HSNC UNIVERSITY, MUMBAI

Board of Studies in Faculties of Science & Technology

Board of Studies in Zoology Subject

1) Name of Chairperson/Co-Chairperson/Coordinator:-
    a. **Dr. Tejashree Shanbhag (Assistant Professor, Department of Life Sciences, K. C. College, Churchgate) tejashree.shanbhag@kccollege.edu.in 9892370263**

2) Two to five teachers each having minimum five years teaching experience amongst the full time teachers of the Departments, in the relevant subject.
    a. **Dr. Shalini Rai (Assistant Professor, Department of Life Sciences, K. C. College, Churchgate) shalini.rai@kccollege.edu.in 9987326613**

    b. **Dr. Aashu Vajpai (Assistant Professor, Department of Life Sciences, K. C. College, Churchgate) aashu.vajpai@kccollege.edu.in 9702073377**

    c. **Dr. Suvarna Sharma (Assistant Professor, Department of Life Sciences, K. C. College, Churchgate) suvarna.sharma@kccollege.edu.in 9869525362**

3) One Professor / Associate Professor from other Universities or professor / Associate Professor from colleges managed by Parent Body; nominated by Parent Body;-
    a. **Dr. Lata Sardesai (Associate Professor and Head, Department of Zoology, R. D. National College, Bandra) latasardesai10@gmail.com 9987755199**

4) Four external experts from Industry / Research / eminent scholar in the field relevant to the subject nominated by the Parent Body;
    a. **Dr. Saikumar Menon -** Dept of Pharma Analytical Sciences, KAUSHAL Kendra, Ramnarain Ruia, Autonomus College, Matunga, Mum-400019 drsasikumarmenon@ruiacollege.edu 9821541776
    b. **Dr. Kersi Avari -** Consultant & freelance, Embryologist Programme Director, Embryology academy for research and training kersiavari@hotmail.com 9322405935
    c. **Dr. Manoj Borkar-** Associate Professor &Head, Dept of Zoology, Carmel college for women, Nuwem, Goa. borkar.manoj@rediffmail.com 9850641163
    d. **Principal Dr. B.B. Sharma –** Department of Zoology, KET's Vaze Kelkar College drbharatbhushansharma@gmail.com 9820502142
    e. **Principal Dr. Chhaya Panse**- Department of Zoology, MD College, Dr. S.S. Rao road, Parel, Mumbai-400012 principal@mdcollege.in 8828135592

5) Top rankers of the Final Year Graduate and Final Year Post Graduate examination of previous year of the concerned subject as invitee members for discussions on framing or revision of syllabus of that subject or group of subjects for one year.
    a. **Mr. Sudha Savant – Application Scientist, Buisness unit at Beckman Coulter, USA sudhasavant@gmail.com +1(317)294 9850**
    b. **Mr. Akshay Kawale – Marketing Manager, Glenmark Pharmaceuticals akshaykawale@gmail.com 9869777675**

Part –I

Outline of Choice Based Credit System as outlined by University Grants Commission:

R. **: The Definitions Of the Key Terms Used in The Choice Based Credit System And Grading System Introduced From TheAcademicYear2020-2021AreAs Under:**

1. **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

2. **Elective Course:** Generally, a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

2.1 **Discipline Specific Elective (DSE) Course:** Elective courses may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by main discipline/subject of study).

2.2 **Dissertation/Project:** An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline specific elective paper.

2.3 **Generic Elective (GE) Course:** An elective course chosen generally from an unrelated discipline/subject, with an intention to seek exposure is called a Generic Elective.

P.S.: A core course offered in a discipline/subject may be treated as an elective by other discipline/subject and vice versa and such electives may also be referred to as Generic Elective.

3. **Choice Base Credit System:** CBCS allows students to choose inter- disciplinary, intra-disciplinary courses, skill-oriented papers (even from other disciplines according to their learning needs, interests and aptitude) and more flexibility for students.

4. **Honours Program:** To enhance employability and entrepreneurship abilities among the learners, through aligning Inter Disciplinary / Intra Disciplinary courses with Degree Program. Honors Program will have 40 additional credits to be undertaken by the learner across three years essentially in Inter / Intra Disciplinary course.

   A learner who joins Regular Undergraduate Program will have to opt for Honours Program in the first year of the Program. However, the credits for honours, though divided across three years can be completed within three years to become eligible for award of honors Degree.

5. **Program:** A Program is a set of course that are linked together in an academically meaningful way and generally ends with the award of a Degree Certificate depending on the level of knowledge attained and the total duration of study, B.Sc. Programs.

6. **Course:** A 'course' is essentially a constituent of a 'program' and may be conceived of as a composite of several learning topics taken from a certain knowledge domain, at a certain level. All the learning topics included in a course must necessarily have academic coherence, i.e. there must be a common thread linking the various components of a course. A number of linked courses considered together are in practice, a 'program'.

7. **Bridge Course:** Bridge course is visualized as Pre semester preparation by the learner before commencement of regular lectures. For each semester the topics, whose knowledge is considered as essential for effective and seamless learning of topics of the Semester, will be specified. The Bridge Course can be conducted in online mode. The Online content can be created for the Bridge Course Topics.

8. **Module and Unit:** A course which is generally an independent entity having its own separate identity, is also often referred to as a 'Module' in today's parlance, especially when we refer to a 'modular curricular structure'. A module may be studied in conjunction with other learning modules or studied independently. A topic within a course is treated as a Unit. Each course should have exactly 3 Units.

9. **Self-Learning: 20% of the topics will be marked for Self-Learning.** Topics for Self-Learning are to be learned independently by the student, in a time- bound manner, using online and offline resources including online lectures, videos, library, discussionforums, fieldwork, internships etc.

   Evaluative sessions (physical/online), equivalent to the credit allocation of the Self Learning topics, shall be conducted, preferably, every week for each course. Learners are to be evaluated real time during evaluative sessions. The purpose of evaluative

sessions is to assess the level of the students' learning achieved in the topics earmarked for Self-Learning.

The teacher's role in these evaluative sessions will be that of a Moderator and Mentor, who will guide and navigate the discussions in the sessions, and offer concluding remarks, with proper reasoning on the aspects which mayhave been missed by the students, in the course of the Self-Learning process.

The modes to evaluate self-learning can be a combination of the various methods such as written reports, handouts with gaps and MCQs, objective tests, case studies and Peer learning. Groups can be formed to present self- learning topics to peer groups, followed by Question and Answer sessions and open discussion. The marking scheme for Self-Learning will be defined under Examination and Teaching. The topics stipulated for self-learning can be increased or reduced as per the recommendations of the Board of Studies and Academic Council from time to time. All decisions regarding evaluation need to be taken and communicated to the stakeholders preferably before the commencement of a semester. Some exceptions may be made in exigencies, like the current situation arising from the lockdown, but such ad hoc decisions are to be kept to the minimum possible.

10. **Credit Point:** Credit Point refers to the 'Workload' of a learner and is an index of the number of learning hours deemed for a certain segment of learning. These learning hours may include a variety of learning activities like reading, reflecting, discussing, attending lectures / counseling sessions, watching especially prepared videos, writing assignments, preparing for examinations, etc. Credits assigned for a single course always pay attention to how many hours it would take for a learner to complete a single course successfully. A single course should have, by and large a course may be assigned anywhere between to 8 credit points wherein 1 credit is construed as corresponding to approximately 30 to 40 learning hours.

11. **Credit Completion and Credit Accumulation:** Credit completion or Credit acquisition shall be considered to take place after the learner has successfully cleared all the evaluation criteria with respect to a single course. Thus, a learner who successfully completes a 4 CP (Credit Point) course may be considered to have collected or acquired 4 credits. learner level of performance above the minimum prescribed level (viz. grades / marks obtained) has no bearing on the number of credits collected or acquired. A learner keeps on adding more and more credits as he completes successfully more and more courses. Thus, the learner 'accumulates' course wise credits.

12. **Credit Bank:** A Credit Bank in simple terms refers to stored and dynamically updated information regarding the number of Credits obtained by any given learner along with details regarding the course/s for which Credit has been given, the

course-level, nature, etc. In addition, all the information regarding the number of Credits transferred to different programs or credit exemptions given may also be stored with the individual's history.

13. **Credit Transfer:** (performance transfer) When a learner successfully completes a program, he/she is allowed to transfer his/her past performance to another academic program having some common courses and Performance transfer is said to have taken place.

14. **Course Exemption:** Occasionally, when two academic programs offered by a single university or by more than one university, may have some common or equivalent course-content, the learner who has already completed one of these academic programs is allowed to skip these 'equivalent' courses while registering for the new program. The Learner is 'exempted' from 'relearning' the common or equivalent content area and from re-appearing for the concerned examinations. It is thus taken for granted that the learner has already collected in the past the credits corresponding to the exempted courses.

Part-II

O*** The fees for transfer of credits or performance will be based on number of credits that a learner has to complete for award of the degree.**

The Scheme of Teaching and Examination:

The performance of the learners shall be evaluated in two components: Internal Assessment with 40% marks by way of continuous evaluation and by Semester End Examination with 60% marks by conducting the theory examination.

INTERNAL ASSESSMENT:- It is defined as the assessment of the learners on the basis of continuous evaluation as envisaged in the credit based system by way of participation of learners in various academic and correlated activities in the given semester of the programme.

A). Internal Assessment – 40%
40 marks
B). Practical's (internal Components of the Practical Course

1. For Theory Courses

Sr. No.	Particulars	Marks
1	**ONE** class test / online examination to be conducted in the given semester	15 Marks
2	One assignment based on curriculum (to be assessed by the teacher Concerned	10 Marks
3	Self-Learning Evaluation	10 Marks
4	Active participation in routine class instructional deliveries	05 Marks

2. For Courses with Practicals
Each practical course can be conducted out of 50 marks with 20 marks for internal and 30 marks for external

Practical's (Internal component of the Practical Course)

Sr. No	Evaluation type	Marks
1	Two Best Practicals /Assignments/Presentation /Preparation of models/ Exhibits **Or** One Assignment/ project/presentation to be assessed by teacher concerned	10
2	Journal	05
3	Viva	05

The semester end examination (external component) of 60 % for each course will be as follows:

i) **Duration – 2 Hours** ii) **Theory Question Paper Pattern**: -

1. There shall be four questions each of 15 marks. On each unit there will be one question and the fourth one will be based on entire syllabus.
2. All questions shall be compulsory with internal choice within the questions. (Each question will be of 20 to 23 marks with options.)
3. Question may be subdivided into sub-questions a, b, c… and the allocation of marks depend on the weightage of the topic.

The marks will be given for all examinations and they will be converted into grade (quality) points. The semester-end, final grade sheets and transcripts will have only credits, grades, grade points, SGPA and CGPA.

3. Project and Assignment:

- Project or Assignment, which can in the following forms
- Case Studies
- Videos
- Blogs
- Research paper (Presented in Seminar/Conference)
- Field Visit Report
- Presentations related to the subject (Moot Court, Youth Parliament, etc.)
- Internships (Exposition of theory into practice)
- Open Book Test
- any other innovative methods adopted with the prior approval of Director Board of Examination and Evaluation.

4.Self-Learning Evaluation

14.1 20% OF THE TOPICS OF CURRICULUM ARE LEARNED BY THE STUDENT THROUGH SELF LEARNING USING ONLINE / OFFLINE ACADEMIC RESOURSE SPECIFIED IN THE CURRICULUM.

14.2 HENCE 20% OF THE LECTURES SHALL BE ALLOCATED FOR EVALUATION OF STUDENTS ON SELF LEARNING TOPICS

14.3 The identified topics in the syllabus shall be learnt independently by the students in a time bound manner preferably from online resources. Evaluative sessions shall be conducted by the teachers and will carry 10 Marks.

CLUB The self-learning topics into 3-4 GROUPS OF TOPICS ONLY FOR EVALUATION.

- **PRESCRIBE TIME DURATION (IN DAYS) FOR COMPLETION OF EACH GROUP OF TOPIC AND EARMARK SELF LEARNING EVALUATION LECTURES IN THE TIMETABLE. HENCE EACH GROUP OF TOPIC CAN BE ASSIGNED 3 REGULAR LECTURES FOR THIS EVALUATION FOR ENTIRE CLASS**

3 Sub Topics
Each evaluative session shall carry 3 Marks (3 x 3 Units = 9 Marks). Students who participate in all evaluative sessions shall be awarded 1 additional Mark.

4 Sub Topics
Each evaluative session shall carry 2.5 Marks (2.5 x 4 Units = 10 Marks)

EVALUATION OF SELF LEARNING TOPICS CAN COMMENCE IN REGULAR LECTURES ASSIGNED FOR SELF LEARNING EVALUATION IN THE TIMETABLE

15. Evaluative sessions

Each evaluative session shall carry 3 Marks (3 x 3 = 9 Marks). Students who participate in all evaluative sessions shall be awarded 1 additional Mark.

16. Evaluative sessions

Each evaluative session shall carry 2.5 Marks (2.5 x 4 = 10 Marks).

Methods for Evaluation of Self-learning topics:

16.1 Seminars/presentation (PPT or poster), followed by Q&A – Objective questions /Quiz / Framing of MCQ questions.
16.2 Debates

- Group discussion
- You-Tube videos (Marks shall be based on the quality and viewership)
- Improvisation of videos
- Role Play followed by question-answers

TEACHERS CAN FRAME OTHER METHODS OF EVALUATION ALSO PROVIDED THAT THE METHOD, DULY APPROVED BY THE COLLEGE EXAMINATION COMMITTEE, IS NOTIFIED TO THE STUDENTS AT LEAST 7 DAYS BEFORE THE COMMENCEMENT OF THE EVALUATION SESSION AND IS FORWARDED FOR INFORMATION AND NECESSARY ACTION AT LEAT 3 DAYS BEFORE THE COMMENCEMENT OF THE EVALUATION SESSION

- Viva Voce
- Any other innovative method

SEMESTER END EXAMINATION: - It is defined as the examination of the learners on the basis of performance in the semester end theory / written examinations.

B. Semester End Examination- 60 % - *60 Marks*

1) Duration – These examinations shall be of 2 Hours duration.

2) Question Paper Pattern: -

i. There shall be four questions each of 15 marks. ii. All questions shall be compulsory with internal choice within the questions.

iii. Question may be sub-divided into sub-questions a, b, c, d & e only and the allocation of marks depends on the weightage of the topic.

THE MARKS OF THE INTERNAL ASSESSMENT SHOULD NOT BE DISCLOSED TO THE STUDENTS TILL THE RESULTS OF THE CORRESPONDING SEMESTER IS DECLARED.

HSNC University, Mumbai

Ordinances and Regulations

With Respect to

Choice Based Credit System

(CBCS)

For the Programmes under

The Faculty of Science and Technology

For the course

Zoology

Curriculum – First Year Undergraduate Programmes
Semester-I and Semester-II

2020-2021

Section C
Zoology
Part 1- Preamble

Zoology as a subject offers the basic understanding about the animal kingdom and their functioning of various physiological, metabolic, biochemical aspects. This Course takes the students through the fascinating world of animals and their habitats, it explains economic and ecological importance of the animals and the Conservation Strategies. The course includes Classical Zoology, Biodiversity, Biotechnology, Instrumentation, Ecology and Population Studies which enables the students to strengthen their knowledge in Animal Sciences and helps to develop and understanding of scope of the subject as an employment opportunity.

This Course has Two Theory Papers and Two Practical Paper in each of the Semesters. With the introduction of Choice Based Grading System, there will be a continuous evaluation throughout the year in the form of Internal Assessment and Term End Assessment.

1 **Course Objectives:**

USFZO101:

- Curiosity will be ignited in the mind of learners, to know more about the fascinating world of animals which would enhance their interest and love for the subject of Zoology.
- Learners would appreciate treasure of Biodiversity, its importance and hence would contribute their best for its conservation.

USFZO102:

- Learners would work safely in the laboratory and avoid occurrence of accidents (mishaps) which will boost their scholastic performance and economy in use of materials/chemicals during practical sessions.

- Learners would understand recent advances in the subject and their applications for the betterment of mankind; and that the young minds would be tuned to think out of the box.

- Students will be skilled to select and operate suitable instruments for the studies of different components of Zoology of this course and also of higher classes including research.

USFZO201:

- Curiosity will be ignited in the mind of learners, to know more about the fascinating world of animals which would enhance their interest and love for the subject of Zoology.
- This unit would allow learners to study about nature of animal population, specific factors affecting its growth and its impact on the population of other life form.
- Learners would be inspired to choose career options in the field of wild life conservation, research, photography and ecotourism

USFZO202:

- Healthy dietary habits would be inculcated in the life style of learners in order to prevent risk of developing health hazards in younger generation due to faulty eating habits.
- Promoting optimum conservation of water, encouragement for maintaining adequate personal hygiene, optimum use of electronic gadgets, avoiding addiction, thus facilitating achievement of the goal of healthy young India in true sense.
- Learners will be able to promptly recognize stress related problems at initial stages and would be able to adopt relevant solutions which would lead to psychologically strong mind set promoting positive attitude important for academics and would be able to acquire knowledge of cause, symptoms and precautions of infectious diseases.

1. **Process adopted for curriculum designing:**

   The department conducted multiple meetings with the academic, Industry partners and established alumni. After discussion with them at different stages of syllabus development, the changes in the syllabus were introduced.

2. **Salient features, how it has been made more relevant:**

   After discussion and interaction with the industry and academic partners and understanding the requirement of the industries and other related fields certain changes in the syllabus are introduced. Certain portion of animal diversity were added to provide the physiological and other related study of various organisms in addition to their specialty in the animal world.

3. **Learning Outcome**

   First year B.Sc. course is the entry point for the students to undergraduate classes which acts like a guiding force for them to make up their mind in selecting a subject they would wish to pursue their studies in future for carving their career in a particular field. This curriculum will enable the following:

- To nurture interest in the students for the subject of Zoology
- To take the learner through a captivating journey of understating the diversity of Animal Kingdom and hoarded wealth of marvelous animal world (Invertebrates).
- To orient learners about rich heritage of Biodiversity of India and make them understand significance of its conservation.
- To impart knowledge of different components of ecosystem and educate about essentials of coexistence of human beings with all other living organisms.
- To create awareness of the basic and modern concepts of Zoology
- To orient students about the importance of abiotic and biotic factors of environment and their conservation.
- To provide an insight to the basic nutritional and health aspects of human life.
- To inculcate good laboratory practices in students and to train them about scientific handling of important instruments.
- To facilitate the learning of population ecology, its dynamics and regulatory factors important for its sustenance
- To impart knowledge about source, quantum and need for conservation of fast depleting water resource and essentials of maintaining proper sanitation, hygiene and optimizing use of electronic gadgets.
- To educate learners about causes, symptoms and impact of stress related disorders and infectious diseases.
- To make learners understand the importance of balanced diet and essential nutrients of food at different stages of life.

4. **Input from stakeholders:**
    - Inclusion of relevant topics has been done based on the inputs from the stakeholders of the Department including students and teachers.
    - The study of Invertebrate and vertebrates will be taught in addition to the wonders of Animal kingdom.
    - More hands-on and skill-based practical sessions have been added in the syllabus.
    - In view of Economic Zoology as an important branch from carrier prospects, industrial visits are suggested.
    - Study of Instrumentation and Applied Zoology has made the syllabus more suitable for absorption in Industries.
    - Economic Zoology will motivate the students to become an entrepreneur,

Part 2- The Scheme of Teaching and Examination is as under:

Semester – I

Summary

Sr. No.	Choice Based Credit System			Subject Code	Remarks
1	Core Course (**Zoology**)			US-FZO-101 US-FZO-102 US-FZO-P1 US-FZO-P2	NIL
2	Elective Course	Discipline Specific Elective (DSE) Course		-	
		2.1	Interdisciplinary Specific Elective (IDSE) Course	-	
		2.2	Dissertation/Project	-	
		2.3	Generic Elective (GE) Course	-	
3	Ability Enhancement Courses (AEC)			US-FFC	
	Skill Enhancement Courses (SEC)			-	

First Year Semester I Internal And External Detail Scheme

Sr. No.	Subject Code	Subject Title	Periods Per Week						Seasonal Evaluation Scheme				Total Marks
			Units	S. L.	L	T	P	Credit	S. L. E	CT	TA	SEE	
1	USFZO101	Diversity and Wonders of Animal Kingdom	3	20% *	3	0	0	2	10	20	10	60	100
2	USFZO102	Laboratory Safety, Units of Measurement, Instrumentation and Animal Biotechnology	3	20% *	3	0	0	2	10	20	10	60	100
3	USFZOP1	Practicals Based on course 1 Practicals Based on course 2			0	0	6	2				100 (80+ 20)	100
	Total Hours / Credit							06	Total Marks				300

***One to two lectures to be taken for CONTINUOUS self -learning Evaluation.**

Ist Year Semester – I Units – Topics – Teaching Hours

S. N	Subject Code	Subject Unit Title		Hours/Lectures	Total No. of hours/lectures	Credit	Total Marks
1	USFZO101	I	Diversity and Wonders of Animal Kingdom-I	15	45 L	2	100 (60+ 40)
		II	Biodiversity and its Conservation	15			
		III	Ecosystem Ecology	15			
2	USFZO102	I	Laboratory Safety and units of Measurement	15	45L	2	100 (60+ 40)
		II	Animal Biotechnology	15			
		III	Instrumentation	15			
3	USFZOP1	I	Practicals based on course 1 of theory	3	45x2= 90L lectures per batch	2	100 (80+ 10+10)
		II	Practicals based on course 2 of theory	3			
			TOTAL			6	300

- **Lecture Duration – 48 Minutes**
- **One Credit = 15 classroom teaching Hours**

Part - 3 Detail Scheme Theory

Curriculum Topics along with Self-Learning topics - to be covered, through self-learning mode along with the respective Unit. Evaluation of self-learning topics to be undertaken before the concluding lecture instructions of the respective unit

Course Code: USFZO101 - Diversity and Wonders of Animal Kingdom

Unit	Content	No. of Lectures
I	**Diversity and Wonders of Animal Kingdom I** 1.1. Unicellular andmulticellular organization (Salient features with examples of phylum and classes mentioned below) 1.2.1: Unicellular organization: Phylum Protozoa 1.2.2: Multicellular organization: Colonization level- Phylum Porifera 1.2.3: Multicellular organization: Division of labour (Cell differentiation) Phylum Coelenterata; Formation of Corals 1.3.1: Triploblastic acoelomate and Pseudocoelomate organization 1.3.2: Acoelomate organization - Phylum Platyhelminthes 1.3.3: Pseudocoelomate organization – Phylum Nemathelminthes 1.4 :Triploblasticcoelomate organization 1.4.1:Animals with metameric segmentation- Phylum Annelida 1.4.2: Animals with jointed appendages - Phylum Arthropoda; Bioluminescence	15
II	**Biodiversity and its Conservation** 2.1: Introduction to Biodiversity - Definition, Concepts, Scope and Significance 2.2: Levels of Biodiversity - Introduction to Genetic, Species and Ecosystem Biodiversity 2.3: Introduction of Biodiversity Hotspots- (Western Ghats and Indo- Burma Border) 2.4: Values of biodiversity - Direct and Indirect use value 2.5: Threats to Biodiversity - Habitat loss 2.6: Biodiversity conservation and management 2.6.1: Conservation strategies: in situ, ex-situ, National parks, Sanctuaries and Biosphere reserves. 2.6.2:Introduction to International efforts : Convention on Biological Diversity (CBD), International Union for Conservation of Nature and Natural Resources (IUCN), United Nations Environment Program - World Conservation Monitoring Centre (UNEP- CMC) 2.6.3: National Biodiversity Action Plan, 2002- 2003 2.6.4: Introduction to Indian Wildlife (Protection) Act, 1972 and	15

	Convention for International Trade of endangered species	
III	**Ecosystem Ecology** 3.1 : Concept of Ecosystems 3.1.1 : Ecosystem Definition and components 3.1.2 : Impact of temperature on biota 3.1.3 : Biogeochemical cycles (Water, Oxygen, Nitrogen, Sulphur) 3.1.4 : Fresh water ecosystem – Lentic and Lotic 3.1.5 : Food chain and food web in ecosystem (Fresh water and Grass land). 3.1.6 : Ecological pyramids - energy, biomass and number. 3.1.7: Animal interactions (commensalism, mutualism, predation, antibiosis, parasitism) Two Case Studies can be mentioned.	15

Self-Learning topics (Unit wise)

Unit	Topics
I	The students will identify one model organism in their vicinity or during a visit and do the detailed investigation on the same with respect to their classification and body organization. Also the students can identify the animal for its economic or environmental importance.
II	The students can identify the "Threats to Biodiversity - Habitat loss and Man-Wildlife conflict" in their surrounding areas and list them. They can consider the examples of Sanjay Gandhi National Park and Arrey Colony etc.
III	The students have an opportunity to identify a Fresh water ecosystem in their area and comment on the ecological status with respect to the fauna and food chain and food web in it. Example as Ban-Ganga and Powai Lake.

Online Resources

Swayam portal:

Introduction of Biodiversity Hotspots- (Western Ghats and Indo- Burma Border)

Values of biodiversity - Direct and Indirect use value

Concept of Ecosystems: Ecosystem Definition and components

1. *epgp.inflibnet.ac.in, moocs online sourses Environmental Sciences, (530) Paper -03 Biodiversity and conservation, Module : 03, 04,05*
2. *epgp.inflibnet.ac.in, moocs online courses Environmental Sciences, (530) Paper -1 Ecosystem structure & amp. And functions, Module : 01,02,03 Ecosystem concept structure, structure and function*
3. epgp.inflibnet.ac.in Zoology (184)Paper 1: Principles of Ecology Module 8 a and b Life and fecundity table part 1 and 2
4. Moocs online Course (UG) Moocs online course UG: Diet Management in Health and disease

Reference books for USFZO101 Paper 1

Sr	Unit	Reference
1	Unit I	InVertebrate Zoology, Volume I- Jordan and Verma, S. Chand and Co
2	Unit I	Invertebrate Zoology- P. S.Dhami and J. K. Dhami , R.Chand and Co.
3	Unit I	A Textbook of Zoology, Vol.II- T. Jeffery Parker and William. A. HaswellLow Price Publications
4	Unit II	Biodiversity- K.C.Agarwal- Agro Botanica Publications
5	Unit II	Wildlife Laws and its Impact on Tribes- Mona Purohit , Deep and Deep Publication
6	Unit III	Ecology and Environment- P. D. Sharma, R. K. Rastogi Publications
7	Unit III	Introduction to Ecology- R. Dajoz
8	Unit III	P.S. Verma and V. K. Agrawal, 2008. Cell biology, genetics, molecular biology, Evolution and Ecology. S. Chand Publications, New Delhi

Course Code: USFZO102 - Laboratory Safety, Units of Measurement, Instrumentation and Animal Biotechnology

Unit	Content	No. of Lectures
I	**Laboratory safety and Units of Measurement** 1.1: Introduction to good laboratory practices 1.2: Use of safety symbols: meaning, types of hazards and precautions 1.3: Units of measurement: 1.3.1:Calculations and related conversions of each: Metric system- length (meter to micrometer); weight (gram to microgram), Volumetric (Cubic measures) 1.3.2:Temperature: Celsius, Fahrenheit, Kelvin 1.3.3:Concentrations: Percent solutions, ppt, ppm, ppb dilutions, Normality, Molarity and Molality. 1.3.4:Biostatistics: Introduction and scope, Sampling and its types, Central Tendencies (mean, median, mode) Tabulation, Graphical representations (Histograms, bar diagrams, pie diagrams).	15
II	**Animal Biotechnology** 2.1: Biotechnology: Scope and achievements of Biotechnology (Fishery, Animal Husbandry, Medical, Industrial) 2.2: Transgenesis: Retro viral method, Nuclear transplantation method, DNA microinjection method and Embryonic stem cell method 2.3: Cloning (Dolly) 2.4: Ethical issues of transgenic and cloned animals 2.5: Applications of Biotechnology: 2.5.1:DNA fingerprinting: Technique in brief and its application in forensic science (Crime Investigation) 2.5.2:Recombinant DNA in medicines (recombinant insulin) 2.5.3:Gene therapy: Ex-vivo and In vivo, Severe Combined Immunodeficiency (SCID), Cystic Fibrosis 2.5.4:Green genes: Green Fluorescent Protein (GFP) from Jelly fish- valuable as reporter genes used to detect food poisoning. 2.6: Food biotechnology: Applications of biotechnology in making bread, beer, wine, yogurt and cheese	15
III	**Instrumentation** 3.1: Microscopy 3.1.1: Construction, principle and applications of dissecting and compound microscope, Scanning Electron Microscropy, Transmission Electron Microscopy. 3.2: Colorimetry and Spectroscopy - Principle and applications. 3.3: pH - Sorenson's pH scale, pH meter - principle and applications.	15

	3.4: Centrifuge - Principle and applications (clinical and ultra-centrifuges). 3.4: Chromatography- Principle and applications (Partition and Adsorption) 3.5: Electrophoresis - Principle and applications (AGE and PAGE) 3.6: Introduction to PCR	

Self-Learning topics (Unit wise)

Unit	Topics
I	Students will list out the precautions while performing any practical in the laboratory. The students will prepare the MSDS for the chemicals used in experiment will the use of safety symbols.
II	The student will try to identify the ancient and traditional method of preparation of Bread/Wine/Beer/Vinegar and try to compare it with the modern techniques of Biotechnology.
III	The students will be working in the laboratory with various instruments throughout the academic year and will learn to use them efficiently by learning their SOPs.

Online Resources

Swayam portal

Transgenesis: Retro viral method, Nuclear transplantation method, DNA microinjection method and Embryonic stem cell method

Chromatography- Principle and applications (Partition and Adsorption)

1. *epgp.inflibnet.ac.in, moocs online courses Biotechnology (261) Paper -09 Animal Cell*
2. *epgp.inflibnet.ac.in, moocs online courses Analytical chemistry/ instrumentation (221) Paper -03 Chromatography Techniques, Module : 01 & 02*

References for USFZO102 Paper 2

Sr	Unit	Reference
1	Unit I	Introduction to Practical Biochemistry – David T. Plummer (Tata McGraw Hill Publishing Co. Ltd.)
2	Unit I	Principles and Techniques of Practical Biochemistry – Keith Wilson and John
3	Unit I	Introduction to Practical Biochemistry – David
4	Unit II	Biochemistry by Harper
5	Unit II	Biotechnology by Jogdang
6	Unit II	A Textbook of Biotechnology – R. C. Dubey, S. Chand Publication
7	Unit III	Bioinstrumentation – L. Veerakumari, (M.J.P. Publishers)
8	Unit III	Biological instruments and methodology – Dr. P.K. Bajpai, S. Chand
9	Unit III	epgp.inflibnet.ac.in, moocs online courses Analytical chemistry/ instrumentation (221) Paper -03 Chromatography Techniques, Module : 01- 02

Part - 4

Paper-I-Practical **Total Credit: 1**

Title of Paper: Diversity and Wonders of Animal Kingdom

Course Code: US-FZO-P1			
Unit	**Content**	**No. of Lectures**	**Reference Books**
I,II and III	1. Mounting of foraminiferan shells from sand (any 3) Study of types of Corals - Brain, Organ pipe, Stag Horn, Mushroom coral 2. Study of the following; a. Symbiosis (Termite and Trychonympha, hermit crab and sea anemone) b. Camouflage (leaf insect, chameleon) c. Cannibalistic mate-eating animals (Spider and Praying Mantis) d. Animal architects: Termites, Harvester ant and Baya weaver bird e. Study of bioluminescent organisms – Noctiluca, glow worm, fire fly, angler fish. 4. Breeding and parental care in Amphibia- Rhacophorus, Midwife toad, Darwin's frog, Caecilian. 5. Mounting of scales of fish (placoid, cycloid and ctenoid) 6. a) Study of Adaptive radiation in Reptiles - Turtle, Tortoise, Phrynosoma, Draco) 6. b) Identification and differentiation of venomous and non-venomous snakes (Scales, Fangs, Bite marks, etc.) 7. Study of Types of feathers(contour, filoplume, down), beaks(Nectar feeding , Filter feeding), claws (perching, wading, swimming, hopping) in birds 8. a. Identification of birds - Coppersmith Barbet, Bulbul, Rose ringed Parakeet, Magpie Robin, two local birds. 8. b. Field Report – To be done in a group of ten students (submission of written / typed report preferably along with photographs/ tables/ graphs. Other Suggested topics for field observation/survey: 9. Butterflies/ Fishes/ Migratory birds of local area. Variations in Human like Attached vs. Free Earlobes, Blood Groups, Eye colour, etc. using statistical method. Observations of fauna in the field (with reference to theory syllabus).	03 lectures per practical per batch	Practical Referenc e 1,2,3

*Note –
The practical may be conducted by using specimens authorized by the wild such other regulating authorities though it is strongly recommended that the same should be taught by using photographs/audio-visual aids/ simulations / models, etc. as recommended the UGC and as envisaged in the regulations of the relevant monitoring bodies. Specimen, however, shall be procured for the purpose of conducting practical here-in-above.

#There shall be at least one excursion/field trip

Paper-II-Practical **Total Credit: 1**

Title of Paper: Laboratory Safety, Units of Measurement, Instrumentation and Animal Biotechnology

Course Code: US-FZO-P1			
Unit	**Content**	**No. of Lectures**	**Reference Books**
I,II and III	1. Interpretation of safety symbols (toxic, corrosive, explosive, flammable, skin Irritant, oxidizing, Compressed gases, aspiration hazards and Biohazardous infectious material.) 2. Study of Central tendencies and plotting of Bar diagram, histogram and pie diagram. 3. Identification of transgenic fish (Trout and Salmon) / cloned animals (Dolly sheep, cc cat and Snuppy dog) from photograph. 4. Extraction of fruit juice with pectinase from apple/guava/or any other suitable fruit 5. Calculation of pH of three different samples (one each acidic, alkaline and neutral) using pH paper/Universal Indicator and confirming the result with pH meter. 6. Application of DNA Fingerprinting in criminology (photograph of electrophoretic pattern to be given for interpretation by the students) 7. Study the effect of Papain as meat tenderizer. 8. Study of parts of microscope and their functions. Technique of focusing a permanent slide under 10x and 45x (objectives). 9. Dilution of given sample and estimation of OD by using colorimeter. Calculation of concentration from the given OD using formula.	03 lectures per practical per batch	Practical Reference 1,2,3

	10. Calculation of pH of three different samples (one each acidic, alkaline and neutral) using pH paper/universal indicator/pH indicator from red cabbage and confirming the result with pH meter. 11. Separation of amino acids from the mixture by paper chromatography. 12. Calculation of Rf value of separated pigments/amino acids from given chromatogram and their identification from standard chart. 13. Separation of pigments by adsorption chromatography using chalk. 14. Separations of lipids by TLC		

*Note –

The practical may be conducted by using specimens authorized by the wild such other regulating authorities though it is strongly recommended that the same should be taught by using photographs/audio-visual aids/ simulations / models, etc. as recommended the UGC and as envisaged in the regulations of the relevant monitoring bodies. Specimen, however, shall be procured for the purpose of conducting practical here-in-above.

#There shall be at least one excursion/field trip

References USFZOP1 Practical

Sr	Practical	Reference
1	I and II	Invertebrate Practical Zoology- P.S.Verma and Agrawal
2	I and II	A Manual of Medical Laboratory Technology -A. H. Patel, Navneet Prakashan
3	I and II	Biological instruments and methodology – Dr. P. K. Bajpai, S. Chand Co. LTD

Part 5

The Scheme of Teaching and Examination is as under: Ist Year Semester – II Summary

Sr. No.	Choice Based Credit System			Subject Code	Remarks
1	Core Course (**Zoology**)			US-FZO-201 US-FZO-202 US-FZO- P1 US=FZO-P2	NIL
2	Elective Course	Discipline Specific Elective (DSE) Course		-	
		2.1	Interdisciplinary Specific Elective (IDSE) Course	-	
		2.2	Dissertation/Project	-	
		2.3	Generic Elective (GE) Course	-	
3	Ability Enhancement Courses (AEC)			US-FFC	
	Skill Enhancement Courses (SEC)			-	

First Year Semester -II Internal and External Assessment

Detail Scheme

Sr. No.	Subject Code	Subject Title	Periods Per Week						Seasonal Evaluation Scheme				Total Marks
			Units	S. L.	L	T	P	Credit	S. L. E	CT	TA	SEE	
1	USFZO201	Diversity and Wonders of Animal Kingdom, Population Ecology and Wild Life Management	3	20% *	3	0	0	2	10	20	10	60	100
2	USFZO202	Nutrition, Public Health and Hygiene and Common Diseases	3	20% *	3	0	0	2	10	20	10	60	100
3	USFZOP2	Practicals Based on course 3 Practicals Based on course 4			0	0	6	2				100 (80+ 20)	100
	Total Hours / Credit							06	Total Marks				300

***One to two lectures to be taken for CONTINUOUS self -learning Evaluation.**

Ist Year Semester – II Units – Topics – Teaching Hours

S. N	Subject Code	Subject Unit Title		Hours/Lectures	Total No. of hours/lectures	Credit	Total Marks
1		I	Diversity and Wonders of Animal Kingdom –II	15	45 L	2	100 (60+40)
		II	Population Ecology	15			
		III	Wild Life Management	15			
2		I	Nutrition and Health	15	45L	2	100 (60+40)
		II	Public health and Hygiene	15			
		III	Common human Diseases	15			
3		I	Practicals based on course 3 of theory	3	45x2= 90 L lectures per batch	2	100 (80+10+10)
		II	Practicals based on course 4 of theory	3			
			TOTAL			6	300

- **Lecture Duration – 48 Minutes**
- **One Credit = 15 classroom teaching Hours**

Part -6 Detail Scheme Theory

Curriculum Topics along with Self-Learning topics - to be covered, through self-learning mode along with the respective Unit. Evaluation of self-learning topics to be undertaken before the concluding lecture instructions of the respective unit

Course Code: USFZO201 – Diversity and Wonders of Animal Kingdom, Population Ecology and Wild Life Management

Unit	Content	No. of Lectures
I	**Animal Diversity II and Wonders of Animal Kingdom** 1. Triploblastic coelomate organization 1.1: Animals with mantle: Phylum Mollusca ;Pearl Formation 1.2: Animals with enterocoel: Phylum Echinodermata , Phylum Hemichordata 1.3: Phylum Chordata 1.3.1: Subphylum Urochordata 1.3.2: Subphylum Cephalochordata 1.4: Subphylum Vertebrata 1.4.1: Super class: Agnatha- Class Cyclostomata 1.4.2: Super class: Gnathostomata 1.4.2.1 : Class Pisces (Cartilaginous and bony fish);Parental Care 1.4.2.2 : Class Amphibia ; Parental Care 1.4.2.3 : Class Reptilia; Regeneration 1.4.2.4 : Class Aves ; Brood Parasitism 1.4.2.5 : Class Mammalia; Parental Care	15
II	**Population Ecology** 2.1: Population Dynamics 2.1.1: Population density 2.1.2: Natality 2.1.3: Mortality 2.1.4: Fecundity 2.1.5: Age structure 2.1.6: Sex ratio 2.1.7: Life tables 2.1.8: Survivorship curves 2.1.9: Population dispersal and distribution Patterns 2.1.10:Niche concept 2.2: Population growth regulation 2.2.1: Intrinsic – Density dependent fluctuations and oscillations 2.2.2: Extrinsic - Density independent, environmental and climate factors, population interactions 2.3: Population growth pattern	15

	2.3.1: Sigmoid 2.3.2: J Shaped 2.4: Human census (India) – Concept, mechanism and significance	
III	**Wild Life Management** 3.1 : Concept of IUCN Red listed species using examples of Indian Wildlife with respect to National Parks and Wildlife 3.2: Sanctuaries of India (Sanjay Gandhi National Park, Tadoba Tiger Reserve, Corbett National Park, Kaziranga National Park, Gir National Park, Silent Valley, Pirotan Island Marine Park, Koeladeo Ghana National Park, Bandipur Sanctuary) 3.3: Management strategies with special reference to Tiger and Rhinoceros 3.4: Ecotourism 3.5: Biopiracy	15

Self-Learning topics (Unit wise)

Unit	Topics
I	The students will identify one model organism in their vicinity or during a visit and do the detailed investigation on the same with respect to their classification and body organization. Also the students can identify the animal for its economic or environmental importance.
II	The students from their area or Zone of Municipal Office can collect the data on Human Sensex and compare the two consecutive year's data and understand the mechanism of Human Sensex of India.
III	Students can choose a Sanctuary or National Park of Asia other than India and comment on their biodiversity. The students can understand the requisite to declare a place as an Ecotourism spot.

Online Resources

Swayam portal, Fecundity

Red Book Data on endangered species.

Reference for USFZO201 Paper 1

Sr	Unit	Reference
1	**Unit I**	Vertebrate Zoology Volume I- Jordan and Verma , S. Chand and Co
2	**Unit I**	Chordate Zoology- P. S. Dhami and J. K. Dhami , R. Chand and Co
3	**Unit II**	Fundamentals of Ecology- E. P. Odum , Sunders Publication
4	**Unit II**	epgp.inflibnet.ac.in Zoology (184) Paper 1: Principles of Ecology
5	**Unit II**	Essentials of Ecology and Environmental Science - S.V.S Rana
6	**Unit III**	Field Biology and Ecology – Alen H. Benton and William E. Werner ,Tata McGraw Hill ltd, New Delhi
7	**Unit III**	Ecology - Subramaniam and Others, Narosa Publishing House

8	**Unit III**	Economic Zoology, Biostats and Animal Behaviour - Shukla, Mathur,

Part 6: Detail Scheme Theory 2nd Semester"

Course Code: USFZO202 Nutrition, Public Health and Hygiene and Common Diseases

Unit	Content	No. of Lectures
I	**Nutrition and Health** 1.1 Concept of balanced diet, dietary recommendations to a normal adult, infant, pregnant woman and aged. 1.2 Malnutrition disorders – Anemia (B_{12} and Iron deficiency), Rickets, Marasmus, Goiter, Kwashiorkar (cause, symptoms, precaution and remedy). 1.3 Constipation, piles, starvation, acidity, flatulence, peptic ulcers (cause, symptoms, precaution and remedy). 1.4 Obesity (Definition and consequences). 1.5 Importance of fibres in food. 1.6 BMI calculation and its significance.	**15**
II	**Public Health and Hygiene** 2.1 : Health 2.1.1: Definition of Health, the need for health education and health goal. 2.1.2: Physical, psychological and Social health issues. 2.1.3: WHO and its programmes - Polio, Small pox, Malaria and Leprosy (concept, brief accounts and outcome with respect to India). 2.1.4: Ill effects of self-medication. 2.2: Water and water supply 2.2.1: Sources and properties of water. 2.2.2: Purification of water, small scale, medium scale and large scale (rapid sand filters) 2.2.3: Water footprint (concept, brief accounts and significance). 2.3 : Hygiene: 2.3.1: Hygiene and health factors at home, personal hygiene, oral hygiene and sex hygiene. 2.4: Radiation risk: 2.4.1: Mobile Cell tower and electronic gadgets (data of recommended level, effects and precaution). 2.5: Blood bank – Concept and significance	15
III	**Common Human Diseases** 3.1: Stress related disorders 3.1.1:Hypertension, Diabetes type II, anxiety, insomnia,migraine,	15

	depression (cause, symptoms, precaution and remedy) 3.2: Communicable and non-communicable diseases 3.2.1:Tuberculosis , Typhoid and Dengue 3.2.2:Hepatitis (A and B), AIDS, Gonorrhea and Syphilis 3.2.3:Diseases of respiratory system- Asthma, Bronchitis. 3.2.4:Oral Cancer (Discuss cause/causative agents, symptoms, diagnostics, precaution /prevention and remedy) 3.2.5: Swine flu (cause, symptoms, precaution and remedy).	

Self-Learning topics (Unit wise)

Unit	Topics
I	The students will find out the detailed information on the Government initiatives to improve the health status of poor and malnourished children and pregnant women in the state of Maharashtra.
II	The students will have to find out the role and directives of WHO during Epidemic and Pandemic in Country/World level.
III	The students should collect the information by conducting a preliminary survey to understand the Hygiene status of a population for communicable and non – communicable disease considering COVID 19 as an example and collate the data and prepare a report on it.

Online Resources

Swayam portal:

Concept of balanced diet, dietary recommendations to a normal adult, infant, pregnant woman and aged.

1. *epgp.inflibnet.ac.in, moocs online courses Biotechnology (261) Paper -09 Animal Cell Biotechnology, Module: 10 Methods of creating Transgenic Animals*
2. *epgp.inflibnet.ac.in, moocs online courses Analytical chemistry/ instrumentation (221) Paper -03 Chromatography Techniques, Module: 01 & 02*

Reference for USFZO202 Paper 2

Sr	Unit	Reference
1	**Unit I**	epgp.inflibnet.ac.in moocs online course UG: Diet Management in Health and disease
2	**Unit II**	Nutrition: Principles and Application in Health Promotion - J. B. Lippincott
3	**Unit II**	Moocs online course UG: Diet Management in Health and disease
4	**Unit II**	Human Physiology – Volume I – II C. C. Chatterjee, Medical Allied agenc Kolkata
5	**Unit III**	Common Medical Symptoms edited - P. J. Mehta National Inblisents and Distributions
6	**Unit III**	Parasitology (Protozoology and Helminthoology) - K. D. Chatterjee

Part - 7

Paper-I Practical **Total Credit: 1**

Title of Paper: Diversity and Wonders of Animal Kingdom, Population Ecology and Wild Life Management

Course Code: USFZOP2

Unit	**Content**	**No. of Lectures**	**Reference Books**
I, II and III	1. Interpretation of the given graphs/ tables and comment on pattern of population nature : i. Survivorship curve ii. Life tables iii. Fecundity tables iv. Age structure v. Sex ratio 2. a) Calculation of Natality, Mortality, Population density from given data b) Estimation of population density by capture recapture method 3. Interpretation of Growth curves (Sigmoid and J shaped) 4. Estimation of hardness from given water sample (tap water v/s well water) 5. Estimation of Free carbon dioxide (Free CO_2) from two different samples aerated drinks(diluted) v/s tap water 6. Identification and interpretation of aquatic and terrestrial (Grassland) food chains and food webs 7. Construction of food chain/food web using given information/data. a) Identification and interpretation of ecological pyramids of energy, biomass and number b) Construction of different types of pyramid from given data. 8. Study of the following: a) Endangered (Great Indian Bustard, Asiatic lion, Blackbuck, Olive Ridley sea turtle) and critically endangered species (Slender-billed vulture, Gharial, Malabar civet) of Indian wildlife and state reasons for their decline b) Study Biodiversity hotspots using world map (Western Ghats and Indo-Burma)	03 lectures per practical per batch	Practical Reference 1-5

	c) Study of sanctuaries, national parks, biosphere reserves in India with respect to its brand fauna as listed in theory)		

*Note –

The practical may be conducted by using specimens authorized by the wild such other regulating authorities though it is strongly recommended that the same should be taught by using photographs/audio-visual aids/ simulations / models, etc. as recommended the UGC and as envisaged in the regulations of the relevant monitoring bodies. Specimen, however, shall be procured for the purpose of conducting practical here-in-above.

#There shall be at least one excursion/field trip

Paper-II-Practical Total Credit: 1

Title of Paper: Laboratory Safety, Units of Measurement, Instrumentation and Animal Biotechnology Course Code: USFZOP2

Unit	Content	No. of Lectures	Reference Books
I,II and III	1. Qualitative est. of Vitamin C by Iodometric method. 2. Study of microscopic structure of starch granules of different cereals (wheat, maize and jowar). a) Estimation of maltose from brown/white bread. b) Moisture content from biscuits or other suitable food products. 3. Food adulteration Test: a) Milk adulterants (starch and glucose), methylene blue reduction Test (MBRT). b) Adulterants in Cheese, Butter, Jaggery, Ghee, Honey, Iodised Salt. 4. a) Estimation of protein content of two egg varieties. b) Study of efficacy of different antacids (any two antacids). 5. Study of Human Parasites 1.Endoparasites - Protozoans (Entamoeba, Plasmodium), Helminths (Ascaris, Wuchereria), Ectoparasites (Head louse, tick) and Exoparasites (Bed bug, Mosquito). 2. Screening of anaemic/non-anaemic persons using CuSO4 method. 3. First Aid – Demonstration Practical Training for teachers and students to be conducted by the experts from Red cross, Civil defense, Civic authorities by individual institute or cluster colleges in rotation.	03 lectures per practical per batch	Practical Reference 1-5

	4. BMI analysis - Measurement of Height/ Weight and calculation of BMI using formula, preparation and submission of report (10students / group - 50 readings/group)		

*Note –

The practical may be conducted by using specimens authorized by the wild such other regulating authorities though it is strongly recommended that the same should be taught by using photographs/audio-visual aids/ simulations / models, etc. as recommended the UGC and as envisaged in the regulations of the relevant monitoring bodies. Specimen, however, shall be procured for the purpose of conducting practical here-in-above.

#There shall be at least one excursion/field trip

Reference for USFZOP2 Practical

Sr	Practical	Reference
1	**For both practicals I and II**	Economic Zoology, Biostats and Animal Behaviour - Shukla, Mathur, Upadhyay, Prasad. Rastogi Publications
2		Ecology - Subramaniam and Others, Narosa Publishing House
3		A Treatise on Hygiene and Public Health. -B. N. Ghosh. Calcutta Scientific
4		Prevention of Food Adulteration, Act 1954. Asian Law House
5		A Complete Handbook of Nature Cure - Dr. H.K. Bakru, Jaico Publishing House