



**VIVEKANAND COLLEGE, KOLHAPUR
(AUTONOMOUS)**

**DEPARTMENT OF ZOOLOGY
Three/Four- Years UG Programme
Department/Subject Specific Core or Major (DSC)**

**Curriculum, Teaching
and Evaluation
Structure**

for

B. Sc. I Zoology

Semester-I & II

(Implemented from academic year 2023-24 onwards)

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

Department of Zoology

Program Outcomes (POs):

PO1: Disciplinary Knowledge: Graduates will gain in-depth understanding in their specific major or discipline, mastering the foundational principles and theories, as well as advanced concepts. Execute strong theoretical and practical understanding developed from the specific programme in the area of work.

PO2: Problem-Solving Skills: Graduates will learn to use their knowledge to identify, analyze, and solve problems related to their field of study.

PO3: Analytical Skills: Graduates will gain the ability to collect, analyze, interpret and apply data in a variety of contexts. They might also learn to use specialized software or equipment.

PO4: Research Skills and Scientific temper: Depending on the field, graduates might learn how to design and conduct experiments or studies, analyze results, and draw conclusions. They might also learn to review and understand academic literature.

PO5: Communication Skills: Many programs emphasize the ability to communicate effectively, both orally and in writing. Graduates may learn to present complex information clearly and succinctly, write detailed reports, and collaborate effectively with others.

PO6: Ethics and Professionalism: Graduates may learn about the ethical and professional standards in their field, and how to apply them in real-world situations.

B.Sc. in Zoology

Program Specific Outcomes (PSOs):

PSO1: Understand the nature and basic concepts of Animal diversity, taxonomy, Comparative anatomy, Developmental biology, physiology, Biochemistry, Genetics, Evolutionary Biology and related subjects.

PSO2: Perform procedures as per laboratory standards in the areas of Animal diversity, Taxonomy, Comparative anatomy, Developmental biology, physiology, Biochemistry, Genetics and Evolutionary Biology, Entomology, Sericulture, Biochemistry, Animal biotechnology, Immunology, research methodology etc

PSO3: Understand the applications of Zoology in Apiculture, Aquaculture, Agriculture and Medical zoology and other subjects

PSO4: Acquired knowledge about research methodologies and skills of problem solving methods

PSO5: Students will Contributes the knowledge for Nation building and society welfare.

VIVEKANAND COLLEGE, KOLHAPUR (AUTONOMOUS)

Department of Zoology

**Teaching and Evaluation scheme
Three/Four- Years UG Programme
Department/Subject Specific Core or Major (DSC)**

First Year Semester- I & II

Sr. No.	Course Abbr.	Course code	Course Name	Teaching Scheme Hours/week		Examination Scheme and Marks				Course Credits
				TH	PR	ESE	CIE	PR	Marks	
Semester-I										
1	DSC-I	DSC03ZOO11	Animal Diversity I	2	-	40	10	-	50	2
2	DSC-II	DSC03ZOO12	Cell biology	2	-	40	10	-	50	2
3	MIN-I	MIN03ZOO11	Animal Diversity I	2	-	40	10	-	50	2
4	MIN-II	MIN03ZOO12	Cell biology	2	-	40	10	-	50	2
5	OEC-I	OEC03ZOO11	Public health and hygiene	2	-	40	10	-	50	2
6	OEC-II	OEC03ZOO12	Haematology	2	-	40	10	-	50	2
Semester-II										
1	DSC-III	DSC03ZOO21	Animal Diversity II	2	-	40	10	-	50	2
2	DSC-IV	DSC03ZOO22	Genetics	2	-	40	10	-	50	2
3	MIN-III	MIN03ZOO21	Animal Diversity II	2	-	40	10	-	50	2
4	MIN-IV	MIN03ZOO22	Applied Zoology	2	-	40	10	-	50	2
5	OEC-III	OEC03ZOO21	Diversity in living organism	2	-	40	10	-	50	2
6	OEC-IV	OEC03ZOO22	Structural organization in Animals	2	-	40	10	-	50	2
7	SEC-I	SEC03ZOO29	Vermicomposting	-	4	-	-	50	50	2
Annual										
1	DSC-PR-I	DSC03ZOO29	DSC Zoology Lab-1	-	4	-	-	50	50	4
2	MIN-PR-I	MIN03ZOO29	MIN Zoology Lab-1	-	4	-	-	50	50	4
3	OEC-PR-I	OEC03ZOO29	OEC Zoology Lab-1	-	4	-	-	50	50	4
Total				24	16	480	120	200	800	38

B. Sc. Part – I Semester -I ZOOLOGY
DSC-I: DSC03ZOO11: ANIMAL DIVERSITY I

Theory: 30 hrs.

Marks-50 (Credits: 02)

Course Outcomes: After the completion of the course the student will be able to:

CO1: Recall the systematic, classification and biology of animals

CO2: Compare the morphological peculiarities of animals

CO3: Classify the animals among invertebrates

CO4: Apply the knowledge for identification of animals

CO5: Evaluate the importance of diversity of animals

Unit -1:

(15 Lectures)

Importance and scope of animal diversity

Kingdom Protista- General characters and classification up to classes; locomotion in Protozoa

Phylum Porifera- General characters and classification up to classes; Canal System in *Sycon*

Phylum Cnidaria- General characters and classification up to classes; Polymorphism in *Obelia*

Phylum Platyhelminthes: General characters and classification up to classes; Life history of *Taenia solium* and its parasitic adaptations

Unit -2:

(15 Lectures)

Phylum Nemathelminthes- General characters and classification up to classes; Life history of *Ascaris lumbricoides* and its parasitic adaptations

Phylum Annelida- General characters and classification up to classes; Metamerism in Annelida

Phylum Arthropoda- General characters and classification up to classes; Metamorphosis in insects

Phylum Mollusca- General characters and classification up to classes, Sense organ in Mollusca

Phylum Echinodermata- General characters and classification up to classes; Water-vascular system in star fish

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
- 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.

B. Sc. Part – I Semester -I ZOOLOGY
DSC-II: DSC03ZOO12: CELL BIOLOGY
Theory: 30 hrs.
Marks-50 (Credits: 02)

Course Outcomes: After the completion of the course the student will be able to:

CO1: Define various terms in cell biology

CO2: Explain ultra-structure and functions of cell organelles

CO3: Apply knowledge of cell biology in research

CO4: Distinguish between various cell components

CO5: Design and implement experimental procedure using relevant techniques in cell biology

Unit-1: (15 Lectures)

Introduction-Cell as basic unit of life, Importance of Cell Biology, Structure and function of Prokaryotic (*E. coli*) and Eukaryotic cell (Animal Cell)

Plasma Membrane: Structure, chemical composition and functions of plasma membrane, Fluid mosaic model.

Ultrastructure and Functions: Mitochondria, Endoplasmic Reticulum, Golgi apparatus, Ribosomes.

Nucleus: Structure and function of Nucleus, Chromatin: Euchromatin and Heterochromatin

Unit-2: (15 Lectures)

Structure of Nucleic acid: DNA, RNA and its types

Chromosome: Morphology, types of chromosome, Giant chromosome-polytene chromosome & Lampbrush chromosome

Cell cycle and division: Overview of cell cycle, Phases and significance of mitosis and meiosis

Cytoskeleton: Structure and organization of microtubules, microfilaments and intermediate filaments

Reference books:

- Bruce Albert. Molecular biology of the Cell. Pub. By Garland Pub. Inc. New York & London.
- Lodish Berk, Matsudaira, Kaiser, Krleger (2004). Molecular Cell biology –pub. By W. H. Freeman & Company, New York.
- Gerald carp (2005). Molecular cell biology –pu. By John Wiley & Sons.

- Avers C.J. (1986)/ latest edition) Molecular Cell Biology, Addison- Westey, Reading in Massachusettes.
- Stearns, T. & Winey, M. (1997). The Cell Center at 100 Cell 91:303-309.

B. Sc. Part – I Semester -II ZOOLOGY
DSC-III: DSC03ZOO21: ANIMAL DIVERSITY II
Theory: 30 hrs.
Marks-50 (Credits: 02)

Course Outcomes: After the completion of the course the student will be able to:

- CO1: Recall diversity in kingdom animalia
- CO2: Understand classification among chordates
- CO3: Identify and classify the chordates
- CO4: Analyze the various adaptations in vertebrates.
- CO5: Evaluate the significance of animal biodiversity

Unit-1: **(15 Lectures)**

Protochordata: General characters and Classification of Protochordata

Agnatha: General characters of Agnatha and Classification of cyclostomes up to classes

Pisces: General characters of Pisces, General characters of Chondrichthyes and Osteichthyes with examples; aquatic adaptations of fishes

Amphibia: General features and Classification up to orders; Parental care in Amphibia

Unit-2: **(15 Lectures)**

Reptiles: General characters and Classification up to orders, Venomous and non-venomous snakes, Biting mechanism in snake, Types of venom and anti-venom

Aves: General characters and Classification up to orders, Flight Adaptations in birds

Mammals: General characters and classification up to subclasses; Important characters of following Eutherian orders with examples, Primates, Chiroptera and Rodentia

Reference Books:

- Adam Sedgwick (1990).A Students Text Book of Zoology, Low Price Publications, Delhi, Vol. I, II & Vo1. III
- Alfred Sherwood Romer. Thomas S. Pearson ‘The Vertebrate Body, Sixth edition, CBS college Publishing, Saunders College Publishing
- Colbert E.H. (2011). Evolution of the Vertebrates, Wiley Student Edition,
- Dhami and Dhami (2014). Chordate Zoology, R. Chand & Co.
- Ekambaranatha Ayyar (1982). A Manual of Zoology Vo1. II, S. Vishwanathan Pvt. Ltd.
- Jordan E. L. and Verma P. S. (2013). ‘Chordate Zoology’ -. S. Chand Publications.Kotpal R.L. (2016). Modern Text Book of Zoology – Vertebrates, Rastogi Publications.

B. Sc. Part – I Semester -II ZOOLOGY

DSC-IV: DSC03ZOO22: GENETICS

Theory: 30 hrs.

Marks-50 (Credits: 02)

Course Outcomes: After the completion of the course the student will be able to:

CO1: Describe the basic concept of genetics

CO2: Understanding the laws and concepts of Mendelian inheritance and its extension

CO3: Apply knowledge to solve the genetic examples

CO4: Distinguish between different genetic disorders

CO5: Explain basic human genetics and mechanism of inheritance

Unit-1:

(15 Lectures)

Introduction to Genetics: Definition, scope and importance of genetics, Classical and modern concept of gene (Cistron, Muton, Recon),

Brief explanation of following terms: Alleles, Wild type, Mutant allele, Locus, Dominant and recessive trait, Homozygous and heterozygous, Genotype and phenotype, Genome

Mendelian Genetics: Mendel's law of inheritance (Law of Dominance, Segregation and Independent assortment) Monohybrid cross, Dihybrid Cross, Test cross, Back cross.

Extension of Mendelian Genetics: Chromosomal theory of inheritance, Incomplete dominance and co-dominance, Multiple alleles with respect to ABO, RH blood group, Polygenic inheritance with reference to skin colour and eye colour in man, Lethal Alleles, Concept of Pleiotropy

Unit-2:

(15 Lectures)

Mutations: Mutagenic agents (Physical and Chemical), Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy, Induced gene mutation

Basics of Human genetics: Autosomes and Sex chromosomes (Structure), Normal human Karyotype

Sex Determination: Sex determination in man, haploidy-diploidy mechanism in Honey bee, environmental sex determination (Bonellia)

Genetic Disorders: Causes and symptoms of genetic disorders, Sickle cell Anaemia, Phenylketonuria, Albinism, Down syndrome, Turner's Syndrome, Edward Syndrome, Klinefelter syndrome

Reference books:

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Ed..Wiley India.

- Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Ed. John Wiley & Sons Inc.
- Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. 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.

DSC- PR-I: DSC03ZOO29: DSC ZOOLOGY LAB-1

Practicals based on

Animal diversity (DSC03ZOO11) and Cell biology (DSC03ZOO12)

Practical: Four lectures of 60 minutes per week per batch

Marks: 50 (Credits 02)

ZOOLOGY LAB

1. Study of the following specimens with respect to classification and morphological peculiarities
Amoeba, Paramecium, Sycon, Euplectella, Obelia, Physalia, *Taenia solium*, Male and female *Ascaris lumbricoides*, Aphrodite, *Hirudinaria*, Limulus, *Periplaneta*, Pila, Octopus, Star fish, Antedon
2. Study of the following permanent slides:
 - a. T.S. or L.S. of Sycon
 - b. T.S. of male and female *Ascaris lumbricoides*
3. Mounting of mouth part in cockroach/honey bee/ any insect
4. Study of Microscope: Simple and Compound
5. Temporary preparation of mitotic cell from onion roots
6. Extraction of DNA from given sample
7. Study of Cell organelles (any three) by using microphotographs
8. Stained squash preparation of salivary gland chromosomes
9. Stained preparation of mitochondria from oral mucosa/ onion peels

ZOOLOGY LAB Practical based on

Animal Diversity II (DSC03ZOO21) and Genetics (DSC03ZOO22)

1. Study of the following specimens with reference to morphological peculiarities and Classification up to orders:
 - a. Protochordata: Amphioxus
 - b. Cyclostomata: Petromyzon, Myxine
 - c. Pisces: Torpedo, Exocoetus, Labeo
 - d. Amphibia: Ichthyophis, Bufo
 - e. Reptilia: Draco, Chamaeleon
 - f. Aves: Passer, Columba
 - g. Mammalia: Funambulus, Loris
2. Characters identifying venomous and non-venomous snakes
3. Study of any six common birds from different orders with the help of photographs and keys.
4. Demonstration of Barr bodies
5. Study of Mendelian Inheritance and gene interactions (Non-Mendelian Inheritance) using suitable examples.

6. Study of Human Karyotypes (normal and abnormal)
7. Study of polytene chromosome
8. Study of Sex determination in *Drosophila*
9. Examples based on pedigree analysis
10. Study of genetic disorders (with images/photographs) Turner's syndrome, Patau's syndrome, Down syndrome

B. Sc. Part – I Semester -I ZOOLOGY
MIN-I: MIN03ZOO11: ANIMAL DIVERSITY I

Theory: 30 hrs.

Marks-50 (Credits: 02)

Course Outcomes: After the completion of the course the student will be able to:

CO1: Recall the systematic, classification and biology of animals

CO2: Compare the morphological peculiarities of animals

CO3: Classify the animals among invertebrates

CO4: Apply the knowledge for identification of animals

CO5: Evaluate the importance of diversity of animals

Unit -1:

(15 Lectures)

Importance and scope of animal diversity

Kingdom Protista- General characters and classification up to classes; locomotion in Protozoa

Phylum Porifera- General characters and classification up to classes; Canal System in Sycon

Phylum Cnidaria- General characters and classification up to classes; Polymorphism in Obelia

Phylum Platyhelminthes: General characters and classification up to classes; Life history of *Taenia solium* and its parasitic adaptations

Unit -2:

(15 Lectures)

Phylum Nemathelminthes- General characters and classification up to classes; Life history of *Ascaris lumbricoides* and its parasitic adaptations

Phylum Annelida- General characters and classification up to classes; Metamerism in Annelida

Phylum Arthropoda- General characters and classification up to classes; Metamorphosis in insects

Phylum Mollusca- General characters and classification up to classes, Sense organ in Mollusca

Phylum Echinodermata- General characters and classification up to classes; Water-vascular system in star fish

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- 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.

B. Sc. Part – I Semester -I ZOOLOGY
MIN-I: MIN03ZOO11: CELL BIOLOGY
Theory: 30 hrs.
Marks-50 (Credits: 02)

Course Outcomes: After the completion of the course the student will be able to:

CO1: Define various terms in cell biology

CO2: Explain ultra-structure and functions of cell organelles

CO3: Apply knowledge of cell biology in research

CO4: Distinguish between various cell components

CO5: Design and implement experimental procedure using relevant techniques in cell biology

Unit-1:

(15 Lectures)

Introduction-Cell as basic unit of life, Importance of Cell Biology, Structure and function of Prokaryotic (*E. coli*) and Eukaryotic cell (Animal Cell)

Plasma Membrane: Structure, chemical composition and functions of plasma membrane, Fluid mosaic model.

Ultrastructure and Functions: Mitochondria, Endoplasmic Reticulum, Golgi apparatus, Ribosomes.

Nucleus: Structure and function of Nucleus, Chromatin: Euchromatin and Heterochromatin

Unit-2:

(15 Lectures)

Structure of Nucleic acid: DNA, RNA and its types

Chromosome: Morphology, types of chromosome, Giant chromosome-polytene chromosome & Lampbrush chromosome

Cell cycle and division: Overview of cell cycle, Phases and significance of mitosis and

meiosis

Cytoskeleton: Structure and organization of microtubules, microfilaments and intermediate filaments

Reference books:

- Bruce Albert. Molecular biology of the Cell. Pub. By Garland Pub. Inc. New York & London.
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- Stearns, T. & Winey, M. (1997). The Cell Center at 100 Cell 91:303-309.

B. Sc. Part – I Semester -II ZOOLOGY

MIN-I: MIN03ZOO11: ANIMAL DIVERSITY II

Theory: 30 hrs.

Marks-50 (Credits: 02)

Course Outcomes: After the completion of the course the student will be able to:

CO1: Recall diversity in kingdom animalia

CO2: Understand classification among chordates

CO3: Identify and classify the chordates

CO4: Analyze the various adaptations in vertebrates.

CO5: Evaluate the significance of animal biodiversity

Unit-1:

(15 Lectures)

Protochordata: General characters and Classification of Protochordata

Agnatha: General characters of Agnatha and Classification of cyclostomes up to classes

Pisces: General characters of Pisces, General characters of Chondrichthyes and Osteichthyes with examples; aquatic adaptations of fishes

Amphibia: General features and Classification up to orders; Parental care in Amphibia

Unit-2:

(15 Lectures)

Reptiles: General characters and Classification up to orders, Venomous and non-venomous snakes, Biting mechanism in snake, Types of venom and anti-venom

Aves: General characters and Classification up to orders, Flight Adaptations in birds

Mammals: General characters and classification up to subclasses; Important characters of following Eutherian orders with examples, Primates, Chiroptera and Rodentia

Reference Books:

- Adam Sedgwick (1990). A Students Text Book of Zoology, Low Price Publications, Delhi, Vol. I, II & Vol. III
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- Dhami and Dhami (2014). Chordate Zoology, R. Chand & Co.
- Ekambaranatha Ayyar (1982). A Manual of Zoology Vol. II, S. Vishwanathan Pvt. Ltd.
- Jordan E. L. and Verma P. S. (2013). 'Chordate Zoology' -. S. Chand Publications.
- Kotpal R.L. (2016). Modern Text Book of Zoology – Vertebrates, Rastogi Publications.

B. Sc. Part – I Semester -II ZOOLOGY

MIN-I: MIN03ZOO11: GENETICS

Theory: 30 hrs.

Marks-50 (Credits: 02)

Course Outcomes: After the completion of the course the student will be able to:

CO1: Describe the basic concept of genetics

CO2: Understanding the laws and concepts of Mendelian inheritance and its extension

CO3: Apply knowledge to solve the genetic examples

CO4: Distinguish between different genetic disorders

CO5: Explain basic human genetics and mechanism of inheritance

Unit-1:

(15 Lectures)

Introduction to Genetics: Definition, scope and importance of genetics, Classical and modern concept of gene (Cistron, Muton, Recon),

Brief explanation of following terms: Alleles, Wild type, Mutant allele, Locus, Dominant and recessive trait, Homozygous and heterozygous, Genotype and phenotype, Genome.

Mendelian Genetics: Mendel's law of inheritance (Law of Dominance, Segregation and Independent assortment) Monohybrid cross, Dihybrid Cross, Test cross, Back cross.

Extension of Mendelian Genetics: Chromosomal theory of inheritance, Incomplete dominance and co-dominance, Multiple alleles with respect to ABO, RH blood group, Polygenic inheritance with reference to skin colour and eye colour in man, Lethal Alleles, Concept of Pleiotropy.

Unit-2:

(15 Lectures)

Mutations: Mutagenic agents (Physical and Chemical), Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy, Induced gene mutation.

Basics of Human genetics: Autosomes and Sex chromosomes (Structure), Normal human

Karyotype.

Sex Determination: Sex determination in man, haploidy-diploidy mechanism in Honey bee, environmental sex determination (Bonelia).

Genetic Disorders: Causes and symptoms of genetic disorders, Sickle cell Anaemia, Phenylketonuria, Albinism, Down syndrome, Turner's Syndrome, Edward Syndrome, Klinefelter Syndrome.

Reference books:

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Ed..Wiley India.
- Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Ed. John Wiley & 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.

MIN-PR-I: MIN03ZOO29: MIN ZOOLOGY LAB-1
Animal diversity (MIN03ZOO11) and Cell biology (MIN03ZOO12)
Practical: Four lectures of 60 minutes per week per batch
Marks: 50 (Credits 02)

ZOOLOGY LAB

1. Study of the following specimens with respect to classification and morphological peculiarities
Amoeba, Paramecium, Sycon, Euplectella, Obelia, Physalia, *Taenia solium*, Male and female *Ascaris lumbricoides*, Aphrodite, *Hirudinaria*, Limulus, *Periplaneta*, Pila, Octopus, Star fish, Antedon
2. Study of the following permanent slides:
 - a. T.S. or L.S. of Sycon
 - b. T.S. of male and female *Ascaris lumbricoides*
3. Mounting of mouth part in cockroach/honey bee/ any insect
4. Study of Microscope: Simple and Compound
5. Temporary preparation of mitotic cell from onion roots
6. Extraction of DNA from given sample
7. Study of Cell organelles (any three) by using microphotographs
8. Stained squash preparation of salivary gland chromosomes
9. Stained preparation of mitochondria from oral mucosa/ onion peels

ZOOLOGY LAB Practicals based on

Animal Diversity II (MIN03ZOO21) and Genetics (MIN03ZOO22)

1. Study of the following specimens with reference to morphological peculiarities and Classification up to orders:

- a. Protochordata: Amphioxus
 - b. Cyclostomata: Petromyzon, Myxine
 - c. Pisces: Torpedo, Exocoetus, Labeo
 - d. Amphibia: Ichthyophis, Bufo
 - e. Reptilia: Draco, Chamaeleon
 - f. Aves: Passer, Columba
 - g. Mammalia: Funambulus, Loris
2. Characters identifying venomous and non-venomous snakes
 3. Study of any six common birds from different orders with the help of photographs and keys.
 4. Demonstration of Barr bodies
 5. Study of Mendelian Inheritance and gene interactions (Non-Mendelian Inheritance) using suitable examples.
 6. Study of Human Karyotypes (normal and abnormal)
 7. Study of polytene chromosome
 8. Study of Sex determination in Drosophila
 9. Examples based on pedigree analysis
 10. Study of genetic disorders (with images/photographs) Turner's syndrome, Patau's syndrome, Down syndrome

B. Sc. Part – I Semester -I ZOOLOGY
OEC-I: OEC03ZOO11: PUBLIC HEALTH AND HYGIENE
Theory: 30 hrs.
Marks-50 (Credits: 02)

Course Outcomes: After the completion of the course the student will be able to:

- CO1: Tell importance of personal and public hygiene
- CO2: Explain methods to maintain societal health
- CO3: Apply the knowledge in nutrition and human health
- CO4: Compare different human diseases
- CO5: Interpret between malnutrition and health

Unit -1: (15 Lectures)

Maintenance of personal hygiene: Introduction to public health and hygiene- Role of health education environment improvement and prevention of diseases. Personal hygiene, oral hygiene and sex hygiene.

Nutrient deficiency diseases: Classification of food into micro and macro nutrients. Balanced diet, Malnutrition anomalies –Anemia (Iron and B12 deficiency), Kwashiorkor, Marasmus, Rickets, and Goiter (cause, symptoms, precaution and cure). Substitution of diet with required nutrients to prevent malnutrition disorders

Unit -2: (15 Lectures)

Communicable and contagious diseases: Infectious agents responsible for diseases in humans. Communicable viral diseases- measles, chicken pox, dengue, chikungunya, rabies and hepatitis. Communicable bacterial diseases- tuberculosis, typhoid, cholera, tetanus, sexually transmitted diseases- AIDS, Health education and preventive measures for communicable diseases

Non-communicable diseases and cure: Non-communicable diseases such as Osteoporosis, osteoarthritis and rheumatoid arthritis- cause, symptom, precautions. Diabetes- types and its effect on human health, gastrointestinal disorders- acidity, peptic ulcer, constipation, piles (cause, symptoms, precaution and remedy) etc. Obesity (Definition and consequences), Mental illness (depression and anxiety)

Reference Books:

- Mary Jane Schneider (2011). Introduction to Public Health.
- Muthu, V. K. (2014). A Short Book of Public Health.
- Detels, R. (2017). Oxford Textbook of Public Health (6th edition).
- Gibney, M. J. (2013). Public Health Nutrition.
- Wong, K.V. (2017). Nutrition, Health and Disease.

**B. Sc. Part – I Semester -I Zoology
OEC -II: OEC03ELE12: HEMATOLOGY
Theory: 30 hrs.
Marks-50 (Credits: 02)**

Course Outcomes: After the completion of the course the student will be able to:

CO1: Recall properties of blood and blood cells

CO2: Understand morphology and production of blood cells

CO3: Apply the knowledge for identification of ABO blood group system and blood transfusion

CO4: Compare haematological disorders

CO5: Develop haematological skill and interpret the result

Unit-1:

(12 Lectures)

Introduction to Haematology and haemopoiesis

Blood: Composition and function of blood, basic properties of blood, composition of serum and plasma, plasma proteins and their functions. Blood cells – (RBC, WBC and Platelet morphology, production, functions and fate)

Haemoglobin: Structure and properties, Blood clotting mechanism

Unit-2:

(18 Lectures)

Blood collection: Anticoagulants used in Haematology, Normal values in Hematology, blood storage and transport

Blood pressure: Total pressure, lateral pressure, importance of different pressure, Measurements, factors controlling BP, hypertension: causes and effects, Blood Grouping (ABO blood group system), Blood Transfusion mechanism

Anaemia: Classification of Anemia (Morphological & etiological), Definition, Basic Concepts in Anemia, causes, classification & lab findings of Iron Deficiency Anemia,

megaloblastic Anemia, Hemolytic Anemia, Aplastic Anaemias

Leukemia: Basic Concepts of Leukemia, Classification, Acute Leukaemias, Chronic Leukaemias.

Reference Books:

- Ramanic Sood, Laboratory Technology (Methods and interpretation) 4th Ed. J.P. Bros, New Delhi
- Satish Gupta Short text book of Medical Laboratory for technician J.P. Bros, New Delhi
- Shirley Mitchell Lewis , Barbara J. Bain , Imelda Bates (2006). Dacie and Lewis Practical Haematology, 10th Ed, Churchill Livingstone/Elsevier.
- Barbara A. Brown (2008). Hematology: principles and procedures 6th Ed Lea & Febiger.
- Bernadette F. Rodak, George A. Fritsma, Kathryn Doig (2007). Hematology: Clinical Principles and Applications 3rd Ed, Elsevier Health Sciences.

B. Sc. Part – I Semester -II ZOOLOGY

OEC-III: OEC03ZOO21: DIVERSITY IN LIVING ORGANISM

Theory: 30 hrs.

Marks-50 (Credits: 02)

Course Outcomes: After the completion of the course the student will be able to:

CO1: Recall diversity among living organisms

CO2: Explain various types classification systems for living organism

CO3: Organize living organisms according to their complexity

CO4: Analyze taxonomical hierarchy of organism

CO5: Evaluate the significance of biodiversity

Unit-1:

(15 Lectures)

Introduction to living world: The Living World Biodiversity; Need for classification, types of classification, Nomenclature, international code of nomenclature, binomial nomenclature, trinomial Nomenclature.

Five Kingdom Systems and concept of six kingdom system: Five kingdoms classification; Salient features and classification of Monera, Protista, Salient features and classification of Fungi into Major groups: Lichens, Viruses and Viroids

Unit-2:

(15 Lectures)

Animal Kingdom: Overview of animal kingdom

Three domains of life: Three domains of life, taxonomy and systematics, taxonomical hierarchy, types of taxonomy; Concept of species.

Natural history of Indian subcontinent: Biogeographic zones and their fauna, common Indian Mammals, Importance, Causes of loss and Conservation strategies of biodiversity.

Reference Books:

- Adam Sedgwick (1990). A Students Text Book of Zoology, Low Price Publications, Delhi, Vol. I, II & Vo1.III,
- Alfred Sherwood Romer. Thomas S. Pearson 'The Vertebrate Body, Sixth edition, CBS college Publishing, Saunders College Publishing
- Colbert E.H. (2011). Evolution of the Vertebrates, Wiley Student Edition,
- Dhama and Dhama (2014). Chordate Zoology, R. Chand & Co.
- Ekambaranatha Ayyar (1982). A Manual of Zoology Vo1. II, S. Vishwanathan Pvt. Ltd.

B. Sc. Part – I Semester -II ZOOLOGY

OE -IV: OEL03ZOO22: STRUCTURAL ORGANISATION IN ANIMAL

Theory: 30 hrs.

Marks-50 (Credits: 02)

Course Outcomes: After the completion of the course the student will be able to:

- CO1: Define the terms in structural biology of organism
- CO2: Explain the organization of various animals
- CO3: Identify level of organization in animal
- CO4: Correlate the functions of organs
- CO5: Evaluate the importance of organs

Unit-1:

(15 Lectures)

1. Prokaryotic and eukaryotic cells-Organization in a Multicellular Animal
 - a. Cellular level of organization
 - b. Tissue Level of organization
 - c. Organ Level of organization
2. Types of animal tissues
 - a. Epithelial tissue
 - b. Connective Tissue
 - c. Muscle tissue
 - d. Neural tissue
3. Sense organ- Photoreceptor, Tangoreceptors, Statoacoustic

Unit-2:

(15 Lectures)

1. Study of various systems in human
 - a. Digestive system
 - b. Nervous system
 - c. Circulatory system
 - d. Male reproductive system
 - e. Female reproductive system
 - f. Respiratory system
 - g. Skeletal system
 - h. Endocrine gland

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.

OE-PR-I: OEL03ZOO29: OEC ZOOLOGY LAB-1

Practicals based on

Public health & hygiene (OEC03ZOO11) and Haematology (OEC03ZOO12)

Practical: Four lectures of 60 minutes per week per batch

Marks: 50 (Credits 02)

ZOOLOGY LAB

1. Study the steps to follow in day-to-day lives to maintain good health and improve personal hygiene
2. Study of common contagious and non-communicable diseases (Any 4)
3. Study of balance diet
4. Preparation of blood smear and study of blood cells
5. Study of cells of bone marrow (with photographs/images)
6. Preparation of hemin crystals
7. Detection of blood groups
8. Detection of bleeding time of own blood.
9. Detection of clotting time of own blood
10. Study of Erythrocyte Sedimentary Rate (E.S.R)
11. Estimation of Hb by Sahli's haemometer
12. Measurement of human blood pressure
13. Observation of different types of nucleus of WBC
14. Study of packed cell volume of blood cells

ZOOLOGY LAB Practical based on

Diversity in Living Organism (OEC03ZOO21) and Structural Organization in Animal (OEC03ZOO22)

Study of the following specimens with respect to classification and morphological peculiarities: Bacteria, Oscillatoria, Spirogyra, Rhizopus, mushroom, yeast, liverwort, moss, fern, pine

1. Temporary Preparation of whole mount of Paramecium
2. Study of Prokaryotic and Eukaryotic cells using slides or microphotographs

3. Study of different types of tissues using slides or microphotographs
Epithelial tissue
Connective Tissue
Muscle tissue
Neural tissue
4. Demonstration of body parts -Morphology of Mammals (Rat and Human)
5. Demonstration of organs and organ systems -Mammals- Digestive system, Nervous system, Circulatory system, Reproductive system, Respiratory system
6. Study of locomotion in protozoa
7. Preparation of Animal album- w. r. t. Critically endangered, endangered, vulnerable, rare species
8. Collection and identification of insects from college campus/ stored grain insects
9. Field visit

B. Sc. Part – I Semester -II ZOOLOGY

SEC -I: SEC03ZOO29: VERMICOMPOSTING

Theory: 30 hrs.

Marks-50 (Credits: 02)

Course Outcomes: After completion of this course students will be able to

CO1: Recall the importance of earthworms in maintaining soil quality.

CO2: Learn the techniques of composting in a limited space

CO3: Develop technical skills on harvesting and management of vermicomposting

CO4: Understand the scope of vermicomposting as entrepreneurship

CO5: Choose vermicomposting that leads to organic farming and healthy food production.

Vermicomposting

1. Collection of native earth worm species to study habit and habitat.
2. Keys to identify different species of earth worm.
3. Life cycle of *Eisenia fetida* and *Eudrilus eugeniae*.
4. Dissection of digestive and reproductive system.
5. Study of vermicomposting equipments and devices.
6. Preparation of vermibeds and their maintenance.
7. Study of different vermicomposting methods.
8. Harvesting, separation of worms, packaging, transport and storage of varmicompost.
9. Vermiwash collection and processing.
10. Small scale earth worm farming for home gardens and studying the effect of vermicompost on garden plants.
11. Budget and cost scenario of vermiculture (Project).
12. Diseases and natural enemies of earth worms and their control measures.
13. Role of vermitechnology in environmental protection.
14. Economics and Marketing of vermicompost and vermiwash.
15. Visit to vermiculture farm to acquaint with latest techniques.

Reference Books:

- Bhatt J.V. and S.R. Khambata (1959). Role of Earthworms in Agriculture| Indian Council of Agricultural Research, New Delhi
- Edwards, C.A. and J.R. Lofty (1977). Biology of Earthworms| Chapman and Hall Ltd., London.
- Lee, K.E. (1985). Earthworms: Their ecology and Relationship with Soils and Land Use| Academic Press, Sydney.
- Kevin, A and Lee K. E. (1989). Earthworm for Gardeners and Fisherman| (CSIRO, Australia, Division of Soils)
- Satchel, J.E. (1983). Earthworm Ecology| Chapman Hall, London.
- Wallwork, J.A. (1983). Earthworm Biology| Edward Arnold (Publishers) Ltd. London