MODERN COLLEGE OF ARTS, SCIENCE AND COMMERCE GANESHKHIND, PUNE-16

(AUTONOMOUS)

SYLLABUS OF FIRST YEAR ZOOLOGY

F.Y.B.Sc (SEMESTER I AND II)

To be implemented from

Academic Year 2025-2026

FRAMED BY

BOARD OF STUDIES IN ZOOLOGY

Progressive Education Society's
MODERN COLLEGE OF ARTS, SCIENCE AND COMMERCE, GANESHKHIND, PUNE- 16
(AUTONOMOUS)

❖ Introduction

The NEP-2020 offers an opportunity to effect paradigm shift from a teacher-centric to student-centric higher education system in India. It caters skill based education where the graduate attributes are first kept in mind to reverse-design the programs courses and supplementary activities to attain the graduate attributes and learning attributes. The learning outcomes-based curriculum framework for a degree in B.Sc. (Honours) Zoology is intended to provide a comprehensive foundation to the subject and to help students develop the ability to successfully continue with further studies and research in the subject while they are equipped with required skills at various stages. Effort has been made to integrate use of recent technology and use of MOOCs to assist teaching-learning process among students. The framework is designed to equip students with valuable cognitive abilities and skills so that they are successful in meeting diverse needs of professional careers in a developing and knowledge-based society. The curriculum framework takes into account the need to maintain globally competitive standards of achievement in terms of the knowledge and skills in Zoology and allied courses, as well develop scientific orientation, spirit of enquiry problem solving skills and human and professional values which foster rational and critical thinking in the students. This course serves as plethora of opportunities in different field's right from classical to applied Zoology.

❖ GRADUATE ATTRIBUTES IN B.Sc. (Hons.) ZOOLOGY

- Some of the characteristic attributes a graduate in Zoology should possess are:
- Disciplinary knowledge and skills.
- Skilled communication.
- Critical thinking and problem solving capacity.
- Logical thinking and reasoning.
- Team Spirit & Leadership Quality.
- Digital efficiency.
- Ethical awareness / reasoning.
- National and international perspective.
- Lifelong learning.

❖ **Flexibility**

- The programmes are flexible enough to allow liberty to students in designing them according to their requirements. Students may choose a single Major, one Major or two Majors during third year (5th semester onwards). Teacher
- Education or Vocational courses may be chosen in place of Minor/s. Below listed are the various options students may choose from.
- One discipline, Two Languages, Generic Electives, Ability Enhancement, Skill Development and Vocational courses including Extracurricular Activities.
- One discipline along with Languages, Generic Electives, Ability Enhancement, Skill Development and Vocationalcourses including Extracurricular Activities.

❖ AIMS AND OBJECTIVES OF UG PROGRAM IN ZOOLOGY:

- The Programme offers both classical as well as modern concepts of Zoology in higher education.
- It enables the students to study animal diversity in both local and global environments.
- To make the study of animals more interesting and relevant to human studies more emphasis is givento branches like behavioral biology, evolutionary biology and economic Zoology.
- More of upcoming areas in cell biology, genetics, molecular biology, biochemistry, geneticengineering and bioinformatics have also been included.
- Equal importance is given to practical learning and presentation skills of students.
- The lab courses provide the students necessary skills required for their employability.
- Skill enhancement courses in classical and applied branches of Zoology enhance enterprising skillsof students.
- The global practices in terms of academic standards and evaluation strategies.
- Provides opportunity for the mobility of the student both within and across the world.
- The uniform grading system will benefit the students to move across institutions within India tobegin with and across countries.
- It will also enable potential employers in assessing the performance of the candidates across the world.

❖ About the course :

The course is a walk for the Bachelor's entrant through the amazing world of medical and forensic zoology. Students will learn various concepts and principles related to medical and forensic zoology. The course will provide hands on learning experience to learn new techniques related to hematology, pathology, imaging,

analytical techniques and other biomedical and forensic techniques. The course also provide knowledge of diversified subject such as bioinstrumentation, bioeconomics, public health and hygiene, food and healthy lifestyle, etc.

❖ Learning outcomes :

After successfully completing this course, the students will be able to:

- Develop understanding on the scope, importance and need of Medical & Forensic Zoology.
- Develop deep understanding of human physiology, food, balanced diet and related disorders.
- Develop the fundamental principles and functions of forensic science and its significance to human society.
- Develop critical understanding to learn different investigating bio-medical techniques and modern tools, techniques and skills in forensic investigations.
- Understand the epidemiology, pathogenicity, symptoms, preventive measures and treatment of various human diseases.
- Learn various bio-medical techniques ranging from studying Human ABO blood group system, preparing blood smear to examining vital blood parameters such as Hb percentage, RBC, WBC, DLC, haemin crystals, bleeding time, clotting time, identification of blood parasites, identification of toxins and drugs in the sample in human blood sample.
- Develop deep understanding of human physiology and related disorders.
- Understand entrepreneurship skills through courses like bioeconomics, bioinstrumentation, food and healthy lifestyle.
- The project assignment and experimental protocol will also give them a flavor of hands on experience and research to develop experimental skills.

❖ ELIGIBILITY CRITERIA:

1 First Year B.Sc.: A student who has passed the Higher Secondary School Certificate (10+2) Science stream with Biology or its equivalent examination as per the University of Pune eligibility norms.

2 Second Year B.Sc.: Keeping terms of First Year of B. Sc. with zoology as one of the subjects. Other students if they fulfill the conditions approved by the equivalence committee of Faculty of Science of the University of Pune are also eligible.

3 Third Year B.Sc.: Student shall pass all First Year B. Sc. courses and satisfactorily keeping terms of Second Year of B. Sc. with zoology as one of the subjects.

❖ Program outcomes (POs) :

PO1: Demonstrate and apply the fundamental knowledge of the basic principles of major fields of Zoology.

PO2: Apply knowledge to solve the issues related to animal sciences.

PO3: To foster curiosity in the students for Zoology.

PO4: To create awareness amongst students for the basic and applied areas of Zoology.

PO5: To orient students about the scope, importance and need of medical and forensic zoology.

PO6: To orient students about the entrepreneurship in bioeconomics and bioinstrumentation, bio-medical and forensic field.

PO7: To provide an insight to the aspects of public health and hygiene and food and healthy lifestyle.

PO8: To inculcate good laboratory practices in students and to train them about proper handling of lab instruments.

❖ Program Specific Outcomes (PSOs) :

PSO 1 : Understand the basic concepts and principles of medical zoology and forensic Zoology.

PSO 2 : Develop scientific and research attitude in students.

PSO 3 : Perform procedures as per laboratory standards in the areas of Medical zoology, forensic zoology, Human Physiology, Cell biology, Ctyogenetics, Applied Zoology, Clinical pathology, tools and techniques of Zoology, Toxicology, bio-medical techniques, crime investigations, apiculture, sericulture, vermiculture, fish culture, lac culture, microscopy, hematology, Biochemistry, food and dietics.

PSO 4 : Understand the applications of Zoology in Medical, Forensics, Medicine, Agriculture, Medicine and daily life.

PSO 5 : Gains knowledge about research methodologies, effective communication and skills of problem solving methods.

PSO 6 : 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 medical zoology, forensic zoology, aquatic biology, sericulture, apiculture, vermiculture, prawn culture, dairy management, animal breeding and management, wildlife conservation and management, wildlife photography etc.

PSO 7 : Analyze the relationships among animals, plants, humans and microbes.

PSO 8 : Analyze the mechanisms involved in life processes up to the molecular level.

PSO 9 : Contributes the knowledge for Nation building.

❖ Preamble :

Zoology is a major subject of Basic Sciences which deals with all aspects of animal biology. It includes an interesting range of highly diverse topics. The advancements in biological Sciences demands a zoology student to be a master of many areas in the subject. This Postgraduate degree program has been designed by the Board of Studies in Zoology with a tangible understanding of what is needed from zoologists and what zoologists need to pursue as a skilled career. It emulates closely the Benchmark Statement for Biosciences and the guidelines laid down by the University Grants Commission, New Delhi. This Newly designed Curriculum is an appropriate blend of the classical aspects in Zoology which has been the "backbone" knowledge required for all zoologists and the recent and specialized areas. The flexibility in the Curriculum allows the students to choose their areas of interest leading to enhanced employability. Students will be provided sufficient number of hours for their skill development through the Lab Courses and the Project component. The lab courses have differing flavours and priorities to make a good zoologist. This degree offers specialization in Entomology along with a range of core courses like Biochemistry, Molecular Biology, Comparative Animal Physiology, Developmental Biology, Environmental Biology etc. The field trip/surveys and study tours are included to give the student an enticing taste of what life is specially outside the walls of the classroom. On successful completion of the programme, the students are expected to understand the key life processes of human and other animal groups, the functioning of molecules, cells, tissues, organs and systems. Also the students will gain increased confidence to use initiative and judgement to make decisions in complex and changeable situations and reflect critically and analytically on personal experience and make informed decisions about further study, training and employment opportunities. The Master of Science (M.Sc.) in Zoology is a Postgraduate program under the Faculty of Science and Technology. The curriculum designed M. Sc. Zoology encompasses subjects like Physiology, Entomology, Genetics, Cell Biology, Developmental Biology, Endocrinology, Biochemistry, Molecular Biology, Freshwater Zoology, Environmental Biology etc. Both classical and applied subjects of Zoology have been rightly blended to offer holistic understanding of the subject. The Choice Based Credit System (CBCS) will be implemented through this curriculum. This curriculum would certainly felicitate students to develop a strong base of the fundamentals and specialize in the desired area of their fondness and abilities. The students pursuing this program would get a privilege to select optional subjects of their choice. This curriculum will allow students to acquire the skill in handling scientific instruments planning and performing in the laboratory and exercising critical judgement, independent thinking and problem solving skills.

❖ 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 Modern College of Arts, Science & Commerce, Ganeshkhind, 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 assignments, class tests, MCQs, short questions, open book test, field visits, tutorials, Problem solving sessions, practice sessions, group discussion, unit tests, seminars, presentations, project work, quiz, etc.

II. **One Credit of Practical** = 30 clock hours.

❖ Examination Pattern :

- **Theory Paper of 02 Credits** –
  - Internal Exam (20 Marks) + College Theory Exam (30 Marks) = 50 Marks.
  - Duration : For Internal exam = 40 Minutes and For College Exam = 02 hours.
- **Practical Paper of 1 Credits** –
  - Internal Exam (20 Marks) + College Practical Exam (30 Marks) = 50 Marks.
  - Duration : For Internal exam = 40 Minutes and For College Exam = 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.

Weightage for assessmentsType of Course	Formative Assessment / IAMarks (in Percentage)	Summative AssessmentMarks (in percentage)
Theory	40	60
Practical	40	60
Projects*	40	60
Experiential Learning(Internships)		

❖ 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 following at the time of practical examination: Certified Journal, Certified Study tour report / Field visit report and Any other prescribed for the course.

REVISED NEP COURSE STRUCTURE (As per GR dated 23rd March, 2024)

Course Structure: **Course Structure with Credit Distribution of the Undergraduate Science Program in Zoology- B.Sc in Zoology**

F.Y. B.Sc

Course Type	Course Code	SEMESTER I	Course Code	Semester II	Credits
	24ZOO11101	Medical Zoology (2C) (T)	24ZOO12101	Forensic Zoology (2C) (T)	**2+2**
	24ZOO11102	Practicals in Medical Zoology (2C) (P)	24ZOO12102	Practicals in Forensic Zoology (2C) (P)	**2+2**
Minor		-		-	
Open elective	24ZOO11303	Food and Healthy Lifestyle (2C) (T)	24ZOO12303	Public Health and hygiene (2C) (T)	**2+2**
Open elective	24ZOO11304	Bioeconomics (2C) (T)	24ZOO12304	Biomedical instrumentation (2C) (T)	**2+2**
VSEC		-		-	
SEC	24ZOO11405	Practicals in Clinical Pathology (2C) (P)	24ZOO12405	Practicals in Cytogenetics (2C) (P)	**2+2**
VEC		By College (2C) (T)		By college (2C) (T)	**2+2**
AEC		By College (2C) (T)		By College (2C) (T)	**2+2**
IKS		By College (2C) (T)		By College (2C) (T)	**2+2**
CC		Online course based on Yoga (2C) (P)		Physical Education/ Cultural activities/ NSS/ NCC/ Fine/ Applied/ Visual/ Performing Arts Course (2C) (P)	**2+2**
				Total credits:	**44**

SEMESTER - I

Course Code: 24ZOO11101						
Course Title: Medical Zoology (Theory)						
F.Y. B.Sc SEMESTER-I						
Teaching Pattern				**Evaluation Pattern**		
Course Type	**Credits**	**Number of Teaching hours**	**Lectures per week**	**Internal Assessment**	**End Semester Exam**	**Total**
Subject 1 (under vertical 1)	**02**	**30**	**02**	**20**	**30**	**50**

Course Outcomes :

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

CO1: To understand the scope, importance and need of Medical Zoology.

CO2: To understand the various branches of Medical Zoology.

CO3: Students will be able to understand the physiology of human and disorders.

CO4: Students will be able to explain different investigating techniques.

CO5: Students will be able to understand various diseases in humans.

Sr. No.	Name of the Topic	Lectures allotted
1	**Unit 1: Introduction to Medical Zoology and its importance.** 1.1 Introduction of Medical Zoology. 1.2 Importance and Scope of Medical Zoology.	(02L)
2	**Unit 2: Introduction to Human Physiology and its disorders** 2.1 Introduction to Human Physiology. 2.2 Human organ system and associated disorders.	(04L)
3	**Unit 3: Medical Hematology** 3.1 Composition of Blood. 3.2 Blood groups. 3.3 Blood bank. 3.4 Transfusion of blood**.**	(05L)

	3.5 RBC, WBC and platelets count using haemocytometer (Neubauer chamber).	
4	**Unit 4: Non-infectious disorders** 4.1 Causes, types, symptoms, complications and prevention of Diabetes -Type I and Type II. 4.2 Cardiovascular diseases.	(03L)
5	**Unit 5: Viral diseases** 5.1 AIDS. 5.2 COVID-19 disease. 5.3 Poliomyelitis. 5.4 Chicken pox.	(04L)
6	**Unit 6: Parasitic diseases** 6.1 Morphology, life history, mode of infection, pathogenicity, prophylaxis and treatment. 6.2 Protozoa: *Plasmodium vivax*. 6.3 Platyhelminthes: *Taenia solium*.	(04L)
7	**Unit 7: Vector borne human diseases** 7.1 Dengue. 7.2 Malaria.	(03L)
8	**Unit 8: Biomedical Technologies** 8.1 Radiodiagnosis & imaging techniques-X ray, MRI, ECG, Sonography. 8.2 2- D Echo, Colour Doppler. 8.3 Angiography, Angioplasty. 8.4 Dialysis. 8.5 Biopsy.	(05L)

REFERENCES:

1. Baker, F.J. and Silverton, R.E. (1985) Introduction to Medical Laboratory Technology, (6th ed), Butler worth and Co. Ltd.
2. Kuby, J. (2000), Immunology, W.H. Freeman & Co., USA.
3. Chatterjee, K.D. (1995), Parasitology, Protozoology and Helminthology (12th ed).
4. Cheesborough, M. (1987), Medical Laboratory Technology for Tropical countries (2nd ed), Butler worth and Co., Ltd.
5. Garcia, L.S. (2001), Diagnostic Medical Parasitology, (4th ed), ASM Press Washington.
6. Kimball, J.W. (1986), Introduction of Immunology, Mac Millian Publishing Co., New York.
7. Rathod A.K., Deshmukh N.Z., Kumar D. and Goswami R. (2015), Applied and Economic Zoology, Astral International (P) Ltd. New Delhi
8. Roitt, I. (1984), Essential Immunology, Blackwell Scientific Publications, Oxford.
9. Talib, V.H. (1999), Essential Laboratory Manual, Mehta Publishers, New Delhi.

Course Code: 24ZOO11102						
Course Title: Practicals in Medical Zoology						
F.Y. B.Sc SEMESTER-I						
Teaching Pattern				**Evaluation Pattern**		
Course Type	**Credits**	**Number of Teaching hours (practical)**	**Practical per week**	**Internal Assessment**	**End Semester Exam**	**Total**
Subject 2 (under vertical 1)	**02**	**30**	**01**	**20**	**30**	**50**

Course Outcomes :

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

CO1: Students will be able to understand the Human ABO blood group system.
CO2: Students will be able to analyze various biomedical techniques.
CO3: Students will be able to explain various diseases in humans.
CO4: Students will be able to understand the technique of preparation of blood smears.

Sr. No.	Title of the Practical	Practical Allotted
Practical in Medical Zoology		
1.	To study the Human blood group system (ABO and Rh).	1 P
2.	Determination of bleeding time and clotting time.	1 P
3.	Estimation of haemoglobin by using Sahli's haemoglobinometer.	1 P
4.	To study the haemin crystals.	1 P
5.	Total leucocyte count from blood by using Neubauer chamber.	1 P
6.	To study the differential count of leucocytes from blood smear.	2 P
7.	To estimate the blood glucose level from given sample.	
8.	Methods of preparation of blood smear (thick and thin blood smear).	2 P
9.	Study of disorders caused by endocrine glands with the help of photographs.	1 P
10	Qualitative detection of nitrogenous waste products from the given sample.	1 P
11	Study of Medical imaging techniques X-ray, ECG , CT scan and MRI	1 P
12	Visit to Hospital / pathology lab and submission of report.	2 P

REFERENCES

1. Baker FJ, Silverton R.E. 1985. Introduction to Medical Laboratory Technology 6th Editions.
2. District Laboratory Practice in Tropical Countries**.** 2002.
3. Cambridge, Part I, Low Price Editions. 3. Frances Fischach**.** 1998. Manual of Laboratory and Diagnostic Tests, 4th Edition.
4. Gebeyehu Damcha.1997. Clinical Chemistry Principles, Procedures and Interpretation.
5. John J. Perkins. 2000. Principles and Methods of Sterilization in Health Sciences, 2nd Edition.
6. Mary Ellen, Wedding Sally A**.** 1998. Medical Laboratory Procedures. 2nd Edition.
7. M. George and Malaciski. 2005. Essential of Molecular Biology, 4th Edition.
8. Monica Cheesbrough. 1998. District Laboratory Practice in Tropical Countries, Part I, Volume.

Course Code: 24ZOO11303						
Course Title: Food and healthy lifestyle (Theory) **Open Elective (OE-4)**						
F.Y. B.Sc SEMESTER-II						
Teaching Pattern				**Evaluation Pattern**		
Course Type **Open Elective**	**Credits**	**Number of Teaching hours**	**Lectures per week**	**Internal Assessment**	**End Semester Exam**	**Total**
Subject 3 **(under vertical 3)**	**02**	**30**	**02**	**20**	**30**	**50**

Course Outcomes :

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

CO1 : Understand the role of food and nutrients in health and disease.

CO2 : Provide culturally competent nutrition services for diverse individuals.

CO3 : Implement strategies for food access, procurement, preparation, and safety that are relevant for the culture, age, literacy level and socio-economic status of clients and groups.

CO4 : Perform food system management and leadership functions that consider sustainability in business, healthcare, community, and institutional arenas.

Unit. No.	Name of the Topic	Lectures allotted
1	**Unit 1: Nutrition and dietary nutrients** 1.1 Basic concept of Food: Components and nutrients. 1.2 Concept of balanced diet, nutrient requirements and dietary pattern for different groups viz., adults, pregnant and nursing mothers, infants, school children, adolescents and elderly people. 1.3 Contribution of government schemes and NGOs for children and family welfare.	(06L)
2	**Unit 2: Macro nutrients and micronutrients** 2.1 Nutritional Biochemistry: Macronutrients- Carbohydrates, Lipids, Proteins- Definition, Classification, their dietary source and role.	(08L)

	2.2 Micronutrients- Vitamins: Water-soluble and Fat-soluble vitamins- their sources and importance. 2.3 Important minerals *viz*., Iron, Calcium, Phosphorus, Iodine, Selenium and Zinc: their biological functions.	
3	**Unit 3: Malnutrition and nutrient deficiency diseases** 3.1 Definition and concept of health. 3.2 Common nutritional deficiency diseases- Protein Malnutrition (e.g., Kwashiorkor and Marasmus). 3.3 Lifestyle dependent diseases- hypertension, diabetes mellitus, PCOD, cancer and obesity- their causes and prevention. 3.4 Social health problems- smoking, alcoholism, narcotics, Acquired Immuno-deficiency Syndrome (AIDS): causes, treatment and prevention. 3.5 Respiratory diseases-allergy, asthma, COPD.	(08L)
4	**Unit 4: Food Hygiene** 4.1 Potable water- sources and methods of purification at domestic level. 4.2 Food and Water-borne diseases.	(08L)

REFERENCES:

1. Mudambi, S.R. and Rajagopal, M.V. (2007). Fundamentals of Foods, Nutrition andDiet Therapy; Fifth Ed; New Age International Publishers

2. Srilakshmi, B. (2002). Nutrition Science; New Age International (P) Ltd.

3. Srilakshmi, B. (2007). Food Science; Fourth Ed; New Age International (P) Ltd.

4. Swaminathan, M. (1986). Handbook of Foods and Nutrition; Fifth Ed; BAPPCO.

5. Bamji, M.S.; Rao, N.P. and Reddy, V. (2009). Textbook of Human Nutrition;Oxford & IBH Publishing Co. Pvt Ltd.

6. Wardlaw, G.M. and Hampl, J.S. (2007). Perspectives in Nutrition; Seventh Ed;McGraw Hill.

7. Lakra, P. and Singh M.D. (2008). Textbook of Nutrition and Health; First Ed;Academic Excellence.

8. Manay, M.S. and Shadaksharaswamy, M. (1998). Food-Facts and Principles; New Age International (P) Ltd.

Course Code: 24ZOO11304						
Course Title: Bioeconomics (Theory) **Open Elective (OE-1)**						
F.Y. B.Sc SEMESTER-I						
Teaching Pattern				**Evaluation Pattern**		
Course Type **Open Elective**	**Credits**	**Number of Teaching hours**	**Lectures per week**	**Internal Assessment**	**End Semester Exam**	**Total**
Subject 4 **(under vertical 3)**	**02**	**30**	**02**	**20**	**30**	**50**

Course Outcomes :

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

CO1 : Gain knowledge about silkworms rearing and their products.

CO2 : Gain knowledge in Bee keeping and apiary management.

CO3 : Acquaint knowledge about the culture techniques of fishes.

CO4 : Acquaint the knowledge about basic procedure and methodology of Vermiculture.

CO5 : Learn various concepts of lac cultivation.

CO6 : Students can start their own business i.e. self-employments.

CO7 : Get employment in different applied sectors.

Sr. No.	Name of the Topic	Lectures allotted
1	**Unit 1: Sericulture** 1.1 History and present status of sericulture in India. 1.2 Mulberry and non-mulberry species in Karnataka and India. 1.3 Moriculture-Mulberry cultivation. 1.4 Morphology and life cycle of *Bombyx mori*. 1.5 Silkworm rearing techniques: Chawki rearing, Processing of cocoon, reeling. 1.6 Silkworm diseases-pests and their control.	(06L)

	1.7 Government schemes and funding agency for sericulture.	
2	**Unit 2: Apiculture** 2.1 Introduction and present status of apiculture. 2.2 Species of honey bees in India, life cycle of *Apis indica.* 2.3 Colony organization, division of labour and communication. 2.4 Bee keeping as an agro-based industry. 2.5 Bee keeping methods and equipment: indigenous modern methods, extraction of honey from the comb and processing. 2.6 Bee flora, honey and bees wax and their uses. 2.7 Bee Pests and diseases of bees and their management.	(06L)
3	**Unit 3: Fish culture** 3.1 Common fishes used for culture. 3.2 Types of fisheries. 3.3 Ornamental fishery. 3.4 Construction and maintenance of aquarium: Construction of home aquarium, materials used, setting up of freshwater aquaria, aquarium plants, ornamental objects, cleaning the aquarium, maintenance of water quality. Control of snail and algal growth. 3.5 Entrepreneurship in fisheries industry. Government schemes for entrepreneurship.	(06L)
4	**Unit 4: Vermiculture** 4.1 Scope of Vermiculture. 4.2 Types of earthworms- indigenous and exotic species. 4.3 Methodology of vermicomposting: containers for culturing, raw materials required, preparation of bed, environmental pre-requisites, feeding, harvesting and storage of Vermicompost. 4.4 Advantages of vermicomposting.	(06L)
5	**Unit 5: Lac Culture** 5.1 History of lac and its organization, lac production in India.	(06L)

	5.2 Life cycle, host plants and strains of lac insect. 5.3 Lac cultivation: Local practice, improved practice, propagation of lac insect, inoculation period, harvesting of lac. 5.4 Lac composition, processing, products and its uses.	

REFERENCES:

1. Eikichi, H. (1999). Silkworm Breeding (Translated from Japanese). Oxford & IBH PublishingCo. Pvt. Ltd., New Delhi.
2. Ganga, G. (2003). Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling.
3. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Mahade vappa, D., Halliyal, V.G., Shankar, D.G. and Bhandiwad, R., (2000). Mulberry Silk
5. Reeling Technology Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Roger, M (1990). The ABC and Xyz of Bee Culture: An Encyclopedia of Beekeeping, KindleEdition.
7. Shukla and Upadhyaya (2002). Economic Zoology, Rastogi Publishers
8. YadavManju (2003). Economic Zoology, Discovery Publishing House.
9. Jabde Pradip V (2005). Textbook of applied Zoology, Discovery Publishing House, New Delhi.
10. Sathe, T.V. Vermiculture and Organic farming.
11. Bard. J (1986). Handbook of Tropical Aquaculture.
12. Santhanam, R. A. Manual of Aquaculture.

Course Code: 24ZOO11404						
Course Title: Practicals in Clinical Pathology **SEC**						
F.Y. B.Sc SEMESTER-I						
Teaching Pattern				**Evaluation Pattern**		
Course Type **SEC**	**Credits**	**Number of Teaching hours**	**Practicals per week**	**Internal Assessment**	**End Semester Exam**	**Total**
Subject 4	**02**	**30**	**01**	**20**	**30**	**50**

(under vertical 4)						

Course Outcomes :

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

CO1: Students will gain knowledge about lab techniques.

CO2: Students will be able to use the technique in diagnosing various diseases.

CO3: Students will know about various components of blood and their normal levels.

CO4: Students will get knowledge about histology.

Sr. No.	Name of the Practical	Practical allotted
1	Estimation of blood glucose.	1P
2	Qualitative analysis of protein (Albumin).	1P
3	Qualitative analysis of carbohydrates.	1P
4	Study of pathological slides (T.S of liver, kidneys and pancreas).	1P
5	Measurement of BP, Heart rate, BMR and SPO_2.	1P
6	Clinical significance of Urine and Determination of normal and abnormal constituents of urine.	1P
7	Study of myopia and heteromyopia.	1P
8	To study the principle and working of Autoanalyzer	1P
9	Study of Analyzing techniques-ELISA, RIA and Alpha.	
10	Interpretation of ECG	1P
11	Visit to a pathology lab to understand the analysis of blood and urine samples to detect various pathological conditions in humans.	1P
12	Study based on clinical reports.	2P

REFERENCES:

1. Dondelinger, Robert M. "Spectrophotometers." Biomedical Instrumentation & Technology 45.2 (2011): 139-143.
2. Ridley, John W. Fundamentals of the study of urine and body fluids. Basel, Switzerland: Springer, 2018.
3. Törnqvist, M., et al. "Protein adducts: quantitative and qualitative aspects of their formation, analysis and applications." Journal of Chromatography B 778.1-2 (2002): 279-308.

4. Lagier, Jean-Christophe, et al. "Current and past strategies for bacterial culture in clinical microbiology." Clinical microbiology reviews 28.1 (2015): 208-236.
5. Rawat, Sonu, et al. "Urine Analysis for Abnormal Urine in Pathology Laboratory."
6. Pan, Chen-Wei, Dharani Ramamurthy, and Seang-Mei Saw. "Worldwide prevalence and risk factors for myopia." Ophthalmic and Physiological Optics 32.1 (2012): 3-16.
7. Practical Clinical Biochemistry: Methods and Interpretations By Ranjna Chawla (2014)
8. Pathology Practical Book By Harsh Mohan (2007)
9. Oxford Handbook of Clinical Pathology (2012) https://doi.org/10.1093/med/9780199591633.001.0001

SEMESTER - II

Course Code: 24ZOO12101						
Course Title: Forensic Zoology (Theory)						
F.Y. B.Sc SEMESTER-II						
Teaching Pattern				**Evaluation Pattern**		
Course Type	**Credits**	**Number of Teaching hours**	**Lectures per week**	**Internal Assessment**	**End Semester Exam**	**Total**
Subject 1 (under vertical 1)	**02**	**30**	**02**	**20**	**30**	**50**

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

CO1 : The students will be able to understand the basics principles of Forensic Zoology.

CO2 : The students will able to understand scientific methods in crime detection.

CO3 : The students will be able to understand the advancements in the field of Forensic Zoology.

CO4 : The students will be able to understand modern tools, techniques and skills in forensic investigations.

CO5 : The students will be able to describe the fundamental principles and functions of forensic science and its significance to human society.

Detailed Syllabus :

Unit No.	Name of the Topic	Lectures Allotted
1.	**Unit1: Introduction to Forensic Zoology** 1.1 Definition, Scope and Application of Forensic Zoology. 1.2 Basic Principles of Forensic Science with Examples. 1.3. Forensic Science Laboratories in India. **1**.4 Organisation of a Forensic Science Laboratory.	(05L)
2.	**Unit 2: Crime Scene** 2.1 Nature of crime scene. 2.2 Types of crime scene.	(03L)

	2.3 Preservation of Scene of Crime.	
3.	**Unit 3: Medico-legal Autopsy** 3.1 Death and its Causes. 3.2 External examination of deceased body. 3.3 Internal Examination – Determination of time since death and cause of death. 3.4 Preparation of Post mortem report.	(05L)
4.	**Unit 4: Forensic Medicine** 4.1 Introduction to Forensic Medicine: Definitions and Scope of Forensic Medicine. 4.2 Medical evidence documentations.	(03L)
5.	**Unit 5: Forensic Analysis-I** 5.1 Examination of Biological Materials: Examination of Hair, plants materials, human tissues. 5.2 Examination of Body Fluid: Blood, Semen and Saliva. 5.3 DNA Fingerprinting Technique and Examination of Biological Traces. 5.4 Forensic Entomology**:** Insects of forensic importance - indicators of time of death.	(07L)
6.	**Unit 6: Forensic Analysis-II** 6.1 Toxicological Investigations**:** Poisons – Definition, Forms of Poison – Physical, Chemical & Mechanical state. 6.2 Types of poisons-neurotoxic, cardiovascular, hemotoxic.	(06L)

REFERENCES:

1. Godkar P. B and Godkar D. P, Textbook of Medical Laboratory Technology, II Edition, Bhalani Publications

2. Text book of pathology: Robbins & Cotran, Vol. 1 & 2, Tenth Edition, Elsevier Publication.

3. Essentials of medical pharmacology: K. D. Tripathi, 8th edition, Jaypee brothers publishers.

4. W. G. Eckert and S. H. James, Interpretation of Bloodstain Evidence at Crime Scenes, CRC Press, Boca Raton (1989).

5. The essentials of forensic medicine & toxicology: K. S. Narayan Reddy.

6. A textbook of Clinical pharmacology: Roger H. J., Spector R. G., Trounce J. R., Hodder & Stoughton publishers.

7. Pharmacology & Pharmacotherapeutics: Satoskar R. S., Bhandarkar S. D., Popular Prakashan, Mumbai.

8. The synopsis of forensic medicine & toxicology: K. S. Narayan Reddy.

Course Code: 24ZOO12102						
Course Title: Practicals in Forensic Zoology						
F.Y. B.Sc SEMESTER-II						
Teaching Pattern				**Evaluation Pattern**		
Course Type	**Credits**	**Number of Teaching hours**	**Practical per week**	**Internal Assessment**	**End Semester Exam**	**Total**
Subject 2 (under vertical 1)	**01**	**10**	**02**	**20**	**30**	**50**

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

CO1 : The students will be able to understand morphology, scale pattern of human hair.

CO2 : The students will able to understand various types of fingerprints.

CO3 : The students will be able to identify blood stains and determine blood group from fresh blood and blood stains.

CO4 : The students will be able to understand modern tools, techniques and skills in forensic investigations.

CO5 : The students will be able to learn TLC, identification of toxins and drugs in the sample.

Sr. No.	Name of the Practical	Practical allotted
1	Examination of hair morphology and determination of the species to which the hair belongs.	1P
2	To examine human hair for cortex and medulla.	1P
3	To prepare slides of scale pattern of human hair.	1P
4	Identification and differentiation of various types of Fingerprints.	1P
5	To carry out ten digit classification of fingerprints.	
6	Identification of blood stains.	1P
7	To determine blood group from fresh and dried blood samples.	1P
8	Thin layer chromatography of toxins.	1P
9	Identification of drugs of abuse by visuals and coloured charts.	1P

10	To carry out extraction of DNA from body fluids.	1P
11	Collection and study of insects of forensic importance.	1P
12	To visit a Forensic Laboratory and submission of the report.	2P

REFERENCES:

1. W. G. Eckert and S. H. James, Interpretation of Bloodstain Evidence at Crime Scenes, CRC Press, Boca Raton (1989).

2. A textbook of Clinical pharmacology: Roger H. J., Spector R. G., Trounce J. R., Hodder & Stoughton publishers.

3. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).

4. J.E. Cowger, Friction Ridge Skin, CRC Press, Boca Raton (1983)

5. D.A. Ashbaugh, Quantitative-Qualitative Friction Ridge Analysis, CRC Press, Boca Raton (2000).

6. C. Champod, C. Lennard, P. Margot an M. Stoilovic, Fingerprints and other Ridge Skin Impressions, CRC Press, Boca Raton (2004).

7. Lee and Gaensleen's, Advances in Fingerprint Technology, 3rd Edition, R.S. Ramotowski (Ed.), CRC Press, Boca Raton (2013).

8. T. Bevel and R. M. Gardner, Blood stain Pattern Analysis, 3rd Edition, CRC Press, Boca Raton (2008).

Course Code: 24ZOO12303						
Course Title: Public Health and Hygiene (Theory) **Open Elective (OE-2)**						
F.Y. B.Sc SEMESTER-I						
Teaching Pattern				**Evaluation Pattern**		
Course Type **Open Elective**	**Credits**	**Number of Teaching hours**	**Lectures per week**	**Internal Assessment**	**End Semester Exam**	**Total**
Subject 3 **(under vertical 3)**	**02**	**30**	**02**	**20**	**30**	**50**

Course Outcomes :

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

CO1 : To learn the principles of nutrition and dietetics.

CO2 : To understand the ill effects of modern lifestyle.

CO3 : To understand and apply the emerging concepts and issues to health, hygiene and sanitation.

CO4 : To critically understand the present scenario of health hygiene.

CO5 : To apply and design hygiene promotion and education programmes for development.

Sr. No.	Name of the Topic	Lectures allotted
1	**Unit 1: Introduction to Health and Hygiene** 1.1 Definition of Health, the need for health education and health goal. 1.2 Physical, psychological, and social health issues. 1.3 Meaning and definition of terms-Epidemiology, epidemic and pandemic. 1.4 WHO & CDC and its programmes.	(04L)
2	**Unit 2: Introduction to Sanitation and Hygiene for Health** 2.1 Definitions and Concepts. 2.2 Global, national and regional perspective. 2.3 Relation between health, hygiene & sanitation. 2.4 Relevance & importance of health, hygiene in the contemporary times.	(05L)
3	**Unit 3: Health Hazards:** 3.1 Health dynamicity – definition, factors influencing health, health as a medium of socio-economic development. 3.2 Diseases – Common food borne and water borne diseases (jaundice, cholera, diarrhoea and typhoid) – mode of transmission, causative agents, symptoms, prevention and control. 3.3 Vector Borne and Zoonotic diseases - Malaria, dengue, chikunguniya (general methods of mosquito control and the need to prevent mosquito breeding in and around our homes).	(10L)

	3.4 Sexually transmitted diseases– AIDS, hepatitis B– causative agents, symptoms, modes of transmission and prevention.	
4	**Unit 4: Occupational Health and Hygiene** 4.1 Concept, definition and its role. 4.2 Link between occupational hygiene, risk assessment & risk management. 4.3 Sanitation problems of the workplace: industries, academic institutions, corporate, hospitals, Public spaces etc.	(06L)
5	**Unit 5: Health Hygiene, Promotion & Education:** 5.1 Hygiene Behavior promotion & education- concept and its importance. 5.2 Hygiene promotion & education in children & adolescence. 5.3 Government initiatives & policies in rural & urban area.	(05L)

REFERENCES:

1. Jatin V. Modi and Renjith S. Chawan. Essentials of Public Health and Sanitation –Part I- IV.
2. Murray, C. J. L. and A.D. Lopez. (1996). The Global Burden Of Disease. World Health Organization.
3. Park, J.E. and Park, K. Textbook of Community Health for Nurses. Swaminathan S. Principles of Nutrition and Dietetics.
4. A. Jiménez et al. infrastructure function and hygiene. Journal of Epidemiology and Community Health, 65, 432– 437. doi:10.1136/jech.2009.091637.
5. Bailie, R. S. et al. (2011). Evaluation of an Australian indigenous housing programme: Community level impact on crowding, 288.

E-RESOURCES:

• Water, Sanitation and Culture, http://www.sswm.info/content/water-sanitation-and-culture.

Course Code: 24ZOO12304						
Course Title: Biomedical instrumentation (Theory) **Open Elective (OE-3)**						
F.Y. B.Sc SEMESTER-II						
Teaching Pattern				**Evaluation Pattern**		
Course Type **Open Elective**	**Credits**	**Number of Teaching hours**	**Lectures per week**	**Internal Assessment**	**End Semester Exam**	**Total**
Subject 4 **(under vertical 3)**	**02**	**30**	**02**	**20**	**30**	**50**

Course Outcomes :

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

CO1 : To make learners aware of risks involved in handling of different hazardous chemicals.

CO2 : To handle biological specimens especially during practical

sessions in the laboratory andto train them to avoid mishap.

CO3 : To enable the learners to work safely in the laboratory and avoid occurrence of accidents.

CO4 : To create an awareness about the use of materials/chemicals during practical sessions.

Unit. No.	Name of the Topic	Lectures allotted
1	**Unit 1: Introduction to Biology Laboratory and museum.** 1.1 Biology laboratory set up. 1.2 Museum.	(04L)
2	**Unit 2: Microscope** 2.1 Construction, principle and applications of dissecting and compound microscope. 2.2 Types of microscopes and their uses in detail.	(05L)
3	**Unit 3: pH** 3.1 Sorenson's pH scale. 3.2 pH meter – principle and applications.	(03L)

4	**Unit 4: PCR** 4.1 Principle, working and application of PCR. 4.2 RT-PCR.	(04L)
5	**Unit 5: Electrophoresis** 5.1 Principle and applications of electrophoresis.	(03L)
6	**Unit 6: Blood and estimation of components of blood** 6.1 Composition of human blood. 6.2 ABO blood group. 6.3 Lipid profile-cholesterol (good and bad cholesterol in blood).	(05L)
7	**Unit 7: Hematological techniques** 7.1 Blood cell count –Total count of RBCs, WBCs and Differential count of WBCs and their significance. 7.2 Estimation of hemoglobin percentage, bleeding time, clotting time and their significance.	(06L)

REFERENCES:

1. Introduction of Medical Laboratory Technique,1998, 7th Edn., Baker F. J., Silverton R. E., Pallister C. J., Butterworth-Heinemann, UK.

2. Hematology: Basic Principles and Practice, 2008, 5th Edn., Ronald Hoffman , Bruce Furie, Philip McGlave, Churchill Livingstone Elsevier, USA

3. Basic Separation Techniques in Biochemistry, 1998, Okotore R. O., New Age International, New Delhi.

4. Cytological techniques: The Principles Underlying Routine Methods, 1963, Baker J.R, Methuen & Co, London.

5. Notes on Microscopical Techniques for Zoologist, 1964, Pantin C. F.A.: Cambridge University Press

6. Biological Instrumentation and methodology, 2008, 2nd Revised Edition, P.K. Bajpai, S. Chand and Co. Ltd., New Delhi.

Course Code: 24ZOO12404						
Course Title: Practicals in Cytogenetics						
F.Y. B.Sc SEMESTER-II						
Teaching Pattern				**Evaluation Pattern**		
Course Type **SEC**	**Credits**	**Number of Teaching hours** **(practical)**	**Practical per week**	**Internal Assessment**	**End Semester Exam**	**Total**
Subject **(under vertical 4)**	**02**	**30**	**02**	**20**	**30**	**50**

Course Outcomes :

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

CO1: Students will be aware of the microscopic technique.

CO2: Students will know about the structure of cell organelles.

CO3: Students will get knowledge about isolation and estimation of DNA.

CO4: Students will be able to solve the problems of population genetics.

CO5: Students will gain knowledge about the diseases associated with chromosomal abnormalities.

Sr. No.	Name of the Practical	Practical allotted
1	To study different parts of microscope and visualisation of prokaryotic and eukaryotic cell.	1P
2	Preparation of mitotic slide of onion root tips and observation of cell division.	1P
3	Study of principle and working of PCR and detection of pathogen.	1P
4	To study Barr bodies.	1P
5	Detection of mitochondria by Janus green.	1P
6	Cell viability assay using Trypan blue.	1P
7	Study of Down's syndrome/Turner's syndrome/Klinefelter's syndrome/Patau syndrome.	1P
8	Study of Hardy– Weinberg equilibrium in human population.	1P

9	Detecting defect of colour vision by Ishihara chart.	1P
10	Preparation of Polytene chromosome.	1P
11	To analyse the prevalence of PTC taste sensitivity.	1P
12	Preparation of pedigree charts for blood group, tongue rolling and Colour blindness.	1P
13	Visit to ZSI/ICMR/IISER/Forensic lab and submission of report.	2P

REFERENCES:

1. Gilbert, Daniel F., Oliver Friedrich, and Gilbert. *Cell viability assays*. Springer New York, 2017.
2. Ohlendieck, Kay, and Stephen E. Harding. "Centrifugation and ultracentrifugation." *Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology* 1.2 (2018): 424-453.
3. Alpini, Gianfranco, et al. "Recent advances in the isolation of liver cells." *Hepatology* 20.2 (1994): 494-514.
4. Hill, Ronald J., Margaret R. Mott, and Dale M. Steffensen. "The preparation of polytene chromosomes for localization of nucleic acid sequences, proteins, and chromatin conformation." *International review of cytology* 108 (1987): 61-118.
5. García-Alegría, Alejandro Monserrat, et al. "Quantification of DNA through the NanoDrop spectrophotometer: methodological validation using standard reference material and Sprague Dawley rat and human DNA." *International journal of analytical chemistry* 2020 (2020).
6. Lawless, Harry. "A comparison of different methods used to assess sensitivity to the taste of phenylthiocarbamide (PTC)." *Chemical Senses* 5.3 (1980): 247-256.
7. Ahmad, Faraz, et al. "Simple, reliable, and time-efficient colorimetric method for the assessment of mitochondrial function and toxicity." *Bosnian Journal of Basic Medical Sciences* 18.4 (2018): 367.

Chairman, BOS **Principal**