॥ सा 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

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

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

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विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत राष्ट्रीय शैक्षणिक धोरण २०२० नुसार पदव्यूत्तर द्वितीय 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 राष्ट्रीय शैक्षणिक धोरणानुसार पदव्यूत्तर द्वितीय वर्षाचे अभ्यासक्रम लागू करण्याच्या दृष्टीकोनातून विज्ञान व तंत्रज्ञान विद्याशाखे अंतर्गत येणा–या अभ्यासमंडळांनी तयार केलेल्या पदव्यूत्तर द्वितीय वर्षाच्या 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 एम. एस्सी द्वितीय वर्षाचे अभ्यासक्रम (Syllabus) लागू करण्यात येत आहेत.

1) M. Sc. II year - Analytical Chemistry (Affiliated College)
2) M. Sc. II year - Biochemistry (Affiliated College)
3) M. Sc. II year - Organic Chemistry (Affiliated College)
4) M. Sc. II year - Physical Chemistry (Affiliated College)
5) M. Sc. II year - Inorganic Chemistry (Affiliated College)
6) M. Sc. II year - Analytical Chemistry (Campus)
7) M. Sc. II year - Industrial Chemistry (Campus)
8) M. Sc. II year - Medicinal Chemistry (Campus)
9) M. Sc. II year - Organic Chemistry (Campus)
10) M. Sc. II year - Physical Chemistry (Campus)
11) M. Sc. II year - Polymer Chemistry (Campus)
12) M. Sc. II year - Computer Management (Affiliated College)
13) M. Sc. II year - Computer Sciene (Affiliated College)
14) M. Sc. II year - Software Engineering (Affiliated College)
15) M. Sc. II year - System Administration & Networking (Affiliated College)
16) M. Sc. II year - Computer Application (Campus)
17) M. Sc. II year - Computer Network (Campus)
18) M. Sc. II year - Computer Science (Campus)
19) M. Sc. II year - Zoology (Campus)
20) M. Sc. II year - Zoology (Affiliated College)
21) M. Sc. II year - Physics (Campus)
22) M. Sc. II year – Physics (Affiliated College)

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/२०२४–२५/993
दिनांक १३.०६.२०२४

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

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

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY

NANDED- 431606

Maharashtra State- India

SYLLABUS

M. Sc. Zoology - Second year - Semester - III and Semester - IV

For the University Campus

Department of Zoology, School of Life Sciences, S. R. T. M. University, Nanded

(Two Years PG Program)

As per Semester Based Credit and Grading System

As per NEP-2020

With effect from June, 2024.

From Desk of Chairman, B. O. S. Zoology and Director, SLS and HOD Zoology, SLS, S. R. T. M. University, Nanded.

Under the New Educational Policy (NEP) 2020 the University Grants Commission, New Delhi (UGC) has initiated some important measures to enhance academic standards in higher education in India, for the purpose improvement in curriculum is one of the important concerns in this regard. Swami Ramanand Teerth Marathwada University, Nanded has already initiated reforms in higher education by implementing semester system for the continuous teaching and learning process using Choice Based Credit System (CBCS) as per the UGC guidelines. Revision and updating the syllabus is a continuous process as per the demand for the development of self-reliable and useful human resource for the society and ready to work human resource for the country. The CBCS provides choice for students to select any particular subject from the same course or from the same Program (DSE) and also from other sources and Programs within the School of Life Sciences. There is also choice for the students to choose NPTL, SWYAM, MOOC like online educational portals as an additional credit earning resources. In the new curriculum reform, there is compulsory slot for Skill Enhancement/Development Courses so as to provide skills for the students through this course. Therefore, Board of Studies (BOS) in Zoology in consent with the HOD Zoology, the staff of the department and the Director, School of Life Sciences has prepared the curriculum for PG Course in subject Zoology, Department of Zoology at School of Life Sciences this University. The curriculum is designed to include updated contents on various branches of subject Zoology and animal sciences in general.

Already the comments and opinion from students, stakeholders, parents, research students and industries are considered positively to revise the syllabus and the suggestions are incorporated. Moreover, the valuable suggestions for further improvement and quality enhancement in this regard are welcome.

Two Year (**Four Semester**) CBCS pattern teaching program M. Sc. Zoology at this University Campus is having autonomous status has an intake of 20 students. The program curriculum also includes the courses such as Research methodology to introduce the students about research needs in higher education that may be immediately implemented. Also it includes research projects and on job training, field based projects. It indicates the promotion of research in the new education policy instead of more theoretical knowledge. In the third and fourth semester Department specific electives included so as to take care of student choice as per their interest and the mindset to study a particular subject and a specific course during completion of this PG program M. Sc. Zoology. The medium of instruction and examination of this course is English. The M. Sc. Zoology course offers 06 credit research project as an important component that convert as dissertation as one of the important components. It is for those students who are interested in pursuing their career in research. There is an option against Research Project to write a scientific review on selected research topics. Based on the academic performance of a student in semester-I, Semester-II the Dissertation Allocation Committee (DAC) under the chairmanship of Head of the Department to advice the students whether to go for the dissertation or Research Review. Under this new policy a uniformity in assessment system has been introduced i. e. 20:80 as continuous assessment (CA) for 20 % marks and 80 % as end semester assessment (ESA).

Program Educational Objectives:

1. Exposure of students to animal diversity and to provide them systematic tools of traditional and modern types to acquire this knowledge and skill.

2. To update the syllabus essential for appearing in NET, SET, GATE, ASRB and other competitive exams of UPSC and MPSC.
3. To make aware the students to know the natural resources of country, to utilize by sustainable methods and conservation of living and non-living resources.
4. To develop trained and knowledgeable human resource for educational and research institutions and industries; to use this human resource for self-reliant India.
5. To develop self-employable ability and to apply knowledge for several Agri-based industries like sericulture, Goat farming and Apiculture; it will also provide employment to other dependents.

Program Specific Outcome (PSO):

1. The students will be acquainted to animal diversity, its present status and applied use.
2. Students will get the knowledge and skill from learning this course for self-employment and will provide job for others for entrepreneurship development.
3. The students will get updated knowledge of basic and applied branches of Zoology so as to qualify for various state and national level competitive examinations to get employment.
4. The learned students of this course will be leaders in the educational and research institutions and for the industries in the country and abroad.
5. To develop self-reliant human resource for entrepreneurship and employability to make our country self-reliant.

Prerequisite:

This Post Graduate Degree Course will be offered to the students having basic knowledge of Zoology and willing to gain additional knowledge in applied and research aspects of Zoology. Admission to this PG Program is given to the students who have studied Zoology subject as one of the optional subject or honours in subject Zoology at their graduation level.

Admission: The Admission will be given to the students for this program on the basis of merit of Marks secured in the Entrance Examination conducted by this University. The students interested for the admission for this program should have Zoology as their major subject or one of the Optional Subject or Zoology Honours for UG level (B. Sc.). The rules for admission including reservation are as per the S. R. T. M. University, Nanded and Maharashtra State Govt. Policy for the Admissions to PG Courses.

Dr. H. S. Jagtap
Chairman, BOS, Zoology,
S. R. T. M. University, Nanded- 431606

Prof. S. P. Chavan
Director School of Life Sciences,
HOD, Zoology, School of Life Sciences
S. R. T. M. University, Nanded - 431606

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*	*Email & Contact No.*
1	Dr. Hanumant Shahaji Jagtap	Chairman	Dept. of Zoology, Shri Shivaji College, Parbhani	9423717670 Email: hsjagtap1704@gmail.com
2	Dr. Shivaji Prabhakar Chavan	Member	HOD. Zoology, School of Life Sciences, S. R. T. M. University, Nanded. Director, School of Life Sciences, S. R. T. M. U., Nanded	8830995765, 9421046372 schavan646@gmail.com
3	Dr. Dhanraj Bhure	Member	Yeshwant Mahavidylaya, Nanded	8149407814 drajbhure82@gmail.com
4	Dr. Sanjay. S. Nanaware	Member	HOD Zoology, Yeshwant Mahavidhyalaya, Nanded	9423401227 snanware@rediffmail.com
5	Dr. P. P. Joshi	Member	Asso. Prof. Department of Zoology, Aadarsh Mahavidhyalaya, Hingoli	9595648535 drprashantjo@gmail.com
6	Dr. Ratna Kirtane	Member	Dayanand Science College, Latur	9422185834 ratnakirtane@gmail.com
7	Dr. Deepak Pandurang Katore	Member	Asso. Prof. Dept. of Zoology, Nagnath College, Aundha Nagnath, Dist. Hingoli	9765737373 katoredeepak@gmail.com
8	Dr. Karmaveer Nagnathrao Kadam	Member	HOD Zoology, Kumarswami Mahavidhyalaya, Ausa, Dist. Latur.	karmbeernk@gmail.com 9970129929
9	Dr. Sanjay Sadashivrao kale	Member	Asoo. Prof. Kumarswami Mahavidhyalaya, Ausa	9423348798 Sanjaykale.sks@gmail.com
10	Dr. Anil M. Mane	Member	Arts, Science and Commerce College, Shankarnagar, Dist. Nanded	9422874110 Anilmane531@gmail.com
11	Dr. Ramrao Janardhanrao Chavan	Member	Professor, Department of Zoology, Dr. B. A. M. University, Aurangabad. M. S.	9423030859 chavanrj@gmail.com
12	Dr. Ranjitsingh Krishnarao Nimbalkar	Member	Govt. Institute of Forensic Science, Aurangabad	9422345234 rknimbalkar@gmail.com
13	Dr. Shivesh Pratap Singh	Member	Govt. P. G. College, Satna, M. P.	7987155634 drshiveshsingh2004@gmail.com

14	Dr. Chandrashekhar Devidasrao Basarkar	Member	Director, Nimkar seeds Pvt Ltd, Phaltan, Dist. Satara	basarkarcd@gmail.com 9822652659
15	Pandharpure Laxmi Gurunath (UG Merit student	Invitee member	Maharashtra Mahavidhyalaya, Nilanga	9529251388
16	Dusnale Prashant Baliram	Invitee member	Yeshwant Mahavidhyalaya, Nanded	9834642631
	(PG Merit student)			

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDEE

FACULTY OF SCIENCE AND TECHNOLOGY

Credit Framework for Two Year PG Program (M. Sc.) at Department of Zoology, School of Life Sciences, S. R. T. M. U. Nanded

Subject: Zoology

Year and Level *1*	Sem. *2*	Major Subject (DSC) *3*	Major Subject (DSE) *4*	RM *5*	OJT/FP *6*	Research Project *7*	Practical *8*	Credits *9*	Total Credits *10*
1	1	**SZOOCT401 (4 Cr)** **SZOOCT402 (4 Cr)** **SZOOCT403 (4 Cr)**	**SZOOET401 (3 Cr)**	**SVECRT401** Research Methodology **(3 Cr)**	**----**		**SZOOCP401 (1 Cr)** **SZOOCP402 (1 Cr)** **SZOOCP403 (1 Cr)** **SZOOEP401 (1 Cr)**	**22**	**44**
	2	**SZOOC451 (4 Cr)** **SZOOC452 (4 Cr)** **SZOOC453 (4 Cr)**	**SZOOET451 (3 Cr)**	**---**	**SZOOJT451 (3 Cr)**	**-** **-**	**SZOOCP451 (1 Cr)** **SZOOCP452 (1 Cr)** **SZOOCP453 (1 Cr)** **SZOOEP451 (1 Cr)**	**22**	
Exit Option: Exit option with PG Diploma (After 2024-25)									
2	3	**SZOOCT501(4 Cr)** **SZOOCT502 (4 Cr)** **SZOOCT503 (3 Cr)**	**SZOOET501 (3 Cr)** **or** **SZOOET502 (3 Cr)** (From Same Department/School)	**---**		Research Project SZOORP501 **(4 Cr)**	**SZOOCP501 (1 Cr)** **SZOOCP502 (1 Cr)** **SZOOCP503 (1Cr)** **SZOOEP501 (1 Cr)** Or **SZOOEP502 (1 Cr**	**22**	**44**
	4	**SZOOCT551(4Cr)** **SZOOCT552(4Cr)**	**SZOOET552 (3 Cr)** (From Same Department/School)	SZOOTR551 Publication Ethics (2 Cr)		Research Project SZOORP552 **(6 Cr)**	**SZOOCP551 (1 Cr)** **SZOOCP552 (1 Cr)** **SZOOEP551 (1 Cr)**	**22**	
Total Credits		**43**	**12**	**05**	**03**	**10**	**15**		**88**

M. Sc. Second Year Zoology- Semester III *(Level 6.0)*

Credit Framework for Two Year PG Program (M. Sc.) at Department of Zoology, School of Life Sciences, S. R. T. M. U. Nanded

Teaching Scheme

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	**SZOOCT501**	Biochemistry and Immunology	04	--	**04**	04	--
	SZOOCT502	Ecology and Ethology (Elective: for other PG Programs in the School of Life Sciences of same semester or for same Program)	04	--	**04**	04	--
	SZOOCT503	Bioinstrumentation and Cell Communication	03	--	**03**	03	--
Elective (DSE)	**SZOOET501 / SZOOET502**	**Fishery Science-1** (Fish Taxonomy, Morphology and Anatomy)**/or** **Entomology-1** (Insect Taxonomy and Morphology)	03 or 03	--	**03 or 03**	03 + 03	--
Research Project	**SZOORP501**	Research Project	--	04	**04**	04	
DSC Practical	**SZOOCP501**	Lab 1 – Practical in Biochemistry and Immunology	--	01	**01**	--	02
	SZOOCP502	Lab 2 – Practical in Ecology and Ethology	--	01	**01**	--	02
	SZOOCP503	Lab-3- Practical in Bioinstrumentation and Cell Communication	--	01	**01**	--	02
DSE Practical	**SZOOEP501 or SZOOEP502**	Elective Lab- Practical in Fishery **Science-1** (Fish Taxonomy, Morphology and Anatomy)**/or** **Entomology-1** (Insect Taxonomy and Morphology)	--	01 or 01	**01**	--	02 + 02
Total Credits			14	08	**22**	19	06

[20% Continuous Assessment (CA) and 80% End Semester Assessment (ESA)]

M. Sc. Second Year Semester III *(Level 6.0)*

Credit Framework for Two Year PG Program (M. Sc.) at Department of Zoology, School of Life Sciences, S. R. T. M. U. Nanded

Examination Scheme

[20% Continuous Assessment (***CA***) and 80% End Semester Assessment (***ESA***)]

Subject	Course Code	Course Name	Theory				Practical		Total Col (6+7) / Col (8+9)
			Continuous Assessment (CA)			ESA			
			Test I	Test II	Avg. of (T1+T2)/2	Total	CA	ESA	
Major	**SZOOCT501**	Biochemistry and Immunology	20	20	20	80	--	--	100
	SZOOCT502	Ecology and Ethology (Elective: for other PG Programs in the School of Life Sciences of same semester or for same Program)	20	20	20	80	--	--	100
	SZOOCT503	Bio-instrumentation and Cell Communication.	15	15	15	60	--	--	75
Elective (DSE)	**SZOOET501 / SZOOET502**	**Fishery Science-1** (Fish Taxonomy, Morphology and Anatomy)/**or Entomology-1** (Insect Taxonomy and Morphology)	15	15	15	60	--	--	75
Research Project	**SZOORP501**	Research Project	--	--			**20**	**80**	100
DSC Practical	**SZOOCP501**	Lab 1 – Practical in Biochemistry and Immunology	--	--	--	--	**05**	**20**	25
	SZOOCP502	Lab 2 – Practical in Ecology and Ethology	--	--	--	--	**05**	**20**	25
	SZOOCP503	Lab-3- Practical in Bio-instrumentation and Cell Communication					**05**	**20**	25
DSE Practical	**SZOOEP501 Or SZOOEP502**	Elective Lab- Practical in **Fishery Science-1** (Fish Taxonomy, Morphology and Anatomy)/**or Entomology-1** (Insect Taxonomy and Morphology)	--	--	--	--	**05**	**20**	25

M. Sc. Second Year - Semester IV *(Level 6.0)*

Credit Framework for Two Year PG Program (M. Sc.) at Department of Zoology, School of Life Sciences, S. R. T. M. U. Nanded

Teaching Scheme

[20% Continuous Assessment (CA) and 80% End Semester Assessment (ESA)]

	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
			Theory	Practical	Total	Theory	Practical
Major	SZOOCT551	**Molecular Biology**	04	--	**04**	04	--
	SZOOCT552	**Animal Physiology**	04	--	**04**	04	--
Elective (DSE)	SZOOET551	**Fishery Science-2** (Fish Biology, Aquaculture and Marine fisheries) **or /Entomology-2**(Insect Pests and Forensic Entomology)	03 **or 03**	--	**03**	03 +03	--
	SZOORT551	Publication Ethics	02	--	**02**	02	--
Research Project	SZOORP551	Research Project (Field Project/Research Review)	02	04	**06**	--	06
DSC Practical	SZOOCP551	Lab 1- Practical in Molecular Biology	--	01	**01**	--	02
		Lab 2- Practical in Animal Physiology					
DSE Practical	**SZOOEP551 Or SZOOEP552**	**Fishery Science-2** (Fish Biology, Aquaculture and Marine fisheries) **or /Entomology-2**(Insect Pests and Forensic Entomology)	--	01 or 01	**01**	--	02 + 02
Total Credits			**15**	**07**	**22**	**13**	**10**

M. Sc. Second Year Semester IV *(Level 6.0)*

Credit Framework for Two Year PG Program (M. Sc.) at Department of Zoology, School of Life Sciences, S. R. T. M. U. Nanded

Examination Scheme

[20% Continuous Assessment (***CA)*** and 80% End Semester Assessment (***ESA***)]

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)**	
Major	SZOOCT551	Molecular Biology	20	20	20	80	--	--	100
	SZOOCT552	Animal Physiology	20	20	20	80	--	--	100
Research Project	SZOORP551	Research Project (Field Project/Research Review)					30	120	150
	SZOORT551	Publication Ethics	10	10	10	40	--	--	50
DSE Practical	**SZOOEP551 or SZOOEP552**	**Fishery Science-2** (Fish Biology, Aquaculture and Marine fisheries) or **/Entomology-2**(Insect Pests and Forensic Entomology)	--	--	--	--	05	20	25

[20% Continuous Assessment (CA) and 80% End Semester Assessment (ESA)]

G Credit Framework of Sci. & Tech. Faculty of S.R.T.M.U. Nanded

Guidelines for Course Assessment: Examination and Evaluation System. 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 04 credits, 100 marks and need to be modified depending upon credits of an individual paper)

1. **ESA Question paper consists of 6 questions, each of 20 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.

Note: 1. Number of lectures required to cover syllabus of a course depends on the number of credits assigned to a particular course. **01 credit** of **theory** corresponds to **15 Hours** lecturing and for **practical course 01 credit** corresponds to **30 Hours.**

2. for a course of 02 credits 30 lectures of one hour duration are assigned, while that for a three-credit course 45 lectures.
3. For the evaluation of Research Project, the committee members as examiners include HOD as internal Examiner and one External Examiner. Average of the marks of two examiners will be final marks for the Research Project? Field Project for ESA section.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Faculty of Science and Technology,

Two Years PG Program, Syllabus (w.e.f., June, 2024),

Department of Zoology, School of Life Sciences, S. R. T. M. Univ., Nanded

M. Sc. Zoology, Second Year - Semester- III

Course Code: SZOOCT-501- Course Title- Biochemistry and Immunology

Periods: 60 **No. of Credits: 4** **(Marks: 100)**

Course pre-requisite:

Students are expected to have basic knowledge of biomolecules in plants and animals.

Course objectives:

1. Objective of this course is to help the student to navigate the discipline of Biochemistry that explains how the collection of inanimate molecules.

2. To determine the biochemistry and biochemical reactions in the animals as their life processes.

Course outcomes:

1. The students may clear the NET/SET/GATE and other scientific screening tests conducted by various departments and agencies involved actively in research and development in science and technology.

2. There are opportunities for the students after completing this course in bioprocessing and biotechnological research institutes.

Curriculum Details

Module No.	Unit No.	Title of the Topics	Hrs. Required to cover the topic
1.0	**1.1**	Acids and bases, Buffer solutions, Physiological and Biological Buffers.	15
	1.2	Introduction to Amino acids and proteins. Amino acid, structure and properties of Amino Acids. Non-standard, Modified Amino acids, biologically important peptides.	
	1.3	Structure of proteins (Primary, Secondary, Tertiary and Quaternary) , Ramachandran plot. Types of proteins: Fibrous proteins, Globular proteins, collagen, elastin, keratins, myoglobins, haemoglobins	
	1.4	haemoglobin variants and pathological effects, Protein sequencing	
2.0	**2.1**	Nucleic acids: Structure and functions Double stranded DNA (A, B and Z form of DNA). Triple and quadraplex structures, RNA Types and biological functions.	15

	2.2	Introduction to Enzymes and their Classification. Enzyme action Coenzymes	
	2.3	Glycolysis, Glycogenesis, Gluconeogenesis,	
	2.4	Krebs's Cycle (TCA Cycle) and importance.	
3.0	**3.1**	Cells and organs related to immunity- T-Cells and B-cells (Generation, activation and differentiation)	15
	3.2	Types of immunity: Innate and Acquired immunity	
	3.3	Structure, Classification, and functions of Antigen and Antibody.	
	3.4	Complement System Pathway.	
4.0	**4.1**	MHC (Major Histocompatibility Complex) Structure and functions.	15
	4.2	Antibodies. Hybridoma Technology Monoclonal antibodies and polyclonal	
	4.3	Hypersensitivity: Types and causing factors.	
	4.4	Auto-immune diseases, Types of Vaccine.	

References

Biochemistry

1. Biochemical calculations- Erwin, H. Segel. John Willy and Sons

2. General Chemistry- Linus Pauling. W. H. Freeman and Company

3. Biochemistry-D. Voet and J. G. Wileymand Sons.

4. Physical Biochemistry- D. Frefilelder. W. H. Freemand and Company.

5 Laboratory Techniques in Biochemistry and Molecular Biology, Worh and Work.

6. Understanding Chemistry, CNR Rao, Universities Press, Hyderabad.

7. A biologists Guide to Principles and Practices in Biochemistry- K. Wilson and K. H Coulding FLRS, (1986).

8. Tools of Biochemistry- T. G. Cooper.

Immunology

9. Kuby Immunology- Richard A. Goldsby, Thomas J. Kindt & Barbara A.Osborne, W. H. Freeman & Company, New York.

10. Essential Immunology- Roitt I. M., ELBS Edition.

11. Fundamentals of Immunology- Paul W.

12. Modern Immunology- Das Gupta.

13. Immunology & Serology- Carpenter.

14. The Immune System- Hobert & Mc Cornel.

15. Practical Immunology- Hay & Hudson.

16. Immunology- Donald M. Weir & John Stewart, ELBS Publication. 20. Practical Immunology- Volume I & II, Talwar and Gupta.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED
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Swami Ramanand Teerth Marathwada university, Nanded

School of Life Sciences, S. R. T. M. U. N.

Two Years PG Program, Syllabus (w.e.f., June, 2024) SLS, SRTMUN

M. Sc. Zoology, Second Year - Semester- III

Course Code: SZOOCT-502.

Title of the Course – Ecology and Ethology

Periods: 60 **No. of Credits: 4** **(Marks: 100)**

Course pre-requisite:

Students should have basic idea about the ecological factors, environment. The diversity of animals, sense organs in animals and concept of nervous system and progressive development in the system during evolution.

Course objectives:

1. To study higher levels of the organization of life on the earth and the interrelations between organisms and their environment.
2. To study the ecological and evolutionary basis for animal behaviour and its role in enabling animals to adapt to their ecological niches.

Course outcomes:

The student will get idea about the ecological process in its surrounding and at national, global level and the use of his/her knowledge on ecology, behaviour and Biostatics can be applied in education, research and extension programs in his further career.

Curriculum Details

Module No.	Unit No.	Title of the Topics	Hrs. Required to cover the topic
1.0	**1.1**	Basic concepts in Ecological studies (Definitions): Ecological Species, Biotop, Individual, Population, Community, Biocoenosis, Ecosystem, Biome, Biosphere, Autecology, Synecology, Ecotone, Edge effect, ecocline, techno-ecosystem, ecological footprint, Natural capital, Guild, Ecological equivalent, Ecological amplititude, ecads (Ecophene), Ecotype, Ecological compression, Habitat, Home range, territory.	15
	1.2	Physical environment: Abiotic factors and their role in the Environment: a. Climatic factors: Rainfall, Temperature, Light, Wind, Fire. b. Topography. c. Edaphic factors	
	1.3	Biotic and abiotic interactions.	
	1.4	The concept of habitat and niche, Types of Niches, Niche width and niche overlapping, Niche differentiation	
2.0	**2.1**	Ecosystem structure, Ecosystem function, Energy flow and mineral cycling (C, N, P).	15
	2.2	Ecological Succession: Steps in succession, Types of succession, Theories of succession, Ecological successional model.	

	2.3	Species interactions: Types of interactions.	
	2.4	Structure and food web of ecosystem: Terrestrial ecosystem (Forest, Grassland), Aquatic ecosystem (Freshwater, Marine, Estuarine).	
3.0	**3.1**	Population and their characteristics: Population size, Density, Abundance, Birth rate, Death rate, Age distribution, Dispersion.	15
	3.2	Population counting: Head capture method, Line transect method, Mark recaptured method, Quadrat method, Suction trap method, Sweep net, Mist net, Pitfall traps, Baited trap, Light traps.	
	3.3	Life history strategies (r and k selection) and concept of metapopulation	
	3.4	Population growth: Types of population growth a. Unlimited growth. b) Limited growth.	
4.0	**4.1**	Introduction to Ethology.	15
	4.2	Innate Behaviour: a) Taxis b) Reflexes c) Instincts	
	4.3	Acquired Behaviour and its neural basis- a) Learning b) Reasoning c) Memory.	
	4.4	Colonial structure/Social Behaviour in Termites and Honey Bees. Mimicry in animals. Pheromones in Animals.	

References:

Ecology – Odum
2. Ecology and Environment – P. D. Sharma – Rastogi Pub., Merrut
3. Concept of Ecology - Edmond Cormondy, Himalaya Publishing house, Mumbai.
4. Ecology – M. P. Arora, Himalaya Publishing house, Mumbai.
5. Environmental Pollution, H. Loggen, - Holt Reinholt, Winston.
6. Noise Pollution and its control – T. N. Tiwari, V. P. Kudesia, Pragati Prakashan, New Delhi.
7. Environmental Relation, Thermal Pollution and Control – G. R. Chatwal, M. C. Mehera, Amol Publication, New Delhi.
8. Animal Behavior – Vinod Kumar, Himalaya Publishing House, New Delhi.
9. A Text Book of Animal Behavior – H. S. Gundevia, H. G. Singh. S. Chand and Co. Ltd.
10. Animal Behavior, An Evolutionary Approach – Alcock, Sinauer Assci. And Co. Ltd.
11.Animal Behavior – Boulanger
12. A text book of Animal Behavior – Harjinder Singh, - Amol Pub. Pvt. Ltd, New Delhi.

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Two Years PG Program, Syllabus (w.e.f., June, 2024) SLS, SRTMUN
M. Sc. Zoology, Second Year - Semester- III
Course Code: SZOOCT-503.
Title of the Course – Bioinstrumentation and Cell communication
Periods: 45 No. of Credits: 3 (Marks: 75)

Course pre-requisite:

There is a need of various instruments in the biological studies. The learners should have or expected have a sufficient knowledge about the existence of complex and simple molecules in animal body and up to the cell level as nucleic acids and specific proteins

Course Objectives:

1. To introduce the students about various methods of analysis and fine analysis up to cellular fractionation.
2. To develop understanding for the students on integration, self-control and communications in the cells of various kinds that organize the animal body

Course outcomes:

1. The students will learn about basics of instrumentation in analysis of biomolecules, their confirmation, characterization and quantification.
2. The students will apply this molecular analytical knowledge in biological research and development of new molecules.

Curriculum Details

Module No.	Unit No.	Title of the Topics	Hrs. Required to cover the topic
1.0	**1.1**	Scope and importance of Bio-instrumentation applications in Zoology.	15
	1.2	Biomaterial and Bio-molecule separation systems: Centrifugation. RPM based Centrifuge machine types. Ultra-centrifuge machine. Ultracentrifuge system	
	1.3	Introduction to structure, working and applications of : Hot air Oven, Hot Water-bath, Heating plates, Incubator (Thermostat), Shaking incubator, Microtome machine, Ultramicrotome. Autoclave.	
	1.4	Introduction to Chromatography and its applications: Paper Chromatography, Thin layer Chromatography (TLC). HPTLC Various solvents used in Chromatography and Electrophoresis. Poly-acrylamide Gel Electrophoresis (PAGE).	
2.0	**2.1**	Colorimeter and applications. Single beam and double beam Spectrophotometer and applications.	15
	2.2	Introduction to Gas Chromatography/Mass Spectrometry (GC/MS) and its applications. X-Ray Spectroscopy. Flame Spectroscopy.	

	2.3	Introduction to NIR spectroscopy and applications. Introduction to NMR spectroscopy and applications. Introduction to Atomic Absorption Spectroscopy (AAS) and applications. Visible and UV Spectroscopy.	
	2.4	Introduction to cell communication and Cell signalling. Types of Cell signalling.	
3.0	**3.1**	Hormones and their receptors, Cell surface Receptors, Signalling through G-Protein coupled receptors. RTK Pathways.	15
	3.2	Signal transduction Pathways, secondary messengers and regulation of signalling pathways. Wnt Signalling Pathways.	
	3.3	General Principles of cell communication. Cell adhesion and role of different adhesion molecules. Gap Junction and extracellular matrix, tight junction	
	3.4	Cancer: Integrins, neurotransmission and its regulation. Genetic rearrangement in progenitor cells. Oncogenes and tumour suppressor genes.	

References:

1. Bioinstrumentation- Webster (2007).- Google.co.in
2. Bioinstrumentation- John Denis Enderile
3. Principles of Bioinstrumentation- Richard Norman
4. Biomedical Instrumentation. Technology and Applications R. S. Khandpur.
5. Signal Transduction. Carl Henrik Heldin, Mary Purton.
6. Cell to Cell signalling from Experiments to Theoretical Models – A. Goldbeter.
7. Cell Signalling- Wendell Lim, Bruce Mayer, Tany Pawson (Books.google.com)

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Two Years PG Program, Syllabus (w.e.f., 2023) SLS, SRTMUN

M. Sc. Zoology, Second Year - Semester- III

Course Code: SZOOET-501.

Title of the Course – Fishery Science-I (Taxonomy, Morphology and Anatomy)

Periods: 60 **No. of Credits:** **4 (Marks: 100)**

Curriculum Details

Course pre-requisite:

The students should have basics about distribution of fishes in fresh water and marine water. They must have knowledge about external morphological variations in shape, symmetry and size of fishes.

Course Objective

1. To equip and train the students to understand about fish biology and processes,
2. To determine the importance of culture practices and processes involved in preservation and marketing of fish and other edible organisms.
3. To determine the uses of fishes to prepare fish products and biproducts.

Course Outcome:

Student can apply his knowledge to pursue his career in private, Government sector related to fisheries, fish culture and may enter in this particular field as entrepreneur. The students may join to the research institutes as research fellow, project fellow and researcher.

Module No.	Unit No.	Title of the Topics	Hrs. Required to cover the topic
1.0	**1.1**	a) General account on Distribution, evolution and species diversity in the world. b) Introduction to Fossil fishes: Ostracoderms and Placoderms-Evolutionary period, species diversity, characters and distribution. c) Recent Scheme of fish Classification. d) General Characters and differences in Sharks, Skates and rays. e) General Characters of teleost, External Morphology of a scaly teleost and Scale-less teleost.	15
	1.2	a) Fishery Science Related Education and Research Institutes in India: CIFE, CIBA, CIFT, CMFRI, CIFA. b) Study of some Ichthyologists and Fish Taxonomists: Lagler, Berg, Gunther, F. Day, Gunther, Jhingran. c) Preservation of Fish samples: Whole fish, Gut Content, Scales, Visceral organs for the taxonomical study. d) Preparation of fish and body parts as specimen for the Museum.	
	1.3	a) Introduction to use of online data base on Fish Systematics-Fishbase.org (Frose and Pauly).	

		b) Institute of Fish Genetic Resources and Fish Gene Bank. c) Introduction to Extraction of DNA and RNA from fish sample. Fish DNA Barcoding. d) Introduction to Bioinformatics in Fish identification and Taxonomy.	
	1.4	Different body forms in fishes and their importance in survival. Morphometric and meristic characters, descriptive characters used in fish identification and to determine the habitat of fishes, food and feeding habits.	
2.0	**2.1**	Types of scales, development and modifications in fish body scales. Importance of scale study in fishes. Various structures in fish body viz. scales, otolith, fins, bones that used in growth and study of fish breeding and spawning.	
	2.2	Coloration, chromatophores, colour change, control on colour change and significance of coloration in fishes. Mimicry in fishes.	
	2.3	Structure and function of Air bladder and Weberian Ossicles in fishes Structure and functions of lateral line system in fishes.	15
	2.4	Endocrine glands, hormones and functions in fishes. Digestive system in fishes: structural differences and modifications in teeth and gill rakers in fishes useful in feeding.	
3.0	**3.1**	Gill respiration in fishes, other structures as accessory organs of respiration in fishes.	15
	3.2	Structure of Reproductive system in Teleost's and gonadal developmental cycles in fishes.	
	3.3	Heart and circulatory system in teleost. Skull, Vertebrae and girdles in teleost.	
	3.4	Sensory organs in fishes: Eye, Barbels, Membranous labyrinth. Introduction to electric organs in fishes.	

REFERENCES:

1. **Text Books-**

   An Introduction to fishes- S. S. Khanna

2. **Reference Books-**

1. Bardach, et al. Aquaculture – The Farming and Husbandry of Freshwater and Marine Organisms. John Wiley & Sons, NY, 1972.
2. Stickney, R.R. Principles of Water Aquaculture. John Wiley & Sons, NY, 1979.
3. Chondar, C.L. Hypophysation of Indian major carps. Satish Book Enterprise, Agra, 1980.
4. Jhingran, V.G. Fish and fisheries of India. Hindustan Publ. Corporation (India), 1982.
5. Santhanam, R. et. Al. A Manual of Freshwater Aquaculture. Oxford & IBH Publishing Co. Pvt. Ltd., 1987.
6. Pilley, T.V.R. Aquaculture – Principles and Practices. Fishing News (Books) Ltd., London, 1990.
7. Pandey, A.C. Air Breathing Fishes. Reliance Publishing House, New Delhi, 1990.
8. Janardhana Rao, K. & S.D. Tripathi. A Manual of Giant Freshwater Prawn Hatchery. CIFA, Kausalyaganga, Orissa, India, 1993.
9. Iso Matsui. Theory and Practice of Eel Culture. American Publishing Co. Pvt. Ltd 1980.

10. Aquaculture and Aquarium keeping- S. P. Chavan, M. S. Kadam, S. D. Niture. Educational Books Publishers and Distributors, Aurangpura Aurangabad, MS

11. A Manual of Fresh Water Aquaculture, Santhanam. Oxford and IBH Publishers and Distributors New Delhi.

12. Introduction to Fishes – S. S. Khanna, Central Book Depot, Allahabad

13. Taxonomy of fishes – Jhingran and Talwar

14. Physiology of fishes – Hoar and Randall.

15. Fish Biology and Indian fishes – R. P. Parihar, - Central publishing house, Allahabad.

16. A text book of fish, fisheries and Technology, Biswas – Narendra Publishing House, New Delhi.

17. Aquaculture and Aquarium Keeping – Chavan S. P., Kadam M. S. and Niture S. D., - Educational Books and Publishers, Aurangabad, M. S.

18. Fishery Science and Indian Fisheries – C. B. L. Shrivastava - Kitab Mahal, New Delhi.

19. Aquaculture Principles and Policies – T.V.R. Pilley – Daya PublishingHouse, New Delhi

20. Aquaculture and Practices a selected review – FAO

21 Aquaculture Project Formulation – FAO

22. Bacterial Diseases of Fishes – Veleri Englis Ronald – Daya Publishing House New Delhi.

23. Taxonomy of Fishes Vol I, Vol II – Francis Day (Narendra Publishing House New Delhi)

24. Marine Fisheries – Bal and Rao.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

School of Life Sciences, S. R. T. M. U. N.

Two Years PG Program, Syllabus (w.e.f., June, 2024)

M. Sc. Zoology, Second Year - Semester- III

Course Code: SZOOET-502

Title of the Course – Entomology-I (Insect Taxonomy and Morphology)

Periods: 45 **No. of Credits: 3** **(Marks: 75)**

Curriculum Details

Course pre-requisite:

Students should know about Invertebrate taxonomy and taxonomic position of Insects.

The students should have knowledge about usefula, harmful and disease causing Insects and their distribution.

Course objectives:

1. To determine the basics of Insect morphology, anatomy, physiology, reproduction and endocrinology, Taxonomy and behaviour was main aim behind the design of this course.
2. To use the basic studies in entomology for human welfare and nature conservation.

Course outcomes:

The students will get an idea about what an Insect is, what is physiology, anatomy and reproduction in Insects as a basic study, that can be used in agriculture and research and human life.

Module No.	Unit No.	Title of the Topics	Hrs. Required to cover the topic
1.0	**1.1**	What is insect? Classification of Insects. E-content and websites for Insect classification.	15
	1.2	Distribution of Insects; Role of insects in ecosystem regulation.	
	1.3	The standard literature and references used in Insect Taxonomy. General Characters of insect orders with examples: a) Apterygote Orders: Entognathus- Collembola; Ectognathus- Thysanura. b) Pterygot Orders: Odonata, Embidina, Phasmida, Diptera, Hemiptera, Hymenoptera, Coleoptera, Lepidoptera, Orthoptera, Hemiptera	
	1.4	Insect Migration. Swarming in Insects. Insects and their food value	
2.0	**2.1**	External characters of Insects: Head- Types and segmentation; Cervix; Thorax- Skeleton, segmental regions, sternum and pleuron	15
	2.2	Types of legs and their importance in Insects. Coloration, shapes and mimicry in Insects	
	2.3	Types of mouth parts in Insects. Abdominal appendages- pre-genital, genital and post-genital.	
	2.4	Thoracic appendages: Types of wings and wing venation in Insects. Flight in insects.	

3.0	**3.1**	Structure of trachea and respiration in Insects. Structures for respiration in Insects. Types of Food in Insects. Structure of Eye in insects. Introduction to skeleton in Insects.	15
		Types of reproduction in Insects. Physiological regulation of reproduction. Reproductive system in Grasshopper Reproductive system and reproduction in Mosquito	
	3.3	Endocrine system in an Insect and Hormones, functions of Hormones.	
	3.4	Metamorphosis in Insects. Moulting in Insects.	

REFERENCES:

1. A Text Book of Applied Entomology: Vol. II. K. P. Srivastava.
2. Elements of Entomology. Rajendra Singh.
3. Sericulture and Pest Management. T. V. Sathe and A. D. Jadhav.
4. Agricultural Pests of South East Asia and India. A. S. Atwal.
5. 6. Bee Keeping in India. ICAR New Delhi. S. Singh.
6. Principles of Insect Morphology. R. E. Snodgrass.
7. Insect Structure and Function. R. F. Chapman.
8. Entomology. Gillot C.
9. General Entomology. Mani M. S. Oxford IBH Pub.
10. Modern Entomology. Tembhre D. B. Himalaya Pub.
11. Insect Physiology and Anatomy. Pant N. S. and Ghai S. L.
12. Ericulture in India. Sarkar D. C. CSB Benguluru.
13. Sericulture for rural Development. Hanumappa. Himala

2. Text Books:

A Text Book of Forest Entmology. T. V. Sathe

A Textbook of Agricultural Entomology. Dhruti S. H. ICAR New Delhi

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Two Years PG Program, Syllabus (w.e.f., June, 2024)

M. Sc. Zoology, Second Year - Semester- III

Course Code: SZOOCP-501

Title of the Course – Practical in Biochemistry and Immunology

Periods: 30 No. of Credits: 01 (Marks: 25)

Curriculum Details

Practical No.	Practical Title	No. of Hrs. to complete the Practical = 30
1.	Preparation of Molar, Normal solution and buffers.	02
2.	Determination of pH and use of pH meter	02
3.	Qualitative analysis of carbohydrates	04
4.	Estimation of Glucose by DNS method	04
5.	Estimation of protein by biuret method/lowry's method	02
6.	Effect of pH on the activity of human salivary alpha amylase	04
7.	Separation of amino acid by Paper chromatography	02
8.	Separation of amino acid by Thin layer chromatography (TLC)	04
9	Identification of blood group A, B, AB, O with Rh factor	02
10	Differential Leucocytes count (DLC)/ Blood cell counter machine	02
11	Elisa (Enzyme linked immune sorbent assay)	02

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M. Sc. Zoology, Second Year - Semester- III

Course Code: SZOOCP-502

Title of the Course – Practical in Ecology and Ethology

Periods: 30 **No. of Credits: 01** **(Marks: 25)**

Curriculum Details

Practical No.	Practical Title	Total No. of Hrs. to complete the Practical = 30
1	Qualitative and quantitative measurement of plankton, comparative Primary production estimate. Sedgewick Rafter Counting Chamber Method.	02
2	Determination of water quality parameters (BOD, COD, DO, CO2, acidity and alkalinity, Carbonates and bicarbonates, Phosphates in water samples.	04
3	Identification of LC 50, LD 50 studies and histopathological lesions due to toxic effects by microscopy and Microtomy. (Exposure of Fish/Mollusc to Chemical pollutant: Cuso4, Formalin or Plant extract).	04
4	Computer simulated experiments on behaviour in animals.	02
5	Collection and identification of mimicry in Insects (Photo based study). Video recording on animal behaviour from nature and its behavioural explanation.	04
6	Adaptive behaviour, mimicry, predation, mating calls, nest building in birds, rodents and submission/demonstration during examination. Preparation of audio/video	02
7	Estimation of animal population structure using biostatistics- Similarity Index, Diversity Index, Richness, Evenness for Insects, Birds, Mammals. Representation of Data using Excel Programs on Computers.	04
8	Collection, preservation and identification of fresh water plankton; Isolation of biota from coastal zone of a reservoir by sieve method.	04
9	Preparation of artificial nests/Models for birds and observations on nest selections, nest materials used.	04

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M. Sc. Zoology, Second Year - Semester- III

Course Code: SZOOCP-503

Title of the Course – Practical in Bioinstrumentation and Cell signalling

Periods: 30 **No. of Credits: 01** **(Marks: 25)**

Curriculum Details

Practical No.	Practical Title	No. of Hrs. to complete the Practicals = 30
1	Introduction and working principle of: Hot Air Oven, Centrifuge (RPM based variants), Hot plate,	02
2	Introduction and working principle of: Water bath, Incubator	02
3	Introduction to working of Colorimeter and recent variant models	04
4	Introduction to working of GC/MS and its application	04
5	Introduction to HPTLC and applications	02
6	Introduction to spectrophotometer: Single Beam, double Beam	04
7	Microtomy of Insect, Fish tissues up to slide preparation	04
8	Immuno-electrophoresis Assay - for detection of Antigen antibody	04
9	Biological sample preparation for SEM and TEM	04

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Two Years PG Program, Syllabus (w.e.f., June, 2024)
M. Sc. Zoology, Second Year - Semester- III
Course Code: SZOOEP-501
Title of the Course – Practical in Fishery Science- I (Fish Taxonomy, Morphology and Anatomy)
Periods: 30 No. of Credits: 01 (Marks: 25)

Curriculum Details

Practical No.	Practical Title	No. of Hrs. to complete the Practical = 30
1.	Types of scales, fins, types of teeth, structure of alimentary canal, gill rakers,	02
2	Age determination in fishes. To determine morphological variations in scales of teleost.	04
3	Fish identification by Morphometrics and meristic. Use of standard literature on Fish taxonomy and use of Online fish base website: www.fishbase.org. Frose and Pauly	04
4	Taxonomy and biology of fishes from fresh water and marine water using computer assisted learning aids/specimen /model. *Labeo rohita, b. Catla catla, c Cirrihina mrigala, d. Cyprinus carpio, e. Labeo calbasu. F. Ctenopharyngodon idella g. Hypopthalmychthys molitrix, h. Tilapia sp. I) Notopterus kapirat j) Wallago attu k) Mastacembelus armatus l) Chimaera sp. M) Acipensor sp. N)Puntius ticto.*	06
5	Taxonomy and biology of fishes from fresh water and marine water using computer assisted learning aids/specimen /model. *Torpedo spp) Horpodon neherius q) Oil sardine, r) Mackeral s) Sole t) Pomfreet. Lobsters, Fresh water prawns and marine prawns.*	04
6	Molecular Taxonomy of fishes. Extraction of DNA from fish tissue.	02
7	Demonstration / Use of computer assisted digital programs/models/edible fish for determination of anatomical features of the following organs in fishes: Air Bladder, Weberian ossicles, Mouth, Gill rakers, Teeth and their locations, Gonads, Heart, Ventral aorta and its branches brain and cranial nerves	04
8	Visit to fish Market/ Fishing Station: Collection of Fishes, Scales. Preperation of Fish Skeleton and observation of vertebrae and girdles, Skull. Submission of Market visit report focussing on fish diversity and conservation status.	04

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Two Years PG Program, Syllabus (w.e.f., June, 2024)

M. Sc. Zoology, First Year - Semester- III

Course Code: SZOOEP-502

Title of the Course – Practical in Entomology-I

(Insect Taxonomy and Morphology)

Periods: 30 **No. of Credits: 01** **(Marks: 25)**

Curriculum Details

Practical No.	Practical Title	No. of Hrs. required = 30
1.	Insect traps and insect collection methods: Collection of Insects from various habitats.	04
2	Identification and characters of mouth parts in Insects from the collected samples. Preparation of Parmanand mount preparation.	02
3	Identification of Types of legs and types of wing venation in insects and importance in Taxonomy.	02
4	Types of Antennae and modifications in Insects	02
5	Practical methods for Processing and preservation of Insects. Observation of permanent mount slides. Identification, Characters and control on household Insects: Mosquito, Bedbug, Cockroach.	04
6	Classification and Characters of Insects, eggs and their larvae of stored grains (any 05): Rice, Wheat, Pulses. Microscopic observation of grains for damage caused and control.	04
7	Insects pests of Agriculture crop (Any 02): Classification Identification and characters of pests on Soybean, Cajanus Cajan, Cotton, Sugarcane, wheat and rice.	04
8.	Preparation of Insect collection box and Insect preservation.	04
9.	Study of structure of Termite mound and Honeybee comb, Spider webs	02
10	Characters of Scorpion, Spiders, Wasps, Honeybee, Termites, Lac Insect and Silk moth, Butterfly	02

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School of Life Sciences, S. R. T. M. U. N.
Two Years PG Program, Syllabus (w.e.f., June, 2024) SLS, SRTMUN
M. Sc. Zoology, Second Year- Semester- IV

Course Code: SZOOCT-551.
Title of the Course – Molecular Biology
Periods: 60 **No. of Credits: 4** **(Marks: 100)**

Course pre-requisite:

Students need to have idea and knowledge about cell structure, cell organelles, Types of cells. The concept of Nucleic acids and Cell to cell interactions.

Course Objectives:

1. To study the structure and function of the basic unit of living organisms.
2. To study stages in cell cycle (including cell death and cancer), cell differentiation, and organelles and other cellular structures in the growth and functioning of the cell (including membrane transport and signalling).
3. To understand the basic concepts and processes in development of an organism.
4. The objective of this course is to provide a clear understanding of DNA so that they can manipulate and understand the basic tools and techniques involved in it. Strong foundation in genetics and molecular biology enables the students to familiarize themselves with genetic engineering.

Course Outcome:

The students will be able to apply the knowledge in education and research on molecular biology in various fields at industrial, institutional levels. Nationally as well as Internationally.

Curriculum Details

Module No.	Unit No.	Title of the Topics	Hrs. Required to cover the topic
1.0	**1.1**	Nucleic Acid: structure, DNA and RNA as genetic material, Chemical structure and base composition of Nucleic acids.	15
	1.2	Double helix structure, Super-coiled DNA, Force stabilizing the Nucleic acid structure. Properties of DNA. Renaturation and denaturation of DNA. Structure of RNA.	
	1.3	DNA replication: general feature of DNA replication, enzymes and proteins of DNA replication.	
	1.4	Prokaryotic and Eukaryotic DNA replication mechanism, replication in PHAGES, Replication in Retro-Virus.	
2.0	**2.1**	Transcription: Mechanism of transcription in Prokaryotes and Eukaryotes	15
	2.2	Post-transcriptional processing of t-RNA, r-RNA and m-RNA (5-capping and 3-Polyadenylation and splicing.	
	2.3	Antisense and Ribozyme technology: Molecular mechanism of anti-sense molecules. Inhibition of splicing. Polyadenylation and translation.	
	2.4	Disruption of RNA structure and capping. Biochemistry of ribozyme. Strategies for the designing ribozymes. Application of ribozymes and antisense.	

3.0	**3.1**	Translation: Genetic code, general features, deciphering of genetic code, Code in mitochondria.	15
	3.2	Translation mechanism in Prokaryotes and Eukaryotes	
	3.3	Post-translation modification and Protein transport	
	3.4	Protein targeting, non-ribosomal poly-peptide synthesis, Antibiotic inhibitors and translation.	
4.0	**4.1**	Regulation of gene expression in Prokaryotes and Eukaryotes. Operon Concept, Positive and negative control. LAC-Operon, TRP and Arb-Operon	15
	4.2	Regulation of gene expression in Eukaryotes	
	4.3	Homologous recombination: Holiday Junction, FLP or FRT and CRE/LON combination.	
	4.4	REC-A and other combinations.	

References:

1. Molecular Biology- Verma P. S. and Agarwal V. K. (2009).
2. Molecular Biology- David P. Clark, Nanette J. Pazdemik. (2012).
3. Cell and Molecular Biology. S. C. Rastogi. (Books.google.com)
4. Molecular Biology of the Cell 6E- John Wilson, Tim Hunt
5. Fundamentals of Molecular Biology. Veer Bala Rastogi
6. Molecular Biology: Genes to Proteins- Burton E. Tropp
7. Molecular Biology and Genetic Engineering – P. R. Gupta (2008)
8. Molecular Biology Techniques. D. Scott Witherow, Sue Carsen. (2011).
9. Google Books.com on Molecular Biology- Free e-Books.
10. www.pdf.net.in

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Two Years PG Program, Syllabus (w.e.f., June, 2024) SLS, SRTMUN

M. Sc. Zoology, Second Year- Semester- IV

Course Code: SZOOCT-552.

Title of the Course – Animal Physiology

Periods: 60 No. of Credits: 4 (Marks: 100)

Course pre-requisite:

Knowledge about Systems in animal body, the structure and functioning.

Course Objectives:

1. To understand the fundamental principles of animal physiology.
2. To understand the physiology and functions of animal systems.
3. To understand the body functions and adaptations in respect to its external & internal environments related to nervous integration, sensation, metabolism & reproduction in animals..

Course outcomes:

1. Students are able to understand the physiology at the cellular and system level.
2. Able to understand the types and mechanism of nerve cells.
3. Able to understand the nature endocrine glands and their secretion,
4. Possible to determine the role and functions of different systems. That can be applied in various required fields in career development.

Curriculum Details

Module No.	Unit No.	Title of the Topics	Hrs. Required to cover the topic
1.0	**1.1**	General Organization of alimentary canal – Role of salivary glands, liver, pancreas & intestinal glands in the process of digestion.	15
	1.2	Digestion and Absorption of proteins, carbohydrates and lipids and its hormonal regulation. Pancreatic hormones and their role in digestion. Details on Diabetes.	
	1.3	Body fluids, formed elements of blood (Composition of blood), Coagulation of blood and theories of coagulation.	
	1.4	Nitrogenous and non-nitrogenous excretory products in animals. Urea cycle.	
2.0	**2.1**	Structure of mammalian heart and it's working. Closed system of circulation in Mammals. Lymphatic system and its physiology.	15
	2.2	Structure of mammalian kidney–Urine formation- acid base regulatory mechanisms. Endocrine regulation of water & mineral balance. Osmoregulation and mechanisms.	
	2.3	Types of muscles – Ultra-structure-Mechanism of contraction of skeletal muscles.	

		Nerve conduction- Synapse-Neurotransmitters- Nervous co-ordination- Coding information to sensory organs	
	2.4	Male and female reproductive system in a Mammal and hormonal control of sex and reproduction.	
3.0	**3.1**	Hormones, Neurohormones, Neurotransmitters. Physiology of Hormone action.	15
	3.2	Pituitary gland, Thyroid gland, Parathyroid gland and Adrenal gland: Structure, hormones and their functions.	
	3.3	Thyroid hormone synthesis and its regulation, Physiology of Goitre.	
	3.4	Hormones and calcium metabolism in vertebrates.	
4.0	**4.1**	Endocrine system in a Crustacean. Hormones and color changes in Crustacea.	15
	4.2	Endocrine glands, hormones and their functions in fishes. Hormones and color changes in Fishes.	
	4.3	Structure of endocrine system and hormones in insects. Hormonal regulation of reproduction, moulting and development in insect	
	4.4	Parthenogenesis in Insects and its mechanism	

References:

1. Ganong, H, Review of Medial Physiology, 1989. 14th edition, Appleton &Lange publisher, New York
2. Physiology: A regulatory system approach, Fleur, and Strand, (1978). Macmillan Publishing Company, New York; Collier Macmillan Publishers, London.
3. Shier, D., Butler, J. And Lewis, R., Hole‟s Human Anatomy and Physiology, (10th edition) 2003. WCB/McGraw Hill, Boston. 2003.
4. Human Physiology- Gyton. (Elsvier Publication).
4. Animal Physiology, EcKert, R (5th edition), 2002. W.H.Freeman.
5. Williams S. Hoar (1991) General and Comparative Physiology 3rd edition. Prentice Hall of India- New Delhi.
6. Neilson, K.S. Animal Physiology, 1997. Cambridge University Press, Pergamon Press, Oxford.
7. Prosser, C.L. and Brown-Jr. F.A.: Comparative Animal Physiology, 1961. W.B. Saunders, Philadelphia.
8. A Text Book of Comparative Vertebrate endocrinology – P. J. Bentley – S. Chand and co. New Delhi.
09. Comparative vertebrate Endocrinology – Gorbman and Ber n – ELBS Publishers, London, New York.
10. Comparative Vertebrate Endocrinology – Turner – ELBS Pub.
11. Endocrinology of Reproduction – Nalbandhu.
12. A Text Book of Animal Physiology – Nagbhushnam, Kodarkar and Sarojini – Oxford and IBH Co. New Delhi.
13. Fish Endocrinology – J. M. Matty.
14. Invertebrate Endocrinology – Hyman L. H.
15. Fish Endocrinology Vol. – I- VI, Hoar and Randall.
16. Invertebrate Endocrinology by Hyman & Hill

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M. Sc. Zoology, Second Year- Semester- IV

Course Code: SZOOET-551.
Title of the Course – Fishery Science – II
(Fish Biology, Aquaculture and Marine Fisheries)
Periods: 45 No. of Credits: 3 (Marks: 75)

Course pre-requisite:

Knowledge about fish anatomy, morphology and physiology, food and feeding process and reproduction. The natural resources and its utilization for the fish production.

Objectives:

1. To understand about fish biology and processes,
2. To determine the importance of culture practices;
3. To determine processes involved in preservation, processing and marketing of fish and other edible organisms and the products derived from them.

Course outcomes:

1. Students will apply the knowledge on aquaculture methods, problems and techniques they learned to operate a fish culture/aquaculture farm.
2. They may work for the development of either private or Government or their own farm.

Curriculum Details

Module No.	Unit No.	Title of the Topics	Hrs. Required to cover the topic
1.0	**1.1**	Introduction to Inland fisheries resources, fish culture and aquaculture systems. External characters, fish formula, food feeding and reproduction, Gonadal development and breeding season of: Indian Major Carps, Exotic Carps	15
	1.2	Carp Breeding: Bundh Breeding, Happa Breeding and Breeding in Chinese Hatchery system.	
	1.3	Structure and working and management of various components in Chinese Hatchery unit. Induced breeding in Fishes: Pituitary hormones and breeding in fishes. Synthetic hormones and dosage for induced breeding in fishes. To subject the fish for induced breeding.	
	1.4	Management of spawn and Incubation tank. Management of fry and fingerling. Management of Brood fish. Structure, components and managements of Ideal fish farm: Construction, structure and management of Nursery, Rearing and Stocking pond	

2.0	**2.1**	Semi-intensive and intensive methods for aquaculture.	15
	2.2	Air-breathing fish culture.	
	2.3	Cage Culture. Raceway culture. Pen Culture. Monoculture. Reservoir fishery: Types and classification of reservoirs. Lease of reservoir for fishery activities. Fish seed stalking, management and harvesting the fish.	
	2.4	Fish market and marketing: market structure, Marketing trends, Culture and management of Tilapia, Thai Magur, Indian *Channa species* and *Macrobrachium rosenbergii* (fresh water prawn)	
3.0	**3.1**	Traditional methods of fishing and equipments. Types of fishing methods, nets and gears used and their limitations. Fishing crafts, Mechanized and non-mechanized Fishing boats.	15
	3.2	Structure and working of fish cooperative society in inland fisheries and marine fisheries. Indian EEZ, International fishing, Deep sea fishing.	
	3.3	Use of remote sensing, GPRS and fish finding devices in marine fisheries	
	3.4	Government promotion and development plans for Inland fisheries development. Marine fisheries in India: Bombay Duck, Mackeral, Sole, Oil Sardine, Hilsa, Molluscs. Current trends and dynamics in Marine fisheries of India. Shrimps and Lobsters of edible importance. Processing, Preservation and export of sea food from India.	

References:

1. Introduction to fishes. S. S. Khanna.
2. Bardach, et. Al. Aquaculture – The Farming and Husbandry of Freshwater and Marine Organisms. John Wiley & Sons, NY, 1972.
3. Stickney, R.R. Principles of Water Aquaculture. John Wiley & Sons, NY, 1979.
4. Chondar, C.L. Hypophysation of Indian major carps. Satish Book Enterprise, Agra, 1980.
   Jhingran, V.G. Fish and fisheries of India. Hindustan Publ. Corporation (India), 1982.
5. Santhanam, R. et. Al. A Manual of Freshwater Aquaculture. Oxford & IBH Publishing Co. Pvt. Ltd., 1987.
6. Pilley, T.V.R. Aquaculture – Principles and Practices. Fishing News (Books) Ltd., London, 1990.
7. Janardhana Rao, K. & S.D. Tripathi. A Manual of Giant Freshwater Prawn
8. Iso Matsui. Theory and Practice of Eel Culture. American Publishing Co. Pvt. Ltd 1980.
9. A Manual of Fresh Water Aquaculture, Santhanam. Oxford and IBH Publishers and Distributors New Delhi.
10. Introduction to Fishes – S. S. Khanna, Central Book Depot, Allahabad
11. Taxonomy of fishes – Jhingran and Talwar
12. Physiology of fishes – Hoar and Randall.
13. Fish Biology and Indian fishes – R. P. Parihar, - Central publishing house, Allahabad.
14. A text book of fish, fisheries and Technology, Biswas – Narendra Publishing House, New Delhi.
15. Aquaculture and Aquarium Keeping – Chavan S. P., Kadam M. S. and Niture S. D., - Educational Books and Publishers, Aurangabad, M. S.
16. Fishery Science and Indian Fisheries – C. B. L. Shrivastava - Kitab Mahal, New Delhi.
17. Aquaculture Principles and Policies – T.V.R. Pilley – Daya PublishingHouse, New Delhi
18. Aquaculture and Practices a selected review – FAO
19. Bacterial Diseases of Fishes – Veleri Englis Ronald – Daya Publishing House New Delhi.
20. Taxonomy of Fishes Vol I, Vol II – Francis Day (Narendra Publishing House New Delhi)
21. Marine Fisheries – Bal and Rao.

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Two Years PG Program, Syllabus (w.e.f., June, 2024) SLS, SRTMUN
M. Sc. Zoology, Second Year- Semester- IV
Course Code: SZOOET-552.
Title of the Course –Entomology – II
(Insect Pests and Forensic Entomology)
Periods: 45 No. of Credits: 3 (Marks: 75)

Course pre-requisite:

Students should have basic knowledge of Insect structure and function, distribution and scope of entomology

Course Objectives:

1. To educate the students about applied aspects of insects.
2. To determine the role of insects as causative agents for various diseases and damages in agriculture crop, stored grains and mosquito like insects as important vectors for human and veterinary diseases.
3. To determine insect diversity and control measures, useful and harmful insects in the world.
4. Application of knowledge on Insects for the livelihood, agriculture protection and protection of health. To determine the importance of forensic entomology.

Course outcomes:

The students will get an idea about what are common Insect pests in agriculture and grain stores, their control and management.

Curriculum Details

Module No.	Unit No.	Title of the Topics	Hrs. Required to cover the topic
1.0	**1.1**	External Characters, Classification, Mouthparts, Food and feeding, Reproduction, Crop damage and control of Insect Pests (3 species) infecting Cotton and Sugarcane.	15
	1.2	Cabbage caterpillar, Potato tuber moth, Onion thrips, Brinjal fruit and stem borer, Mealy bug, Chilli Thrips, Coconut weevil and Rhinoceros Beetle.	
	1.3	External Characters, Classification, Mouthparts, Food and feeding, Reproduction, Crop damage and control of Insect Pests (3 species) infecting Wheat, Rice and Pulses.	
	1.4	Species diversity and Morphology, pathology and control of Ticks.	
2.0	**2.1**	Role of Mosquito species in human diseases. Parasitic insects and their biology, Parasitoides in Insects.	15

	2.2	Insect species as vectors for diseases to Human and other Bovines.	
	2.3	Species diversity, morphology, pathology and control of Mites.	
	2.4	External Characters, Classification, Mouthparts, Food and feeding, Reproduction, Grain damage and control of Insect Pests (3 species) infecting stored rice, Pulses and Oil seeds.	
3.0	**3.1**	Introduction to Forensic entomology and scope of Forensic Entomology: Flesh flies species and their host specificity, reproduction. Species specificity in larvae of flesh flies and its forensic importance.	15
	3.2	Introduction to Forensic Entomology, DNA and Entomotoxicology. Decomposition of Animals and Insect species involved. Insects as indicators of time of death.	
	3.3	The insects involved in their various life stages during decomposition stages of human body.	
	3.4	Methods of insect control. Insect traps, types and applications.	

References:

REFERENCES:

1. A Text Book of Applied Entomology: Vol. II. K. P. Srivastava.
2. Elements of Entomology. Rajendra Singh.
3. Sericulture and Pest Management. T. V. Sathe and A. D. Jadhav.
4. Agricultural Pests of South East Asia and India. A. S. Atwal.
5. 6. Bee Keeping in India. ICAR New Delhi. S. Singh.
6. Principles of Insect Morphology. R. E. Snodgrass.
7. Insect Structure and Function. R. F. Chapman.
8. Entomology. Gillot C.
9. General Entomology. Mani M. S. Oxford IBH Pub.
10. Modern Entomology. Tembhre D. B. Himalaya Pub.
11. Insect Physiology and Anatomy. Pant N. S. and Ghai S. L.
12. Ericulture in India. Sarkar D. C. CSB Benguluru.
13. Sericulture for rural Development. Hanumappa. Himala
14. Forensic Entomology- 3rd Edition (2020). Jason H. Byrd
15. Current Concepts in Forensic Entomology (Springer Link- E-Book) 376 pages. Editors: Jens Amendt, M. Lee Goff, Carlo P., Campobasso, Martin Grassberger.
16. Forensic Entomology An Introduction (2nd Edition). Dorothy Gennard. John Willy and Sons. 272 Pages.

2. Text Books:

A Text Book of Forest Entmology. T. V. Sathe

A Textbook of Agricultural Entomology. Dhruti S. H. ICAR New Delhi

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M. Sc. Zoology, Second Year- Semester- IV

Course Code: SZOORT-551.

Title of the Course – Publication Ethics

Periods: 30 **No. of Credits: 2** **(Marks: 50)**

Course pre-requisite:

The student should know about how to write a research paper, the steps and component of research article, chapter

Course outcomes:

The students will learn about ethical issues while writing a research article and they will know where it is documented in soft and hard form in the National and international libraries, data bases.

Curriculum Details

Module No.	Unit No.	Title of the Topics	Hrs. Required to cover the topic
1.0	**1.1**	Introduction to ethics: Definition, moral philosophy, nature of moral judgements and reactions. Ethics with respect to science and research	15
	1.2	Intellectual honesty and research integrity, scientific misconduct: Falsification and plagiarism (FFP)	
	1.3	Redundant publication, duplicate and overlapping publications, Salmi-slicing, selective reporting and miss presentation of Data	
	1.4	Publication Ethics: Definition, introduction and importance. Conflict of Interest	
2.0	**2.1**	Violation of Publication ethics, authorship and contributorship, identification of publication misconduct, complaints and appeal.	15
	2.2	Predatory publishers and journals. Software tools to identify predatory publications developed by SPPU.	
	2.3	Data Base: Indexing data base, citation database, Web of Science, SCOPUS etc.	
	2.4	Use of plagiarism software: Turnitin, URKUND and other open source software's. Impact factor of Journals, citation report: SNIP, SJR, IPP, Cite Score. Metrix: H-Index, G-Index, i10_index, altmatrics,	

References:

1. Bird A. (2006): Philosophy of science, Routledge
2. Macintyre, Alasdair (1967): A short history of Ethics. London
3. P. Chaddah (2018): Ethics in competitive research: Do not get scooped: Do not get plagarized. ISBN: 978-9387-48086.
4. Indian National Science Academy: (INSA)- Ethics in Science Education, research and governance (2019)

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Two Years PG Program, Syllabus (w.e.f., June, 2024)

M. Sc. Zoology, Second Year - Semester- IV

Course Code: SZOOCP-551

Title of the Course – Practical in Molecular Biology

Periods: 30 **No. of Credits: 01** **(Marks: 25)**

Curriculum Details

Practical No.	Practical Title	No. of Hrs.
1.	Introduction to use of various tools in molecular Biology: Micropipettes, Autoclave, Centrifuge machines, Rota-mix, magnetic stirrers.	02
2.	Isolation of Genomic DNA from given animal tissue	02
3	Isolation of Genomic DNA from given plant tissue	02
4	Agarose gel electrophoresis	04
5	Polymerase chain reaction (PCR)	02
6	Extraction of RNA from any vertebrate tissue. (Using manual or Kits)	02
7	Estimation of DNA by Diphenyl Amine (DPA) Method using colorimeter	04
8	Protein separation from given protein mixture sample using SDS PAGE	04
9.	Western Blotting using ready kits.	04
10	Characterization of DNA by spectrophotometric assay	04

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M. Sc. Zoology, Second Year - Semester- IV

Course Code: SZOOCP-552

Title of the Course – Practical in Animal Physiology

Periods: 30 **No. of Credits: 01** **(Marks: 25)**

Curriculum Details

Practical No.	Practical Title	No. of Hrs. to complete the Practical
1.	Measures of Blood pressure in Human.	02
2	Estimation of serum, bilirubin (Direct and Indirect methods).	04
3	Oral glucose tolerance test.	02
4	Physiology experiments based on computer simulations.	04
5	Demonstration of endocrine glands in edible teleost/Crab	02
6	Effect of eye-stalk ablation on oxygen consumption in edible crab/prawn	04
7	Effect of Hormonal injections on coloration in edible fish.	04
8	Preparation of pituitary gland extract and injection to fishes to study the coloration and locomotory behaviour in a teleost.	04
9.	Determination of Blood clotting time using self-samples.	04

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M. Sc. Zoology, Second Year - Semester- IV

Course Code: SZOOEP-551

Title of the Course – Practical in Fishery Science- II
(Fish Biology, Aquaculture and Marine Fisheries)

Periods: 30 No. of Credits: 01 (Marks: 25)

Curriculum Details

Practical No.	Practical Title	No. of Hrs. to complete the Practical=30
1.	Study of models of fishing nets crafts and boats-i) Gill Net ii) Cast Net iii) Bag Net iv) Plankton net v) Different kinds of traditional and modern crafts and rafts used in fresh water and marine water. Vi) Mechanized Boats, Trawls. Vii) Ship for fishing with advance technology- Echo sounder, light fishing, Electric fishing, GPs and Remote sensing applications in Fisheries.	04
2	Ova diameter study using occulometer to determine spawning periods of a fish	02
3	Estimation of fecundity in fish.	04
4	Weight and length relationship and growth studies in fishes.	04
5	Gut content analysis of fishes	04
6	Rigor Mortis and spoilage characters of fishes.	02
7	Sampling and Characterization of Bacteria from fish: Fresh, spoiled, from Gut content, Gills, Slime, Mouth.	04
8	Collection and identification of ectoparasites and endoparasites from fishes: Protozoans, Copepods, Anchor worms, Helminth parasites	04
9	Field Visits/ Excursion tour to visit the Circular Chinese Hatchery of fish seed production/ Fishing Centre/Fish Market and submission of Report.	02

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M. Sc. Zoology, Second Year - Semester- IV
Course Code: SZOOEP-552
Title of the Course – Practical in Entomology-II
(Insect Pests and Forensic Entomology)
Periods: 30 No. of Credits: 01 (Marks: 25)

Curriculum Details

Practical No.	Practical Title	No. of Hrs. to complete the Practical = 30
1.	Mounting and identification of Insect larvae: Mosquito, Mayfly, Chironomids; mounting of Trachea.	02
2	Identification of Scorpion and Spiders: 02 examples each.	02
3	Identification of Ants.	02
4	Identification of Butterflies and Moths.	02
5	External characters of economically important insects: Honey bees, Lac insect, Silk Moth	02
6	Collection, mounting and identification of plant gall flies.	02
7	Pheromone traps, biological control agents of Insects.	02
8	Collection, identification and control measure studies in insects of vegetable crops: Brinjal, Chile (02 examples each)	02
9	Collection of stored grain pests and identification	02
10	Identification of flies of Carcass: eggs, larvae and adult of any two species	02