



*Rayat Shikshan Sanstha's*  
**R. B. Narayanrao Borawake College, Shrirampur**  
**(Autonomous)**

(Affiliated to Savitribai Phule Pune University, Pune)

**Department of Zoology**

**FYUG (Zoology) Syllabus as per NEP-2020**

*Implemented*  
*From*  
**Academic Year: 2023-24**

## F.Y.B.Sc. (Zoology) Core Subjects (Semester-I)

Year	Semester	Course Type	Course Code	Course Title	Theory/ Practical	Credits	No. of Lectures/ Practical to be conducted	Page No.
1 <sup>st</sup>	I	DSC (Major)	ZO-MJ-111T	Systematics & Diversity of Life	Theory	2	30L	4-5
			ZO-MJ-112T	Fundamental of Cell Biology	Theory	2	30L	6-7
			ZO-MJ-113P	Zoology Practical-I	Practical	2	11P	8-9
		VSC	ZO-VSC-114T	Dairy Production and Technology	Theory	2	30L	10-11
		SEC	ZO-SEC-115P	Medical Laboratory Technology	Practical	2	13P	12-13
		IKS	ZO-IKS-116T	Animal Diversity & Conservation in Indian Culture	Theory	2	30L	14-15

## F.Y.B.Sc. (Zoology) Core Subjects (Semester-II)

Year	Semester	Course Type	Course Code	Course Title	Theory/ Practical	Credits	No. of Lectures/ Practical to be conducted	Page No.
1 <sup>st</sup>	II	DSC (Major)	ZO-MJ-121T	Human Physiology	Theory	2	30L	17-18
			ZO-MJ-122T	Genetics	Theory	2	30L	19-20
			ZO-MJ-123P	Zoology Practical - II	Practical	2	12P	21-22
		VSC	ZO-VSC-124P	Bee Keeping	Practical	2	07P	23-24
		SEC	ZO-SEC-125P	Public Health and Hygiene	Practical	2	10P	25-26

# Syllabus for F. Y. B. Sc. (Zoology)

## Semester I

**DISCIPLINE SPECIFIC CORE COURSE (ZO-MJ-111T): Systematics & Diversity of Life**

Course Code & Title	Credits	Credit Distribution of the Course	
		Lecture	Practical
<b>ZO-MJ-111T - Systematics &amp; Diversity of Life</b>	2	2	--

**LEARNING OBJECTIVES:**

The Learning objectives of this course are as follows:

- Understand the Animal Diversity around us.
- Acquire the knowledge of principles and classification of animals.
- Knowing the terminology needed in classification.
- Understand the differences and similarities in the various aspects of classification.
- Classify invertebrates and to be able to understand the possible group of the invertebrate observed in Nature.

**COURSE OUTCOMES:**

After completion of this course students will be able to:

- CO 1-** Understand classification and identification of animals.  
**CO 2-** Know the importance of classification of animals and classifies them effectively.  
**CO 3-** The student knows his role in nature as a protector, preserver and promoter of life.  
**CO 4-** Recognize our role as a caretaker and promoter of life.

**SYLLABUS of ZO-MJ-111T:****[30 Hours]****Unit-I: Origin of Life on Earth****[7 Hours]**

**Products of evolutionary process Multicellularity;** From simple collections of poorly differentiated cells to complex body plans. Biological diversity. Animal Systematics and taxonomy. Species concept, clades. Nomenclature and utility of scientific names.

**Unit-II: Diversity in Kingdom Animalia & Kingdom Protista****[8 Hours]**

**General Features of kingdom Animalia-**General characters of Kingdom Animalia, Grades of organization And Symmetry

**Kingdom Protista** (Phylum: Protozoa) Introduction to Phylum Protozoa-Salient features of Phylum Protozoa, Classification of Phylum Protozoa up to classes with two examples- Class-Rhizopoda (e.g. :Entamoeba histolytica, Arcella), Class-Mastigophora (e.g.: Euglena viridis, Trypanosoma gambiense), Class-Ciliata (e.g-Paramoecium caudatum, Opalina, Ranarum) Class-Sporozoa (e.g Plasmodium vivax, Toxoplasma gondii)

**Locomotion in Protozoa:** Amoeboid, Ciliary and Flagellar with suitable examples.

**Type Study: Paramecium caudatum:** Classification, Habit and Habitat, External morphology, Feeding and digestion, Excretion, Reproduction (binary fission and conjugation)

**Economic importance of Protozoa-Harmful Protozoa:** Plasmodium vivax (malarial parasite), Entamoeba histolytica (Amoebic dysentery), Trypanosoma gambiense (Gambian sleeping sickness), **Useful Protozoa:** Trichonympha.

### **Unit-III: Origin of Metazoa & Phylum Porifera**

**[7 Hours]**

**Origin of Metazoa-** Introduction Origin and importance of Metazoa

**Phylum Porifera-** Introduction to Phylum Porifera, Classification of Phylum Porifera up to classes with two examples of each class: Class-Calcareous (e.g.: Leucosolenia, Sycon (Scypha) Class-Hexactinellida (e.g: Euplectella (venus flower basket), Hyalonema (glass sponge), Class-Demospongiae (e.g: Chalina (Mermaid's gloves, Spongilla (freshwater sponge), Canal system in sponges: Ascon, Leucon and Rhagon type. Skeleton in sponges: Spicules, its types: Microscleres & Megasccleres-Monoaxon, monactinal, diactinal, Amphidiscs, Triaxon, Polyaxon, Sponginfibers. Regeneration in sponges. Economic importance of Phylum Porifera.

### **Unit-IV: Diversity in Phylum Cnidaria, Phylum- Platyhelminthes:**

**[8 Hours]**

**Phylum: Cnidaria-** Introduction, Salient features of Phylum Cnidaria, Classification two examples, Class-Hydrozoa e.g.: Hydra, Physalia (Portuguese man of war), Class-Scyphozoa e.g: Aurelia (Jelly fish), Leucernaria (trumpet shaped Jellyfish), Class-Anthozoa: e.g; Metridium (Common sea anemone) Polymorphism in Hydrozoa: Polyps & Medusa (polyp types: gastrozooids, dactylozooids, gonozooids) and functions. Economic importance of Cnidarians with reference to Corals and Coral reefs.

**Phylum Platyhelminthes-** Introduction, Salient features Classification with two examples Class: Turbellaria (e.g: Dugesia, Bipallium), Class: Trematoda (e.g: Fasciola hepatica, Schistosoma haematobium), Class Cestoda: Taenia solium (pork tape worm), Echinococcus granulosus (dog tapeworm), Parasitic adaptations in Platyhelminthes: structural and physiological. Economic importance of Platyhelminthes.

### **ESSENTIAL/RECOMMENDED READINGS:**

- 1) Barnes, R. S. K.; Calow, P.; Olive, P. J. W.; Golding, D. W.; Spicer, J. I. (2002) The Invertebrates: A Synthesis, Blackwell Publishing.
- 2) Barnes, R.D. (1982). Invertebrate Zoology, V Edition. Holt Saunders International Edition.
- 3) 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
- 4) Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson
- 5) Boradale, L.A. and Potts, E.A. (1961). Invertebrates: A Manual for the use of Students.

**DISCIPLINE SPECIFIC CORE COURSE (ZO-MJ-112T): Fundamental of Cell Biology**

Course Code & Title	Credits	Credit Distribution of the Course	
		Lecture	Practical
<b>ZO-MJ-112T - Fundamental of Cell Biology</b>	2	2	--

**LEARNING OBJECTIVES:**

The Learning objectives of this course are as follows:

- Identification of cell types based on structural peculiarities.
- Comparison of structural properties of the cells.
- Construction the models of types of cells, cell organelles, and stages of cell division.
- The learner will understand the importance of cell as a structural and functional unit of life.
- The learner understands and compares between the prokaryotic and eukaryotic system and extrapolates the life to the aspect of development.

**COURSE OUTCOMES:**

After completion of this course student will be able to-

**CO1:** Identify cell types based on structural peculiarities.

**CO2:** Explain the functions of cell organelles.

**CO3:** Recall the facts & definitions of cytology, mitosis, meiosis, etc.

**CO4:** Explain the concept of cell division.

**CO5:** Interpret the stage of cell division with the help of pictures.

**SYLLABUS of ZO-MJ-112T:**

**[30 Hours]**

**Unit-I: Introduction to Cell Biology:**

**[5 Hours]**

Definition and brief history, Introduction to cell theory.

Study of Prokaryotic cell And Eukaryotic cell: Comparative study of Prokaryotic cell and Eukaryotic cell, Comparative study of plant and animal cell.

**Unit-II: Structure and functions of cell membrane:**

**[6 Hours]**

Chemical composition, Fluid mosaic model, Functions of cell membrane. Cytoplasm: Physical Organization, Chemical Composition & Biological Properties.

**Unit-III: Study of cell organelles and their Functions:**

**[12 Hours]**

Endo-plasmic reticulum, Golgi complex, Lysosomes & Peroxisomes, Ribosomes, Mitochondria.

Nucleus: Ultrastructure of nucleus, Functions of nucleus

**Unit-IV: Cell cycle in brief, Cell division:****[7 Hours]**

1. Mitosis, 2. Meiosis, Significance of cell division

**ESSENTIAL/RECOMMENDED READINGS:**

- 1) Powar, C. B., & Powar, C. B. (1970). Cell Biology. Himalaya Publishing House.
- 2) Du Praw, E. J. (1968). Cell and molecular biology (No.QH581 D83).
- 3) Avers, C. J. (1978). Basic cell biology.
- 4) Karp, G. (2009). Cell and molecular biology: concepts and experiments. John Wiley & Sons.
- 5) Cooper, G. M., Hausman, R. E., & Hausman, R. E. (2007). The cell: a molecular approach 649-656). Washington, DC: ASM press.
- 7) Cell Biology by Arumugamm, Saras Publication. VII Edition. Lippincott Williams and Wilkins, Philadelphia.



**DISCIPLINE SPECIFIC CORE COURSE (ZO-MJ-113P):**  
**Zoology Practicals- I**

Course Code & Title	Credits	Credit Distribution of the Course	
		Lecture	Practical
<b>ZO-MJ-113P - Zoology Practicals-I</b>	2	--	2

**LEARNING OBJECTIVES:**

The Learning objectives of this course are as follows:

- Explain the role of compartmentalization and signalling in cellular biology.
- Interpret and explain key experiments in the history of cell biology.
- Evaluate and apply knowledge of modern techniques in cellular biology.
- Interpret, analyse, describe and present new experimental data.

**COURSE OUTCOMES:**

After completion of this course student will be able to-

**CO1-**Recall the classification system of Invertebrates and chordate animals. Identify the animals belonging to different phylum of animals. Retrieve the data of animals from field visit.

**CO2-**Identify and classify the animals in Animal Kingdom according to Phylum and appropriate distinguishing characteristics of all phyla.

**CO3-**Interpret the data of field visit. Organize the animals as per their hierarchy of classification.

**CO4-**Classify and compare and distinguish the chordates and non-chordates based on morphological characters of Animals.

**CO5-**Compare the similarities and differences between animal and plant cell.

**SYLLABUS of ZO-MJ-113P:****[60 Hours]**

- 1) Museum Study of phylum Protozoa: Euglena, Paramecium, Amoeba, Plasmodium sp. **(D)**
- 2) Museum study of phylum Cnidaria: Hydra, Physalia, Aurelia, Metridium **(D)**
- 3) Museum Study of phylum Platyhelminthes: Planeria, Fasciola hepatica, Taenia solium **(D)**
- 4) Study of Paramecium: Culture, External morphology, Conjugation and Binary fission **(E)**
- 5) Study of permanent slides: Spicules and Gemmules in Sponges, T.S. of Sycon, T.S. of Hydra, Taenia solium: Scolex, Gravid proglottid **(D)**
- 6) Study of Microscope: Simple and Compound **(E)**
- 7) Ultra structure study of: a. Mitochondria, b. Nucleus, c. Endoplasmic Reticulum, d. Golgi complex (With Picture/Model/Chart) **(D)**
- 8) Preparation of blood smears to observe the blood cells **(E)**

- 9) Study of mitotic cell division using onion root tips. **(E)**
- 10) Study of cell: Preparation of temporary mount of human buccal epithelial cells. **(E)**
- 11) Demonstration of mitochondria using Janus Green B stain. **(D)**

**ESSENTIAL/RECOMMENDED READINGS:**

- 1) Hickman, C.; Roberts, L.S.; Keen, S.L.; Larson, A. and Eisenhower, D. (2018) Animal Diversity, McGraw-Hill.
- 2) Holland, P. (2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.
- 3) Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.
- 4) Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia Publishing Home.

## VOCATIONAL SKILL COURSE (ZO-VSC-114T): Dairy Production and Technology

Course Code & Title	Credits	Credit Distribution of the Course	
		Lecture	Practical
<b>ZO-VSC-114T - Dairy production and Technology</b>	2	2	--

### LEARNING OBJECTIVES:

The Learning objectives of this course are as follows-

- Better understand the basic components of dairy science and technology, including: properties of milk, milk processing and technology, milk products development and ingredients, safety considerations in products manufacturing.
- Identify how dairy technology impacts and supports various aspects of food science and technology
- Identify trends in the dairy industry.

### COURSE OUTCOMES:

After completion of this course student will be able to-

**CO1-**Describe the nutritive value and composition of milk. Identify the various breeds of cattle.

**CO2-**Understand the challenges in management and setting of dairies, Distinguish the cattle breed.

**CO3-**Apply the knowledge of management of dairy to improve the business profit. Implement the dairy business.

**CO4-**Explain history and future of dairy industry, Distribution map of dairy farming areas/ major milk producing regions in India.

### SYLLABUS of ZO-VSC-114T:

[30 Hours]

#### Unit-I: Planning and maintaining desired cattle breeds:

[10 Hours]

History and future of Dairy Industry, Distribution map of dairy farming areas/ major milk producing regions in India. Dairy Products and their nutritive value. Milk, cheese, yoghurt, gluten etc; Dairy farm planning Management. Challenges in setting up a dairy farm. Environment and facilities: Managing Dairy Cattle. Breed selection: Breeds of cattle and buffalo, Native cow varieties, Indian exotic breeds their popularity and performance.

#### Unit-II: Types of Milk

[10 Hours]

Pasteurized milk, Sterilized milk, Standardized milk, Boiled milk, Toned milk, Flavored milk, Homogenized milk, Fermented milk, Ultra-high temperature (UHT) milk, Skimmed milk, Mixed milk.

**Unit-III: Housing and maternity management: [08 Hours]**

Housing of Dairy Cattle. Dairy and shed design. Cooling strategies, Cow comfort Management; Cleaning Management. Animal signs Management. Dairy herd Management and growth; Cow health and reproductive performance. Artificial insemination and conception; Maternity management, The Lactation Cycle, Calf management, Common management procedures. Vaccination.

**Unit-IV: Business prospects, Biosecurity: [02 Hours]**

Dairy business profit strategies. Common disorders and diseases in Dairy Cattle and calf; Managing Dairy Facilities for sick and lame cows. Manure handling.

**ESSENTIAL/RECOMMENDED READINGS:**

- 1) Klaus, A. J. (2015) Dairy Farming: The Beautiful Way.
- 2) G.C. Banerjee (1998) Animal Husbandry.
- 3) Leitch, A. (2018) The Dairy Farm: Dairy Cattle Methods, and Dairy Farm Management.
- 4) Britz, T.J. and Robinson, R.K. 2008. Advanced Dairy Science and Technology. Blackwell Publishing Ltd. Garsington Road, Oxford, UK.
- 5) Chandan, R.C., Kilara, A. and Shah, N. 2008. Dairy processing and quality assurance, John Wiley & Sons Inc., New York, USA.
- 6) MHFW. 2005. Manual of Methods of Food Analysis (Milk and Milk Products). Lab Manual. Ministry of Health and Family Welfare, Govt. of India, India.
- 7) Walstra, P, Wouters JTM and Guerts TJ. 2006. Dairy Science & Technology, 2nd ed. CRC Press, Taylor & Francis Group, Boca Raton, FL, USA.
- 8) Alfa Laval/Tetra Pak. 1995. Dairy processing handbook. Tetra Pak Processing System, Lund, Sweden.

**SKILL ENHANCEMENT COURSE (ZO-SEC-115P): Medical  
Laboratory Technology**

Course Code & Title	Credits	Credit Distribution of the Course	
		Lecture	Practical
<b>ZO-SEC-115P - Medical Laboratory Technology</b>	2	--	2

**LEARNING OBJECTIVES:**

**The Learning objectives of this course are as follows-**

- Learn the Clinical Biochemistry and role of Medical Lab Technologist.
- Understand the about advanced equipment of laboratory.
- Know about all body medical tests.
- Learn how to perform laboratory test in clinical laboratory.
- Study the Fundamentals of Medical Laboratory Techniques.

**COURSE OUTCOMES:**

**After completion of this course student will be able to-**

- CO1-** Students will understand glassware and equipment use in Laboratory.  
**CO2-** Get knowledge of the Clinical Biochemistry and role of Medical Lab Technologist.  
**CO3-** Review Fundamentals of Medical Laboratory Techniques.  
**CO4-** Understand the Principle and procedure of various laboratory test.

**SYLLABUS of ZO-SEC-115P:****[60 Hours]**

- 1) Collection of Blood Sample by Finger prick and Vein Puncture method.
- 2) Demonstration, Usage and handling of Laboratory equipment and instruments.
- 3) Demonstration of Colorimeter.
- 4) Demonstration of Spectrophotometer.
- 5) Estimation of Haemoglobin by Sahli's apparatus.
- 6) Identification of Normal Blood cell.
- 7) Estimation of Blood Group by ABO method.
- 8) Analysis of Urine: Microscopy and Chemical component.
- 9) Estimation of Blood Sugar.
- 10) Total Red Blood Cell (RBC) Count Using Haemocytometer / Neubauer's Chamber.
- 11) Total White Blood Cell (WBC) Count Using Haemocytometer / Neubauer's Chamber.
- 12) Erythrocyte sedimentation rate (ESR): principle, method, procedure and clinical application.
- 13) Visit to nearest Any Medical Laboratory OR Clinical Pathological Laboratory.

**ESSENTIAL/RECOMMENDED READINGS:**

- 1) Medical Laboratory procedures Manual (T-M) by K.L. Mukherjee, Vol.I, II, III.
- 2) A manual of laboratory Diagnostic tests Fischback
- 3) Practical clinical Biochemistry, Harold Varley.
- 4) Text book of Medical Laboratory Technology – Prafull B. Godkar and Darshan B. Godkar.
- 5) Clinical chemistry – Theory, Analysis, Correlation by Kaplan.
- 6) Principles and Techniques of biochemistry and molecular biology by Keith Wilson & Walker.

**INDIAN KNOWLEDGE SYSTEM (ZO-IKS-116T): Animal Diversity & Conservation in Indian Culture**

Course Code & Title	Credits	Credit Distribution of the Course	
		Lecture	Practical
<b>ZO-IKS-116T - Animal Diversity &amp; Conservation in Indian Culture</b>	2	2	--

**LEARNING OBJECTIVES:**

The Learning Objectives of this course are as follows:

- Understand the basic information on animals in Indian culture.
- Classify some animals by Indian ascetics.
- Understand the habitat and behavioral diversity of animals in perspective of Indian culture.
- Correlation between Indian culture and Animal conservation.
- Understand role of animals in ecosystem.
- Aware about the domestication of animals
- Acquire knowledge of animal taming in Indian culture.

**COURSE OUTCOMES:**

After completion of this course student will be able to-

- CO 1:** Recall facts about animals in Indian culture.  
**CO 2:** Classify animals as per Indian tradition.  
**CO 3:** Compare habitat and behavioral diversity of animals.  
**CO 4:** Analyze role of Indian culture in animal conservation.  
**CO 5:** Explain role of animals in ecosystem.  
**CO 6:** Predicts correlation between Indian culture and animal domestication.  
**CO 7:** Explain the concept of animal taming in Indian culture.

**SYLLABUS of ZO-IKS-116T:**

**[30 Hours]**

**Unit-I: Sacred Animals of India (Non-chordates):**

**[8 Hours]**

Ants, Bees, Praying mantis, Butterflies, Spider, Earthworm

**Unit-2: Sacred Animals of India (Chordates):**

**[7 Hours]**

Fish, Frog, Tortoise, Snakes, Mouse, Squirrel

**Unit-3: Sacred Animals of India (Chordates):**

**[7 Hours]**

Eagle, Peacock, Elephant, Horse, Pig, Tiger, Deer

**Unit-4: Introduction to Animal Classification in Ancient India:**

**[8 Hours]**

Owl, Crow, Cow, Buffalo, Goat, Pigeon, Giraffe

**ESSENTIAL/RECOMMENDED READINGS:**

- 1) Nanditha Krishna, (2010). Sacred Animal of India. Penguin Books India Pvt. Ltd.
- 2) Krishna N., Amrithalingam M. and Godbole A, (2006). 'Sacred Animals of Maharashtra', Ecological Traditions of Maharashtra, C.P.R. Environment Education Centre, Chennai.
- 3) Majupuria, T.C., (2000). Sacred Animals of Nepal and India, Gwalior.
- 4) Ramanujam, Geetha, (2006). Environmental Awareness in Jainism, Department of Jainology, University of Madras, Chennai.
- 5) Chitampalli M., and Bhatkhande N, (1993). Hansadev Virachit Mriga Pakshi Shastra, Maharashtra Rajya Sahitya Aani Sanskruti Mandal, Go M, Mumba.





# Syllabus for F. Y. B. Sc. (Zoology) Semester II

**DISCIPLINE SPECIFIC CORE COURSE (ZO-MJ-121T): Human  
Physiology**

Course Code & Title	Credits	Credit Distribution of the Course	
		Lecture	Practical
<b>ZO-MJ-121T -Human Physiology</b>	2	2	--

**LEARNING OBJECTIVES:**

**The Learning Objectives of this course are as follows:**

1. Student will gain knowledge about Human physiology.
2. The students will be able to understand process of digestion, respiration and excretion.
3. Students able to understand special assessment techniques which may be used in the physical examination of the cardiovascular system, including blood pressure and electro cardiogram (ECG).
4. Students will be able to understand cardiac disorders, abnormality in blood pressure and ECG.

**COURSE OUTCOMES:**

**After completion of this course student will be able to-**

**CO 1-** Learn various physiological processes.

**CO 2 -** Define various terms of physiology

**CO 3 -** Draw various figures of Human physiological system.

**CO 4 -** Summarize what he learns in Human physiology.

**SYLLABUS of ZO-MJ-121T:****[30 Hours]****Unit-I: Digestion:****[08 Hours]**

Physiology of digestion in the alimentary canal of Human being: Absorption of carbohydrates, proteins, lipids.

**Unit-II: Respiration in Human being:****[06 Hours]**

Pulmonary ventilation, Transport of oxygen and carbon dioxide in blood, Excretion, Structure of nephron, Mechanism of urine formation, Counter – Current Mechanism.

**Unit-III: Human Cardiovascular system:****[09 Hours]**

Blood, Muscle, Gastro Intestinal Tract, Kidney, Endocrines, Reproduction, Cardio Vascular System, Respiration, Central Nervous System, Composition of blood, Structure of heart, origin and conduction of the cardiac impulse, Cardiac Cycle, Blood Pressure, Measurement of systolic & diastolic pressure, cardiac output, ECG measurement, Physiological measurement & significance.

**Unit-IV: Human Reproductive Physiology:****[07 Hours]**

Reproduction and Endocrine glands: Physiology of Male reproduction: Hormonal control of Spermatogenesis, Physiology of female reproduction: Hormonal control of menstrual cycle.

**ESSENTIAL/RECOMMENDED READINGS:**

- 1) John Young, The Life of Vertebrates, III Edition. (Oxford university press, 2004)
- 2) Harvey Pough, Vertebrate life , VIII Edition, (Pearson International,2012) Pages 720.
- 3) Brian Hall and Bendedikt Hallgrimsson. Strickberger's Evolution, IV Edition, (Jones And Barlett publishers Inc., 2008) Pages 760.
- 4) Gerard Tortora, and Bryan Derrickson, Principles of Anatomy and Physiology, XI Edition , (John Wiley & Sons , Inc., 2009).
- 5) Eric Widmaier, Hershel Raff and Kevin Strang, Vander's Human Physiology, XI Edition, (Boston: McGraw Hill Higher Education, 2008) Pages 770.
- 6) Arthur Guyton, and John Hall, Textbook of Medical Physiology, XII Edition, (Harcourt Asia Pvt .Ltd /W.B. Saunders Company, 2011) Pages1112.

**DISCIPLINE SPECIFIC CORE COURSE (ZO-MJ-122T): Genetics**

Course Code & Title	Credits	Credit Distribution of the Course	
		Lecture	Practical
<b>ZO-MJ-122T - Genetics</b>	2	2	--

**LEARNING OBJECTIVES:**

The Learning Objectives of this course are as follows:

- The rapid advancements in understanding the role of human genome in health and disease.
- Basic concepts of identifying human chromosome.
- Human karyotypes and numerical alterations Objectives and outcome of human genome project.
- To create awareness to human society through genetic counselling.
- Learn the basic concepts of Mendelian traits; identify the charts of normal and abnormal karyotypes.

**COURSE OUTCOMES:**

After completion of this course student will be able to:

- CO1-** Define different terminology of genetics. Describe the concepts of Genetics, gene interaction, lethal genes, euploidy, aneuploidy, sex linked inheritance and principles of inheritance.
- CO2-** Understand the cause and effect of alterations in chromosome number and structure.
- CO3-** Apply the principles of Mendelian inheritance in Human Traits.
- CO4-** Relate the conventional and molecular methods for gene manipulation in other biological systems.
- CO5-** Appraise and differentiate between multiple alleles and multiple genes.

**SYLLABUS of ZO-MJ-122T:****[30 Hours]****Unit-I: Concept Genes and Genomics:****[10 Hours]**

Mendel's laws of inheritance, Chromosomal basis of inheritance and its applications. Exceptions to Mendelian Inheritance: Incomplete dominance, Codominance, Multiple allelism, Lethal alleles, Pleiotropy, Epistasis- Recessive, Double recessive and double dominant. Genomic imprinting, Penetrance and expressivity, Phenocopy, Polygenic inheritance. Applications of Genomics.

**Unit-II: Sex determination in organisms:****[05 Hours]**

Sex Chromosomes and sex-linkage: XX/XO, XX/XY, ZZ/ZW and Haploidy/Diploidy types, Autosomal dominant and autosomal recessive, X-linked dominant and X-linked recessive. Haplo-diploidy, Intersex, Gynandromorphy.

**Unit-III: Human Genetics/ Introduction to inborn errors: [10 Hours]**

Human Genetics: Morphological and molecular organization of chromosome, Pedigree analysis. Karyotype, Structural and numerical alterations of chromosomes, Genetic disorders: chromosomal aneuploidy (Down, Turner and Klinefelter syndromes), chromosome translocation (Chronic Myeloid Leukemia) and deletion (“cry of cat” syndrome), gene mutation (sickle cell anemia). Inborn errors of metabolisms- PKU, AKU. Albinisms.

**Unit-IV: Application of Genetics: [05 Hours]**

Concept of genetic engineering, Principle and Applications of PCR, DNA fingerprinting and its applications. Animal cloning.

**ESSENTIAL/ RECOMMENDED READINGS:**

1. Gardner, E.J. et al. (2006) Principles of Genetics (John Wiley).
2. Russell, P.J. (2010) Genetics (Benjamin Cummings).
3. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. (VIII edition) Wiley India.
4. Anthony Griffith (1976) Introduction to the Genetics.

**DISCIPLINE SPECIFIC CORE COURSE (ZO-MJ-123P): Zoology**  
**Practicals-II**

Course Code & Title	Credits	Credit Distribution of the Course	
		Lecture	Practical
<b>ZO-MJ-123P - Zoology Practical-II</b>	2	--	2

**LEARNING OBJECTIVES:**

The Learning Objectives of this course are as follows:

- To gain a basic understanding on human genetics and hereditary.
- To define various terms of Genetics.
- To learn real life situations and one's life the principles of human heredity.
- To understand concept of Blood group in Human Being
- To know estimation of Estimation of hemoglobin.

**COURSE OUTCOMES:**

After completion of this course student will be able to-

CO 1-The student will gain a basic understanding on human genetics and hereditary.

CO 2-Student should able to define various terms of Genetics.

CO 3- Students can apply to real life situations and one's life the principles of human heredity.

CO 4- They learn about estimation of Blood Group.

**SYLLABUS of ZO-MJ-123P:****[60 Hours]**

1. Microscopic study of epithelial, connective tissue, muscular and nervous tissue.
2. Determination of heart rate and pulse rate.
3. To estimate the blood glucose level from given sample.
4. Study of blood groups in human (ABO and Rh).
5. Preparation of haemin and haemochromogen crystals.
6. Estimation of bleeding and clotting time.
7. Measurement of lung capacity.
8. Study of monohybrid ratio and dihybrid ratio by providing hypothetical data and deducing applicability of Mendelian laws (three examples of each ratio).
9. Preparation of culture media and maintenance of Drosophila Culture.
10. Study of Drosophila: External characters and sexual dimorphism.
11. Study of Drosophila mutants (any two eye and any two-wing mutant).
12. Study of genetic traits in human beings (tongue rolling, widow's peak, ear lobes, colour blindness and PTC tasters/non-tasters).

**ESSENTIAL/RECOMMENDED READINGS:**

1. Gardner, E.J. et al. (2006) Principles of Genetics (John Wiley).
2. Russell, P.J. (2010) Genetics (Benjamin Cummings).
3. CL Ghai, Jaypee brother Medical Publishers.
4. Richard Dawkins (1976), The selfish Gene.

**VOCATIONAL SKILL COURSE (ZO-VSC-124P): Bee Keeping**

Course Code & Title	Credits	Credit Distribution of the Course	
		Lecture	Practical
<b>ZO-VSC-124P - Bee Keeping</b>	2	--	2

**LEARNING OBJECTIVES-**

**The Learning Objectives of this course are as follows:**

- To understand the basic life cycle of the honeybees, beekeeping tools and equipments.
- To learn for managing beehives for honey production and pollination.
- To get knowledge of biology of honeybees.
- To understand properties and application in various fields Medicinal properties of honey.

**COURSE OUTCOMES:**

**After completion of this course student will be able to-**

- CO1** -Describe the concepts of apiculture, importance of bee keeping, traditional and modern bee keeping methods.
- CO2** -Aware about the medical properties of honey and its application in various fields, its nutrients and composition.
- CO3** -Apply the knowledge of bee keeping in establishment and maintenance of bee colonies and for the use of various equipment to obtained bee products like honey, bee wax, royal jelly etc. Demonstrate the technique of handling the bees and processing of honey.
- CO4** -Explain the social organization and division of labour in the honeybees. Compare the indigenous and exotic species of honeybees and differentiate queen, workers and drone bees.
- CO5** -Appraise the importance of propagation of bee flora and its role in the agricultural crop pollination. Evaluate the impact of pesticides on honeybees.
- CO6** -Design the calendar for management of bee colonies. Prepare the proposal for financial assistance from banks for starting a bee keeping project.

**PRACTICALS for ZO-VSC-124P:****[60 Hours]**

1. Study of Honey bee Morphology (E)
2. Study of Honey bee species, Castes (D)
3. Study of Beekeeping equipment: Bee box and tools. (D)
4. Study of Communication in Bees. (D)
5. Study of Bee products: Honey, Bees wax, Pollens, Royal Jelly, Propolis and Bee venom.(D)
6. Study of diseases of Honey bee (D)



7. Study of Enemies of Honeybee **(D)**
8. A compulsory visit to an Apiary or Central Bee Research and Training Institute a Beekeeper to gain a first-hand experience in handling bees. **(D)**

**ESSENTIAL/RECOMMENDED READINGS:**

- 1) Abrol, D. P. (1997) Bees and Beekeeping. Kalyani Publisher, New Delhi.
- 2) Abrol, D. P. (2010) A Comprehensive guide to Bees and Beekeeping. Scientific Publisher, New Delhi.
- 3) Withhead, S. B. (2010) Honey bees and their management Axis books Publisher, Jodhpur.
- 4) Nagaraja, N. and Rajagopal, D. (2013) Honey bees: Diseases, Parasites, Pests, Predator and their management. M.J.P Publisher, Chennai.
- 5) Dharamsing and Singh, D. P. A Handbook of Beekeeping, Agrobios India (Publisher), Jodhpur.

**SKILL ENHANCEMENT COURSE (ZO-SEC-125P): Public Health and Hygiene**

Course Code & Title	Credits	Credit Distribution of the Course	
		Lecture	Practical
<b>ZO-SEC-125P - Public Health and Hygiene</b>	2	--	2

**LEARNING OBJECTIVES-**

**The Learning Objectives of this course are as follows:**

- To understand Public Health and Hygiene.
- To know pest: Ectoparasites of cats, dogs & birds.
- To learn Infectious agents responsible for diseases in humans. The difference between a pandemic, an epidemic, endemic, and an outbreak.
- The practical exercises aim to provide hands-on training in epidemiology and collection of primary and secondary data relevant to public health issues.

**COURSE OUTCOMES-**

**After completion of this course student will be able to-**

**CO1-** Describe maintenance of personal hygiene.

**CO2-** Classify food into micro and macro nutrients.

**CO3 -**Explain non-communicable diseases/Life style diseases.

**CO4-** Discriminate between a pandemic, an epidemic, endemic, and an outbreak.

**CO5-** Review about Nutrient deficiency diseases.

**PRACTICALS for ZO-SEC-125P:**

**[60 Hours]**

- 1) To detect adulterants in the food samples by appropriate tests. **(E)**
- 2) Study of pets: Ectoparasites of cats, dogs & birds. **(D)**
- 3) Study of housefly, cockroach, Ants rats with reference to public hygiene. **(D)**
- 4) Epidemiological study of chicken guinea, measles, swine flu. **(D)**
- 5) A compulsory visit to water purification (treatment) plant. **(D)**
- 6) Visit to sewage treatment plant / effluent treatment plant / Public health laboratory. **(D)**
- 7) Testing potability of water for human consumption by MPN method. **(D)**
- 8) Study of Sexual Transmitted Diseases (STD) **(D)**
- 9) Pandemic Diseases: SARS, Covid, Bird Flu.
- 10) Study of Any three Dipterian parasitic diseases.

**ESSENTIAL/ RECOMMENDED READINGS:**

1. Mary Jane Schneider (2011): Introduction to Public Health.
2. Muthu, V.K. (2014): A Short Book of Public Health.
3. Details, R. (2017): Oxford Textbook of Public Health (6th edition).
4. Gibney, M.J. (2013): Public Health Nutrition.
5. Wong, K.V. (2017): Nutrition, Health and Disease.

