

FOUR YEAR BACHELOR'S DEGREE PROGRAMME WITH HONOURS/ RESEARCH
(B.Sc. Zoology)

SYLLABUS (w.e.f. 2022-23)

B.Sc. First Year (I Semester)

CORE ZOOLOGY (CZ-1 to CZ-4)
(Theory: 4 Credits; Practical: 2 Credits)

ADDITIONAL INTERDISCIPLINARY ZOOLOGY (AIZ-1 to AIZ-4)
(Theory: 2 Credits; Practical: 2 Credits)
[For students with Core Subjects other than Zoology]

SOLS/ZOO/CZ-1 Animal Diversity-I

4 Credits [60 hours]

Unit I. Introduction to Non-Chordata: General characters; Outline classification up to Classes [4 Hours]

Unit II. Protozoa: Salient features; Study of *Amoeba*, *Euglena* and *Paramecium* with reference to structure, locomotion, nutrition and reproduction (life history) [8 Hours]

Unit III. Origin of Metazoa.

Porifera: Salient features; Study of *Sycon* with reference to structure, reproduction (life history); Canal system in Syconoid sponge; Skeleton system [6 Hours]

Unit IV. Coelenterata: Salient features; Study of *Aurelia* with reference to morphology and reproduction (life history); Alternation of generation in Coelenterates [6 Hours]

Unit V. Helminthes: Salient features; Study of *Taenia* and *Ascaris* with reference to morphology, reproduction (life-cycle) and parasitic adaptations [6 Hours]

Unit VI. Annelida: Salient features; Types and significance of coelom; Metamerism and its significance; Study of *Nereis* and *Hirudinaria* with reference to morphology and reproduction; Parasitic adaptations of *Hirudinaria*; Trochophore larva and its significance [8 Hours]

Unit VII. Arthropoda: Salient features; Study of *Palaemon* with reference to morphology, respiration, excretion and reproduction; Zoological importance of *Peripatus* and *Limulus*; Economic importance of arthropods [8 Hours]

Unit VIII. Mollusca: Salient features; Study of *Pila* and *Unio* with reference to morphology, respiration and reproduction (life-history) [8 Hours]

Unit IX. Echinodermata: Salient features; Study of *Asterias* with reference to morphology, locomotion, water vascular system, mode of feeding and reproduction [6 Hours]

SOLS/ZOO/AIZ-1 Animal Diversity-I

2 Credits [30 Hours]

Unit I. Introduction to Non-Chordata: General characters; Outline classification up to Classes.

Protozoa: Salient features; Study of locomotion and nutrition in Protozoa [8 Hours]

Unit II. Origin of Metazoa.

Porifera: Salient features; Study of canal system and skeleton system in sponges.

Coelenterata: Salient features; Alternation of generation in Coelenterates; Corals and Coral reef [6 Hours]

Unit III. Helminthes: Salient features; Parasitic adaptations in helminths.

Annelida: Salient features; Types and significance of coelom; Metamerism and its significance; Trochophore larva and its significance [8 Hours]

Unit IV. Arthropoda: Salient features; Zoological importance of *Peripatus* and *Limulus*; Economic importance of arthropods.

Mollusca: Salient features; Torsion; Pearl formation

Echinodermata: Salient features; Study of water vascular system in star fish [8 Hours]

SUGGESTED READINGS

1. Barnes, RD: Invertebrate Zoology (4th ed.), Holt-Saunders, 1980.
2. Barrington, EJW: Invertebrate Structure and Function, Nelson, 1987.
3. Hickman, Roberts & Hickman: Integrated Principles of Zoology (7th ed) Times-Mirror, Mosby, 1984.
4. Iyer: A Manual of Zoology, Part I. Viswanathan, 1973.
5. Kotpal, RL: Modern Text Book of Zoology: Invertebrates, Rastogi Publications, 12th edition, 2019
6. Marshall & William: Text Book of Zoology, Vol I (Parker & Haswell, 7th ed.) Macmillan, 1972.

SOLS/ZOO/CZ-1(P) Animal Diversity-I (Practical)	[2 Credits]
SOLS/ZOO/AIZ-1(P) Animal Diversity-I (Practical)	[2 Credits]

Study of museum specimens/slides:

Protozoa: *Amoeba, Euglena, Plasmodium, Paramecium, Trichomonas, Trypanosoma, Monocystis, Vorticella*

Porifera: *Sycon* (including T.S. and L.S.), *Hyalonema, Euplectella, Euspongia*

Coelenterata: *Obelia, Physalia, Aurelia, Tubipora, Metridium, Hydra, Gorgonia, Pennatula*

Platyhelminthes: *Taenia solium* and study of its life history stages, *Schistosoma, Fasciola*

Nemathelminthes: Male and female *Ascaris lumbricoides, Wuchereria, Ancylostoma*

Annelida: *Aphrodite, Nereis, Pheretima, Hirudinaria, Polygordias*

Arthropoda: *Palaemon, Cancer Limulus, Palamnaeus, Scolopendra, Julus, Periplaneta, Apis, Musca*

Mollusca: *Chiton, Dentalium, Pila, Unio, Loligo, Sepia, Octopus*

Echinodermata: *Pentaceros, Ophiura, Echinus, Cucumaria, Antedon, Holothuria, Astreas*

B.Sc. First Year (II Semester)

SOLS/ZOO/CZ-2 Animal Diversity-II	4 Credits [60 Hours]
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Unit I. Introduction to Chordata: General characters and outline classification of Chordates up to Classes.

Hemichordata: General characters and classification; *Balanoglossus*: morphology and development [6 Hours]

Unit II. Urochordata: General characters and classification; *Herdmania*: Morphology, blood vascular system, reproductive system and development [6 Hours]

Unit III. Cephalochordata: Classification and salient features; *Branchiostoma (=Amphioxus)*: Morphology, digestive, excretory, reproductive system and development [6 Hours]

Unit IV. Cyclostomata: General characters and classification; External features of *Petromyzon* and *Myxine*; Comparison between Lampreys and Hagfishes [4 Hours]

Unit V. Pisces: General characters of cartilaginous and bony fish;

Dipnoi: Distribution, General characters, and affinities;

External features, Digestive, Respiratory, Blood vascular, Nervous and Urinogenital system of *Scoliodon*; Scales and fins of fishes, respiratory organs in fish [11 Hours]

Unit VI. Amphibia: General characters and classification, Elementary idea of parental care [3 Hours]

Unit VII. Reptilia: Terrestrial Adaptations; General characters and distribution of Chelonia, Rhynchocephalia, Ophidia and Crocodilia; Poisonous and non-poisonous snakes; Biting mechanism in snakes; Venom and Antivenom [8 Hours]

Unit VIII. Aves: General characters; Morphology, Digestive, Respiratory and Urinogenital System of *Columba*; Feathers in Birds; Aerial adaptations in birds [8 Hours]

Unit IX. Mammalia: General organization, salient features and distribution of Prototheria, Metatheria and Eutheria [8 Hours]

SOLS/ZOO/AIZ-2 Animal Diversity-II	2 Credits [30 Hours]
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Unit I. Introduction to Chordata: General characters and outline classification of Chordates up to Classes.

Hemichordata: General characters, classification and affinities.

Urochordata: General characters, classification and affinities; Retrogressive metamorphosis in *Herdmania*

Cephalochordata: General characters, classification and affinities [8 Hours]

Unit II. Cyclostomata: General characters, classification and affinities; Comparison between Lampreys and Hagfishes.

Pisces: General characters, classification and affinities; Scales, fins and respiratory organs of fishes;

Dipnoi: Distribution, General characters, and affinities [8 Hours]

Unit III. Amphibia: General characters and classification, Elementary idea of parental care.

Reptilia: Terrestrial Adaptations; General characters, distribution and affinities; Poisonous and non-poisonous snakes; Biting mechanism in snakes; Venom and Antivenom [7 Hours]

Unit IV. Aves: General characters and classification; Feathers in Birds; Aerial adaptations in birds.

Mammalia: General characters, classification and distribution of Prototheria, Metatheria and Eutheria [7 Hours]

SUGGESTED READINGS

1. Kotpal, R.L.: Modern Text-book of Zoology, Vertebrates. Rastogi Publication, 2007
2. Jordan, E.L. and P.S. Verma: Chordate Zoology. S. Chand & Co. Ltd., 2013
3. Hildebrand, M. Goslow, G.: Analysis of Vertebrate Structure, Wiley, 1998
4. Romer, A.S., T.S. Parsons: Vertebrate Body, Saunders (W.B.) Co Ltd; 5th Revised edition, 1977
5. Pandey, B.N., Mathur, V. Biology of Chordates. PHI Learning Pvt. Ltd., Delhi, 2019

SOLS/ZOO/CZ-2(P) Animal Diversity-II (Practical)

[2 Credits]

SOLS/ZOO/AIZ-2(P) Animal Diversity-II (Practical)

[2 Credits]

Study of museum specimens/slides:

Protochordata: *Balanoglossus, Herdmania, Branchiostoma*, Agnatha: *Petromyzon, Myxine*

Pisces: *Sphyrna, Pristis, Torpedo, Exocoetus, Anguilla, Acipenser, Latimaria, Chimaera*

Amphibia: *Ichthyophis/ Ureotyphlus, Salamandra, Bufo, Hyla*

Reptilia: *Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis*; Key for Identification of poisonous and non-poisonous snakes

Aves: Study of six common birds from different orders

Mammalia: *Sorex, Bat, Funambulus, Loris, Platypos, Opossum, Kangaroo, Manis, Dolphin, Whale, Lutra, Camel, Polar Bear* (Photographs)

An "animal album" containing photographs, cut outs, with appropriate write up about the abovementioned taxa. Different taxa/ topics may be given to different sets of students for this purpose. These need not be repeated as drawings by the album maker.

B.Sc. Second Year (III Semester)

SOLS/ZOO/CZ-3 Elementary Cell Biology & Molecular Biology

4 Credits [60 Hours]

Unit I. Introduction to Cell theory; Comparison of a generalised Pro- & Eukaryote cell.

Elementary idea of cell fractionation; Light & Phase Contrast Microscopy, Confocal and Electron Microscopy (TEM & SEM) [8 Hours]

Unit II. Elementary knowledge of the structure & function of plasma membrane, cytoplasm [4 Hours]

Unit III. Introduction to the organelles constituting endomembrane system (Endoplasmic reticulum, Golgi complex, Lysosome, Peroxisome); Nucleus & Nucleolus; Ribosome; Mitochondria; Chloroplast; Introduction to cytoskeleton [10 Hours]

Unit IV. Basic features of Cell cycle; Mitosis & Meiosis [6 Hours]

Unit V. DNA as genetic material: Structure of DNA, Types of DNA; Replication of DNA in prokaryotes and eukaryotes: Semiconservative nature of DNA replication, Bi-directional replication, DNA polymerases; primosome, replisome, Rolling circle replication, Unique aspects of eukaryotic chromosome replication [8 Hours]

Unit VI. DNA damage and repair: Causes and types of DNA damage, mechanism of DNA repair: Photoreactivation, base excision repair, nucleotide excision repair, mismatch repair, recombinational repair, non-homologous end joining [6 Hours]

Unit VII. RNA structure and types of RNA: Transcription in prokaryotes—Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains; Transcription in eukaryotes—Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance and elongation RNA splicing and processing [10 Hours]

Unit VIII. Regulation of gene expression and translation: Regulation of gene expression in prokaryotes—Operon concept (inducible and repressible system), Genetic code and its characteristics; aminoacyl tRNA synthetases, Mechanism of initiation, elongation and termination of polypeptides [8 Hours]

SOLS/ZOO/AIZ-3 Elementary Cell Biology & Molecular Biology	2 Credits [30 Hours]
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Unit I. Introduction to Cell theory; Comparison of a generalised Pro- & Eukaryote cell. Elementary knowledge of the structure & function of plasma membrane, cytoplasm [6 Hours]

Unit II. Introduction to the organelles constituting endomembrane system (Endoplasmic reticulum, Golgi complex, Lysosome, Peroxisome); Nucleus & Nucleolus; Ribosome; Mitochondria; Chloroplast; Introduction to cytoskeleton; Basic features of Cell cycle; Mitosis & Meiosis [10 Hours]

Unit III. DNA as genetic material: Structure of DNA, Types of DNA; Replication of DNA in prokaryotes and eukaryotes: Semiconservative nature of DNA replication, Bi-directional replication, DNA polymerases; primosome, replisome [6 Hours]

Unit IV. RNA structure and types of RNA: Transcription in prokaryotes—Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation, elongation and termination of RNA chains; Transcription in eukaryotes—Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation.

Regulation of gene expression and translation: Regulation of gene expression in prokaryotes—Operon concept (inducible and repressible system), aminoacyl tRNA synthetases, Mechanism of initiation, elongation and termination of polypeptides [8 Hours]

SUGGESTED READINGS

1. Alberts et al.: Molecular Biology of the Cell, Garland Pub., New York, 1989.
2. DeRobertis & DeRobertis: Cell & Molecular Biology, 1996
3. Friefelder: Molecular Biology. Narosa Publ. House, 1996
4. Sharma, V.K.: Techniques in Microscopy and Cell Biology, Tata McGraw Hill, 1991
5. Strickberger: Genetics, Prentice Hall, 1996.
6. Verma, P.S. and Agarwal, V. K. Cell Biology, Genetics, Molecular biology, Evolution and Ecology (S. Chand & Co.)
7. Pandey, B.N. B.Sc. Zoology Series: Cytology, Genetics and Molecular Genetics. Tata McGraw Hill, 2012

SOLS/ZOO/CZ-3(P) Elementary Cell Biology & Molecular Biology (Practical)	[2 Credits]
SOLS/ZOO/AIZ-3(P) Elementary Cell Biology & Molecular Biology (Practical)	[2 Credits]

1. Photographs of prokaryotic cell
2. Photographs of cell organelles
3. Stages of Mitosis by squash technique
4. Photographs of structure of DNA, RNAs
5. Diagrams of translation, transcription
6. Preparation of solutions for Molecular Biology experiments.
7. Isolation of chromosomal DNA from bacterial cells.
8. Isolation of Plasmid DNA by alkaline lysis method
9. Agarose gel electrophoresis of genomic DNA & plasmid DNA
10. Preparation of restriction enzyme digests of DNA samples
11. Demonstration of AMES test or reverse mutation for carcinogenicity

SOLS/ZOO/CZ-4 Physiology and Elementary Biochemistry

4 Credits [60 Hours]

A. PHYSIOLOGY

Unit I. Nerve and muscle: Introduction to CNS, PNS, ANS; Structure of a neuron, Types of neurons; Types of muscle, Ultrastructure of skeletal muscle, Molecular and chemical basis of muscle contraction [6 Hours]

Unit II. Digestion: Comparative Physiology of vertebrate digestion e.g., Digestion in different segments of the alimentary canal; Absorption of carbohydrates, proteins, lipids. Ruminant stomach in ungulates [8 Hours]

Unit III. Respiration: Comparative account of vertebrate respiration; Transport of oxygen and carbon dioxide in blood [6 Hours]

Unit IV. Osmoregulation and thermoregulation: Osmoregulation in fishes, structure of nephron, mechanism of urine formation. Thermoregulation in poikilotherms, homeotherms and heterotherms. Aestivation and Hibernation [8 Hours]

Unit V. Cardiovascular system: Blood: Comparative account of circulatory system (Open and Closed), Composition of Blood, Lymph, tissue fluid, comparative anatomy of vertebrate heart and aortic arches. Homeostasis, Heart structure, Origin and conduction of the cardiac impulse, cardiac cycle [6 Hours]

Unit VI. Reproduction and Endocrine Glands: Autocrine, paracrine, juxtacrine and endocrine mode of action; Introduction to Endocrine glands: Structure and function of hypothalamus, pituitary, thyroid, parathyroid, pancreas, adrenal and gonads' Reproductive physiology of male and female fertility [6 Hours]

B. BIOCHEMISTRY

Unit VII. Introduction to Biomolecules: Carbohydrates, Proteins, Lipids: structure, types and functions [6 Hours]

Unit VIII. Introduction to Enzymology: Mechanism of action, Kinetics, inhibition and regulation [6 Hours]

Unit IX. Introduction to metabolism of Carbohydrate, Protein and Lipids: Glycolysis, Krebs's cycle, pentose phosphate pathway, glycogen metabolism, electron transport chain, transamination, deamination, urea cycle, β -oxidation in fatty acids [8 Hours]

SOLS/ZOO/AIZ-4 Physiology and Elementary Biochemistry

2 Credits [30 Hours]

A. PHYSIOLOGY

Unit I. Nerve and muscle: Structure of a neuron, Types of neurons; Types of muscle, Ultrastructure of skeletal muscle, Molecular and chemical basis of muscle contraction.

Digestion: Physiology of digestion in different segments of the alimentary canal; Absorption of carbohydrates, proteins, lipids [8 Hours]

Unit II. Respiration: Pulmonary ventilation, Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood.

Excretion: Structure of nephron, Mechanism of Urine formation.

Cardiovascular system: Open and Closed circulatory system, Composition of Blood; Structure of Heart, Origin and conduction of the cardiac impulse, cardiac cycle.

Reproduction and Endocrine Glands: Physiology of male & female reproduction; Introduction to Endocrine glands [8 Hours]

B. BIOCHEMISTRY

Unit III. Introduction to Biomolecules: Carbohydrates, Proteins and Lipids: structure, types and functions; Introduction to metabolism of Carbohydrate, Protein and Lipids [10 Hours]

Unit IV. Enzymes: Mechanism of action, Kinetics, inhibition and regulation [4 Hours]

SUGGESTED READINGS

1. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H. Freeman and Co.
2. Hall, John E. (2015). Guyton and Hall Textbook of Medical Physiology, W.B. Saunders Company
3. Jain, A.K. (2018). Textbook of Physiology, Arya Publications

- Murray, R. K., Granner, D. K., Mayes, P. A. and Rodwell, V. W. (2009). Harper's Illustrated Biochemistry. XXVIII Edition. Lange Medical Books/ Mc Graw Hill
- Nelson, D. L., Cox, M. M. and Lehninger, A.L. (2009). Principles of Biochemistry. IV Edition. W.H Freeman and Co.
- Schmidt-Nielsen, Knut (1997). Animal Physiology: Adaptation and Environment, Cambridge University Press
- Singh, HR and N. Kumar Animal Physiology and related Biochemistry, SL, Nagin Chand and Co, Delhi
- Tortora, G.J.& Derrickson, B.H. (2009). Principles of Anatomy and Physiology, 12th edn., John Wiley & Sons, Inc.
- Widmaier, E.P., Raff, H. & Strang, K.T. (2008) Vander's Human Physiology, 11th edn., McGraw Hill

SOLS/ZOO/CZ-4(P) Physiology and Elementary Biochemistry (Practical)	[2 Credits]
SOLS/ZOO/AIZ-4(P) Physiology and Elementary Biochemistry (Practical)	[2 Credits]

A. PHYSIOLOGY

- Preparation of hemin crystals
- Examination of permanent histological sections of mammalian pituitary, thyroid, parathyroid, pancreas, adrenal
- Examination of permanent slides of spinal cord, duodenum, liver, lung, kidney, bone, cartilage, blood cells
- Models/ Photographs: Structure of neuron, types and structure of muscles, structure of heart
- Charts/ Photographs: Glycolysis, Krebs's cycle, electron transport chain

B. BIOCHEMISTRY

- Identification of unknown carbohydrates in given solutions (Starch, Sucrose, Lactose, Galactose, Glucose, Fructose)
- Colour reactions to identify functional group in the given solution of proteins
- Study of activity of salivary amylase under optimum conditions

SKILL COURSE (SZ-1—SZ-6)

(Theory: 2 Credits)

[Student will elect one course each *EITHER* in I & II *OR* in III & IV Semester]

SOLS/ZOO/SZ-1 Laboratory Techniques in Biology	2 Credits [30 Hours]
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Unit I. Solutions Preparation: Solute, Solvent, Solution; Water-based or aqueous solution for biological application, Methods for dissolving the solute in purified water and adjusting the pH of the solution. Method for addition of the quantity sufficient (QS) to reach the desired volume; Buffer solution; Molarity, Normality [6 Hours]

Unit II. Concentration and Measuring Volumes: Serial dilution, Use of a serial dilution to prepare standards for generating a standard curve; Serological Pipettes, Pipettors use of pipet-aid [4 Hours]

Unit III. Measuring Mass: Analytical balance, Weighing, tarring [2 Hours]

Unit IV. Study the parts of a compound microscope - eye piece and objective lens, condenser lens, mirror, stage, coarse and fine adjustment knobs, and their basic functions. Micrometry- Measuring microscopic organism, measuring cell size in permanent slide viz. protozoan, microscopic invertebrates, egg diameter etc. Recording of microscopic images and videos using microscopic camera [6 Hours]

Unit V. Museum preparation- Preserving macroscopic organisms (invertebrate and vertebrate specimen). Permanent slide preparation: basic histological and histochemical techniques [6 Hours]

Unit VI. Laboratory safety: Laboratory lay out, wet lab, storage of chemicals and glassware. Maintenance of Laboratory equipment (microscopes, centrifuge, incubators, analytical and electronic balances, electrophoretic units, pH meter, turbidity meter etc.); precautions while working in laboratory [6 Hours]

SUGGESTED READINGS

- Charles R Cantor, Paul R. Schimmel (2008). Biophysical Chemistry (Techniques for the Study of Biological Structure and Function), Part II, W.H. Freeman and Company, ISBN-13: 978-0716711902
- Plummer David T. (2004). Introduction to Practical Biochemistry, 3rd edition, Tata McGraw Hill, ISBN-9780070994874

3. Wester John G. (2008). Bioinstrumentation, Wiley & Sons, ISBN-97881265136
4. Wilson Keith, John Walker (2010). Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, ISBN-978052173167

SOLS/ZOO/SZ-2 Basic Instrumentation	2 Credits [30 Hours]
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Unit I. Principles and applications of Microscopy: Light, phase contrast, confocal, transmission electron microscopy (TEM & SEM) [2 Hours]

Unit II. Principle and application of Colorimeter. Principle of UV-Visible absorption spectrophotometry, instrumentation and applications, Fluorimetry: Phenomena of fluorescence, intrinsic and extrinsic fluorescence, instrumentation and applications [6 Hours]

Unit III. Principle of centrifugation, basic rules of sedimentation, sedimentation coefficient, various types of centrifuges, different types of rotors, differential centrifugation, density gradient centrifugation [4 Hours]

Unit IV. Basic principles of chromatography: Partition coefficient, concept of theoretical plates, various modes of chromatography (paper, thin layer, column), preparative and analytical applications, LPLC and HPLC. Principle and applications of: Paper Chromatography, Thin Layer Chromatography. Molecular Sieve Chromatography, Ion Exchange Chromatography, Affinity Chromatography [8 Hours]

Unit V. Basic Principle of electrophoresis, Paper electrophoresis, Gel electrophoresis, discontinuous gel electrophoresis, PAGE, SDS-PAGE. Agarose gel electrophoresis, buffer systems in electrophoresis. Electrophoresis of proteins and nucleic acids, protein and nucleic acid blotting, detection and identification [6 Hours]

Unit VI. Principle and applications of pH meter, autoclave, biosafety cabinets/practices; polymerase chain reaction; Water analysis kit; Principle and application of Turbidity meter, Conductivity meter, Flow meter; Types of Owen & Incubators-BOD & COD Incubator [4 Hours]

SUGGESTED READINGS

1. Freifelder, D. (1982). Physical Biochemistry: Applications to Biochemistry and Molecular Biology, 2nd ed., W.H. Freeman and Company, New York
2. Plummer D. T. (1998). An Introduction to Practical Biochemistry, 3rd ed., Tata McGraw Hill Education Pvt. Ltd., New Delhi

SOLS/ZOO/SZ-3 Public Health and Hygiene	2 Credits [30 Hours]
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Unit I. Definition of Public health; Types of hygiene; Examples of public hygiene; Importance of public health; Key elements of public health; Scope of Public health and Hygiene; Nutrition and health – classification of foods, Nutritional deficiencies - Vitamin deficiencies [6 Hours]

Unit II. Environment and Health hazards – Environmental degradation, Pollution and associated health hazards [4 Hours]

Unit III. Communicable diseases and their control measures such as Measles, Polio, Chikungunya, Rabies, Plague, Leprosy and AIDS; Pandemic-Covid 19 [6 Hours]

Unit IV. Non-Communicable diseases and their preventive measures such as Hypertension, Coronary Heart diseases, Stroke, Diabetes, Obesity and Mental ill-health [6 Hours]

Unit V. Health Education in India: WHO Programmes, Government and Voluntary Organizations and their health services; Precautions, First Aid and Awareness on sporadic diseases [6Hours]

Unit VI. Relationship of environmental, social, cultural, occupational and political factors and systems on health and health care [2 Hours]

SUGGESTED READINGS

1. Bolduan, Charlest Frederick, Nils William Bolduan 1949. Public Health and Hygiene (4th ed.), Philadelphia: Saunders
2. Dass, K 2021. Public Health and Hygiene, Notion Press ISBN-10: 1639209603, ISBN-13: 978-1639209606
3. Goel, Arvind Kumar 2005. A College Textbook of Health & Hygiene, ABD Publishers, ISBN 8189011863, 9788189011864
4. Kumaresan, V, R. Sorna Raj, Public Health and Hygiene, Saras Publication ISBN: 9789386519689
5. Park, K. 2007. Preventive and Social Medicine, B.B. Publishers

6. Shanmugavel, G., Binu George 2021. Textbook of Public Health and Hygiene, Darshan Publishers, ISBN, 9386739550, 9789386739551
7. Wagh, Sudhir R., Vinod B. Kakade, Jiwan P. Sarwade Public Health and Hygiene Success Publications, ISBN 9789351585053

SOLS/ZOO/SZ-4 Aquarium Fish Keeping	2 Credits [30 Hours]
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Unit I. Introduction to Aquarium Fish Keeping: Scope of Aquarium fish keeping; Types of aquaria, Aquarium setup and accessories, Aquarium filters; Criteria of selection for aquarium fishes [4 Hours]

Unit II. Biology of Aquarium Fishes: Exotic and Endemic species of Aquarium Fishes (Exotic Aquarium Fishes–Puffer, Humphead & Siamese Tiger fish; Endemic Aquarium Fishes – Zebra Danio, Striped Panchax & Honey Gourami); Common characters and sexual dimorphism of Aquarium fishes: Fresh water (Guppy, Gold fish, Angel fish), Brackish water (Molly, Sword tail, Ray fish), and Marine (Moorish idol, Anemone fish & Butterfly fish) [8 Hours]

Unit III. Food and feeding of Aquarium fishes: Use of live fish feed organisms. Preparation and composition of formulated fish feeds [2 Hours]

Unit IV. Aquarium Fish Diseases: Parasitic, Bacterial, Viral, Protozoan, Fungal & Deficiency diseases [4 Hours]

Unit V. Fish Transportation: Live fish transport - Conditioning, packing, transport and quarantine methods; Factors associated with live fish transport [4 Hours]

Unit VI. Maintenance of Aquarium: General Aquarium maintenance; Water quality requirements: Maintenance and Temperature control; Budget for setting up an Aquarium/ ornamental Fish Farm as a Cottage Industry [8 Hours]

SUGGESTED READINGS

1. Bailey, Mary, Gina Sandford (1999). The Complete Guide to Aquarium Fish Keeping, Lorenz Books
2. Hargreaves, Vincent B. (2007). Complete Book of the Freshwater Aquarium 2007 Thunder Bay Pr., ISBN-10: 159223514X, ISBN-13: 978-1592235148
3. Saha, Sanjib (2022). Aquarium Fish Keeping, Techno World, Kolkata

SOLS/ZOO/SZ-5 Medical Diagnostics	2 Credits [30 Hours]
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Unit I. Introduction to Medical Diagnostics and its importance [2 Hours]

Unit II. Diagnostic's 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 Hours]

Unit III. Diagnostic Methods Used for Urine Analysis; Urine Analysis: Physical characteristics; Abnormal constituents [8 Hours]

Unit IV. 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 [3 Hours]

Unit V. Infectious Diseases: Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis [3 Hours]

Unit VI. Tumours Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs) [4 Hours]

SUGGESTED READINGS

1. Cheesbrough M., J. McArthur (1976). A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses, Churchill Livingstone ISBN: 9780443011443
2. Godkar P.B. and Godkar D.P. (2014). Textbook of Medical Laboratory Technology, 3rd Edition, Bhalani Publishing House
3. Hall, John E. (2015). Guyton and Hall Textbook of Medical Physiology, Saunders
4. Park, K. (2007), Preventive and Social Medicine, B.B. Publishers
5. Prakash, G. (2012), Lab Manual on Blood Analysis and Medical Diagnostics, S. Chand and Co. Ltd.

Unit I: Introduction to Bioinformatics: Introduction, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics [2 Hours]

Unit II: Databases in Bioinformatics: Introduction, Biological Databases, Classification format of Biological Databases, Biological Database Retrieval System [4 Hours]

Unit III: Biological Sequence Databases: National Center for Biotechnology Information (NCBI) - Tools and Databases of NCBI, Database Retrieval Tool, Sequence Submission to NCBI, Basic local alignment search tool (BLAST), Nucleotide Database, Protein Database, Gene Expression Database; EMBL Nucleotide Sequence Database (EMBL-Bank) - Introduction, Sequence Retrieval, Sequence Submission to EMBL, Sequence analysis tools.

DNA Data Bank of Japan (DDBJ) - Introduction, Resources at DDBJ, Data Submission at DDBJ; Protein Information Resource (PIR) - About PIR, Resources of PIR, Databases of PIR, Data Retrieval in PIR; Swiss-Prot - Introduction and Salient Features [10 Hours]

Unit IV: Sequence Alignments: Introduction, Concept of Alignment, Multiple Sequence Alignment (MSA), MSA by CLUSTAL W, Scoring Matrices, Percent Accepted Mutation (PAM), Blocks of Amino Acid Substitution Matrix (BLOSUM) [8 Hours]

Unit V: Molecular Phylogeny: Methods of Phylogeny, Software for Phylogenetic Analyses, Consistency of Molecular Phylogenetic Prediction [4 Hours]

Unit VI: Applications of Bioinformatics: Structural Bioinformatics in Drug Discovery, Quantitative structure-activity relationship (QSAR) techniques in Drug Design, Microbial genome applications, Crop improvement [2 Hours]

SUGGESTED READINGS

1. Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.
2. Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.
3. Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley Blackwell.