. and L.S. of *Sycon*, Study of life history stages of *Taenia*, T.S. of Male and female *Ascaris*
5. Key for Identification of poisonous and non-poisonous snakes

An “**animal album**” containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose.

SUGGESTED READINGS

- 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
- Young, J. Z. (2004). *The Life of Vertebrates*. III Edition. Oxford university press.
- Pough H. *Vertebrate life*, VIII Edition, Pearson International.
- Hall B.K. and Hallgrimsson B. (2008). *Strickberger's Evolution*. IV Edition. Jones and Bartlett Publishers Inc.

2ND SEMESTER SYLLABUS (REGULAR)

SEM-II						
Paper Code	Course	Credit	Credit Distribution (L+T+P)	End Sem Marks	Internal Marks	Total Marks
ZOO-201R	DSC-1B: Comparative Anatomy and Developmental Biology of Vertebrates	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-202R	DSC-2B	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-203R	DSC-3B	6	4+0+2	60(Theo)+20(Pract)	20	100
COMM-204HR	AEC: AECC-2: Environmental Science	2	2+0+0	50	-	50
Total		20	20	290	60	350

DSC-1B: COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES

<u>THEORY</u>	(CREDITS 4)
Unit 1: Integumentary System	4 Lectures
Derivatives of integument w.r.t. glands and digital tips	
Unit 2: Skeletal System	3
Evolution of visceral arches	
Unit 3: Digestive System	4
Brief account of alimentary canal and digestive glands	
Unit 4: Respiratory System	5
Brief account of Gills, lungs, air sacs and swim bladder	
Unit 5: Circulatory System	4
Evolution of heart and aortic arches	
Unit 6: Urinogenital System	4
Succession of kidney, Evolution of urinogenital ducts	
Unit 7: Nervous System	3
Comparative account of brain	
Unit 8: Sense Organs	3
Types of receptors	
Unit 9: Early Embryonic Development	12
Gametogenesis: Spermatogenesis and oogenesis w.r.t. mammals, vitellogenesis in birds; Fertilization: external (amphibians), internal (mammals), blocks to polyspermy; Early development of frog and humans (structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula); types of morphogenetic movements; Fate of germ layers; Neurulation in frog embryo.	
Unit 10: Late Embryonic Development	10
Implantation of embryo in humans, Formation of human placenta and functions, other types of placenta on the basis of histology; Metamorphic events in frog life cycle and its hormonal regulation.	
Unit 11: Control of Development 8	
Fundamental processes in development (brief idea) – Gene activation, determination, induction, Differentiation, morphogenesis, intercellular communication, cell movements and cell death	

<u>PRACTICAL</u>	(CREDITS 2)
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1. Osteology:
 - a) Disarticulated skeleton of fowl and rabbit
 - b) Carapace and plastron of turtle /tortoise
 - c) Mammalian skulls: One herbivorous and one carnivorous animal.
2. Frog - Study of developmental stages - whole mounts and sections through permanent slides – cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole external and internal gill stages.
3. Study of the different types of placenta- histological sections through permanent slides or photomicrographs.
4. Study of placental development in humans by ultrasound scans.
5. Examination of gametes - frog/rat - sperm and ova through permanent slides or photomicrographs.

SUGGESTED READINGS

- 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.
- Gilbert, S. F. (2006). *Developmental Biology*, VIII Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
- Balinsky, B.I. (2008). *An introduction to Embryology*, International Thomson Computer Press.
- Carlson, Bruce M (1996). *Patten's Foundations of Embryology*, McGraw Hill, Inc.

3RD SEMESTER SYLLABUS (REGU)LAR

SEM-III						
Paper Code	Course	Credit	Credit Distribution (L+T+P)	End Sem Marks	Internal Marks	Total Marks
ZOO-301R	DSC-1C: Human Physiology	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-302R	DSC-2C	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-303R	DSC-3C	6	4+0+2	60(Theo)+20(Pract)	20	100
ZOO-304HR	AEC: SEC-1: Sericulture	2	2+0+0	50	-	50
Total		20	20	290	60	350

DSC-1C: HUMAN PHYSIOLOGY

THEORY **(CREDITS 4)**

Unit 1: Digestion and Absorption of Food **12 Lectures**

Structure and function of digestive glands; Digestion and absorption of carbohydrates, fats and proteins; Nervous and hormonal control of digestion (in brief)

Unit 2: Functioning of Excitable Tissue (Nerve and Muscle) **10**

Structure of neuron, Propagation of nerve impulse (myelinated and non-myelinated Nerve fibre); Structure of skeletal muscle, Mechanism of muscle contraction (Sliding Filament theory), Neuromuscular junction

Unit 3: Respiratory Physiology **6**

Ventilation, External and internal Respiration, Transport of oxygen and carbon dioxide in blood, Factors affecting transport of gases.

Unit 4: Renal Physiology **8**

Functional anatomy of kidney, Mechanism and regulation of urine formation

Unit 5: Cardiovascular Physiology **10**

Structure of heart, Coordination of heartbeat, Cardiac cycle, ECG

Unit 6: Endocrine and Reproductive Physiology **14**

Structure and function of endocrine glands (pituitary, thyroid, parathyroid, pancreas, adrenal, ovaries, and testes), Brief account of spermatogenesis and oogenesis, Menstrual cycle

PRACTICAL **(CREDITS 2)**

1. Preparation of temporary mounts: Neurons and Blood film.
2. Preparation of haemin and haemochromogen crystals.
3. Estimation of haemoglobin using Sahli's haemoglobinometer.
4. Examination of permanent histological sections of mammalian oesophagus, stomach, duodenum, rectum, lung, kidney, thyroid, pancreas, adrenal, testis, ovary.

SUGGESTED READINGS

1. Tortora, G.J. and Derrickson, B.H. (2009). Principles of Anatomy and Physiology, XII Edition, John Wiley and Sons, Inc.
2. Widmaier, E.P., Raff, H. and Strang, K.T. (2008). Vander's Human Physiology, XI Edition, McGraw Hill.
3. Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology, XII Edition, Harcourt Asia Pvt. Ltd/ W.B. Saunders Company.
4. Marieb, E. (1998). Human Anatomy and Physiology, IV Edition, Addison-Wesley.
5. Kesar, S. and Vashisht, N. (2007). Experimental Physiology, Heritage Publishers.
6. Prakash, G. (2012). Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Company Ltd.

SEC-1: SERICULTURE

THEORY

(CREDITS 2)

Unit 1: Introduction

(3 Lectures)

Sericulture: Definition, history and present status; Silk route

Types of silkworms, Distribution and Races

Exotic and indigenous races

Mulberry and non-mulberry Sericulture

Unit 2: Biology of Silkworm

(3)

Life cycle of *Bombyx mori*

Structure of silk gland and secretion of silk

Unit 3: Rearing of Silkworms

(13)

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 4: Pests and Diseases

(4)

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 5: Entrepreneurship in Sericulture

(2)

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

SUGGESTED READINGS

- Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhanna CSB, 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.

4TH SEMESTER SYLLABUS (REGULAR)

SEM-IV						
Paper Code	Course	Credit	Credit Distribution (L+T+P)	End Sem Marks	Internal Marks	Total Marks
ZOO-401R	DSC-1D: Genetics and Evolutionary Biology	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-402R	DSC-2D	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-403R	DSC-3D	6	4+0+2	60(Theo)+20(Pract)	20	100
ZOO-404HR	AEC: SEC-2: Aquarium Fish Keeping	2	2+0+0	50	-	50
Total		20	20	290	60	350

DSC-1D: GENETICS AND EVOLUTIONARY BIOLOGY**THEORY****(CREDITS 4)****Unit 1: Introduction to Genetics****3 Lectures**

Mendel's work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information

Unit 2: Mendelian Genetics and its Extension**8**

Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and codominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, sex linked inheritance, extra-chromosomal inheritance

Unit 3: Linkage, Crossing Over and Chromosomal Mapping**9**

Linkage and crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence, Somatic cell genetics – an alternative approach to gene mapping

Unit 4: Mutations**7**

Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy; Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor mutations

Unit 5: Sex Determination**4**

Chromosomal mechanisms, dosage compensation

Unit 6: History of Life**2**

Major Events in History of Life

Unit 7: Introduction to Evolutionary Theories**5**

Lamarckism, Darwinism, Neo-Darwinism

Unit 8: Direct Evidences of Evolution**5**

Types of fossils, Incompleteness of fossil record, Dating of fossils, Phylogeny of horse

Unit 9: Processes of Evolutionary Change**9**

Organic variations; Isolating Mechanisms; Natural selection (Example: Industrial melanism); Types of natural selection (Directional, Stabilizing, Disruptive), Artificial selection

Unit 10: Species Concept**6**

Biological species concept (Advantages and Limitations); Modes of speciation (Allopatric, Sympatric)

Unit 11: Macro-evolution**5**

Macro-evolutionary Principles (example: Darwin's Finches)

Unit 12: Extinction**6**

Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail), Role of extinction in evolution

PRACTICAL**(CREDITS 2)**

1. Study of Mendelian Inheritance and gene interactions (Non Mendelian Inheritance) using suitable examples. Verify the results using Chi-square test.
2. Study of Linkage, recombination, gene mapping using the data.
3. Study of Human Karyotypes (normal and abnormal).
4. Study of fossil evidences from plaster cast models and pictures
5. Study of homology and analogy from suitable specimens/ pictures
6. Charts:
 - a. Phylogeny of horse with diagrams/ cut outs of limbs and teeth of horse ancestors
 - b. Darwin's Finches with diagrams/ cut outs of beaks of different species
7. Visit to Natural History Museum and submission of report

SUGGESTED READINGS

- 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.
- Ridley, M. (2004). *Evolution*. III Edition. Blackwell Publishing
- Barton, N. H., Briggs, D. E. G., Eisen, J. A., Goldstein, D. B. and Patel, N. H. (2007). *Evolution*. Cold Spring, Harbour Laboratory Press.
- Hall, B. K. and Hallgrimsson, B. (2008). *Evolution*. IV Edition. Jones and Bartlett Publishers
- Campbell, N. A. and Reece J. B. (2011). *Biology*. IX Edition, Pearson, Benjamin, Cummings.
- Douglas, J. Futuyma (1997). *Evolutionary Biology*. Sinauer Associates.

SEC-2: AQUARIUM FISH KEEPING

THEORY

(CREDITS 2)

Unit1: Introduction to Aquarium Fish Keeping

The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes

Unit 2: 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 3: Food and feeding of Aquarium fishes

Use of live fish feed organisms. Preparation and composition of formulated fish feeds

Unit 4: Fish Transportation

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

Unit 5: Maintenance of Aquarium

General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry

5TH SEMESTER SYLLABUS (REGULAR)

SEM-V						
Paper Code	Course	Credit	Credit Distribution (L+T+P)	End Sem Marks	Internal Marks	Total Marks
ZOO-D1HR	DSE-1A: Immunology	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-502R	DSE-2A	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-503R	DSE-3A	6	4+0+2	60(Theo)+20(Pract)	20	100
ZOO-504R	AEC: SEC-3: Public Health & hygiene	2	2+0+0	50	-	50
Total		20	20	290	60	350

DSE 1A: IMMUNOLOGY

THEORY **(CREDITS 4)**

Unit 1: Overview of the Immune System **10 Lectures**

Introduction to basic concepts in immunology, components of immune system, principles of innate and adaptive immune system

Unit 2: Cells and Organs of the Immune System **8**

Haematopoiesis, Cells of immune system and organs (primary and secondary Lymphoid organs) of the immune system

Unit 3: Antigens **8**

Basic properties of antigens, B and T cell epitopes, haptens and adjuvants

Unit 4: Antibodies **8**

Structure, classes and function of antibodies, monoclonal antibodies, antigen Antibody interactions as tools for research and diagnosis

Unit 5: Working of the immune system **12**

Structure and functions of MHC, exogenous and endogenous pathways of Antigen presentation and processing, Basic properties and functions of cytokines, Complement system: Components and pathways.

Unit 6: Immune system in health and disease **10**

Gell and Coombs' classification and brief description of various types of hypersensitivities, Introduction to concepts of autoimmunity and immunodeficiency,

Unit 7: Vaccines **4**

General introduction to vaccines, Various types of vaccines

PRACTICAL **(CREDITS 2)**

1. *Demonstration of lymphoid organs
2. Histological study of spleen, thymus and lymph nodes through slides/ photographs
3. Preparation of stained blood film to study various types of blood cells.
4. Ouchterlony's double immuno-diffusion method.
5. ABO blood group determination.
6. *Cell counting and viability test from splenocytes of farm bred animals/cell lines.
7. Demonstration of
 - a. ELISA
 - b. Immunoelectrophoresis

(*Subject to UGC guidelines)

SUGGESTED READINGS

- Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). *Immunology*, VI Edition. W.H. Freeman and Company.
- David, M., Jonathan, B., David, R. B. and Ivan R. (2006). *Immunology*, VII Edition, Mosby, Elsevier Publication.
- Abbas, K. Abul and Lichtman H. Andrew (2003.) *Cellular and Molecular Immunology*. V Edition. Saunders Publication.

SEC-3: MEDICAL DIAGNOSTICS

THEORY	(CREDITS 2)
Unit 1: Introduction to Medical Diagnostics and its Importance	2 Lectures
Unit 2: Diagnostics Methods Used for Analysis of Blood 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.)	10
Unit 3: Diagnostic Methods Used for Urine Analysis Urine Analysis: Physical characteristics; Abnormal constituents	6
Unit 4: 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	6
Unit 5: Infectious Diseases Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis	3
Unit 6: Tumours Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs).	3

SUGGESTED READINGS

- 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.

6TH SEMESTER SYLLABUS (REGULAR)

SEM-VI						
Paper Code	Course	Credit	Credit Distribution (L+T+P)	End Sem Marks	Internal Marks	Total Marks
ZOO-D2HR	DSE-1B: Animal Biotechnology	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-602H	DSE-2B	6	4+0+2	60(Theo)+20(Pract)	20	100
Paper-603R	DSE-3B	6	4+0+2	60(Theo)+20(Pract)	20	100
ZOO-604R	AEC: SEC-4: Apiculture	2	2+0+0	50	-	50
Total		20	20	290	60	350

DSE-1B: ANIMAL BIOTECHNOLOGY

THEORY **(CREDITS 4)**

Unit 1: Introduction **8 Lectures**

Concept and scope of biotechnology

Unit 2: Molecular Techniques in Gene manipulation **24**

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.

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 3: Genetically Modified Organisms **18**

Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection

Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knockout mice.

Production of transgenic plants: *Agrobacterium* mediated transformation.

Applications of transgenic plants: insect and herbicide resistant plants.

Unit 4: Culture Techniques and Applications **10**

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

PRACTICAL **(CREDITS 2)**

1. Genomic DNA isolation from *E. coli*
2. Plasmid DNA isolation (pUC 18/19) from *E. coli*
3. Restriction digestion of plasmid DNA.
4. Construction of circular and linear restriction map from the data provided.
5. Calculation of transformation efficiency from the data provided.
6. To study following techniques through photographs
 - a. Southern Blotting
 - b. Northern Blotting
 - c. Western Blotting
 - d. DNA Sequencing (Sanger's Method)
 - e. PCR
 - f. DNA fingerprinting
7. Project report on animal cell culture

SUGGESTED READINGS

- 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.

SEC-4: APICULTURE

THEORY

(CREDITS 2)

Unit 1: Biology of Bees

(4 Lectures)

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

Unit 2: Rearing of Bees

(10)

Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth
Bee Pasturage

Selection of Bee Species for Apiculture

CBCS Undergraduate Program in Zoology

Bee Keeping Equipment

Methods of Extraction of Honey (Indigenous and Modern)

Unit 3: Diseases and Enemies

(5)

Bee Diseases and Enemies

Control and Preventive measures

Unit 4: Bee Economy

(2)

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

Unit 5: Entrepreneurship in Apiculture

(4)

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

SUGGESTED READINGS

- 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.
