

**KAVAYITRI BAHINABAI CHAUDHARI NORTH
MAHARASHTRA UNIVERSITY, JALGAON**

॥ अंतरी पेटवू ज्ञानज्योत ॥



Faculty: Science and Technology

**Semester wise Code structure and Syllabus for
Bachelor of Science
(Honours and Honours with Research)**

F. Y. B. Sc. Zoology

As per NEP2020 for Affiliated Colleges

**With Effect From
June 2024**

Program at a Glance

Name of the program (Degree)	: B. Sc.
Subject	: Zoology
Faculty	: Science and Technology
Duration of the Program	: Three years (four semesters) / Four years (six semesters)
Medium of Instruction and Examination	: English
Credits of the program	: Total 176 credits
Examination Pattern	: The 30: 20 (30 marks University assessment (exam) and 20 marks continuous internal college assessment (exam))
Evaluation mode	: CGPA
Passing standards	: The 40% in each exam separately (separate head of passing)
Result	: As per the University's rules of CGPA system

1. Introduction to Program in B.Sc. (Hons. / Hons. With Research) Zoology

Welcome to the Graduate Program in Zoology! Our program offers an exciting and comprehensive curriculum designed to equip students with the knowledge, skills, and practical experience necessary to understand and contribute to the fascinating field of zoology. Zoology encompasses the study of animal life in all its diversity, from microscopic organisms to complex vertebrates.

As a graduate student in Zoology, you will have the opportunity to delve deep into the intricacies of animal biology, behavior, evolution, and ecology. Our program emphasizes a multidisciplinary approach, combining theoretical knowledge with hands-on experiences in the field and laboratory settings. You will have access to state-of-the-art facilities, research opportunities, and a dedicated faculty who are passionate about sharing their expertise and mentoring the next generation of zoologists.

Throughout your journey in our program, you will develop a strong foundation in core zoological concepts. You will explore topics such as taxonomy, physiology, anatomy, evolution, animal behavior, and ecological interactions. You will also gain a comprehensive understanding of the principles and methodologies employed in the study of animals, including data collection, analysis, and interpretation.

Fieldwork and practical experiences are integral to our program. You will have the opportunity to engage in field expeditions, ecological surveys, and hands-on research projects. These experiences will allow you to observe and study animals in their natural habitats, contributing to our understanding of biodiversity, conservation, and the ecological dynamics of various ecosystems.

Communication and critical thinking skills are emphasized throughout the program. You will learn to effectively communicate scientific concepts, both in written and verbal forms, and present your research findings to diverse audiences. We also encourage collaboration and interdisciplinary approaches, as zoology intersects with numerous other scientific disciplines, including genetics, ecology, physiology, and conservation biology.

Our program is designed to prepare you for a wide range of career paths. Whether you aspire to pursue further studies, conduct cutting-edge research, or work in fields such as wildlife management, conservation, education, or science communication, the Graduate Program in Zoology will provide you with the necessary skills and knowledge to succeed. You will also develop a deep appreciation for the ethical considerations associated with studying and working with animals and contribute to the responsible stewardship of our natural world.

We are excited to have you join our vibrant and dynamic community of zoologists. Together, we will explore the wonders of the animal kingdom, push the boundaries of scientific knowledge, and make meaningful contributions to the field of zoology. Get ready for an enriching and transformative journey in the Graduate Program in Zoology!

UG Department of ZOOLOGY - Programme Outcomes (PO)

PO No.	On completion of B.Sc. Degree programme, the graduates will be able to
PO-1	Thorough knowledge and understanding of the theories, models, concepts and principles of zoology and related zoological applications.
PO-2	Recognize the relationship between parts of different species, our physical, biological and cultural environment.
PO-3	Gain an understanding of the evolutionary history and key characteristics of animal groups.
PO-4	Understanding and critical analysis of population processes, dynamics and interactions, and related models.
PO-5	Comprehend the ecosystem, biogeography, diversity, and correlation with climatic, paleo-historic and evolutionary factors.

Programme Specific Outcomes (PSO)

PSO No.	On completion of B.Sc. Zoology Degree Programme, the graduates will be able to:	Mapping
PSO-1	To know the basic principles of zoology. Recognition, the relationship between structure and function, and biological organization of animals.	PO-2
PSO-2	Analyze animal theory, classification, form and function, and evolution, and compare the structures of prokaryotes and eukaryotes.	PO-3
PSO-3	Understand the diversity of animals with taxonomy and the classification of animals with diagnostic features.	PO-2
PSO-4	Apply knowledge and understanding of conservation and restoration Biodiversity, ecological integrity, and health.	PO-5
PSO-5	To understand practical biological sciences such as sericulture, Fish farming and beekeeping	PO-1
PSO-6	Collect, record and analyze data using relevant environmental, genetic, Physiological methods in the field and in the laboratory.	PO-3
PSO-7	Effectively use information technology systems to analyze and interpret Review of information and evidence.	PO-3
PSO-8	Develop writing skills required in this program; publish research papers, oral presentations and conference posters.	PO-1
PSO-9	Describe the molecular and cellular basis of animal physiological functions.	PO-3
PSO-10	Provide innovative skills which will enable the knowledge and skills required for employment.	PO-2
PSO-11	Perform practical skills in the areas of basic and applied zoology	PO-1

➤ **Curriculum in subjects has to follow these Model Program Structures. The Terminology used in these Program Structures is as under;**

- **Major DSC (Mandatory):** is the subject that represents the main focus of the degree, and the degree will be awarded in that Subject. Students should secure a minimum 50% of total credits through Major (core) Courses (mandatory courses, electives, vocational courses, Internship/ Field Projects/ Apprenticeship/ Community Engagement Projects, Seminars, and Group Discussion. In addition, Entrepreneurship, IPR and Research Project shall be offered in case of Honors with Research Degree) in Three /Four Years for the award of Major Degree.
- **Major Specific IKS (Cr-2)** is included under Major.
- **Minor:** is the subject that may complement the Major subject or can have interdisciplinary bandwidth. Minor subject may be related or unrelated to the Major subject. The Minor subjects may be from the different disciplines of the same faculty of DSC Major (Core) or they can be from different faculty altogether.
- **GE/OE:** is to be chosen compulsorily from faculty other than that of the Major and from the faculty-wise baskets of **OE** prepared by University/Colleges.
- **SEC (Skill Enhancement Courses)** to be selected from the basket of **Skill Courses** approved by the University.
- **VC (Vocational Skill Courses):** including **Hands on Training** corresponding to the Major and/or Minor Subject, to be selected from the basket. Wherever applicable vocational courses will include skills based on advanced laboratory practical of Major.
- **AEC (Ability Enhancement Courses):** **a)** English: 04Credits, **b)** Modern Indian Language (MIL):04 credits,
- **VEC (Value Education Courses):** to be chosen from the courses, such as; Understanding India, Environmental Science/Education, and Digital and Technological Solutions,
- **IKS (Indian Knowledge System):** Courses on IKS to be selected from the basket of IKS courses approved by the University.
- **CC: (Co-curricular Courses):** to be chosen from the courses, such as; Health and Wellness, Sports and Yoga, Environmental Awareness, Constitution of India, Cyber Security, Human Rights and Environment Law, Communication Skills and Personality Development, Cultural Activities, NSS/NCC and Fine/ Applied/ Visual/ Performing Arts. (Activities/Theory/ Practical/Assignment).
- **FP/CEP:** Field Projects/Community Engagement and Service corresponding to the Major (Core) Subject.

Pedagogy involves L+T+P model. The subjects with practical involve L+P, while the subjects without practical involve L+T model. The numbers in parentheses indicate credits allotted to various courses/papers as per definitions of Choice Based Credit System (CBCS). One hour of Lecture and 2 hours of practical per week in a semester is assigned one credit. The core subject theory courses/papers and practical have 2 or 4 credits.

Subject prerequisite: To study ZOOLOGY at the bachelor's level, a student must pass Biology or any other equivalent subject in class 12th.

Medium of instruction

The medium of instruction and examination for each course shall be English.

Credit to contact hour

One credit is equivalent to 15 periods of 60 minutes each for a theory course lecture. One credit is equivalent to 30 periods of 60 minutes each for a practical course.

Attendance

The student enrolled for B.Sc. Zoology must have 75% attendance in each course in order to appear for term-end examinations, otherwise, the candidate may not be allowed to appear for term end examination as per ordinance.

Credit distribution structure for three/ four year Honors/ Honors with Research Degree Programme with Multiple Entry and Exit

Year (Level)	Sem.	Faculty	Subject-I (M-1)	Subject-II (M-2)	Subject-III (M-3)	Open Elective (OE)	VC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT, RP	Min. Credits for the Year (Sem)	Degree.
1 (4.5)	Sem-I	Science	DSC-1 (2T) DSC-2 (2P)	DSC-1 (2T) DSC-2 (2P)	DSC-1 (2T) DSC-2 (2P)	OE-1(2T)	----	AEC-1 (2) (Eng) VEC-1 (2) (EA) IKS (2)	CC-1 (2)	44 (22+22)	UG Certificate In Faculty
	Sem-II	Science	DSC-3 (2T) DSC-4 (2P)	DSC-3 (2T) DSC-4 (2P)	DSC-3 (2T) DSC-4 (2P)	OE-2(4T)	----	AEC-2 (2) (Eng) VEC-2 (2) (CI)	CC-2 (2)		
Credit: 1 st Year			08	08	08	06	---	10	4	44	

Note:

T: Theory Course, P: Practical course, Number in bracket indicate credit allotted. The courses which do not have practical, 'P' will be treated as 'T'

If student select subject other than faculty in the subjects M-1, M-2, and M-3, then that subject will be treated as Minor subject, and can not be selected as Major at Second year.

- Co-curricular Course (CC): CC-1: CC-120: Sports and Yoga and CC-2: CC-130: Cyber Security
- Ability Enhancement Courses (AEC): AEC-1: EG: 101 – English -1 and AEC-2: EG: 102 – English -2
- Value Education Courses (VEC): VEC1: ES-118: Environmental Science and VEC2: CI-129: Constitution of India
- Indian Knowledge System (IKS): IK: 119: Ayurvedic Medicine in Ancient India

T: Theory Course

P: Practical course

DSC: Discipline Specific Core Course

DSE: Discipline Specific Elective Course

MIN: Minor subject

VSEC: Vocational skill and Skill enhancement courses

VC: Vocational Skill Courses

SEC: Skill Enhancement Courses

GE/OE: Generic/Open elective

CI: Constitution of India

AEC: Ability Enhancement Courses

VEC: Value Education Courses

IKS: Indian Knowledge System

CC: Co-curricular course

CEP: Community engagement and service

OJT: On Job Training: Internship/ Apprenticeship

RP: Research Project

RM: Research methodology EA: Environment

Awareness ENG: English

MIL: Modern Indian language

NEP 2020 Structure and Credit Distributions with Selection of Major at Second Year

B.Sc (Honours/Honours Research) – Second year

Year (Level)	Sem.	Faculty	Subject-I (M-1) Major		Subject-II (M-2) Minor	Subject-III (M-3)	Open Elective (OE)	VC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT, RP	Min. Credits for the Year (Sem)	Degree.
			Mandatory DSC	Elective DSE	MIN							
			Student must choose one subject as a Major subject out of M-1, M-2, M-3 that He/She has chosen at First Year.		Student must choose one subject out of M-1, M-2, M- 3 that He/She has chosen at First Year. (Minor must be other than Major)							
2 (5.0)	Sem-III	Science	DSC-5 (2T) DSC -6 (2T) (IKS) DSC -7 (2P)	---	MIN-1 (2T) MIN-2 (2T) MIN-3 (2P)	---	OE-3 (2T)	SEC-1 (2T) SEC-2 (2P)	AEC-3 (2) (MIL)	CC-3 (2)	44 (22+22)	UG Diploma In Faculty
	Sem-IV	Science	DSC -8 (2T) DSC -9 (2P)	---	MIN-4 (2T) MIN-5 (2P)	---	OE-4 (2T)	VC-1 (2T) VC-2 (2P)	AEC-4 (2) (MIL)	CC-4 (2) and *OJT / Int/CEP (4)		
Credit: 2 nd Year			10	---	10	---	04	08	4	08	44	

* OJT/Internship/CEP should be completed in the summer vacation after 4th semester.

CC-3: CC-220: Human Rights and Environment Law and CC-4: CC-229: Communication Skills and Personality Development

AEC-3: MR: 201 – Marathi -1; AEC-3: HN: 201 – Hindi -1; AEC-3: MR: 202 – Marathi -2 and AEC-3: HN: 202 – Hindi -2

NEP 2020 Structure and Credit Distributions with Selection of Major at Third Year

B.Sc (Honors/Honours Research) – Third year

Year (Level)	Sem.	Faculty	Subject-I (M-1) Major		Subject-II (M-2) Minor	Subject-III (M-3)	Open Elective (OE)	VC, SEC (VSEC)	AEC , VEC , IKS	CC, FP, CEP, OJT, RP	Min. Credits for the Year (Sem)	Degree.
			Mandatory DSC	Elective DSE								
3 (5.5)	Sem-V	Science	DSC -10 (2T) DSC -11 (2T) DSC -12 (2T) DSC -13 (2T) DSC -14 (2T) DSC -15 (2P) DSC -16 (2P)	DSE-1 (2T) DSE-2 (2P)	----	---	---	SEC-3 (2T)	----	FP-1 (2)	44 (22+22)	UG Degree
	Sem-VI	Science	DSC -17 (2T) DSC -18 (2T) DSC -19 (2T) DSC -20 (2T) DSC -21 (2P) DSC -22 (2P)	DSE-3 (2T) DSE-4 (2P)	----	---	----	VC-3 (2T) VC-4 (2P)	----	FP-2 (2)		
Credit: 3rd Year			26	08	00	00	00	06	00	04	44	
Cum. Cr. of 3 Years			44	08	18	08	10	14	14	16	132	132

FP: Field Project should be completed in respective semester.

Question Paper Pattern for 2 Credit Course

Subject

Total Pages: 02

Time: One and half Hours

Marks: 30

Max.

Instruction to Candidates:

1. Do not write anything on question paper except Seat No.
2. All questions are compulsory.
3. Figures to right indicate full marks.
4. Students should note, no supplement will be provided.
5. Graph or diagram should be drawn with the black ink pen or black HB pencil.

1.	A	Multiple Choice questions	06
	i)		
	ii)		
	iii)		
	iv)		
	v)		
	vi)		
2.		Attempt any three of the following.	06
	i)		
	ii)		
	iii)		
	iv)		
3		Attempt any two of the following.	06
	i)		
	ii)		
	iii)		
4.	A	Attempt any one of the following.	04
	i)		
	ii)		
4.	B	Compulsory question.	02
	(i)		
5.		Attempt any one of the following	06
	i)		
	ii)		

Semester-wise Code structure for B. Sc. (Honors/Research) Programme as per NEP2020, for Affiliated Colleges w.e.f – June 2024.

B. Sc (Honors/Research) – First Year, SEMESTER – I, Level – 4.5

Course	Course Type	Course Code	Course Title	Credits	Teaching Hours/Week			Marks (Total 100)			
					T	P	Total	Internal (CA)		External (UA)	
								T	P	T	P
DSC-1	DSC	ZO-111	Fundamentals of Medical Laboratory Techniques	2	2	--	2	20	--	30	--
DSC-2	DSC	ZO-112	Practicals of Fundamentals of Medical Laboratory Techniques	2	--	4	4	--	20	--	30
OE-1	OE	ZO -113	Vermitechnique	2	2	--	2	20	--	30	--
VEC-1	VEC	ES-118	Environmental Science	2	2	--	2	20	--	30	--
IKS	IKS	IK-119	Ayurvedic Medicine in Ancient India	2	2	--	2	20	--	30	--
CC-1	CC	CC-120	Sports and Yoga	2	2	--	2	50	--	--	--
AEC-1	AEC	EG-101	English -1	2	2	--	2	20	--	30	--

B. Sc (Honors/Research) – First Year, SEMESTER – II, Level – 4.5

DSC-3	DSC	ZO -121	Forensic Zoology	2	2	--	2	20	--	30	--
DSC-4	DSC	ZO -122	Practicals of Forensic Zoology	2	--	4	4	--	20	--	30
OE-2	OE	ZO -123	Public health and hygiene	4	4	--	4	40	--	60	--
VEC-2	VEC	CI-129	Constitution of India	2	2	--	2	20	--	30	--
CC-2	CC	CC-130	Cyber Security	2	2	--	2	50	--	--	--
AEC-2	AEC	EG-102	English -2	2	2	--	2	20	--	30	--

Cumulative Credits For First Year – 44

SEMESTER I

Semester I**Course Title: DSC-01 ZO-111 Fundamentals of Medical Laboratory Techniques**

Course Title/Code: DSC-01 Fundamentals of Medical Laboratory Techniques	
Course Code: ZO- 111	Course Credits: 2 - L-T-P per week: 2-0-0
Total Contact Hours: 30	Duration of Lecture: 1 Hour
College Assessment (CA) Marks: 20	University Assessment (UA) Marks: 30

Course Objectives

- Develop a strong understanding of laboratory safety protocols, including signage, personal hygiene, and first aid procedures, to ensure a safe working environment.
- Gain proficiency in using essential medical laboratory instruments like microscopes, centrifuges, balances, autoclaves, and spectrophotometers.
- Learn and perform essential blood tests such as blood group typing, hemoglobin estimation, erythrocyte sedimentation rate, packed cell volume, smear preparation, and basic cell counts (RBC, WBC, differential).
- Develop skills in performing a basic urinalysis, including physical examination (color, clarity, odor) and chemical analysis to identify normal and abnormal constituents.

Course Outcomes

- Apply proper safety protocols in the laboratory by interpreting signage, maintaining personal hygiene, and implementing first aid procedures when necessary.
- Competently operate essential laboratory instruments like microscopes, centrifuges, balances, autoclaves, and spectrophotometers for various laboratory tasks.
- Accurately perform basic blood tests (blood group typing, hemoglobin estimation, ESR, PCV) and prepare blood smears for cell counting (RBC, WBC, differential).
- Effectively perform a urinalysis to evaluate physical characteristics and identify normal and abnormal constituents through chemical analysis.

Zoology DSC-01 ZO-111 Fundamentals of Medical Laboratory Techniques

Unit	Topics	Periods	Marks
1.	INTRODUCTION <ul style="list-style-type: none"> • Introduction to Medical Laboratory Techniques • Signs and symbols used in a laboratory • Lab safety protocols • Laboratory Safety Precautions-Personal Hygiene • First Aid Practice in Laboratory 	07	12
2.	INSTRUMENTS OF MEDICAL LABORATORY Principle and applications of following medical laboratory instruments; <ul style="list-style-type: none"> • Microscope • Centrifuge • Distillation apparatus, • Electronic balance • Autoclave • Spectrophotometer 	08	13
3.	BLOOD DIAGNOSIS <ul style="list-style-type: none"> • Blood Composition and function • Blood group test, HB estimation, ESR, PCV • Smear preparation, RBC count, WBC count, DLC 	08	13

4.	URINE DIAGNOSIS <ul style="list-style-type: none"> • Urine formation and composition • Physical Examination of Urine- color, clarity, odor. • Chemical Analysis of Urine- Normal and Abnormal Urine constituents 	07	12
		30	50

Reference Books

- Praful Godkar (2021) - Textbook of medical laboratory technology, Bhalani Publishing House
- Payal Soan, Gitesh Amrohit (2020) - A Hand Book of D.M.L.T. (Diploma in Medical Laboratory Technology), Vardhan Publishers and Distributors
- Ramnik Sood (2006) - Textbook of Medical Laboratory Technology Jaypee Brothers Medical Publishers

CO No.	Upon completion of this course, students will be able to:	PSO addressed	Blooms taxonomy classification	Cognitive level
CO-1	Recall factual information and basic concepts - List the steps of a specific laboratory technique.	9, 11	Remembering	01
CO-2	Grasp fundamental principles and concepts - Explain the purpose of quality control in laboratory testing.	9	Understanding	02
CO-3	Apply knowledge to solve problems and scenarios - Perform a blood smear preparation following standard protocols.	1,9	Applying	03
CO-4	Break down complex information and identify relationships - Analyze laboratory test results to identify potential errors and - Identify the factors that may affect the accuracy of a test.	6	Analysing	04
CO-5	Make judgments, critiques, and informed decisions - Evaluate the reliability of different laboratory techniques and - Assess the effectiveness of a laboratory procedure in diagnosing diseases.	11	Evaluating	05
CO-6	Synthesize information to generate new ideas or hypotheses - Design a new laboratory protocol to improve efficiency and accuracy and - Propose innovative methods for sample collection and processing.	9	Creating	06

Course Title: DSC-02 : Practicals of Fundamentals of Medical Laboratory Techniques	
Course Code: ZO- 112	Course Credits: 2 - L-T-P per week: 0-0-4
Total Contact Hours: 60	Duration of Practical: 4 Hours
College Assessment (CA) Marks: 20	University Assessment (UA) Marks: 30

Course Objectives

- Gain proficiency in basic laboratory techniques like glassware washing and interpreting laboratory signage for efficient and safe work practices.
- Understand and adhere to safety regulations, learn first-aid procedures, and maintain accurate clinical laboratory records to ensure a safe and organized laboratory environment.
- Develop practical skills in using essential medical laboratory instruments like microscopes, centrifuges, balances, autoclaves, and spectrophotometers.
- Learn and perform fundamental laboratory tests, including blood group typing, hemoglobin estimation, ESR, PCV, cell counts (RBC, WBC, differential), and basic urinalysis for physical examination and chemical analysis.

Course Outcomes

- Effectively wash glassware and utilize laboratory signage to ensure a clean and safe workspace.
- Demonstrate adherence to safety regulations, apply first-aid procedures when necessary, and maintain accurate clinical laboratory records.
- Competently operate essential laboratory instruments (microscopes, centrifuges, balances, autoclaves, spectrophotometers) for various laboratory tasks.
- Accurately perform basic blood tests (blood group typing, hemoglobin estimation, ESR, PCV, cell counts) and basic urinalysis (physical examination, chemical analysis) to identify normal and abnormal parameters.
- Gain firsthand experience by visiting a pathology laboratory and observing professional laboratory operations.

Practical	Title of Practical	Hours
1	Washing of glassware.	4
2	Study of signs and symbols used in a laboratory	4
3	Study of Safety regulations, first aid, and clinical laboratory records	4
4	Study of principle, and working of <ul style="list-style-type: none"> • Microscope • Centrifuge • Distillation apparatus, 	4
5	Study of principle, and working of <ul style="list-style-type: none"> • Electronic balance • Autoclave • Spectrophotometer 	4
6	Determination of ABO blood group with Rh factor.	4
7	Estimation of Hemoglobin concentration (HB)	4
8	Estimation of Erythrocyte Sedimentation Rate (ESR)	4
9	Estimation of Packed Cell Volume (PCV)	4
10	Estimation of Red Blood Corpuscles (RBC)	4
11	Estimation of White Blood Corpuscles (WBC)	4
12	Estimation of Differential Leucocytes Count.	4

13	Physical Examination of Urine- color, clarity, odor.	4
14	Qualitative analysis of normal and abnormal constituents of urine.	4
15	Visit to Pathological laboratory.	4

Reference Books:

- Praful Godkar (2021) - Textbook of medical laboratory technology, Bhalani Publishing House
- Payal Soan, Gitesh Amrohit (2020) - A Hand Book of D.M.L.T. (Diploma in Medical Laboratory Technology), Vardhan Publishers and Distributors
- Ramnik Sood (2006) - Textbook of Medical Laboratory Technology Jaypee Brothers Medical Publishers

CO No.	Upon completion of this course, students will be able to:	PSO addressed	Blooms taxonomy classification	Cognitive level
CO-1	Recall information and basic concepts - List the steps of a specific laboratory technique.	9, 11	Remembering	01
CO-2	Grasp fundamental principles and concepts - Explain the purpose of quality control in laboratory testing.	9	Understanding	02
CO-3	Apply knowledge to solve problems and scenarios - Perform a blood smear preparation following standard protocols.	1,9	Applying	03
CO-4	Break down complex information and identify relationships - Analyze laboratory test results to identify potential errors and - Identify the factors that may affect the accuracy of a test.	6	Analyzing	04
CO-5	Make judgments, critiques, and informed decisions - Evaluate the reliability of different laboratory techniques and - Assess the effectiveness of a laboratory procedure in diagnosing diseases.	11	Evaluating	05
CO-6	Synthesize information to generate new ideas or hypotheses - Design a new laboratory protocol to improve efficiency and accuracy and - Propose innovative methods for sample collection and processing.	9	Creating	06

Course Category/ Title: OE-1 Vermitechnique	
Course code: ZO- 113	Course Credit: 2 - L-T-P per week: 2-0-0
Total Contact Hours: 30	Duration of Lecture :1 Hour
College Assessment (CA) Marks:20	University Assessment (UA) Marks:30

Course Objectives

- Gain fundamental knowledge of Vermitechnology, including earthworm anatomy and physiology, vermicomposting methods (pit and bed methods), and its applications in waste management.
- Develop practical skills in harvesting worms (manual, migration, mechanical methods), collecting and utilizing vermicast (worm castings), vermicompost (composted material), and vermivash (liquid extract).
- Understand how earthworms contribute to soil fertility, analyze the benefits of vermicompost for crop production and land improvement, and appreciate their role in waste management and bioremediation.
- Critically analyze the economics of vermicomposting, including marketing strategies for vermicomposting products, financial support options (KVIC, NABARD), and eligibility criteria for financial aid.

Course Outcomes

- Articulate the principles of Vermitechnology, describe earthworm anatomy, and explain different vermicomposting methods for organic waste management.
- Competently harvest worms using various methods, collect and utilize vermicast, vermicompost, and vermivash for different applications.
- Critically evaluate how earthworm activity contributes to soil fertility, explain the benefits of vermicompost in crop production and land reclamation, and discuss their role in waste management and bioremediation processes.
- Evaluate the economic feasibility of vermicomposting, propose marketing strategies for vermicomposting products, and identify potential financial support options (KVIC, NABARD) with their eligibility criteria.

Zoology OE-01 OE -1 - ZO-113 Vermitechnique

Unit	Topics	Periods	Marks
1	Vermitechnology 1.1. Introduction to Vermitechnology, 1.2. Morphological and anatomical characteristics of Earth worm- <i>Eudrilus eugeniae</i> and <i>Esenia foetida</i> 1.3. Methods of Vermicomposting – Pit method and Bed Method 1.4. Vermicomposting Technology	07	12
2	Harvesting 2.1 Vermiculture Techniques for harvesting Worm- Manual, Migration and Mechanical	08	13

	2.2 Worm Cast 2.3 Vermicompost 2.4 Vermiwash		
3	Role of Earth worms 2.1 Role of Earthworms in Soil Fertility 2.2. Use of Vermicompost for Crop Production 2.3. Use of Vermicompost in Land improvement and Reclamation 2.4. Role of Earthworms in Waste Management 2.5 Earthworms as Bioreactors 2.6. Interaction of Earthworms with other Organisms 2.7. Influence of Chemical Inputs on Earthworm Activity	07	12
4	Branding and Marketing 4.1. Organic farming 4.2. Marketing of Vermicomposting Products 4.3. Economics of Vermicomposting 4.4. Financial Support for Vermicomposting 4.4.1 Khadi and Village Industries Commission (KVIC) 4.4.2 National Bank for Agriculture and Rural Development (NABARD) 4.4.3 Eligibility for financial support	08	13
		30	50

Reference Books

- Arvind Kumar, A. (2005) Verms and Vermitechnology, APH Publishing Corporation.
- Ashok Kumar Rathour (2020) Vermitechnology, Farm and Fertilizer, Discovery Publishing House Pvt Ltd. India.
- Christy, M.V. (2008) Vermitechnology, 1st edition, MJP Publishers.
- Lekshmy, M. S., Santhi R. (2012) Vermitechnology, Sara Publications, New Delhi, India
- M Seethalekshmy, R Santhi (2012) Vermitechnology, 1st Edition Saras Publication.
- Sinha, R. K. et.al (2010) Vermitechnology-The Emerging 21st Century Bioengineering technology for sustainable development and protection of human health and environment Review, Dynamic Soil and Dynamic Plant, Global Science Books.

CO No.	Upon completion of this course, students will be able to:	PSO addressed	Blooms taxonomy classification	Cognitive level
CO-1	This subject will describe soil earthworms, their characteristic features, occurrence, their influence on soil fertility and solid waste management.	9, 11	Remember	01
CO-2	Provides knowledge of developing vermicompost unit for the production of vermicompost and vermiwash	9	Understand	02
CO-3	Provides employment opportunities	1,9	Understand	02
CO-4	Develops practice of converting rural and urban biowastes into excellent manure.	6	Apply	03
CO-5	Enhance Green revolution	11	Remember	01

SEMESTER II

Course Title/Code: DSC-03 Forensic Zoology	
Course Code: ZO - 121	Course Credits: 2 - L-T-P per week: 2-0-0
Total Contact Hours: 30	Duration of Lecture: 1 Hour
College Assessment (CA) Marks: 20	University Assessment (UA) Marks: 30

Course Objectives

- Develop an understanding of how zoological principles and analysis of insect evidence contribute to forensic investigations.
- Gain practical skills in recognizing and analyzing biological evidence such as hair, teeth, blood, semen, and saliva for forensic purposes.
- Learn various techniques for collecting and examining insect evidence at crime scenes, including blow flies, dermestid beetles, and other relevant insects, to estimate time of death.
- Gain basic knowledge of forensic medicine and medical jurisprudence, including legal aspects of documenting medical evidence for court proceedings.

Course Outcomes

- Demonstrate an understanding of how zoological evidence contributes to solving crimes, identifying perpetrators, and reconstructing events.
- Competently identify and analyze different types of biological evidence (hair, teeth, blood, semen, saliva) with potential forensic significance.
- Effectively collect and examine insect evidence at crime scenes, focusing on blow flies, dermestid beetles, and other relevant insects, to estimate the post-mortem interval.
- Explain the basic principles of forensic medicine and medical jurisprudence, highlighting the importance of accurate and legally compliant medical evidence documentation.

Zoology DSC -03 DSC- 03 - ZO - 121 Forensic Zoology

Unit	Topics	Periods	Marks
1	Introduction to Forensic Zoology: 1.1 Definition, Scope, and Application of Forensic Zoology. 1.2 Forensic Laboratories in India. 1.3 Basic Principles of Forensic Science with Examples.	07	12
2	Forensic Medicine: 2.1 Introduction to Forensic Medicine: Definitions of Forensic Medicine. 2.2 Medical Jurisprudence (Law). 2.3 Medical evidence documentations	07	12
3	Forensic Analysis: 3.1 Detection of Biological Evidences: Hair, Teeth, Blood, Semen and Saliva. 3.2 Technique and Examination of Biological Traces: Liquid blood, blood stains and swabs, semen, tissues, Bones, Hairs, Saliva 3.3 DNA Fingerprinting	08	13
4	Forensic Importance of Insects:	08	13

4.1 Role of Blow flies and Dermestid Beetles in forensic Zoology		
4.2 Insects as indicators of time of death		
4.3 Evidence collection of insects		
	30	50

Reference Books

- A Fly in the ointment: How Insect Evidence is Used in Criminal Investigations (2010) by David R. Levine. Cambridge University Press.
- Forensic Entomology(2011) by Dorothy Oehler. Wiley-Blackwell.
- Manual of Forensic Entomology(2013) by James Byers. John Wiley & Sons.
- Forensic Entomology: An Introduction(2019) by Jason H. Byrd and James C. Castner. CRC Press.
- Criminalistics: An Introduction to Forensic Science(2018) by Richard Saferstein. Pearson Education Limited.
- Forensic Science: An Introduction(2016) by William Goodwin, Richard Saferstein, and Colin Rogers. Pearson Education Limited.
- Lee and Gaen's Advances in Forensic Science (2016) by Matthew J. Hickman, Henry C. Lee, Robert E. Gaen, and David Housby. Elsevier Science & Technology.
- Scientific Examination of Documents(2012) by David Owen. Gower Publishing Ltd.
- Strengthening Forensic Science in the United States: A Path Forward(2009) by National Research Council. The National Academies Press.

CO No.	Upon completion of this course, students will be able to:	PSO addressed	Blooms taxonomy classification	Cognitive level
CO-1	Understand the basics principles of Forensic Zoology.	9, 11	Remember	01
CO-2	Understand scientific methods in crime detection.	9	Understand	02
CO-3	Understand the advancements in the field of Forensic Zoology.	1,9	Understand	02
CO-4	Apply modern tools, techniques, and skills in forensic investigations.	6	Apply	03
CO-5	Describe the fundamental principles and functions of forensic science and its significance to human society.	11	Remember	01

Course Title/ Code : DSC-4: Practicals of Forensic Zoology	
Course Code : ZO - 122	Course Credits:2 - L-T-P per week: 0-0-4
Total Contact Hours: 60	Duration of Practical: 4 Hours
College Assessment (CA) Marks: 20	University Assessment (UA) Marks: 30

Course Objectives

- Develop practical skills in examining and analyzing biological evidence, including human hair (morphology, species identification), blood (detection and grouping), and semen (identification tests), for use in forensic investigations.
- Learn and practice techniques for observing and interpreting insect evidence (blow fly and dermestid beetle life cycles) to estimate the post-mortem interval in crime scenes.
- Gain practical experience in preparing evidence casts (footprints) and analyzing microscopic evidence (diatoms) for forensic applications.
- Apply knowledge of forensic entomology and wildlife forensics to real-world scenarios by preparing case reports on these topics and visiting a forensic laboratory to observe professional practices.

Course Outcomes

- Skilled in examining human hair morphology, preparing slides for scale pattern analysis, and differentiating fingerprint types.
- Competently detect blood presence, perform blood grouping tests (limited to practical scope), and utilize the acid phosphatase test for semen identification.
- Effectively observe and interpret insect development stages (blow flies, dermestid beetles) to estimate the post-mortem interval at crime scenes.
- Demonstrate skills in preparing casts of footprints, performing microscopic analysis of diatoms (citing relevant case studies), and writing comprehensive case reports on forensic entomology and wildlife forensics. Note: The practicality of performing some techniques (e.g., blood grouping) may vary depending on the course level and safety considerations.

Zoology DSC-04 Lab Course ZO - 122: Practicals of Forensic Zoology

practical	Title of Practical	Hours
1.	Examine human hair for cortex and medulla. (E)	4
2.	Examine hair morphology and determine the species to which the hair belongs. (E)	4
3.	To prepare slides of scale pattern of human hair. (E)	4
4.	Identify and differentiate various types of Thumb prints. (E)	4
5.	Detection of Blood group (E)	4
6.	Teichmann Crystal Test for dry Blood (E)	4
7.	Acid phosphatase (AP) test for Semen (E)	4
8.	Study of Life Cycle of Blow fly - <i>Glossina</i> (D)	4
9.	Study of Life Cycle of Dermistid Beetle- <i>Dermestes maculatus</i> (D)	4
10.	To prepare cast of foot prints.	4
11.	To carry out microscopic examination of diatoms.	4
12.	To cite a crime case in which diatoms have served as forensic evidence.	4

13.	To prepare a case report on forensic entomology.	4
14.	To prepare a case report on problems of wildlife forensics.	4
15.	Visit to Forensic Laboratory	4

Reference Books

- A Fly in the ointment: How Insect Evidence is Used in Criminal Investigations (2010) by David R. Levine. Cambridge University Press.
- Forensic Entomology(2011) by Dorothy Oehler. Wiley-Blackwell.
- Manual of Forensic Entomology(2013) by James Byers. John Wiley & Sons.
- Forensic Entomology: An Introduction(2019) by Jason H. Byrd and James C. Castner. CRC Press.
- Criminalistics: An Introduction to Forensic Science(2018) by Richard Saferstein. Pearson Education Limited.
- Forensic Science: An Introduction(2016) by William Goodwin, Richard Saferstein, and Colin Rogers. Pearson Education Limited.
- Lee and Gaen's Advances in Forensic Science (2016) by Matthew J. Hickman, Henry C. Lee, Robert E. Gaen, and David Housby. Elsevier Science & Technology.
- Scientific Examination of Documents(2012) by David Owen. Gower Publishing Ltd.
- Strengthening Forensic Science in the United States: A Path Forward(2009) by National Research Council. The National Academies Press.

CO No.	Upon completion of this course, students will be able to:	PSO addressed	Blooms taxonomy classification	Cognitive level
CO-1	Understand the basics principles of Forensic Zoology.	9, 11	Remember	01
CO-2	Understand scientific methods in crime detection.	9	Understand	02
CO-3	Understand the advancements in the field of Forensic Zoology.	1,9	Understand	02
CO-5	Describe the fundamental principles and functions of forensic science and its significance to human society.	11	Remember	01
CO-4	Apply modern tools, techniques, and skills in forensic investigations.	6	Apply	03

Course Title/Code: OE 2- Public health and hygiene	
Course Code: ZO- 123	Corse Credits: 4 - L-T per week: 4-0-0
Total Contact Hours: 60	Duration of Lecture: 1 Hour
College assessment (CA) Marks: 40	University Assessment(UA):Marks: 60

Course Objectives

- Develop an understanding of nutrition principles, balanced diets, and dietary needs for different life stages (infants, children, adults, pregnancy, lactation), promoting healthy eating practices for disease prevention.
- Gain knowledge of common food-borne and water-borne diseases (causes, symptoms, transmission), and apply strategies for prevention and control.
- Learn and practice essential personal hygiene habits (body care, oral hygiene, sleep hygiene) and understand the importance of social hygiene (cleanliness, occupational hygiene, food safety) for public health.
- Understand the negative health impacts of excessive technology use and unhealthy habits (smoking, alcoholism, drug abuse) and explore positive lifestyle choices like physical activity (cycling, walking), stress management (yoga), and responsible family planning practices.

Course Outcomes

- Demonstrate the ability to design balanced meal plans considering calorie needs and dietary requirements for different individuals and life stages.
- Effectively communicate the causes, symptoms, and prevention strategies for common food-borne and water-borne diseases.
- Competently demonstrate essential personal hygiene practices and advocate for social hygiene initiatives in the community.
- Articulate the negative health consequences of unhealthy habits and positively promote physical activities like cycling and walking, stress management techniques (yoga), and responsible family planning methods.

Zoology OE-02 ZO - 123 Public health and hygiene

Unit	Topics	Periods	Marks
1	Nutrition and health 1.1 Introduction: Scope and importance of Public health and hygiene. 1.2 Balanced diet, diet control for diabetics and cholesterol, etc. 1.3 Concept of energy, calories, daily food intake as per occupation, pregnancy and lactation. 1.4 Dietary requirements of infants, pre-school children, schoolchildren, adults.	15	25
2	Health Hazards 2.1 Health dynamicity – definition, factors influencing health, health as a medium of socio-economic development. 2.2 Diseases – Common food borne and water borne diseases (jaundice, cholera, diarrhoea and typhoid) – causative agents, symptoms, mode of transmission, prevention and control. 2.3 Lifestyle habits – excessive usage of T.V., computer, mobile phones, two wheelers, and their impacts on health.	15	25

3	Health hygiene 3.1 Personal hygiene - body odour, oral hygiene and sexual hygiene, grooming, feminine hygiene, sleep hygiene, hand washing, toiletry. 3.2 Social hygiene – clean living movements, occupational hygiene, food and cooking hygiene, medical hygiene, excessive hygiene.	15	25
4	Health Education 4.1 Definition, objectives, principles 4.2 Ill effects of smoking, alcoholism and drug abuse (hashish, opium, brown sugar). 4.3 Population control and family welfare- use of contraceptives 4.4 Importance of Body fitness 4.5 Importance of cycling and walking exercise. 4.5 Stress reduction management – Importance of yoga 4.6 Sickle Cell Disorder	15	25
		60	100

Reference Books

- Jatin V. Modi and Renjith S. Chawan. Essentials of Public Health and Sanitation – Part I-IV.
- Murray, C. J. L. and A.D. Lopez. (1996), The Global Burden Of Disease. World Health Organization.
- Park, J.E. and Park, K. Textbook of Community Health for Nurses.
- Swaminathan S. Principles of Nutrition and Dietetics.

CO No.	Upon completion of this course, students will be able to:	PSO addressed	Blooms taxonomy classification	Cognitive level
CO-1	Students will get a holistic overview of the interdisciplinary nature of Public health and hygiene	9, 11	Remember	01
CO-2	Understand public health and hygiene issues in India particularly related to Malnutrition, sanitation issues and related burden of infectious disease, and the role of pollution as a public health concern.	9	Understand	02
CO-3	Understand the public policies applicable and implemented in India.	1,9	Understand	02
CO-4	Apply the known knowledge to adopt health and hygiene.	6	Apply	03
CO-5	Recall to appreciate the social aspects that govern many public health issues and implementation of policies	11	Remember	01

Semester-wise Code structure for B. Sc (Honors/Research) Programme as per NEP2020, for Affiliated Colleges w.e.f – June 2024.

B. Sc (Honors/Research) – Second Year, SEMESTER – III, Level – 5.0

Course	Course Type	Course Code	Course Title	Credits	Teaching Hours/Week			Marks (Total 100)			
					T	P	Total	Internal (CA)		External (UA)	
								T	P	T	P
DSC-5	DSC	ZO -211	Fundamentals of Genetics	2	2	--	2	20	--	30	--
DSC-6	DSC	ZO -212	Ethnozoology	2	2	--	2	20	--	30	--
DSC-7	DSC	ZO -213	Practicals of Fundamentals of Genetics	2	--	4	4	--	20	--	30
MIN-1	MIN	ZO -214	Developmental biology	2	2	--	2	20	--	30	--
MIN-2	MIN	ZO -215	Ecology	2	2	--	2	20	--	30	--
MIN-3	MIN	ZO -216	Practicals of Ecology and Developmental biology	2	--	4	4	--	20	--	30
OE-3	OE	ZO -217	Agricultural Pest management	2	2	--	2	20	--	30	--
SEC-1	SEC	ZO -218	Pearl Culture Techniques	2	2	--	2	20	--	30	--
SEC-2	SEC	ZO -219	Practicals of Pearl Culture Techniques	2	--	4	4	--	20	--	30
CC-3	CC	CC-220	Human Rights and Environment Law	2	2	--	2	50	--	--	--
AEC-3	AEC	MR-201	Marathi -1	2	2	--	2	20	--	30	--
		HN-201	Hindi -1	2	2	--	2	20	--	30	--
B. Sc (Honors/Research) – Second Year, SEMESTER – IV, Level – 5.0											
DSC-8	DSC	ZO -221	Animal Type – <i>Labeo rohita</i>	2	2	--	2	20	--	30	--
DSC-9	DSC	ZO -222	Practicals of Animal Type - <i>Labeo rohita</i>	2	--	4	4	--	20	--	30
MIN-4	MIN	ZO -223	Food and Nutrition	2	2	--	2	20	--	30	--
MIN-5	MIN	ZO -224	Practicals of Food and Nutrition	2	--	4	4	--	20	--	30
OE-4	OE	ZO -225	Ornamental Fish Culture	2	2	--	2	20	--	30	--
VC-1	VSC	ZO-226	Apiculture	2	2	--	2	20	--	30	--
VC-2	VSC	ZO-227	Practicals of Apiculture	2	--	4	4	--	20	--	30
OJT* / Int/CEP	OJT / Int/CEP	ZO -228	OJT / Int / CEP corresponding to the Major (Core) Subject: e.g. Approaches to Animal diversity conservation	4	--	4	4	--	40	--	60
CC-4	CC	CC-229	Communication Skills and Personality Development	2	2	--	2	50	--	--	--
AEC-4	AEC	MR-202	Marathi -2	2	2	--	2	20	--	30	--
		HN-202	Hindi -2	2	2	--	2	20	--	30	--

Cumulative Credits For First Year – 44

* Students need to complete one month on job training (OJT) or internship in any industry related to major subject.

Semester-wise Code structure for B. Sc (Honors/Research) Programme as per NEP2020, for Affiliated Colleges w.e.f – June 2024.

B. Sc (Honors/Research) – Third Year, SEMESTER – V, Level – 5.5

Course	Course Type	Course Code	Course Title	Credits	Teaching Hours/Week			Marks (Total 100)			
					T	P	Total	Internal (CA)		External (UA)	
								T	P	T	P
DSC-10	DSC	ZO -311	Animal diversity of non-chordates	2	2	--	2	20	--	30	--
DSC-11	DSC	ZO -312	Cell and Molecular Biology	2	2	--	2	20	--	30	--
DSC-12	DSC	ZO -313	Microtechnique	2	2	--	2	20	--	30	--
DSC-13	DSC	ZO -314	Biochemistry	2	2	--	2	20	--	30	--
DSC-14	DSC	ZO -315	Parasitology	2	2	--	2	20	--	30	--
DSC-15	DSC	ZO -316	Practicals of Animal diversity of non-chordates and Cell and Molecular Biology	2	--	4	4	--	20	--	30
DSC-16	DSC	ZO -317	Practicals of Microtechnique, Biochemistry and Parasitology	2	--	4	4	--	20	--	30
DSE-1	DSE	ZO-318 (A)	Endocrinology	2	2	--	2	20	--	30	--
	DSE	ZO-318 (B)	Evolutionary biology	2	2	--	2	20	--	30	--
DSE-2	DSE	ZO-319 (A)	Practicals of (A) Endocrinology	2	--	4	4	--	20	--	30
		ZO-319 (B)	Practicals of (B) Evolutionary biology	2	--	4	4	--	20	--	30
SEC-3	SEC	ZO -320	Aquatic Biology	2	2	--	2	20	--	30	--
FP-1	FP	ZO -321	Field Project on Major (Core) Subject: Zoology related industries, gardens, museums, zoo, etc and prepare report	2	--	4	4	--	20	--	30
B. Sc (Honors/Research) – Third Year, SEMESTER – VI, Level – 5.5											
DSC-17	DSC	ZO -322	Animal Diversity of Chordates	2	2	--	2	20	--	30	--
DSC-18	DSC	ZO -323	Animal Physiology	2	2	--	2	20	--	30	--
DSC-19	DSC	ZO -324	Animal Biotechnology	2	2	--	2	20	--	30	--
DSC-20	DSC	ZO -325	Applied Zoology	2	2	--	2	20	--	30	--
DSC-21	DSC	ZO -326	Practicals of Animal Diversity of Chordates and Animal Physiology	2	--	4	4	--	20	--	30
DSC-22	DSC	ZO-327	Practicals of Applied Zoology and Animal Biotechnology	2	--	4	4	--	20	--	30
DSE-3	DSE	ZO -328(A)	Oceanography	2	2	--	2	20	--	30	--
		ZO -328(B)	Basics of Animal Taxonomy	2	2	--	2	20	--	30	--
DSE-4	DSE	ZO -329(A)	Practicals of Oceanography	2	--	4	4	--	20	--	30
		ZO -329(B)	Practicals of Basics of Animal Taxonomy	2	--	4	4	--	20	--	30
VC-3	VSC	ZO -330	Medical Lab Techniques (MLT)	2	2	--	2	20	--	30	--
VC-4	VSC	ZO -331	Practicals of Medical Lab Techniques (MLT)	2	--	4	4	--	20	--	30
FP-2	FP	ZO -332	Field Project on Major (Core) Subject: Medical Lab Techniques (MLT)	2	--	4	4	--	20	--	30