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

SYLLABUS OF SECOND YEAR ZOOLOGY

S.Y.B.Sc (SEMESTER III AND IV)

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)

Preamble:

Zoology is one of the major subjects of Basic Sciences and deals with all aspects of animal biology. It includes an interesting range of highly diverse topics. A zoology student needs to gain understanding of many areas of the subject to keep pace with advancements in Life Sciences.

This under-graduate degree program has been designed by the Board of Studies in Zoology of Savitribai Phule Pune University with a substantial component of what is needed from a zoologist as a skilled career and what zoologists needs to pursue for post-graduation and further academic studies. It follows the guidelines laid down by the University Grants Commission, New Delhi. This newly designed curriculum is a perfect blend of the classical aspects in Zoology with the advanced and more specialized areas.

This degree offers Discipline Specific Core Courses **[CC]** in Animal Systematics, Animal Ecology, Animal Cell biology, Applied Zoology, Pest Management, Histology, Biological Chemistry, Genetics, Developmental Biology, Parasitology, Medical & Forensic Zoology, Animal Physiology, Molecular Biology, Entomology, Techniques in Biology and Evolutionary Biology.

In addition to the Core Courses, Ability Enhancement Compulsory Courses **[AECC]** have been added in the second year i.e. Semester III and Semester IV of the undergraduate course. In the third year i.e. Semester V and Semester VI, Discipline specific Elective Courses **[DSEC]** and Skill Enhancement Courses **[SEC**] have been offered. The students, therefore, have an opportunity to take courses in Environment Awareness, Language & communication, English / Marathi, Aquarium Management, Poultry Management and Environmental Impact Assessment. In Semester VI the students also have a course dedicated to Project work.

The syllabus has been framed in such a way that the student gains each year, a broader perspective of the subject as he progresses towards completion of the degree program. Field visits, Educational visits and the Project work have been included for the student to experience the applications of the theory learnt in the classroom.

After completion of the program, it is expected that students will understand and appreciate: animal diversity, few applications of Zoology, the structure, functions and life processes at cellular, tissue, organ and system level, significance of evolution, and basic concepts of human health. The students

would also gain an insight into laboratory and field work through the practical course, field work and the project.

The new course will be effective from the academic year 2025- 2026 and will follow the Choice Based Credit System in a Semester mode. It has been primed keeping in view the distinctive requirements of B. Sc. Zoology students. The contents have been drawn-up to accommodate the widening prospects of the discipline of Life Sciences. They reflect the changing pre requisites of the students. This graduate program has been introduced with 144 credits for the subject group while 08 credits to earn from any of the 08 groups offering a range of curricular, co-curricular and extracurricular activities. This pattern has been specially aimed towards the overall development of the students.

The calculation of credits and CGPA will be as per the guidelines of the University. The B. Sc. Zoology program provides an appropriate blend of classical and applied aspects of the subject. This newly designed 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. The Syllabus has been revised with the following aims -

• To foster curiosity in the students for Zoology,

• To create awareness amongst students for the basic and applied areas of Zoology,

• To orient students about the importance of abiotic and biotic factors of environment and their conservation,

• To provide an insight to the aspects of animal diversity,

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

Instructions for the Students:

The students seeking admission to S.Y.B.Sc Zoology course is hereby informed that they are supposed to adhere to the following rules:

1. A minimum of 75 % attendance for lectures / practical is the pre-requisite for grant of term.
2. There shall be tutorial / practical / surprise test / home assignment / referencing of research papers / seminar / industrial visits/Field Visit / training course/viva-voce as a part of internal assessment in each semester. The students are supposed to attend all the tests. The students should note that re-test will not be permitted to the student absent for the test/s unless the case is considered by competent authority.
3. The students opting for dissertation course shall follow the rules framed for the same.

4. The students are supposed to attend all the Industrial Workshops / Laboratory Workshops / Training Programme/ symposia/ seminar/ field visit / study tour organized by the department/ college. The students shall attend these programmes at their own cost.

Examination

[A] Pattern of Examination Evaluation of Students:

1) The In-semester and End-Semester examinations will be of 20 marks each for 2 credits and 40 marks for 4 credits and for End-semester 30 marks for 2 credits and 60 marks for 4 credits.

2) Student has to obtain minimum of 40 % passing separately in both the In-Semester and End- Semester.

3) Internal marks remain unchanged and internal assessment cannot be repeated. If student remain absent during internal assessment examination, he/she will have second chance with the permission of the competent authority. But it will not be right of the student. It will be under the discretion of the competent authority and internal departmental assessment committee. In case he/she wants to repeat Internal, he/she can do so only by registering for the said courses.

5) There shall be revaluation of answer script of end semester examination, but not of internal assessment papers.

i. In-semester Examination:

Internal assessment for each course would be continuous and dates for each tutorials/practical tests etc. will be pre-notified in the time table for teaching or placed separately as a part of time table. Department / College Internal Assessment Committee will coordinate this activity.

a) Theory Courses:

Students should be encouraged to participate in various academic activities. A teacher must select a variety of the procedures for conducting internal assessment suggested as follows.

a) Multiple choice questions

b) Combination of objective and subjective questions.

c) Open book test (concerned teacher will decide the allowed books)

d) Tutorial

e) Surprise test specified topics in a given notified period

f) Oral

g) Assignments

h) Review of research paper

i) Seminar presentation

j) Journal/Lecture/Library notes Student has to preserve the documentation of the internal assessment except midterm test answer script. It is the responsibility of the student to preserve the documents.

b) Practical Courses:

It is a continuous evaluation process. Practical courses will be evaluated on the basis of the following:

1. Performance assessment of each experiment on the basis of attendance, punctuality, journal completion, practical skills, results, oral and analysis.
2. Assessment on practical course be conducted before the end-semester examination.
3. Assessment of each experiment shall be done for each practical weekly.
4. Assessment of the Activity will be based on any one of the following (per practical course).

i. Special training programs in recognized research institutes such as NCL, NIO, NIV, ZSI, BNHS, etc.

ii. Project on Research Methodology

iii. Industrial/Institution Visit report

iv. Field visit report/ study tour repor.

The student strength of practical batch should be 12

Project Course: Project will be evaluated by the examiner/s in consent with the project guide if required.

ii. End-Semester Examination:

The End-semester examination programme will be scheduled as per the notifications and guidelines issued by the Examination section of University of Pune.

[B] Standard of Passing

Student has to obtain 40% marks separately in In-Semester and End-Semester assessment.

Program outcomes (POs):

After successfully completing the S.Y.B.Sc Zoology program students will be able to:

PO1. Zoology knowledge: Apply the knowledge of Zoology, Life Sciences and allied subjects to the understanding of complex life processes and phenomena.

PO2. Problem analysis: Identify, review research literature, and analyse complex situations of living forms.

PO3. Design/development of solutions: Design processes/strategies that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge andresearch methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions in real situations.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources,and ICT tools for understanding of the subject.

Programme Specific outcomes

PSO1: Understand the impact of the natural and anthropogenic activities in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. Identify a range of invertebrates and vertebrates and justify their conservation.

PSO2: Apply ethical principles and commit to professional ethics and responsibilities andnorms of the work/research practice.

PSO3: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

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 (S.Y.B.Sc)**

S.Y. B. Sc					
Course Type	**Course Code**	**SEMESTER III**	**Course Code**	**SEMESTER IV**	**Credits**
Major DSC	24ZOO23101	Cell Biology and Genetics (4C) (T)	24ZOO24101	Mammalian Histology and Physiology (4C) (T)	**4+4**
Major DSC	24ZOO23102	Practicals in Cell Biology and Genetics (2C) (P)	24ZOO24102	Practicals in Mammalian Histology and Physiology (2C) (P)	**2+2**
Major Specific IKS	24ZOO23103	Indian Natural History- Animal Kingdom (2C) (T)			**2+0**
Minor	24ZOO23204	Environment Impact Assessment (2C) (T)	24ZOO24203	Human health, hygiene and Nutrition (2C) (T)	**2+2**
Minor	24ZOO23205	Practicals in Environmental Impact Assessment (2C) (P)	24ZOO24204	Practicals in Food and Nutrition (2C) (P)	**2+2**
OE	24ZOO23306	Fascinating world of Animals (2C) (T)	24ZOO24305	Ethology (2C) (T)	**2+2**
VSEC	24ZOO23407	Practicals in Clinical Hematology (2C) (P)	24ZOO24406	Practicals in Public Health and hygiene (2C) (P)	**2+2**
SEC		-	24ZOO24407	Practicals in Good Laboratory Practices (2C) (P)	**2**
AEC		By College (2C) (T)		By College (2C) (T)	**2+2**
FP	24ZOO23608	Field project (2C) (P)			**2**
CEP			24ZOO24608	Community Engagement program (2C) (P)	**2**
CC		By College (2C) (P)		By College (2C) (P)	**2+2**

				Total credits	**44**

Subject Code: - 24ZOO23101 **Subject Name -: Cell Biology and Genetics** **No. of credits: 04**						
Year : II			**Semester : III**			
Teaching Scheme				**Evaluation Scheme**		
Course Type	**Credits**	**Number of Teaching hours**	**Lectures per week**	**Internal Assessment**	**Semester End Exam**	**Total**
Mandatory Major	**04**	**60**	**02**	**40**	**60**	**100**

Course Outcomes:

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

1. The learner understand the meaning, branches, scope and importance of Cell Biology.
2. To understand the structure and function of various cell organelles present in a cell.
3. To understand the basics the concept of Mendelian & non - Mendelian genetics.
4. Concept and characteristics of multiple alleles, ABO blood group system, Inheritance of Rh antigen, Erythroblastosis foetalis and their medico-legal importance.
5. Understand the structure of chromosomes, chromatin and its types, giant chromosomes and chromosomal aberrations.
6. Successfully solve genetic problems using Punnett squares, probability calculations and pedigree analysis.
7. Recognize and explain the inheritance patterns and molecular basis of common genetic disorders, including both Mendelian and complex traits.

Sr. No.	**Name of the Topic**	**No of lectures allotted**

1	**Unit 1: Cell as Basic unit of Life** 1.1 Introduction to Cell and Cell theory. 1.2 Prokaryotic and Eukaryotic cells. 1.3 Structure of Prokaryotic cell. 1.4 Structure of Eukaryotic cells (Animal and Plant cell).	(04L)
2	**Unit 2: Plasma Membrane** 2.1 Structure of plasma membrane: Fluid mosaic model. 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. 2.4 Functions of Plasma membrane.	(06L)
3	**Unit 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.	(15L)
4	**Unit 4: Cell Division:** 4.1 Cell Cycle. 4.2 Mitosis. 4.3 Meiosis.	(05L)
5	**Unit 5: Recapitulation of Mendelian Genetics:** 5.1 Mendel's work: Selection of experimental plant. 5.2 Mendelian Inheritance: Laws of heredity and their practical applications.	(05L)

	(Monohybrid cross and Dihybrid cross). 5.3 Test cross and back cross.	
6	**Unit 6: Non-Mendelian Genetics:** 6.1 Concept of Gene Interaction. 6.2 Intra-allelic interactions-Dominance. 6.3 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). 6.4 Lethal genes in *Mus musculus*.	(08L)
7	**Unit 7: Multiple alleles** 7.1 Concept and characteristics. 7.2 ABO blood group system, Inheritance of Rh antigen, Erythroblastosis foetalis and their medico-legal importance.	(03L)
8	**Unit 8: Chromosomes** 8.1 Introduction: Morphology and types of chromosomes (based on the position of centromere and involvement in sex determination). 8.2 Chromatin, its structure and its types (Euchromatin and Heterochromatin). 8.3 Giant chromosomes (Polytene chromosome and Lamp brush chromosomes). 8.4 Chromosomal Aberrations: Structural (Deletion, duplication, inversion and translocation) and Numerical (Euploidy, monoploidy, polyploidy - autopolyploidy & allopolyploidy and aneuploidy - monosomy, nullisomy, trisomy).	(06L)
9	**Unit 9: Sex Determination** 5.1 Genetically controlled sex determination: (Heterogametic males: XX - XY & XX - XO systems, Heterogametic females: ZZ - ZW system), Genetic balance system in Drosophila. 5.2 Parthenogenesis and Gynandromorphism.	(04L)

10	**Sex-linked Inheritance:** 6.1 Sex-linked inheritance: Characteristics, types (X - linked, Y - linked, and XY - linked). 6.2 Examples of Sex-linked inheritance: Haemophilia, Colour blindness and Hypertrichosis. 6.3 Linkage-Complete and Incomplete linkage with example.	(04L)
	Total Lectures	60

REFERENCES :

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
3. Biology of the Cell, Gerl and Publ. Inc., New York, 2008.
4. 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.
5. 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.
6. De Robertis, E. D. P. and De Robertis, E. M. F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
7. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
8. Powar, C. B.: Cell Biology, Himalaya Publishing House, Bombay, 1999. Genetics: Verma, P. S. and Agrawal, V. K., S. Chand and Co., New Delhi.
9. Fundamentals of Genetics: B. D. Singh, Kalyani Publishers, New Delhi.
10. Principle of Genetics: Sinnott, Dunn and Dobzhansky, Tata McGraw Hill Edition, New Delhi.
11. Genetics: Gupta, P. K., Rastogi Publication, Meerut.
12. Genetics: Sarin, C., Tata McGraw Hill, New Delhi.
13. Principles of Genetics: Gardner, E. J., Simmons, M. J. and Snustad, D. P., John Wiley and Sons.
14. Cytology and Genetics: Dyan Sagar V. R., Tata McGraw Hill Pub. Co. Ltd., New Delhi.

Subject Code: - 24ZOO23102 Subject Name -: Practicals in Cell Biology and Genetics No. of credits: 02						
Year : II			Semester : III			
Teaching Scheme				Evaluation Scheme		
Course Type	**Credits**	**Number of Teaching hours**	**Practicals per week**	**Internal Assessment**	**Semester End Exam**	**Total**
Mandatory Major	**02**	**30**	**01**	**20**	**30**	**50**

Course Outcomes:

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

CO1: Understand principles and workings of simple and compound microscopes.

CO2: Acquire the skills to accurately measure microscopic objects using micrometry.

CO3: Learn to visualize plant and animal cells under microscope.

CO4: Learn to study various stages of mitosis and meiosis.

Sr. No.	Name of the Practical	Practical allotted
1	Study of principle and working of simple and compound microscope.	1P
2	Measurement of microscopic objects using micrometry.	1P
3	Identification of ultrastructure of different cell organelles from electron micrographs / photographs/video.	1P
4	Staining and visualization of mitochondria by Janus green stain.	1P
5	Preparation of temporary stained squash of onion root tip to study various stages of mitosis.	1P
6	Preparation of temporary stained squash of onion root tip/Grasshopper testis to study various stages of meiosis.	1P

7	Experiments on monohybrid, dihybrid cross ratio and deducing the applicability of Mendelian laws (three examples of each ratio).	1P
8	Experiments on test cross and back cross ratio and deducing the applicability of Mendelian laws (three examples of each ratio.	1P
9	Study of Mendelian genetic traits in human beings (tongue rolling, widow's peak, attachment of ear lobes, colour blindness (Isihara chart) and PTC tasters / non-tasters) using collected data from a limited population/photographs.	1P
10	Study of facultative heterochromatin from humans: Barr body (buccal cells) /Drumstick (Neutrophils).	1P
11	Study of polytene chromosomes from Drosophila / Chironomous larva. (E)	1P

REFERENCES :

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
3. Biology of the Cell, Gerl and Publ. Inc., New York, 2008.
4. 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.
5. 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.
6. De Robertis, E. D. P. and De Robertis, E. M. F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
7. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
8. Powar, C. B.: Cell Biology, Himalaya Publishing House, Bombay, 1999. Genetics: Verma, P. S. and Agrawal, V. K., S. Chand and Co., New Delhi.

Fundamentals of Genetics: B. D. Singh, Kalyani Publishers, New Delhi

Subject Code: - 24ZOO23103 Subject Name -: Indian Natural History- Animal Kingdom No. of credits: 02						
Year : II			Semester : III			
Teaching Scheme				Evaluation Scheme		
Course Type	**Credits**	**Number of Teaching hours**	**Lectures per week**	**Internal Assessment**	**Semester End Exam**	**Total**
Major Specific IKS	**02**	**30**	**02**	**40**	**60**	**100**

Course Outcomes :

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

CO1: Students will be able to learn most of the essential aspects of Evolutionary Biology in detail which will help them in acquiring better understanding regarding the subject.

CO2: Explain important processes, principles and concepts and critically evaluate theories and empirical research within evolutionary biology

CO3: Apply evolutionary theory and concepts to address empirical and theoretical questions in evolutionary biology.

CO4: Independently investigate evolutionary questions using literature and analyses of empirical data.

CO5: Communicate the principles, theories, problems and research results associated with questions that lie within the evolutionary framework to students.

Sr. No.	Name of the Topic	No. of lectures allotted
1	**Unit 1:** The origin of earth and life	(02L)
2	**Unit 2: Theories of evolution** 2.1 Darwinism and Neo-Darwinism.	(04L)

	2.2 Lamarckism. 2.3 Modern synthetic theory.	
3	**Unit 3:** Tools and methods used in evolutionary biology.	(03L)
4	**Unit 4: Geological time scale** 4.1 Eons, Eras, Periods, Epochs and Age.	(03L)
5	**Unit 5: Life in the Precambrian** **5.1** The Cambrian explosion.	(02L)
6	**Unit 6: Age of the Tetrapods** **6**.1 Amniotes and attainment of full territoriality. 6.2 Carboniferous period. 6.3 Devonian period- Age of Fishes. 6.4 Mesozoic era- Golden Age of reptiles. 6.5 Life in the Jurassic and Triassic.	(06L)
7	**Unit 7: Zoogeographical Realms** Palearctic, Nearctic, Neotropical, Ethiopian, Australian, Oriental realms with unique fauna.	(04L)
8	**Unit 8: Indian Natural History Museums,** IKS Centre for Animal Science	(02L)
9	**Unit 9: Antiquity of Man:** Stages in Human evolution- Australopithecus, Kenyapithecus, Homo habilis, Homo erectus, Cromagnon, Neanderthal, Homo sapiens.	(04L)

REFERENCES:

1. Mark Ridley. Evolution. 3rd Edition. Blackwell Publishing. (2004).
2. Mathur, Tomar, Singh. Evolution and Behaviour. Rastogi Publication, Merrut.
3. Mohan P. Arora. Evolutionary Biology, Himalaya Publishing House, Bombay.
4. P. S. Vermin and V. K. Agarwal. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, Revised Edition. S. Chand Publication (2004).
5. Strickberger. Evolution. Prentic Hall. (2002).
6. Theodore H., Jr Eaton. Evolution. 1st Edition. W. W. Norton Publication. (1970).

Organic Evolution, Richard Swann Lull, Light & Life Publishers.

Subject Code: - 24ZOO23204 Subject Name -: Environmental Impact Assessment (Minor) No. of credits: 02						
Year : II			Semester : III			
Teaching Scheme				Evaluation Scheme		
Course Type	**Credits**	**Number of Teaching hours**	**Lectures per week**	**Internal Assessment**	**Semester End Exam**	**Total**
Minor	**02**	**30**	**02**	**20**	**30**	**50**

Course Outcomes:

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

CO1: Describe the branches and scope of Environmental biology, emphasizing its environmental importance.

CO2: Understand impact of pollution on wildlife, natural resources and development..

CO3: Understand concept of sustainable development.

CO4: Students understand the Environment protection acts, environment impact assessment process and agencies associated with it.

Sr. No.	Name of the Topic	No of lectures allotted
1	**Unit 1: Environment** 1.1 Definition. 1.2 Divisions. 1.3 Importance.	(02L)
2	**Unit 2: Pollution** 2.1 Definition and types. 2.2 Impact on wildlife, natural resources, development.	(03L)
3	**Unit 3: Sustainable development:**	(02L)

	3.1 Definition and need. 3.2 Exploitation of natural resources. 3.3 Concept of carrying capacity. 3.4 Three pillars of Sustainability. 3.5 UN 17 Sustainable Development Goals (SDGs).	
4	**Unit 4: Overview of Environmental Protection acts:** 4.1 The Air (Prevention and Control of Pollution) Act 1981. 4.2 The Water (Prevention and Control of Pollution) Act 1974. 4.3 The Environment Protection Act 1986. 4.4 The National Green Tribunal Act 2010. 4.5 Biological Diversity Act 2002.	(05L)
5	**Unit 5: Environmental Impact Assessment (EIA):** 5.1 Definition, need and importance of EIA. 5.2 EIA notification 2006 - key elements, History and Evolution of EIA. 5.3 Categories of Industries / establishments requiring EIA, Types of EIA - strategic EIA, regional EIA, sectoral EIA, project level EIA and life cycle assessment. 5.4 Rapid and comprehensive EIA.	(05L)
6	**Unit 6: EIA Process:** 6.1 Screening, Scoping and consideration of alternatives. 6.2 Baseline data collection, Impact analysis, Mitigation, Reporting, Public hearing. 6.3 Review of EIA. 6.4 Decision-making, monitoring clearance conditions. 6.4 Case study based on EIA.	(05L)
7	**Unit 7: Stakeholders in EIA process:** 7.1 Project proponent, Environmental consultant. 7.2 CPCB / MPCB. 7.3 Public, EIA agency (IAA).	(03L)

8	**Overview of Scheme for Accreditation of EIA Consultant Organizations (NABET / QCI):** 8.1 Eligibility and benefits. 8.2 EIA coordinator (EC), Functional area experts (FAEs). 8.3 Functional area associate (FAA) and team members: Role, educational qualification, experience and functions.	(05L)
	Total Lectures	30

REFERENCES:

1. Fundamentals of Ecology - M C Dash, Tata Mcgraw-Hill Publishing Co. Ltd.1998

2. Concepts of Ecology - Edward J. Kormondy, Prentice-Hall Of India Pvt. Ltd.1996

3. Ecology - Mohan P. Arora, Himalaya Publishing House, 2004

4. Environmental Biology-Biswarup Mukherjee, Tata Mcgraw-Hill Publishing Co.Ltd,1996

5. Fundamentals of Ecology-Eugene P. Odum, Natraj Publishers, 199.

6 Environmental Education - Nagarajan and Sivakumar. P, Ram Publishers, Chennai, (2002). 7. A text book of Environment - Agarwal. K. M. Sikdar. P. K. and Deb. S. C, Mac Miller India Ltd., Calcutta, (2002).

Subject Code: - 24ZOO23205 **Subject Name -: Practicals in Environmental Impact Assessment** **No. of credits: 02**	
Year : II	**Semester : III**
Teaching Scheme	**Evaluation Scheme**

Course Type	Credits	Number of Teaching hours	Practicals per week	Internal Assessment	Semester End Exam	Total
Minor	**02**	**30**	**01**	**20**	**30**	**50**

Course Outcomes:

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

CO1: Describe the need and importance of environmental monitoring in environmental engineering field and problems associated with it.

CO2: Acquire the skills to use different sampling techniques.

CO3 Prepare different solutions during analytical procedures for determination of water and air pollutants content.

CO4: The students will be exposed to various standard protocols used in environmental monitoring.

Sr. No.	Name of the Practical	Practical allotted
1	Study of a simple ecosystem (Suggested Habitats: Pond/ Grassland/ Forest) And Description of The Biotic And Abiotic Components of The Ecosystem	1P
2	Study of effects of human interaction with Natural Environment	1P
3	Survey of vegetation, birds, insects and other animals in an area	1P
4	Study of any environmental problem of your locality and suggest corrective measures for the same.	1P
5	Identifying the sources of pollution in water obtained from different sources.	1P
6	Study of physiochemical properties of water & soil sample.	1P
7	Study of role of biological indicators in an ecosystem.	1P
8	To determine the biological oxygen demand of the given water sample.	1P
9	To determine the dissolved oxygen content of the given water sample.	1P
10	Study of biodiversity indices (Shannon/Simpson).	1P
11	Study of insects by pitfall trap.	1P

142	Visit to an ecosystem and assessment of biodiversity using quadrat method (line or belt transect method).	2P

REFERENCES:

1. Radojevic M. and Valdimir N.B. (2006) Practical Environmental Analysis, RSC publishing.

2. APHA (1980) Standard Methods for the Examination of Water and Wastewater Published by American Public Health Association, 15th ed.

Suggested readings

1. Kim Y.J. and Platt U. (Eds.) (2008) Advanced Environmental Monitoring, XXII, 420 p. Springer.

2. Laboratory Analytical Techniques Series (LATS), published by CPCB.

3. Roa M. (2008) Environmental Science Activities Kit, Jossey-Bas.

4. Wagner T.P. and Robert S. (2009) Environmental Science: Active Learning Laboratories and Applied Problem Sets, 2nd Edition, Wiley.

5. Wells E. (2009) Lab Manual for Environmental Science, Cengage Learning

Case studies

Subject Code: - 24ZOO23306

Subject Name -: Fascinating World of Animals

No. of credits: 02

Year : II			**Semester : III**			
Teaching Scheme				**Evaluation Scheme**		
Course Type	**Credits**	**Number of Teaching hours**	**Lectures per week**	**Internal Assessment**	**Semester End Exam**	**Total**
Open Elective	**02**	**30**	**02**	**40**	**60**	**100**

Course outcomes:

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

CO1: Define the basic information about differences between the vertebrate and invertebrate world.

CO2: Understand the interesting facts about the invertebrate animals.

CO3: Knowledge of the interesting features of the vertebrate animals.

CO4: Apply the knowledge of animals in the real world.

Sr. No.	Name of the Topic	No. of lectures allotted
1	**Unit 1: Amazing facts of the invertebrate world -I** 1.1 World in a drop of water. 1.2 Use of bath sponge/ Portuguese man of war.	(02L)
2	**Unit 2 : Amazing facts of the invertebrate world -II** 2.1 Budding in Hydra. 2.2 Stinging in Jellyfish. 2.3 Coral reefs. 2.4 Bioluminescence in Ctenophora. 2.5 Earthworms- friend of farmers.	(04L)
3	**Unit 3: Amazing facts of the invertebrate world -III** 3.1 Use of Honey bees for honey, wax, royal jelly, propolis, pollinators. 3.2 Harvesting of silkworms in making silk garments. 3.3 World of butterflies. 3.4 Use of insects as bioindicators and in Forensic Science. 3.5 Web formation in spiders/ venomous scorpions and spiders.	(04L)
4	**Unit 4: Amazing facts of the invertebrate world -IV** 4.1 Octopus as Devilfish. 4.2 World under water- Shells and pearls.	(02L)
5	**Unit 5: Amazing facts of the invertebrate world -V** 5.1 Regeneration in Starfish and Planaria. 5.2 Types of Parasites and diseases.	(03L)
6	**Unit 6: Amazing facts of the vertebrate world -I** 6.1 World of fishes.	(04L)

	6.2 Nesting behaviour in Turtles. 6.3 Venomous and non venomous snakes. 6.4 Camouflage in Chameleon.	
7	**Unit 7: Amazing facts of the vertebrate world -II** 7.1 Winter sleep and summer sleep in frogs and bear. 7.2 Parental care in Animals.	(02L)
8	**Unit 8: Amazing facts of the vertebrate world -III** 8.1 Migration in birds and fishes. 8.2 Nest building behaviour in birds. 8.3 Echolocation in bats.	(03L)
9	**Unit 9: Amazing facts of the vertebrate world -IV** 9.1 Porpoising in penguins. 9.2 Exciting facts about whales, dolphins and walruses.	(02L)
10	**Unit 10: Amazing facts of the vertebrate world -V** 10.1 Interesting features of Animals as pets. 10.2 Police dog squad- K9 dog. 10.3 Facts about big cats.	(02L)
11	**Unit 11: Amazing facts of the vertebrate world -VI** 11.1 Animal Human coexistence with suitable example. 11.2 Similarities between monkeys, apes and man.	(02L)
	Total no. of lectures	30

REFERENCES:

1.Barnes, R. S. K.; Calow, P.; Olive, P. J. W.; Golding, D. W.; Spicer, J. I. (2002) The Invertebrates: a Synthesis, Blackwell Publishing.

2. Hickman, C.; Roberts, L.S.; Keen, S.L.; Larson, A. and Eisenhour, D. (2018) Animal Diversity, McGraw-Hill.

3. Holland, P. (2011) The Animal Kingdom: A Very Short Introduction, Oxford University Press.

4. Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4th edition), McGraw- Hill.

5. Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S.and Nelson.

6. Integrated Principles of Zoology, Eleventh Edition, Hickman CP, Roberts LS & Larson A. International Edition ISBN 0–07–118077–X, The McGraw-Hill Companies, Inc.,

Course Code: 24ZOO23407						
Course Title: Practicals in Clinical Hematology						
Year : II			**Semester : III**			
Teaching Pattern				**Evaluation Pattern**		
Course Type	**Credits**	**Number of Teaching hours**	**Practicals per week**	**Internal Assessment**	**End Semester Exam**	**Total**
VSEC	**02**	**30**	**02**	**20**	**30**	**50**

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	Study of human blood composition	1P
2	Estimation of blood glucose by anthrone method.	1P
3	Estimation of bleeding time and clotting time	1P
4	Differential Leucocyte Count.	1P
5	Study of normal reference range of blood.	
6	Estimation of Serum urea/creatinine	1P

7	Determination of normal and abnormal constituents of blood	1P
8	Reticulocyte count and its clinical significance.	1P
9	Study of ABO and Rh system and its significance	1P
10	Estimation of haemoglobin percentage by using haemoglobinometer	1P
11	Visit to a pathology lab to understand the analysis of blood samples to detect various pathological conditions in humans.	2P
12	Study based on clinical reports.	1P

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

Course Code: 24ZOO23608	
Course Title: Field Project (FP)	
Year : II	**Semester : III**

Teaching Pattern				Evaluation Pattern		
Course Type	Credits	Number of Teaching hours	Practicals per week	Internal Assessment	End Semester Exam	Total
VSEC	02	30	02	20	30	50

SEMESTER IV

Subject Code: - 24 ZOO24101 Subject Name -: Mammalian Histology and Physiology No. of credits: 04						
Year : II			Semester : IV			
Teaching Scheme				Evaluation Scheme		
Course Type	Credits	Number of Teaching hours	Lectures per week	Internal Assessment	Semester End Exam	Total
Mandatory Major	04	60	04	40	60	100

Course Outcomes:

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

CO1: The students will be able to identify, understand and classify the different types of tissue.

CO2: The students will understand the complexity of various tissues in an organ.

CO3: The students will understand the concept of energy requirements.

CO4: The students will be able to understand various aspects of Digestive and excretory physiology.

CO5: The students will be able to develop understanding in Structure and functions of muscles.

CO6: The students will gain knowledge about the process of formation of gametes and function of endocrine glands.

Sr. No.	Name of the Topic	No. of lectures allotted
1	**Unit 1:- Introduction to Histology** 1.1 Definition and Scope of Histology. 1.2 Introduction to Fixation and Staining- Types of Fixatives and Stains. 1.3 Introduction to microtechniques- Microtome and Cryotome.	(01L)
2	**Unit 2: Definitions and Review of Types of Tissues:** 2.1 Epithelial tissue. 2.2 Connective tissue. 2.3 Nervous tissue. 2.4 Muscular tissue.	(03L)
3	**Unit 3: Histological study of following mammalian organs**: 3.1 V.S of Skin 3.2 V.S. Tooth 3.3 C.S. of Tongue with reference to mucosa papillae and taste buds.	(05L)
4	**Unit 4: Histological study of Alimentary canal and Liver:** 4.1 T.S. of Oesophagus 4.2 T.S of Stomach 4.3 T.S. Duodenum 4.4 T.S. Rectum 4.5 C.S. of Liver	(06L)
5	**Unit 5: Histological study of Respiratory organs:** 5.1 T.S. of Trachea 5.2 C.S of Lung	(02L)
6	**Unit 6:-** : **Histological study of Excretory organs:** 6.1 Kidney (L. S.). 6.2 Juxtaglomerular complex.	(03L)
7	**Unit 7: Histological study of Reproductive and Endocrine organs**	(04L)

	7.1 T.S of Testis with reference to Seminiferous Tubules and Cells of Leydig. 7.2 C.S of Ovary 7.3 L.S. of Pituitary gland. 7.4 T.S. of Thyroid gland. 7.5 T.S. of Adrenal gland. 7.6 C.S. of Pancreas including both exocrine and endocrine components.	
8	**Unit 8: Nutrition and Digestion:** 8.1 Nutritional requirement & balanced diet. 8.2 Digestion and absorption of carbohydrates, proteins and lipids. 8.3 Vitamins - outline of fat soluble and water-soluble vitamins; dietary sources and deficiency disorders.	(06L)
9	**Unit 9: Respiration** 9.1 Characteristics of respiratory tissue. 9.2 Types of respiration: Internal and External. 9.3 Mechanism of respiration: Regulation of ventilation in lungs, exchange of gases at respiratory surface. 9.4 Haemoglobin and Transport of gases : O2 and CO2 transport.	(06L)
10	**Unit 10: Circulation** 10.1 Blood: Definition and its constituents, functions of blood. 10.2 Heart: Structure of human heart, Pace maker, Cardiac Cycle. 10.3 Origin and conduction of heart beat.	(05L)
11	**Unit 11: Excretion** 11.1 Structure of Uriniferous tubule. 11.2 Mechanism of urine formation. 11.3 Normal and abnormal constituents of urine, Elementary idea of dialysis.	(04L)
12	**Unit 12: Muscle physiology** 12.1 Structure of smooth, skeletal and cardiac muscles. 12.2 Mechanism of muscle contraction by Sliding filament theory.	(03L)

13	**Unit 13: Reproduction and Endocrine Glands** 13.1 Structure of sperm and spermatogenesis, Physiology of male reproduction. 13.2 Structure of ovum and oogenesis, Physiology of female reproduction. 13.3 Hormones and functions of pituitary, thyroid, parathyroid, pancreas and adrenal glands.	(06L)
	Total no. of lectures	60

REFERENCES:

1. A Text Book of Histology, 2014, 5th Edn. Krishna Garg, Indira Bahl & Mohini Kaul CBS Publication & Distributors, Delhi.

2. Histology, 1987, 9th Edn., Arthur W. Ham, David H. Cormack, J. B. Lippincott Co. Philadelphia.

3. Histology, 1977, 4th Edn., R. O. Greep and L. Weiss, McGraw Hill Int. Book Co., New York.

4. Hand Book of Histo-pathogical & Histo-chemical Techniques, 1983, 3rd Edn. reprint, Butterworth & Co. (Publishers) Ltd, UK.

5.Textbook of Medical Physiology, Guyton A. C. & Hall J. E., 2006, 11th Edition, Hercourt Asia Pvt. Ltd. / W. B. Saunders Company

6. Principles of Anatomy & Physiology, 2006, 11th Edition, Tortora G. J. & Grabowski S., John Wiley & sons, Inc.

7. Haematology: De Gruchi.

8. Human physiology, Vol. I & II, 1980, 12th Edn. Dr. C. C. Chatterjee, Medical Applied Agency, Kolkata

9. Text book of Animal Physiology, 2008, 2nd Edn. Nagabhushanam, S. V. S. Rana, S. Kalavathy, Oxford University Press, India.

10. Animal Physiology: Adaptation and Environment, 1997, Schmidt-Nielsen, Knut, Cambridge University Press.

11. General and Comparative Physiology, 1983, 3rd Edn., Hoar W. S., Prentice Hall, UK.7.

12. Medical Physiology, 2006, Asis Das, Books and Allied Pvt. Ltd., Kolkata.

Subject Code: - 24 ZOO24102 Subject Name -: Practical in Mammalian Histology and Physiology No. of credits: 02						
Year : II			Semester : IV			
Teaching Scheme				Evaluation Scheme		
Course Type	Credits	Number of Teaching hours	Practicals per week	Internal Assessment	Semester End Exam	Total
Mandatory Major	02	30	01	20	30	50

Course Outcomes:

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

CO1: To understand the classification of various types of basic tissues.

CO2: To study structure & functions of various tissues in organ system.

CO3: To understand histological structure of various glands and its functions.

CO4: To acquaint students with the principles and basic facts of Animal Physiology

CO5: To acquaint students with some of the laboratory techniques and equipment used in the gaining of physiological facts

Sr. No.	Name of the Practical	Practical allotted
	Section I: Practicals in Mammalian Histology	
1	Study of the different types of tissues with the help of permanent slides – Epithelial tissue, Connective tissue, Muscular tissue and Nervous tissue.	1P
2	Study of permanent histological slides of T. S. of skin, V. S. of tooth and C. S. of tongue.	1P
3	Study of permanent histological slides of digestive parts – T. S. of Stomach, T. S. of Duodenum, T. S. of Rectum, C. S. of Liver.	1P
4	Study of permanent histological slides of glands - T. S. of Pituitary gland, T. S. of Thyroid gland, T. S. of Adrenal gland, C. S. of Pancreas.	1P
5	Study of permanent histological slides of reproductive organs- T. S. of Testis,	1P

	C. S. of Ovary.	
6	Temporary mounting of smooth / skeletal muscle fibre	1P
Section II: Practicals in Mammalian Physiology		
1	Measurement of blood pressure and oxygen saturation level in humans.	1P
2	Effect of exercise on breathing rate.	1P
3	Estimation of cholesterol from the given sample.	1P
4	Determination of vital capacity of lungs by respirometer.	1P
5	To study the total count of Leucocytes.	1P
6	To study the total count of RBC.	1P
7	Estimation of lactic acid in muscles/blood.	1P

REFERENCES:

1. Histology, 1977, 4th Edn., R. O. Greep and L. Weiss, McGraw Hill Int. Book Co., New York.

2. Hand Book of Histo-pathogical & Histo-chemical Techniques, 1983, 3rd Edn. reprint, Butterworth & Co. (Publishers) Ltd, UK.

3. Principles of Anatomy & Physiology, 2006, 11th Edition, Tortora G. J. & Grabowski S., John Wiley & sons, Inc.

4. Haematology: De Gruchi.

5. Human physiology, Vol. I & II, 1980, 12th Edn. Dr. C. C. Chatterjee, Medical Applied Agency, Kolkata

Subject Code: - 24 ZOO24203 Subject Name -: Human Health Hygiene & Nutrition No. of credits: 02						
Year : III			Semester : IV			
Teaching Scheme				Evaluation Scheme		
Course Type	Credits	Number of Teaching hours	Lectures per week	Internal Assessment	Semester End Exam	Total
Minor	02	30	02	20	30	50

Course Outcomes:

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

CO1: Understand the relationship between nutrition, health, and fitness.

CO2: Have a knowledge of the life style related diseases.

CO3: Analyse the good indicators of health.

CO4: Understand the indicators of Good health.

Sr. No.	Name of the Topic	No. of lectures allotted
1	**Unit 1: Concept of health** 1.1 Definition and concept of health (WHO). 1.2 Major nutritional Deficiency diseases- (kwashiorkor and marasmus), Deficiency disorders, their causes, symptoms, treatment, prevention and government programmes,	(05L)
2	**Unit 2: Life style related diseases** 2.1 Life style related diseases- hypertension, diabetes mellitus, 2.2 Atherosclerosis and obesity- their causes and prevention through dietary and lifestyle	(05L)

	modifications. 2.3 Social health problems- smoking, alcoholism, drug.	
3	**Unit 3: Indicators of Good Health** 3.1Pulse rate, Blood Pressure, Temperature, Respiratory rate, weight. 3.2 Body Mass Index (BMI) Cholesterol (lipid profile) ,Blood sugar (HbA1c) Complete blood count (CBC). 3.3 Liver Test, Thyroid test.	(05L)
4	**Unit 4: Food and infections** 4.1 Bacterial infection: typhoid fever, dysentery. 4.2 Viral infection: Hepatitis, Poliomyelitis. 4.3 Protozoan infection: amoebiasis, giardiasis. 4.4 Parasitic infection: taeniasis and ascariasis their transmission, causative agent, sources of infection, symptoms and prevention. 4.4 Brief account of food spoilage: Causes of food spoilage and their preventive measures.	(05L)
5	**Unit 5: Human Nutrition** 5.1 Nutrition and Balanced diet. 5.2 Carbohydrates: Type, Source, Function, Dietary requirements and physiological significance. Glycaemic index of foods. 5.3 Proteins: Type, Source, Function, Dietary requirements. Evaluation methods and improvement of protein quality.	(05L)
6	**Unit 6: Vitamins** 6.1 Types and Source of Fat soluble and Water soluble vitamins. Function, Dietary requirements, Deficiency and Toxicity of Fat soluble and Water soluble vitamins.	(02L)
7	**Unit 7: Role of Minerals** 7.1Role of Minerals: Macro minerals: calcium, phosphorus, magnesium, sodium, potassium and chloride. 7.2 Micro minerals: Iron, copper, zinc, manganese, iodine, fluoride. Trace minerals: selenium, cobalt, chromium.	(03L)

REFERENCES:

1) Mudambi, SR and Rajagopal, MV. Fundamentals of Foods, Nutrition and Diet Therapy; Fifth Ed; 2012; New Age International Publishers

2) Park and Park Park's Textbook of Preventive and Social Medicine, Book by K. Park

3) Mudambi, SR, Rao SM and Rajagopal, MV. Food Science; Second Ed; 2006; New Age International Publishers

4) Srilakshmi B. Nutrition Science; 2012; New Age International (P) Ltd.

5) Srilakshmi B. Food Science; Fourth Ed; 2010; New Age International (P) Ltd.

6) Swaminathan M. Handbook of Foods and Nutrition; Fifth Ed; 1986; BAPPCO.

7) Bamji MS, Rao NP, and Reddy V. Text Book of Human Nutrition; 2009; Oxford & IBH Publishing Co. Pvt Ltd

. 8) Wardlaw GM, Hampl JS. Perspectives in Nutrition; Seventh Ed; 2007; McGraw Hill.

9) Lakra P, Singh MD. Textbook of Nutrition and Health; First Ed; 2008; Academic Excellence.

10) Manay MS, Shadaksharaswamy. Food-Facts and Principles; 2004; New Age International (P) Ltd.

Subject Code: - 24ZOO24204 **Subject Name -: Practicals in Food and Nutrition** **No. of credits: 02**						
Year : II			**Semester : IV**			
Teaching Scheme				**Evaluation Scheme**		
Course Type	**Credits**	**Number of Teaching hours**	**Practicals per week**	**Internal Assessment**	**Semester End Exam**	**Total**
Minor	**02**	**30**	**01**	**20**	**30**	**50**

Course Outcomes:

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

CO1: Describe the need and importance of assessment of food adulterants

CO2: Build competent professionals in the field of food industry, health care sector to address societal & national needs.

CO3: Understand chemical function and properties of major food components.

CO4: Know the effects of chemical reactions of food components on the quality of food.

Sr. No.	Name of the Practical	Practical allotted
1	Study of disorders caused due to protein and energy malnutrition	1P
2	Study of anthropometry (measuring of height, weight and upper arm circumference)	1P
3	Prepare diet plan for healthy and malnourished persons	1P
4	Study of therapeutic diet plans (diabetes, hypertension, renal diseases)	1P
5	To detect the presence of adulterants in fat oil and butter.	1P
6	To detect the presence of adulterants in sugar/milk/paneer.	1P
7	To detect the presence of adulterants in sample of chilli powder, turmeric powder and pepper.	1P
8	Analysis of macro and micronutrients from the given food material.	1P
9	Study of different food preservatives and their analysis.	1P
10	Study of common food preservation techniques.	1P
11	Visit to food safety laboratory	2P

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). Text Book 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.

Subject Code: - 24ZOO24305 **Subject Name -: Ethology** **No. of credits: 02**						
Year : II			**Semester : IV**			
Teaching Scheme				**Evaluation Scheme**		
Course Type	**Credits**	**Number of Teaching hours**	**Lectures per week**	**Internal Assessment**	**Semester End Exam**	**Total**
Open elective	**02**	**30**	**02**	**20**	**30**	**50**

Course Outcomes:

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

CO1: Understand the meaning, branches, scope and concept of Ethology.

CO2: Know the basic principles of Ethology.

CO3: Analyse the scientific methods in studying animal behaviour.

CO4: Evaluate the advancements and applications in the field of Ethology.

Sr. No.	Name of the Topic	No. of lectures allotted
1	**Unit 1: Introduction to the study of Animal Behaviour** 1.1 Definition and Meaning of Ethology. 1.2 History of Ethology. 1.3 Branches of Ethology 1.4 Scope of Ethology.	(04L)

2	**Unit 2: Concepts of Ethology** 2.1 Motivation. 2.2 Fixed Action Patterns (FAP). 2.3 Sign or key stimulus or Releasers. 2.4 Innate Releasing Mechanism (IRM). 2.5 Physiological basis. 2.6 Imprinting. 2.7 Evolution of behaviour.	(06L)
3	**Unit 3: Methods of studying behaviour** 3.1 Introduction to methods of studying behavior. 3.2 Methods of studying behaviour in Laboratory and Wild. 3.3 Identification, Naming and Locating of Individuals in Wild.	(06L)
4	**Unit 4: Learning and Memory** 4.1 Definition and meaning of learning and memory. 4.2 Types of learning. 4.3 Theories and laws of learning.	(05L)
5	**Unit 5: Hormones and behavior** 5.1 Definition and meaning of hormones. 5.2 Hormones of Gonads. 5.3 Hormones of Adrenal gland. 5.4 Hormones of Pituitary gland. 5.5 Effects of hormones on different behavioral patterns. 5.6 Paternal-Maternal behavior; Parent-young one bond.	(05L)

6	**Unit 6: Social Organisation, Social behavior and Communication** 6.1 Introduction- Definition and meaning of social organization, social behaviour and communication. 6.2 Social organization in Honey bees, termites, monkeys and Lion; Altruism, Kin-selection.	(04L)
	Total Lectures	30

REFERENCES :

1."Animal Behavior: An Evolutionary Approach" by John Alcock.

2."The Behavior of Animals: Mechanisms, Function And Evolution" by Luc–Alain Giraldeau and Johan Bolhuis.

3. “Animal Behaviour”: A textbook by Reena Mathur.

4. Animal Behaviour : A textbook by S. Chand.

Subject Code: - 24ZOO24406 **Subject Name -: Practicals in Public Health and Hygiene** **No. of credits: 02**						
Year : II			**Semester : IV**			
Teaching Scheme				**Evaluation Scheme**		
Course Type	**Credits**	**Number of Teaching hours**	**Practicals per week**	**Internal Assessment**	**Semester End Exam**	**Total**
VSEC	**02**	**30**	**01**	**20**	**30**	**50**

Course Outcomes:

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

CO1: Define and describe the concepts of hygiene and sanitation.

CO2: Explain the concepts of health and the parameters used for assesment.

CO3: Analyse different methods to examine the different types of disease causing agents.

CO4: Get an exposure to various standard measures used in understanding the epidemiology of a disease.

Sr. No.	Name of the Practical	Practical allotted
1	Determination of individual overall health level.	1P
2	Assess the nutritional status by weight and height of a person (BMI).	1P
3	Calculate Ideal Body Weight (IBW), Total energy expenditure, physical activity level (PAL), etc.	1P
4	Collection and interpretation of local data on diseases prevalence.	1P
5	Case study on recent disease outbreak.	1P
6	Demonstration of medically important entomological specimens.	1P
7	Preparation and examination of peripheral blood smear.	1P
8	Microscopic examination of Fungi.	1P
9	Microscopic examination and staining techniques for bacterial strains.	1P
10	Visit to a clinic/ pathological laboratory/local hospital.	1P
11	Visit to a local surrounding community and preparation of health card of volunteers.	1P

REFERENCES:

1.Bamji, M.S., K. Krishnaswamy & G.N.V. Brahmam (2009) Textbook of Human Nutrition(3rd edition) Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi

2.Swaminathan (1995)Food & Nutrition(Vol I, Second Edition) The Bangalore Printing &Publishing Co Ltd., , Bangalore

3.Vijaya Khader (2000)Food, nutrition & health, Kalyan Publishers, New Delhi

4.Srilakshmi, B., (2010)Food Science, (5th Edition) New Age International Ltd., New Delhi

India Institute of Hygiene and Public Health: http://aiihph.gov.in/healthin-india-2016

5. Park, K. (2009). Preventive and Social Medicine. Jabalpur: M/s Banarsidas Bhanot. – ¬Park, W. H. (2019).

7. Introduction to Community and Public Health. USA: John Wiley & Sons. – Swachh Bharat Mission: http://swachhbharatmission.gov.in/sbmcms/index.htm

Subject Code: - 24ZOO24407 Subject Name -: Practical in Good Laboratory Practices No. of credits: 04						
Year : II			Semester : III			
Teaching Scheme				Evaluation Scheme		
Course Type	**Credits**	**Number of Teaching hours**	**Practicals per week**	**Internal Assessment**	**Semester End Exam**	**Total**
SEC	**02**	**30**	**01**	**20**	**30**	**50**

Course outcomes:

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

CO1: Understand the basic calibration and handling of instrumentation in laboratory.
CO2: Safely practice, basic laboratory procedures and protocols in the laboratory.
CO3: Maintain laboratory records, complaints with current industry standards.
CO4: Have a knowledge of the maintenance of the audit records.

Sr. No.	Name of the practical	Practical allotted
1.	Introduction to Good laboratory practices and Standard operating procedures.	2P
2.	Protocols for Lab safety measures.	1P
3	Precaution and Safety in handling of chemicals, Laboratory tools, Glassware and instruments.	2P
4	Use of safety symbols: meaning, types of hazards and precautions.	1P
5	Waste disposal management and segregation of wastes based on OECD principles.	
6	Log Book Maintenance, Basic SOPs for instrument handling and Maintenance.	1P

7	Calibration of Instruments.	2P
8	Use of Microsoft word, Excel. (For Data entry, calculation and graphical representation).	2P
9	Keeping data records, its analysis by using statistical and mathematical tools. Result analysis and its interpretation.	2P

Subject Code: - 24ZOO24608
Subject Name -: Community Engagement Program
No. of credits: 02

Year : II **Semester : IV**

Teaching Scheme				Evaluation Scheme		
Course Type	**Credits**	**Number of Teaching hours**	**Practicals per week**	**Internal Assessment**	**Semester End Exam**	**Total**
CEP	**02**	**30**	**01**	**20**	**30**	**100**

Chairman, BOS **Principal**