



The Poona Gujarati Kelvani Mandal's

Haribhai V. Desai College (Arts, Science & Commerce), Pune (Autonomous)

4 Year Bachelor Degree Program in Zoology

(Faculty of Science & Technology)

To be implemented from Academic Year 2024 - 2025

Revised Syllabi for B. Sc. Zoology

As per National Education Policy (2020) for

F. Y. B. Sc. Zoology (Semester I & II)

(for Colleges Affiliated to Savitribai Phule Pune University, Pune)

Framed by

BOARD OF STUDIES IN ZOOLOGY

Haribhai V. Desai College (Arts, Science & Commerce), Pune (Autonomous) – 411 002

❖ Aims and Objectives :

- Focus is on building concepts in biological sciences and enabling them to apply their experimental knowledge in various sectors of life sciences specifically in animal biology.
- Specifically, this programme aims at enhancing the professional competencies and skills.
- Analyze complex interactions among various animals of different phyla, their distribution and their relationship with the environment.
- Helps to understand the physiological, biochemical, molecular and genetic principles of animals and their surroundings.
- Empower learners by enabling them with communication, professional and life skills.
- This course provides an advanced knowledge of modern biology and help to develop a range of generic skills that are relevant to wage employment, self-employment and entrepreneurship.

❖ Program outcomes (POs) :

The curriculum is designed after a long thinking and interacting process with various components of the stakeholders. After successful completion of B. Sc. Zoology Major program students will be able to gain the basic, applied and research based knowledge pertaining to the various branches of Animal sciences.

1. Knowledge and skills on the topic :

- i. In-depth knowledge of the major concepts, theoretical principles and experimental skills of zoology and its various fields, including biodiversity, anatomy, physiology, biochemistry, bio-nanotechnology, ecology, evolutionary biology, cell biology, molecular biology, immunology, genetics, as well as some other areas of applied research such as wildlife conservation and management, beekeeping, sericulture, vermiculture, neuroscience, aquatic biology, fisheries science, animal breeding, bioinformatics and research methodology, etc.
- ii. Interdisciplinary knowledge of life sciences, environmental sciences, and related biochemical sciences.
- iii. Learn about the various techniques, tools, and computer software used to analyze the forms and functions of animals.

2. Skillful communication : Ability to communicate complex zoological information effectively and efficiently.

- 3. Critical thinking and problem-solving skills :** The ability to rationally analyze and solve animal science issues without relying on hypotheses and guesswork.
- 4. Logical thinking and reasoning :** Ability to search for solutions and solve them logically by experimenting and processing the data manually or by using softwares.
- 5. Team spirit and leadership qualities :** Ability to identify and mobilize the resources required for the project and management of the project responsibly while adhering to ethical scientific concern and bio-safety protocols.
- 6. Digital efficiency :** Ability to use computers and other tools for biological simulations, calculations, appropriate bio-statistical software, and research tools to locate, retrieve, and evaluate zoology-related data.
- 7. Ethical awareness and reasoning :** Avoid unethical behaviour such as data falsification, forgery or deception, plagiarism and value environmental and sustainability issues.
- 8. Lifelong learning :** Capable of independent, self-directed learning with the aim of personal and social development.
- 9. Entrepreneurship qualities :** Develop entrepreneurship qualities as this course contains almost all branches of applied zoology. One can establish a start up project by learning various courses.
- 10. Advanced education :** Students will be able to develop their mind with some advanced and superior knowledge, research outcomes and also the new as well as easy system of education. This will make them more reliable and capable in the world to lead the nation.

❖ **Program Specific Outcomes (PSOs) :**

- PSO 1 :** After completion of this course students will be able to contribute as policy makers in biodiversity conservation, animal preservation and environment protection.
- PSO 2 :** Equip with the knowledge of animal classification and diversity, ecology and economic importance of animals.
- PSO 3 :** Acquire the advanced concepts in insect rearing and various animal breedings for the food security of human beings.
- PSO 4 :** Inculcate the traditional knowledge of using various animal based products in human healthcare system.
- PSO 5 :** Adapt scientific research techniques in various applied branches of Zoology for sustainable development.
- PSO 6 :** Perform procedures as per laboratory standards in the areas of Taxonomy,

Physiology, Ecology, Cell biology, Genetics, Applied Zoology, Toxicology, Entomology, Sericulture, Biochemistry, Fish biology, Animal breeding and Clinical Pathology.

PSO 7 : Zoology course also provide a knowledge of applied subjects to develop various skills to make a career and become an entrepreneur in the field of aquatic biology, sericulture, apiculture, vermiculture, prawn culture, dairy management, animal breeding and management, wildlife conservation and management, wildlife photography etc.

PSO 8 : Analyze the relationships among animals, plants, and microbes.

PSO 9 : Understand and analyze the ecological and evolutionary significance of different taxa of animals.

PSO 10 : Analyze the mechanisms involved in life processes up to the molecular level.

PSO 11 : Gains knowledge about research methodologies, effective communication and skills of problem solving methods.

PSO 12 : Contributes the knowledge for Nation building.

❖ **Course Title :**

- B. Sc. Zoology Major (03 years) / B. Sc. Honours in Zoology (04 years) / B. Sc. Honours in Zoology with Research (04 years).
- Revised syllabus as per the National Education Policy (NEP), 2020 for the Colleges Affiliated to Savitribai Phule Pune University, Pune.

❖ **Faculty : Science and Technology**

❖ **Preamble :**

Zoology is a significant branch of study in the Basic Sciences, which covers every facet of animal biology. Animals and organisms almost occupy every habitat available to them, and they are indivisible part of all ecosystems, food chains and food webs.

The goal of the National Education Policy 2020 (NEP 2020) is to prepare students for lifelong learning by giving them leadership skills, values, and knowledge. Goal 4 (SDG4) of the 2030 Agenda for Sustainable Development, which India adopted in 2015, aims to ensure inclusive and equitable quality education and promote lifelong learning opportunities for all by 2030, which is in line with the global agenda for development in education.

The University Grants Commission (UGC) has decided to implement the National Education Policy (NEP), 2020, by revising the curriculum across the nation. At SPPU, the Board of Studies in Zoology has updated the curriculum to include the policies and procedures mentioned in the NEP, 2020, which is going to be implemented from the academic year 2024 - 2025 in the colleges affiliated to Savitribai Phule Pune University. It covers a wide variety of fascinating subjects. The NEP aims to integrate general (academic) education, vocational education, skill based education and experiential learning to improve the effectiveness and holistic nature of education. The objective of NEP 2020 is to foster academic excellence, ease smooth academic mobility, and augment the global competitiveness of Indian students by instituting a credit structure and course framework that are both nationally and internationally equivalent. The NEP offers a comprehensive, multidisciplinary education program that will support students' intellectual, scientific, social, physical, emotional, moral, and ethical growth.

Students can select their areas of interest due to the curriculum's flexibility, which improves their employment opportunities. For students' development, the NEP 2020 guarantees adaptable curriculum framework and a course-based result strategy.

In reaction to the swift progress in science and technology as well as the changing perspectives in diverse fields of basic and applied Zoology, the Board of Studies in Zoology at SPPU, Pune framed the first year B. Sc. Zoology curriculum, which not only surpasses the confines of conventional academia but also transcends traditional academic boundaries. Students will have the freedom to tailor their course to interests and to specialise or maintain breadth in their studies. The range of research and transferable skills they will learn will enhance their employability as a graduate.

The students admitted for Zoology degree will acquire extensive disciplinary knowledge in the related branches of Zoology. The curriculum is not only designed to make the students capable of securing their career in Life science industries but also become capable of becoming potential entrepreneurs by starting their own business such as Vermiculture, Sericulture, Apiculture, Pet breeding and management, Dairy management, Aquarium management, Pest management, Laboratory animal breeding and management, Fishery management and marketing, Toxicology, etc. At the end of the program, students can possess skills that will give them a competitive advantage in pursuing higher studies in India and abroad as well as seeking a job. In an educational framework based on the learning outcomes

of the program, students are able to define and explain the main concepts of the life sciences. They will be familiar with a variety of biological instruments and appropriate laboratory techniques, impart biological knowledge in oral and written form, and identify the relationship between structure and function at all levels : molecular, cellular, tissue, organic, systemic, and organizational.

Students should be able to identify, classify, and distinguish a variety of non-chordate and chordate organisms based on their basic morphological, anatomical, biochemical, and molecular characters. They can also describe the economic, environmental, and medical importance of different animals in human life. This program inspires curiosity and awareness among students to learn more about the diversity of animals, and also pursue wildlife exploration as a career option. Procedural knowledge of animal identification and classification as well as various skill based courses will provide the students with professional advantages for seeking employment in teaching, research, and taxonomy in various public and private organizations. Students can apply scientific methods for answering questions in biology by formulating testable hypotheses, collecting data related to those hypotheses, and analyzing that data to evaluate the extent to which their scientific work supports their hypotheses.

The world's present scenario of drastic changes in the climatic conditions has resulted in total uncertainties of sustainable agricultural production and food security for human beings. Zoology will be the most promising branch for providing food and protein security for the ever increasing population in future as many insects, organisms and animals are important part of the human diet worldwide.

❖ Program Duration and Exit Options :

- The UG Program is of four years divided in eight semesters. Student may leave the program after third year if, they prefer to receive a three year graduate degree.
- If the student decides to exit after first year, they will receive a UG Certificate, if they decide to exit after Second year; they will receive a UG Diploma. This will also depend on the total required credits they had earned.
- Re-entry within three years to finish the degree program is allowed for those who had left with a UG Certificate or UG Diploma.
- A student must earn minimum 22 credits and a maximum 26 credits in each semester.

- The minimum number of credits required to be earned for award of Undergraduate Certificate / Undergraduate Diploma / Bachelor Degree / Bachelor's Degree with Honors in Zoology / Bachelor's Degree with Honors in Zoology with Research are as follows –

Sr. No.	Type of Award	Exit Stage	Mandatory Credits to be obtained
1.	Undergraduate Certificate in Zoology	After successful completion of First year i. e. Semester I & II	44
2.	Undergraduate Diploma in Zoology	After successful completion of Second year i. e. Semester III & IV	88
3.	Bachelor of Science in Zoology Major	After successful completion of Third year i. e. Semester V & VI	132
4.	Bachelor of Science in Zoology (Honors)	After successful completion of Fourth year i. e. Semester VII & VIII	176
5.	Bachelor of Science in Zoology (Honors) with Research	After successful completion of Fourth year i. e. Semester VII & VIII	176

❖ Eligibility Criteria :

- The criteria for F. Y. B. Sc. Zoology admission will be 10 + 2 passed students / MCVC / Diploma courses related to Animal Sciences / Life Sciences etc.
- Other conditions will be as prescribed by Savitribai Phule Pune University, Pune / Government of Maharashtra.

❖ Fee Structure :

As per the norms laid down by Savitribai Phule Pune University, Pune.

❖ Course Implementation criteria :

Each semester consisting of 15 weeks = 12 weeks for Actual Teaching + 3 weeks for Continuous Internal Evaluation.

I. Two Credits of the Theory = 30 clock hours (Actual Teaching of 2 hours per week + 3 hours for continuous internal evaluation which may consists of short questions, class tests, field visits, tutorials, problem solving sessions, practice, group discussion, assignments, unit tests, seminars, quiz, M. C. Q., project work etc.

II. Two Credits of Practical = 60 clock hours.

❖ **Examination Pattern :**

➤ **Theory Paper of 02 Credits –**

- Internal Exam (15 Marks) + University Theory Exam (35 Marks) = 50 Marks.
- Duration : For Internal exam = 40 Minutes, and For University Exam = 02 hours.

➤ **Practical Paper of 2 Credits –**

- Internal Exam (15 Marks) + University Practical Exam (35 Marks) = 50 Marks.
- Duration : For Internal exam = 40 Minutes, and For University Exam = More than 04 hours.

❖ **Assessment Method (For each Semester) :**

The examinations will be conducted after completion of each semester, both for Theory as well as Practical courses. Total marks for 2 credit course examination will be 50.

❖ **Award of Class / Grade and A. T. K. T. Rules :**

As per the norms and conditions laid down by SPPU, Pune.

❖ **Important Instructions :**

- There should be at least a short (1 day) and Distant (2-3 days) Study tour / Field visit / Industrial visit / Institutional visit per year.
- Tours are the part of curriculum and are mandatory to each student, failing which they will not be considered eligible to claim the marks assigned in the practical examination.
- The student has to submit the followings at the time of practical examination : Certified Journal, Certified Study tour report / Field visit report and Any other prescribed for the course.

❖ Question paper pattern for Theory (2 Credit courses) :

The students will have to solve the question paper of 35 marks. Including optional questions, The paper setter should set the paper on entire syllabus for total 61 marks,.

N. B. : All questions are compulsory.

Max. Time : 2 Hours.

Q. 1) Answer any five of the followings in one sentence - 05 Marks

- Attempt any five from six questions.

Q. 2 (a) Attempt any one of the following - 06 Marks

- Attempt any one from the two questions.

Q. 2 (b) Attempt any one of the following - 04 Marks

- Attempt any one from the two questions.

Q. 3 (a) Solve any one of the following - 06 Marks

- Solve any one from the two questions.

Q. 3 (b) Solve any one of the following - 04 Marks

- Solve any one from the two questions.

Q. 4) Write notes on (Any four) - 10 Marks

- Attempt any four from six questions.

Credit Framework for F. Y. B. Sc. Zoology, Semester – I

Semester	Courses	Course Code	Course Title	Credits
I	Subject - 1	ZOO - 101 – TH	Genetics and Medical Zoology (TH)	2
		ZOO - 102 - PR	Practicals in Genetics & Medical Zoology (PR)	2
	Subject - 2		(TH) + (PR)	4
	Subject - 3		(TH) + (PR)	4
	SEC (Skill Enhancement Courses)	SEC - 101 – ZOO - TH	Vermiculture Management (TH)	2
Total				14

Credit Framework for F. Y. B. Sc. Zoology, Semester – II

Semester	Courses	Course Code	Course Title	Credits
II	Subject - 1	ZOO - 151 - TH	Cell Biology and Biomedical Techniques (TH)	2
		ZOO - 152 - PR	Practicals in Cell Biology & Biomedical Techniques (PR)	2
	Subject - 2		(TH) + (PR)	4
	Subject - 3		(TH) + (PR)	4
	SEC (Skill Enhancement Courses)	SEC - 151 - ZOO - PR	Vermiculture Management (PR)	2
Total				



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Principal:

Dr. Rajendra G. Gurao

M.Sc., Ph.D.

Email: principal@hvdesaicollege.edu.in

Restructured Syllabus (CBCS Pattern as per NEP 2020)

To be implemented from Academic Year: 2024-25

Faculty	Zoology
Program	F.Y.B.Sc in Zoology
Class	F .Y. BSc Sem -I

Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
1	ZOO-101-T	Subject -1	Genetics and Medical Zoology (TH)	Theory	2	2

Course Objectives:

Introduce students to fundamental genetics concepts, including inheritance patterns, molecular genetics (DNA replication, transcription, translation), and gene regulation.

Study the genetic basis of human diseases, including mutations, genetic disorders, and their implications for medical research and treatment.

Examine the role of animals in the transmission of diseases to humans, focusing on parasites, vectors, and the genetic factors influencing disease spread.

Explore genetic approaches for controlling infectious diseases, including vector control, vaccines, and understanding genetic resistance to diseases.

Course Outcomes:

After the completion of the course, students should be able to :

CO1 : Apply Mendelian genetic principles to predict outcomes of genetic crosses, interpret pedigrees and understand the basics of genetic inheritance.

CO2 : Recognize and explain the inheritance patterns and molecular basis of common genetic disorders, including both Mendelian and complex traits.

CO3 : Understand the concept of non - Mendelian genetics.

CO4 : Concept and characteristics of multiple alleles, ABO blood group system, Inheritance of Rh

antigen, Erythroblastosis foetalis and their medicolegal importance.

CO5 : Understand the structure of chromosomes, chromatin and its types, giant chromosomes and chromosomal aberrations.

CO6 : Successfully solve genetic problems using Punnett squares, probability calculations and pedigree analysis.

CO7 : Understand basic concepts of medical zoology.

CO8 : Understand different epidemic, vector borne and microbial diseases in humans.

CO9 : Understand about investigations and treatments of human physiological disorders.

Unit No.	Name of the Topic	Lectures Allotted
1.	<p>Recapitulation of Mendelian Genetics:</p> <p>1.1 Mendel's work: Selection of experimental plant.</p> <p>1.2 Mendelian Inheritance: Laws of heredity and their practical applications (Monohybrid cross and Dihybrid cross).</p> <p>1.3 Test cross and back cross.</p>	02
2.	<p>Non-Mendelian Genetics:</p> <p>2.1 Concept of Gene Interaction: Intra-allelic interactions and Interallelic interactions.</p> <p>2.2: Dominance and Co-dominance.</p> <p>2.3 Inter-allelic interactions: Co-dominance and incomplete dominance (concept of epistasis, complimentary factors (9 : 7), supplementary factors (9 : 3 : 4), inhibitory factors (13 : 3), duplicate dominant genes (factors) (15 : 1). Lethal genes in <i>Mus musculus</i>.</p>	03
3.	<p>Multiple alleles:</p> <p>3.1 Concept and characteristics.</p> <p>ABO blood group system, Inheritance of Rh antigen, Erythroblastosis foetalis and their medicolegal importance.</p>	03
4.	<p>Sex Determination:</p> <p>4.1 Genetically controlled sex determination: (Heterogametic males: XX - XY & XX - XO systems, Heterogametic females: ZZ - ZW system), Genetic balance system in <i>Drosophila</i>.</p> <p>Parthenogenesis and Gynandromorphism.</p>	03
5.	<p>Sex-linked Inheritance:</p> <p>5.1 Sex-linked inheritance: Characteristics, types (X - linked, Y - linked, and XY - linked).</p> <p>5.2 Examples of Sex-linked inheritance: Hemophilia, Colour blindness and Hypertrichosis.</p>	03

6.	Introduction to Medical Zoology: 6.1 Definitions: Parasitology, host, parasite, vector, symbiosis, commensalisms, mutualism, parasitism and zoonosis. 6.2. Branches of medical zoology: Medical Protozoology, Medical Helminthology, Medical Entomology.	03
7.	Epidemic Diseases in Human: Occurrence, causative organism, symptoms and eradication programs of the following: 7.1 Typhoid. 7.2 Cholera. 7.3 Small pox.	03
8.	Vector Borne Diseases in Human: Occurrence, causative organism, symptoms and eradication programs of the following: 8.1 Dengue. 8.2 Chicken Guinea. 8.3 Viral Influenza. 8.4 Scabies.	03
9.	Microbial Diseases in Human: Causative organism and clinical features of the following: 9.1 Tuberculosis. 9.2 Hepatitis. 9.3 AIDS.	03

List of Recommended Books and Study Materials:

1. Genetics: Verma, P. S. and Agrawal, V. K., S. Chand and Co., New Delhi.
2. Fundamentals of Genetics: B. D. Singh, Kalyani Publishers, New Delhi.
3. Principle of Genetics: Sinnott, Dunn and Dobzhansky, Tata McGraw Hill Edition, New Delhi.
4. Genetics: Gupta, P. K., Rastogi Publication, Meerut.
5. Genetics: Sarin, C., Tata McGraw Hill, New Delhi.
6. Principles of Genetics: Gardner, E. J., Simmons, M. J. and Snustad, D. P., John Wiley and Sons.

7. Cytology and Genetics: Dyan Sagar V. R., Tata McGraw Hill Pub. Co. Ltd., New Delhi.
8. Baker, F. J. and Silvertan, R. E. : Introduction to Medical Laboratory Technology, (6th ed.), Butler Worth and Co. Ltd.
9. Chatterjee, K. D. (1995), Parasitology, Protozoology and Helminthology (12th ed).
10. Cheesborough, M. (1987), Medical Laboratory Technology for Tropical countries (2nd ed.), Butler Worth and Co. Ltd.
11. Garcia, L. S. (2001), Diagnostic Medical Parasitology, (4th ed.), ASM Press, Washington.
12. Talib, V. H. (1999), Essential Laboratory Manual, Mehta Publishers, New Delhi

Question paper pattern for Theory (2 Credit courses) :

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N. B.: All questions are compulsory.

Max. Time: 2 Hours.

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Q. 2 (b) Attempt any one of the following - 04 Marks

- Attempt any one from the two questions.

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Restructured Syllabus (CBCS Pattern as per NEP 2020)

To be implemented from Academic Year: 2024-25

Faculty	Zoology
Program	F.Y.BSc in zoology
Class	F.Y.BSc Sem- 1

Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
1	ZOO-102-PR	Subject -1	Practical's in Genetics and Medical Zoology	Practical	2	2

Course Objectives:

Enable students to observe and analyze patterns of inheritance through practical experiments, such as Mendelian crosses in model organisms, and explore genetic variation in populations.

Equip students with the skills to identify common parasites and disease vectors under the microscope and understand their life cycles in relation to medical zoology.

Provide practical experiences in studying the genetic aspects of human diseases, including the use of model organisms to understand genetic mutations and disease mechanisms.

Allow students to engage in practical exercises involving the application of genetic knowledge to control disease transmission, such as vector control techniques or genetic modification strategies.

Course Outcomes:

After completion of this course, students should be able to :

CO1 : Calculate and interpret monohybrid, dihybrid, test and back cross ratios based on hypothetical data.

CO2 : Use collected data to understand the inheritance patterns of Mendelian traits.

CO3 : Identify and describe the chromosomal composition of a normal human karyotype.

CO4 : Perform blood typing and interpret blood group results.

CO5 : Perform to understand study of facultative heterochromatin from humans.

CO6 : Learn an experiment to know the structure of polytene chromosomes

CO7 : Learn various vector borne as well as protozoan diseases and their control measures.

CO8 : Learn scientific approach or techniques used in clinical laboratories to investigate various diseases and will be skilled to work in research laboratories.

CO9 : Understand the human immune system and its response to the pathogen.

CO10 : Measurements of blood pressure under normal and stressed condition.

Unit No.	Title of the Practical	Practical Allotted
1.	Problems based on monohybrid, dihybrid cross ratio and deducing the applicability of Mendelian laws (three examples of each ratio). (E) (Compulsory)	1P
2.	Problems based on test cross and back cross ratio and deducing the applicability of Mendelian laws (three examples of each ratio). (E) (Compulsory)	1P
3.	Problems based in multiple alleles, co dominance and epistatic interaction.	1P
4.	Study of chromosomal aberrations by use of pictures. (D)	1P
5.	Study of Mendelian genetic traits in human beings (tongue rolling, widow's peak, attachment of ear lobes and PTC tasters / non-tasters) using collected data from a limited population. (E) (Compulsory)	2P
6.	Preparation of normal and abnormal human karyotype from picture of metaphase chromosomal spread.	1P
7.	Study of colour blind by Ishihara chart.	1P
8.	Study of blood groups in human. (ABO & Rh). (E) (Compulsory)	1P
9.	Study of facultative heterochromatin from humans: Barr body (buccal cells) / Drumstick (Neutrophils). (E) (Compulsory)	1P
10.	Study of polytene chromosomes from <i>Drosophila</i> / <i>Chironomous</i> larva / Housefly. (E) (Compulsory)	1P
11.	Examination of blood for presence / absence of the parasite. (E) (Compulsory)	1P
12.	Study of vectors: Mosquito (<i>Aedes</i> , <i>Culex</i> , <i>Anopheles</i>), Sand fly, Rat flea and Body louse. (D) (Compulsory)	1P

Unit No.	Title of the Practical	Practical Allotted
13.	Epidemic diseases: Occurrence, causative organism, symptoms and control measures of Typhoid, Cholera and Small Pox. (D) (Compulsory)	1P
14.	Vector Borne diseases: Occurrence, causative organism, symptoms and control measures of Dengue, Chicken Guinea and Scabies. (D) (Compulsory)	1P
15.	Microbial diseases: Occurrence, causative organism, clinical features and control measures of Tuberculosis, Hepatitis and AIDS. (D) (Compulsory)	1P
16.	Study of life history, mode of infection, pathogenicity, prophylaxis and treatment of <i>Plasmodium vivax</i> . (D)	1P
17.	Study of life history, mode of infection, pathogenicity, prophylaxis and treatment of <i>Taenia solium</i> . (D)	1P
18.	Study of life history, mode of infection, pathogenicity, prophylaxis and treatment of <i>Fasciola hepatica</i> . (D)	1P
19.	Principle and working of Angiography, Angioplasty, Dialysis. (D) (Compulsory)	1P
20.	Measurement of blood pressure under normal and stressed condition. (E) (Compulsory)	1P



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To be implemented from Academic Year: 2024-25

Faculty	Zoology
Program	F.Y.BSc in Zoology
Class	F .Y. BSc Sem -I

Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
1	SEC-101-ZOO-TH	SEC	Vermiculture Management [TH]	Theory	2	2

Course Objectives:

Learn the biology, life cycle, and behavior of earthworms used in farming and their role in soil health and fertility.

Explore how earthworms improve soil structure, nutrient cycling, and microbial activity, contributing to enhanced soil health.

Understand the use of earthworms in converting organic waste into valuable products like vermicompost, promoting sustainable waste management.

Examine the economic viability of vermiculture and its environmental benefits, such as reducing waste, enhancing soil fertility, and promoting organic farming.

Encourage the use of vermiculture in sustainable agricultural practices, while fostering research, product development, and entrepreneurship opportunities in the field.

Course Outcomes:

After the completion of the course, students should be able to:

CO1 : Acquire a critical knowledge on the role of earthworms in making organic matter from biodegradable wastes.

CO2 : Understand the biology of some important species of earthworms used in vermiculture.

CO3 : Acquire skills in production of vermicompost.

CO4 : Explain benefits and problems with vermiculture and vermicompost.

CO5 : Become an entrepreneur by culturing earthworms.

CO6 : Acquire a knowledge about life cycle of earthworm.

CO7 : Understand economics importance of earthworm.

CO8 : Identify enemies and diseases of earthworm.

Unit No.	Name of the Topic	Lectures Allotted
1.	<p>Introduction to vermiculture :</p> <p>1.1 Definition, history and it's importance in maintenance of soilstructure.</p> <p>1.2 Role of vermiculture in four R's of recycling (Reduce, Reuse, Recycle and Restore)</p> <p>1.3 The matter and humus cycle (product, qualities) of earthworm.</p> <p>1.4 Transformation process in organic matter.</p>	05
2.	<p>Types of earthworms :</p> <p>2.1 Types of earthworms - Epigenic, Endogenic and Anecic.</p> <p>2.2 Indigenous species of earthworms.</p> <p>2.3 Exotic species of earthworms.</p> <p>3.4 Useful species of earthworm: <i>Eisenia foetida</i>, <i>Eudri luseugeniae</i>, <i>Lumbricus rubellus</i>, <i>Perionyx excavates</i> etc.</p>	05
3.	<p>Biology of Earthworm (<i>Eisenia foetida</i> or <i>Eudrilus eugeniae</i>) :</p> <p>3.1 Systematic position, External Morphology, Habit & Habitat.</p> <p>3.2 Life cycle of <i>Eisenia foetida</i> or <i>Eudrilus eugeniae</i>.</p> <p>3.3 Digestive system of <i>Eisenia foetida</i> or <i>Eudrilus eugeniae</i>.</p> <p>3.4 Reproductive system of <i>Eisenia foetida</i> or <i>Eudrilus eugeniae</i>.</p>	06
4.	<p>Vermicomposting :</p> <p>4.1 Small scale farming for house gardens.</p> <p>4.2 Conventional commercial composting / Large scale earthwormfarming - Pit system, Heap system, Bricksy stem, Kadapas lab method.</p> <p>4.3 Earthworm - Feeding and Maintenance.</p> <p>4.4 Vermicompost harvest, processing and packaging.</p> <p>4.5 Vermi-wash preparation, composition, collection & uses.</p>	09
5.	<p>Enemies and diseases of Earthworms :</p> <p>5.1 Enemies of Earthworm – Ants, Birds, Rats, Snakes, Toads.</p> <p>Diseases of Earthworm – Bacterial, Protozoan, Fungal.</p>	03
6.	<p>Economics and marketing :</p> <p>6.1 Economic importance of earthworms, vermicompost and vermiwash.</p> <p>6.2 Vermicompost as business / marketing of vermicompost, employment opportunities.</p>	02

List of Recommended Books and Study Materials:

1. Bhatt J. V. & S. R. Khambata (1959) "Role of Earthworms in Agriculture" Indian Council of Agricultural Research, New Delhi
2. Edwards, C. A. and J. R. Lofty (1977) "Biology of Earthworms" Chapman and Hall Ltd., London.
3. Lee, K. E. (1985) "Earthworms : Their ecology and Relationship with Soils and Land Use" Academic Press, Sydney.
4. Wallwork, J. A. (1983) "Earthworm Biology" Edward Arnold (Publishers) Ltd. London.
5. Kevin, A and K. E. Lee (1989) "Earthworm for Gardeners and Fisherman" (CSIRO, Australia, Division of Soils).
6. The Complete Technology Book on Vermiculture and Vermicompost. by NPCS board. Asis Specific Business Press.
7. Singh K, Nath G, Shukla RC and Bhartiya DK (2014) Textbook of Vermicompost: Vermiwash and Biopesticides.
8. Panda H (2022) Vermiculture and Vermicompost (Earthworm) with Manufacturing Process, Machinery Equipment Details & Plant Layout.

Question paper pattern for Theory (2 Credit courses) :

The students will have to solve the question paper of 35 marks. Including optional questions, The paper setter should set the paper on entire syllabus for total 61 marks,

N. B.: All questions are compulsory.

Max. Time: 2 Hours.

Q. 1) Answer any five of the followings in one sentence - 05 Marks

- Attempt any five from six questions.

Q. 2 (a) Attempt any one of the following - 06 Marks

- Attempt any one from the two questions.

Q. 2 (b) Attempt any one of the following - 04 Marks

- Attempt any one from the two questions.

Q. 3 (a) Solve any one of the following - 06 Marks

- Solve any one from the two questions.

Q. 3 (b) Solve any one of the following - 04 Marks

- Solve any one from the two questions.

Q. 4) Write notes on (Any four) - 10 Marks

- Attempt any four from six questions.



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NAAC Grade B++ (2.86 CGPA) ■ AISHE CODE : C-41829

Principal:

Dr. Rajendra G. Gurao

M.Sc., Ph.D.

Email: principal@hvdesaicollege.edu.in

Restructured Syllabus (CBCS Pattern as per NEP 2020)

To be implemented from Academic Year: 2024-25

Faculty	Zoology
Program	F.Y.BSc in zoology
Class	F.Y.BSc Sem- II

Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
II	ZOO-151-TH	Subject -1	Cell Biology and Biomedical Techniques (TH)	Theory	2	2

Course Objectives:

Gain a comprehensive understanding of cellular structures (organelles, membranes, cytoskeleton) and their functions, as well as how cells interact with their environment.

Learn the molecular and biochemical pathways involved in cellular processes such as cell division, signal transduction, metabolism, and gene expression regulation.

Use the principles of cell biology to understand the underlying mechanisms of human diseases and apply this knowledge to the development of diagnostic, therapeutic, and preventive strategies.

Cultivate the ability to critically assess scientific research articles, experimental designs, and data interpretation in the context of cell biology and biomedical advancements.

Course Outcomes:

After the completion of the course, students should be able to:

CO1 : Demonstrate the knowledge of cell diversity.

CO2 : Explain the cell membrane, cell – cell interactions and its dynamics.

CO3 : Understand nuclear structure and cell organelles.

CO4 : Explain mitochondria and its functions.

CO5 : Understand cytoskeleton and its functions.

CO6 : Understand safety protocols, ethical standards, professional conduct and best practices.

CO7 : Know about the biomedical instruments, their functioning and principle of operation.

CO8 : Apply immunological techniques for the detection of antigens, antibodies, and immune responses in disease diagnosis.

CO9 : Understand and perform hematological tests and diagnose common hematological disorders and interpret urine analysis data.

Unit No.	Name of the Topic	Lectures Allotted
1.	Overview of Cells : 1.1 Prokaryotic (<i>E. coli</i>) and Eukaryotic (Plant & Animal) cells. 1.2 Microscopy – Simple and Compound microscope. 1.3 Micrometry. 1.4 Types of Stains: Acidic, Basic and Neutral.	02
2.	Plasma Membrane: 2.1 Models of plasma membrane. 2.2 Transport across membranes: Active and Passive transport, Facilitated transport, endocytosis, exocytosis. 2.3 Cell – Cell Junction: Structure and function, Tight junctions, Adherent junctions, Gap junctions, Desmosomes and Hemi-desmosomes.	03
3.	Cell organelles: Structure and functions - 3.1 Nucleus and nuclear pore complex. 3.2 Endoplasmic Reticulum. 3.2 Golgi Complex. 3.3 Lysosomes. 3.4 Ribosome. 3.5 Peroxisomes. 3.6 Mitochondria.	06

4.	<p>Chromosomes:</p> <p>4.1 Introduction: Morphology and types of chromosomes (based on the position of centromere and involvement in sex determination).</p> <p>4.2 Chromatin, its structure and its types (Euchromatin and Heterochromatin).</p> <p>4.3 Giant chromosomes (Polytene chromosome and Lamp brush chromosomes).</p> <p>4.4 Chromosomal Aberrations: Structural (Deletion, duplication, inversion and translocation) and Numerical (Euploidy, monoploidy, polyploidy - auto polyploidy & allopolyploidy and aneuploidy - monosomy, nullisomy, trisomy).</p>	04
5.	<p>Cell Division:</p> <p>5.1 Cell Cycle.</p> <p>5.2 Mitosis.</p> <p>5.3 Meiosis.</p>	04
6.	<p>Introduction and Scope of Biomedical Techniques.</p> <p>6.1 Lab safety techniques and sterilization.</p>	01
7.	<p>Biomedical Instruments: Introduction, Principle & Brief working of -</p> <p>7.1 Electrocardiography (ECG).</p> <p>7.2 Ultrasound / Sonography.</p> <p>7.3 Polymerase Chain Reaction (PCR).</p>	03
8.	<p>Clinical Techniques: Introduction and working principle.</p> <p>8.1 Blood collection.</p> <p>8.2 Anticoagulants.</p> <p>8.3 Preparation and staining of blood smears.</p> <p>8.4 Differential Leucocyte Count.</p> <p>8.5 Hemocytometry (RBC and WBC).</p> <p>8.6 Hemoglobin estimation.</p>	04
9.	<p>Urine analysis:</p> <p>9.1 Collection of urine sample.</p> <p>9.2 Preservation of urine sample.</p> <p>9.3 Routine urine analysis – Physical, bio-chemical and microscopic examination.</p>	03

List of Recommended Books and Study Materials:

- 1 .Cell Biology: Verma, P. S. And Agrawal, V. K., S. Chand and Co., New Delhi.
- 2 .Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., Watson, J. D., Molecular Biology of the Cell, Gerl and Publ. Inc., New York, 2008.
3. Becker, W. M., Kleinsmith, L. J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
4. Cooper, G. M. and Hausman, R. E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington, D. C.; Sinauer Associates, M. A.
5. De Robertis, E. D. P. and De Robertis, E. M. F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
6. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
7. Powar, C. B.: Cell Biology, Himalaya Publishing House, Bombay, 1999.
8. Bioprocess engineering basic concepts, Second Edition, by Michael L. Shuler & Fikret Kargi, 2002 published by Prentice Hall PTR.
9. Biotechnology procedures and experiments hand book, S. Harisha, Infinity Science Press 2007.
10. Principles and techniques of biochemistry and molecular biology, Seventh Edition, Keith Wilson and John Walker, Cambridge University Press, 2010

Question paper pattern for Theory (2 Credit courses) :

The students will have to solve the question paper of 35 marks. Including optional questions, The paper setter should set the paper on entire syllabus for total 61 marks,
N. B.: All questions are compulsory.

Max. Time: 2 Hours.

- | | |
|--|-----------------|
| Q. 1) Answer any five of the followings in one sentence - | 05 Marks |
| • Attempt any five from six questions. | |
| Q. 2 (a) Attempt any one of the following - | 06 Marks |
| • Attempt any one from the two questions. | |
| Q. 2 (b) Attempt any one of the following - | 04 Marks |
| • Attempt any one from the two questions. | |
| Q. 3 (a) Solve any one of the following - | 06 Marks |
| • Solve any one from the two questions. | |
| Q. 3 (b) Solve any one of the following - | 04 Marks |
| • Solve any one from the two questions. | |
| Q. 4) Write notes on (Any four) - | 10 Marks |
| • Attempt any four from six questions . | |



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Restructured Syllabus (CBCS Pattern as per NEP 2020)

To be implemented from Academic Year: 2024-25

Faculty	Zoology
Program	F.Y.B.Sc. in Zoology
Class	F.Y.B.Sc Sem -II

Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
II	ZOO-152-P	Subject – 1	Practical's in Cell Biology and Biomedical Techniques (PR)	Practical	2	2

Course Objectives:

Provide students with practical experience in using light, fluorescence, and electron microscopes to study cell structures, cellular processes, and tissue samples.

Enable students to learn and apply methods for culturing, maintaining, and manipulating eukaryotic and prokaryotic cells in laboratory settings.

Teach students the principles and applications of staining techniques to visualize cellular components and biological processes.

Familiarize students with biomedical equipment and techniques like ELISA, flow cytometry, and spectrophotometry, which are essential for diagnosing diseases and conducting biomedical research

Course Outcomes:

After completion of this course, students should be able to:

CO1 : Learn to visualize animal and plant cells under microscope.

CO2 : Understand principles and workings of simple, compound microscopes.

CO3 : Acquire the skills to accurately measure microscopic objects using micrometry.

CO4 : Staining and visualization of mitochondria by Janus green stain.

CO5 : Estimate Hemoglobin using Sahli's haemometer.

CO6 : Perform RBC count in blood by using hemocytometer.

CO7 : Perform WBC count in blood by using hemocytometer.

CO8 : Study of human blood smear to observe different types of blood cells.

CO9 : Study of principle & working of Spectrophotometer, PCR and ECG.

CO10 : Work as a laboratory technician to do urine analysis - normal and abnormal Constituents.

Unit No.	Name of the Practical	Practical Allotted
1.	Visualization of animal cells. (E) (Compulsory)	1P
2.	Visualization of plant cells. (E) (Compulsory)	1P
3.	Study of principle and working of simple and compound microscope. (D)	1P
4.	Measurement of microscopic objects using micrometry. (E) (Compulsory)	1P
5.	Identification of ultrastructure of different cell organelles from electron micrographs / video. (D)	2P
6.	Staining and visualization of mitochondria by Janus green stain. (E)	1P
	(Compulsory)	
7.	Study of permanent slides of mitosis and meiosis. (D)	1P
8.	Preparation of temporary stained squash of onion root tip to study various stages of mitosis. (E) (Compulsory)	1P
9.	Preparation of temporary stained squash of onion root tip to study various stages of meiosis. (E)	1P
10.	Visualization of nuclear fraction by acetocarmine stain. (E)	1P
11.	Lab safety techniques and sterilization. (D)	1P
12.	Study of principle and working of centrifugation and chromatography. (D)	1P
13.	Study of principle and working of spectroscopy, electrophoresis and microtomy. (D)	1P
14.	Study of the principle of ECG, ultrasound / sonography, PCR. (D)	1P
15.	Hemoglobin estimation using Sahli's haemometer. (E) (Compulsory)	1P
16.	Differential Leucocyte Count. (E) (Compulsory)	1P

17.	Total RBC count in blood by using hemocytometer. (E)	1P
18.	Total WBC count in blood by using hemocytometer. (E)	1P
19.	Urine analysis - Normal and abnormal constituents. (E) (Compulsory)	1P
20.	Uric acid crystal examination in urine. (E) (Compulsory)	1P

Question paper pattern for Theory (2 Credit courses) :

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N. B.: All questions are compulsory.

Max. Time: 2 Hours.

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Faculty	Zoology
Program	F.Y.B.Sc in Zoology
Class	F.Y.BSc Sem- II

Semester	Course Code	Type of Course	Course Title	Theory/ Practical	Credits	No. of clock hours per week
II	SEC-151-ZOO-PR	SEC	Vermiculture Management (PR)	Practical	2	2

Course Objectives:

Understanding the principles of vermiculture and its ecological significance.

Learning the techniques of setting up and managing worm farms for composting.

Gaining practical skills in maintaining healthy soil and sustainable waste management using earthworms.

Exploring the different types of earthworms used in vermiculture and their role in organic farming.

Developing proficiency in monitoring and managing the growth and reproduction of worms.

Applying theoretical knowledge to real-world scenarios, including waste recycling and organic fertilizer production

Course Outcomes:

After the completion of the course, students should be able to :

CO1 : Acquire a knowledge on role of earthworms in making vermicompost.

CO2 : Understand the internal structure of earthworms used in vermiculture.

CO3 : Acquire skills on production of vermicompost.

CO4 : Able to prepare small scale and large-scale vermicomposting units.

CO5 : Become an entrepreneur by culturing earthworms.

CO6 : Able to produce allied products.

CO7 : Acquire a knowledge about life cycle of earthworms.

CO8 : Identify of enemies and diseases of earthworm.

Unit No.	Title of the Practical	Practicals Allotted
1.	Identification of earthworm species using standard keys. (D)	1 P
2.	Study of Systematic position, habits, habitat & External characters of <i>Eisenia foetida</i> or <i>Eudrilus eugeniae</i> . (D)	1 P
3.	Study of Life stages and development of <i>Eisenia foetida</i> or <i>Eudrilus eugeniae</i> . (D)	1 P
4.	Study of Vermiculture, Vermiwash & Vermicompost equipment's and devices. (D)	1 P
5.	Study and maintenance of vermicomposting methods: Bed Method and Pit Method. (E)	2 P
6.	Harvesting, packaging, transport and storage of vermicompost. (D)	2 P
7.	Preparation of Vermiwash. (E)	2 P
8.	Study of earthworm diseases & enemies. (E)	2 P
9.	Study the effects of vermicompost & vermiwash on any two short duration crop plants. (E)	2 P
10.	Study the effects of sewage water on development of earthworms. (E)	2 P
11.	Marketing management of vermicompost, vermiwash and allied products. (E)	2 P
12.	Compulsory visit to local vermicompost unit and submission of project report on vermicomposting.	2 P

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