

Shree Warana Vibhag Shikshan Mandal's

**WARANA UNIVERSITY,
WARANANAGAR**

(A State Public University established under Section 3 (6) of MPUA, 2016)



Established:2025

**Structure & Syllabus For
Bachelor of Science (B.Sc.) in Zoology
UNDER
Faculty of Science & Technology
B.Sc. Part –I (Semester- I and II)**

**As Per National Education Policy - 2020
With Effect from Academic Year 2025-26 Onwards**

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Abbreviations:

POs	Program Outcomes
PSOs	Program Specific Outcomes
COs	Course Outcomes
DSC	Discipline Specific Core
DSE	Discipline Specific Elective
GE	Generic Elective
OE	Open Elective
VSC	Vocational Skill Course
SEC	Skill Enhancement Course
IKS	Indian Knowledge System
AEC	Ability Enhancement Course
VEC	Value Education Course
OJT	On Job Training (Internship)
FP	Field project
CEP	Community engagement project
CC	Co-curricular Courses
RM	Research Methodology
RP	Research Project
MJ	Major Course
MN	Minor Course

Preamble – B.Sc. Zoology Program

The Bachelor of Science (B.Sc.) in Zoology is an undergraduate program designed to provide students with a comprehensive understanding of animal biology, biodiversity, and the fundamental principles governing the life processes of animals. Rooted in both classical and modern biological sciences, the program integrates theoretical knowledge with practical and research-based learning to explore the vast diversity of animal life, from molecular and cellular levels to the ecological and evolutionary dynamics of populations and ecosystems.

Zoology is a dynamic and evolving field that intersects with disciplines such as genetics, ecology, physiology, biotechnology, environmental science, and conservation biology. The B.Sc. Zoology program aims to cultivate scientific thinking, analytical skills, and a spirit of inquiry among students, preparing them to contribute meaningfully to scientific research, environmental management, public health, and education.

In an era of rapid environmental change, habitat loss, and biodiversity threats, the study of Zoology is more relevant than ever. This program fosters awareness and responsibility towards wildlife conservation, sustainable development, and the ethical treatment of animals. Graduates will be well-equipped for careers in academia, research institutions, environmental agencies, biotechnology industries, and various governmental and non-governmental organizations, as well as for pursuing higher education in specialized areas of life sciences.

General Objectives of the Zoology

1. To Understand Animal Diversity

Recognize the wide variety of animal life, including classification, taxonomy, and evolutionary relationships among different groups.

2. To Learn Animal Structure and Function

Study the anatomy (structure) and physiology (function) of animals, from single-celled organisms to complex vertebrates.

3. To Explore Evolutionary Relationships

Understand how animals have evolved over time and how natural selection, adaptation, and speciation have shaped life on Earth.

4. To Study Animal Behavior and Ecology

Examine how animals interact with each other and their environment, including behavioral patterns, ecological roles, and life cycles.

5. To Understand Developmental Biology

Learn how animals develop from fertilized egg to adult, including embryology and reproductive strategies.

6. To Gain Skills in Scientific Inquiry and Research

Develop the ability to observe, analyze, and interpret biological data through laboratory experiments and field studies.

7. To Appreciate the Role of Animals in Ecosystems and Human Life

Understand the ecological, economic, and cultural importance of animals, and the impact of human activity on animal life.

8. To Promote Conservation Awareness

Learn the significance of biodiversity conservation and sustainable management of animal resources.

9. To Prepare for Careers in Biological Sciences

Provide foundational knowledge and skills necessary for careers or advanced study in medicine, veterinary science, wildlife biology, research, and more.

10. To Foster Critical Thinking and Problem Solving

Encourage analytical thinking to address biological questions and environmental challenges.

Programme Outcomes (POs)

1. Core Knowledge of Zoology

Acquire comprehensive knowledge of animal biology including structure, function, development, evolution, ecology, and behavior of animals.

2. Scientific Temper and Critical Thinking

Develop scientific temper, logical reasoning, and analytical skills to assess biological phenomena and solve problems in zoological contexts.

3. Laboratory Skills and Techniques

Gain hands-on experience in laboratory and field-based experiments using modern tools and techniques in zoology.

4. Ecological and Environmental Awareness

Understand biodiversity, ecological interactions, conservation strategies, and the impact of human activity on ecosystems.

5. Research Aptitude

Develop the ability to design experiments, collect and analyze data, and present scientific findings in zoological research.

6. Ethics and Animal Welfare

Understand and apply ethical standards in research and practices involving animals; promote animal welfare and biodiversity conservation.

7. Communication Skills

Enhance ability to communicate effectively using scientific terminology in written and oral forms for both academic and general audiences.

8. Teamwork and Leadership

Develop interpersonal skills to work collaboratively in multidisciplinary teams and show leadership qualities in academic or professional settings.

9. Application of Modern Tools

Use modern ICT tools, bioinformatics, and statistical methods for analyzing biological data and solving problems in zoology.

10. Sustainability and Social Responsibility

Apply zoological knowledge in addressing societal and environmental challenges and contribute to sustainable development.

11. Entrepreneurship and Employability

Gain foundational knowledge useful for careers in education, research, environmental management, animal husbandry, pest control, medical labs, and related sectors.

12. Lifelong Learning

Recognize the need for self-directed and life-long learning in the broader context of scientific and technological advancement.

Program Specific Outcomes (PSOs) – B.Sc.Zoology

PSO 1: The students will learn about animal diversity, cell biology, genetics, ecology, ethology, evolution, and entomology.

PSO 2: The students will understand various basic concepts and be able to describe them.

PSO 3: The students can apply their knowledge to classify, distribute, and organize the animals.

PSO 4: The students can solve the problems related to patterns of heredity, pedigree analysis, etc.

PSO 5: The students will acquire skills like sketching the diagrams, karyotype analysis, dissection, and other practical skills.

ELIGIBILITY FOR ADMISSION

As per guidelines obtained from Warana University, Warananagar by following rules and regarding reservations by Govt. of Maharashtra

DURATION

The course shall be a fulltime course. One Year, Semester I and II.

MEDIUM OF INSTRUCTION

The medium of instruction shall be English

MEME Instructions:

In alignment with the National Education Policy (NEP) 2020, the Bachelor of Science (B.Sc.) program adopts the Multiple Entry and Multiple Exit (ME-ME) framework. This flexible structure is designed to provide students with academic mobility, skill development, and lifelong learning opportunities. Through ME-ME framework, the program enables students to enter and exit at different stages with appropriate certifications. Information regarding different entry and exit options available to students and respective mandatory number of credits to be earned by the students are provided in the table below.

Year	Stage of exit	Type of Award	Mandatory Credits to be earned	Minimum credits to be earned
1	After successful completion of One Year	Undergraduate Certificate in Science	44	40
2	After successful completion of Two Year	Undergraduate Diploma in Science	88	80
3	After successful completion of Three Year	Bachelor of Science Degree	132	120

Re-entry provision:

Students leaving after a undergraduate certificate or undergraduate diploma may re-enter the program within 5 years by earning required credits through Academic Bank of Credits.

SCHEME OF TEACHING AND EXAMINATION: [The scheme of teaching and examination should be given as applicable to the course/paper concerned.]

B.Sc. Programme Structure for Level 4.5 of B.Sc.-I Semester I														
Teaching Scheme						Examination Scheme								
Sr. No.	Theory (TH) & Practical (P)					Semester-end Examination (SEE)			Internal Assessment (IA)			Practical		
	Course Type	No. of Lectures	Practical	Hours	Credits	Paper Hours	Max	Min	Internal	Max	Min	Paper Hours	Max	Min
1.	DSC-I	4	1	4+4	6	1	30	12	Assignment	20	8	2	50	20
2.	DSC-I	4	1	4+4	6	1	30	12		20	8	2	50	20
3.	DSC-I	4	1	4+4	6	1	30	12		20	8	2	50	20
4.	OE -I	-	1	4	2	-	-	-		-	-	2	50	20
5.	VEC	-	-	-	-	-	-	-		-	-	-	-	-
6.	IKS (Generic)	2	-	2	2	2	50	20		-	-	-	-	-
Total					22	[DSC (60 X 3) + IKS 50] Total SEE = 230			DSC (40X3) Total IA = 120			Practical. = 50X4 Total Practical. = 200		
						Total Semester –I = 550								

B.Sc. Programme Structure for Level 4.5 of B.Sc.-I Semester II														
Teaching Scheme						Examination Scheme								
Sr. No.	Theory (TH) & Practical (P)					Semester-end Examination (SEE)			Internal Assessment (IA)			Practical		
	Course Type	No. of Lectures	Practical	Hours	Credits	Paper Hours	Max	Min	Internal	Max	Min	Paper Hours	Max	Min
1.	DSC-II	4	1	4+4	6	1	30	12	Assignment	20	8	2	50	20
2.	DSC-II	4	1	4+4	6	1	30	12		20	8	2	50	20
3.	DSC-II	4	1	4+4	6	1	30	12		20	8	2	50	20
4.	OE -II	-	1	4	2	-	-	-		-	-	2	50	20
5.	VEC- I	2	-	2	2	2	50	20		-	-	-	-	-
6.	IKS (Generic)	-	-	-	-	-	-	-		-	-	-	-	-
Total					22	[DSC (60 X 3) + VEC 50] Total SEE = 230			DSC (40X3) Total IA = 120			Practical. = 50X4 Total Practical. = 200		
						Total Semester –I = 550								

General Guidelines for the selection of subjects

1. In first year, student has to choose three DSC subjects from the basket for faculty of Science. (The DSC Basket for faculty of Science includes Mathematics, Physics, Chemistry, Botany, Zoology, Biochemistry, Industrial Microbiology and Computer Science)
2. At the start of second year, out of these 3 DSC subjects, he/she has to opt one subject as Major subject and one as Minor subject. The remaining DSC subject will be dropped.
3. Student cannot select a subject as major or minor other than the subjects taken in first year.
4. OE is to be chosen compulsorily from faculty other than that of the major. (B.Sc. students needs to select OE from faculty of Arts or Faculty of Commerce)
5. VSC is to be selected from the basket of Skill courses approved by the university. 6. IKS (Generic) will be provided by the university separately.

Credit Distribution Structure for B.Sc.I in Zoology with Multiple Entry and Exit Options.

COURSE CATEGORY	ABBREVIATION (Only 2 Letters)	DESCRIPTION	Sem.I Credit	Sem.II Credit
DSC	DSC(DS)	Discipline Specific Course	6x3=18	6x3=18
OE	OE(OE)	Open Elective	2x1=02	2x1=02
SEC	SEC(SE)	Skill Enhancement Course	-----	-----
AEC/IKS/VEC	AEC(AE)	Ability Enhancement Course	-----	-----
	IKS(IK)	Indian Knowledge System (Generic)	2x1=02	-----
	VEC(VE)	Value Education Course	-----	2x1=02
CC/CEP	CC(CC)	Co-curricular Course	2x1=02	-----
	CEP(CE)	Community Engagement Project	-----	-----
			22	22
			Total	--- 44

First-Year (B. Sc. I-Zoology)

	Exit Option: Award of UG Certificate in Major with 44 Credits and an additional 4 credits core NSQF course/ Internship/Skill Courses OR Continue
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Yashwantrao Chavan Warana Mahavidyalaya, Warananagar

Department of Zoology

First Year B. Sc. (Zoology)

Semester-I

(To be implemented from 2025 - 26)

Credit Scheme as per NEP Policy 2020

B. Sc. I. Zoology Sem. - I

Sr. No.	Category	Sub Category	Course Code	Name of Course	Teaching Scheme			Cr.	C H	Examination & Evaluation Scheme			
					L	T	P			Component	Marks	Min for Passing	
1	Program Course	DSC	2502US ZOMJ101	Animal diversity	2	--	--	2	2	ESE	30	11	19
										ISE	20	08	
2		DSC	2502US ZOMJ102	Cell Biology	2	--	--	2	2	ESE	30	11	19
										ISE	20	08	
3		DSCP-I	2502US ZOMJ103	Practical-Laboratory	--	--	4	2	4	PMJ	50	17	17
4	Open Elective Course	OE	2502US ZOOE101	Nutrition and diet	--	--	4	2	4	POE	50	17	17
5	Indian Knowledge System Course	IKS	2502US GEIK101	Introduction to Indian Knowledge System	2			2	2	ESE	50	17	17
								10					

Note: In theory examination, there will be separate passing of ESE and ISE.

Yashwantrao Chavan Warana Mahavidyalaya, Warananagar

Department of Zoology

First Year B. Sc. (Zoology)

Semester-II

(To be implemented from 2025 - 26)

Credit Scheme as per NEP Policy 2020

B. Sc. I. Zoology Sem. - II

Sr. No.	Category	Sub Category	Course Code	Name of Course	Teaching Scheme			Cr.	C H	Examination & Evaluation Scheme			
					L	T	P			Component	Marks	Min for Passing	
1	Program Course	DSC	2502US ZOMJ2 01	Genetics	2	--	--	2	2	ESE	30	11	19
										ISE	20	08	
2		DSC	2502US ZOMJ2 02	Ecology, Ethology, Evolution and Entomology	2	--	--	2	2	ESE	30	11	19
										ISE	20	08	
3		DSCP-II	2502US ZOMJ2 03	Practical-Laboratory	--	--	4	2	4	PMJ	50	17	17
4		OE	2502US ZOOE2 01	Vermicomposting	--	--	4	2	4	POE	50	17	17
5	Value Education Course	VEC	2502US DEVE2 01	Democracy, Election and Constitution	2			2	2	ESE	50	17	17
								10					

Note: In theory examination, there will be separate passing of ESE and ISE.

Course Code Table

A-1) B.Sc.-I: SEMESTER-I (TOTAL CREDITS-22):

COURSE CATEGORY		COURSE NAME	COURSE CODE	CREDITS
DSC	DS-I	Animal diversity	2502USZOMJ101	2
DSC	DS-I	Cell Biology	2502USZOMJ102	2
DSC	DS-I	Practical-Laboratory	2502USZOMJ103	2
OE	OE-I	Nutrition and diet	2502USZOOE101	2
IKS (Generic)	IK	Introduction to Indian Knowledge System	2502USGEIK101	2
CC	CC	-----	-----	---
CREDITS FOR B.Sc.-I, SEM-I:				10

A-2) B.Sc.-I: SEMESTER-II (TOTAL CREDITS-22):

COURSE CATEGORY		COURSE NAME	COURSE CODE	CREDITS
DSC	DS-II	Genetics	2502USZOMJ201	2
DSC	DS-II	Ecology, Ethology, Evolution and Entomology	2502USZOMJ202	2
DSC	DS-II	Practical-Laboratory	2502USZOMJ203	2
OE	OE-II	Vermicomposting	2502USZOOE201	2
VEC	VE	Democracy, Election and Constitution	2502USDEVE201	2
CREDITS FOR B.Sc.-I, SEM-II:				10

NOTE REGARDING OPEN ELECTIVE:

The OE courses offered by the Department of Zoology are available for the first-year students of the faculty of Arts and Humanities or faculty of Commerce and Management. The students of science should select the open elective subject from the OE basket provided by the faculty of Arts and Humanities or the faculty of Commerce and Management. The details of OE courses available are provided in the prospectus and posted on Institutional Website.

B. Sc. Part – I Semester – I
ZOOLOGY Paper - I ZOO 101
ANIMAL DIVERSITY (2502USZOMJ101)
Theory: 30 hrs. Marks-50
(Credits: 02)

Course Objectives (COs): Animal Diversity

The course on animal diversity is aimed at making the student to:

1. Understand the concept and importance of biodiversity
2. Enable the students to identify the similarities and differences among the animals in different Phyla and classes.
3. Develop sensitivity for the conservation of biodiversity in their day-to-day life.
4. Equip the students with the skills of dissection.

MODULE	SUB MODULE	TOPIC	LECTURE PERIOD
1	Unit I	Principles of classification, Five Kingdom classification Binomial nomenclature Levels of Organizations in Kingdom Animalia Germ layers and coelom concept Different modes of nutrition Non-chordates concept, Phyla with prominent characters and examples Phylum Chordata: Characters, subphyla/ classes with prominent characters and examples Difference between non-chordates and chordates Generalized body plans of non-chordates (Annelida/Arthropods) and chordates	(10 Hrs)
2	Unit II	Biodiversity concept and its importance Zoogeographical regions and distribution of animals: Global and Indian biodiversity. Extinct and threatened animals Hotspots of biodiversity and Biodiversity Centres Need for conservation and conservation strategies	(10 Hrs)
3	Unit III	Cockroach: a representative of non-chordates Habit and habitat Systematic position Morphology, Anatomy: Digestive system, nervous system, blood vascular system, Respiratory system, excretory system, reproductive system, and receptor organs.	(10 Hrs)

References:

- Hyman, L. H. – The invertebrate, Vol. I (McGraw Hill)
- Hyman, L. H. – The invertebrate, Vol. II (McGraw Hill)
- Barnes, R. D. – Invertebrate Zoology (W. B. Saunders Co.). 1987
- Parker and Haswell – A Text Book of Zoology – Invertebrate Vol. I Edited by Marshall and Williams, C. B. S. Publishers and Distributors, New Delhi. 1972
- P.S. Dhama and J. K. Dhama – Invertebrates, S. Chand and Company, New Delhi 1979
- A Text Book of Invertebrates – N. C. Nair, N. Soundara Pandian, S. Leelavathy, T. Murugan Saras Publication 2010

B. Sc. Part – I Semester – I
ZOOLOGY Paper - II ZOO 102
CELL BIOLOGY (2502USZOMJ102)
Theory: 30 hrs. Marks-50 (Credits: 02)

Course Objectives (COs): Cell Biology

The Course on cell biology is aimed at making the students to:

1. Understand the general organization of cell organelles and their functions.
2. Apply their knowledge to study the functioning of a cell and cell divisions and its regulation.
3. Analyze the role of cell organelles and cell cycle checkpoints with examples of anemia, diabetic wounds, and cancer.
4. Equip the students with skills like handling the microscope, micrometry, staining techniques, etc.

References:

MODULE	SUB MODULE	TOPIC	LECTURE PERIOD
1	Unit I	General organization of cell 1. Organization of prokaryotic and eukaryotic cells 2. Nucleus: nuclear membrane, nucleoplasm, chromatin, and nucleolus 3. Chromosome: morphology of metaphase chromosome and its organization (Solenoid model) 4. Cytoskeleton	(10 Hrs)
2	Unit II	Ultra-structure and functions of 1. Plasma membrane (Fluid Mosaic Model) 2. Mitochondria 3. Endoplasmic reticulum 4. Golgi complex 5. Lysosome 6. Ribosome	(10 Hrs)
3	Unit III	1. Concept of Cell cycle and its regulation 2. Mitosis 3. Meiosis 4. Abnormalities in cell division: Hypoproliferation (Anemia and diabetic wound) and Hyperproliferation (Cancer)	(10 Hrs)

- Cell and Molecular Biology by De Robertis EDP and De Robertis EME VIII ED ©1997
- Principles of Cell and Molecular Biology by Kleinsmith and Kish Pearson Publisher ©1997
- Molecular cell biology by Harvey Lodish, Berk A, Matsudaira P., Baltimore, D & Darnel I . W. H. Freeman and Co. © 2001
- Becker's World of the Cell by Jeff Hardin and James P. Lodolce, Pearson Publisher © 2020
- Molecular biology of the cell by Bruce Alberts, Johnson A., Lewis J., Raff M., Roberts K & Walter P., 4th Ed. Garland Science Publishing, New York© 2002
- The Cell: A molecular approach by Geoffrey Cooper. OUP USA, © 2019

B. Sc. Part – I Semester – I
ZOOLOGY Practical– I(2502USZOMJ103)
ZOOPR 103 (ANIMAL DIVERSITY AND CELL BIOLOGY)
Practical: 60 hrs. Marks-50 (Credits: 02)

	I: Practical course based on Animal Diversity
	1. One example of each non-chordate phyla 2. One example of each chordate subphyla/class 3. One example of each mode of nutrition 4. Demonstration of cockroach digestive system 5. Demonstration of cockroach nervous system 6. Demonstration of mountings of mouth parts, trachea and cornea of cockroach 7. Placing the animals on a world map according to zoo-geographical distribution 8. One example of each rare, endangered, critically endangered, and extinct animal as per the red data book.
	II: Practical course based on Cell Biology
	9. Cytological experiments a. Study of light microscope: Principles of microscopy; study of its parts; focusing of a slide at low and high power and study of Image Formation. b. Micrometry: Measuring size of microscopic structures. c. Study of osmosis using salt solutions 10. Cytological Preparations: a. Study of facultative heterochromatin (Barr body) b. Isolation of Nucleus and Staining of the nucleus by any nuclear stain c. Staining of mitochondria by Janus green B in oral mucosa or any suitable tissue. 11. Study of mitosis in onion root tips 12. Study of meiosis – observation of permanent slides 13. Study of anemia and diabetic wound and histology of cancerous tumor

B. Sc. I Structure in Zoology NEP 2.0

Open Electives

Sr.no	Semester	Course code	Course title	Credits	Hours of teaching	Marks
1	I	ZOOOE 101	OE I Diet and Nutrition (Practical) OE I आहार आणि पोषण (प्रात्यक्षिक)	2	60	50
2	II	ZOOOE 201	OE II Vermiculture (Practical) OE II गांडूळ पालन (प्रात्यक्षिक)	2	60	50

B. Sc. Part – I Semester – I

ZOOOE 101

OE I Title: Diet and Nutrition

Practical-60 Hrs

Marks-50 (Credits: 02)

Course Objectives (COs): Diet and Nutrition

The course, Diet and Nutrition is aimed at making the students to:

1. Understand the components of the diet
2. Know the importance of a balanced diet and apply the knowledge to day-to-day life.
3. Enable students to calculate the BMI and caloric needs of a person.
4. Develop the skill of designing the diet for different physiological and pathological conditions.

Topic --

1. Components of Diet
2. Sources of Carbohydrates (Minimum 5)
3. Nutritive values of Rice and wheat
4. Iodine test for starch
5. Sources of Proteins (Minimum 5)
6. Nutritive value of any one pulse
7. Sources of Lipids (Minimum 5)
8. Filter paper/ emulsification test for fats
9. Sources of Vitamins 10. Sources of Minerals (Minimum 5)
11. Sources of fibers
12. Drinking Water quality testing (transparency, odor, pH, TDS, microbial contamination)
13. Designing a balanced diet for a normal healthy person/ Balance diet thali/ Recipes of a balanced diet dish
14. BMI: calculation of BMI
15. Calculation of caloric need based on occupation (Any 2)
16. Designing a diet for Weight loss/ Weight gain.

References

1. John E. Hall and Michael Hall (1984). Guyton and Hall textbook of medical physiology. Pp. 1091.
2. Sumati R. Mudambi and M. V. Rajagopal (2007). Fundamentals of Food, Nutrition and Diet Therapy. New Age International Publishers. New Delhi. Pp. 425.
3. Shubhangini A. Joshi (2015). Nutrition and dietetics. McGraw Hill Education Private Ltd. pp. 645.
4. Nutrition Sciences by B. Srilakshmi (2006). New Age International (P) Ltd. Publishers. Pp. 406

B. Sc. Part – I Semester – II
ZOOLOGY Paper - III
ZOO 201 GENETICS (2502USZOMJ201)
Theory: 30 hrs. Marks-50 (Credits: 02)

Course Objectives (COs): Genetics

The course in Genetics is aimed to make the students to:

1. Understand heredity and variation.
2. Apply their knowledge to draw the genetic crosses based on patterns of heredity.
3. Culture the *Drosophila* and handling skills among the students.
4. enable the students to develop a. a gene map using data of crossing over and linkage study, b. draw, and analyze pedigree c. analyze karyotypes.

References

MODULE	SUB MODULE	TOPIC	LECTURE PERIOD
1	Unit I	Molecular Basis of Genetic Information (Central Dogma) Mendel's work and Principles of Inheritance Test cross, back cross, and reciprocal cross Incomplete dominance and co-dominance,	(10 Hrs)
2	Unit II	Gene interaction (Epistasis): Supplementary gene interaction. Complementary gene interaction Multiple alleles: definition, ABO blood group system, and coat colour in rabbit, Sex-linked inheritance: definition, Haemophilia, and colour blindness Linkage and crossing over: Linkage, types of linkage and process of crossing over, Cytological evidence of crossing over.	(10 Hrs)
3	Unit III	Chromosomal Abnormalities Human karyotype analysis Numerical abnormalities: Aneuploidy and Polyploidy, Chromosomal aberrations: Deletion, Duplication, Inversion, Translocation, Pedigree analysis Sex determination Chromosomal theory of sex determination, Genic balance theory, Haploidy-Diploidy mechanism, Environmental sex determination.	(10 Hrs)

- Genetics by Strickberger, M.W. 3rd Edition Pearson Education India, © 2015
- Human Genetics by Winchester A.M. Charles E.Merrill Publishing International; 4th Revised edition© 1983
- Concepts of Genetics by Klug, Cummings, Spencer, and Palladino. Pearson Education India, 2015 • Principles of Genetics by Tamarin, R. H. McGraw-Hill Education © 2001
- Fundamental of Genetics by B. D. Singh. Medtech Science Press © 2022

B. Sc. Part – I Semester – II
ZOOLOGY Paper - IV ZOO 202 (2502USZOMJ202)
 (ECOLOGY, ETHOLOGY, EVOLUTION, AND ENTOMOLOGY)
 Theory: 30 hrs. Marks-50 (Credits: 02)

Course Objectives (COs): Ecology, Ethology, Evolution, and Entomology

The Course in ecology, ethology, evolution, and entomology is aimed to make the students to:

1. understand the basic concepts.
2. enable the students to identify the amazing features of the insect world.
3. train students to arrange the animals on a geological time scale.
4. mold the student to apply their knowledge to construct food chains, food webs, and ecological pyramids.

References.:-

MODULE	SUB MODULE	TOPIC	LECTURE PERIOD
1	Unit I	Ecology a. Introduction and Scope of Ecology b. Basic concepts in ecology: Biosphere, biome, Species, Population, Community, Niche c. Ecosystem: Definition, concept, types, pond ecosystem, and grassland ecosystem d. Food chain, food web e. Ecological pyramids f. Ecological adaptations g. Symbiotic relationships	(10 Hrs)
2	Unit II	3. Ethology and Evolution Ethology a. Introduction to the study of animal behavior b. Mimicry in Monarch butterfly and stick insect c. Camouflage in chameleon and Leaf insect d. Courtship behavior in scorpion and weaver birds e. Social behavior in honeybee Evolution a. Types of fossils, Formation and dating of fossils b. Incompleteness of Fossil record c. Geological time scale	(10 Hrs)
3	Unit III	4. Entomology– a. Introduction to Entomology b. Brief morphology of insects and types of mouth parts c. Entomophagy: Introduction, Nutritional value, economic importance, Examples. d. Wonders in insects Mud wasp, Praying mantis, Giant cockroach, Ladybird beetle, Firefly, Parasitoids- Apanteles in Helicoverpa	(10 Hrs)

Environmental Studies – Based on UGC Syllabus – N. Arumugam and V. Kumaresan. Saras Publisher 2014 • Organic

Evolution – N. Arumugam. Saras Publisher ©2019

• Organic Evolution – Lul. Forgotten Books ©2018

• Ecology by E. P. Odum. Oxford and LBH 2008

• Fundamentals of Ecology – Odum – Saunders Publisher ©1971

• Ecology – Rickelfs. W. H. Freeman Publisher ©1999

• Immelmann- Introduction to Ethology. Plenum Press, ©1980

• The Foundations of Ethology. Springer Verlag, ©1981

• Economic Zoology – Shukla and Upadhyaya – Rastogi Publications

• Economic Zoology – Venkitaraman (Sudarshana Publishers) • The Insect structure function and biodiversity by Ambrose P. Kalyani Publisher ©2015

B. Sc. Part – I Semester – II
 ZOOLOGY Practical– II (2502USZOMJ203)
 ZOOPR 203 (GENETICS AND ECOLOGY, ETHOLOGY. EVOLUTION, AND ENTOMOLOGY)
 Practical: 60 hrs. Marks-50 (Credits: 02)

Sr.no	Title of practical
	Practical based on Genetics 1. Study Mendel's work with the help of different coloured beads and other simulations. 2. Examples based on Gene mapping using data of crossing over and linkages 3. Study of sex-linked inheritance by pedigree study. 4. Study of normal human spread chromosomes and sex determination 5. Identification of genetic syndrome by karyotype analysis 6. Identification of chromosomal aberration by studying karyotype 7. Identification ABO blood group 8. Drosophila culture, handling, Life cycle, and identification of male and female Drosophila and mutants (After induction of mutation) 9. Examples based on Gene interactions and Multiple alleles
II	Practical based on Ecology, Ethology, Evolution, and Entomology
	10. Ecology – Preparation of the following about pond and grassland ecosystems. a. Arranging the organisms in the Food chain and food web b. Arranging the organisms in different trophic levels of Ecological Pyramids 11. Ethology – a. Mimicry in – monarch butterfly and stick insect b. Castes of Honey bee 12. Evolution – a. Types of fossils b. Arrangement of the animals as per the Geological Time Scale 13. Entomology – a. Morphology of insects (Typical body parts of Grasshopper) b. Entomophagy – Examples of edible insects according to theory c. Wonders in insects (Based on theory) Visit to sea shore or any suitable place to study the Ecosystem, Animal diversity, Animal Behavior, etc

B. Sc. Part – I Semester – II
ZOOOE 201 OE II (2502USZOOE201)

Title: Vermiculture

Practical-60Hrs Marks-50 (Credits: 02)

Course Objectives (COs): Vermiculture

1. The course, Vermiculture is aimed at acquiring knowledge about vermiculture, and its importance.
2. It is aimed at understanding the biology of earthworm and earthworm culture.
3. It is aimed to enable the students to become familiar with the procedure of setting up a vermicomposting bed.
4. It is aimed so that the students can use the vermicompost and vermiwash in their fields.

Topics-

1. Vermiculture: types
2. Study of different species of earthworm
3. Pre-requisite for vermiculture
4. Preparation of vermiculture bed
5. Monitoring Temperature, pH, and moisture of vermicomposting bed
6. Harvesting vermicompost
7. Composition of vermicompost
8. Seed germination test for vermicompost
9. Harvesting vermiwash
10. Economic importance of vermiculture

Study of soil characters:

11. Water holding capacity
12. pH of soil
12. Measuring organic matter in a soil sample
13. Study of the morphology of earthworm
14. Study of different stages in the life cycle of an earthworm

References:

- Dr. Keshav Singh (2022). Textbook of Vermicompost: Vermiwash and Biopesticides. Biotech Books. New Delhi.
- EIRI Board of Consultants & Engineers (2009). Handbook Of Biofertilizers and Vermiculture (Pb). Engineers India Research.
- Sathe T. V. (2022). Vermiculture and Organic Farming. Daya Publishing House.

SCHEME OF EXAMINATION:

- The examination shall be conducted at the end of each term for semester pattern.
- The theory paper shall carry 30 marks.
- The evaluation of the performance of the students in theory papers shall be on the basis of Semester Examination of 30 marks.
- The internal evaluation for each paper shall carry 10 marks. (Semester I and II: Home assignment, class assignment, unit test a and midterm test)
- Question paper will be set in the view of the /in accordance with the entire syllabus and preferably covering each unit of syllabi.

STANDARD OF PASSING: As prescribed under rules and regulation for each degree. **SPECIAL INSTRUCTIONS, IF ANY**

Determination of CZPA, Grading and Declaration of result

University has adopted 10-point Grading System as follows: In each semester, marks obtained in each course (Paper) are converted to grade points: If the total marks of course are 100 and passing criteria is 40%, then use the following Table for the conversion.

Gradation Chart: Table

Marks Obtained	Numerical Grade (Grade Point)		CGPA	Letter Grade
Absent	0 (zero)			Ab: Absent
0–39	0 to 4		0.0– 4.99	F: Fail
40– 49	5		5.00–5.49	C: Average
50– 54	6		5.50–6.49	B: Above Average
55– 64	7		6.50–7.49	B+: Good
65– 74	8		7.50–8.49	A: VeryGood
75– 84	9		8.50–9.49	A+: Excellent
85– 100	10		9.50–10.0	O: Outstanding

Note:

1. Marks obtained ≥ 0.5 shall be rounded off to next higher digit.
2. The SGPA & CGPA shall be rounded off to 2 decimal points.
3. Marks obtained in 50 marks or 200 marks paper shall be converted to 100 marks.

EXAMINATION PATTERN FOR DSC ZOOLOGY

1) PATTERN: Theory and practical examinations will be conducted at the end of each semester. Internal examinations will be conducted after completing about half of the syllabus.

2) MEDIUM OF INSTRUCTION: The medium of instruction shall be in English.

3) STRUCTURE OF COURSE: B.Sc.I– Zoology theory and practical and Internal Assessments as per the Framework Set by the Warana University.

SEMESTER-I(Theory and Practical)

Sr. No.	Subject	Internal Exam	University Exam	Total	Credits
1	ZOO101Paper-I	20	30	50	2
2	ZOO102Paper- II	20	30	50	2
3	ZOOPR103Practical -I		50	50	2
		Total =150			6

SEMESTER-II (Theory and Practical)

Sr. No.	Subject	Internal Exam	University Exam	Total	Credits
1	ZOO201Paper-III	20	30	50	2
2	ZOO202Paper- IV	20	30	50	2
3	ZOOPR203Practical -II		50	50	2
		Total =150			6

Minimum Marks required for passing

	Internal Exam	University Exam	Practical
Maximum marks	40	60	50
Minimum marks	16	24	18

SCHEME OF EXAMINATION

The question paper will be set on the entire syllabus and preferably covering each unit of syllabi.

▪ COMMON NATURE OF QUESTION FOR THEORY PAPER:

SEMESTER–I Zoology Paper (I,II) **SEMESTER– II** Zoology Paper (III,IV)

ESE Question paper pattern for theory (Zoology Paper-I, II, III and IV)

Duration: 1 Hr

Total Marks: 30

Q.1 Multiple Choice Questions (six questions)

06

a.

b.

c.

e

f.

g.

Q.2 Short answer questions (Attempt any Three)

12

a.

b.

c.

a.

b.

Q.3 Long answer questions (Attempt any two)

12

a.

b.

c.

SKELETON PAPER FOR PRACTICAL EXAMINATION

B.Sc.Part–I Semester–I

ZOOLOGY Practical – I

ZOOPR103 (Animal Diversity and Cell Biology) Marks- 50

Q.No.1Dissect.....to expose its..... system	10
Q.No.2Cytological experiments	08
Q.No.3CytologicalPreparation	07
Q.No.4 Distribution of animals with their zoogeographical regions	05
Q.No.5 Categorization of animals as per the abundance	05
Q.No.6 Preparation of stained slide of mitosis and identification of stages	10
Q. No.7Journal	05

B.Sc.Part–I Semester–II

ZOOLOGY Practical – II

ZOOPR 203(Genetics,Ecology,Ethology,Evolution and Entomology) Marks-50

Q.No.1.Determination of blood group according to ABO blood group system/Drosophila culture-related experiments	07
Q.No.2 Questions based on karyotype study/ Gene Mapping/construction of pedigree	06
Q.No.3 Construction of food chain/food web/ Ecological Pyramids from the given data	04
Q.No.4 Experiments based on monohybrid/dihybrid cross	06
Q.No.5 Examplein Genetics	07
Q.No.6 Identification	10
Q.No.7 Excursion Report	05
Q.No.8 Certified Journal	05

WARANA CLUSTER UNIVERSITY, WARANANAGAR
NEP-2020:CreditFramework forUG(B.Sc.) Programmes under Faculty of SCIENCE

NEP-2020 (2.0): Credit Framework for UG(B. Sc.) Programme under Faculty of Science and Technology

SEM (Level)	COURSES			OE	VSC/SEC	AEC/VEC/IKS	OJT/FP/CEP /CC/RP
	Course-1	Course-2	Course-3				
SEMI (4.5)	DSC-I(2) DSC-II (2) DSC P-I(2)	DSC-I(2) DSC-II (2) DSC P-I(2)	DSC-I(2) DSC-II (2) DSC P-I(2)	OE-1(2) (T/P)		IKS-I(2)	
SEMII (4.5)	DSC-III(2) DSC-IV (2) DSC P-II(2)	DSC-III(2) DSC-IV (2) DSC P-II(2)	DSC-III(2) DSC-IV (2) DSC P-II(2)	OE-2(2) (T/P)		VEC-I(2) (Democracy, Election and Constitution)	
Credits	8(T)+4(P)=12	8(T)+4(P)=12	8(T)+4(P)=12	2+2=4 (T/P)	--	2+2=4	--
	MAJOR		MINOR				
SEMIII (5.0)	Major V(2) Major VI (2) Major P III (2)	--	Minor V(2) Minor VI (2) Minor P III(2)	OE-3(2) (T/P)	VSC I (2) (P) (Major specific) SEC I(2) (T/P)	AEC I(2) (English)	CC-I (2)
SEMIV (5.0)	Major VII(2) Major VIII (2) Major P IV (2)	--	Minor VII(2) Minor VIII (2) Minor P IV (2)	OE-4(2) (T/P)	SEC-II(2) (T/P)	AEC-II(2) (English) VEC-II(2) (Environmental studies)	CEP-I(2)
Credits	8(T)+4(P)=12		8(T)+4(P)=12	2+2=4(T/P)	4(T/P)+2(P)=6	2+4=6	2+2=4
SEM V (5.5)	Major IX(2) Major X (2) Major P V (4)	Major I (ELEC)(2) Major P-I (ELEC)(2)		OE-5(2) (T/P)	VSC II (2) (Major specific)(P)	AEC III(2) (English)	OJT (04)