

**Rashtrasant Tukadoji Maharaj Nagpur University,
Nagpur, 440033**



Bachelor of Science (Zoology)

**Credit Structure, Scheme and Syllabus
[NEP-2020, 3-2-1 Pattern]**

Session 2026-2027 onwards

Submitted by

Board of Studies (Zoology)

FYUGP-Scheme I-VIII Semester (3-2-1 Pattern)
Bachelor of Science (Honors/Research) (Zoology - Major)
Four Year (Eight Semester Degree Course) Teaching and Examination Scheme

Abbreviations: Discipline Specific Core: DSC, Discipline Specific Elective: DSE, Generic/Open Electives: GE/OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP, Continuous Internal Evaluation: CIE, Semester End Exam: SEE

Level: 4.5 (First Year)

Semester: I

Course Type	Course category	Course Code	Course Title	Credits	Teaching Scheme Hr/Week	Evaluation Scheme and Max Marks*		
						CIE	SEE	Total
Subject- 1	DSC	BZL1DSC01T	Life and Diversity of Animals-Nonchordates (Protozoa to Annelida) (Theory)	2	2	20	30	50
	DSC	BZL1DSC01P	Practical based on Life and Diversity of Animals-Nonchordates (Protozoa to Annelida)	2	4	20	30	50
Subject- 2	DSC		Subject 2_Paper 1 (Theory)	2	2	20	30	50
	DSC		Subject 2_Paper 1 (Practical)	2	4	20	30	50
Subject- 3	DSC		Subject 3_Paper 1 (Theory)	2	2	20	30	50
	DSC		Subject 3_Paper 1 (Practical)	2	4	20	30	50
GE/OE_1	GE/OE	BZL1GOE01T	Indian Birds (Theory) For other faculty students [Refer GE/OE basket]	2	2	20	30	50
SEC_1	SEC	BZL1SEC01P	Beekeeping (Practical)	2	4	20	30	50
IKS_1	IKS	B1IKS01T	IKS-Generic (Theory)	2	2	20	30	50
Language	AEC	BS1AEC01T	Compulsory English (Theory)	2	2	20	30	50
VEC_1	VEC	B1VEC01T	Environmental Studies (Theory)	2	2	20	30	50
Total				22	30	220	330	550

*Minimum passing marks in each head (i.e. CIE, SEE and Total) will be 40% of maximum marks

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Level: 4.5 (First Year)

Semester: II

Course Type	Course category	Course Code	Course Title	Credits	Teaching Scheme Hr/Week	Evaluation Scheme and Max Marks*		
						CIE	SEE	Total
Subject- 1	DSC	BZL2DSC02T	Life and Diversity of Animals-Nonchordates (Arthropoda to Hemichordata) (Theory)	2	2	20	30	50
	DSC	BZL2DSC02P	Practical based on Life and Diversity of Animals-Nonchordates (Arthropoda to Hemichordata) (Practical)	2	4	20	30	50
Subject- 2	DSC		Subject 2_Paper 2 (Theory)	2	2	20	30	50
	DSC		Subject 2_Paper 2 (Practical)	2	4	20	30	50
Subject- 3	DSC		Subject 3_Paper 2 (Theory)	2	2	20	30	50
	DSC		Subject 3_Paper 2 (Practical)	2	4	20	30	50
GE/OE_2	GE/OE	BZL2GOE02T	Attractive Insects (Theory) For other faculty students [Refer GE/OE basket]	2	2	20	30	50
SEC_2	SEC	BZL2SEC02P	Water Quality Analysis (Practical)	2	4	20	30	50
Language	AEC	BS2AEC02T	Second Language (Theory)	2	2	20	30	50
VEC_2	VEC	B2VEC02T	Constitution of India (Theory)	2	2	20	30	50
CC_1	CC	BS2CC01P	Co-Curricular (Practical) [Refer CC basket]	2	4	50	----	50
Total				22	32	250	300	550

*Minimum passing marks in each head (i.e. CIE, SEE and Total) will be 40% of maximum marks.

Exit Option: Award of Certificate in Major with 44 credits and an additional 4 credits core NSQF Course/Internship or continue with major and minor.

Continue Options: Student will select one subject among the (Subject-1, Subject-2, and Subject-3) as major and another as minor and third subject will be dropped.




Level: 5.0 (Second Year)

Semester: III

Course Type		Course Code	Course Title	Credits	Teaching Scheme Hr/Week	Evaluation Scheme and Max Marks*		
						CIE	SEE	Total
Major	DSC	BZL3DSC03T	Life and Diversity of Animals- Chordates (Protochordata to Amphibia) (Theory)	2	2	20	30	50
	DSC	BZL3DSC04T	Cell Biology (Theory)	2	2	20	30	50
	DSC	BZL3DSC03P	Practical based on Life and Diversity of Animals- Chordates (Protochordata to Amphibia) and Cell Biology (Practical)	2	4	20	30	50
	VSC	BZL3VSC01P	Culture of Indian Major Carps (Practical)	2	4	20	30	50
	FP	BZL3FP01P	Major Specific (Practical)	2	4	50	----	50
Minor	Minor	BZL3MN03T	Life and Diversity of Animals- Chordates (Protochordata to Amphibia) (Theory)	2	2	20	30	50
	Minor	BZL3MN03P	Practical based on Life and Diversity of Animals- Chordates (Protochordata to Amphibia) (Practical)	2	4	20	30	50
GE/OE_3	GE/OE	BZL3GOE03T	Fish Farming (Theory) For other faculty students [Refer GE/OE basket]	2	2	20	30	50
IKS_2	IKS	BZL3IKS02T	Zoology in Ancient India (Theory)	2	2	20	30	50
Language	AEC	BS3AEC03T	Second Language (Theory)	2	2	20	30	50
CC_2	CC	BS3CC02P	Co-Curricular (Practical) [Refer CC basket]	2	4	50	----	50
Total				22	32	280	270	550

*Minimum passing marks in each head (i.e. CIE, SEE and Total) will be 40% of maximum marks.

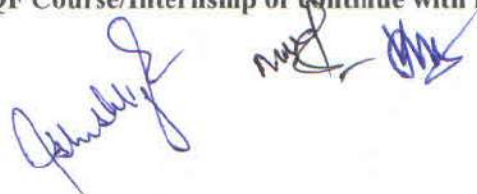
Level: 5.0 (Second Year)

Semester: IV

Course Type		Course Code	Course Title	Credits	Teaching Scheme Hr/Week	Evaluation Scheme and Max Marks*		
						CIE	SEE	Total
Major	DSC	BZL4DSC05T	Life and Diversity of Animals-Chordates (Reptilia to Mammalia) (Theory)	2	2	20	30	50
	DSC	BZL4DSC06T	Genetics (Theory)	2	2	20	30	50
	DSC	BZL4DSC04P	Practical based on Life and Diversity of Animals-Chordates (Reptilia to Mammalia) and Genetics (Practical)	2	4	20	30	50
	VSC	BZL4VSC02P	Aquarium preparation and maintenance (Practical)	2	4	20	30	50
	CEP	BZL4CEP01P	Community engagement program (Practical)	2	4	50	---	50
Minor	Minor	BZL4MN04T	Life and Diversity of Animals-Chordates (Reptilia to Mammalia) (Theory)	2	2	20	30	50
	Minor	BZL4MN04P	Practical based on Life and Diversity of Animals-Chordates (Reptilia to Mammalia) (Practical)	2	4	20	30	50
GE/OE_4	GE/OE	BZL4GOE04T	Animal Husbandry (Theory) For other faculty students [Refer GE/OE basket]	2	2	20	30	50
SEC_3	SEC	BZL4SEC03P	Clinical Pathology (Practical)	2	4	20	30	50
Language	AEC	BS4AEC04T	Compulsory English (Theory)	2	2	20	30	50
CC_3	CC	BS4CC03P	Co-Curricular (Practical) [Refer CC basket]	2	4	50	---	50
Total				22	34	280	270	550

*Minimum passing marks in each head (i.e. CIE, SEE and Total) will be 40% of maximum marks.

Exit Option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4 credits in core NSQF Course/Internship or continue with major and minor.



Level: 5.5 (Third Year)

Semester: V

Course Type	Course category	Course Code	Course Title	Credits	Teaching Scheme Hr/Week	Evaluation Scheme and Max Marks *		
						CIE	SEE	Total
Major	DSC	BZL5DSC07T	General Mammalian Physiology I (Theory)	2	2	20	30	50
	DSC	BZL5DSC08T	Applied Zoology I (Theory)	2	2	20	30	50
	DSC	BZL5DSC09T	Developmental Biology (Theory)	2	2	20	30	50
	DSC	BZL5DSC10T	Evolutionary Biology (Theory)	2	2	20	30	50
	DSC	BZL5DSC05P	Practical based on General Mammalian Physiology I and Applied Zoology-I (Practical)	2	4	20	30	50
	DSC	BZL5DSC06P	Practical based on Developmental Biology and Evolutionary Biology (Practical)	2	4	20	30	50
	DSE	BZL5DSE01AT BZL5DSE01BT BZL5DSE01CT	A. Systematic Entomology OR B. Systematic Ichthyology OR C. Male Mammalian Reproductive Physiology (Theory)	2	2	20	30	50
	DSE	BZL5DSE01P	Practical based on A. Systematic Entomology OR B. Systematic Ichthyology OR C. Male Mammalian Reproductive Physiology (Practical)	2	4	20	30	50
	VSC	BZL5VSC03P	Vermicomposting (Practical)	2	4	20	30	50
	CEP	BZL5CEP02P	Community engagement program (Practical)	2	4	50	---	50
Minor	Minor	BZL5MN05T	General Mammalian Physiology (Theory)	2	2	20	30	50
Total				22	32	250	300	550

*Minimum passing marks in each head (i.e. CIE, SEE and Total) will be 40% of maximum marks.

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Level: 5.5 (Third Year)

Semester: VI

Course Type	Course category	Course Code	Course Title	Credits	Teaching Scheme Hr/Week	Evaluation Scheme and Max Marks*		
						CIE	SEE	Total
Major	DSC	BZL6DSC11T	General Mammalian Physiology II (Theory)	2	2	20	30	50
	DSC	BZL6DSC12T	Applied Zoology II (Theory)	2	2	20	30	50
	DSC	BZL6DSC13T	Molecular Biology (Theory)	2	2	20	30	50
	DSC	BZL6DSC14T	Immunology (Theory)	2	2	20	30	50
	DSC	BZL6DSC07P	Practical based on General Mammalian Physiology II and Applied Zoology II (Practical)	2	4	20	30	50
	DSC	BZL6DSC08P	Practical based on Molecular Biology and Immunology (Practical)	2	4	20	30	50
	DSE	BZL6DSE02AT BZL6DSE02BT BZL6DSE02CT	A. Insect morphology and Physiology OR B. Fish Physiology OR C. Female Mammalian Reproductive Physiology (Theory)	2	2	20	30	50
	DSE	BZL6DSE02P	Practical based on A. Insect morphology and Physiology OR B. Fish Physiology OR C. Female Mammalian Reproductive Physiology (Practical)	2	4	20	30	50
	VSC	BZL6VSC04P	Silkworm culture (Practical)	2	4	20	30	50
	OJT	BZL6OJT01P	Major Specific (Practical)	4	8	40	60	100
Total				22	34	220	330	550

*Minimum passing marks in each head (i.e. CIE, SEE and Total) will be 40% of maximum marks.

Exit Option: Award of UG Degree in Major with 132 credits or continue with major and minor.

Level: 6.0 (Fourth Year)

Semester: VII (Honors)

Course Type	Course category	Course Code	Course Title	Credits	Teaching Scheme Hr/Week	Evaluation Scheme and Max Marks*		
						CIE	SEE	Total
Major	DSC	BZL7DSC15T	Systematic Zoology (Theory)	2	2	20	30	50
	DSC	BZL7DSC16T	Biotechnology (Theory)	2	2	20	30	50
	DSC	BZL7DSC17T	Biostatistics and Bioinformatics (Theory)	2	2	20	30	50
	DSC	BZL7DSC18T	Microtechniques (Theory)	2	2	20	30	50
	DSC	BZL7DSC19T	Parasitology (Theory)	2	2	20	30	50
	DSC	BZL7DSC09P	Practical based on Systematic Zoology and Biotechnology (Practical)	2	4	20	30	50
	DSC	BZL7DSC10P	Practical based on Biostatistics and Bioinformatics, Microtechniques and Parasitology (Practical)	2	4	20	30	50
	DSE	BZL7DSE03AT BZL7DSE03BT BZL7DSE03CT	A. Insect pests OR B. Applied Fisheries OR C. Reproductive Endocrinology and Toxicology (Theory)	2	2	20	30	50
	DSE	BZL7DSE03P	Practical based on A. Insect pests OR B. Applied Fisheries OR C. Reproductive Endocrinology and Toxicology (Practical)	2	4	20	30	50
	RM	BZL7RM01T	Research methodology (Theory)	2	2	20	30	50
	RM	BZL7RM01P	Research methodology (Practical)	2	4	20	30	50
Total				22	30	220	330	550

*Minimum passing marks in each head (i.e. CIE, SEE and Total) will be 40% of maximum marks.

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Level: 6.0 (Fourth Year)

Semester: VIII (Honors)

Course Type	Course category	Course Code	Course Title	Credits	Teaching Scheme Hr/Week	Evaluation Scheme and Max Marks*		
						CIE	SEE	Total
Major	DSC	BZL8DSC20T	Biochemistry (Theory)	2	2	20	30	50
	DSC	BZL8DSC21T	Endocrinology (Theory)	2	2	20	30	50
	DSC	BZL8DSC22T	Wildlife Biology (Theory)	2	2	20	30	50
	DSC	BZL8DSC23T	Ethology (Theory)	2	2	20	30	50
	DSC	BZL8DSC24T	Biotechniques (Theory)	2	2	20	30	50
	DSC	BZL8DSC11P	Practical based on Biochemistry and Endocrinology (Practical)	2	4	20	30	50
	DSC	BZL8DSC12P	Practical based on Wildlife Biology, Ethology and Biotechniques (Practical)	2	4	20	30	50
	DSE	BZL8DSE04AT BZL8DSE04BT BZL8DSE04CT	A. Industrial Entomology OR B. Fishery technology and fish pathology OR C. Avian Biology (Theory)	2	2	20	30	50
	DSE	BZL8DSE04P	Practical based on A. Industrial Entomology OR B. Fishery technology and fish pathology OR C. Avian Biology (Practical)	2	4	20	30	50
	OJT	BZL8OJT02P	Major Specific (Practical)	4	8	40	60	100
Total				22	32	220	330	550

*Minimum passing marks in each head (i.e. CIE, SEE and Total) will be 40% of maximum marks.

Exit Option: Award of UG Honors Degree in major and minor with 176 credits.

OR

Level: 6.0 (Fourth Year)

Semester: VII (Honors with Research)

Course Type	Course category	Course Code	Course Title	Credits	Teaching Scheme Hr/Week	Evaluation Scheme and Max Marks*		
						CIE	SEE	Total
Major	DSC	BZL7DSC15T	Systematic Zoology (Theory)	2	2	20	30	50
	DSC	BZL7DSC16T	Biotechnology (Theory)	2	2	20	30	50
	DSC	BZL7DSC17T	Biostatistics and Bioinformatics (Theory)	2	2	20	30	50
	DSC	BZL7DSC09P	Practical based on Systematic Zoology and Biotechnology (Practical)	2	4	20	30	50
	DSC	BZL7DSC10P	Practical based on Biostatistics and Bioinformatics (Practical)	2	4	20	30	50
	DSE	BZL7DSE03AT	A. Insect pests	2	2	20	30	50
		BZL7DSE03BT	OR B. Applied Fisheries					
		BZL7DSE03CT	OR C. Reproductive Endocrinology and Toxicology (Theory)					
	DSE	BZL7DSE03P	Practical based on A. Insect pests OR B. Applied Fisheries OR C. Reproductive Endocrinology and Toxicology (Practical)	2	4	20	30	50
	RM	BZL7RM01T	Research methodology (Theory)	2	2	20	30	50
	RM	BZL7RM01P	Research methodology (Practical)	2	4	20	30	50
	RP	BZL7RP01P	Research project (Practical)	4	8	40	60	100
Total				22	34	220	330	550

*Minimum passing marks in each head (i.e. CIE, SEE and Total) will be 40% of maximum marks.

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Level: 6.0 (Fourth Year)

Semester: VIII (Honors with Research)

Course Type	Course category	Course Code	Course Title	Credits	Teaching Scheme Hr/Week	Evaluation Scheme and Max Marks*		
						CIE	SEE	Total
Major	DSC	BZL8DSC20T	Biochemistry (Theory)	2	2	20	30	50
	DSC	BZL8DSC21T	Endocrinology (Theory)	2	2	20	30	50
	DSC	BZL8DSC22T	Wildlife Biology (Theory)	2	2	20	30	50
	DSC	BZL8DSC09P	Practical based on Biochemistry and Endocrinology (Practical)	2	4	20	30	50
	DSC	BZL8DSC10P	Practical based on Wildlife Biology (Practical)	2	4	20	30	50
	DSE	BZL8DSE04AT BZL8DSE04BT BZL8DSE04CT	A. Industrial Entomology OR B. Fishery technology and fish pathology OR C. Avian Biology (Theory)	2	2	20	30	50
	DSE	BZL8DSE04P	Practical based on A. Industrial Entomology OR B. Fishery technology and fish pathology OR C. Avian Biology (Practical)	2	4	20	30	50
	RP	BZL8RP02P	Research project (Practical)	8	16	80	120	200
Total				22	36	220	330	550

*Minimum passing marks in each head (i.e. CIE, SEE and Total) will be 40% of maximum marks.

Exit Option: Award of UG Honors with Research Degree in major and minor with 176 credits.

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Basket for Minor Category Courses (Zoology)

Sem-III

Minor	BZL3MN03T	Life and Diversity of Animals- Chordates (Protochordata to Amphibia) (Theory)	2	2	20	30	50
Minor	BZL3MN03P	Practical based on Life and Diversity of Animals- Chordates (Protochordata to Amphibia) (Practical)	2	4	20	30	50

Sem-IV

Minor	BZL4MN04T	Life and Diversity of Animals- Chordates (Reptilia to Mammalia) (Theory)	2	2	20	30	50
Minor	BZL4MN04P	Practical based on Life and Diversity of Animals- Chordates (Reptilia to Mammalia) (Practical)	2	4	20	30	50

Sem-V

Minor	BZL5MN05T	General Mammalian Physiology (Theory)	2	2	20	30	50
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Basket for ELECTIVE (DSE) Category Courses (Zoology)

Sem-V

DSE	BZL5DSE01AT	A. Systematic Entomology OR	2	2	20	30	50
	BZL5DSE01BT	B. Systematic Ichthyology OR					
	BZL5DSE01CT	C. Male Mammalian Reproductive Physiology (Theory)					
DSE	BZL5DSE01P	Practical based on A. Systematic Entomology OR B. Systematic Ichthyology OR C. Male Mammalian Reproductive Physiology (Practical)	2	4	20	30	50

Sem-VI

DSE	BZL6DSE02AT	A. Insect morphology and Physiology OR	2	2	20	30	50
	BZL6DSE02BT	B. Fish Physiology OR					
	BZL6DSE02CT	C. Female Mammalian Reproductive Physiology (Theory)					
DSE	BZL6DSE02P	Practical based on A. Insect morphology and Physiology OR B. Fish Physiology OR C. Female Mammalian Reproductive Physiology (Practical)	2	4	20	30	50

Sem-VII

DSE	BZL7DSE03AT	A. Insect pests OR	2	2	20	30	50
	BZL7DSE03BT	B. Applied Fisheries OR					
	BZL7DSE03CT	C. Reproductive Endocrinology and Toxicology (Theory)					
DSE	BZL7DSE03P	Practical based on A. Insect pests OR B. Applied Fisheries OR C. Reproductive Endocrinology and Toxicology (Practical)	2	4	20	30	50

Sem-VIII

DSE	BZL8DSE04AT	A. Industrial Entomology OR	2	2	20	30	50
	BZL8DSE04BT	B. Fishery technology and fish pathology OR					
	BZL8DSE04CT	C. Avian Biology (Theory)					
DSE	BZL8DSE04P	Practical based on A. Industrial Entomology OR B. Fishery technology and fish pathology OR C. Avian Biology (Practical)	2	4	20	30	50

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Basket for Generic and Open Elective (GE/OE) Category Courses (Zoology)
(For other faculty students)

Sem I

GE/OE_1	GE/OE	BZL1GOE01T	Indian Birds (Theory)	2	2	20	30	50
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Sem II

GE/OE_2	GE/OE	BZL2GOE02T	Attractive Insects (Theory)	2	2	20	30	50
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Sem III

GE/OE_3	GE/OE	BZL3GOE03T	Fish Farming (Theory)	2	2	20	30	50
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Sem IV

GE/OE_4	GE/OE	BZL4GOE04T	Animal Husbandry (Theory)	2	2	20	30	50
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Basket for Skill Enhancement Courses (SEC) Category Courses (Zoology)

Sem I

SEC-1	BZL1SEC01P	Beekeeping (Practical)	2	4	20	30	50
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Sem II

SEC-2	BZL2SEC02P	Water Quality Analysis (Practical)	2	4	20	30	50
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Sem IV

SEC-3	BZL4SEC03P	Clinical Pathology (Practical)	2	4	20	30	50
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Basket for Vocational and Skill Courses (VSC) Category Courses (Zoology)

Sem III

VSC-1	BZL3VSC01P	Culture of Indian Major Carps (Practical)	2	4	20	30	50
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Sem IV

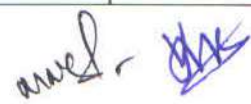
VSC-2	BZL4VSC02P	Aquarium preparation and maintenance (Practical)	2	4	20	30	50
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Sem V

VSC-3	BZL5VSC03P	Vermicomposting (Practical)	2	4	20	30	50
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Sem VI

VSC-4	BZL6VSC04P	Silkworm culture (Practical)	2	4	20	30	50
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B.Sc. Zoology (Honours/ Research)

A four year eight semester degree program

1. Introduction to B.Sc. (Honours/ Research) Zoology

The Bachelor of Science (Honours/Research) in Zoology is a four-year, eight-semester undergraduate degree programme designed in accordance with the National Education Policy (NEP) 2020 and the Learning Outcome-Based Curriculum Framework (LOCF). The programme follows the Choice Based Credit System (CBCS), offering students flexibility through a multidisciplinary curriculum consisting of Discipline Specific Courses (DSC), Discipline Specific Electives (DSE), Generic/Open Electives (GE/OE), Skill Enhancement Courses (SEC), Vocational Skill Courses (VSC), Ability Enhancement Courses (AEC), Value Education Courses (VEC), Indian Knowledge System (IKS) courses, Community Engagement Programmes (CEP), On-the-Job Training (OJT), and Research Projects. Students may exit at different stages with appropriate certifications as prescribed under NEP-2020 or continue towards obtaining an Honours or Honours with Research degree.

The programme is designed to provide students with comprehensive knowledge of animal sciences, ranging from the diversity of animal life to advanced concepts in physiology, genetics, biotechnology, ecology, wildlife biology, and research methodology. The curriculum integrates theoretical knowledge with practical training, field-based learning, vocational skills, and research-oriented activities to develop competent zoologists capable of addressing contemporary biological and environmental challenges.

The teaching-learning process is student-centric and includes classroom teaching, laboratory practicals, field visits, biodiversity surveys, seminars, workshops, project work, internships, and research activities. Modern pedagogical tools such as multimedia presentations, virtual laboratories, digital resources, specimen-based learning, and field investigations are incorporated to enhance learning outcomes. Assessment is based on Continuous Internal Evaluation (CIE) and Semester End Examination (SEE), ensuring both formative and summative evaluation of student performance.

2. Learning Outcome-based Curriculum Framework in BSc (Hons/ Res) Zoology

The Learning Outcome-Based Curriculum Framework (LOCF) for the B.Sc. Zoology (Honours/Research) programme provides a comprehensive academic structure that aligns disciplinary knowledge with practical skills, employability, entrepreneurship, and research competencies. The framework emphasizes outcome-oriented learning and enables students to achieve intellectual growth, scientific temper, environmental awareness, and professional competence.

Nature and Extent of the Programme

The programme encompasses a broad spectrum of zoological sciences, including:

- Life and Diversity of Animals
- Cell Biology
- Genetics
- Developmental Biology
- Evolutionary Biology
- Physiology
- Molecular Biology
- Immunology
- Biotechnology



- Biostatistics and Bioinformatics
- Parasitology
- Endocrinology
- Wildlife Biology
- Ethology
- Applied Zoology
- Fisheries Science
- Entomology
- Aquaculture
- Environmental Biology
- Research Methodology and Scientific Investigation

The curriculum integrates laboratory experimentation, field-based observations, vocational training, community engagement, and research projects to facilitate experiential learning and skill development. It provides flexibility for students to pursue either an Honours Degree or an Honours Degree with Research depending upon their academic interests and career aspirations.

Aims of the Programme: The programme aims to:

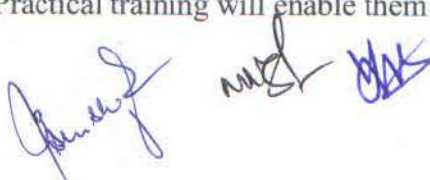
1. Develop a strong foundation in fundamental and advanced concepts of Zoology.
2. Provide practical training in laboratory and field-based biological investigations.
3. Provide in-depth knowledge of biological principles governing structure, function, behaviour, evolution, and diversity of animals.
4. Enhance analytical, problem-solving, and scientific reasoning abilities.
5. Develop awareness regarding biodiversity conservation, environmental sustainability, and wildlife management.
6. Foster entrepreneurship and employability through vocational and skill-oriented courses.
7. Encourage research aptitude through project work, internships, and dissertation-based learning.
8. Prepare students for higher studies, competitive examinations, scientific careers, and professional opportunities in biological sciences and allied disciplines.

3. Programme Specific Outcomes (PSOs) in B.Sc. (Hons/Res) Zoology

Upon successful completion of the programme, students shall be able to demonstrate the following outcomes:

PSO 1: Comprehensive Knowledge of Zoology: Students will acquire a thorough understanding of animal diversity, taxonomy, anatomy, physiology, genetics, molecular biology, biotechnology, ecology, evolution, behaviour, and conservation biology. They will understand the interrelationships among various biological systems and their applications in scientific and societal contexts.

PSO 2: Practical and Laboratory Competence: Students will develop proficiency in laboratory techniques, specimen handling, microscopy, histological methods, molecular techniques, biochemical analyses, physiological experiments, field surveys, biodiversity assessment, and scientific data collection. Practical training will enable them to undertake research and professional laboratory work confidently.



PSO 3: Field and Biodiversity Skills: The programme will enable students to conduct field investigations, biodiversity surveys, ecological assessments, wildlife observations, and environmental monitoring. Students will acquire skills in specimen identification, habitat analysis, and conservation planning.

PSO 4: Research and Scientific Inquiry: Students will develop the ability to formulate hypotheses, design experiments, collect and analyze scientific data, interpret results, prepare scientific reports, and undertake independent research projects. Research methodology and project-based learning will strengthen scientific reasoning and innovation.

PSO 5: Communication and Scientific Reporting: Students will acquire effective oral, written, and digital communication skills through seminars, presentations, project reports, laboratory records, and scientific documentation. They will learn to communicate biological concepts accurately to both scientific and general audiences.

PSO 6: Computational and Analytical Skills: The programme develops competencies in biostatistics, bioinformatics, data management, information retrieval, and computational analysis. Students will be able to use modern biological databases and software tools for scientific investigations.

PSO 7: Employability and Entrepreneurship: Through courses in fisheries, aquaculture, beekeeping, vermicomposting, sericulture, clinical pathology, and applied zoology, students will gain entrepreneurial and vocational skills that enhance self-employment opportunities and professional competence.

PSO 8: Professional Ethics and Social Responsibility: Students will understand ethical principles in biological research, animal welfare, environmental conservation, and sustainable utilization of biological resources. They will develop a sense of responsibility towards society, biodiversity conservation, and ecological sustainability.

PSO 9: Lifelong Learning and Higher Education Readiness: The programme prepares graduates for postgraduate studies, doctoral research, professional courses, civil services, teaching careers, and employment in government, non-governmental, industrial, healthcare, environmental, and research organizations.

4. Structure of the Programme in B.Sc. (Hons/Res) Zoology

The programme includes Core Courses and Elective Courses. The Discipline Specific Core (DSC) Courses are all compulsory courses. There are three types of Elective Courses – Discipline Specific Elective (DSE), Generic Elective (GE), Vocational/ Skill Enhancement Courses (VS). In addition there are Ability Enhancement Courses (AEC). Field based projects and research projects add to the skill component.

Programme: B.Sc. Semester I

Discipline Specific Core Course (DSC-1) - Zoology

Name of Course: Life and Diversity of Animals - Nonchordates (Protozoa to Annelida)

Theory- 2 Credits

Course Code: BZL1DSC01T

+ Practical - 2 Credit

Course Code: BZL1DSC01P

Course Outcomes (COs):

By the end of the course, the students will be able to:

- Understand about early phyla viz., Protozoa, Porifera, Coelenterata, Platyhelminthes, Aschelminthes and Annelida.
- Identify, classify and analyze different animals belonging to phylum Protozoa to Annelida on the basis of levels or grades of organization, symmetry, coelom etc. upto class.
- Learn, analyze, describe a representative animal belonging to phylum Protozoa to Annelida
- Elucidate and explain uniqueness of phylum Protozoa to Annelida and they could able to demonstrate peculiar tissues, organs of animals belonging to these phyla.

THEORY

Course Code: BZL1DSC01T

Credits: 2

Teaching Hours: 02 Hrs / Week

Maximum Marks: (CIE + SEE = Total) 20 + 30 = 50

Unit:I

7h 30m

1.1 Kingdom Protista, Phylum - Protozoa: General characters of Protozoa.

1.2 Paramecium: Structure and reproduction.

1.3 Plasmodium: Structure and life cycle.

1.4 Parasitic Protozoans of Man: *Entamoeba*, *Trypanosoma* - Mode of infection, Damage and control.

Unit: II

7h 30m

2.1 Kingdom- Animalia: General characteristics of Animalia, General characters and classification upto classes of Phylum Porifera.

2.2: Sycon: Structure, Cell types, Canal system in sponges.

2.3 Coelenterata : General characters and classification up to classes.

2.4 Obelia : Structure and life cycle, Types of coral reefs.

Unit III

7h 30m

3.1 Platyhelminthes: General characters and classification up to class.

3.2 *Taenia solium*: Structure and life cycle, parasitic adaptations in *Taenia solium*.

3.3 Aschelminthes: General characters and classification up to classes.

3.4 *Ascaris* : External morphology, reproductive system and life cycle.

Unit – IV

7h 30m

4.1 Annelida: General characters and classification up to classes.

4.2 Leech: Morphology, digestive and urinogenital system.

4.3 Annelidan larvae: Trochophore larva and its significance.

4.4 Economic importance of Annelids: Therapeutic value of Annelids.

PRACTICAL

Course Code: BZL1DSC01P

Credit: 2

Teaching Hours: 04 Hrs / Week

Maximum Marks: (CIE + SEE = Total) 20 + 30 = 50

1. Study of museum specimens (Classification of animals up to orders)

I. Protozoa (Slides): *Paramoecium*, *Euglena*, *Plasmodium vivax*

II. Porifera: *Sycon*, *Leucosolenia*, *Hyalonema*, *Euplectella*, *Spongilla*

III. Coelenterata: *Obelia*, *Aurelia*, *Tubipora*, *Fungia*, *Adamsia*

IV. Platyhelminthes: *Planaria*, *Fasciola*, *Taenia*

V. Aschelminthes: *Ascaris*, *Drancunculus*, *Ancylostoma*, *Wuchereria*

VI. Annelida: *Aphrodite*, *Nereis*, *Chaetopteurs*, *Tubifix*, *Hirudinaria*

2. Study of permanent slides

Enatmoeba, *Giardia*, Sponge gemmules, Sponge spicules, V.S. *Sycon*, T.S. *Sycon*, *Obelia* medusa, Miracidium, Redia and Cercaria larvae of *Fasciola*, T.S. male and female *Ascaris*, Scolex of *Taenia*, Mature and gravid proglottids of *Taenia solium*, T. S. of Leech through crop pockets, Trochophore larva

3. Anatomical observation (Demonstration only through You tube video and other ICT tools, models, and charts)

Digestive, nervous and reproductive system of Earthworm

4. Mounting

Spicules and gemmules of Sponge, *Obelia* colony, *Nereis* parapodia, Nephridia of earthworm.

Practical Examination Assessment Scheme

Total Marks: 50

- Continuous Internal Evaluation (CIE): 20 Marks
- Semester End Examination (SEE): 30 Marks

I. Continuous Internal Evaluation (CIE) – 20 Marks

Component	Description	Marks
Practical Performance	Performance in Identification and Classification, Permanent Slide and Anatomical observation, Mounting	05 M
Practical Record	Maintenance of record with diagrams and regular submission	03 M
Internal Test / Skill Assessment	Short practical-based test on spot identification	10 M
Viva Voce (Internal)	Conceptual understanding of experiments	02 M
Total		20 M

II. Semester End Examination (SEE) – 30 Marks

Practical Examination Scheme

Distribution of Marks – Total Marks: 30

i. Identification and Comment on Spots (6 Museum specimens + 4 slides)	10 M
ii. Anatomical observation or Examination of pond water to identify invertebrates.	05 M
iii. Permanent stained preparation	05 M
iv. Submission of certified practical record	03 M
v. Submission of Slides	02 M
vi. Viva voce	05 M
Total	30 M

List of Recommended Books:

1. Barnes R.D.(1980) – **Invertebrate Zoology**. Halt-Saunders international, 4th Edition, Philadelphia, USA, pp. 1089.
2. Borradaile L.A.and Potts F.A. (1935). **The Invertebrata; a manual for the use of students**, 2nd Edition. McMilan Publisher, New York, USA, pp. 746.
3. Nigam H. C. (2013). **Biology of Nonchordates**. Shoban Lal Nagin Chand, India, pp. 871.
4. Kotpal, Agrawal and Khetrapal (2012). **Modern Text Book of Zoology – Invertebrates**. Rastogi Publication, Meerut, India, pp.
5. Puranik P.G.and Thakur R.S. – **Invertebrate Zoology**
6. Majupuria T.C. – **Invertebrate Zoology**
7. Dhami and Dhami – **Invertebrate Zoology**
8. Parker and Hashwell, **Textbook of Zoology Vol. I (Invertebrates)** A.Z.T.B.S. Publishers and Distributors, New Delhi

9. Dr. S.S. Lal **Practical Zoology Invertebrates 9th edition**, Rastogi Publication Meerut
10. EJW Barrington— **Invertebrate Structure and Function** ELBS III Edition8
11. R.L. Kotpal – **Phylum Protozoa to Echinodermata (series)**, Rastogi and Publication, Meerut
12. Parker J. and Haswell W. – **Text Book of Zoology**, ELBS Edition
13. Vidyarthi – **Text Book of Zoology**, Agrasia Publishers, Agra
14. Jordan E.L. and Verma P.S. – **Chordate Zoology**, S. Chand and Co., New Delhi
15. Life and Diversity of Animals-Nonchordates (Protozoa to Annelida). Himalaya Publishing House
16. M.D. Bhatia – **The Indian Zoological Memories – Leech**
17. Beni Prasad – **The Indian Zoological Memories – Pila**
18. P. K. Gupta – **Vermicomposting for Sustainable Agriculture**, Agrobios India Ltd 4
19. A manual of Practical Zoology Invertebrates – P. S. Verma

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Programme: B.Sc. Semester I

Course Category: Generic Elective (GE) or Open Elective (OE) Course - 1– Zoology

Name of Course: Indian Birds

Course Code: BZL1GOE01T

Theory- 2 Credits

Teaching Hours: 02 Hrs / Week

Maximum Marks: (CIE + SEE = Total) 20 + 30 = 50

Course Outcomes: After successful completion of the course, students will be able to:

1. Identify common Indian birds and understand their classification.
2. Explain basic features of bird morphology and adaptations.
3. Describe feeding habits, migration, and behaviour of birds.
4. Recognize the ecological and economic importance of birds.
5. Understand threats to birds and suggest conservation strategies.

Unit I: Diversity and Classification of Indian Birds

7h 30m

1.1 Introduction to Class Aves: General characteristics

1.2 Comparison of flying birds and Flightless birds

1.3 Diversity of Indian birds: Terrestrial birds (Forest and Grassland birds) and aquatic birds (Pond, River and Coastal birds)

1.4 Common birds of India: Identification and features (Peacock, Sparrow, Crow, Pigeon, Parrot)

Unit II: Morphology and Adaptations

7h 30m

2.1 External morphology: Beak types and their functional significance

2.2 Types of feet and claws (perching, wading, swimming, grasping)

2.3 Feathers: Types and functions

2.4 Adaptations for flight (structural and physiological)

Unit III: Behaviour and Ecology of Birds

7h 30m

3.1 Feeding habits and food chains

3.2 Migration: Types, causes, and examples of migratory birds in India

3.3 Nesting and breeding behaviour

3.4 Bird communication: Calls and songs

Unit IV: Economic Importance and Conservation of Birds

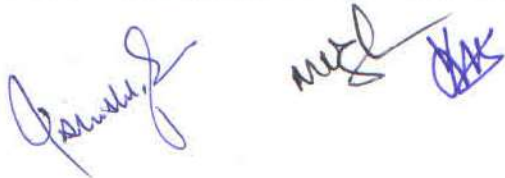
7h 30m

4.1 Role of birds in ecosystems (pollination, seed dispersal, pest control)

4.2 Threats to bird diversity: Habitat loss, pollution, climate change, hunting

4.3 Endangered and protected birds of India (Great Indian Bustard, Sarus Crane, Vultures)

4.4 Conservation measures: Wildlife Protection Act, bird sanctuaries, role of citizens



Continuous Internal Evaluation (CIE) – 20 Marks

Description	Marks
i. Assignment / Project / Presentation on local bird diversity	10 M
ii. Field observation report (optional)	05 M
iii. Class test / Quiz	05 M
Total	20 M

List of Recommended Books:

1. Ali, S. – *The Book of Indian Birds*
2. Grimmett, Inskipp & Inskipp – *Birds of the Indian Subcontinent*
3. NCERT – Environmental Biology (relevant sections)
4. HPH- Semester I – Indian Birds
5. Daniels, R.J.R. – *Birds of India*

Online resources: BNHS (Bombay Natural History Society), eBird India



Programme: B.Sc. Semester I

Course Category: Skill Enhancement Course (SEC-1) – Zoology

Name of Course: Beekeeping

Course Code: BZL1SEC01P

Credits: 2 (Practical)

Teaching Hours: 04 Hrs / Week

Maximum Marks: (CIE + SEE = Total) 20 + 30 = 50

Course Outcomes- After completion of this course, students will be able to:

1. Identify different species and castes of honeybees.
2. Handle bee colonies safely using modern techniques.
3. Understand colony organization and developmental stages.
4. Use beekeeping equipment efficiently.
5. Analyze foraging behaviour and bee flora.
6. Apply practical knowledge for small-scale beekeeping enterprises.

Practical

1: Identification of Honeybee Species and Castes: Identification of Indian honeybee species: *Apis cerana indica*, *Apis dorsata*, *Apis florea*, *Apis mellifera*, Identification of castes: Queen, Worker, Drone, Morphological differences and functions

2: Handling and Examination of Honeybee Colony: Use of protective gear (bee veil, gloves, smoker), Opening hive and frame handling techniques, Identification of brood, honey, pollen cells, Safety precautions

3: Study of Honeybee Colony for Developmental Stages: Observation of life cycle stages: Egg, Larva, Pupa, Adult; Distinguishing worker, drone, and queen brood

4: Study of Honeybee Body Structure and Appendages: Morphometry of honeybee, antennae, legs (pollen basket), mouthparts, wings

5: Study of Hive Structure: Components of modern hive: Brood chamber, super, frames, Structure of honeycomb, Wax production and comb organization

6: Acquaintance with Bee Appliances: Identification and use of equipment: Smoker, hive tool, extractor, queen excluder, feeder; Maintenance and cleaning of equipment

7: Familiarization with Bee Flora: Identification of major nectar and pollen yielding plants, Seasonal availability of bee flora, Preparation of floral calendar (local region-based, e.g., Nagpur region)

8: Study on Foraging Behaviour of Honeybees: Observation of foraging activity, Time of foraging, flower preference, pollen vs nectar collection, Recording bee movements and behaviour

9: Acquaintance with Traditional and Modern Beekeeping through Educational Visit: Visit to apiary / beekeeping farm, Observation of traditional (log, wall hives) and modern (Langstroth hive) systems, Honey Extraction Unit, Honey Analysis Laboratory, Interaction with beekeeper and documentation of practices

Practical Examination Assessment Scheme

Total Marks: 50

- Continuous Internal Evaluation (CIE): 20 Marks
- Semester End Examination (SEE): 30 Marks

Scheme of Semester End Practical Examination (30 Marks)

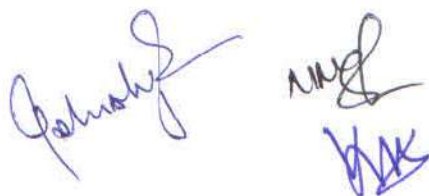
- **Major Experiment:** Handling and Examination of Honeybee Colony / Study of Honeybee Colony for Developmental Stages/ Study of Honeybee Body Structure and Appendages **10 Marks**
- **Minor Experiment:** Study of Hive Structure/ Acquaintance with Bee Appliances/ Preparation of floral calendar **05 Marks**
- **Spotting: (2 specimens/2 equipment/1 flora)** **05 Marks**
- **Practical Record:** **05 Marks**
- **Viva Voce:** **05 Marks**

Continuous Internal Evaluation (20 Marks)

- Field visit report / Assignment **10 Marks**
- Practical performance **05 Marks**
- Attendance and participation **05 Marks**

Suggested Readings

1. Mishra, R.C. – *Honeybee and Beekeeping*
2. Singh, S. – *Beekeeping in India*
3. Prost, P.J. – *Apiculture*
4. ICAR Publications on Beekeeping
5. KVIC Manuals on Apiculture
6. HPH-Beekeeping



Programme: B.Sc. Semester II

Course Category: Discipline Specific Core (DSC-2) – Zoology

Name of Course: Life and Diversity of Animals – Non-Chordates (Arthropoda to Hemichordata)

Theory 2 credits

Course Code: BZL2DSC02T

+ Practical 2 credits:

Course Code: BZL2DSC02P

Course Outcomes: On completion of the course, the student will be able to:

1. Learn, identify, explain and analyze the taxonomic position of animals belonging to phylum Arthropoda to Hemichordata.
2. Describe, explain and analyze phylogeny to understand the course of evolution in animals from phylum Arthropoda to Hemichordata.
3. Describe, explain and differentiate various morphological, anatomical structures and functions of animals of phyla from Arthropoda to Hemichordata.
4. Understand, describe, explain and differentiate the larval forms and development of the invertebrates from phylum Arthropoda to Hemichordata.
5. Describe, explain and analyze the ecological and economic importance of invertebrates.
6. Understand, describe, explain and analyze the ecological role of invertebrates in the biodiversity.

THEORY

Course Code: BZL2DSC02T

Credits: 2

Teaching Hours: 02 Hrs. / Week

Maximum Marks: (CIE + SEE = Total) 20 + 30 = 50

UNIT: I

7h 30m

1.1. Arthropoda: General characters of the phylum and classification up to classes with suitable examples

1.2. Cockroach: Digestive system, Male and Female reproductive system

1.3. Insects as Vectors : Mosquito, Housefly, Tse-Tse fly

1.4. Study of crustacean larvae: Nauplius, Zoea and Megalopa

UNIT: II

7h 30m

2.1 Mollusca: General characters and classification up to classes

2.2 Pila: Respiratory system and Mechanism of Aquatic and Pulmonary respiration.

2.3 Economic importance of Mollusca: Edible oyster farming, pearl forming mollusc, types of pearl culture

2.4 Molluscan larva: Glochidium and Veliger

UNIT: III

7h 30m

- 3.1 **Echinodermata:** General characters and classification up to classes
- 3.2 **Asterias:** External morphology, Straight and Crossed type of Pedicellariae.
- 3.3 Water vascular system in *Asterias*
- 3.4 Echinoderm larva: Bipinnaria and Auricularia

UNIT: IV

7h 30m

- 4.1 **Hemichordata:** General characters of Hemichordata and classification upto Enteropneusta.
- 4.2 **Balanoglossus:** External features and digestive system
- 4.3 Pre-Larval Development in Balanoglossus, Tornaria larva
- 4.4 Affinities of Balanoglossus with Annelida, Echinodermata and Chordata

PRACTICAL

Course Code: BZL2DSC02P

Credit: 2

Teaching Hours: 04 Hrs / Week

Maximum Marks: (CIE + SEE = Total) 20 + 30 = 50

1. **Study of museum specimens** (Classification of animals up to orders)
 - I. **Arthropoda:** Crab, Prawn, *Scolopendra*, *Julus*, Dragonfly, Moth, *Limulus*
 - II. **Mollusca:** *Chiton*, *Dentalium*, *Pila*, *Mytilus*, *Sepia*, *Octopus*
 - III. **Echinodermata:** *Asterias*, *Ophiothrix*, *Holothuria*, *Antedon*, *Echinus*
 - IV. **Hemichordata:** *Balanoglossus*, *Saccoglossus*
2. **Study of permanent slides-** Nauplius, Zoea and Megalopa larva of Arthropoda, Glochidium larva, Bipinnaria larva, T.S. *Balanoglossus* through branchio-genital region, Tornaria larva
3. **Anatomical observation** (Demonstration Only -Through You Tube Video and other ICT tools, Models, Charts) –
 - I. Digestive system of Cockroach
 - II. Male and Female Reproductive system of Cockroach
 - III. Water vascular system in *Asterias*.
4. **Mounting (Any two)** - I. Crustacean larvae and planktons
 - II. Mouth Parts, Legs and Wings of Insects – Cockroach/Mosquitoes/Housefly
 - III. Gill lamella of *Pila*
5. **Collection of photograph of insect vectors.**
6. **Examination of pond water to identify aquatic Arthropods and Molluscs.**



Practical Examination Assessment Scheme

Total Marks: 50

- Continuous Internal Evaluation (CIE): 20 Marks
- Semester End Examination (SEE): 30 Marks

I. Continuous Internal Evaluation (CIE) – 20 Marks

Component	Description	Marks
Practical Performance	Performance in Identification and Classification, Permanent Slide and Anatomical observation, Mounting	05
Practical Record and Collections	Maintenance of record with diagrams and regular submission, Collection of Photographs	03
Internal Test / Skill Assessment	Short practical-based test on spot identification, examination of pond water for identification	10
Viva Voce (Internal)	Conceptual understanding of experiments	02
Total		20

II. Semester End Examination (SEE) – 30 Marks

Practical Examination Pattern

Distribution of Marks – Total Marks: 30

i Identification and Comment on Spots (6 Museum specimens + 4 slides)	10 M
ii Anatomical observation or Examination of pond water to identify invertebrates.	05 M
iii Permanent stained preparation	05 M
iv Submission of certified practical record	03 M
v. Submission of Slides	02 M
vi. Viva voce	05 M

List of recommended books:

1. Barnes – **Invertebrate Zoology (Holt-Saunders international)** Philadelphia, USA
2. Barradaile L.A. and Potts F.A. – **The Invertebrate**
3. Nigam – **Biology of Nonchordates**
4. Kotpal, Agrawal & Khetrapal – **Modern Text Book of Zoology - Invertebrates**, Rastogi Publication, Meerut
5. Puranik P.G. and Thakur R.S. – **Invertebrate Zoology**
6. Majumuria T.C. – **Invertebrate Zoology**
7. Dhami and Dhami – **Invertebrate Zoology**
8. Parker and Hashwell, **Textbook of Zoology Vol. I (Invertebrates)** A.Z.T.B.S. Publishers and Distributors, New Delhi
9. Dr. S.S. Lal **Practical Zoology Invertebrates**. 9th edition, Rastogi Publication Meerut

10. EJW Barrington– **Invertebrate Structure and Function**. 8th Edition, ELBS III
11. R.L. Kotpal – **Phylum Protozoa to Echinodermata (series)**, Rastogi and Publication, Meerut
12. Parker J. and Haswell W. – **Text Book of Zoology**, ELBS Edition
13. Vidyarthi – **Text Book of Zoology**, Agrasia Publishers, Agra
14. Jordan E.L. and Verma P.S. – **Chordate Zoology**, S. Chand and Co., New Delhi
15. HPH – Semester II - Life and Diversity of Animals-Nonchordates (Arthropoda to Hemichordata)
16. M.D. Bhatia – **The Indian Zoological Memories – Leech**
17. Beni Prasad – **The Indian Zoological Memories – Pila**
18. P. K. Gupta – **Vermicomposting for Sustainable Agriculture**, Agrobios India Ltd
19. A manual of Practical Zoology Invertebrates – P. S. Verma

John Singh *masf*
JKS

Programme: B.Sc. Semester II

Course Category: Generic Elective (GE) or Open Elective (OE) -2 – Zoology

Name of Course: Attractive Insects

Course Code: BZL2GOE02T

Theory- 2 Credits

Teaching Hours: 02 Hrs. / Week

Maximum Marks: (CIE + SEE = Total) 20 + 30 = 50

Course Outcomes-

After successful completion of the course, students will be able to:

1. Recognize and classify common attractive insects.
2. Describe morphological features responsible for attractiveness.
3. Explain behaviour and ecological roles of selected insects.
4. Understand economic importance of insects like butterflies, silkworms, and honeybees.
5. Develop awareness about insect conservation and sustainable practices.

Unit I: Introduction and Diversity of Attractive Insects

7h 30m

- 1.1 General characteristics of Class Insecta
- 1.2 Concept of "attractive insects" (colour, patterns, behaviour, utility)
- 1.3 Classification of insects up to order level (overview)
- 1.4 Examples of attractive insects: Butterflies, moths, dragonflies, damselflies, beetles, fireflies

Unit II: Morphology and Adaptations

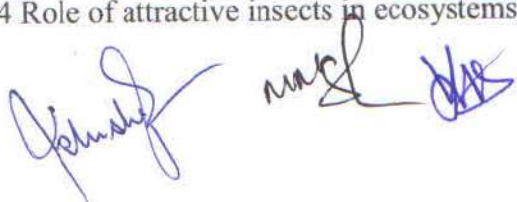
7h 30m

- 2.1 External morphology of insects (head, thorax, abdomen)
- 2.2 Types of wings and coloration (mimicry)
- 2.3 Mouthparts and their modifications
- 2.4 Adaptations for flight and Structural basis of beauty in insects (scales in butterflies, iridescence in beetles)

Unit III: Behaviour and Ecology

7h 30m

- 3.1 Life cycles (complete and incomplete metamorphosis)
- 3.2 Behavioural patterns: courtship, mating displays, bioluminescence (fireflies)
- 3.3 Feeding habits and host plant relationships (especially butterflies)
- 3.4 Role of attractive insects in ecosystems: pollination, food chains, indicators of environmental health



Unit IV: Economic Importance and Conservation

7h 30m

- 4.1 Beneficial insects: Honeybees (apiculture), silkworms (sericulture), lac insects
- 4.2 Butterfly gardening and eco-tourism
- 4.3 Threats to insect diversity: habitat destruction, pesticides, climate change
- 4.4 Conservation strategies: protected areas, biodiversity gardens, public awareness, Role of citizens in insect conservation

Continuous Internal Evaluation (CIE) – 20 Marks

Description	Marks
i. Assignment / Project (e.g., study of local butterflies or insects)	10 M
ii. Field observation report / Presentation / Poster making	05 M
iii. Class test / Quiz	05 M

Total **20 M**

Suggested Readings

1. Gullan, P.J. & Cranston, P.S. – *The Insects: An Outline of Entomology*
2. Evans, J.W. – *Insects: Structure and Function*
3. Kunte, K. – *Butterflies of India*
4. Atwal, A.S. – *Agricultural Pests of India* (selected sections)
5. HPH-Semester II-Attractive Insects
6. Online resources: BNHS, National Biodiversity Authority, Butterfly India



Programme: B.Sc. Semester II

Course Category: Skill Enhancement Course (SEC-2) – Zoology

Name of Course: Water Quality Analysis

Course Code: BZL2SEC02P

Credits: 2 (Practical)

Teaching Hours: 04 Hrs. / Week

Maximum Marks: (CIE + SEE = Total) 20 + 30 = 50

Course Outcomes

After completion of course, students will be able to:

- Analyse basic water quality parameters
- Perform laboratory techniques accurately
- Interpret pollution levels and water standards
- Apply knowledge in environmental assessment

PRACTICALS

1. Determination of pH of water sample.
2. Measurement of temperature and turbidity of water sample.
3. Estimation of total dissolved solids (TDS).
4. Determination of dissolved oxygen (DO) by Winkler method.
5. Estimation of free CO₂ in a given water sample.
6. Estimation of biological oxygen demand (BOD).
7. Estimation of chemical oxygen demand (COD).
8. Determination of total hardness (EDTA method).
9. Estimation of alkalinity.
10. Qualitative analysis of zooplankton/ Permanent Stained slide preparation of Zooplankton.
11. Quantitative analysis of zooplankton.

Field-Based Activity

- Collection of water samples and Zooplankton from different sources.
- Preparation of field report



Practical Examination Assessment Scheme

Total Marks: 50

- Continuous Internal Evaluation (CIE): 20 Marks
- Semester End Examination (SEE): 30 Marks

Continuous Internal Evaluation (20 Marks)

- Class Practical test / Assignment **10 Marks**
- Practical performance **05 Marks**
- Attendance and participation **05 Marks**

Scheme of Semester End Practical Examination (30 Marks)

- **Major Experiment:** Dissolved Oxygen (DO) by Winkler method/ Biological Oxygen Demand (BOD)/Chemical Oxygen Demand (COD)/Total Hardness (EDTA method)/Alkalinity estimation **10 Marks**
- **Minor Experiment:** pH determination/Temperature and turbidity measurement/Estimation of free CO₂ in given water sample/Total dissolved solids (TDS) estimation **05 Marks**
- **Zooplankton Analysis:** **05 Marks**

a) Qualitative Analysis (Identification of given zooplankton specimens e.g., Rotifers, Cladocerans, Copepods, Ostracods)

OR

b) Quantitative Analysis (Counting using Sedgwick-Rafter cell / calculation of density)

- **Practical Record:** **05 Marks**
- **Viva Voce:** **05 Marks**

List of recommended books:

- American Public Health Association, American Water Works Association, & Water Environment Federation. (2023). *Standard methods for the examination of water and wastewater* (24th ed.; W. C. Lipps, E. B. Braun-Howland, & T. E. Baxter, Eds.). American Public Health Association.
- Dodds, W. K., & Whiles, M. R. (2020). *Freshwater ecology: Concepts and environmental applications of limnology* (3rd ed.). Academic Press.
- Trivedy, R. K. and Goel, P. K. (1986) Chemical and Biological method for water pollution studies. *Environmental publication* (Karad, India), 6: 10-12.
- Ward, H. B., & Whipple, G. C. (1959). *Fresh-water biology* (2nd ed., edited by W. T. Edmondson). New York: John Wiley & Sons.
- HPH-Water Quality Analysis
- Wetzel, R. G. (2001). *Limnology: Lake and river ecosystems* (3rd ed.). Academic Press.



QUESTION PAPER PATTERN		
Time: Three Hours] [Max. Marks: 30 N.B.: 1. All questions are compulsory 2. All questions carry equal marks 3. Use of Calculator is permitted 4. Draw labelled diagrams wherever necessary		
1 (a)	Long answer on unit-1	3
(b)	Long answer on unit-1	3
OR		
1 (c)	Short answer on unit-1	2
(d)	Short answer on unit-1	2
(e)	Short answer on unit-1	2
2 (a)	Long answer on unit-2	3
(b)	Long answer on unit-2	3
OR		
2 (c)	Short answer on unit-2	2
(d)	Short answer on unit-2	2
(e)	Short answer on unit-2	2
3 (a)	Long answer on unit-3	3
(b)	Long answer on unit-3	3
OR		
3 (c)	Short answer on unit-3	2
(d)	Short answer on unit-3	2
(e)	Short answer on unit-3	2
4 (a)	Long answer on unit-4	3
(b)	Long answer on unit-4	3
OR		
4 (c)	Short answer on unit-4	2
(d)	Short answer on unit-4	2
(e)	Short answer on unit-4	2
5	Solve any six	6 x 1
(a)	Very short answer on unit-1	
(b)	Very short answer on unit-1	
(c)	Very short answer on unit-2	
(d)	Very short answer on unit-2	
(e)	Very short answer on unit-3	
(f)	Very short answer on unit-3	
(g)	Very short answer on unit-4	
(h)	Very short answer on unit-4	

