॥ मा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड – ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with'B++' grade

Fax : (02462) 215572

Phone: (02462)215542

Academic-1 (BOS) Section

website: srtmun.ac.

E-mail: bos@srtmun.ac.

विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरण २०२० नुसार पदवी प्रथम वर्षाचे अभ्यासक्रम (Syllabus) शैक्षणिक वर्ष २०२४–२५ पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, या विद्यापीठा अंतर्गत येणा–या सर्व संलग्नित महाविद्यालयामध्ये शैक्षणिक वर्ष २०२४–२५ पासून पदवीस्तरावर राष्ट्रीय शैक्षणिक धोरण –२०२० लागू करण्याच्या दृष्टीकोनातून विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत येणा–या अभ्यासमंडळांनी तयार केलेल्या पदवी प्रथम वर्षाचे अभ्यासक्रमांना मा. विद्यापरिषदेने दिनांक १५ मे २०२४ रोजी संपन्न झालेल्या बैठकीतील विषय क्रमांक १५/५९–२०२४ च्या ठरावाअन्वये मान्यता प्रदान केली आहे. त्यानुसार विज्ञान व तंत्रज्ञान विद्याशाखेतील खालील बी. एस्सी प्रथम वर्षाचे अभ्यासक्रम (Syllabus) लागू करण्यात येत आहेत.

01 B. Sc. I year - Biotechnolgy
02 B. Sc. I year – Bio-informatics
03 B. Sc. I year – Biotechnology (Vocational)
04 B. Sc. I year- Dyes and Druge
05 B. Sc. I year – Industrial Chemistry
06 B. Sc. I year – Agrochemical and Fertilizers
07 B. Sc. I year – Chemistry (General)
08 B. Sc. I year – Analytical Chemisrty
09 B. Sc. I year – Biochemistry
10 B. Sc. I year – Statistics
11 B. Sc. I year – Zoology
12 B. Sc. I year – Biotechnolgy (NMD College Hingoli)

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी, ही विनंती.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.:शै–१/एनइपी/विवत्रंविपदवी/२०२४–२५/123
दिनांक २०.०६.२०२४

डॉ. सरिता लोसरवार
सहा.कुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत : १) मा. आधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मुंल्यमापन मंडळ, प्रस्तुत विद्यापीठ.
३) मा. प्राचार्य, सर्व संबधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) मा. प्राचार्य, न्यू मॉडल डिग्री कॉलेज हिंगोली.
५) सिस्टीम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. याना देवून कळविण्यात येते की, सदर परिपत्रक संकेतस्थळावर प्रसिध्द करण्यात यावे.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED - 431 606 (MS)

(Credit Framework and Structure of Four Year UG Program with Multiple Entry and Exit Option as per NEP-2020)

UNDERGRADUATE PROGRAMME OF SCIENCE & TECHNOLOGY

SUB - ZOOLOGY

Major in **DSC** and Minor in **DSM** (Subject)

Under the Faculty of Science & Technology

(Revised as per the Govt. Of Maharashtra circular dt. 13th March 2024)

With effect from June 2024

Effective from the Academic Year 2024 – 2025

(As per NEP-2020)

From the Desk of the Dean, Faculty of Science and Technology

Swami Ramanand Teerth Marathwada University, Nanded, enduring to its vision statement "***Enlightened Student: A Source of Immense Power***", is trying hard consistently to enrich the quality of science education in its jurisdiction by implementing several quality initiatives. Revision and updating curriculum to meet the standard of the courses at national and international level, implementing innovative methods of teaching-learning, improvisation in the examination and evaluation processes are some of the important measures that enabled the University to achieve ***the 3Es, the equity, the efficiency*** and ***the excellence*** in higher education of this region. To overcome the difficulty of comparing the performances of the graduating students and also to provide mobility to them to join other institutions the University has adopted the cumulative grade point average (CGPA) system in the year 2014-2015. Further, following the suggestions by the UGC and looking at the better employability, entrepreneurship possibilities and to enhance the latent skills of the stakeholders the University has adopted the Choice Based Credit System (CBCS) in the year 2018-2019 at graduate and post-graduate level. This provided flexibility to the students to choose courses of their own interests. To encourage the students to opt the world-class courses offered on the online platforms like, NPTEL, SWAYM, and other MOOCS platforms the University has implemented the credit transfer policy approved by its Academic Council and also has made a provision of reimbursing registration fees of the successful students completing such courses.

SRTM University has been producing a good number of high calibre graduates; however, it is necessary to ensure that our aspiring students are able to pursue the right education. Like the engineering students, the youngsters pursuing science education need to be equipped and trained as per the requirements of the R&D institutes and industries. This would become possible only when the students undergo studies with an updated and evolving curriculum to match global scenario.

Higher education is a dynamic process and in the present era the stakeholders need to be educated and trained in view of the self-employment and self-sustaining skills like start-ups. Revision of the curriculum alone is not the measure for bringing reforms in the higher education, but invite several other initiatives. Establishing industry-institute linkages and initiating internship, on job training for the graduates in reputed industries are some of the important steps that the University would like to take in the coming time. As a result, revision of the curriculum was the need of the hour and such an opportunity was provided by the New Education Policy 2020. National Education Policy 2020 (NEP 2020) aims at equipping students with knowledge,

skills, values, leadership qualities and initiates them for lifelong learning. As a result the students will acquire expertise in specialized areas of interest, kindle their intellectual curiosity and scientific temper, and create imaginative individuals.

The curriculum given in this document has been developed following the guidelines of NEP-2020 and is crucial as well as challenging due to the reason that it is a transition from general science based to the discipline-specific-based curriculum. All the recommendations of the ***Sukanu Samiti*** given in the **NEP Curriculum Framework-2023** have been followed, keeping the disciplinary approach with rigor and depth, appropriate to the comprehension level of learners. All the Board of Studies (BoS) under the Faculty of Science and Technology this university have put in their tremendous efforts in making this curriculum of international standard. They have taken care of maintaining logical sequencing of the subject matter with proper placement of concepts with their linkages for better understanding of the students. We take this opportunity to congratulate the Chairman(s) and all the members of various Boards of Studies for their immense contributions in preparing the revised curriculum for the benefits of the stakeholders in line with the guidelines of the **Government of Maharashtra regarding NEP-2020**. We also acknowledge the suggestions and contributions of the academic and industry experts of various disciplines.

We are sure that the adoption of the revised curriculum will be advantageous for the students to enhance their skills and employability. Introduction of the mandatory ***On Job Training, Internship program*** for science background students is praise worthy and certainly help the students to imbibe firsthand work experience, team work management. These initiatives will also help the students to inculcate the workmanship spirit and explore the possibilities of setting up of their own enterprises.

Prof. Dr. M. K. Patil
Dean
Faculty of Science and Technology
Swami Ramanand Teerth Marathwada University, Nanded

From Desk of Chairman, Board of Studies of the Subject Zoology

Preamble:

Education is fundamental for achieving full human potential, developing an equitable and just society, and promoting national development. NEP-2020, New Education Policy lays particular emphasis on the development of the creative potential of each individual. It is based on the principle that education must develop not only cognitive capacities - both the 'foundational capacities' of literacy and numeracy and 'higher-order' cognitive capacities, such as critical thinking and problem solving – but also social, ethical, and emotional capacities and dispositions.

The basic science education in India in general is expanding in manifolds. Now, the challenge is to ensure its quality to the stakeholders along with the expansion. To meet this challenge, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Program outcomes are essentially a range of skills and knowledge that a student will have at the time of graduation from the program. The basic science program must ensure that its graduates understand the basic concepts of science, and use its methodologies of analyses and design, and have acquired skills for life - long learning.

An all Basic Science program must therefore have a mission statement which is in conformity with program objectives and program outcomes that are expected of the educational process. The outcomes of a program must be measureable and must be assessed regularly through proper feedback for improvement of the programme. The curriculum must be constantly refined and updated to ensure that the defined objectives and outcomes are achieved. Students must be encouraged to comment on the objectives and outcomes and the role played by the individual courses in achieving them.

I, as a Chairman, Board of Studies in Zoology, SRTM University, Nanded happy to state that, Program Educational Objectives were finalized with the help of our BOS members, of Zoology. The Program Educational Objectives finalized for undergraduate program in Zoology are listed below;

- To provide students with a strong foundation in the basic science, scientific and fundamentals necessary to formulate, solve and analyze problems and to prepare them for undergraduate studies.
- To prepare students to demonstrate an ability to identify, formulate and solve basic science problems.
- To prepare students to demonstrate ability to design systems and conduct experiments, analyze and interpret data.
- To prepare students to demonstrate for successful career in industry to meet needs

of Indian and multi-national companies.

- To develop the ability among students to synthesize data and technical concepts.
- To provide opportunity for students to work as part of teams on multidisciplinary projects.
- To promote awareness among students for the life-long learning and to introduce them to professional ethics and codes of professional practice.

In addition to Program Educational Objectives, for each course of undergraduate program, objectives and expected outcomes from learner's point of view are also included in the curriculum to support the philosophy of outcome based education. I believe strongly that small step taken in right direction will definitely help in providing quality education to the stake holders.

Prof. Dr. H. S. Jagtap
Chairman,
Board of Studies of the Zoology
Faculty of Science & Technology
Swami Ramanand Teerth Marathwada University, Nanded
Mob: 9423717670/9834345722
E-mail: hsjagtap1704@gmail.com

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology

Details of the Board of Studies Members in the subject **Zoology** under the Faculty of Science & Technology of S.R.T.M. University, Nanded

Sr. No.	Name of the Member	Designation	Address	Contact No.
1	Dr. Hanumant Shahaji Jagtap	**Chairman**	Shri Shivaji College, Parbhani	9423717670 9834345722 hsjagtap1704@gmail.com
2	Dr. Shivaji Prabhakar Chavan	Member	School of Life Sciences, SRTMUN	9421046372 dr_spchavan@rediffmail.com
3	Dr. Dhanraj Balbhim Bhure	Member	Yeshwant Mahavidyalaya, Nanded	8149407814, 8329013983 drajbhure82@gmail.com
4	Dr. Anil M. Mane	Member	Arts, Science & Commerce College, Shankarnagar, Dist. Nanded	9422874110, 9404464462 anilmane531@gmail.com
5	Dr. Prashant P. Joshi	Member	Adarsh Education Society's ACS College, Hingoli	9595648535 7588081822 drprashantjo@gmail.com
6	Dr. Ratna V. Kirtane	Member	Dayanand Science College, Latur	9422185834, 8308886686 ratnakirtane@gmail.com
7	Dr. Sanjay Shamrao Nanware	Member	Yeshwant Mahavidyalaya, Nanded, Tq. & Dist. Nanded	9423401227, 8329199589 snanware@rediffmail.com
8	Dr. Sanjay Sadashivrao Kale	Member	Kumarswami Mahavidyalaya, Ausa, Tq. Ausa, Dist. Latur	9423348758 sanjaykale.sks@gmail.com
9	Dr. Deepak Pandurang Katore	Member	Nagnath Arts, Commerce & Science College, Aundha Nagnath, Dist. Hingoli	9765737373, 9134737373 katoredeepak@gmail.com
10	Dr. Ramrao Janardhanrao Chavan	Member	Dr. Babasaheb Ambedkar Marathwada University, Aurangabad	chavanrj@gmail.com 9423030859
11	Dr. Ranjitsingh Krishnarao Nimbalkar	Member	Government Institute of Forensic Science, Aurangabad	rknimbalkar@gmail.com 9422345234
12	Dr. Karmveer Nagnathrao Kadam	Member	Shri Kumarswami Mahavidyalaya, Ausa Dist. Latur.	karmbeernk@gmail.com 9970129919
13	Dr. Shivesh Pratap Singh	Member	Government PG College, Santa – 485001 (MP)	drshiveshsingh2004@yahoo.com 07987155634

14	Dr. Chandrashekhar Devidasrao Basarkar	Member	Director, Nimbkar Seeds Pvt. Ltd. Phaltan, Dist. Satara	basarkarcd@gmail.com 9822652659
15	Pandhrpure Laxmi Gurunath (UG Merit Student, Zoology)	Invitee Member	C/o. Maharashtra Mahavidyalaya Nilanga	9529251388
16	Dusnale Prashant Baliram (PG Merit Student, Zoology)	Invitee Member	C/o. Yeshwant Mahavidyalaya Nanded	9834642631

B.Sc. First Year Zoology Semester I *(Level 4.5)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Optional	SZOOCT1101	Biodiversity of Non-chordates	02	--	**02**	02	--
	SZOOCP1101	Based on SZOOCC1101 (Biodiversity of Non-chordates)	-	02	**02**		04
Generic Electives (GE or OE)	SZOOGE1101	Animal Diversity - I	02	--	**02**	02	--
Skill Enhancement Course	SZOOSC1101	Parasites of Public Health Importance Or Vermiculture & Vermicomposting		02	**02**		04
Total Credits			**04**	**04**	**08**	**04**	**08**

B.Sc. First Year Zoology Semester I *(Level 4.5)*

Examination Scheme

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total Col (6+7) / Col (8+9) (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)	Total (7)	CA (8)	ESA (9)	
Optional	SZOOCT1101	Biodiversity of Non-chordates	10	10	10	40	--	--	50
	SZOOCP1101	Based on SZOOCC1101 (Biodiversity of Non-chordates)	--	--	--	--	20	30	50
Generic Electives (GE or OE)	SZOOGE1101	Animal Diversity – I	10	10	10	40	--	--	50
Skill Enhancement Course	SZOOSC1101	Parasites of Public Health Importance Or Vermiculture & Vermicomposting					20	30	50
									200

B.Sc. First Year Zoology Semester II *(Level 4.5)*

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Optional	SZOOCT1151	Biodiversity of Chordates	02	--	**02**	02	--
	SZOOCP1151	Based on SZOOCC1151 (Biodiversity of Chordates)		02	**02**	--	04
Generic Electives (GE or OE)	SZOOGE1151	Animal Diversity - II	02	--	**02**	02	--
Skill Enhancement Course	SZOOSC1151	Aquarium Keeping Or Animal Museology		02	**02**		04
Total Credits			**04**	**04**	**08**	**04**	**08**

B.Sc. First Year Semester II *(Level 4.5)*

Examination Scheme

Subject (1)	Course Code (2)	Course Name (3)	Theory				Practical		Total [Col (6+7) / Col (8+9)] (10)
			Continuous Assessment (CA)			ESA			
			Test I (4)	Test II (5)	Avg of (T1+T2)/2 (6)	Total (7)	CA (8)	ESA (9)	
Optional	SZOOCT1151	Biodiversity of Chordates	10	10	10	40	--	--	50
	SZOOCP1151	Based on SZOOCC1151 (Biodiversity of Chordates)	--	--	--	--	20	30	50
Generic Electives (GE or OE)	SZOOGE1151	Animal Diversity - II	10	10	10	40	--	--	50
Skill Enhancement Course	SZOOSC1151	Aquarium Keeping Or Animal Museology					20	30	50
									200

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology,

Four Year UG Program, Zoology (w.e.f. June -2024)

B. Sc. First Year, Semester-I

SZOOCT1101 : Biodiversity of Non-chordates

Periods : 30 **No. of Credits: 02 (Marks: 50)**

Course objectives:

1. To broadly understand biodiversity, habitat, adaptation, anatomical organization and taxonomic status of non-chordates phyla in relation to other animal taxa.
2. Understanding the basic of biological classification and its conceptual framework.
3. Appreciating the structural and functional correlation between different non-chordates groups.

Course outcomes:

1. The student will be able to identify a given non-chordates upto class level.
2. Ability to understand the contribution of non-chordates in the biodiversity index of any given habitat.
3. Ability to understand and appreciate the ecological and economic importance of non-chordates.
4. Ability to identify and describe external morphology and internal anatomical features of representative non-chordates species.

SZOOCT1101 : Biodiversity of Non-chordates : Course Contents

ModuleNo.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0			**7**
	1.1	Introduction of Non-chordates Protozoa: General characters and classification up to class level with suitable examples; Locomotory Organelles and locomotion in Protozoa.	
	1.2	Brief account of each of Structure, Life Cycle, Pathogenicity and Control Measures of *Plasmodium vivax.*	
	1.3	Porifera:-General characters and classification up to class level with suitable examples;	
	1.4	Canal System in *Sycon;* Economic importance of Porifera.	
2.0			**8**
	2.1	Coelenterata: General characters and classification up to class level with suitable examples; Polymorphism in Hydrozoa. Platyhelminthes: General characters and classification up to class level with suitable examples;	
	2.2	Brief account of each of Structure, Life Cycle, Pathogenicity and Control Measures of *Taenia solium.*	
	2.3	Nemathelminthes: General characters and classification up to class level with suitable examples;	
	2.4	Brief account of each of Structure, Life Cycle, Pathogenicity and Control Measures of *Ascaris lumbricoides.*	
3.0			**7**
	3.1	Annelida: General characters and classification up to class level with suitable examples; Metamerism in Annelida; vermiculture and vermicomposting.	
	3.2	Arthropoda: General characters and classification up to class level with suitable examples;	
	3.3	Metamorphosis in Insects.	
	3.4	Cockroach- External Morphology, Digestive system, Respiratory system, Nervous system. Economic importance of insects.	
4.0			**8**
	4.1	Mollusca: General characters and classification up to class level with suitable examples; Economic importance of mollusca.	
	4.2	Echinodermata: General characters and classification up to class level with suitable examples;	
	4.3	Star Fish- External Morphology, Larval forms in Echinoderms.	
	4.4	Hemichordata:General Characters and Affinities.	
		Total	**30**

Text Books

1. Sedgwick, A.A. 'Students Text Book of Zoology', Vol. I, II and III. Central Book Depot, Allahabad.
2. Parker, T.J., Haswell, W.A. 'Text Book of Zoology', Macmillan Co., London.
3. Sedgwick, A.A., Students Text Book of Zoology, Vol.II

Reference Books

1. Hyman L.H. 'The Invertebrates. Vol I-Protozoa through Ctenophora', McGraw Hill Co, New York.
2. Hyman, L.H. 'The Invertebrates Vol-II', McGraw Hill Co., New York.
3. Hyman, L.H. 'The Invertebrates. Vol-VIII', McGraw Hill Co., New York and London.
4. Barnes, R.D. 'Invertebrate Zoology, 3rd edition', W.B. Saunders Co., Philadelphia.
5. Barrington, E.J.W. 'Invertebrate Structure and Function', Thomas Nelson and Sons Ltd., London.
6. Boume, G.H., The Structure and functions of nervious tissue academic Press, New York.
7. Eecles, J.C., The understanding of the brain, McGraw Hill CO., New York and London.
8. Torrey, T.W., Morphogenesis of erthates, John Wiley & Sons Inc., New York.
9. Davidson, E.H. 'Gene activity during early development'Academic press, New York

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology,

Four Year UG Program, Zoology (w. e. f. June -2024)

B. Sc. First Year, Semester-I

SZOOCP1101 : Biodiversity of Non-Chordates (Based on Paper No. SZOOCT1101)

Periods : 60 **No. of Credits: 02 (Marks: 50)**

Objectives:

1. To understand the anatomical organization of any species.
2. To identify and handle different body parts of non-chordates.
3. To understand and perform temporary and permanent mountings.

Outcomes:

1. Ability to understand the anatomical organization of organs and systems in representative species.
2. Ability to identify and describe structure and functions of different body parts of non-chordates.
3. Students would be able to prepare temporary and permanent mountings of biological material.
4. Students would make observations of organisms in their natural environment and document them.

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1. Study of at least two museum specimens from non-chordates Phyla. (Protozoa to Echinodermata and Hemichordata).

2. Demonstration based on Models, Charts and Computer Aided Techniques:

i) Cockroach: Digestive system, Nervous system.

ii) Scoliodon: Digestive system, Heart and ventral Aorta, Afferent arteries, Brain.

3. Permanent Mountings - i) Mouth parts of Cockroach; ii) Trachea of Cockroach; iii) Salivary glands of Cockroach; iv) Nereis Parapodia;

4. An "**Animal Album**" containing photographs, cut outs, with appropriate write up about the different taxa. Different taxa/ topics may be given to different sets of students for this purpose.

5. Short excursion/ study Tour is compulsory.

6. Submission:

i) Practical record book duly signed by the teacher in charge/Head of the Department.

ii) Five permanent stained micro preparations.

iii) Animal Album ***or*** Articulated complete skeleton of any locally available animal

iv) Excursion report.

(Demonstration of animal Dissections through Models, Charts or Computer Aided Techniques as per U.G.C Guidelines)

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology,

Four Year UG Program, Zoology (w.e.f. June -2024)

B. Sc. First Year, Semester – I

Generic Elective (GE/OE)

SZOOGE1101: Animal Diversity - I

Periods : 30 **No. of Credits: 02 (Marks: 50)**

Course objectives :

Zoology is the scientific study of animal life. Animals are the most diverse creatures on this planet.

1. This course gives a framework for understanding the diversity within different groups, and interrelationship among different species and genera within each group.
2. The aim of this course is to understand the importance of animal kingdom in context to hierarchy, body plan and their role in ecological development.
3. This course provides an overview of the invertebrate, including sponges, cnidarians, flatworms, nematodes, annelids, molluscs, arthropods, echinoderms etc.
4. Provide knowledge of coelom formation, different level of organization, different modes of living, evolutionary changes of Non-chordates and their salient features.
5. Also impart knowledge on different classes of non-chordates.
6. After completion of this course, the learners will have a framework for understanding all of the different types of animals, and the characteristics of each.

Course Outcomes :

Upon completion of the course, students will be able to:

1. Distinguish between major phyla of animals through a demonstrated understanding of their taxonomic classification and diversity.
2. Describe the distinguishing characteristics of all major phyla.
3. Understand the fundamental differences among animal body plans and relate them to function, taxonomic classification, and evolutionary relationships among phyla.
4. Illustrate lifecycles, structure, function and reasons for importance of few representative organisms from different groups of animals.
5. Identify anatomical structures from prepared tissues.
6. Observe living animals in the environment and relate observations to theory from the course.
7. Recognize major animal phyla and animals on the basis of their external characteristics.

SZOOGE1101: Animal Diversity-I : Course Contents

ModuleNo.	Unit No.	Topic	Hrs. Required to cover the contents
1. 0			**7**
	1.1	Protista : General characters of Protozoa; Life cycle of Plasmodium	
	1.2	Porifera: General characters and canal system in Porifera	
	1.3	Radiata: General characters of Cnidarians and polymorphism	
	1.4	Aceolomates: General characters of Helminthes;	
2.0			**8**
	2.1	Life cycle of *Taenia solium*. Platyhelminthes.	
	2.2	Pseudocoelomates: General characters of Nemethehelminthes	
	2.3	Parasitic adaptations.	
	2.4	External structure of *Ascaris lumbricoides*	
3.0			**7**
	3.1	Coelomate Protostomes : General characters of Annelida, Metamerism.	
	3.2	Vermiculture & Vermicomposting.	
	3.3	Arthropoda: General characters, Social life in insects.	
	3.4	External morphology of Palaemon (Prawn)	
4.0			**8**
	4.1	Mollusca: General characters of mollusca; Pearl Formation.	
	4.2	Economic importance of Mollusca. External morphology of Pila.	
	4.3	Coelomate Deuterostomes : General characters of Echinodermata	
	4.4	Water Vascular system in Starfish. External morphology of Starfish.	
		Total	**30**

Reference Books

1. Barnes, R.D. (1992). Invertebrate Zoology. Saunders College Pub. USA.
2. Ruppert, Fox and Barnes (2006) Invertebrate Zoology. A functional Evolutionary Approach 7th Edition, Thomson Books/Cole
3. Campbell & Reece (2005). Biology, Pearson Education, (Singapore) Pvt. Ltd.
4. Kardong, K. V. (2002). Vertebrates Comparative Anatomy. Function and Evolution. Tata McGraw Hill Publishing Company. New Delhi.
5. Raven, P. H. and Johnson, G. B. (2004). Biology, 6th edition, Tata McGraw Hill Publications. New Delhi.

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology,

Four Year UG Program, Zoology (w.e.f. June -2024)

B. Sc. First Year, Semester – I

Skill Enhancement Course in Zoology

SZOOSC1101: (A) Parasites of Public Health Importance

Periods : 60 **No. of Credits: 02 (Marks: 50)**

Course Objectives:

1. The main learning objectives of this skill course include study of parasites of public health importance.
2. This course is intended to a detailed treatment of parasites with emphasis on almost all major features of Biology of these parasites.
3. The outbreak and spread of these parasitic diseases is found across the globe and that too on a large scale.
4. To provide knowledge about biology of parasites of public health importance.
5. To study the medical importance of common arthropods with special emphasis on diseases caused by them.
6. To impart training of collection, processing, identification and reporting of parasites of public health importance.

Course Outcomes:

1. Due to this, the study of these parasites is of paramount significance, to which this skill set attempts to address.
2. Knowledge and understanding of biology of parasites of public health importance.
3. Recognize and appreciate the medical importance of common arthropods and diseases caused by them.
3. Flawlessly perform collection, processing, identification and reporting of parasites of public health importance.

SZOOSC1101: (A) Parasites of Public Health Importance

Course Contents:

ModuleNo.	Unit No.	Topic	Hrs. Required to cover the contents
1. 0			**15**
	1.1	Brief introduction of Parasitology, Parasitism, Parasite, Host, Vector.	
	1.2	**Malarial Parasites** History, Geographic distribution, Taxonomic position of different Species of malarial parasites.	
	1.3	Distinguishing characters of different species of human malarial parasites, Life cycle, Pathogenicity, Prevention and control measures of Malarial parasites.	
	1.4	**Practical's:** 1. Preparation of stains- JSB I and II, Leishman and Giemsa. 2. Preparation of blood smears (thick and thin) and staining with JSB, Leishman and Giemsa for malaria parasite infection. 3. Dissection and examination of mosquitoes for malaria parasite infection. 4. Identification of various stages of malaria parasites: (I) Plasmodium vivax (II) P. falciparum (III) P. malariae (IV) P. ovale	
2.0			**15**
	2.1	**Parasitic Platyhelminthes** History, Geographic distribution , Morphology	
	2.2	Life Cycle, Pathogenicity	
	2.3	Prevention and control measures of Schistosoma haematobium and Taenia solium.	
	2.4	**Practicals:** 1. Examination of Urine and stool sample for assessment of presence and intensity of Schistosoma infection. 2. Collection and preservation of Cestodes from locally available hosts intestines. 3. Staining, Mounting, drawing and identification of Cestode Parasites. 4. Identification, classification and description of Parasitic platyhelminths (Schistosoma haematobium and Taenia solium) through permanent slides/photomicrographs or specimens.	
3.0			**15**

	3.1	**Lymphatic Filarial Parasites -** Wuchereria bancrofti. History, Geographic distribution of lymphatic filariasis	
	3.2	Taxonomic position of Filarial worm (Wuchereria bancrofti), Distinguishing characters,	
	3.3	Life cycle, Pathogenicity, Prevention and control measures.	
	3.4	**Practicals** 1. Dissection and examination of mosquitoes for filarial parasite (Wuchereria bancrofti) infection. 2. Staining and examination of blood smears for detection of microfilariae. 3. Identification, classification and description of Lymphatic Filarial Parasites- Wuchereria bancrofti through permanent slides / photomicrographs or specimens.	
4.0			
	4.1	**Insects of Medical Importance** Morphology, Medical importance and Control of Pediculus humanus,	**15**
	4.2	Xenopsylla cheopis Anopheles	
	4.3	Culex, Aedes.	
	4.4	**Practicals** 1.Study of arthropod vectors associated with human diseases: Pediculus, Xenopsylla, Culex, Anopheles, Aedes. 2.Study of different kinds of mouth parts of insects 3.Study of following insect vectors through permanent slides/ photographs: Pediculus humanus, Xenopsylla cheopis, Aedes, Culex, Anopheles. 4. Study of different diseases transmitted by insect vectors. 5. Preparation of slide mounts of insects and their mouth parts. **Submission of a brief report on parasites of Public health importance**	
		Total	**60**

Reference Books

1. A Modern Text Book of Parasitology- Dr.A.N.Latey, Narendra Prakashan, Pune.
2. Textbook of Parasitology- Kochhar S. K., Dominant Publishers and Distributors, New Delhi, 2004.
3. Handbook of Entomology-T.V. R. Ayyar.

Reference Books

1. Introduction to Parasitology- Chandler and Reid.
2. Parasitology – K. D. Chatterjee.
3. Essentials of Parasitology- Gerald D. Schmidt, 4th Edition, Universal Book Stall, New Delhi, 1990.
4. An Introduction to Parasitology- Bernard E. Mathews, Cambridge University, Press, 1998.
5. Applied Parasitology- A Practical Manual – C. J. Hiware, B. V. Jadhav, A. D. Mohekar, Mangaldeep Publication, Jaipur.
6. Parasitic Insects-B. D. Patnaik, Dominant Publishers and Distributors, New Delhi, 2001.
7. Protozoology- Kudo.
8. Clinical Parasitology- Faust.
9. Medical Helminthology- Watson.
10. Indian Insect Life- Lefrey.
11. General Parasitology- Cheng.
12. Bench Aids for the diagnosis of malaria- WHO, 1985.
13. Human Parasitology- Burton J. Bogistch, Clint E. Carter, Thomas N. Oeltmann. 2005. Third Edition, Elsevier Academic press.
14. Malaria: Principles and Practice of Malariology. Vol. I and II,- Warnsdorfer W.H. and Sri. Mc Gregor, I. 1998. Churchill Livingstone, New York.
15. Parasitology (Medical Zoology)- H.S.Singh and P.Rastogi. Rastogi Publications. Meerut.
16. Medical Parasitology- N.C. Dey and T.K.Dey. Allied Agency, Kolkatta
17. Medical Zoology-R.C.Sobti,Shoban Lal Nagin Chand & Co., Jalandhar.

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology,

Four Year UG Program, Zoology (w.e.f. June -2024)

B. Sc. First Year, Semester – I

Skill Enhancement Course in Zoology

SZOOSC1101: (B) Vermiculture & Vermicomposting

Periods : 60 **No. of Credits: 02 (Marks: 50)**

Course Objectives:

1. Study the morphology and biology of different species of earthworms used in vermiculture.
2. Acquire knowledge and skill of rearing earthworms and using them in vermicomposting at different scales and under different culture conditions.
3. Train in the operation and use of implements and equipment used in vermicomposting.

Course Outcomes:

1. Knowledge of morphology and biology of earthworms used in vermiculture.
2. Ability and skill of rearing earthworms and using them in vermicomposting.
3. Proper operating of implements and equipment used in vermicomposting.

SZOOSC1101: (B) Vermiculture & Vermicomposting
Course Contents:

ModuleNo.	Unit No.	Topic	Hrs. Required to cover the contents
1. 0			**15**
	1.1	1. Vermiculture – Definition, History, scope and economic importance.	
	1.2	2. Earthworms-Taxonomic Position and Diversity of different species of earthworms.	
	1.3	3. *Eisenia fetida*- Systematic position, Morphology and Life cycle.	
	1.4	**Practicals:** 1. To Study different species of earthworms. 2. To Study morphological features of composting earthworm, *Eisenia fetida* 3. To study Life cycle of *Eisenia fetida.* 4. Identification of Earthworm cocoons and vermi casts	
2.0			**15**
	2.1	1. Common species for Vermiculture; Environmental requirements; culture methods	
	2.2	2. Applications of Vermiculture. 3. Earthworm Pests and Diseases.	
	2.3	**Practicals:** 1. Collection and identification of common species of earthworms for vermiculture.	
	2.4	2. Study of Earthworm Pests and diseases.	
3.0			**15**
	3.1	**VERMICOMPOSITING** 1. Vermicomposting Materials 2. **Types of vermicomposting:** a) Small Scale Vermicomposting b) Large Scale Vermicomposting	
	3.2	3. **Methods of Vermicomposting:** Bed Method, Pit Method.	
	3.3	4. Phases and Steps of Vermicomiposting.	
	3.4	**Practicals:** 1. Study of Vermicompost equipments, devices. 2. Preparation of Vermibeds. 3. Demonstration of preparation pit method. 4. Preparation of vermicomposting pits at local area (college or home gardens)	
4.0			**15**
	4.1	**VERMICOMPOSTING** 1. Harvesting 2. Nutrient Content of Vermicompost	

	4.2	3. Advantages of Vermicompost 4. Vermiwash, Preperation and Applications	
	4.3	5. Prospects of vermi-culture as self employment venture	
	4.4	**Practicals:** 1. Collection of vermiwash and use of vermiwash. 2. To study the effect of vermicompost on any plant. 3. Visit to Agricultural Farm/Field to nearby Krishi Vidnyan Kendra to study vermicultures and vermicomposting Units.	
		Total	**60**

Text Books

1. Sultan Ahmed Ismail, - The Earthworm Book, Second Revised Edition. Other India Press, Goa, India.

Reference Books

1. R.K. Bhatnagar & R.K. Palta- Earthworm Vermiculture and Vermicomposting, Kalyani Publishers, No. 1, Mahalakshmi Street, T. Nagar, Chennai -600 017.
2. P.K. Gupta - Vermi Composting for Sustainable Agriculture. AGROBIOS (India), Agro House, Behind Nasrani Cinema, Chopasani Road, Jodhpur – 342 002.
3. Sathe, T. V.- Vermiculture and Organic Farming. Daya Publishing House
4. Bhatt J.V. & S.R. Khambata (1959)- Role of Earthworms in Agriculture. Indian Council of Agricultural Research, New Delhi.
5. Dash, M.C., B.K.Senapati, P.C. Mishra (1980) - Verms and Vermicomposting. Proceedings of the National Seminar on Organic Waste Utilization and Vermicomposting Dec. 5-8, 1984, (Part B), School of Life Sciences, Sambalpur University, Jyoti Vihar, Orissa.
6. Edwards, C.A. and J.R. Lofty (1977)- Biology of Earthworms. Chapman and Hall Ltd., London.
7. Lee, K.E. (1985)- Earthworms: Their ecology and Relationship with Soils and Land Use Academic
Press, Sydney.
8. Kevin, A and K.E.Lee (1989)- Earthworm for Gardeners and Fisherman" (CSIRO, Australia,
Division of Soils)
9. Rahudakar V.B. (2004)- Gandul khatashivay Naisargeek Paryay, Atul Book Agency, Pune.
10. Satchel, J.E. (1983)- Earthworm Ecology Chapman Hall, London.
11. Wallwork, J.A. (1983)-Earthworm Biology. Edward Arnold (Publishers) Ltd. London.

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology,

Four Year UG Program, Zoology (w.e.f. June -2024)

B. Sc. First Year, Semester-II

SZOOCT1151 : Biodiversity of Chordates

Periods : 30 **No. of Credits: 02 (Marks: 50)**

Course objectives:

1. To understand Biodiversity, Habitat, Adaptation organization and taxonomic status of Chordates.
2. Explaining the basic aspects of classification of chordates.
3. Develop the ability to understand structural and functional details of Chordates.
4. Develop a broad and correlated view of all chordate groups: extinct and living.
5. Acquire the skill to correlate anatomical and morphological aspects of different chordate groups.

Course outcomes:

1. The student will be able to identify and understand the Biodiversity of Chordates.
2. Ability to understand anatomical relation between different vertebrate classes.
3. The learner will be able to understand the economic importance of Chordates.

SZOOCT1151 : Biodiversity of Chordates : Course Contents

ModuleNo.	Unit No.	Topic	Hrs. Required to cover the contents
1. 0			**7**
	1.1	**Introduction of Chordates** Salient features and classification of chordates up to class level. Origin and Ancestry of Chordata	
	1.2	**Protochordata: Urochordata-**General features and Phylogeny of Urochordata; **Cephalochordata-** General features and Phylogeny of Cephalochordata.	
	1.3	**Agnatha :** General characters and classification of Agnatha with suitable examples.	
	1.4	**Cyclostomata:** General characters with suitable examples.	
2.0			**8**
	2.1	**Pisces:** General characters and classification up to order level with suitable examples;	
	2.2	**Scoliodon (Dogfish):** External morphology, Digestive system, Respiratory system,	
	2.3	Circulatory System, Nervous system, Urinogenital system. Economic importance of Fishes.	
	2.4	**Amphibia:** General characters and classification up to order level with suitable examples; Parental care in Amphibians; Hibernation and aestivation in Frog.	
3.0			**7**
	3.1	**Reptiles:** General characters and classification up to order level with suitable examples;	
	3.2	Poisonous and non-poisonous snakes; Biting mechanism in snakes; Importance of snake Venom.	
	3.3	**Aves:** General characters and classification up to order level with suitable examples;	
	3.4	Flight adaptations in birds; Migration in birds.	
4.0			**8**
	4.1	**Mammals:** General characters and classification up to order level with suitable examples.	
	4.2	**Rat**- External characters, Digestive system,	
	4.3	Respiratory system, Circulatory system,	
	4.4	Nervous system - Brain and spinal cord, Eye and Ear.	
		Total	**30**

Text Books

1. Sedgwick, A.A. 'Students Text Book of Zoology', Vol. I, II and III. Central Book Depot, Allahabad.
2. Parker, T.J., Haswell, W.A. 'Text Book of Zoology', Macmillan Co., London.
3. R.L. Kotpal, Modern text Book of Zoology vertebrates, Rastogi publications Meerut 10th Edition revised
4. Sedgwick, A.A., Students Text Book of Zoology, Vol.II

Reference Books

1. E.L.Jordan and P.S.Verma, Chordate Zoology. S.Chand Publication
2. Boume, G.H., The Structure and functions of nervious tissue academic Press, New York.
3. Carter, G.S., Structure and habit in vertebrate evolution, Sedgwick and Jackson, London.
4. Eecles, J.C., The understanding of the brain, McGraw Hill CO., New York and London.
5. Malcom Jollie, Chordata morphology, East-West press Ltd., New Delhi.
6. Milton Hilderbrand, Analysis of vertebratestructure-IV, Ed. Johan Wily and Sons Ine., New York.
7. Smith, H.S., Evolution of chordara structure, Hold Rinehart and Winstoin Inc, New York.
8. Torrey, T.W., Morphogenesis of erthates, John Wiley & Sons Inc., New York.
9. Walters, H.E. and Sayles, L.D., Ecology of vertebrates, Machillan and Co., New York.
10. Eolstenhoint, E.W. and Knight J. (Ed), Taste and smell in vertebrates, J & A, Churchill, London.
11. Romer, A.S., Vertebrate Body, IInd Edition, W.B. Saunders CO., Philadelphia.
12. Young, J.Z., Life of mammals, Oxford University press, London.
13. Colbert, E.H., Evolution of the vertebrates, Johan Wiley and Sons Inc., New York.
14. Davidson, E.H. 'Gene activity during early development'Academic press, New York

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology,

Four Year UG Program, Zoology (w. e. f. June -2024)

B. Sc. First Year, Semester-II

SZOOCP1151 : Biodiversity of Chordates (Based on Paper No. SZOOCT1151)

Periods : 60 **No. of Credits: 02 (Marks: 50)**

Objectives:

1. To understand the anatomical organization of any species.
2. To identify and handle different body parts of vertebrates.
3. To understand and perform temporary and permanent mountings.
4. To identify and describe structure and functions of different bones.

Outcomes:

1. Ability to understand the anatomical organization of organs and systems in representative species.
2. Ability to identify and describe structure and functions of different body parts of vertebrates.
3. Students would be able to prepare temporary and permanent mountings of biological material.
4. Students would be able to relate different bones and be able to articulate them to form an skeleton.

5 Students would make observations of organisms in their natural environment and document them.

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1. Study of at least two museum specimens from Protochordata to Mammalia.

2. Demonstration based on Models, Charts and Computer Aided Techniques: Demonstration of rat so as to expose its digestive system, reproductive system.

3. Key for Identification of poisonous and non-poisonous snakes.

4. Permanent Mountings - i) Mounting of different types Scales (From Locally Available Fishes): Cycloid, Ctenoid and Placoid.

5. Osteology: a) Disarticulated skeleton of fowl and rabbit/rat; b) Carapace and plastron of turtle /tortoise; c) Mammalian skulls: One herbivorous and one carnivorous animal. (Models / Charts); d) Preparation of articulated complete skeleton of any locally available animal.

6. An "**Animal Album**" containing photographs, cut outs, with appropriate write up about the different taxa. Different taxa/ topics may be given to different sets of students for this purpose.

7. Short excursion/ study Tour is compulsory.

8. Submission:

i) Practical record book duly signed by the teacher in charge/Head of the Department.
ii) Five permanent stained micro preparations.
iii) Animal Album ***or*** Articulated complete skeleton of any locally available animal
iv) Excursion report.

(Demonstration of animal Dissections through Models, Charts or Computer Aided Techniques as per U.G.C Guidelines)

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology,

Four Year UG Program, Zoology (w.e.f. June -2024)

B. Sc. First Year, Semester – II

Generic Elective (GE/OE)

SZOOGE1151: Animal Diversity - II

Periods : 30 **No. of Credits: 02 (Marks: 50)**

Course objectives :

Zoology is the scientific study of animal life. Animals are the most diverse creatures on this planet.

1. This course gives a framework for understanding the diversity within different groups, and interrelationship among different species and genera within each group.
2. The aim of this course is to understand the importance of animal kingdom in context to hierarchy, body plan and their role in ecological development.
3. This course provides an overview of the vertebrate animals, including amphibians, reptiles, birds, and mammals.
4. Provide knowledge of coelom formation, different level of organization, different modes of living, evolutionary changes of chordates and their salient features.
5. Also impart knowledge on different classes of chordates.
6. After completion of this course, the learners will have a framework for understanding all of the different types of animals, and the characteristics of each.

Course Outcomes

Upon completion of the course, students will be able to:

1. Distinguish between major phyla of animals through a demonstrated understanding of their taxonomic classification and diversity.
2. Describe the distinguishing characteristics of all major phyla.
3. Understand the fundamental differences among animal body plans and relate them to function, taxonomic classification, and evolutionary relationships among phyla.
4. Illustrate lifecycles, structure, function and reasons for importance of few representative organisms from different groups of animals.
5. Identify anatomical structures from prepared tissues.
6. Observe living animals in the environment and relate observations to theory from the course.
7. Recognize major animal phyla and animals on the basis of their external characteristics.

SZOOGE1151: Animal Diversity-II : Course Contents

ModuleNo.	Unit No.	Topic	Hrs. Required to cover the contents
1. 0			
	1.1	Protochordates – Silent features	**7**
	1.2	Hemichordata – General characters, classification	
	1.3	Balanoglossus-Habit and Habitat	
	1.4	Affinities of Hemichordata	
2.0			
	2.1	Cepahalochordata and Urochordata	**8**
	2.2	Cephalochordata - General characters, classification; Branchistoma (Amphioxus) Habit & Habitat; Morphology, Affinities of cephalochordate	
	2.3	Urochordata - General characters, classification; Herdmania - Habit & Habitat; Morphology,	
	2.4	Affinities of urochordata	
3.0			
	3.1	Pisces : General characters, *Labeo rohita* – Classification, external morphology,	**7**
	3.2	Scoliodon - General characters, Classification, external morphology. Parental care in fishes.	
	3.3	Amphibia: General characters, Adaptations for terrestrial life, Parental care in Amphibia.	
	3.4	Frog – External morphology, life cycle.	
4.0			
	4.1	Reptiles: General characters	**8**
	4.2	Poisonous and Non-poisonous snakes	
	4.3	Aves: General characters, Flight adaptations in birds	
	4.4	Mammalia: General characters, Classification of Human, Dentition in mammals	
		Total	**30**

Reference Books

1. Barnes, R.D. (1992). Invertebrate Zoology. Saunders College Pub. USA.
2. Ruppert, Fox and Barnes (2006) Invertebrate Zoology. A functional Evolutionary Approach 7th Edition, Thomson Books/Cole
3. Campbell & Reece (2005). Biology, Pearson Education, (Singapore) Pvt. Ltd.
4. Kardong, K. V. (2002). Vertebrates Comparative Anatomy. Function and Evolution. Tata McGraw Hill Publishing Company. New Delhi.
5. Raven, P. H. and Johnson, G. B. (2004). Biology, 6th edition, Tata McGraw Hill Publications. New Delhi.

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology,

Four Year UG Program, Zoology (w.e.f. June -2024)

B. Sc. First Year, Semester – II

Skill Enhancement Course in Zoology

SZOOSC1151: (C) Aquarium Keeping

Periods : 60 **No. of Credits: 02 (Marks: 50)**

Course Objectives:

1. Explore different types of aquariums and material used to fabricate them.
2. Acquire skill to handle and process material and accessories for aquarium fabrication and installation.

Course Outcomes:

1. Describe different types of aquariums and raw material used to fabricate them.
2. Ability to properly handle material and accessories for aquarium fabrication and installation.
3. Identify water parameters and adjust them to normal conditions.

SZOOSC1151: (C) Aquarium Keeping : Course Contents

ModuleNo.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0			**15**
	1.1	Introduction to Aquarium Keeping, Aquarium – Definition, importance	
	1.2	Aquarium –Shape and size	
	1.3	Types of aquarium- wooden, Steel, fibre glass, plastic acrylic, iron frame, full glass, garden pool etc.	
	1.4	**Practicals:** 1. To study different types of aquarium 2. Visit to Aquaria	
2.0			**15**
	2.1	**Construction of aquarium**- Design and fabrication	
	2.2	**Materials** - Aluminum/ Iron angle, Hack sow, blade, drilling machine, Hammer, glass, glass cutter,	
	2.3	tape, file, set square, angle cutter, sticky tape, aquarium cement, silicon tube, silicon gun etc.	
	2.4	**Practicals:** 1. Angle cutting for frame of aquarium. 2. Rivetting of angle to form a side of aquarium. 3. Fixing of glass of one side in the frame of aquarium with the help of bitumen/ aquarium cement / silicon etc. 4. Cutting of glasses of given size	
3.0			**15**
	3.1	**Setting of Aquarium**- Selection of place for aquarium, table or stand, cover for aquarium, light, watering,	
	3.2	planting, preparation of bed-sand, gravels, rocks, coarals, back glass painting or poster,	
	3.3	**Aquarium accessories**- Aerator, air-stone, toys, filtration, hand net, rubber tube and connectors. Thermometer, heater etc.	
	3.4	**Practicals:** 1. Identification of various aquarium tools 2. Identification of various aquarium accessories 3. Preparation of aquarium bed. 4. Watering of aquarium 5. Planting of aquarium 6. Lighting of aquarium	
4.0			**15**
	4.1	**Maintenance** 1. Water parameters/ test and monitor, cycling of water. 2. Cleaning of aquarium, light management 3. Food - live food and dry food	
	4.2	4. Preparation of supplementary food for aquarium fishes.	
	4.3	5. Aquarium fishes 6. Significance of aquarium.	
	4.4	**Practicals:** 1. Cleaning of aquarium 2. Identification of aquarium fishes 3. Preparation of supplementary food from grains for aquarium fishes 4. Checking fish health 5. Marketing	
		Total	**60**

Text Books

1. A Text Book of Pisciculture and Aquarium Keeping- Dhananjay Jadhav, Mohan Babre.
2. A Text Book of Pisciculture & Aquarium Keeping- H. S. Jagtap, S. N. Mukherjee & V. K. Garad., Daya Publishing House, New Delhi.
3. Practical Manual of Pisciculture and Aquarium Keeping- H. S. Jagtap, S. N. Mukherjee & S. S. Nanware, Daya Publishing House, New Delhi
4. The complete book of the Fresh water aquarium-Vincent Hargreaves
5. The Complete aquarium Book- Nilliam T. Innes.
6. Hand Book of Fish aquarium- Hiware and Sonwane,

Reference Books

1. Guide to keeping and breeding the aquarium fishes (1968). Bombay aquarium Society, Mumbai.
2. Fresh water aquarium, Dawes, J.A., Roberts Royee Ltd. London
3. How to maintain your fresh water aquarium-Thoms Riggson

Swami Ramanand Teerth Marathwada University, Nanded

Faculty of Science and Technology,

Four Year UG Program, Zoology (w.e.f. June -2024)

B. Sc. First Year, Semester – II

Skill Enhancement Course in Zoology

SZOOSC1151: (D) Animal Museology

Periods : 60 **No. of Credits: 02 (Marks: 50)**

Course Objectives:

1. The aim of the course is to develop knowledge related to various techniques of preservation of natural history specimens.
2. Record the information and preserve specimens for taxonomic studies.

Course Outcomes:

1. After completion of the course the students self-sufficient in the preservation techniques of biological specimens, which would be an asset for safeguarding artifacts derived from animal and plants act as to provide great opportunity for self-employment.
2. Learners are expected to be able to handle museum objects, identify the factors and causes of deterioration and be able to take proper preservative measures.
3. Job opportunity as a curator.

SZOOSC1151: (D) Animal Museology : Course Contents

ModuleNo.	UnitNo.	Topic	Hrs. Required to cover the contents
1. 0			**15**
	1.1	General Introduction of Museum Definition of museum, Origin, history of museum, need of museology, Museum development in India Types of museum, importance of museum. Nature and composition of Biological Specimens. Causes of deterioration of Natural History collection. Biodeterioration and its control measures.	
	1.2	Definition of Preservation. Types of Preservation; Dry and wet Preservation	
	1.3	Preservatives and their types. Advantage and disadvantage of liquid preservatives like Alcohol, Formalin etc.	
	1.4	Storage of Biological Specimens in a Museums Ethics of collection : Issues related to community and law Types of collection Modes of collection : Fieldwork, purchase/donation/gift, loan, exchange etc. **Practicals** : To study the types of museum and its significance. Preparation of different types of preservatives. Collection and preservation of dead animals.	
2.0			**15**
	2.1	Different type of Preservation techniques Dry preservation of Natural History specimens	
	2.2	Micro techniques for Biological Specimens	
	2.3	Preservation of Insect collection	
	2.4	Definition of Plastination; Plastic embedding and Plastic infiltration **Practicals**: Study of insect preservation, preparation of plastic embedding. Study of microtechniques.	
3.0			**15**
	3.1	Stuffing	
	3.2	Cleaning and Mounting of skeletons	
	3.3	Definition of Taxidermy. Preparation of cabinet skin	
	3.4	Freeze Drying Technique. **Practicals** : To study preservation of skeletons.	
4.0			**15**
	4.1	Methods of wet preservation. Wet preservation of Animals. Color preservation techniques. Alizarin Mount Technique Steps for the preservation of specimens for scientific study. (Euthanizing,Injection and slitting,fixing, labelling,storage etc.)	
	4.2	Fabrication Techniques of Natural History Specimens	
	4.3	Definition of Insecticides and their classification	
	4.4	Preventive and curative methods of deterioration **Practicals**: To study wet preservation of animals. Case study of at least two museum objects with regard to causes and types of deterioration and preventive measures. To study steps for the preservation of specimens for scientific study. Hands-on-training (at least 5 objects) creating complete set of museum documentation records. **Visit to Zoological Museums**.	
		Total	**60**

Reference Books

1. Biological museum methods (vol. I & II) by G. Hangry & M. Dingle
2. Manual of curatorship in natural history museums by Geffery Steinsfield
3. Museum Basics by T. Ambrose & C. Paine
4. Museum Environment by Garry Thomson
5. An introduction to museum work by G. E. Burcaw
6. Museum management by Kevin Moore
7. Biodetoriation of Cultural property by O. P. Agarwal

Swami Ramanand Teerth Marathwada University, Nanded			
Faculty of Science & Technology			
Summer/Winter-20-------, Examination			
Name of Subject:		**Zoology**	
Subject Code : (as per examination time table):			
Class:	**B.Sc. First Year**	Semester:	**I & II**
Paper Title and Paper No (as per examination time table):		**…….** **Paper No. ……..(NEP-2020 Pattern)**	
Time:	**2 Hours**	Maximum Marks:	**40**

nportant Instructions:

i. Question Number 1 is compulsory.
ii. Out of remaining 5 Questions (Q. No. 2 to Q. No. 6) answer any 3 Questions.
iii. All Questions carry equal marks.
iv. Illustrate your answers with suitable labeled diagrams, wherever necessary.

Q.1 Answer each of the following: **10 Marks**

a) (Based on Module 1)
b) (Based on Module 2)
c) (Based on Module 3)
d) (Based on Module 4)

Q.2 Long Question (Based on Module 1) **10 Marks**

OR

Write notes on :
a) (Based on Module 1)
b) (Based on Module 1)

Q.3 Long Question (Based on Module 2) **10 Marks**

OR

Write notes on :
a) (Based on Module 2)
b) (Based on Module 2)

Q.4 Long Question (Based on Module 3) **10 Marks**

OR

Write notes on :
a) (Based on Module 3)
b) (Based on Module 3)

Q.5 Long Question (Based on Module 4) **10 Marks**

OR

Write notes on :
a) (Based on Module 4)
b) (Based on Module 4)

Q.6 Answer each of the following: **10 Marks**

a) (Based on Module 1)
b) (Based on Module 2)
c) (Based on Module 3)
d) (Based on Module 4)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science & Technology

Practical Examination Winter / Summer 20----

B. Sc. First Year Zoology (Semester – I) as per NEP-2020; (w.e.f. June 2024)

Practical (SZOOCP1101)

Based On

(Paper : SZOOCT1101: Biodiversity of non-chordates)

Center : Batch No.:

Date : Time : 4 Hrs

Exam Seat Number : Marks : 30

Q. 1). Spotting: Identify, classify and describe as per instructions. (1-05 Spots) (10)
(Invertebrates)

Q. 2). Demonstrate Cockroach so as to explain its Digestive System / Nervous System (08)
and leave a labelled diagram.

OR

Demonstrate Scoliodon so as to explain its Digestive System / Heart &Ventral Aorta / Afferent arteries / Brain and leave a labelled diagram.

Q. 3). Prepare Permanent Stained Micro Preparation of material provided (Identify, draw (08)
labelled diagram and comment).
(Mounting of Mouth parts/Trachea/ Salivary glands of Cockroach/ Nereis Parapodia)

Q. 4). Viva-voce (04)

Note: 1. Practical Internal Evaluation (Continuous Assessment CA) = 20 Marks
i) Submission of Record book & Excursion Report = 10 Marks;
ii) Animal Album or Articulated complete skeleton & permanent slides=10 Marks;
2. Demonstration of animal Dissections through Models, Charts or Computer Aided Techniques as per U.G.C Guidelines.

Name & Signature
Examiner – 1

Name & Signature
Examiner - 2

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

CHOICE BASED CREDIT SYSTEM (CBCS)

SEMESTER PATTERN

Faculty of Science & Technology

Practical Examination Winter / Summer 20----

B. Sc. First Year Zoology (Semester – II) as per NEP-2020; (w.e.f. June 2024)

Practical (SZOOCP1151)

Based On

(Paper : SZOOCT1151: Biodiversity of Chordates)

Center : Batch No.:

Date : Time : 4 Hrs

Exam Seat Number : Marks : 30

Q. 1). Spotting: Identify, classify and describe as per instructions. (1-05 Spots) (10)
(Vertebrates)

Q. 2). Demonstrate Rat so as to expose its Reproductive system / Digestive system and leave a well labelled diagram. (08)

Q. 3). Prepare Permanent Stained Micro Preparation of material provided (Identify, draw labelled diagram and comment). (Scales of locally available fishes, any One) (08)

Q. 4). Viva-voce (04)

Note: 1. Practical Internal Evaluation (Continuous Assessment CA) = 20 Marks
i) Submission of Record book & Excursion Report = 10 Marks;
ii) Animal Album or Articulated complete skeleton & permanent slides = 10 Marks;
2. Demonstration of animal Dissections through Models, Charts or Computer Aided Techniques as per U.G.C Guidelines.

Name & Signature
Examiner – 1

Name & Signature
Examiner - 2

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Faculty of Science & Technology

B. Sc. First Year Syllabus w.e.f. June, 2024 (NEP-2020)

SKILL ENHANCEMENT COURSE ZOOLOGY (SECZ)

CONTINUOUS ASSESSMENT (CA)

Zoology

Semester- I

SZOOSC1101 - SECZ- I : (A) Parasites of Public Health Importance

Or

SECZ- I : (B) Vermiculture & Vermicomposting

Centre: **Date:**

Marks: 20

SEAT NUMBER :----------

Sr. No.	Continuous Assessment (CA)	Maximum Marks	Marks Obtained
1	Seminar Presentation	10	
2	Test	10	
	Total Marks	**20**	

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Faculty of Science & Technology

B. Sc. First Year Syllabus w.e.f. June, 2024 (NEP-2020)

SKILL ENHANCEMENT COURSE ZOOLOGY (SECZ)

CONTINUOUS ASSESSMENT (CA)

Zoology

Semester- II

SZOOSC1151 - SECZ- II : (C) Aquarium Keeping

Or

SECZ- II : (D) Animal Museology

Centre: **Date:**

Marks: 20

SEAT NUMBER :----------

Sr. No.	Continuous Assessment (CA)	Maximum Marks	Marks Obtained
1	Seminar Presentation	10	
2	Test	10	
	Total Marks	**20**	

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Faculty of Science & Technology

B. Sc. First Year Syllabus w.e.f. June, 2024 (NEP-2020)

SKILL ENHANCEMENT COURSE ZOOLOGY (SECZ)

END SEMESTER ASSESSMENT (ESA)

Zoology

Semester- I

SZOOSC1101 - SECZ- I : (A) Parasites of Public Health Importance

Or

SECZ- I : (B) Vermiculture & Vermicomposting

Centre: **Date:**

Marks: 30

SEAT NUMBER :----------

Sr. No.	Continuous Assessment (CA)	Maximum Marks	Marks Obtained
1	Skill Work Report Submission	10	
2	Overall Skill Judgment	10	
3	Skill Work Presentation	10	
	Total Marks	**30**	

Name & Signature
Examiner – 1

Name & Signature
Examiner - 2

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Faculty of Science & Technology

B. Sc. First Year Syllabus w.e.f. June, 2024 (NEP-2020)

SKILL ENHANCEMENT COURSE ZOOLOGY (SECZ)

END SEMESTER ASSESSMENT (ESA)

Zoology

Semester- II

SZOOSC1151 - SECZ- II : (C) Aquarium Keeping

Or

SECZ- II : (D) Animal Museology

Centre: **Date:**

Marks: 30

SEAT NUMBER :----------

Sr. No.	Continuous Assessment (CA)	Maximum Marks	Marks Obtained
1	Skill Work Report Submission	10	
2	Overall Skill Judgment	10	
3	Skill Work Presentation	10	
	Total Marks	**30**	

Name & Signature
Examiner – 1

Name & Signature
Examiner - 2

Guidelines for Course Assessment:

A. Continuous Assessment (CA) (20% of the Maximum Marks):

This will form 20% of the Maximum Marks and will be carried out throughout the semester. It may be done by conducting **Two Tests** (Test I on 40% curriculum) and **Test II** (remaining 40% syllabus). Average of the marks scored by a student in these two tests of the theory paper will make his **CA** score (col 6).

B. End Semester Assessment (80% of the Maximum Marks):

(For illustration we have considered a paper of 02 credits, 50 marks and need to be modified depending upon credits of an individual paper)

1. **ESA Question paper will consists of 6 questions, each of 10 marks.**
2. **Students are required to solve a total of 4 Questions.**
3. **Question No.1 will be compulsory and shall be based on entire syllabus.**
4. Students need to solve **ANY THREE** of the remaining Five Questions (Q.2 to Q.6) and shall be based on entire syllabus.

C. Assessment of Co-Curricular courses (CC):

a. Continuous Assessment (CA) of the CC course shall be done by the respective course coordinator depending on the regularity, performance of a student and his participation in the international, national, state, university, college level events or camps, wherever applicable.

b. End Semester Assessment (ESA) shall be done on the basis of the write-up and presentation by the student on the activities that he has carried out throughout the semester.

c. Students have freedom to take more than one CC courses, however, score of the best performing CES shall be considered for final assessment.

D. Syllabi, Teaching Scheme and Examination Scheme for the courses in Column 7 and Column 8 (AEC, VEC, IKS, CI, EVS, CCs, etc.) shall be common for all the students from different faculties.

Note: Number of lectures required to cover syllabus of a course depends on the number of credits assigned to a particular course. One credit of theory corresponds to 15 Hours lecturing and for practical course one credit corresponds to 30 Hours. For example, for a course of two credits 30 lectures of one hour duration are assigned, while that for a three credit course 45 lectures.

%%%

Basket 3 : Generic Elective Course (GE)

Note*: Each BOS shall suggest Generic Elective Courses (at least one each for Group A and Group B) for semesters I and II*

* Students will choose one GE course each from Group A and B of Basket 2 (other than subjects DSC and DSM in col. 3 and 4). (For e.g. Refer table below)

Semester	**BOS proposing GE**	**Group A**		**Group B**	
		CODE	**Title of the Corse**	**CODE**	**Title of the Corse**
Sem I	BOS in Zoology	SZOOGE1101	Animal Diversity - I		
Sem II	BOS in Zoology	SZOOGE1151	Animal Diversity - II		