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

(AUTONOMOUS)

Three Year B.Sc. Degree Program in ZOOLOGY
(Faculty of Science)

S. Y. B. Sc. Zoology Syllabus

Choice Based Credit System Syllabus

To be implemented from Academic Year, 2023-2024

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 **Progressive Education Society's Modern College of Arts, Science and Commerce, Ganeshkhind, Pune- 16 (Autonomous)** with a substantial component of what is needed from zoologists as a skilled career and what zoologists need 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 and 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 Biodiv 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 trips, 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.

While presenting this new syllabus to the teachers and students of F.Y.B.Sc. Zoology, I am extremely happy to state that efforts have been made to seek inputs of all the stake holders to make it more relevant.

The new course that will be effective from the academic year 2019- 2020 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 prerequisites of the students. This program has been introduced with 132 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 judgment, independent thinking and problem solving skills. The Syllabus has been revised with the following aims

Program Outcomes:

PO1: To foster curiosity in the students for Zoology

PO2: To create awareness amongst students for the basic and applied areas of Zoology

PO3: To highlight the potential of various branches to become an entrepreneur

PO4: To orient students about the importance of abiotic and biotic factors of environment and their conservation.

PO5: To provide an insight to the aspects of animal diversity.

PO6: 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 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 / 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/ symposial seminar/ field visit / study tour organized by the department/ college. The students shall attend these programmes at their own cost.

4) Eligibility:

The candidate should have a 10+2 Degree with biology as principal subject

Admission: Admissions will be given as per the selection procedure / policies adopted by the respective college, in accordance with conditions laid down by the University of Pune.

Reservation and relaxation will be as per the government rules.

5) Examination

[A] Pattern of Examination

Evaluation of Students:

1) The Internal evaluation will be in form of continuous assesement format of 15 marks and End-Semester examinations will be of 35 marks making total to 50.
2) Student has to obtain 40% marks in the examination of In-Semester and End-Semester assessment. Separate passing is mandatory

4) Internal marks remain unchanged and internal assessment cannot be repeated. If student remain absent during internal assessment examination, he/she will have 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.

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

Surprise test specified topics in a given notified period

f) Oral

g) Assignments

h) Review of research paper

1) 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

iv. Field visit report/ study tour report

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.

i 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 in the combined examination of In-Semester and End Semester assessment. Separate passing is mandatory

[C] ATKT Rules

A student cannot register for third semester if he/she fails to complete the 50% credits of the total credits expected to be ordinarily completed within two semesters.

[D] Award of Class

Grades will be awarded from grade point average (GPA) of the credits.

I. Course Structure with Credit Distribution of the First year Zoology Syllabus

Semester	Course	Course code	Name of the Course	Credits
I	CC	**22-**ZO-111	Animal Systematics and Diversity I	2 Credits (30 L)
	CC	**22-**ZO-112	Ecosystem and its Dynamics	2 Credits (30 L)
	CC	**22-**ZO-113	Zoology Practical	1.5 Credits
Semester II	CC	**22-**ZO-121	Animal Systematics and Diversity II	2 Credits (30 L)
	CC	**22-**ZO-122	Fundamentals of Cell Biology	2 Credits (30 L)
	CC	**22-**ZO-123	Zoology Practical	1.5 Credits
	Mandatory Credit Course	**22-**12999	Democracy, Election and Governance	2 Credits (30L)

II. Course Structure with Credit Distribution of the Second year Zoology Syllabus

Semester	Course	Course code	Name of the Course	Credits
III	CC	**23-**ZO -231	Animal Systematics and Diversity III	2 Credits (30 L)
	CC	**23-**ZO -232	Industrial Zoology- I	2 Credits (30 L)
	CC	**23-**ZO -233	Zoology Practical	1.5 Credits
	AECC	**23-**LA-231	English / Marathi	2 Credits (30 L)
	AECC	**23-**EVS-231	Environmental Awareness	2 Credits (30 L)
Semester IV	CC	**23-** ZO -241	Animal Systematics and Diversity IV	2 Credits (30 L)
	CC	**23-**ZO -242	Industrial Zoology- II	2 Credits (30 L)
	CC	**23-**ZO -243	Zoology Practical	1.5 Credits
	AECC	**23-**LA-241	English / Marathi	2 Credits (30 L)
	AECC	**23-**EVS-241	Environmental Awareness	2 Credits (30 L)

III. Course Structure with Credit Distribution of the Third year Zoology Syllabus

Semester	Course	Course code	Name of the Course	Credits
V	DSEC	**24-**ZO -351	Pest Management	2 Credits (30 L)
	DSEC	**24-**ZO-352	Histology and Histopathology	2 Credits (30 L)
	DSEC	**24 -**ZO -353	Biological Chemistry	2 Credits (30 L)
	DSEC	**24 –**ZO -354	Genetics	2 Credits (30 L)
	DSEC	**24-**ZO -355	Developmental Biology	2 Credits (30 L)
	DSEC	**24 –**ZO-356	Medical Parasitology	2 Credits (30 L)
	DSEC	**24-**ZO-357	Zoology Practical –I	2 Credits
	DSEC	**24-**ZO-358	Zoology Practical –II	2 Credits
	DSEC	**24-**ZO-359	Zoology Practical –III	2 Credit s
	SEC	**24-**ZO-3510	Fishery Management	2 Credits (30 L)
	SEC	**24-**ZO-3511	Basics in Biostatistics/Poultry Management	2 Credits (30 L)
Semester VI	DSEC	**24-**ZO-361	Forensic Zoology	2 Credits (30 L)
	DSEC	**24-**ZO-362	Animal Physiology	2 Credits (30 L)
	DSEC	**24-**ZO-363	Molecular Biology	2 Credits (30 L)
	DSEC	**24-**ZO-364	Applied Entomology	2 Credits (30 L)
	DSEC	**24-**ZO-365	Biotechniques	2 Credits (30 L)
	DSEC	**24-**ZO-366	Evolutionary Biology	2 Credits (30 L)
	DSEC	**24-**ZO-367	Zoology Practical –I	2 Credits
	DSEC	**24-**ZO-368	Zoology Practical –II	2 Credits
	DSEC	**24-**ZO-369	Zoology Practical –III	2 Credits
	SEC	**24-**ZO-3610	Biodiversity Assessment	2 Credits (30 L)
	SEC	**24-**ZO-3611	Project/Internship/Hands on Training or Workshop	2 Credits

CC=Core Courses, **AECC** =Ability Enhancement Compulsory Courses,

DSEC= Discipline specific Elective Courses **SEC**=, Skill Enhancement Courses

1. **In addition to the compulsory credits of 132, the student has to earn additional 8 Credits from following groups by taking/participating/conducting respective activities.**
2. **Courses in Group-I are compulsory.**
3. **The student can earn maximum 04 credits from an individual group from Group 2 to Group-9. These extra credits will not be considered for GPA calculation; however, These are mandatory for the completion and award of B. Sc. Degree**.

Group 1: Physical Education (at F. Y.B. Sc. Sem. I)-01 credit
Physical Education (at F. Y.B. Sc. Sem. II)-01credit (Note: Group I is Compulsory for all the students as stated above.)

Group 2: Sport representation at Collegelevel-01 credit
Sport representation at University/Statelevel-02 credits

Group 3: National Social Service Scheme (participation in Camp): 01 credits
N.C.C. (with participation in annual camp)-01credit
N. C. C. (with B certificate/C certificate award)-02 credits
N.S.S. /N.C.C. Republicdayparadeparticipation-04 credits

Group 4: Avishkar participation; Extension activity participation, Cultural activity Participation–01 credit, Avishkar selection at University level-02 credits.
Avishkar winner at state level-04credits

Group 5: Research paper presentation at State/National level-01 credits.
Research paper presentation at international level-02 credits

Group 6: Participation in Summer school/programme; Short term course (not less than 1-Week duration) -03 credit.

Group 7: Scientific Survey, Societal survey, -02 credits.

Group 8: Field Visits; Study Tours; Industrial Visits; Participation in curricular/Co-curricular Competitions - 01 Credit.

Group 9: Online certificate Courses /MOOC Courses/ Career Advancement Course up to 04 credits (Minimum10 Hrs. / credit)

Completion of Degree Course:

- A student who earns 140 credits, shall be considered to have completed the requirements of the B. Sc. degree program and CGPA will be calculated for such student.

Course Title: Animal Systematics & Diversity III
Course Code-23-ZO-231
Semester III (2 credits-30 lectures)

Course Outcomes:

CO1: To acquaint the students with phylum Chordata

CO2: To acquaint the students with group Protochordata and Euchordata.

CO3: To understand the anatomical and morphological features of representative animal.

Sr. no.	Unit	Required Lectures
1.	1. **Introduction to Phylum Chordata** 1.1 Origin & Ancestry of Chordates. 1.2 Classification of Phylum Chordata up to classes – Pisces, Amphibia, Reptilia, Aves, Mammalia. 1.3 Salient features of Phylum Chordata. 1.4 Comparative account of fundamental characters of Chordates with Non Chordates.	(03)
2.	**2. Introduction to Group – Protochordata.** 2.1 Salient features of Protochordata. 2.2 Salient features of Subphylum's with ONE example each - Names and Classification. Hemichordata – *Balanoglossus*, Urochordata - *Herdmania*, Cephalochordata –*Branchiostoma* (Amphioxus).	**(03)**
3	**3. Introduction to Group – Euchordata** 3.1 Salient Features of Euchordates 3.2 Salient features of Subphylum Vertebrata. 3.2 Introduction and General characters of Division with two examples - Names and classification. Agnatha–*Myxine* Gnathostomata–Frog.	**(**03)
4	**4. Introduction to Superclass – Pisces** 4.1 Salient features of Superclass – Pisces. 4.2 Introduction and Salient features of sections with one examples - Names. Class – Chondrichthyes–*Chimaera* &Osteichthyes –*Catla* 4.3 Respiratory Adaptations in Fishes	(04)
5	**5. Introduction to Class – Amphibia** 5.1 Salient features of Class – Amphibia. 5.2 Introduction to order – Apoda–*Ichthyophis*, Urodela–*Salamandra* (Salamander) and& Anura - *Rana*. 5.3 Parental care in Amphibia. 5.4 Neoteny and Paedogenesis	(04)

6	**6. Study of Scoliodon** 6.1 - Systematic position, Geographical distribution, Habit, Habitat & External characters 6.2 - Digestive System, Food and feeding mechanism. 6.3 - Respiratory System – Structure of Holobranch only. 6.4- External & Internal Structure of heart, Working of heart 6.5 - Nervous System – CNS & PNS 6.6 - Male Urinogenital system & Female reproductive System. 6.7- Viviparity in Sharks.	(13)

Course Title: Industrial Zoology- I
Course Code-23-ZO-232
Semester III (2 credits-30 lectures)

Course Outcomes:

CO1: To acquaint the student with Sericulture as Entrepreneurship.

CO2: To understand the practice of Moriculture and Rearing of silkworm for silk production.

CO3: The student learns various agricultural pests and their nature of damage.

CO4: The student learns different methods of pest control.

Sr. no.	Unit	Required Lectures
Sericulture:		
1.	**Sericulture as Cottage industry** 1.1 An Introduction, Scope and Entrepreneurial Aspects of Sericulture in India, 1.2 Study of different types of silk moths *Mulberry, Tassar, Eri and Muga* silk moths., their distribution and Classification, 1.3 Structure of Silk Glands and silk secretion 1.4 External Morphology and life cycle of *Bombyx mori.*	**05**
2.	**Moriculture :** 2.1Varieties for cultivation, 2.2 Rain fed and irrigated mulberry cultivation- Fertilizer schedule, Pruning methods and leaf yield. 2.3 Harvesting of mulberry: a) Leaf plucking, b) Branch cutting, c) Whole shoot cutting.	**03**
3	**Silk worm rearing :** 3.1 Varieties for rearing, 3.2 Rearing house, 3.3 Rearing techniques, 3.4 Important diseases and pests.	**04**
4	**Post-harvest processing of cocoons** 4.1 Preparation of cocoons for marketing. 4.2 Sniffling, sorting, storage, deflossing and riddling, 4.3 Cocoon cooking, reeling equipment and re reeling, washing and polishing 4.4 Biotechnological and Biomedical applications of silk	**04**
Agricultural Pests and Control		
1	An introduction to Agricultural Pests: 1.1 Definition and Concept of pest 1.1 Types of pests (agricultural, store grain, veterinary, Nursery & Forestry).	**01**
2	Major insect pests of agricultural importance (Marks of identification, life cycle, nature of damage and control measures). 2.1 Jowar stem borer,	**05**

	2.2 Red cotton bug, 2.3 Brinjal fruit borer, 2.4 Rice weevil, 2.5 Pulse beetle	
3	Non insect pests: Rats, Crabs, Snails, and Squirrels	**02**
4	Pest control practices in brief: 4.1 Different methods of pest Control: Cultural control, Physical control, Mechanical control, Chemical control, Biological control, Pheromonal control,Autocidal control and Concept of IPM in brief 4.2Hazard Due to Pesticides, Emergence of bio-pesticides	**04**
5.	Plant protection appliances: 5.1 Shoulder type Rotary duster, 5.2 Knapsack sprayer, 5.3 Cynogas Pump.	**02**

Course Title: Zoology Practical
Course Code-23-ZO -233
Semester III (1.5 Credit)

Course Outcomes:

CO1: Student understands the taxonomy of representative museum specimen.

CO2: Student understands the anatomy of locally available fish.

CO3: Student learns the adaptive measures of fish.

CO4: To acquaint the student with silkworm rearing.

CO5: Student gets practical knowledge and skill of identification of pest & its control.

Sr. no.	**Unit of Animal Systematics and Diversity III**
1.	Museum study of Group Protochordata: *Balanoglossus, Herdmania, Amphioxus*. (D)
2.	Museum study of Class Pisces: *Labeo, Hammerheaded Shark, Hippocampus.* (D)
3	Museum study of Class Amphibia: *Salamandra, Rana, Ichthyophis*. (D)
4	Study of external characters & digestive system of locally available fish. (E) -
5	Study of brain of locally available fish. (D)
6	Temporary preparation of scales & its identification from locally available fish. - (E)
7	Study of types of scales in fishes: Placoid scale, Cycloid scale, Ctenoid scale & Ganoid scale. (D)
8	Study of types of tail fins in fishes: Homocercal, Heterocercal &Diphycercal. (D)
9	Morphometric study of Fish using Vernier caliper (E)
Sr. no.	**Unit of Sericulture**
1.	Study of external morphology and life-cycle of *Bombyx mori*. (D)
2.	Study of five equipments in Sericulture. (E) -
3.	Preparation of a map showing distribution of silk moth and rearing/ sericulture practices in India. (E)
Sr. no.	**Unit of Agricultural Pests and their control**
1.	Study of following insect pests with respect to marks of identification, nature of Damage, economic importance and control measures. (D) a) Red cotton bug, b) Brinjal fruit borer, c) Mango stem borer d) Rice weevil, e) Pulse beetle

2.	Study of any two non-insect pests corresponding to theory course. (D)
4.	Compulsory submission of at least five Insect Pests/ Photographs/ Sketches. (E)
5.	Study of pest control appliances (as per theory course). (D)
6.	Compulsory study tour/field visit to sericulture institute / Agricultural farm and report writing **(2 P)**

Course Title: Animal systematics & Diversity –IV
Course Code- 23-ZO-241
Semester II (2 credits-30 lectures)

CO1: To acquaint the students with class Reptilia, Aves and Mammalia

CO2: Student understands various adaptations of higher vertebrates.

CO3: To understand the morphological and anatomical features of representative animal.

Sr. no.	Unit	Required Lectures
1.	**Introduction to class –Reptilia** 1.1 Salient features and classification of class Reptilia with one example- *Crocodile* 1.2 Study of temporal Vacuities in reptiles 1.3 Snake venom, symptoms, effect and cure of snake bite, first aid treatment of snakebite. 1.4 Desert adaptations in reptiles in brief. 1.5 Environmental Sex determination in reptiles.	**06**
2.	**Introduction to class –Aves** 2.1 Salient features of class Aves with one example – Peacock 2.2 *Archaeopteryx* –Connecting link between reptiles and Aves. 2.3 Flight adaptations in birds. 2.4 Migration in birds – Altitudinal, Latitudinal, Diurnal and Nocturnal. 2.5 Nesting pattern in birds.	**05**
3	**Introduction to class - Mammalia.** 3.1 Salient features and Classification of class Mammalia with one example- Rabbit. 3.2 Adaptations in Mammals- Volant adaptations, Aquatic adaptations, Cursorial adaptations, Fossorial adaptations. 3.3 Dentition in Mammals.	**05**
4	**Study of Rat** 4.1 Systematic position, habit and habitat and External characters. 4.2 Respiratory system. 4.3 Digestive system, food and feeding. 4.4 Respiratory System 4.5 Blood Vascular system- Structure of Heart. 4.6 Nervous system – Central Nervous system only. 4.7 Reproductive system- Male and Female.	**14**

Course Title: Industrial Zoology II
Course Code-23-ZO -242
Semester II (2 credits-30 lectures)

Course Outcomes:

CO1: To acquaint the student with Apiculture as Entrepreneurship.

CO2: To understand the practice of Apiculture and Rearing of honeybees.

CO3: Student understands the rearing of fishes.

Sr. no.	Unit	Required Lectures
Apiculture		
1.	**Introduction:** 1.1 Introduction, Scope and Entrepreneurial aspects of Apiculture in India 1.2Systematic position, Study of habit, habitat and nesting behaviour of *Apisdorsata*, *Apisindica*, *Apis florae* and *Apismellifera Mellipona* 1.3 Life cycle, Colony organization and Division of labour. 02 1.4 Bee behaviour and communication (Round Dance ,Wag-Tail Dance, DVAV & Cleaning dance).	**04**
2.	**Bee keeping and requirements** 2.1 Bee keeping equipments : **a)** Bee box (Langstroth type), **b)** Honey extractor, **c)** Smoker, **d)** Bee-veil, **e)** Gloves, **f)** Hive tool, **g)** Bee Brush, **h)** Queen excluder. 2.2 Bee keeping and seasonal management and pollination 2.3 Bee products (composition and uses) : **a)** Honey, **b)** Wax, **c)** Bee Venom, **d)** Propolis, **e)** Royal jelly, **f)** Pollen.	**06**
3	**Threats to Honeybees** 3.1Diseases and enemies of Bees : **a)** Bee diseases - Protozoan (Nosema), Bacterial (American foul brood), Viral (Sac brood), Fungal (Chalk brood). **b)** Bee pests - Wax moth (Greater and Lesser), Wax beetle. 3.2 Effect of Pesticides on Honeybees	**05**

Fisheries		
1	**Introduction to Fisheries** 1.1 An Introduction, Scope and Entrepreneurship aspects of Fisheries in India 4.2 Introduction to Fresh water Marine water Brackish Water Inshore Offshore and Coastal Fishery .	**03**
2	**Culture and Harvesting Methods** 2.1 Habit, habitat culture methods & Economic importance of following freshwater forms : **a)** Rohu (*Labeo rohita*) , **b)** Catla (*Catla catla*) , **c)** Mrigal (*Cirrhinus mrigala*). d) Giant Prawn (*Macrobranchium rosenbergii*) 2.3 Harvesting methods of following marine forms: **a)** *Harpodon*, **b)** Mackerel, **c)** Pearl oyster. d) Lobster 2.4 Crafts and Gears in Indian Fishery: **a)** Crafts – Catamaran, Machwa, Dinghi, Dug out canoe, Built net. **b)** Gears – Gill net, Dol net, Rampani net, Cast net.	**06**
3	**Fishery Byproducts and Preservation Techniques** **3.1 Fishery byproducts:** **a)** Fish meal, **b)** Fish flour, **c)** Fish Liver oil, **d)** Fish manure, **e)** Fish fin soup. **3.2Fish preservation technique:** **a)** Chilling, **b)** Freezing, **c)** Salting, **d)** Drying, **e)** Canning	**04**
4	**By-catch- Emerging problem to sustainable fishery**	**02**

Course Title: Zoology Practical
Course Code- 23-ZO-243
Semester IV (1.5 credits)

Course Outcomes:
After successfully completing this course, students will be able to:
CO1: Identify, Classify and describe the representative specimens.

CO2: Understand the beak and feet adaptations in birds.

CO3: Explain and illustrate the systems of Rat

CO4: Explain the biology of bees, basic beekeeping equipments and bee products

CO5: Explain economic important of fishes, various crafts and gears used in fisheries.

Sr. no.	Unit of Animal Systematics & Diversity - IV
1	Museum study of Class Reptilia: Venomous & Non-venomous snake – Two each. (D)
2	Identification of Venomous & Non-venomous snakes with the help of pictorial taxonomic keys.
3	Museum study of Class Aves: Sparrow, *Kingfisher*& Duck. (D)
4	Study of types of beaks & feet in birds –(D)
5	Museum study of Class Mammalia: Squirrel, Shrew & Bat. (D)
6	Study of external characters & digestive system of Rat. (D)
7	Study of Heart and Brain of Rat. (D)
8	Commonly occurring birds around Campus / Pune Region.
	Unit of Apiculture –
1.	Study of external morphology, life cycle and polymorphism in Honey Bee. (D)
2.	Temporary mounting of mouth parts, legs, wings and sting apparatus of worker bee. (E)
3.	Study of Bee keeping Equipment: Bee box, Honey extractor, Smoker**,** Bee-veil, queen excluder. (D)- Compulsory
4.	Study of Bee products: Honey, Wax, Venom, Royal jelly, Pollen. (D)
5.	Estimation of carbohydrates from Honey in different samples. (D)- Compulsory
6.	Study of Bee enemies: Wax moth, Bee eater, ant, King crow, Wasp, Lizard. (D)
7.	Determination of Honey Purity and Quality
	Unit of Fisheries –
8.	Identification, Classification and study of habit, habitat and economic importance of **a)** Rohu (*Labeo rohita*), **b)** Catla (*Catla catla*), **c)** Mrigal (*Cirrhinus mrigala*). (D)

9.	Identification, Classification and study of habit, habitat and economic importance of **a)** Prawn, **b)** Crab, **c)** Lobster, **d)** Pearl Oyster. (D)
10.	Study of crafts: **a)** Catamaran, **b)** Machwa, **c)** Dinghi (Photographs/models/line drawings). (D)
11.	Study of gears in fishing: **a)** Gill net, **b)** Dol net, **c)** Rampani net, **d)** Cast net. (Photographs/models/line drawings). (D)
12.	Study of nutritional value of fish: Biochemical estimation of fish muscle proteins by using Biuret method. (E) - Compulsory
13.	Compulsory study tour/field visit to Apiculture institute / Fish farm/ Aquarium/ Fish market. (E) **(2 P)**

Recommended Reference Books

Animal Systematics & Diversity – III & IV

1. Text Books of Zoology, Invertebrates Vol- II, 1992, T.J.Parker and W.A. Haswel, Edited by Marshall and Williams,CBS publications and distribution, New Delhi.
2. Integrated Principles of Zoology, Eleventh Edition, Hickman CP, Roberts LS & Larson A. International Edition ISBN 0–07–118077–X, The McGraw-Hill Companies, Inc.,
3. Modern Text Book of Zoology, Vertebrates. R. L. Kotpal, 3rd edn. Rastogi Publications, Meerut.
4. Chordate Zoology, 1982, P.S.Dhami and J.K.Dhami, R. Chand and Co., New Delhi.
5. Biology, Campbell nand Reece. 7th Edn. Pearson Education in South Asia, Delhi.
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