Vidyasagar University

Curriculum for B.Sc (Honours) in Zoology

[Choice Based Credit System]

Semester-IV

Course	Course Code	Name of the Subjects	Course Type/ Nature	Teaching Scheme in hour per week			Credit	Marks
				L	T	P		
CC-8		**C8T:** Comparative Anatomy of Vertebrates	Core Course - 8	4	0	0	6	75
		C8P: Practical		0	0	4		
CC-9		**C9T:** Animal Physiology: Life Sustaining Systems	Core Course - 9	4	0	0	6	75
		C9P: Practical		0	0	4		
CC-10		**C10T:** Immunology	Core Course - 10	4	0	0	6	75
		C10P: Practical		0	0	4		
GE-4	TBD		Generic Elective -4				4/5	75
							2/1	
SEC-2		**SEC2:** Medical Diagnostic Techniques **Or** Sericulture	Skill Enhancement Course-2	1	1	0	2	50
Semester Total							**26**	**350**

L=Lecture, **T**= Tutorial, **P**=Practical, **CC** = Core Course, **GE**= Generic Elective, **SEC** = Skill Enhancement Course, **TBD** = to be decided

Generic Elective (GE) (Interdisciplinary) from other Department [**Four papers are to be taken and each paper will be of 6 credits**]: **Chemistry/Botany/Physiology/Computer Sc./Microbiology/Bio Technology/ Geology /Nutrition /Aquaculture Management.**

Modalities of selection of Generic Electives (GE): A student shall have to choose **04** Generic Elective (GE1 to GE4) strictly from **02** subjects / disciplines of choice taking exactly **02** courses from each subjects of disciplines. Such a student shall have to study the curriculum of Generic Elective (GE) of a subject or discipline specified for the relevant semester.

Semester-IV

Core Course (CC)

CC-8: Comparative Anatomy of Vertebrates **Credits 06**

C8T: Comparative Anatomy of Vertebrates **Credits 04**

Course Contents:

Unit 1: Integumentary System

Structure, function and derivatives of integument in amphibian, birds and mammals

Unit 2: Skeletal System

Overview of axial and appendicular skeleton; Jaw suspension; Visceral arches.

Unit 3: Digestive System

Comparative anatomy of stomach; dentition in mammals

Unit 4: Respiratory System

Respiratory organs in fish, amphibian, birds and mammals

Unit 5: Circulatory System

General plan of circulation, Comparative account of heart and aortic arches

Unit 6: Urinogenital System

Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri

Unit 7: Nervous System

Comparative account of brain, Cranial nerves in mammals

Unit 8: Sense Organs

Classification of receptors, Brief account of olfactory and auditory receptors in vertebrate

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 Saxena, R.K. &Saxena, S.C.(2008) : Comparative Anatomy of Vertebrates, Viva Books Pvt. Ltd.

C8P: Comparative Anatomy of Vertebrates **Credits 02**

List of Practical

1. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs.
2. Study of disarticulated skeleton of Toad, Pigeon and Guineapig.
3. Demonstration of Carapace and plastron of turtle.
4. Identification of mammalian skulls: One herbivorous (Guineapig) and one carnivorous (Dog) animal.
5. Dissection of Tilapia: Circulatory system, Brain, pituitary, urinogenital system.

CC-9: Animal Physiology: Life Sustaining Systems **Credits 06**

C9T: Animal Physiology: Life Sustaining Systems **Credits 04**

Course Contents:

Unit 1: Physiology of Digestion

Structural organisation and functions of Gastrointestinal tract and Associated glands; Mechanical and chemical digestion of food, absorption of Carbohydrates, Lipids, Proteins and Nucleic Acids; Digestive enzymes

Unit 2: Physiology of Respiration

Mechanism of Respiration, Respiratory volumes and capacities, transport of Oxygen and Carbon dioxide in blood, Dissociation curves and the factors influencing it, respiratory pigments; Carbon monoxide poisoning

Unit 3: Physiology of Circulation

Components of Blood and their functions; Structure and functions of haemoglobin Haemostasis; Blood clotting system, Fibrinolytic system Haemopoiesis; Basic steps and its regulation Blood groups; ABO and Rh factor

Unit 4: Physiology of Heart

Structure of mammalian heart, Coronary Circulation, Structure and working of conducting myocardial fibres, Origin and conduction of cardiac impulses Cardiac Cycle and cardiac output Blood pressure and its regulation

Unit 5: Thermoregulation & Osmoregulation

Physiological classification based on thermal biology.

Thermal biology of endotherms

Osmoregulation in aquatic vertebrates

Extrarenal osmoregulatory organs in vertebrates

Unit 6: Renal Physiology

Structure of Kidney and its functional unit, Mechanism of urine formation, Regulation of acid-base balance

Suggested Readings:

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt
- Asia PTE Ltd. W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons,
- Eckert Animal Physiology: Mechanisms and adaptations Randall, Burggren and FrenchVander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills
- 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

C9P: Animal Physiology: Life Sustaining Systems Lab **Credits 02**

List of Practical

1. Determination of ABO Blood group
2. Enumeration of red blood cells and white blood cells using haemocytometer
3. Estimation of haemoglobin using Sahli's haemoglobinometer
4. Preparation of haemin and haemochromogen crystals
5. Recording of blood pressure using a sphygmomanometer

CC-10: Immunology **Credits 06**

C10T: Immunology **Credits 04**

Course Contents:

Unit 1: Overview of Immune System

Basic concepts of health and diseases, Historical perspective of Immunology, Cells and organs of the Immune system

Unit 2: Innate and Adaptive Immunity

Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral).

Unit 3: Antigens

Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, B and T-Cell epitopes

Unit 4: Immunoglobulins

Structure and functions of different classes of immunoglobulins, Antigen- antibody interactions,

Immunoassays (ELISA and RIA), Hybridoma technology, Monoclonal antibody production

Unit 5: Major Histocompatibility Complex

Structure and functions of MHC molecules.

Structure of T cell Receptor and its signalling, T cell development & selection

Unit 6: Cytokines

Types, properties and functions of cytokines.

Unit 7: Complement System

Components and pathways of complement activation.

Unit 8: Hypersensitivity

Gell and Coombs' classification and brief description of various types of hypersensitivities.

Unit 9: Immunology of diseases

Malaria, Filariasis, Dengue and Tuberculosis

Unit 10: Vaccines

Various types of vaccines. Active & passive immunization (Artificial and natural).

Suggested Readings:

- Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). Immunology, VI Edition. W.H. Freeman and Company.
- Abbas, K. Abul and Lechtman H. Andrew (2003.) Cellular and Molecular Immunology. V Edition. Saunders Publication.

C10P: Immunology Lab **Credits 02**

List of Practical

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. ABO blood group determination.
5. Demonstration of ELISA

Skill Enhancement Courses (SEC)

SEC-2: Medical Diagnostic Techniques **Credits 02**

SEC2T: Medical Diagnostic Techniques

Course Contents:

Unit 1: Introduction to Medical Diagnostics and its Importance

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.)

Unit 3: Diagnostic Methods Used for Urine Analysis

Urine Analysis: Physical characteristics; Abnormal constituents

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

Unit 5: Infectious Diseases

Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis, Malarial parasite (Microscope based and ELISA based)

Unit 6: Clinical Biochemistry

LFT, Lipid profiling

Unit 7: Clinical Microbiology

Antibiotic Sensitivity Test

Unit 8: Tumours

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

Unit 9: Visit to Pathological Laboratory and Submission of Project

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. T*extbook 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.

Or

SEC-2: Sericulture **Credits 02**

SEC2T: Sericulture

Course Contents:

Unit 1: 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 2: Biology of Silkworm

Life cycle of *Bombyx mori*

Structure of silk gland and secretion of silk

Unit 3: 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 4: 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 5: 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.

Suggested Readings:

- Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
- Solar energy - M P Agarwal - S Chand and Co. Ltd.

- Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd Godfrey Boyle, “Renewable Energy, Power for a sustainable future”, 2004,
- Oxford University Press, in association with The Open University.
- Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
- J. Balfour, M. Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA). http://en.wikipedia.org/wiki/Renewable_energy

Generic Elective Syllabus
GE-4 [Interdisciplinary for other department]

GE-4: Insect Vectors and Diseases **Credits 06**

GE4T: Insect Vectors and Diseases **Credits 04**

Course Contents:

Unit 1: Introduction to Insects

General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth Parts

Unit 2: Concept of Vectors

Brief introduction to Vectors (mechanical and biological vectors),Reservoirs, Host-vector relationship, Adaptations as vectors, Host specificity

Unit 3: Insects as Vectors

Detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

Unit 4: Dipteran as Disease Vectors

Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies

Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis Control of mosquitoes

Study of sand fly-borne diseases –Leishmaniasis,; Control of Sand fly

Study of house fly as important mechanical vector, Myiasis, Control of house fly

Unit 5: Siphonaptera as Disease Vectors

Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases – Plague, Typhus fever; Control of fleas

Unit 6: Siphunculata as Disease Vectors

Human louse (Head, Body and Pubic louse) as important insect vectors; Control of human louse

Unit 7: Hempitera as Disease Vectors

Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures

Suggested Readings:

- Imms, A.D. (1977). A General Text Book of Entomology. Chapman & Hall, UK
- Chapman, R.F. (1998). The Insects: Structure and Function. IV Edition, Cambridge University Press, UK
- Pedigo L.P. (2002). Entomology and Pest Management. Prentice Hall Publication
- Mathews, G. (2011). Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases. Wiley-Blackwell
- Mosquito (2000) Chandra G, Sribhumi Publication Co. Kolkata
- Medical Entomology, Hati A. K Allied Book Agency, Kolkata

GE4P: Insect Vectors and Diseases Lab **Credits 02**

List of Practical

1. Study of different kinds of mouth parts of insects
2. Study of following insect vectors through permanent slides/ photographs: *Aedes*, *Culex*, *Anopheles*, *Pediculus humanus capitis*, *Pediculus humanus corporis*, *Phithirus pubis*, *Xenopsylla cheopis*, *Cimex lectularius*, *Phlebotomus argentipes*, *Musca domestica* through permanent slides/ photographs
3. Study of different diseases transmitted by above insect vectors

Submission of a project report on any one of the insect vectors and disease transmitted

Or

GE-4: Environment and Public Health **Credits 06**

GE4T: Environment and Public Health **Credits 04**

Course Contents:

Unit 1: Introduction

Sources of Environmental hazards, Hazard identification and accounting, Fate of toxic and persistent substances in the environment, Dose response evaluation, Exposure assessment.

Unit 2: Climate Change

Greenhouse gases and global warming, Acid rain, Ozone layer destruction, Effect of climate change on public health

Unit 3: Pollution

Air, water, noise pollution sources and effects, Pollution control.

Unit 4: Waste Management Technologies

Sources of waste, types and characteristics, Sewage disposal and its management, Solid waste disposal, Biomedical waste handling and disposal, Nuclear waste handling and disposal, Waste from thermal power plants.

Unit 5: Diseases

Causes, symptoms and control of tuberculosis, Asthma, Cholera, Minamata disease, typhoid, filariasis

Suggested Readings:

- Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.
- Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Handbook", McGraw Hill Inc., New York, 1996.
- Kofi Asante Duah "Risk Assessment in Environmental management", John Wiley and sons, Singapore, 1998.
- Kasperson, J.X. and Kasperson, R.E. and Kasperson, R.E., Global Environmental Risks, V. N. University Press, New York, 2003.
- Joseph F Louvar and B Diane Louver Health and Environmental Risk Analysis
- fundamentals with applications, Prentice Hall, New Jersey 1997.

GE4P: Environment and Public Health Lab **Credits 02**

List of Practical

To determine pH, Cl, SO_4, NO_3 in soil and water samples from different locations.