Shiv Chhatrapati Shikshan Sanstha's

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

Structure and Curriculum of Four Year Multidisciplinary Degree (Honors/Research) Programme with Multiple Entry and Exit option

Undergraduate Programme of Science and Technology

B.Sc. (Honors/Research) in Zoology

Board of Studies

in

Zoology

Rajarshi Shahu Mahavidyalaya, Latur

(Autonomous)

w.e.f. June, 2023

(In Accordance with NEP-2020)

CERTIFICATE

I hereby certify that the documents attached are the Bonafide copies of the Curriculum of **B.Sc. (Honors/Research) in Zoology** Programme to be effective from the **Academic Year 2023-24.**

Date: 14/07/2023

Place: Latur

Dr. D.S. Rathod
Chairperson
Board of Studies in Zoology

Rajarshi Shahu Mahavidyalaya, Latur

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Members of Board of Studies in the Subject Zoology

Under the Faculty of Science and Technology

Sr. No.	Name	Designation	In position
1	**Dr. D.S.Rathod** Head, Department of Zoology Rajarshi Shahu Mahavidyalaya (Autonomous), Latur	Chairperson	HoD
2	**Prof. S. P .Chavan** Director, School of Life Science Swami Ramanand Teerth Marathwada University, Nanded	Member	V.C. Nominee
3	**Prof. Ragvender Rao** Walchand Centre for Research in Nanotechnology & Bio-Nanotechnology Walchand College of Arts and Science, Ashok Chowk, Solapur – 413006 Maharashtra, India	Member	Academic Council Nominee
4	**Dr. Mamidala Estari** Head, Department of Zoology, Infectious Diseases & Metabolic Disorders Research Lab, Kakatiya University, Hanumakonda-506 009. Telangana State, India.	Member	Academic Council Nominee
5	**Prof. D. H. Jadhav** Head, Department of Zoology Maharashtra Mahavidyalaya, Nilanga	Member	Expert from outside for Special Course
6	**Mr. Ishrar Deshmukh** Pharma Pune, Maharashtra, India	Member	Expert from Industry
7	**Dr. Vinay Biradar** Department of Zoology, Savitribai Phule University, Pune	Member	P.G. Alumni
8	**Dr. K. S. Raut**	Member	Faculty Member
9	**Mr. Datta Nalle**	Member	Faculty Member
10	**Mrs. Dhanshree Jagtap**	Member	Faculty Member
11	**Dr. A. A. Yadav**	Member	Member from same Faculty

From the Desk of the Chairperson…

The Department of Zoology was established in the year 1971. The department has been recognized by our parent University as Research center since 8th May 2003 and now it has been developed into center of teaching and research in Zoology.

To reach the mission of "Pursuit of Excellence" in higher education to make our students globally competent. The departmental staff is committed towards our work with dedication, determination and devotion.

National Education Policy NEP-2020 focuses more on practical rather than theoretical learning. It also focus on developing overall personality of students by incorporating Humanitarian and Constitutional values, creativity and critical thinking, harnessing innovation, use of modern technology and interaction with various stakeholders. It uses the practical based pedagogy to evolve and make education more experiential, holistic, integrated, learner-centric, flexible and developing skill etc. To skilled and trained students can accept the challenge of the future, as we know that the new policy also envisages the refinement and improvement in the Learning Outcome based Curriculum Framework.
The syllabus of B.Sc. I have been designed as per the National Education Policy (NEP), 2020, the present structure comprises Discipline specific courses (DSC), Discipline Specific Electives (DSE), Discipline Specific Minor Course (DSM), Generic/Open Electives (GE/OE), Vocational Specific Course (VSC), Skill Enhancement Course (SEC), Ability Enhancement Course (AEC) etc. The discipline specific courses (DSC) are compulsory and the elective courses can be chosen from the given Basket. Except Ability Enhancement courses, all other courses, comprise theory and practicals.

The project work is specially underlined in this structure. The project will mainly involve experimental work. The students will be asked their choice for project. The Generic Electives will be offered to the students of other departments of the college. The students will have the option to choose one generic elective from the given Basket. The generic elective comprises theory as well as practical. The students will also undertake one Vocational Specific Course (VSC) and one Skill Enhancement Course (SEC) of two credits each. The VSC and SEC also comprise theory and practicals. These courses will be chosen by the students from the concerned basket. One of the DSC is specified for Indian Knowledge Systems (IKS). Indian Knowledge Systems have a strong foundation in Indian Culture, Philosophy and Spirituality and have evolved through thousands of years.

B.Sc. Zoology course will help to understand the behaviour, structure and evolution of animals. Zoologists use a wide range of approaches to do this, from genetics to molecular and cellular biology, as well as physiological processes and anatomy, whole animals, populations, and their ecology. The scope of Zoology as a subject is very broad. The intention is to understand the subject of Zoology in the evolving biological paradigm in modern times; where, living beings need to be understood at the level of atomic interactions; and comparative systems of organisms need to be studied through the prism of integrated chemical, physical, mathematical and molecular entities to appreciate the inner working of different organisms at morphological, cellular, molecular, interactive and evolutionary levels. The key areas of study within the disciplinary/subject area of Zoology comprise: animal diversity, principles of ecology, comparative anatomy and developmental biology of vertebrates, physiology and biochemistry, genetics and

evolutionary biology, animal biotechnology, applied zoology, behaviour, immunology, reproductive biology, and insect, vectors and diseases. B.Sc. degree programme in Zoology also deals with skill enhancement courses such as apiculture, aquarium fish keeping, medical diagnostics, sericulture etc. The depth and breadth of study of individual topics dealt with would vary with the nature of specific Zoology programmes.

Our institution gives importance in mission to provide value and need based education which can be useful to students to get the skill for entrepreneurship and jobs or self-help for earnings. This institution is connected long back with anti-superstition activity to develop the scientific attitude among students.

As a part of the efforts to enhance the interest and employability of graduates of Zoology programmes, the curricula for these programmes are expected to include learning experiences that offer opportunities for higher studies and research at reputed laboratories.

(**Dr. D. S. Rathod)**
Chairperson
Board of Studies in Zoology

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Faculty of Science and Technology

Structure for Four Year Multidisciplinary Undergraduate Degree Programme in Zoology Multiple Entry and Exit (In accordance with NEP-2020)

Year & Level	Sem	Major		Minor	GE/OE	VSC/ SEC (VSEC)	AEC/ VEC	OJT,FP,CEP, RP	Credit per Sem.	Cum./Cr. per exit
		DSC	DSE							
1	**2**	**3**		**4**	**5**	**6**	**7**	**8**	**9**	**10**
I 4.5	I	DSC I: 04 Cr. DSC II: 04 Cr.	NA	NA	GE-I: 04 Cr.	VSC-I: 02 Cr. SEC-I: 02 Cr.	AEC-I MIL: 02 Cr. VEC-I: 02 Cr.	CC-I: 02 Cr. (NSS, NCC, Sports, Cultural)/ CEP-I: 02 Cr. (SES-I)/ OJT: 02 Cr. / Mini Project: 02 Cr.	22	44 Cr. UG Certificate
	II	DSCIII: 04 Cr. DSC IV: 04 Cr. (IKS)	NA	NA	GE-II: 04 Cr.	VSC-II: 02 Cr. SEC-II: 02 Cr.	AEC-II MIL: 02 Cr. VEC-II: 02 Cr.	CC-II: 02 Cr. (NSS, NCC, Sports, Cultural)/ CEP-II: 02 Cr. (SES-II)/ OJT: 02 Cr. / Mini Project: 02 Cr.	22	
	Cum. Cr.	16	-	-	08	04+04=08	04+02+02=08	04	44	
Exit Option: Award of UG Certificate in Major with 44 Credits and Additional 04 Credits Core NSQF Course/Internship or continue with Major and Minor										

Abbreviations:

1. **DSC : Discipline Specific Core (Major)**
2. **DSE : Discipline Specific Elective (Major)**
3. **DSM : Discipline Specific Minor**
4. **GE/OE : Generic/Open Elective**
5. **VSEC : Vocational Skill and Skill Enhancement Course**
6. **VSC : Vocational Skill Courses**
7. **SEC : Skill Enhancement Course**
8. **AEC : Ability Enhancement Course**
9. **MIL : Modern Indian Languages**
10. **IKS : Indian Knowledge System**
11. **FSRCE : Fostering Social Responsibility & Community Engagement**
12. **VEC : Value Education Courses**
13. **OJT : On Job Training**
14. **FP : Field Projects**
15. **CEP : Community Engagement and Service**
16. **CC : Co-Curricular Courses**
17. **RP : Research Project/Dissertation**
18. **SES : Shahu Extension Services**

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Department of Zoology

B.Sc. (Honors/Research) Zoology

Year & Level	Semester	Course Code	Course Title	Credits	No. of Hrs.
I 4.5	I	101ZOO1101 (DSC-I)	Life and Diversity of Non-chordates	03	45
		101ZOO1103	Lab Course-I	01	30
		101ZOO1102 (DSC-II)	Life and Diversity of Chordates	03	45
		101ZOO1104	Lab Course-II	01	30
		GE-I	From Basket	04	60
		101ZOO1501 (VSC-I)	Biochemical Techniques and Instrumentation	02	45
		(SEC-I)	From Basket	02	30
		(AEC-I)	From Basket	02	30
		(VEC-I)	Constitution of India	02	30
		AIPC/OJT-I	Mini Project	02	60
	Total Credits			**22**	
	II	101ZOO2105 (DSC-III)	Cell Biology	03	45
		101ZOO2107	Lab Course-III	01	30
		101ZOO2106 (DSC-IV) IKS	Ancient Zoology and Present Status in India	03	45
		101ZOO2108	Lab Course-IV	01	30
		GE-II	From Basket	04	60
		101ZOO2502 (VSC-II)	Sericulture Industry and Marketing	02	45
		(SEC-II)	From Basket	02	30
		(AEC-II)	From Basket	02	30
		(VEC-II)	FSRCE (CBPR)	02	30
		AIPC/OJT-II	Case Study	02	60
	Total Credits			**22**	
Total Credits (Semester I & II)				**44**	

Programme Outcomes (POs) for B.Sc. Programme	
PO 1	
PO 2	
PO 3	
PO 4	
PO 5	
PO 6	
PO 7	

Programme Specific Outcomes (PSOs) for B.Sc. Zoology (Honors/Research)	
PSO No.	Upon completion of this programme the students will be able to
PSO 1	The Students are expected to acquire the knowledge of animal Science, natural phenomenon, and manipulation of nature and environment by man.
PSO 2	Understanding the scientific terms, concepts, facts, phenomenon and their interrelationship.
PSO 3	Applications of the knowledge develop skills in practical work, experiments and laboratory materials.
PSO 4	Students followed and understood general laboratory practice guidelines, including safety.
PSO 5	They are able to handle instruments for basic and modern analysis.
PSO 6	To develop scientific attitude which is the major objective this makes the students open minded, critical observations, curiosity, thinking etc.
PSO 7	Abilities to apply scientific methods, collection of scientific data, problem solving.
PSO 8	Students are expected to work.
PSO 9	Utilize the developed expertise in concepts, theories, and emerging methodologies to succeed in tackling real-world issues in aquaculture and aquatic science.
PSO 10	Demonstrate advanced knowledge and competency in taxonomy and natural history of aquatic flora and fauna.
PSO 11	Demonstrate hands-on experience in aquatic sampling inventory and measurement techniques. Become an independent, self-motivated professional with the ability to recognize problems in their field of aquaculture and aquatic science and apply critical thinking and problem-solving skills.

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Department of Zoology

Course Type: DSC-I

Course Title: DSC-I: Life and Diversity of Non chordates
Course Code: 101ZOO1101

Credits: 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning Objectives:

LO 1. To understand of systematics, taxonomy and structural organization of animals
LO 2. To understand evolutionary history and relationships of different non-chordates through functional and structural affinities.
LO 3. To understand Relationship among these Phylum Onychophora, Arthropod and Mollusca
LO 4. To understand Relationship between these Phylum Echinodermata and Hemichordata

Course Outcomes:

After completion of course the student will be able to:

CO 1. Develop understanding about the systematic, taxonomy and structural organization of animals.
CO 2. Analyze diversity of non-chordates living in varied habit and habitats.
CO 3. Critical analysis of the organization, complexity and characteristic features of non-chordates.
CO 4. Comprehend the economic importance of non-chordates, their interaction with the environment and role in the ecosystem.

Unit No.	Title of Unit & Contents	Hrs.
I	**Basis of Classification and Lower Invertebrates**	**12**
	Phylum Protozoa: General characters and classification upto classes; Structure, lifecycle and clinical significance of human Plasmodium Parasites and their diseases. **Phylum Porifera:** General characters and classification upto classes: Sycon type study, Canal system in Sponges; Integumentary system in sponges. **Phylum Cinideria:** General characters and classification upto classes: Polymorphism in Coelenterates; Corals and Coral reef formation with their significance	
	Unit Outcome: UO 1. After completion of the unit the students will develop understanding about the systematic, taxonomy and structural organization of animals.	
II	**Phylum Platyhelminthes to Annelida**	**10**
	Phylum Platyhelminthes: General characters and classification upto classes; life cycle of Fasciola hepatica,	

Unit No.	Title of Unit & Contents	Hrs.
	Phylum Nematohelminthes: General characters and classification up to classes; Life history of Ascaris lumbricoides and its parasitic adaptations **Phylum Annelida:** General characters and classification up to classes; Metamerism in Annelida; Significance of Hirudin of Leech	
	Unit Outcome: After completion of the unit the students will analyze diversity of non-chordates living in varied habit and habitats	
III	**Phylum Onychophora, Arthropoda and Mollusca**	**11**
	Phylum Onychophora: General characters and classification upto classes: Taxonomic position of Peripatus and its affinities with Annelida and Arthropoda. **Phylum Arthropoda:** General characters and classification upto classes: Cockroach type study **Phylum Mollusca:** General characters and classification classes; Torsion in gastropods	
	Unit Outcome: UO 1. After completion of the unit the students will Critical analysis of the organization, complexity and characteristic features of non-chordates	
IV	**Phylum Echinodermata and Hemichordata**	**12**
	Phylum Echinodermata: General characters and classification up to classes; Water-vascular system in Asteroidea; Affinities of Echinoderm with Hemichordata and chordates **Hemichordates and chordates.** Affinities of Balanoglossus with chordates and non- chordates.	
	Unit Outcome: UO 1. After completion of the unit the students will Comprehend the economic importance of non-chordates, their interaction with the environment and role in the ecosystem	

Learning Resources:

1. Protozoa through Echinodermata, Kotpal Volumes Rastogi Publications
2. Invertebrate Zoology, Jordan & Verma (revised editions) S. Chand and Co. Ltd., New Delhi.
3. Biology of the Invertebrates, Jan Pechenik (2014). McGraw-Hill Science, 2014
4. Non-Chordate Zoology by Dhabi and Dhami Pradeep Publication, Opposite Sitla Mandir,
   Jalndhar-144008
5. Invertebrate Zoology (Multicolor Edition) By P.S. Verma
6. Textbook of Zoology Invertebrates-I, Parker and Haswell Paperback – 1 January 2021
7. Invertebrate Zoology, Author - E. L. Jorden and P. S. Verma.
8. Morden text book of Zoology Invertebrate, Author –R.L.Kotpal

9. https://www.google.co.in/books/edition/Invertebrate_Zoology_Multicolour_Edition/TAkrDAAAQBAJ?hl=en&gbpv=1&dq=invertebrate+zoology&printsec=frontcover
10. Handbook of Invertebrate Zoology for Laboratories and Seaside Work By William Keith Brooks https://www.google.co.in/books/edition/Handbook_of_Invertebrate_Zoology/pkUAAAAAQAAJ?hl=en&gbpv=1&dq=invertebrate+zoology&printsec=frontcover

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Department of Zoology

Course Type: Lab Course
Course Title: Lab Course –I (Based on DSC-I)
Course Code: 101ZOO1103
Credits: 01 **Max. Marks: 50** **Hours: 30**

Leaning Objectives

LO 1. To understand practical approach of Life and Diversity of Non-chordate
LO 2. To understand Identification, Classification of different invertebrates specimens
LO 3. To learn dissection of earthworms skill by demonstration /Software/ Charts etc

Course outcomes

After completion of course the student will be able to-

CO 1. Analyze Identification, Classification of different invertebrate's specimens.

CO 2. Comprehend the dissection of earthworms skill by demonstration Software/Charts

Practical No.	Unit
1	Theoretical and practical knowledge of simple and compound microscope.
2	Identification, Classification and comments on the slides/specimens of;
3	Protozoa: Amoeba, Euglena, Plasmodium, Paramecium, Trypanosoma, Elphidium, Vorticella,
4	Porifera: Sycon, Hyalonema, and Euplectella
5	Cnideria: Hydra, Obelia, Physalia, Aurelia, Tubipora
6	Aschelminthes: Ascaris, Ancylostoma, Wuchereria,
7	Platyhelminthes: Fasciola, Taenia and their larvae,
8	Arthropoda: Palaemon (Prawn), Crab, Palamnaeus
9	Annelida: Pheretima, Hirudinaria (Leech), Nereis, (Scorpion)
10	Mollusca: Pila (Apple snail), Lamellidens (Unio), Sepia, Octopus
11	Echinodermata: Asterias (Sea Star), Echinus (Sea urchin)
12	Hemichordata: Balanoglossus
13	Demonstration of earthworm Nerve ring and Ovaries; appendages of Arthropoda
14	Theoretical and practical knowledge of simple and compound microscope.

N.B.: Any Ten Practicals from above.

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Department of Zoology

Course Type: DSC-II

Course Title: DSC-II: Life and Diversity of Chordates
Course Code: 101ZOO1102

Credits: 03 **Max. Marks: 75** **Lectures: 45 Hrs.**

Learning Objectives

LO 1. To understand of origin and phylogeny of Protochordates and Agnatha
LO 2. To learn and Classification up to orders; Osmoregulation in Fishes; Migration and parental care in Pisces and Amphibians
LO 3. To understand classification, Relationship between Reptiles and Aves
LO 4. To understand classification of Mammals and Type study of Rat

Course outcomes

After completion of course the student will be able to-

CO 1. Develop understanding about origin and phylogeny of Protochordates and Agnatha
CO 2. Examine diversity of chordates living in varied habit and habitats.
CO 3. Learn Critical analysis of classification, Relationship between Reptiles and Aves
CO 4. Comprehend the classification of Mammals and Type study of Rat

Unit No.	Title of Unit & Contents	Hrs.
I	**Introduction and origin of Protochordates**	**12**
	Protochordates - General features and Phylogeny of Urochordates and Cephalochordates. Retrogressive metamorphosis; **Agnatha -** General features of Agnatha and classification of cyclostomes up to classes;	
	Unit Outcome: UO 1. After completion of the course the students will Develop understanding about origin and phylogeny of Protochordates and Agnatha	
II	**Pisces and Amphibians**	**10**
	1. **Pisces -** General features and Classification up to orders; Osmoregulation in Fishes; Migration and Parental care in fishes 2. **Amphibian** Classification upto orders, Parental care	
	Unit Outcome: UO 1. After completion of the course the students will examine diversity of chordates living in varied habit and habitats.	
III	**Reptiles and Aves**	**11**
	Reptiles - Classification upto orders Poisonous and non-poisonous snakes in India, Biting mechanism in snakes;	

Unit No.	Title of Unit & Contents	Hrs.
	Aves - Classification upto orders, flight adaptations, Mechanism of flight and Migration. Mammals - Classification upto orders. Origin of Mammals	
	Unit Outcome: UO 1. After completion of the course the students will Learn Critical analysis of classification, Relationship between Reptiles and Aves	
IV	**Classification of Mammals and Type study: Rat**	**12**
	Classification of Mammals Morphology, Digestive system Respiratory system, Circulatory, Brain and Reproductive system Sense organs:- Ear and Eye	
	Unit Outcome: UO 1. After completion of the course the students will learn detail type study of rat and various systems.	

Learning Resources:

1. Vertibrate Zoology by Jordan E.L. and P.S.Verma S.Chand Publication, and Co., Ltd. Ram
   Nager New Delhi
2. Chordate Zoology by Dhami and Dhami- Pradeep Publication, Opposite Sitla Mandir,
   Jalndhar-144008
3. Rat a mammalian type By G.R. Kshirsagar., G.Y.-Rane Prakashan, Tilak Road, Poona 30.
4. Kotpal (2015). Modern Textbook of Zoology Vertebrates, Rastogi publishers, New Delhi
5. Textbook of Zoology Vertebrates-II, Parker and Haswell Paperback – 1 January 2021
6. Vertebrate Zoology an Experimental Field Approach By Nelson G. Hairston · 1994 https://www.google.co.in/books/edition/Vertebrate_Zoology/gqM8AAAAIAAJ?hl=n&gbpv=1&dq=vertebrate+zoology&printsec=frontcover
7. A Course in Vertebrate Zoology A Guide to the Dissection and Comparative Study of Vertebrate Animals
   https://www.google.co.in/books/edition/A_Course_in_Vertebrate_Zo%C3%B6logy/vCgaAAAAYAAJ?hl=en&gbpv=1&dq=vertebrate+zoology&printsec=frontcover

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Department of Zoology

Course Type: Lab Course
Course Title: Lab Course –II (Based on DSC-II)
Course Code: 101ZOO1104
Credits: 01 **Max. Marks: 50** **Hours: 30**

Learning Objectives

LO 1. To understand practical approach of Life and Diversity of chordate
LO 2 To understand Identification, Classification of different vertebrates specimens
LO 3. To learn mounting skills of different scales of fishes and other material of animals

Course outcomes

After completion of course the student will be able to-

CO 1. Analyze Identification, Classification of different vertebrate's specimens.

CO 2. Comprehend the skills of Mounting of different materials of animals

Practical No.	Unit
1	Protochordates: Herdmania; Amphioxus
2	Pisces: Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla
3	Estimation of age of fishes through Scales
4	Amphibia: Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla
5	Reptiles: Cobra; Viper , Calotis; Varanus; Chamilon; Rock Python, Draco, Crocodiles, Gharial, turtle, tortoise.
6	Distinction between Poisonous and Non-poisonous snake
7	Aves; Sparrow; Parrot; Columba; Myna Owl; Duck; Woodpecker, penguin
8	Collection of different types of feathers from birds
9	Mammals: Mole; Playtypus, Guinepig; Bat, Whale
10	Mountings: Spicules and gemmules of sycon,
11	Mountings: Obelia colony, Jaws of leech & Nephridia, Nereis Parapodia

N.B.: Any Ten Practicals from above.

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Course Type: VSC-I

Course Title: VSC: Biochemical Techniques and Instrumentation

Course Code: 101ZOO1501

Credits: 02 **Max. Marks: 50** **Lectures: 30 Hrs.**

Learning Objectives:

LO 1. To understand biochemical techniques and instrumentation
LO 2 To understand colorimetric, Chromatography and spectrophotometric analytical Techniques
LO 3 To understand Principles of centrifugation and Blotting
LO 4. To understand analysis of different Biomolecules

Course Outcomes:

After completion of course the student will be able to:

CO 1. Learn about Theory and applications of Spectrophotometer Colorimeter and Chromatography.
CO 2. Understand about Handling and principal of centrifugation.
CO 3. Learn about Analysis of various Biomolecules.
CO .4 Understand to handle paper chromatography, blotting techniques and PCR

Unit No.	Title of Unit & Contents	Hrs.
I	**Spectrophotometer Colorimeter and Chromatography:**	**8**
	Theory and applications of Spectrophotometer Principle and working of Colorimeter Basic principles of chromatographic techniques Thin layer chromatography Column Chromatography Ion Exchange Chromatography	
	Unit Outcome: UO 1. After completion of the course the students will Learn about Theory and applications of Spectrophotometer Colorimeter and Chromatography.	
II	**Centrifugation.**	**8**
	Principles of centrifugation, Ultracentrifugation, Southern Blotting Northern Blotting and Western Blotting Polymerase chain reaction ,Cloning, Cell culture Hybridoma technology Electrophoresis - Principle of electrophoresis, Paper and gel electrophoresis (Agarose and SDS PAGE).	
	Unit Outcome: UO 1. After completion of the course the students will Understand about Handling and principal of centrifugation	

III	**Practicals**	7
	Analysis of glucose, amino acids / proteins fatty acids/ lipids and RNA/DNA in fish tissues by spectrophotometer/ Colorimeter.	
	Unit Outcome: UO 1. After completion of the course the students will Learn about Analysis of various Biomolecules.	
IV	**Practicals**	**7**
	Identification of amino acids by paper chromatography. Demonstration of blotting techniques and PCR. Sub-cellular fractionation by centrifugation.	
	Unit Outcome: UO 1. After completion of the course the students will understand to handle paper chromatography, blotting techniques and PCR	
V	**Practicals (Included in above 04 units)**	
	1. Estimation of Glucose in Biological Fluids 2. Estimation of amino acid by Paper / Thin chromatography 3. Demonstration on polyacrylamide gel electrophoresis (PAGE) of proteins 4. Demonstration of separation of lipids by TLC. 5. Glucose by DNS method. 6. Protein by Biuret method. 7. Protein by Lowry's method 8. Extraction and estimation of DNA 9. Extraction and estimation of RNA	

Learning Resources:

1. Biological Instrumentation and methodology, Bajpai, P.K. S. Chand & Co. Ltd 2006.
2. Biochemistry and Molecular Biology K. Wilson and J. Walker Eds. 2005. Cambridge University Press.
3. Principles and techniques of Practical Biochemistry K. Wilson and KH Goulding. 1986.. (3 edn) Edward Arnold, London
4. Practical research methods 4. Dawson, C. (2002), UBS Publishers, New Delhi.
5. Principles and Techniques of Biochemistry and Molecular Biology, by Keith Wilson (Editor), John Walker, Cambridge University Press; 7th edition (4 March 2010)
6. Basic Techniques in Biochemistry and Molecular Biology, by R.K. Sharma S.P.S. Sangha Dreamtech Press (25 June 2020); Dreamtech Press
7. Advanced Lab Practices in Biochemistry & Molecular Biology, by Suphiya khan Swati Agarwal , Dreamtech Press (1 November 2019)
8. Introduction to instrumentation of Life Sciences , by Dr. Suchitra Sharma , Notion Press; 1st edition (1 January 2019)
9. Introduction to Instrumentation in Life Sciences, By A SHARMA P S BISEN, CRC Press)1 January 2012(
10. Basics of Clinical Biochemistry & Instrumentation, by Poonam Bachcheti, Vayu Education of India; Revised edition (1 January 2015)

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UG First Year

Basket I: Generic/Open Elective (GE/OE)

(GEs offered to the Science & Technology students in Sem.-I)

Sr. No.	BoS Proposing GE/OE	Code	Course Title	Credits	Hrs.
1	Commerce	101AAF1401	Mutual Fund Management	04	60
2	Commerce	101MAE1401	Fundamentals of Statistics	04	60
3	English	101ENG1402	English for Science and Technology	04	60
4	Geography	101GEO1401	General Geography	04	60
5	Commerce	101BAI1401	Personal Financial Management	04	60
6	Marathi	101MAR1401	स्पर्धा परीक्षा आणि मराठी भाषा	04	60
7	Political Science	101POL1401	Human Rights	04	60
8	Biotechnology	101BIO1401	Nutrition, Health and Hygiene	04	60
9	Music	101MUS1401	Indian Vocal Classical & Light Music	04	60
10	NCC Studies	101NCC1401	Introduction to NCC	04	60
11	Sports	101SPO1401	Counseling and Psychotherapy	04	60

Note: Student can choose any one GE from the basket

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Basket II: Skill Enhancement Courses (SEC)

(SEC offered to the Science & Technology students in Sem.-I)

Sr. No.	BoS Proposing SEC	Code	Course Title	Credits	Hrs.
1	Chemistry	101CHE1601	Pesticides and Green Chemistry	02	30-45
2	Information Technology	101COM1601	Basics of Python Programming	02	30-45
3	Physics	101PHY1601	Physics Workshop Skills	02	30-45
4	Biotechnology	101BIO1601	Food Processing Technology	02	30-45
5	Botany	101BOT1601	Mushroom Cultivation Technology	02	30-45
6	English	101ENG1601	Proof Reading and Editing	02	30
7	Information Technology	101COA1601	PC Assemble and Installation	02	30-45
8	Marathi	101MAR1601	कथा/पटकथालेखन	02	30
9	Zoology	101ZOO1601	Bee Keeping	02	30-45

Note: Student can choose any one SEC from the basket

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Basket III: Ability Enhancement Courses (AEC)

(AEC offered to the Science & Technology students in Sem.-I)

Sr. No.	BoS Proposing AEC	Code	Course Title	Credits	Hrs.
1	Marathi	101MAR7101	भाषिक कौशल्य भाग – १	02	30
2	Hindi	101HIN7101	हिंदी भाषा शिक्षण भाग – १	02	30
3	Sanskrit	101SAN7101	व्यावहारीक व्याकरण व नितिसुभाषिते	02	30
4	Pali	101PAL7101	उपयोजित व्याकरण	02	30

Note: Student can choose any one AEC from the basket.

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Extra Credit Activities

Sr. No.	Course Title	Course Code	Credits	Hours T/P
1	MOOCs		Min. of 02 credits	Min. of 30 Hrs.
2	Certificate Courses		Min. of 02 credits	Min. of 30 Hrs.
3	IIT Spoken English Courses		Min. of 02 credits	Min. of 30 Hrs.

Guidelines:

Extra -academic activities

1. All extra credits claimed under this heading will require sufficient academic input/ contribution from the students concerned.
2. Maximum 04 extra credits in each academic year will be allotted.
3. These extra academic activity credits will not be considered for calculation of SGPA/CGPA but will be indicated on the grade card.

Additional Credits for Online Courses:

1. Courses only from SWAYAM and NPTEL platform are eligible for claiming credits.
2. Students should get the consent from the concerned subject Teacher/Mentor/Vice Principal and Principal prior to starting of the course.
3. Students who complete such online courses for additional credits will be examined/verified by the concerned mentor/internal faculty member before awarding credits.
4. Credit allotted to the course by SWAYAM and NPTEL platform will be considered as it is.

Additional Credits for Other Academic Activities:

1. One credit for presentation and publication of paper in International/National/State level seminars/workshops.
2. One credit for measurable research work undertaken and field trips amounting to 30 hours of recorded work.
3. One credit for creating models in sponsored exhibitions/other exhibits, which are approved by the concerned department.
4. One credit for any voluntary social service/Nation building exercise which is in collaboration with the outreach center, equivalent to 30 hours
5. All these credits must be approved by the College Committee.

Additional Credits for Certificate Courses:

1. Students can get additional credits (number of credits will depend on the course duration) from certificate courses offered by the college.
2. The student must successfully complete the course. These credits must be approved by the Course Coordinators.
3. Students who undertake summer projects/ internships/ training in institutions of repute through a national selection process, will get 2 credits for each such activity. This must be done under the supervision of the concerned faculty/mentor.

Note:

1. The respective documents should be submitted within 10 days after completion of Semester End Examination.
2. No credits can be granted for organizing or for serving as office bearers/ volunteers for Inter-Class / Associations / Sports / Social Service activities.
3. The office bearers and volunteers may be given a letter of appreciation by the respective staff coordinators. Besides, no credits can be claimed for any services/activities conducted or attended within the college.
4. All claims for the credits by the students should be made and approved by the mentor in the same academic year of completing the activity.
5. Any grievances of denial/rejection of credits should be addressed to Additional Credits Coordinator in the same academic year.
6. Students having a shortage of additional credits at the end of the third year can meet the Additional Credits Coordinator, who will provide the right advice on the activities that can help them earn credits required for graduation.

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Examination Framework

Theory:

40% Continuous Assessment Tests (CATs) and 60% Semester End Examination (SEE)

Practical:

50% Continuous Assessment Tests (CATs) and 50% Semester End Examination (SEE)

Course	Marks	CAT & Mid Term Theory				CAT Practical		Best Scored CAT & Mid Term	SEE	Total
1	2	3				4		5	6	5 + 6
		Att.	CAT I	Mid Term	CAT II	Att.	CAT			
DSC/DSE/ GE/OE/Minor	100	10	10	20	10	-	-	40	60	100
DSC	75	05	10	15	10	-	-	30	45	75
Lab Course/AIPC/ OJT/FP	50	-	-	-	-	05	20	-	25	50
VSC/SEC/ AEC/VEC/CC	50	05	05	10	05	-	-	20	30	50

Note:

1. All Internal Exams are compulsory
2. Out of 02 CATs best score will be considered
3. Mid Term Exam will be conducted by the Exam Section
4. Mid Term Exam is of Objective nature (MCQ)
5. Semester End Exam is of descriptive in nature (Long & Short Answer)
6. CAT Practical (20 Marks): Lab Journal (Record Book) 10 Marks, Overall Performance 10 Marks.